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E. MORTON LINSLEY

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VOLUME 10

THE GRASSHOPPERS OF CALIFORNIA
(Orthoptera: Acridoidea)

BY

H. E. [illegible]

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DAVID C. [illegible]

UNIVERSITY OF CALIFORNIA PRESS

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An endemic California grasshopper, *Morsea californicus tamalpaisensis* Rehn and Hebard, male. (Courtesy of E. S. Ross.)

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BY

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THE GRASSHOPPERS OF CALIFORNIA[1]
(Orthoptera: Acridoidea)

BY

H. F. STROHECKER, WOODROW W. MIDDLEKAUFF
AND DAVID C. RENTZ

INTRODUCTION

ALTHOUGH GRASSHOPPERS possess many attributes which should make them sought after by entomologists, they have never attracted the large number of collectors and students which have been drawn to such other groups as the butterflies and beetles. Knowledge of North American grasshoppers grew very slowly from the time of Linnaeus to the last decade of the eighteenth century, during which period most descriptions of Nearctic species were from the pens of European entomologists. During the period 1825 to 1865, the American authors Thomas Say, Thaddeus Harris, Samuel Haldeman, Asa Fitch and P. R. Uhler published descriptions of a number of species and several genera. Nevertheless, Scudder's catalogue of 1868 listed fewer than seven presently recognized species of Acridoidea from America north of the Rio Grande.

In 1873 Cyrus Thomas essayed a synopsis of North American Acrididae, a work valuable now for it original descriptions, but otherwise more likely to confuse than to direct a student. A rapid perusal of the section of this work devoted to the region north of the Rio Grande shows 145 specific names considered, of which quite a few are now regarded as synonyms. This work of Thomas, while dealing with species, is not at all comparable to the *Classification of North American Coleoptera* presented ten years later by Leconte and Horn.

The last quarter of the nineteenth century brought many papers from the pens of Samuel Scudder and Cyrus Thomas. These two workers were joined in the eighties by Lawrence Bruner but it was 1897 before the first adequate treatments of even limited groups of North American grasshoppers were published. Scudder's *Revision of the Melanopli* and Jerome McNeill's *Revision of the Truxalinae* remain fundamental works.

Understandably the study of California grasshoppers was far behind. The first report based on California acridids was the description by Stal in 1861 of two species. From 1876 into the twentieth century Scudder, Thomas and Brunner described species and genera based on material collected by army and geological survey expeditions. Saussure at Geneva and Bruner in Vienna received material from America. Economic damage caused by grasshoppers had attracted attention and several works on their destructive activities were published in the last two decades of the nineteenth century. C. F. Baker and James Grinnell collected California Orthoptera early in this century, and a rudimentary account of California acridids may be extracted from Bruner's volume of the *Biologia Centrali-Americana*. Rehn and Hebard published in 1909 the results of extensive collecting in California, and material taken by them on subsequent trips has been reported in part in a number of papers.

Only recently, however, has a list of California grasshoppers been published. The *Index of the Acridoidea of California* compiled by Thompson and

[1] These studies were financed in part by funds from Regional Research Project (W-37), a cooperative project with Federal and Experiment Station workers participating in Arizona, Montana, Colorado, Idaho, Wyoming, and California.

Buxton (1964) is a valuable guide to the systematic literature.

BIONOMICS

The Orthoptera, while comprising only a fraction of the number of species to be found in such orders as the Lepidoptera, Coleoptera and Diptera, must be judged as among the more successful groups of insects. Grasshoppers are the most ubiquitous, conspicuous, and destructive group in the Orthoptera.

While mostly phytophagous, grasshoppers may on occasion consume a variety of organic matter. The reported "cannibalism" is the eating of dead or molting and helpless individuals rather than active predation. A few instances of monophagy seem definitely established, for example, acridids of the genus *Boötettix* are confined to *Larrea,* but such a restricted food habit seems to be exceptional.

All students of acridian ecology have recognized the occurrence of particular species of grasshoppers with certain plant associations but have differed as to the importance of specific feeding habits in restricting the range of species of acridids. Anderson (1964) attributes to vegetative cover a definite influence on acridids both by its taxonomic composition and physical structure but points out, as did Isely (1938*b*) and others, that colonies of grasshoppers may be localized within large areas more or less covered by a favored food plant. Gangwere (1961), in summarizing extensive observations on feeding habits of a number of acridid species of eastern North America, states that, "The herbivores among Orthoptera show definite constant preferences. They usually specialize in a single category of foods, e.g., grasses or forbs, but select widely within the category. . . . food probably plays only a minor part in the insects' habitat selection" (p. 134).

Isely (1944) tested the acceptability of various plants as food for some Texas Orthoptera and correlated mandibular structure with predominant consumption of grasses or forbs. Acridinae generally tend to grass feeding and Cyrtacanthacridinae to consumption of forbs, but mixed diets are common.

The band-winged locusts, long known as Oedipodinae, occur only in areas where there is considerable bare earth. These insects are seldom found on plants, at least as adults, but squat on the ground, from which they rise from time to time in short flights, often with a crackling sound. The general color of these insects usually matches closely the color of the earth, in fact Faure (1932) demonstrated that some locusts reared on variously colored substrates changed color at molts to match the background. Isely (1938*a*) reared grasshoppers of different colors by this technique and exposed them, on plots of dark and light earth, to predation by chickens, a turkey, and native mockingbirds. His reports indicate definite survival value for background-matching coloration.

A stringent requirement for persistence of acridian populations is a suitable site for oviposition. This site is generally moist but well-drained soil; loose or sandy soil seems to meet the requirements of the greatest number of species. Some acridids regularly oviposit in cracked or decaying wood and Criddle (1930) reported that partly dried cow dung, as well as decaying wood, was used as a place of oviposition by the cow grasshopper, *Neopodismopsis abdominalis* Thos., in Manitoba. Such habits have not been recorded for California acridids although Wilson and Keifer (1941) observed egg pods of *Melanoplus marginatus* in the crowns of alfalfa. According to Parker (1957) human artifacts, for example, roadway shoulders and railway embankments, may increase the sites favorable for egg deposition. Edwards and Epp (1965) have recently presented the results of experiments on the effect of soil moisture and soil pH on oviposition by *Melanoplus sanguinipes.* Sand which is dry on the surface but moist at a depth of an inch was approximately as favored for egg deposition as sand damp throughout; dry sand was used by few females. A range of pH from 5 to 9 seemed without significance.

Overlying local ecological conditions is the effect of temperature according to latitude and altitude (Morse, 1889). In all ecological studies generalizations should be tempered by recognition of the probability that a species of wide range exists as a series of physiological "races" of different requirements or tolerance. Hastings and Pepper (1964) bring out this problem in their study of populations of *Aulocara* in Montana.

In preparing a site for oviposition the female grasshopper bends her abdomen into an arc to bring the ovipositor valves to a position perpendicular to the substrate. In this action the dorsal and ventral valves are brought together and thrust into the soil, then spread apart. The scooplike form of the valves, particularly the dorsal ones, acts as a pair of miniature spades in excavating. The alternate juxtaposition and spreading of the dorsal and ventral valves is con-

tinued until a cylindrical pit much deeper than the normal length of the abdomen is dug. In this process the abdomen becomes greatly elongated.

When excavation is completed the insect slowly withdraws the abdomen while discharging eggs most often enveloped in a frothy matrix. This latter hardens into a spongy but firm capsule, enclosing the eggs. After the abdomen is finally withdrawn the ovipositor is used to close and obliterate the opening.

The number of eggs per pod or packet varies both inter- and intra-specifically. A number commonly reported is 12 to 25. Differences have also been noted in the number of pods produced by individual females. The eggs are rather large, 2.5 millimeters or more, even in small acridids, and of cylindrical form, rounded at the ends. Slifer (1938) has described a special water-absorbing area in the outer covering or chorion of the egg.

From the few observations reported, Parker (1930) and Wilson and Keifer (1941), it appears that the eggs of some grasshoppers are able to survive considerable desiccation with initiation or resumption of development when water again becomes available. The eggs may also endure quite low temperatures. Parker (1930) reported 50 percent survival of eggs from Montana populations of *Melanoplus sanguinipes*[2] and *Camnula pellucida* experimentally subjected for sixteen hours to a temperature of —25° C, and 80 percent survival after sixteen hours at —20°C. Such cold-hardiness may be, however, exceptional. Northward extension of range of some species may well be limited by winter soil temperatures.

The eggs of some acridians, for example, some *Arphia, Chortophaga, Chimarocephala* and *Xanthippus,* are deposited fairly early in the summer, develop continuously and hatch during middle or late summer. The young nymphs hibernate after a period of growth, resuming development in the spring, and reach maturity early in the year. In most species of acridids oviposition occurs in late summer or early fall, and winter is passed in the egg stage with development arrested through low temperatures, or by onset of diapause. Diapause is naturally broken by a period of low temperature. With re-elevation of temperature, development is resumed. Parker (1930) presents many provocative data on the response of grasshopper eggs to temperature. The intrinsic physiology of diapause is best approached through comprehensive works on this subject: Bodine and Robbie (1940) Slifer (1946, 1958), Bucklin (1953).

Although the rate of development of eggs is much affected by available water and temperature, there is no good evidence that any species of North American acridid regularly produces more than one generation a year. According to Rehn and Grant (1961) some tetrigids produce two broods a year, and occasionally *Melanoplus sanguinipes* will produce a second generation (Shotwell, 1941).

Hatching of the eggs occurs within the egg pod. The newly emerged acridid is wormlike in appearance and wriggles its way to the surface of the soil surrounding the egg pod. As soon as it reaches open air it sheds its surrounding envelope. According to Carothers (1923) the shed pellicle is a true cuticle and not an embryonic membrane, as some observers have conjectured. With this first molt the characteristic acridian appearance is evident and little altered in subsequent development except for the development of wings in most species and a relative decrease in head size at maturity. Nymphal development comprises five or six instars. In some species, at least, a definite interval has been noted between attainment of structural maturity and the onset of fertility. Wilson and Keifer (1941) record this as eighteen days for *Melanoplus marginatus.* A much longer period in the case of *Melanoplus devastator* has been reported by Middlekauff (1964). Wilson and Keifer (1941) give a detailed and illustrated account of the life history of *M. marginatus.* It seems to be typical of acridian biology.

In many terrestrial ecosystems grasshoppers constitute an important agent in the transfer of energy from plants to animals. The eggs, nymphs, and adults are each subjected to a large array of both vertebrate and invertebrate predators and parasites. A recent review of the insect enemies of the Acridoidea is given by Greathead (1963).

Localized populations may be decimated by attacks of predators (Middlekauff, 1959), parasites or infectious diseases, (Pickford and Riegert, 1964) but attempts to manipulate these agents to reduce populations of undesirable grasshoppers have not met with notable success. Climatic factors may significantly affect grasshopper numbers. Outbreaks are frequently noted following a series of years of below-normal rainfall and conversely a period of rainy and

[2] From Gurney's (1962) taxonomic studies it appears that the name *Melanoplus sanguinipes* (Fabr.) should be used for the insect reported in the past as *M. mexicanus, M. atlanis* or *M. bilituratus. M. mexicanus* (Saussure) has a very limited range in the United States.

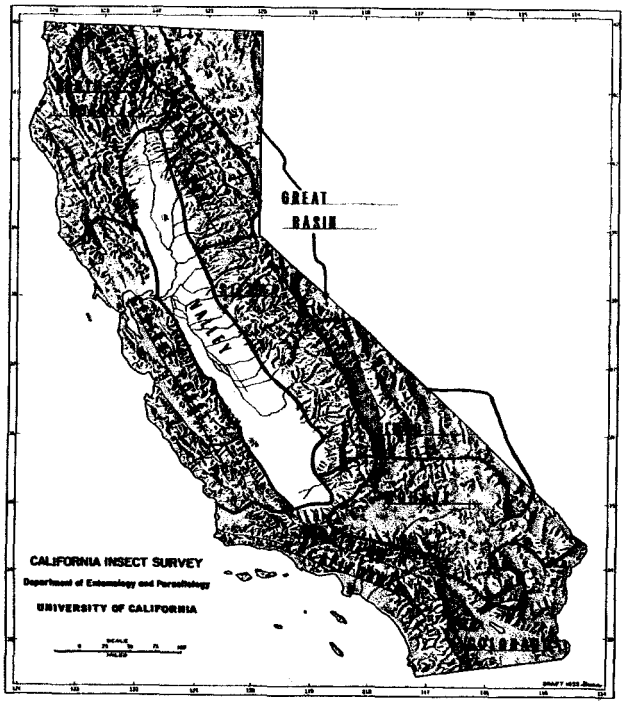
humid weather may result in a rapid population decline.

DISTRIBUTION

The political boundaries of California enclose a great diversity of climatic and topographic features, which is reflected in a rich and diverse flora and fauna, as is particularly shown in our grasshoppers.

The characteristics of the California insect fauna were pictured by Van Dyke (1919) largely from consideration of the Coleoptera, and more recently Rehn (1958) presented a discussion of the affinities and reputed centers of origin of the orthopterous genera of western North America. On the basis of Rehn's study we may construct a brief sketch of the distributional patterns of California Acridoidea.

For this sketch the floristic subdivisions of California drawn by Stebbins and Major (1965), map 1, serve better than the broader concepts of Van Dyke, but there are no real contradictions between the two. Combining the Colorado and Mohave subdivisions of Stebbins and Major into a Sonoran, after Van Dyke and others, is sometimes convenient since there are only three endemic grasshoppers in the Colorado and one in the Mohave within California, while thirty or more species range over both areas.



Map 1. Subdivisions of the California floristic province. Redrawn from Stebbins and Major (1965).

The Sonoran area of the state extends across our border into adjacent Nevada, Arizona, and Mexico, permitting a number of xeric species to range widely. While only *Spaniacris deserticola* and the eumastacids *Psychomastax deserticola deserticola* and *P. psylla psylla* are endemics, a number of other grasshopper species are typical of this area, but not confined to it alone. *Anconia integra, Ligurotettix coquilletti, Xeracris minimus, Coniana snowi, Tytthotyle maculata, Mohavacris timberlakei* and *Tanaocerus koebelei* are some of the characteristic Sonoran desert grasshoppers. As shown in table 1 the Mohave area has a richer grasshopper fauna than does the Colorado, some fifty-six species occurring within our border in this area while only forty-three are reported from the Colorado.

While not as rich as the North and Central Coast areas, the Inyo and adjacent Sierra subdivisions are notable for endemic and undoubtedly autochthonous genera and species of high altitudes. The localized species of the melanopline genera *Agnostokasia, Hebardacris,* and *Hypsalonia* are flightless forms and probably represent post-Pleistocene evolution in situ, especially the three species of *Hebardacris* and the six of *Hypsalonia. Xanthippus sierra* is a high- altitude species of a genus having a wide distribution in the Great Basin and Plains. *Melanoplus eremitus* and *M. ablutus* of the Immunis Group; *M. lepidus,* a disjunct member of the Saltator Group; and *M. rileyanus* and *M. platycercus* of the Rileyanus Group are all montane species found at somewhat lower elevations. Endemic species found in the Inyo region are: *Agnostokasia sublima, Dracotettix plutonius, Hypsalonia petasata, Melanoplus platycercus, Parapomala calamus, Psychomastax psylla inyo,* and *Xanthippus sierra.*

The north-south valleys of this region, with their characteristic sagebrush scrub, have allowed some migrations in both directions between California and the Great Basin and also into the adjacent Mohave. The species *Xanthippus olancha* is clearly derived from Great Basin *Xanthippus.* A collateral or possibly annectant form, *X. corallipes miniatus,* occurs in the White and Panamint Mountains, and the Sierra Nevada.

The North Sierra-Cascade shows little endemism. *Asemoplus sierranus,* an element of a rather widely distributed genus, and *Bradynotes obesa opima* are probably autochthons of recent derivation. *Hypsalonia merga* and *H. satur* are high-montane species with their congeners in similar habitats to the south

in the Sierra-Inyo areas. Two species of *Melanoplus, M. ascensus ascensus* and *M. lepidus,* are also endemic here.

The North Coast subdivision contains a number of endemic species which appear to be of no great age, perhaps late Pleistocene in origin. Notable is the speciation in the genus *Melanoplus;* ten species of this group *(buxtoni, caroli, chimariki, elaphrus, elater, harperi, hupah, keiferi, lithophilus,* and *siskiyou)* being confined solely to this area. It is likely that of the above *M. harperi, M. chimariki,* and *M. keiferi* are of earlier divergence.

Napaia dianae, a derivative of a holarctic group, ranges through the North Coast and overlaps a congener *(gracilis)* in the San Francisco area. Along coastal dunes *Trimerotropis helferi* is found, and in the northern Coast Range at an elevation of 5000 feet is the localized *Aerochoreutes stenometopus,* apparently isolated by the Sacramento Valley from its Great Basin congener *A. carlinianus.* The recently described subgenus *Karokia* of *Boonacris,* an element of a group of Holarctic distribution, is so distinctive that Gurney (in litt.) proposes that it be given generic status. All endemics of the North Coast subdivision may be regarded as autochthonous.

The Central Coast subdivision, an area also rich in endemics, includes the areas occupied by *Trimerotropis coquilletti, Esselenia vanduzeei violae,* and the monotypic *Microtes occidentalis.* The first of these is probably a relict from an old fauna, and *Microtes* may be an extant representative of acridid types ancestral to *Dissosteira* and *Spharagemon.* The genus *Chimarocephala,* established on both sides of the valley and southward into San Diego County, may have evolved its modern features in this region. It appears to be nearer the ancestral stirps than do the related genera *Chortophaga, Encoptolophus,* and *Arphia.* Panoche, San Benito County, is the southwestern limit of the range of the widely distributed *Agymnastus ingens,* a derivative of *Xanthippus* stock. The lubberly, flightless (at least in the coastal areas) females of *Agymnastus* characteristic of these coastal populations may have been an evolutionary response to insular or peninsular conditions in past times. Eight species of *Melanoplus,* all in the Marginatus Group, are found only in the Central Coast subdivision. These are *M. fricki, M. fultoni, M. hesperus, M. ligneolus, M. microtatus, M. muricolor, M. nanus,* and *M. sonomaensis.* The remarkable speciation in this apparently primitive group of *Melanoplus* may be considered evidence of the existence of an archipelago in this region in the late Pliocene and early Pleistocene. Eardley (1951) theorized such a stage in the history of the area on geological evidence. *Aeoloplides fratercula* of the Central Coast is not strongly differentiated from its southern congener *A. fuscipes.* The presence of *Morsea* and *Dracotettix* is likely the result of a rather late northward intrusion of these forms, and the same explanation may be postulated for the occurrence here of *Trimerotropis thalassica* and *Psoloessa thamnogaea. Dissosteira pictipennis* may have reached its present evolutionary phase in this region but its present great latitudinal distribution makes any guess as to its region of origin hazardous.

The Southern California subdivision, essentially the Californian of Van Dyke (1919), does not have a very distinctive assemblage of acridoids and the probable history of those which occur here is quite different from the account of the beetle fauna as sketched by Van Dyke. Excepting the eumastacid genera *Morsea* and *Psychomastax* and the romaleine *Dracotettix,* all acridoid genera with endemic species in the Southern California subdivision have wide distributions. *Encoptolophus, Derotmema, Cordillacris,* and *Oedaleonotus* each has one species restricted to this area, while *Melanoplus has three (M. bernardinae, M. rileyanus varicus,* and *M. wilsoni*). *Napaia gracilis, Circotettix splendidus,* and *Melanoplus bernardinae* are of northern derivation, the last two widely disjunct from related species. So far as is now known, the populations of *Napaia gracilis* in Southern California are rather broadly separated from the nearest conspecific populations in San Benito County to the north. If Gurney's placement of *Melanoplus wilsoni* in the Immunis Group is correct, its presence in San Diego County is a case of remarkable isolation.

The Valley subdivision has not been an area of evolution of Acridoidea. The forty-three species recorded from here are, with the Colorado, fewer than from any other biotic subdivision of the state, and not a single one is endemic. The impoverished flora and fauna as well as the paucity of endemics has been similarly noted in plants (Stebbins and Major, 1965), megachiline bees (Hurd and Michener, 1955), cerambycids (Linsley, 1958), and crab spiders (Schick, 1965). It is without question a reflection of the recent appearance of this area as a habitat suitable for terrestrial plants and animals. A few intrusive species, however, reach their greatest abundance here, notably *Melanoplus marginatus, M. differentialis nigricans, Dissosteira spurcata, Trimerotropis pallidi-*

pennis, T. pseudofasciata, Oedaleonotus enigma, and *Eupnigodes sierrana.*

In table 1 we have listed the genera which have one or more endemic species in California, have shown the biotic subdivision for those species in the genus which are restricted to a single floristic area, and lastly have tabulated the number of grasshoppers (Acridoidea) which have been reported from the state and from each biotic subdivision.

The North Coast and the Central Coast areas with thirteen endemic species each are followed closely by the Sierran with eleven; Southern California, eight; Inyo, seven; Cascade-North Sierra, five; Mohave, two; and the Colorado, one. Some 113 species (54 percent) of California's 211 species of Acridoidea are endemic to the state.

TABLE 1

DISTRIBUTION WITHIN CALIFORNIA OF SPECIES OF ACRIDOIDEA

		Number and Distribution of indigenous species which are confined to a single biotic subdivision in California									
	Number of endemic species	North Coast	Central Coast	Southern California	Valley	Cascade—North Sierra	Sierra	Great Basin	Inyo	Mohave	Sonoran Colorado
Genera with endemic species in California											
Aeoloplides	4		1								
Aerochoreutes	2	1									
Agnostokasia	1								1		
Agymnastus	1										
Arphia	2										
Asemoplus	1					1					
Boonacris	1	1									
Bruneria	1										
Chimarocephala	3										
Circotettix	1										
Conozoa	1										
Cordillacris	2			1							
Cratypedes	1						1				
Derotmema	2			1							
Dracotettix	2								1		
Encoptolophus	1			1							
Esselenia	2		1								
Eupnigodes	2										
Hebardacris	3						2				
Hesperotettix	2										
Hypsalonia	6					2	3		1		
Lactista	1										
Melanoplus	36	10	8	3		2	3		1		
Microtes	1		1								
Mohavacris	1										
Morsea	2		1	1							
Napaia	2										
Oedaleonotus	5			1							
Paropomala	1								1		
Psychomastax	3								1	2	
Spaniacris	1										1
Sticthippus	1										
Tetrix	2						2				
Trepidulus	1										
Trimerotropis	12	1	1								
Xanthippus	3								1		
Total number of endemics	113	13	13	8	0	5	11	0	7	2	1
Total number of species & subspecies in each subdivision		54	77	90	43	50	79	52	78	56	43

MORPHOLOGY

We are concerned here with the problems of specific identification, and these rest to an appreciable extent upon the morphology of the adults. Features commonly used in taxonomic studies are as follows (figs. I–IX):

Head—Hypognathous type (fig. I). The dorsal area between and in front of the eyes is the *fastigium* of the vertex (fig. I, f), and may be convex, plane or concave. On each side of the fastigium, in front of the eye, is a lateral *foveola* (fig. I, fov), which is a flattened or depressed area. These are sometimes obsolete. The *frontal costa* (fig. II, fc) is a broad, elevated strip on the face, often grooved, with its lateral carinae continuous above with the ridges of the fastigium. The median ocellus (fig. II, mo) is located on the frontal costa.

Pronotum—The dorsal shield of the prothorax, commonly extended backward as a lobe or triangular process; over the wing bases and extending to or beyond the tip of the abdomen in the tetrigids. Laterally the pronotum extends downward as a lateral lobe (fig. I, ll). The pronotum usually shows a *median carina* (fig. I, mc) and *lateral carinae* (fig. I, lc) of variable development. In most acridoids a transverse groove crosses the pronotum, and is continued down the lateral lobes, dividing the pronotum into an anterior *prozona* (fig. I, pz) and posterior *metazona* (fig. I, mz). This groove is the principal sulcus. In front of this another transverse sulcus may divide the prozone into *anterior* and *posterior lobes.* In some of the spur-throated locusts a third

transverse sulcus may be present. The principal sulcus is always hindmost. The posterior lobe of the prozona may have on each side a C-shaped ridge. This condition is known as *scutellate*.

Sterna—The metasternum has a pair of deep pits. The area between the pits has been called the *metasternal interspace* (fig. III, mtf). On each side of this is a *metasternal lobe* (fig. III, mtl).

Wings—Two pair of wings are usually present, the leathery mesothoracic pair are referred to as the *tegmina* (singular, *tegmen)* fig. IX. In some genera of Acridinae use has been made of the venation, especially the presence and features of the *intercalary vein* (fig. IX, i.v.), a spurious vein between the median (media) and ulnar (cubitus) veins. The term *wing* will be reserved for the metathoracic wing, characterized by a fanlike expansion of the anal area, which has several *radiate veins*. In some species of acridoids the tegmina and wings may be much reduced or entirely absent. Adults of species with vestigial wings may be distinguished from nymphs of alate species by observing that the vestigial tegmen is leathery and closely appressed to the body, whereas the developing tegmina and wings have an approximately perpendicular position and are soft. Additional indications of mature specimens are the rigidity of the exoskeleton and the "finished" structure of the male subgenital plate and female ovipositor.

Abdomen—This offers few features of taxonomic worth. In the Eumastacidae, Tanaoceridae and Tetrigidae the pleural membrane is extensive and the spiracles are located in it. In the Acrididae, extension of sclerotization ventrad encloses the spiracles in the tergites. The ninth sternite in the male is more or less upturned around the end of the abdomen as the *subgenital plate* (fig. VI, sg); its most distal portion is carried to a dorsal position and reflexed as the *pallium* over the retracted phallus. The last tergite is a triangular plate, the *epiproct* (fig. VI, ep) or supra-anal plate. On each side of its base is a *cercus* (fig. VI, c), which shows specific forms in some genera. The tenth tergite may bear a pair of short to long projections which together form the *furcula*. Roberts (1941) has suggested that for brevity of reference each process be called a furcula.

Hubbell (1932) and Eades (1961) show that the structure of the phallus may give clear indications of specific differences in the genus *Melanoplus*, and this taxonomic technique has been found useful in some other groups, but cannot be universally applied.

The entire phallus may be quickly extruded from fresh or thoroughly relaxed male specimens by pushing back the pallium from the tip of the aedeagus and inserting a No. 3 pin downward and forward under the epiproct to engage the front of the phallus. Caudad pressure on the pin, with some lifting force, will cause the entire phallus to move backward and upward. It may be left to dry in this position, or torn loose and treated with 10 percent KOH solution until fully inflated (in the case of specimens which were previously dry). Alkali treatment is followed by washing in 10 percent alcohol, during which time softened bits of muscle may be carefully removed from the preparation. The phallus is finally saturated with glycerol and stored in a microvial. Gurney et al. (1964) have recently offered some useful suggestions on this technique. The phallus, extruded and dried in situ, may be adequately inflated by the liberal application of 10–15 percent ammonium hydroxide, applied with a watercolor brush.

The distal extremity of the phallus, which projects dorsally, is the *aedeagus* (fig. VII–VIII), composed of two pairs of valves, one pair dorsal (fig. VII, dv) (anterior), the other pair ventral (fig. VII, vv) (posterior). Dorsally on its base the phallus bears two pairs of sclerites, the *epiphallus*. Roberts (1941) designates the anterior, hooklike sclerites the *ancorae* (fig. VI, an) and the posterior upright plates the *lophi* (fig. VI, lo). Ancorae and lophi may be connected by a membrane as in the Acridinae, or fused into one sclerotized structure as in the Cyrtacanthacridinae. Eades (1961) introduced some modifications in the nomenclature of the phallus, and especially of the aedeagus.

Features of the female subgenital plate and ovipositor may be taxonomically useful but have been little employed.

Legs—The only terms which need definition are those referring to the armament of the hind tibiae. The dorsal or extensor surface of the hind tibia (fig. V) bears two rows of fixed *spines*. Distally the tibia is equipped with large spurs or *calcars* (figs. IV and V) which are articulated at the bases. The upper one is designated the *dorsal internal calcar* (dic) and the lower one the *ventral internal calcar* (vic). The *metatarsus* (fig. V, t) is the proximal tarsomere.

The *distal external spine* (fig. V, es) is generally present in the subfamily Romaleinae, but is absent in our endemic genus *Spaniacris*, and in the subfamily Cyrtacanthacridinae.

FIGURES I - IX

Morphological details of several species of grasshoppers illustrating structures used in keys.

Fig. I *Chimarocephala californica* (Bruner) male, head and pronotum, dorsal view; (f) fastigium; (fov) foveola; (lc) lateral carina; (ll) lateral lobe; (lo) lateral ocellus; (mc) median carina; (mz) metazona.

Fig. II *C. californica* (Bruner) male, front view of head; (a) antenna; (cl) clypeus; (fc) frontal costa; (lb) labrum; (lo) lateral ocellus; (mo) median ocellus.

Fig. III *C. californica* (Bruner) male, meso- and meta-sternum; (ms) mesosternum; (msi) mesosternal interspace; (msl) mesosternal lobe; (mtf) metasternal foramen; (mtl) metasternal lobe.

Fig. IV *Ageneotettix deorum* (Sc.), inner face of the apex of metatibia; (dic) dorsal internal calcar; (vic) ventral internal calcar.

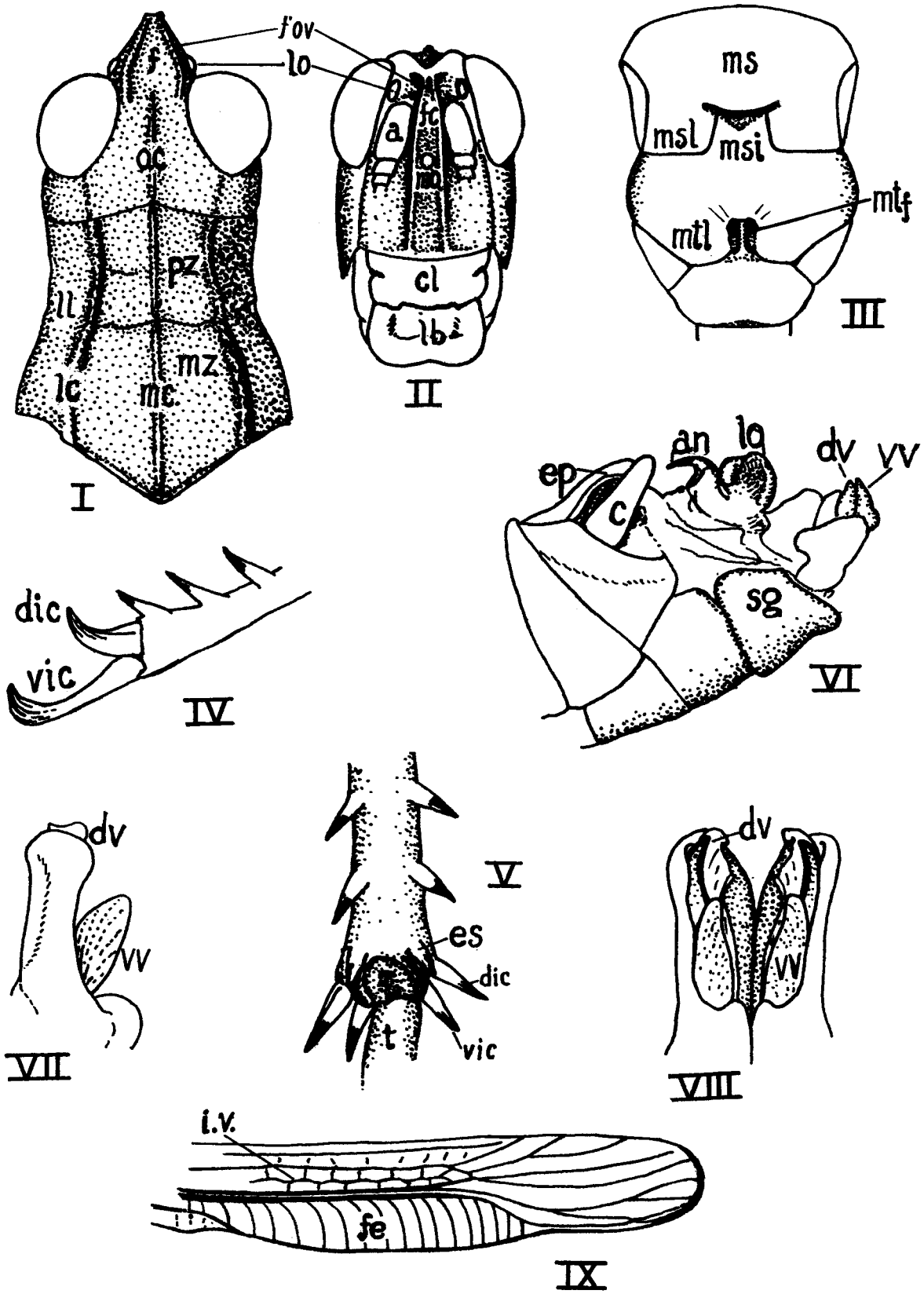
Fig. V *Dracotettix monstrosus* Bruner, dorsal view of apex of hind tibia; (ca) calcars; (es) distal external spine; (t) metatarsus.

Fig. VI *Agymnastus ingens* (Sc.), male, left side of apex of abdomen with phallus exserted; (an) ancora; (c) cercus; (dv) dorsal valve of aedeagus; (ep) epiproct; (lo) lophus; (sg) subgenital plate; (vv) ventral valve of aedeagus.

Fig. VII *Melanoplus yarrowii* (Thos.), male, left lateral view of aedeagus, dried preparation; (dv) dorsal valve; (vv) ventral valve.

Fig. VIII *Melanoplus yarrowii* (Thos.), male, caudal view of aedeagus, dried preparation; (dv) dorsal valve; (vv) ventral valve.

Fig. IX *Ligurotettix coquilletti* McNeill, male, left tegmen, in repose; (fe) fenestrate costal area.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IX

PRESERVATION OF SPECIMENS

The best museum specimens, which will give most satisfaction to the collector and be most useful to science, are obtained by using special techniques. Mere killing and pinning is often not sufficient to assure good specimens, and grasshoppers so treated, especially those with large, heavy bodies, usually darken and frequently will rot.

There is no method of killing specimens intended for standard taxonomic study that equals the cyanide bottle. Ethyl acetate tends to cause color changes, and evaporates too quickly. Chloroform and carbon tetrachloride induce muscular tetany, often resulting in detachment and loss of hind legs.

Rapid drying is essential in the preparation of good museum specimens.

Large specimens such as most females of Romaleinae and Cyrtacanthacridinae should be eviscerated soon after killing. This is accomplished by either cutting a transverse slit in the dorsum of the cervix (neck) and with fine forceps carefully lifting out the midgut, or by cutting a longitudinal slit in the abdomen and similarly removing the contents. A loose wad of cotton can then be inserted.

A method of preservation developed by Dr. Julio A. Rosas-Costa of Buenos Aires, and put into successful practice by Prof. Carlos Carbonell of Montevideo, consists of a mixture of three parts of talc and one part of boric acid powders placed into the body after evisceration. One of us (Rentz) has found it quite useful in helping to preserve color and promoting quick drying. It requires a bit more time but the results are well worth the effort.

Teneral or soft-bodied adults and nymphs may be preserved by an ether-immersion technique described by Rentz (1962*a*).

As soon as specimens are prepared by any of the above techniques, they should be dried quickly. This can be done easily and rapidly in the laboratory with minimal color loss by using an infrared lamp placed a safe distance (about 12 inches) away from the specimens, being careful not to overheat.

On extensive field trips, specimens should be eviscerated, prepared with powder and cotton, and placed in layers of cellucotton in cigar boxes or other suitable containers. The boxes can be placed in the sun or on the warm hood of an automobile for drying.

Dried unpinned specimens may be subsequently softened in a humidity chamber and then pinned. Arrangement of the legs and antennae close to the body on styrofoam or polyethylene foam is desirable since it saves storage space and helps prevent breakage.

ACKNOWLEDGMENTS

Some years ago the late Morgan Hebard placed paratypes of some California acridid species of his authorship and other identified western material in the collection of the senior author. These have been useful in the present study. The late J.A.G. Rehn and his associate and successor, the late H. J. Grant, Jr., of the Academy of Natural Sciences of Philadelphia have been generous in the loan of critical specimens. P. J. Darlington, Jr., and W. L. Brown, Jr., have sent for study, material from the Scudder Collection at Harvard. Access to types of species described by Saussure was provided by Max Beier of Vienna and H. Gisn of Geneva, and to the monotype of *Oedaleonotus borckii* (Stal) by Per Inge Persson of Stockholm.

Many unusual California acridids have been made available by G.M. Buxton of the State Department of Agriculture and by J. R. Helfer of Mendocino. T. H. Hubbell loaned material from the University of Michigan collections. Over a period of many years the senior author has received specimens of California Orthoptera from several correspondents, notably A. T. McClay, Kenneth Hagen, and Glenn Pollard.

A special debt is owed A. B. Gurney for his mediation of loans of material from the United States National Museum and, more important, for his critical examination of original material in the National Museum. In addition to these services his valued opinions on taxonomic problems have repeatedly been helpful.

We gratefully acknowledge the cooperation of the following institutions and individuals in making specimens available for our study. Abbreviations below indicate the present location of specimens seen in this study:

Academy of Natural Sciences, Philadelphia . . . . . (ANSP)

California Academy of Sciences, San Francisco . . . . . (CAS)

California Department of Agriculture, Sacramento . . . . . (CDA)

California Insect Survey, University of California, Berkeley . . . . . (CIS)

David C. Rentz . . . . . (DCR)

James D. Birchim, Independence, California . . . . . (JDB)

University of California, Davis . . . . (UCD)

University of Michigan, Museum of Zoology, Ann Arbor . . . . . (UMMZ)

San Jose State College, San Jose, California . . . . . (SJSC)

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SYSTEMATIC TREATMENT

Superfamily ACRIDOIDEA

THE FAMILIES Tetrigidae, Eumastacidae, Tanaoceridae and Acrididae constitute the superfamily Acridoidea[3]. Members of the first three families are of little or no economic concern.

Species in this assemblage of families of the so called grasshopper type have the antennae inserted near the inner margins of the eyes, nearly always with more than twelve segments; the anterior legs are of the ambulatory type; the cerci are composed of a single segment; the ovipositor of the female is formed by two pairs of opposed valves, and the hind tarsi are composed of three segments.

Measurements given under the species diagnosis are in millimeters and were made from single specimens selected as typical; the first number of each couplet is for the male, the second for the female, for example, "Body 15–20." The length of the body can vary widely, especially in females, when maturation of eggs results in distension and extension of the abdomen. Non-gravid females were selected for measurement.

KEY TO CALIFORNIA FAMILIES AND SUBFAMILIES OF THE ACRIDOIDEA

1 Pronotum covering entire abdomen; front and middle tarsi two-jointed; small (body 10 mm.) . Tetrigidae (p. 13)
Pronotum not as above; all tarsi three-jointed . . 2

2 Abdominal spiracles in pleural membrane; often invisible in dried specimens 3
Abdominal spiracles enclosed in tergites . . . Acrididae 4

3 Antennae shorter than front femur . . . . Eumastacidae (p. 15)
Antennae elongate, filamentous . . . . . Tanaoceridae (p. 19)

4 Apex of hind tibiae with paired dorsal spines . Romaleinae (p. 22)
Apical spine lacking in outer row of spines on hind tibiae . . . . . , ... 5

5 Frontal costa abruptly lower at median ocellus, and hardly evident below it; clypeus protuberant, face almost vertical; head deep, occiput elevated; pronotum sellate; thoracic pleura strigosely pitted . Romaleinae (p. 22)
Without above combination of features 6

6 Antenae very broad and much flattened basally, acute at apex, ensiform; face strongly oblique; elongate, slender forms 7
Antennae, if flattened, not very broad; face rather strongly oblique in *Bootettix* and *Horesidotes*, usually not so slender 8

7 Fastigium with median sulcus; lateral foveolae absent, the lateral ocelli visible from above; prosternum with cylindrical tubercle (marshy areas) Cyrtacanthacridinae (p. 24)
Fastigium without median sulcus; foveolae present, lateral ocelli invisible from above . Acridinae (p. 66)

8 Prosternum with a prominent process which is usually cylindric or linguiform, but acutely pyramidal in some apterous montane species . . . Crytacanthacridinae (p. 24)
Tubercle absent from prosternum, if present, broad and rounded and costal area of male tegmen broadly fenestrate, e.g., *Ligurotettix* (fig. IX) . 9

[3]According to Rehn and Grant (1961). Dirsh (1961), however, considers the Tetrigidae as a distinct superfamily.

9 Antennae usually flattened, much broader basally than distally; face oblique; hind wings clear, not brightly colored; forms do not stridulate in flight but possess pegs on inner surfaces of hind femora which are rubbed against the external surface of the tegmina when at rest . . . Acridinae (p. 66)

Antennae filiform, not appreciably flattened, of nearly uniform width throughout, hind wings usually very brightly colored; forms stridulate in flight . . . . . Oedipodinae (p. 81)

Family TETRIGIDAE

Subfamily TETRIGINAE

Members of this family are commonly referred to as "grouse or pygmy locusts," the first generic name used for any of them being *Tetrix*, a Greek word which refers to a species of grouse. They are among the smallest of the grasshoppers or locusts and thus derive their other common name, pygmy locusts. Few of them attain a length of an inch. While apparently very old as a group, there is very little in the way of a fossil record.

One of the most characteristic features of this family is the long and tapering pronotum which extends backwards to (brachypronotal), or exceeds the apex of the abdomen (macropronotal). The prosternum is extended forward as a chin plate covering the mouth. The tegmina are represented by small, scalelike plates at the base of the well-developed wings.

These extremely active acridids occupy a variety of habitats, but are nearly always associated with damp situations or water where they feed on fungi, algae, mosses, lichens, grasses, seeds and other organic matter. Species living around water may swim and dive with alacrity. They are often colored to match their environment and are frequently difficult to see. The adults hibernate and may live for two or more years. Eggs are laid in the spring and at least some species have been reported to be parthenogenetic.

The family consists of approximately two hundred genera and one thousand species, which in distribution cover almost the entire world except the Arctic and Antarctic regions (Rehn and Grant, 1961). Only two genera and five species are found in California.

KEY TO THE CALIFORNIA GENERA AND SPECIES OF TETRIGIDAE

1 Fastigium from dorsal aspect broad, wider than width of eye, extended forward beyond the eyes, its front margin convex . . . *Tetrix* 2 (p. 14)

Fastigium from dorsal aspect narrow, no wider than width of eye, not extending forward beyond the eyes, its front margin truncate. *Paratettix* 4 (p. 13)

2 Front margin of fastigium roundly convex (fig. 3); frontal costa strongly sinuate in profile (fig. 4) . *ornata insolens* Rehn & Grant (p. 15)

Front margin of fastigium obtuse-angulate (figs. 1,5); frontal costa feebly sinuate in profile (figs. 2,6) 3

3 Transverse carina of fastigium when viewed dorsally broadly interrupted by median carina of vertex; median carina of vertix advanced beyond transverse facial carina; tegmen small, less than 2/3 as long as middle femur . . . . *Tetrix sierrana* Rehn & Grant (p. 15)

Transverse carina of fastigium when viewed dorsally almost entire, only slightly interrupted by the median carina of vertex; median carina of vertex not advanced beyond transverse facial carina; tegmen at least as long as middle femur . *Tetrix subulata* (Linnaeus) (p. 15)

4 Lower margin of middle femur distinctly lobed (fig. 9 . . . *Paratettix mexicanus* (Saussure) (p. 14)

Lower margin of middle femur at most undulate . *Paratettix aztecus* (Saussure) (p. 13)

Genus *Paratettix* Bolivar, 1887

The genus *Paratettix* is probably the most widely distributed and certainly one of the most plastic members of the family. It is found in most areas where tetrigids are encountered. Our two species, *aztecus* and *mexicanus*, are widely distributed and both have numerous synonyms due to color and morphological diversity.

Paratettix aztecus (Saussure)
(Fig. 7)

Tettix azteca Saussure, 1861, Rev. et Magas. de Zool., (2) 13:400. Lectotype ♀, Rehn & Grant 1957, "Mexico calidad" = Potrero, Mexico, selected locality of lectotype.

Synonyms.—Paratettix fallax I. Bolivar, 1887:272, 282; *Paratettix aztecus* I. Bolivar, 1887:272; *Paratettix hesperus* Morse, 1899:198; *Telmatettix parviverticis* Hancock, 1902: 128, 130; *Telmatettix aridus* Hancock, 1902:39, 129, 133; *Telmatotettix parviverticis* Hancock 1902:39, 128, 130; *Telmatettix minutus* Hancock, 1902:134–135; *Telmatettix minutus rugosus* Hancock, 1902:135.

Brown or, more often, almost black, the lower portion of lateral lobes of pronotum often strikingly pale. Median carina low throughout, not at all cristate.

Total length 9–14.

Geographic range.—From Puget Sound area, Snake and Columbia rivers in Washington, western Idaho, southward over most of California to Arizona, and southern New Mexico, broadly across Texas to its east-central portion, south, central and eastern Oklahoma and Crawford County in western Arkansas. To the south of the United States it extends broadly over Mexico as far south as Panama.

California records.—ALAMEDA Co.: Mines Rd., VII–11–59 D. C. Rentz, DCR). EL DORADO Co.: Caldor, on Dogtown Creek, VIII–1–64 (D. C. & K. A. Rentz, DCR). INYO Co.: Darwin Flats, V–8–58 (R. M. Bohart, UCD). LAKE Co.: N. Fork Cache Creek, V–17–58 (A. E. Menke, UCD). Putah Creek, VI–23–58 (D. C. Rentz, DCR). LOS ANGELES Co.: Tanbark Flat, VI–21–56 (G. I. Stage, CIS). MARIN Co.: Phoenix Lake, IV–12–58, V–1–59 (D. C. Rentz, DCR). Alpine Lake, III–9–58 (D. C. Rentz, DCR). Bon Tempe Dam, VI–6–58 (D. C. Rentz, DCR). MENDOCINO Co.: Hopland, VII–15–57 (S. M. Fidel, CIS). Eel River, VII–26–58 (J. R. Helfer, CAS). MONTEREY Co.: 14 mi. W. Jolon, IV–2–59 (C. W. O'Brien, DCR). NAPA Co.: Samuel Springs, V–28–56 (C. A. Moore, CIS). PLUMAS Co.: Mohawk, VII–15–57 (D. C. Rentz, DCR). Near Twain, VII–3–60 (D. C. Rentz, DCR). RIVERSIDE Co.: Palm Canyon, I–12–53 (P. H. Arnaud, DCR). SAN DIEGO Co.: Palm Canyon, Borrego Valley, IV–19–57 (E. I. Schlinger, CIS). SHASTA Co.: 15 mi. N.E. Redding, VI–19–60 (D. C. Rentz, DCR). SIERRA Co.: Near Salmon Lake, VII–2–60 (D. C. Rentz, DCR). SONOMA Co.: Geyserville, IV–20–57 (S. M. Fidel, CIS). TUOLUMNE Co.: Rose Creek, V–1–60 (M. Lundgren, DCR). YOLO Co.: Davis, IV–9–57 (R. F. Schoeppner, UCD). Putah Canyon, IV–9–57 (R. H. James, UCD); IV–11–57 (W. H. Lange, UCD). Rumsey, IV–11–57 (R. F. Schoeppner, UCD).

Discussion—Generally prefers stony or gravelly situations near water. In the more southern and more montane portions of California it has two broods per year. Adults hibernate in the northern areas. Its range in California apparently includes all suitable habitats throughout the state.

Paratettix mexicanus (Saussure)

(Figs. 8, 9)

Tettix mexicana Saussure, 1861, Rev. et Magas. de Zool., (2) 13:400. Lectotype ♂, ♀ Rehn & Grant 1957, "Mexico calida" = Tampico, Tamaulipas, Mexico, selected locality of lectotypes.

Synonyms.—*Paratettix toltecus extensus* Morse, 1899:198; *Paratettix morsei* Hancock, 1902:39, 119; *Paratettix mexicanus abortus* Hancock, 1902:110, 117; *Paratettix toltecus* race *arizonus* Hancock, 1902:39, 110, 120; *Paratettix tuberculatus* Hancock, 1902:39, 110, 117; *Paratettix toltecus sonorensis* Hancock, 1902:39, 110, 121; *Paratettix robustus* Hancock, 1902:39, 110, 121; *Paratettix leuconotus* Nabours, 1914:143; *Paratettix leucothorax* Nabours, 1914:143; *Paratettix punctofemora* Nabours, 1914:143; *Paratettix luteolineatus* Nabours, 1914:143; *Paratettix rufrolineatus* Nabours, 1914:143; *Paratettix melanothorax* Nabours, 1914:143; *Paratettix luteonotatus* Nabours, 1914:143; *Paratettix nigronotatus* Nabours, 1914:143; *Paratettix cucullatus extensus* Hebard, 1935:279.

Pale to dark gray, dorsum with a pair of black crescents behind shoulders and scattered black markings. Median carina low but becoming somewhat cristate in front. Stout, usually with pronotum not extending beyond apex of body, but elongate in some specimens.

Total length 7.5–11, up to 14 in caudate females.

Geographic range.—Southward in western United States from Oregon, north-central Idaho and northwestern Wyoming, over broad areas of California except northeastern corner of Modoc and Lassen counties, parts of Nevada, Utah and Colorado, and many localities in Arizona, New Mexico, and Texas. Eastward in the Gulf region across Louisiana, southern Mississippi and Alabama, extreme southern Georgia and broadly over Florida. South of the border it extends to Panama.

California records.—ALAMEDA Co.: Niles Canyon, IV–13–57 (L. A. Sanchez, CIS). Arroyo Mocho, III–2–58 (D. Burdick, CIS). COLUSA Co.: Colusa, VIII–15–55, IX–1–55 (R. O. Schuster, CIS). FRESNO Co.: Lost Lake, 1 mi. W. Friant, VII–1–56 (R. O. Schuster, CIS). Prather, VI–29–56 (R. O. Schuster, CIS). LAKE Co.: N. Fork Cache Creek, V–17–58 (C. G. Moore & A. E. Menke, UCD). LOS ANGELES Co.: San Fransquito Canyon, VII–15–56 (G. I. Stage, CIS). MARIN Co.: Alpine Lake, VI–6–58 (D. C. Rentz, DCR). Phoenix Lake, V–1–59 (D. C. Rentz, DCR). Lake Lagunitas, IV–12–58, V–18–58, IV–27–58, XII–23–58 (D. C. Rentz, DCR). Nicasio, VII–25–59 (C. W. O'Brien, DCR). MENDOCINO Co.: Hansen, VI–10–59 (D. C. Rentz, DCR). Mill Creek Dam, E. of Ukiah, VI–9–59 (D. C. Rentz, DCR). Squaw Rock, VI–9–59 (D. C. Rentz, DCR). Yorkville, V–28–58 (J. R. Helfer, CAS). SAN BENITO Co.: Idria, VI–15–55 (P. Wygodzinsky, CIS). 11 mi. E. Gonzales, IV–15–60 (D. C. Rentz, DCR). SAN BERNARDINO Co.: Victorville, VII–25–58 (P. D. Hurd, CIS). SAN DIEGO Co.: Borrego Valley, IV–19–57 (R. M. Bohart, UCD). Borrego State Park, IV–24–55 (R. O. Schuster, UCD). SANTA CRUZ Co.: Ben Lomond, VIII–1959 (C. E. Wemmer, DCR). Mt. Hermon, IV–12–56 (D. J. Burdick, CIS). STANISLAUS Co.: Newman, IV–30–57 (C. G. Moore, CIS).

Discussion—Prefers vicinity of standing or running water or at least mucky ground. Will also be found in or around vegetation near water. It is two-brooded over all or much of southern California, especially at lower elevations.

Genus *Tetrix* Latreille, 1802

Representatives of three of the four lines of development in this genus are found in California: the Palearctic derived *subulata;* the distinctive brachypronotal *sierrana,* which is probably a relict of an ancient intrusion; and the third member *ornata insolens,* which is the California subspecies of the plastic and widespread Nearctic *ornata.* In addition to characters mentioned in the key, the genus *Tetrix* may be separated from our only other genus *Paratettix* by the lack of a scutellate frontal costa, relatively smaller eyes and greater inter-ocular width across the vertex. Neither color nor color patterns are regionally or sexually correlated, and morphological variation may be pronounced.

Tetrix ornata insolens Rehn and Grant

(Figs. 3, 4)

Tetrix ornata insolens Rehn & Grant, 1956, Proc. Acad. Nat. Sci. Phila., 108:150–152. Type ♀, Kernville, Kern Co., Calif. (CAS).

Described as deep olive-gray with fuscous blotches on head, pronotum and hind femora, the pro- and mesoforma annulate.

Total length of female 8.9.

Geographic range.—California.

California records.—(Map 2) KERN CO.: Kernville, V–25–40, grasses (C. G. Lewis, CAS). MARIPOSA CO.: Fish Camp, VIII–14–1897 (MCZ).

Discussion—The type was taken in "grasses" which is the only information available as to the preferred habitat.

Tetrix sierrana Rehn and Grant

(Figs. 5, 6)

Tetrix sierrana Rehn & Grant, 1956, Proc. Acad. Nat. Sci. Phila., 108:110–115. Type ♀, Sugar Pine, Madera Co., Calif., 4300–5000 ft. (No. 5792, ANSP).

Of varied shades of brown, dorsum with dark triangles behind shoulders and wavy dark markings. Median carina of pronotum rather strongly elevated and arched in profile.

Total length female 9.6.

Geographic range.—California.

California records.—(Map 2) MADERA CO.: Sugar Pine, VIII–24 to 31–14, 4300–5000 ft. elevation (J. C. Bradley, ANSP).

Discussion—Known only from the unique type.

Tetrix subulata (Linnaeus)

(Figs. 1, 2, Map 2)

Gryllus subulatus Linnaeus, 1761, Fauna Suecia, ed. 2:236. Type locality Sweden.

Synonyms:—*Acridium granulatum* Kirby, 1837:251; *Tettix incurvatus* Hancock, 1895:761; *Tettix luggeri* Hancock, 1899:188; *Tettix morsei* Hancock, 1899:280.

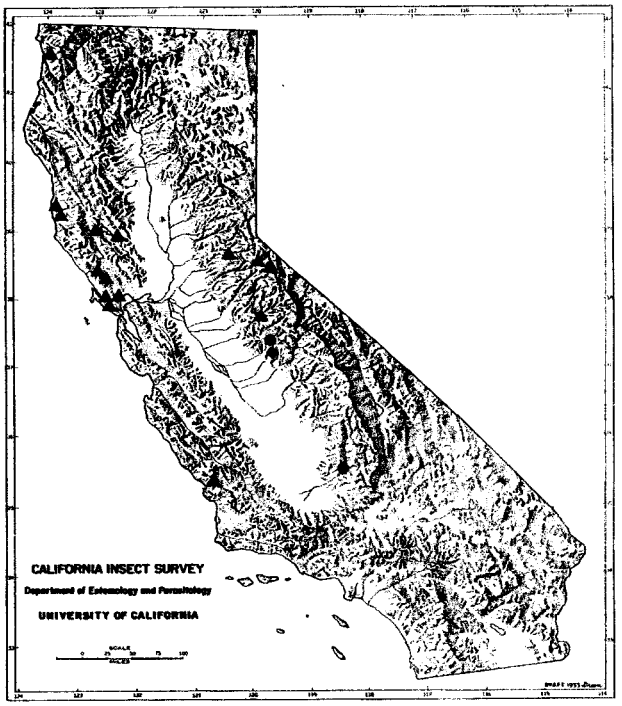
Light brown or gray to almost black, dorsum often with fine black markings. Median carina or pronotum well raised throughout, subcristate near front.

Total length 11–14.5.

Geographic range.—Most of Canada, Alaska and the United States, except for the southeastern and south central states.

California records.—(Map 2) (Rehn & Grant (1961) record *sublata* from most of the countries in the northern two-thirds of the state and at elevations up to 9000 ft.). ALPINE CO.: Luther Pass, VI–15–30 (A. T. McClay, UCD). Markleeville, V–29–57 (R. P. Allen, CIS). DEL NORTE CO.: Klamath, IV–28–38 (A. T. McClay, UCD). EL DORADO CO.: Caldor, on Dogtown Creek, VIII–1–64 (D. C. & K. A. Rentz, DCR). LAKE CO.: Clear Lake, IV–22–38 (A. T. McClay, UCD). Lakeport, IV–22–38 (A. T. McClay, UCD). MARIN CO.: Phoenix Lake, V–1–59 (D. C. Rentz, DCR). 2 mi. N. Bolinas, X–5–63 (L. B. O'Brien, DCR). 4 mi. W. Fairfax, near Alpine Lake, IV–28–63 (D. C. Rentz, DCR). MENDOCINO CO.: Mendocino, VI–24, VII–19–58 (J. R. Helfer); V–4–63 (D. C. Rentz, DCR). Fort Bragg, V–1–58 (J. R. Helfer, DCR). SAN LUIS OBISPO CO.: Atascadero, IV–23–40. SONOMA CO.: Forestville, VI–6–38 (A. T. McClay, UCD). Sebastopol, V–20–36 (A. T. McClay, UCD). TUOLUMNE CO.: Ackerson Meadow, 3 mi. S. Mather, VI–11–60 (D. C. Rentz, & C. D. MacNeill, DCR).

Discussion—Typical habitat is wet meadow.



Map 2. California distribution of: ●, *Tetrix ornata insolens* Rehn and Grant; ■, *Tetrix sierrana* Rehn and Grant; ▲, *Tetrix sublata* (Linneaus).

Family EUMASTACIDAE

The name by which these insects are commonly known is eumastacids, although entomologists have applied the name "monkey grasshoppers" because of the agility by which they move through or over the branches and twigs of brush and chaparral.

They are of relatively small size, none of our California species exceeding one inch in length. The family as now recognized is predominantly a tropical one. It is widely distributed throughout the southwestern United States, but is infrequently encountered because of the reticent habits of the insects. It is well represented in California with seven species and subspecies in two genera recorded.

The head of the eumastacids is remarkably enlarged, projecting dorsad beyond the cephalic margin of the pronotum. The 12- or 13-segmented antennae are shorter than the combined length of the head and pronotum. The male sub-genital plate is simple, the proximal abdominal tergite is without evident lateral tympanic membrane. Abdominal spiracles are situated in the latero-dorsal membrane. Females have one or more abdominal tergites preceding the epiproct with a marked medio-longitudinal fold or fissure. The mesosternum and metasternum are strongly united into a more obviously single structure than in the Acrididae. The caudal femora are without the dorso-proximal over-hanging lobe found in most acridids. The caudal tibiae have two pair of distal spurs (calcaria) and a tarsal arolium is well developed.

One of us (Rentz) has found that, like their relatives the Tanaoceridae, eumastacids are nocturnal. Large numbers of individuals may be observed and collected at night on the foliage of such plants as *Purshia tridentata, Cercocarpus* spp., *Eriogonum fasciculatum,* and *Arctostaphylos* spp., when they are active in feeding or engaging in sexual activity. Males have been observed on the extremities of such bushes where they sit until disturbed. The small numbers of specimens in collections can likely be attributed to the nocturnal habits of the various species since night collecting usually results in large collections.

KEY TO THE CALIFORNIA GENERA AND SPECIES OF EUMASTACIDAE

(Modified from Rehn and Grant, 1959)

1 Antennae with thirteen segments, node on ventral surface of segment 10; male cerci compressed, distally falcate; face in profile undulate, the fastigio-frontal angle acute. Subgenital plate of male with a recurved, median dorso-proximal sclerotized linguiform process . . *Morsea* (p. 16) (The genus consists of only one polytypic species, *M. californica.* Three of the recognized five subspecies occur in California. Their systematics are difficult. See Rehn & Grant, 1961).

Antennae with twelve segments, node on ventral surface of 9th segment; male cerci styliform; face in profile convex, the fastigio-frontal junction rectangular. Subgenital plate of male without a recurved, median dorso-proximal sclerotized linguiform process . . . . . *Psychomastax* 2

2 Hind femur of female hardly more than five times as long as its greatest width; front and middle legs stouter . *deserticola deserticola* Hebard (p. 18)

Hind femur of female six or more times as long as its greatest width; front and middle legs more slender 3

3 Frontal costa of female of almost uniform width ventrad of the paired ocelli, its margins at most feebly sinuate . *psylla psylla* Rehn & Hebard (p. 18)

Frontal costa of female of varying width ventrad of the paired ocelli, its margins plainly undulate 4

4 Antenna shorter in both sexes, sclerotized lateral portions of the subgenital plate of the male strongly narrowing to their apices dorso-mesad. (Inyo, White Mountains, eastern slope of Sierra Nevada . . *psylla inyo* Rehn & Grant (p. 18)

Antenna longer in both sexes, sclerotized lateral portions of the subgenital plate of the male broader at their lateral bases and less markedly narrowing to their apices dorso-mesad. (East side of Sierra Nevada, California; Charleston Mts., Nevada.) . . . *robusta Hebard* (p. 19)

Subfamily MORSEINAE

Genus *Morsea* Scudder, 1898

The single species included in this genus, *M. californica,* is composed of five subspecies, each one fairly well separated geographically. Three of the recognized subspecies occur in California. Individuals are small, twiglike and elusive and do not occur in large numbers in nature or in collections.

Morsea californica californica Scudder

(Map 3)

Morsea californica Scudder, 1898, Psyche, 8:179. Type ♂, Mt. Wilson, Calif., selected type locality. Rehn & Hebard 1918 (MCZ).

Morsea californica californica, Rehn & Hebard, 1918, Trans. Amer. Ent. Soc., 44:229.

Geographic range.—From the Santa Inez Mountains in Santa Barbara County, eastward to Mill Creek in the San Bernardino range, southward to the Baja California border and eastward as far as Jacumba, San Diego County.

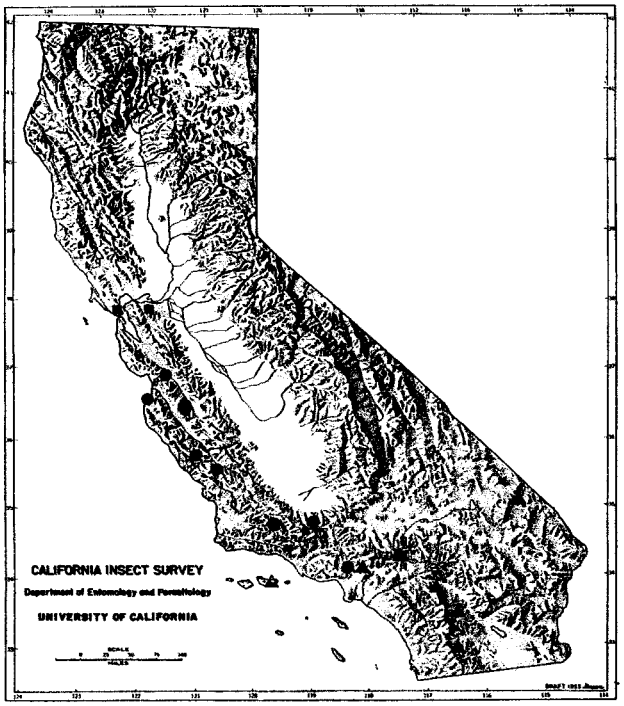
California records.—(Map 3) (Los Angeles, Riverside, San Bernardino and San Diego counties.) SAN BERNARDINO CO.: New York Mts., 6 air mi. S. Ivanpah, VIII–13–64 (J. D. Birchim, DCR). Same data (J. D. Birchim & C. D. MacNeill, CAS). LOS ANGELES CO.: Mt. Wilson, X–18–17 (E. P. Van Duzee, CAS). Tanbark Flat, VII–8–50, immatures (F. X. Williams, CAS).

Discussion—A chaparral inhabitant, nearly always taken from the exposed upper portion of the bushes in which it perches. It has been taken from chamise, *Adenostoma fasciculatum;* manzanita, *Arctostaphylos tomentosa;* ceanothus, *Ceanothus cuneatus;* mountain mahogany, *Cercocarpus betulifolia;* bitter brush, *Purshia tridentata;* and buckwheat, *Eriogonum polifolium.* It seems to prefer chamise.

It intergrades to the northwest with *M. c. tamalpaisensis* and to the northeast with *M. c. piute.*

Intermediates between *M. c. californica* and *M. c. tamalpaisensis.*—SAN BENITO CO.: Pinnacles Nat'l. Mon., Chalone

Camp, VIII–25–62 D. C. Rentz & E. W. Kirschbaum, DCR); VI–13–64 (D. C. & K. A. Rentz, DCR); IX–28–64 (J. D. Birchim, JDB).



Map 3. California distribution of: ▲, *Morsea californica californica* Scudder; ■ *Morsea californica tamalpaisensis* Rehn and Hebard; ●, intermediates between *Morsea c. californica* and *Morsea c. tamalpaisensis;* ▲ *Morsea californica* subspecies.

Morsea californica piute Rehn and Grant

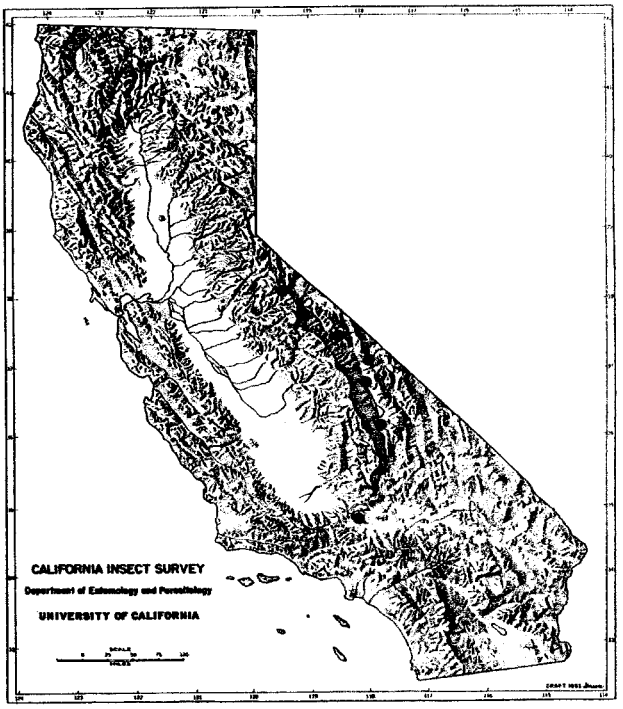
(Fig. 10, Map 4)

Morsea californica piute Rehn & Grant, 1958, Trans. Amer. Ent. Soc., 84:239. Type ♂, 1 mi. N. Current Summit, Horse Range, White Pine Co., Nev. (No. 5809, ANSP).

Geographic range.—(Map 4) This subspecies ranges from the Mono Lake region of California to Beaver County, Nevada, in the north, southwestern Utah, and south to northwestern Arizona.

California records.—(Inyo, Kern and Mono Counties.) INYO CO.: Rock Creek, 1 mi. W. Tom's Place, VIII–7–59, VIII–8–61, IX–3–64, at 15 watt black light (C. D. MacNeill, G. F. MacNeill & D. C. Rentz, CAS). Cedar Flat, Westgard Pass, VIII–21–63, 7310 ft. elevation, on flowers of *Chrysothamnus vicidiflorus* (H. B. Leech, CAS); same locality and date, swept from *Purshia glandulosa* (C. D. MacNeill, CAS). 6 mi. W. Independence, VII–25–65 (D. C. Rentz & J. D. Birchim, DCR, JDB). Westgard Pass plateau, VII–21–65 (J. D. Birchim, JDB). MONO CO.: 10 mi. N. Leevining, VIII–9–61 (D. C. Rentz, CAS). 11 mi. N. Paradise Camp, VII–17–65 (J. D. Birchim, JDB).

Discussion—The preferred host plants of this subspecies are bitterbrush, *Purshia tridentata,* and *P. glandulosa,* from which nearly all specimens have



Map. 4. California distribution of *Morsea californica piute* Rehn and Grant.

been beaten. It has also been taken on desert almond, *Prunus fasciculata,* and cliff rose, *Cowania mexicana,* and *Artemesia.* Specimens are difficult to capture during the day because of their concealment on the host shrubs. Their coloration and markings blend well with the leaflets and twigs upon which they rest. They can very rarely be seen by direct observation but can best be collected by beating. Characteristically, they perch with the hind legs relaxed in a lateral position, thus more closely resembling the tridentate appearance of the bitterbrush leaves.

Large numbers have been collected in the Owens Valley at night on bitterbrush. In areas of contact it intergrades with *M. c. californica* and *M. c. tamalpaisensis.*

Morsea californica tamalpaisensis Rehn and Hebard

Morsea californica tamalpaisensis Rehn & Hebard, 1909, Proc. Acad. Sci. Phila., 61:421. Lectotype ♂, Rehn & Hebard, 1918, Mt. Tamalpais, Marin Co., Calif.

Geographic range.—Mt. Tamalpais area, Marin County, and Mt. Diablo, Contra Costa County, California.

California records.—(Map 3) CONTRA COSTA CO.: Mt. Diablo St. Park, summit 3849 ft. elevation, VIII–14–65 (D. C. Rentz, DCR), on *Cercocarpus* at night. MARIN CO.: Mill Valley, X–3–47, X–10–47, XI–1948, IX–11–49, X–8–50,

IX–1951, IX–1953, VIII–7–55, VIII–10–58 (E. S. Ross, CAS). Mt. Tamalpais, VIII–17– , 1500 ft. elevation (R. L. Usinger, CAS). Alpine Lake, VII–25–59 (C. D. MacNeill, DCR). 5 mi. N. Alpine Lake, VIII–8–60 (E. P. Catts, DCR). Lake Lagunitas, VI–24–58, VIII–6–58, nymphs (D. C. Rentz, DCR).

Discussion—The typical form of this subspecies is known only from Mt. Tamalpais and Mt. Diablo. Intergrades with *M. c. californica* over much of the Coast Range south of the Golden Gate.

It is found mostly on chamise, *Adenostoma fasciculatum* and manzanita, *Arctostaphylos glandulosa.*

Genus *Psychomastax* Rehn and Hebard, 1918

This genus is composed of three species, two of which are very closely related. The line represented by the single species *P. psylla* is largely confined to the western and southwestern parts of the genus' range. The second line composed of *P. robusta* and *P. deserticola* is more northern in distribution. Only the Nevada subspecies *P. deserticola indigena* is absent from the California fauna. Members of this genus range from low altitude desert habitats to heights of over 11,000 feet.

Psychomastax deserticola deserticola Hebard

Psychomastax psylla deserticola Hebard, 1934, Trans. Amer. Ent. Soc., 59:364, Type ♂, Cushenbury Ranch, lower slopes of San Bernardino Mts., Calif.

Psychomastax deserticola deserticola, Rehn & Grant, 1959, Trans. Amer. Ent. Soc., 84:292.

Geographic range.—This subspecies is known only from Cushenbury Canyon in the north side of the San Bernardino Mountains, California.

California records.—(Map 6).

Discussion—Occurs only in arid environments. Has been taken from chamise, *Adenostoma fasciculatum.* Moderately high elevations (4100–5900 feet) in the lower Sonoran Life Zone.

Psychomastax psylla psylla Rehn and Hebard

Psychomastax psylla Rehn & Hebard, 1918, Trans. Amer. Ent. Soc., 44:243. Type ♂, Strawberry Valley, San Jacinto Mts., Riverside Co., Calif.

Psychomastax psylla psylla, Rehn & Grant, 1959, Trans. Amer. Ent. Soc., 84:284.

Geographic range.—Entirely within California from Riverside County in the south, northwest to the Ventura Mountains, and east to the San Jacinto and San Bernardino Mountains.

California records.—(Map 5).

Discussion—*P. psylla psylla* intergrades with *P. p. inyo* to the north in the Panamint Range, Inyo County. Typical *P. p. psylla* ranges from 3800 to 8300 feet in Upper Sonoran and Transition Life Zones.

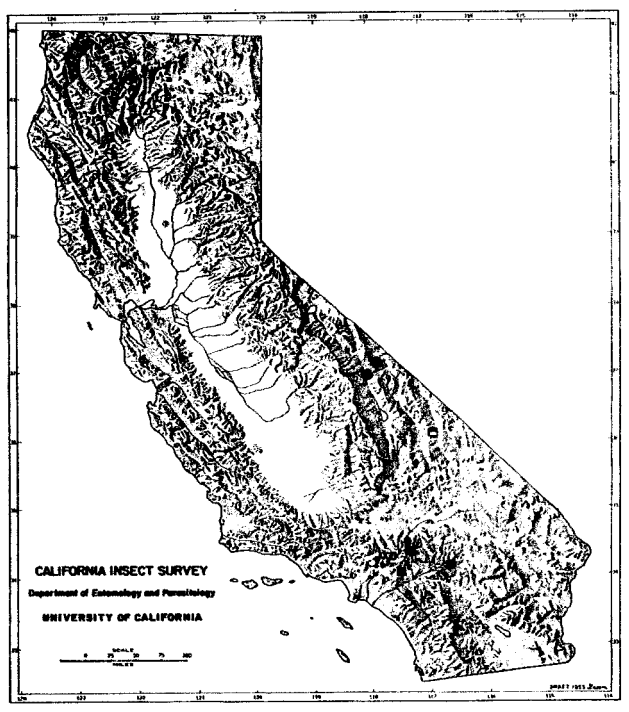
It is usually found in brush under open cover or forest. It has been taken under juniper, pinyon, sugar pine, incense cedar, and Douglas fir. In these situations the associated brush has been sage, bitterbrush, manzanita, chinquapin, and other low bushes.

Psychomastax psylla inyo Rehn and Grant

Psychomastax psylla inyo Rehn & Grant, 1959, Trans. Amer. Ent. Soc., 84:288. Type ♂, near Goat Spring, White Mts. Inyo Co., Calif.

Geographic range.—The known distribution is based upon the localities on the west slope of the White Mountains section of the White-Inyo Range bordering Owens Valley and on the east slopes of the southern Sierra Nevada.

California records.—(Map 5) INYO CO.: Sage Flat Camp, 10 mi. W. Big Pine, VII–20–64, on blossoms of *Eriogonum fasciculatum,* at night (D. C. Rentz, DCR). Westgard Pass, VII–26–62, 7200 ft. elevation, on blossoms of *Eriogonum fasciculatum* (D. C. Rentz, CAS). 11 mi. W. Lone Pine, VII–22–64 (D. C. & K. A. Rentz, DCR); VII–22–65 (D. C. Rentz & J. D. Birchim, DCR, JDB). 6 mi. W. Independence, VII–22–65 (D. C. Rentz & J. D. Birchim, DCR, JDB).



Map 5. California distribution of: ■, *Ssychomastax psylla spylla* Rehn and Hebard; ●, *Psychomastax spylla inyo* Rehn and Grant; ◪. intermediates between *Ssychomastax p. psylla* and *Psychomastax p. inyo.*

Discussion—Has been taken in wild gooseberry bushes, *Ribes* sp., and among bristle cone pines, *Pinus aristata,* on a bare, shale slope at high altitudes, 9500 feet or over.

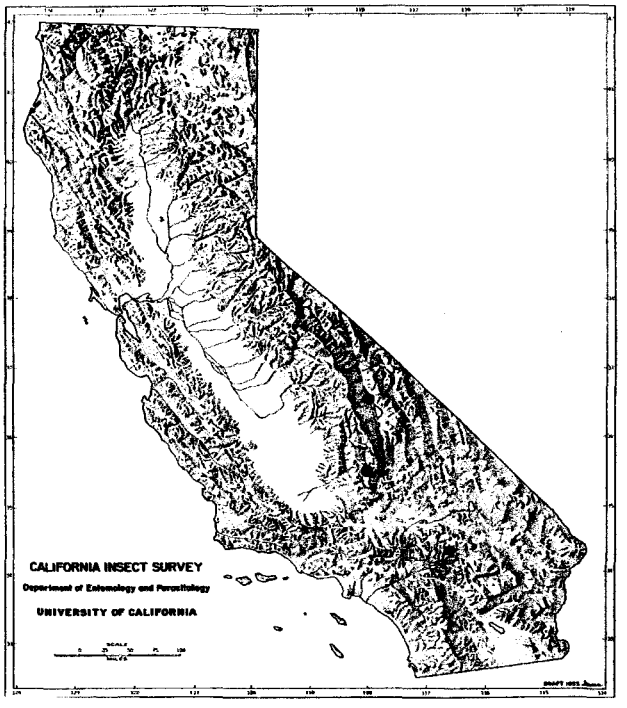
Psychomastax robusta Hebard

Psychomastax psylla robusta Hebard, 1934, Trans. Amer. Ent. Soc., 59:364. Type ♂, Charleston Peak, Nev.

Psychomastax robusta, Rehn & Grant, 1959, Trans. Amer. Ent. Soc., 84:289.

Geographic range.—Restricted to the east side of the southern Sierra Nevada around Mt. Whitney and in the adjacent Spring Mountains of Nevada.

California records.—(Map 6) INYO CO.: 11 mi. W. Lone Pine, VII–6–61, VII–22–64, on blossoms of *Eriogonum fasciculatum,* at night (D. C. Rentz, DCR, CAS). 9 mi. N. Lone Pine, VII–9–61, on blossoms of *Eriogonum fasciculatum,* at night (D. C. Rentz, CAS). 9 mi. W. Lone Pine, VII–23–64 (J. D. Birchim, JDB). Bristlecone Pines Rd., VIII–25–65 (J. D. Birchim, JDB). 11 mi. W. Lone Pine, VII–3–65 (J. D. Birchim, JDB). TULARE CO.: Cedar Grove, IX–10–55 (S. Elems, DCR).



Map 6. California distribution of: ■, Psychomastax deserticola deserticola Hebard; ●, Psychomastax robusta Hebard.

Discussion—Has been taken from juniper, pinyon, wild gooseberries, and mountain mahogany, *Cercocarpus ledifolius,* as well as on bare ground. The over story was composed of *Pinus aristata, P. ponderosa,* and *P. balfouriana.* Rentz has found them on the flowers of wild buckwheat, *Eriogonum,* at night. At very high altitudes (10,700 feet) it has been taken on granite gravel and on boulders.

Family TANAOCERIDAE

desert long-horned grasshoppers

Members of this family, which were recently removed from the Eumastacidae (Dirsh, 1955) appear as adults early in spring and are seldom encountered by daytime collectors. They are remarkably agile, especially the males.

They are of medium size, the male moderately elongate, the female relatively robust. They differ from the Acrididae in that the frontal costa consists of a single carina ventrad of the median ocellus, suggestive of the Tetrigidae in that respect. The antennae are slightly longer than the body (males), or slightly shorter (females). Wings are completely absent. The stridulatory ridge is located on the side of the third abdominal segment and on the lower internal basal margin of the hind femur. The hind tibiae have the external apical spine present, as in the Romaleinae. Because of the presence of this external apical spine, the group was considered to belong to the Romaleinae. Recent research on the male and female internal genitalia, however, has clarified some of the complexities of many of these aberrant species. The subgenital plate of the male is composed of two or three sclerotic plates connected by a membrane.

According to Rehn and Grant (1961) the tanaocerids are an endemic North American family restricted to the southwestern United States and northern Baja California, Mexico. The family is known from the states of Utah, Nevada, Arizona and California. It is found only in the Upper and Lower Sonoran Life Zones.

Like so many so-called rarities, once the habitat or proper time of occurrence is discovered, many specimens can be collected. In the course of collecting desert decticids, one of us (Rentz) has discovered that the tanaocerids, like the eumastacids, are nocturnal. Collecting trips to the Mojave Desert during the late winter and early spring have resulted in obtaining relatively large numbers of specimens of both genera. Collecting on a warm spring night during April, 19 miles northeast of Mojave, Kern County, yielded several dozen individuals of *Tanaocerus koebelei.* The same was true a few days later in Riverside County at Pinyon Flats. Males were very

active and females, although quite sedentary on bushes and grasses, could be spotted fairly easily.

Large numbers of *Mohavacris timberlakei* were also obtained a few days later 3 miles north of Cajon Pass in San Bernardino County on *Artemisia tridentata,* also at night. The specimens were less active than the *Tanaocerus,* but diligent searching turned up one or so every half hour. Although *Tanaocerus* possesses a so-called stridulatory apparatus, the authors have not been able to hear it used for this purpose.

Grant and Rentz (1967) have recently published some notes on the biosystematics of the family.

KEY TO THE CALIFORNIA GENERA AND SPECIES OF TANAOCERIDAE

1 Dorso-median carina of pronotum rising posteriorly, forming a high, conspicuous lamellate lobe; in lateral view, first antennal segment twice as long as broad; posterior margin of pronotum not undulate . . . *Mohavacris timberlakei* Rehn (p. 20)

Dorso-median carina of pronotum absent or nearly so, not forming a posterior lamellate lobe; in lateral view first antennal segment as long as broad; posterior margin of pronotum regularly undulate . . *Tanaocerus koebelei* Bruner (p. 20)

Genus *Mohavacris* Rehn, 1948

Only one species, *timberlakei,* is known for this genus. The strong pronotal carinae and long antennae, broad at the base and tapering to a filamentous apical portion, easily distinguishes this genus from *Tanaocerus.*

Mohavacris timberlakei Rehn

Mohavacris timberlakei Rehn, 1948, Proc. Acad. Nat. Sci. Phila., 100:18. Type ♂, Highway 138, Mojave Desert, Calif., 3600 ft. (probably a few miles east of Llano, near the course of Rock Creek Wash).

The strong pronotal carinae and long antennae, broad at base and tapering to a filamentous apical portion, are distinctive.

Geographic range.—Known mostly from the southern part of the Mojave Desert in northeastern Los Angeles County and southwestern San Bernardino County. Buxton (1964) reported one specimen from Bishop, Inyo County.

California records.—(Map 7) INYO CO.: Bishop, IV–1964, in black light trap (R. Keleman, CDA). LOS ANGELES CO.: Mojave Desert, V–9–37, grass (N. F. Hardman, CIS). Desert Springs, Mojave Desert, V–19–55 (P. D. Hurd, CIS). SAN BERNARDINO CO.: 3.5 mi. N. Cajon Pass, IV–19–62 (M. Lundgren, CIS).

Discussion—This is one of the most interesting of North American Orthoptera. It has been scarce in collections but because of the discovery of its nocturnal habits, perhaps more specimens will be seen and collected and its bionomics discovered. Although Rehn and Grant (1960) indicated that the host plant was *Adenostoma,* we feel that it is a more general feeder. A large series of specimens was collected at night three miles north of Cajon Pass, San Bernardino County, on sagebrush, *Artemesia.* Individuals tended to be on the stems and branches, not on the leaves. The carination of the dorsum blended well with the rough sagebrush bark and rendered them somewhat difficult to see.

Genus *Tanaocerus* Bruner, 1906

The genus includes but two species, only one of which, *T. koebelei,* is found in California. It may be separated from its only known relative, *Mohavacris,* by the characters enumerated in the preceding key.

Tanaocerus koebelei Bruner

(Fig. 11)

Tanaocerus koebelei Bruner, 1906, Biol. Centr.-Amer., Orth., 2:192. Type ♀, Panamint Valley, Calif.

Tanaocerus koebelei koebelei, Rehn, 1948, Proc. Acad. Nat. Sci. Phila., 100:3.

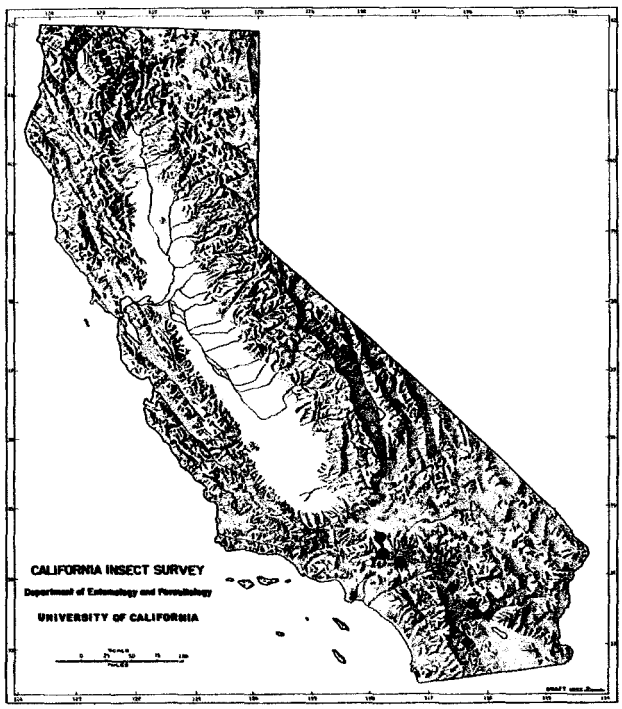
Tanaocerus koebelei albatus Rehn, 1948, Proc. Acad. Nat. Sci. Phila., 100:14.

Geographic range.—(Map 7) Extreme southwestern Utah, west to Nye County, Nevada, and Inyo County, California, southwest in eastern Kern, western San Bernardino, and eastern Los Angeles counties to Riverside County, California.

California records.—INYO CO.: Surprise Canyon, Panamint Mts., IV–24–57 (G. I. Stage, CIS). Silver Canyon Trail, White Mts., 8200 ft. elevation (J. Rehn, ANSP). RIVERSIDE CO.: Whitewater, III–9–30 (C. M. Dammers, ex: Rehn). Oasis, III–8–36 (P. H. Timberlake, ex: Rehn). San Jacinto Mts., W. Indio, IV–12–42, 3500 ft. elevation (H. R. Roberts, ANSP). Pinyon Crest, 12 mi. S.W. Palm Desert, IV–10–63 (R. L. Langston, CIS). SAN DIEGO CO.: Borrego, IV–10–52 (J. Linsley, CIS).

Discussion—Inhabits a broad range of desert environments and may be beaten from vegetation or taken on the ground. Chiefly found on *Larrea tridentata, Franseria dumosa,* and *Yucca brevifolia.* The ground surfaces it seems to prefer are shaly pebbles on gentle slopes, fine gravel or coarse sand, or smooth bare spots of moderate size with scattered grass, or under bushes.

La Rivers (1948) collected nymphs in Nevada in October, speculating that eggs hatch in August or September.



Map 7. California distribution of: ●, *Mohavacris timberlakei* Rehn; ■, *Tanaocerus koebelei* Bruner.

Adults are usually taken from February to May and quite likely overwinter. Tinkham (1947) reports having taken adults in late December. He notes that males are remarkable jumpers, difficult to follow and catch. The females are sluggish and poor jumpers.

Collecting at night yields large numbers of specimens. Large females may be readily spotted sitting a few inches to a foot above ground level, on small bushes or grasses. Nothing is known about the egg-laying habits, methods of stridulation, or mating of any of the species of Tanaoceridae.

Family ACRIDIDAE

This large and important family contains the so-called "short-horned" grasshoppers and true locusts. Worldwide there are over one thousand genera and ten thousand species, including a number of man's most important agricultural pests. All acridids feed on plant material with all species showing definite, consistent food preferences, but usually specializing in a single category of food such as grasses or forbs within which they may select widely. Only a very few species confine themselves solely to a single plant species. Occasionally a few species may be somewhat carnivorous. Most of the damage to range grasses and forbs, or agricultural crops is done by a relatively small number of species but many others may do some damage at times.

They are characterized by relatively short antennae, usually shorter than the body, filiform, ensiform, or clavate, with the segments distinct. There are three ocelli, two laterad to and one mesad in the frontal costa. The frontal costa is well marked, never replaced ventrad of the median ocellus by a single carina as in the Tanaoceridae. The lateral temporal foveolae are usually present, frequently well marked and sharply outlined, varying in position, and important to the classification of the group. The eyes are lateral, usually relatively large.

The pronotum is proportionately large, variously produced and ornamented. The dorsal surface, or disk, usually has a distinct mediolongitudinal carina which may be elevated into an entire or interrupted crest. The lateral carinae defining the lateral margins of the disk may or may not be present. A single transverse sulcus is almost invariably present, this being the caudal sulcus; anterior sulci may also be indicated. That portion of the pronotum anterior to the principal sulcus is termed the prozona, that posterior is the metazona.

The tegmina are usually narrowly elongate, occasionally brachypterous, and are sometimes present in the male and absent in the female. When present they are always at least as long as the wings, usually dull-colored and thickened or coriaceous. In numerous cases certain veins of the marginal or discoidal fields may be specialized for stridulating purposes. Hind wings vary as do the tegmina, from fully developed to very abbreviate, or absent, but never exceeding the tegmina in length. In some cases the radiate veins of the wings are thickened and rodlike, and their surfaces are specialized, along with certain veins of the anterior field and the anal complex, for stridulating purposes. The membranous hind wings may be brightly colored (Oedipodinae) and very attractive.

The auditory organs are with few exceptions (in some apterous species) on the side of the proximal abdominal tergite. The external genitalia of both sexes are basically as in the other families of the Acridoidea. The abdominal spiracles are placed ventrad in the sides of the dorsal sclerites, not in the membrane as in the Tetrigidae and Eumastacidae. The prosternum is with (Cyrtacanthacridinae) or without a median spine or tubercle. When present this is usually well marked, and its form varies in different groups.

Fore and middle legs are short, relatively slender, usually subequal in size and general form. The hind femora are much larger, modified for jumping. Stridulating organs are often located on the inner side of the hind femora. All species in the family show the outer surface of the hind femora with the same type of impressed striae. The hind tibiae have their extensor margins armed with spaced spines for the greater part of their length, and two distal spurs (calcaria) are found on each side. The tarsi of all limbs are composed of three segments, the proximal one (the metatarsus) with three pads or pulvilli. The tarsal claws have a distinct pad or arolium between them.

We have elected to divide the Acrididae along former lines, Romaleinae, Cyrtacanthacridinae, Acridinae, Oedipodinae, rather than considering the Acridinae and Oedipodinae in a single subfamily as suggested by Dirsh (1961). This does not mean we reject his placement but rather we feel that this will aid in identification which is one of the primary purposes of this Bulletin. It will be quickly noted, therefore, that certain genera, *Ligurotettix, Xeracris, Cibolacris* are keyed out under both subfamilies. These genera seem to show overlapping characters and the use of a single subfamily seems indicated by difficulty of their placement.

Subfamily ROMALEINAE

This subfamily comprises a diverse group of genera and species, restricted to the New World. While principally tropical in distribution, three genera, with but four species, occur in California. No single morphological character will serve to distinguish members of this group.

KEY TO CALIFORNIA GENERA AND SPECIES OF ROMALEINAE

1 Tegmina and wings abbreviated; median pronotal carina sharp, crested (fig. 169) . *Dracotettix* 2

Tegmina and wings not abbreviated; median pronotal carina feeble, especially on the prozona . 3

2 Median carina lower on metazona than on prozona; fastigium no longer than its proximal width (Argus and Panamint mountains) . . . . *D. plutonius* Bruner (p. 23)

Median carina subequal throughout; fastigium longer than its proximal width (coast ranges; San Jacinto and San Bernardino mountains) (fig. 169) . . . . *D. monstrosus* Bruner (p. 22)

3 External apical spine of hind tibia absent; form slender; pronotum saddle-shaped . . . . . *Spaniacris deserticola* (Bruner) (p. 24)

External apical spine of hind tibia present; form robust; pronotum not saddle-shaped (fig. 170) *Tytthotyle maculata* (Bruner) (p. 24)

Genus *Dracotettix* Bruner, 1889

This distinctive genus is found only in California and the west side of northern Baja California. The produced rostrum, distinctive pronotal crest, and abbreviated tegmina and wings will serve to distinguish it. The Baja California species, *Dracotettix newboldi* Hebard, has much longer wings than either of the other two species and is slightly smaller.

Dracotettix monstrosus Bruner

(Figs. V, 169)

Dracotettix monstrosus Bruner, 1890, Proc. U.S. Nat. Mus., 12:50. Lectotype ♂, selected by Rehn & Hebard, 1912, Los Angeles, Calif.

Dracotettix californicus Bruner, 1907, Biol. Centr.-Amer., Orth., 2:226.

The features cited in the keys lead to ready placement to genus. The specific differences between this and the next species are more subtle and are treated at length by Rehn and Grant (1961).

Geographic range.—The greater part of the coast ranges as well as the southern mountains and adjacent lower levels of southern California, apparently reaching to, or at least close to, sea level in a few places, and over the Tehachapi Range northeastward as far as the summit of Walker Pass. It is not known from the floor of the Central Valley, from the main Sierra Nevada chain, nor from any part of the desert stretches east of the main mountain masses.

California records.—(Map 8) CONTRA COSTA CO.: Russelmann Park, IV–2–60 (J. M. & S. M. Burns, DCR); VI–14–60, X–15–60 (D. C. Dentz, DCR). Mt. Diablo, X–7–60 (R. Broatch, DCR). LAKE CO.: Middletown, V–11–40 (K. Frick, CIS). LOS ANGELES CO.: Brown's Cyn., IV–19–36 (K. W. Opitz, CIS). MARIN CO.: Cypress Ridge, IV–17–61 (C. D. MacNeill, DCR); VI–14–60 (D. C. Rentz, DCR). 1 mi. N. Alpine Lake, IV–4–61 (E. P. Catts, DCR). Alpine Lake, V–14–60 (J. M. Burns, DCR); V–30–62 (C. D. MacNeil, CAS). 4 mi. W. Fairfax, IV–28–61 (D. C. Rentz, DCR). ½ mi. N. Alpine Lake, III–31–61 (E. P. Catts, DCR). Carson Ridge, V–6–62 (C. W. O'Brien, CAS); VII–4–62 (D. C. Rentz, CAS). MONTEREY CO.: Arroyo Seco, V–8–60 (G. I. Stage & R. R. Snelling, DCR). NAPA CO.: Pope Valley, IV–15–65 (E. W. Kirschbaum, DCR). Calistoga, III–8–34, (E. O. Essig, CIS). St. Helena, IV–3–20 (A. Koebele, CIS). Monticello, IV–28–36 (CIS). RIVERSIDE CO.: Pinyon Flats, V–24–40 (R. Buckner, CIS). Marion Mtn. Camp, San Jacinto Mts., VII–1–52 (W. V. Garner, CIS). SAN BENITO CO.: Idria Road, west end, VIII–22–58 (D. C. Rentz, DCR). 2 mi. W. jct. Cienega and Lime Kiln Roads, IV–24–65, III–30–63 (D. C. & K. A. Rentz, DCR). Idria, V–30–54 (E. G. Linsley, R. F. Smith, CIS). SAN DIEGO CO.: Nellie IV–30–17 (E. P. Hewlett, CIS). San Felipe Vy., VI–7–40 (C. D.

Michener, CIS). SANTA BARBARA CO.: Los Padres Nat'l. Forest, VI–20–56 (C. Cushner, DCR). SANTA CLARA CO.: Mt. Hamilton, VI–6–64, 1 immature ♂ (D. C. & K. A. Rentz, CAS). VENTURA CO.: Mt. Pinos, V–6–1959, 8000 ft. elev. (J. Powell, CIS).

Discussion—Little is know about the preferred habitat of this ground inhabiting species. It is usually found on rocky or gravelly mountain areas with sparse grass and other scattered plants such as wild buckwheat, *Eriogonum; Brickellia californica;* and others. Males are active, but flightless, as are the females, but the latter depend upon their camouflage to escape detection. Adults overwinter since they have been collected beneath loose bark and in other sheltered spots in mid-winter.

Stridulation consists of the scraping of the base of the hindfemora against the sides of the abdomen, producing a raspy, scratchy sound. No spiracular "hissing" was observed. Stridulation was noted only when the specimens were handled, indicating that the stridulation may be more of a defense mechanism rather than a mate-finding apparatus.

A mating pair was taken on April 17, 1961, in Marin County.

Dracotettix plutonius Bruner

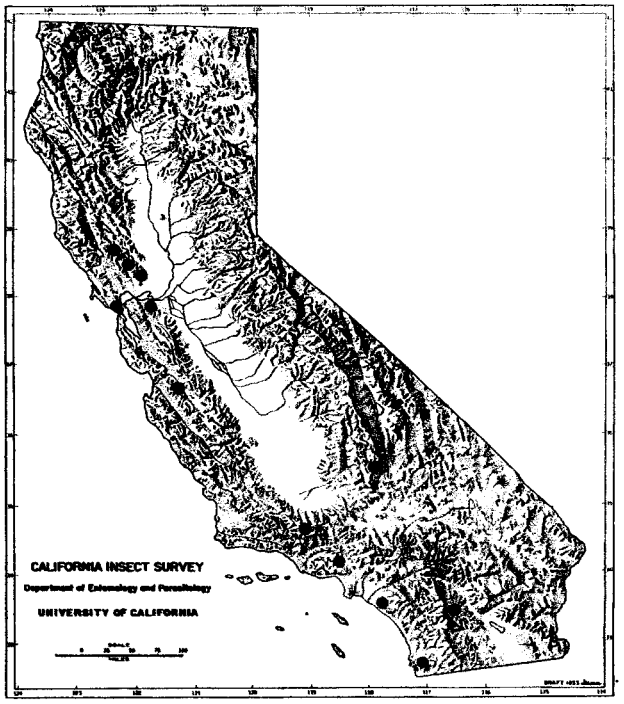
Dracotettix plutonius Bruner, 1893, N. A. Fauna, 7:267. Lectotype ♀, selected by Rehn & Hebard, 1912. Panamint Valley, Calif.

Geographic range.—Between the mountains to the east of Owens Lake, the western side of the Panamint Range and recently five specimens have been collected at the Nevada Test Site (Barnum, 1964).

California records.—(Map 8) Panamint and Argus mountains in Inyo County. No specimens in the CIS collection.

Discussion—According to Rehn and Grant (1961), the species occurs in the upper part of the Lower Sonoran Life Zone, and probably enters the Upper Sonoran. The authors further state that little information is available on the exact conditions where *plutonius* has been taken. Apparently it occurs above the *Larrea* belt and below that of juniper and pinyon.

According to Barnum (1964), the preferred vegetation of the insect at the Nevada Test Site is definitely sagebrush *(Artemisia tridentata),* of what might be considered the Upper Sonoran Zone. Attempts at securing this species by sweeping the brush were futile. It was also usless to try to spot the insect visually. The one specimen obtained by Barnum was from a shrub that had been inspected visually and then kicked forcefully at the base. It was found that a strong kick at the base of the shrub would be violent enough to remove the other Orthoptera, so this technique was used, finally, in securing the specimen. After being kicked out of the sagebrush it tried to return to the bush immediately in a series of quick hops, the wings being useless to the large body. The insects apparently rest on the stouter vertical branches where they are almost perfectly concealed by the patches of light and dark bark of the shrub. The feeding habits of the insect are unknown, but from an examination of the area the insect undoubtedly feeds on *Artemisia tridentata.*



Map 8. California distribution of: ●, *Dracotettix monstrosus* Bruner; ■, *Dracotettix plutonius* Bruner.

Rehn and Grant (1961) consider this species a spring form, recording it in April and May. Barnum (1964) collected it from March 24 to April 16 and September 19, 1961, at the Nevada Test Site, and concludes that it is probably present from early spring to autumn, but never common.

Genus *Spaniacris* Hebard, 1937

This genus has until recently (Rehn and Grant, 1960b) been placed in the classic Oedipodinae, but the above authors, after studying the internal genitalia, have shown that its affinities lie with the Romaleinae. It shows a more general relationship to *Tytthotyle* than to any other known genus. Only one species in the genus.

Spaniacris deserticola (Bruner)

Ramona deserticola, 1906, Biol. Centr.-Amer., Orth., 2:187. Type ♂, Indio, Riverside Co., Calif. (No. H79, ANSP). (*Ramona* preoccupied, Casey, 1886.)
Spaniacris deserticola Hebard, 1937, Trans. Amer. Ent. Soc., 63:375.

Whitish, tegmina with rather large dusky or olivaceous spots. Hind tibia yellow. Pronotum sometimes with longitudinal dusky stripes. The strongly ascendant occiput, sellate pronotum and long slender legs are ready features for identifying this locust. The hind femur is about seven times as long as its greatest width. One of the most distinctively desertícolous acridids. Hebard (1937) has given an account of its habitat.

Body 19–27; tegmen 18–28; hind femur 11.5–16.

Geographic range.—Imperial and Coachella valleys, California.

California records.—(Map 9) IMPERIAL CO.: 6 mi. N.W. Kane Springs, IX–17–22 (Rehn & Hebard, ANSP). 10 mi. E. Coyote Wells, VIII–25–31 (E. R. Tinkham, ANSP). RIVERSIDE CO.: Blythe, VI–24–45, coyote melon (CIS). Indio (H. F. W. Wickman, ANSP). Palm Springs, VI–28–52 (R. M. Evans, CIS).

Discussion—An inhabitant of low, silt desert areas of intense, furnace-like heat. Very local in distribution and never numerous. Rehn and Grant (1960b) placed this genus in the Romaleinae.

Genus *Tytthotyle* Scudder, 1897

This genus contains but one species, *T. maculata.* It has been regarded by some authors as an aberrant oedipodine, but Bruner (1906) correctly contrasted it with *Phrynotettix,* its nearest relative, a genus which does not occur in California.

Tytthotyle maculata (Bruner)
(Fig. 170)

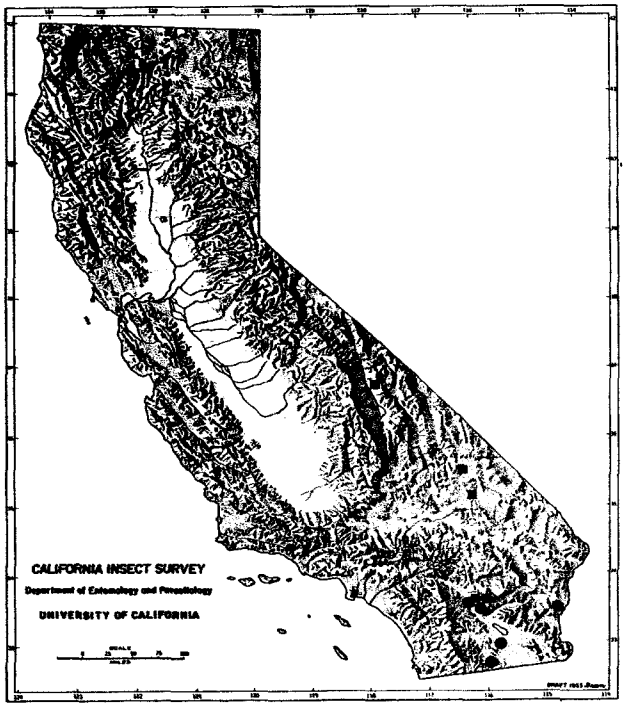
Thrincus maculatus Bruner, 1890, Proc. U. S. Nat. Mus., 12:79. Lectotype ♀, designated by Rehn & Hebard, 1912. Needles, Calif. (ANSP, No. H80).
Tytthotyle maculata, Scudder, 1897, Canad. Ent., 29:75.

The presence of the external apical spine of the hind tibia, the absence of pronotal carinae and large size distinguish the species. The usual coloration is a mottling of whites, grays, and browns. The wing is clear, tinted weakly with green or blue.

Body 28–38; tegmen 30–40; hind femur 16–22.

Geographic range.—Arizona, California, Nevada, Utah.

California records.—(Map 9) INYO CO.: Surprise Canyon, VI–3–57 (J. F. Lawrence, CIS); IV–24–57, small immatures (J. J. Menn, CIS). Mazourka Canyon Rd., VII–22–65, on desert floor at night (J. D. Birchim, JDB). RIVERSIDE CO.: Palm Springs, V–24–44 (C. D. Michener, CIS). Magnesia Canyon, VI–28–52 and VII–2–52 (W. V. Garner, CIS); IX–5–51 (J. J. Menn, CIS). Thousand Palms, VIII–23–58 (D. M. Newell, CIS). Cathedral City, VII–16–50 (H. L. Hansen, CIS). SAN BERNARDINO CO.: Baker, VI–24–30 (F. H. Wymore, CIS). Saratoga Springs, Death Valley, V–5–60 (A. E. Menke, UCD). SAN DIEGO CO.: Borrego, IV–28–54 (P. D. Hurd & D. E. Barcus, CIS); Borrego Valley, IV–29–54 (M. Wasbauer, CIS); IV–19–57 (R. M. Bohart, UCD). Narrows, IV–7–47 (G. A. Marsh, CIS).



Map 9. California distribution of: ●, *Spaniacris deserticola* (Bruner); ■, *Tytthotyle maculata* (Bruner).

Discussion—Roberts (1941) placed this genus in the subfamily Romaleinae. It is known only from the hottest and most arid sections of its range from below sea level to 4800 feet. It is usually very localized. It is known to feed on creosote bush, *Larrea,* where it is frequently collected. It is a strong flier and prefers to land in the *Larrea* rather than on the ground. Several authors mention that it can be captured by hand more readily than with a net.

Subfamily CYRTACANTHACRIDINAE

The species of this subfamily, commonly known as the "spine-breasted" locusts, may be easily recognized by the presence of a conical or cylindrical elevation, termed the prosternal spine, projecting from the prosternum. The face is usually vertical, the head decidedly rounded. The tarsal pulvilli are exceptionally

large, a feature correlated with plant-loving species. A well-developed arolium is present between the tarsal claws.

These insects are customarily found on vegetation, in sharp contrast to the soil-frequenting habits of most of the other acridids. Although some are decidedly colorful, they are generally drab, less attractively colored, the coloration being generally protective. This coloration is mainly a combination of olivaceous, yellow and brown of varying shades with ornamental touches of reds or blues.

As with the other groups of the Acrididae, in order to present a comprehensive picture of the subfamily, a study of the internal genital structures would be required. Apart from these structures, the most reliable external features are the form of the cercus and other terminal abdominal appendages of the male. In *Melanoplus,* one of the largest of the North American genera of grasshoppers, a knowledge of these structures is absolutely essential. The females of this genus are very difficult to identify owing to the variability of external characters.

Many important economic species which are found in cultivated and rangeland areas are found in this group. Most of the economic species belong to the genera *Melanoplus, Schistocerca,* and *Oedaleonotus.* Many are omnivorous, others are selective in food habits, feeding primarily on dicotyledons (forbs), especially the perennial members of the plant family Asteraceae. The migrations and plagues of grasshoppers throughout American history were primarily due to species belonging to this subfamily.

KEY TO GENERA AND SOME SPECIES OF CYRTACANTHACRIDINAE

1 Elongate, slender, face strongly oblique; antennae thick and triangular at base, tapering, acute . *Leptysma hebardi* Rehn & Eades (p. 35)
Form normally acridoid or stout, antennae linear . 2

2 Body 35 mm. or more in length; subgenital plate of male deeply notched at apex . . . . . *Schistocerca* Stal (p. 64)
Body less than 35 mm. in length (except in some *Melanoplus* spp.); apex of male subgenital plate entire or feebly notched 3

3 Tegmina present, often fully developed 4
Tegmina absent; stout, montane forms 15

4 Hind margin of pronotum truncate or convex . . 5
Hind margin or pronotum broadly emarginate . . 14

5 Head and thorax marked with red; tegmina olive green; male subgenital plate attenuate . . . *Poecilotattix sanguineus* Scudder (p. 64)
Without such combination of characters 6

6 Carinae of pronotum obsolete, especially on prozona 7
Carinae of pronotum distinct, more or less elevated 10

7 Subgenital plate of male with strong subapical tubercle 8
Male subgenital plate without subapical tubercle but sometimes with apex elevated . . . . . *Melanoplus* Stal (p. 36)

8 Slender; green or brown; head, pronotum and tegmina with white stripes (hind femur unbanded) . . . . . *Hesperotettix* Scudder (p. 31)
Body and legs stout; colors not as above 9

9 Lower sulcus of hind femur greenish yellow . . *Aeoloplides* Caudell (p. 26)
Lower sulcus of hind femur carmine . . . . . *Agnostokasia sublima* Gurney & Rentz (p. 28)

10 Male subgenital plate with subapical tubercle . 11
Male subgenital plate without subapical tubercle but sometimes elevated at apex 12

11 Pronotum with median carina absent on prozona . *Aeoloplides* Caudell (p. 26)
Pronotum with median carina evident on prozona . *Melanoplus* Stal (p. 36)

12 Head relatively large; body compressed, the lateral lobes of pronotum flared in front; frontal costa flat and widened below ocellus; male subgenital plate narrow, conoid; ventral valves of aedeagus elongate, tapering, much exceeding the dorsal valves . *Phoetaliotes nebrascensis* (Thomas) (p. 63)
Head normal; pronotum hardly flared in front; ventral valves of aedeagus not as above . . . 13

13 Prozona of pronotum tumid, its two transverse sulci usually deep and continuous. Male cerci very broad at base, abruptly narrowed with apex digitiform. Dorsal valves of aedeagus minute. Ovipositor retracted . *Oedaleonotus* Scudder (p. 57)
Transverse sulci of pronotal prozona usually interrupted at midline. Male cerci styliform, spatulate or distally widened. Ovipositor exserted . . . *Melanoplus* Stal (p. 36)

14 Hind tibia red, with seven external spines (southern) . . . *Oedomerus corallipes* Bruner (p. 63)
Hind tibia not red; external spines more than seven (northeastern forests) . . . . . *Asemoplus sierranus* Hebard (p. 28)

15 Tympanum (of first abdominal segment) normal, conspicuous 16
Tympanum minute, inconspicuous 17

16 Dorsum of pronotum convex, rounded into lateral lobes. Male epiproct with transverse ridges . . *Boonacris (Karokia) blanci* Rehn (p. 28)
Dorsum of pronotum flat, lateral carinae strong, calloused. Male epiproct without transverse ridges *Bradynotes* Scudder (p. 29)

17 Epiproct of male with large protuberances; metasternal interspace about as wide as metasternal lobe. Epiproct of female with a pair of transverse ridges . . . *Hypsalonia* Gruney & Eades (p. 33)
Epiproct of male without protuberances; metasternal interspace narrower than a lobe. Epiproct of female with transverse ridges feeble or absent *Hebardacris* Rehn (p. 30)

Genus *Aeoloplides* Caudell, 1897

Five of the known ten species are recorded from California. They tend to be rather localized in distribution and once located in a particular patch of brush, may be fairly common. Colonies may be far removed from one another. Shrubs of the Chenopodiacae, such as saltbush, *Atriplex,* and Russian thistle, *Salsola,* are usually the favored hosts. Males stridulate weakly. Wallace (1955) revised the genus.

KEY TO CALIFORNIA SPECIES OF AEOLOPLIDES

1 Hind femur sulcate below, the sulcus closed basad by a flange, which in lateral view is wedge-shaped 2
Hind femur not sulcate and without flange . . . 3

2 Femoral flange (male) in side view longer than its basal width; tegmina much surpassing apex of hind femora . . *tenuipennis* (Scudder) (p. 27)
Femoral flange (male) shorter than its basal width; tegmina seldom attaining apex of hind femora *minor* (Bruner) (p. 27)

3 Pronotal prozona without lateral carinae; tegmina elongate . . . . *californicus* (Scudder) (p. 26)
Prozona with lateral carinae; tegmina short, ovate . 4

4 Cercus of male straight, the apex narrowly rounded (figs. 64, 65) . . *fratercula* (Hebard) (p. 26)
Cercus of male subfalcate at apex, the tip somewhat widened and incurved (figs. 62, 63) . . *fuscipes* (Scudder) (p. 26)

Aeoloplides californicus (Scudder)

Aeoloplus californicus Scudder, 1897, Proc. U.S. Nat. Mus., 20:73. Lectotype ♂, Calif., designated by Rehn & Hebard, 1912 (MCZ).

Aeoloplides californicus, Wallace, 1955, Ann. Ent. Soc. Amer., 48:470-471.

Generally resembles *tenuipennis* but fuscous stripes on occiput and pronotum more prominent and hind femur without basal wedge or flange.

Body 23–26; tegmen 22–23; hind femur 13.5–15.

Geographic range.—California.

California records.—(Map 10) (Wallace, 1955, records this species from Kern, Los Angeles, San Luis Obispo, and Tulare counties.) FRESNO CO.: Coalinga, VIII–30–22, 700 ft. elevation (Rehn & Hebard, ANSP). KERN CO.: Shafter, VII–13–55 (J. Powell, CIS). 14 mi. W. Shafter, X–10–52 (A. D. Telford). Bakersfield, Jewetta, IX–1–22, 450 ft. elevation (Rehn & Hebard, ANSP). Bakersfield, IX–15–10 (ANSP); VIII–20–09, 415 ft. elevation, manzanita-covered hillside (ANSP). RIVERSIDE CO.: Palm Desert, VII–2–58 (C. Cushner, DCR). TULARE CO.: Lemoncove, VII–26–29 (R. H. Beamer, ANSP). VENTURA CO.: Cuyama Ranch, VII–25–35 (E. I. Beamer, ANSP).

Aeoloplides fratercula (Hebard) new combination

(Figs. 64, 65)

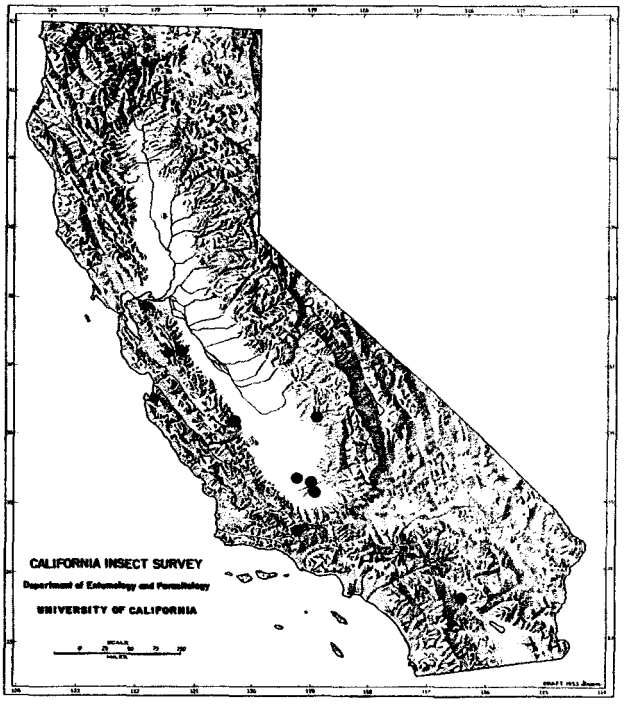
Oedaleonotus fratercula Hebard, 1919, Trans. Amer. Ent. Soc., 45:269. Type ♂, Del Monte, Monterey Co., Calif. (No. 487, ANSP).

Differs from *A. fuscipes* in shorter tegmina and in the features of male cerci and aedeagus which are figured. Topotypic specimens are very small; the specimens from Stanislaus County are similar in size to *fuscipes.*

(Paratypes) Body 12.5–15; tegmen 1.8–2.2; hind femur 7.5–9.

Geographic range.—California.

California records.—(Map 10) CONTRA COSTA CO.: Kircher Pass to Antioch, V–12–45; V–11–46 (E. G. Linsley & R. F. Smith, CIS). MONTEREY CO.: Del Monte, IX–9, 10, 1910 (Rehn & Hebard, ANSP). SANTA CLARA CO.: Mt. Hamilton, VI–9, 20–22. STANISLAUS CO.: Adobe Creek, V–6–48 (R. Smith, CIS).



Map 10. California distribution of: ●, *Aeoloplides californicus* (Scudder); ■, *Aeoloplides fratercula* (Hebard).

Aeoloplides fuscipes (Scudder) new combination

(Figs. 62, 63)

Melanoplus fuscipes Scudder, 1897, Proc. Amer. Phil. Soc., 36:12. Lectotype ♂, between San Luis Obispo and San Simeon Bay, Calif., designated by Rehn & Hebard, 1912 (MCZ).

Oedaleonotus fuscipes, Hebard, 1919, Trans. Amer. Ent. Soc., 45:269.

Dark brown, upper part of lateral lobe of pronotum with a broad black band. Hind femur with bold transverse dark bands. Hind tibiae pale blue. Lateral carinae of pronotum intensified by the dark bands of the lateral lobe. Tegmina shorter than pronotum, rounded.

Body 14–20; tegmen 3–3; hind femur 8–11.

Geographic range.—California.

California records.—(Map 11) LOS ANGELES CO.: Los Angeles (ex: Scudder). Sierra Madre, V–30– (ex: Caudell). Mt. Lowe, San Gabriel Range, 4400 ft. elevation, VIII–8–22 (Rehn & Hebard, ANSP). Rubio Canyon, VIII–8–22, 2200–3000 ft. elevation (Rehn & Hebard, ANSP). Tanbark Flat, VI–19 to VII–13–50 (A. T. McClay, E. G. Linsley, J. C. Hall & H. L. Hansen, UCD, CIS); VII–6–52 (A. A. Grigarick, UCD). Llano, VII–1–57 (W. E. Simonds, CDA). Los Angeles Universal City, VII–10–26 (C. H. Hicks, ANSP). Sierra Madre, V–1930 (Dyar & Caudell, ANSP). Los Angeles, Coquillett (ANSP). Claremont, VI–29–35 (E. I. Beamer, ANSP). Palmdale, VIII–1–35 (J. Beamer, ANSP). MONTEREY CO.: Lockwood, VI–24–35 (E. I. Beamer, ANSP). RIVERSIDE CO.: Riverside, VI–24–30 (Timberlake, ANSP). Idlewild, VIII–3–35 (E. I. Beamer, ANSP). SAN BERNARDINO CO.: May (ex: Scudder). San Bernardino Mts., Harvey's Mill Creek, VIII–30–19, 3700 ft. elevation (Rehn & Hebard, ANSP). SAN DIEGO CO.: May (ex: Scudder). Oak Grove, VI–3–46 (D. F. & J. N. Knull, CIS). Newton, VII–14–49 (D. J. & J. N. Knull, CIS). Laguna Mts., VIII–1922 (ANSP). 4 mi. W. Jacumba, IV–16–42 (H. R. Roberts, ANSP). Potrero, IX–12–22 (Rehn & Hebard, ANSP). Anza, VIII–6–35 (R. H. Beamer, ANSP). Jacumba, VIII–13–35 (J. Russell, ANSP). Campo, VIII–10–35 (E. I. Beamer, ANSP). SAN LUIS OBISPO CO.: 10 mi. W. Simmler, V–5–62 (R. W. Thorp, CIS). VENTURA CO.: Cuyama Ranch, VII–25–35 (E. I. Beamer, ANSP).

Aeoloplides minor (Bruner)

Aeoloplus minor Bruner, 1904, Colo. Agri. Expt. Sta. Bull., 94:60. Lectotype ♂, Delta, Colo. designated by Rehn & Hebard, 1912 (ANSP).

Aeoloplus eremiaphila Hebard, 1919, Trans. Amer. Ent. Soc., 45:257.

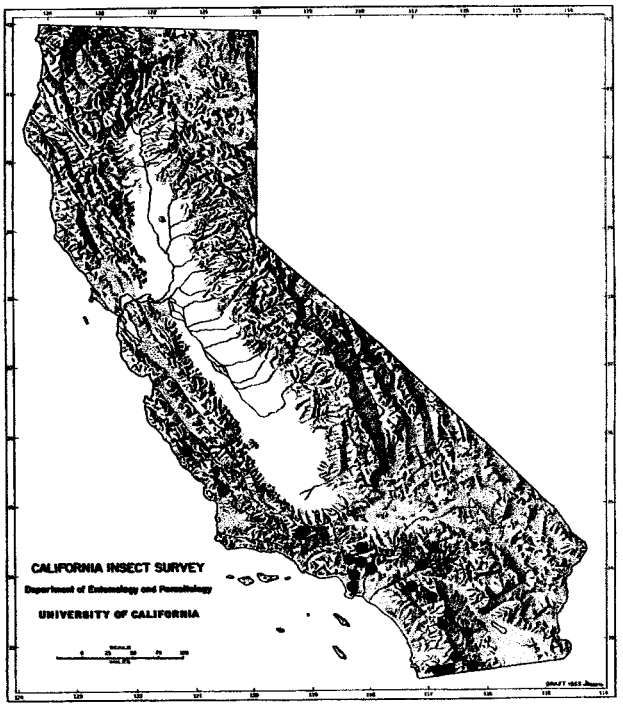
Aeoloplides minor, Wallace, 1955, Ann. Ent. Soc. Amer., 48: 473.

Smaller than *tenuipennis* and with less development of basal wedge of hind femur. Hind tibiae pale pink. Tegmina variable in length, but usually not more than twice the length of pronotum, tapering in apical half and narrowly rounded at apex.

Body 14–19; tegmen 6–7; hind femur 8–9.

Geographic range.—Southeastern Oregon, Nevada to Utah, eastern California.

California records.—(Map 11) INYO CO.: Antelope Spring, 8 mi. S.W. Deep Spring, VII–10–62 (W. A. Foster, CIS). LASSEN CO.: Amedee, 3960 ft. elevation (ex: Wallace). SAN BERNARDINO CO.: Cushenberry Ranch, VIII–31– (ex: Wallace).



Map 11. California distribution of: ●, *Aeoloplides tuscipes* (Scudder); ▲, *Aeoloplides minor* (Bruner).

Aeoloplides tenuipennis (Scudder)

Aeoloplus tenuipennis Scudder, 1897, Proc. U.S. Nat. Mus., 20:70. Type ♂, Fort Grant, Graham Co., Ariz. (USNM).

Aeoloplus oculatus Scudder, 1897, Proc. U.S. Nat. Mus., 20: 70.

Aeoloplus arizonensis Scudder, 1897, Proc. U.S. Nat. Mus., 20:78–79.

Aeoloplides tenuipennis, Wallace, 1955, Ann. Ent. Soc. Amer., 48:471.

Yellow-brown, tegmina green with yellow veins, hind tibiae pale blue or pink. Body very stout through thorax, the head notably small. Male with front and middle femora much swollen, hind femur stout, hardly more than three times as long as its greatest width, cerci styliform, subgenital plate with subapical tubercle.

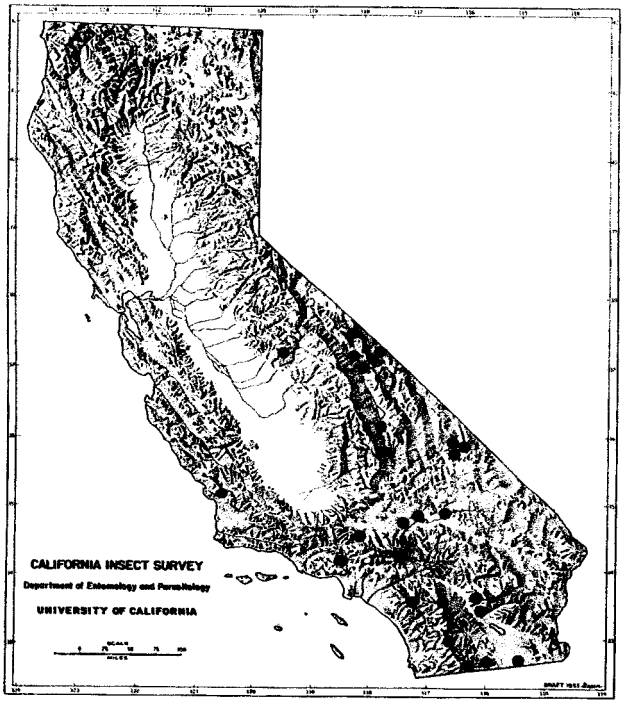
Body 21–21; tegmen 19–19; hind femur 10.5–12.

Geographic range.—California.

California records.—(Map 12) (Wallace, 1955, records this species from Imperial, Inyo, Kern, Los Angeles, and San Diego counties.) IMPERIAL CO.: Coyote Wells, IX–16–22, 270 ft. elevation (Rehn & Hebard, ANSP). Colorado, XI–1–10, 120 ft. elevation (ANSP). Calexico, VIII–11–14 (J.C. Bradley, ANSP). INYO CO.: Olancha, VI–26–49 (H. E. Cott, UCD). Shoshone, VIII–8–19 (M. Hebard, ANSP). Tecopa, VIII–8–19 (ANSP). Acme, VIII–8–19 (M. Hebard, ANSP). 2 mi. E. Big Pine, VII–28–62 (D. C. Rentz & C. D. MacNeill, CAS). Near Westgard Pass, VIII–10–61 (D. C. Rentz, CAS). 2 mi.

W. Bishop, VIII–10–59 (D. C. Rentz, DCR). Deep Springs, VIII–9–59 (D. C. Rentz, DCR). Big Pine, VII–21–64 (D. C. & K. A. Rentz, DCR). Little Lake, VIII–5–61 (C. W. O'Brien, DCR). 3 mi. E. Big Pine, VII–21–64 (D. C. & K. A. Rentz, DCR). LOS ANGELES CO.: Saugus (ANSP). Lancaster, VIII–1–1897 (ANSP). MADERA CO.: Summit House, IX–3–07, 3200 ft. elevation (ANSP). MONO CO.: Benton, VII–20–64 (D. C. & K. A. Rentz, DCR). RIVERSIDE CO.: Oasis, IX–17–22, 106 ft. below sea level (Rehn & Hebard, ANSP). Indio, VIII–5–26 (J. Russell, ANSP). Perris, VIII–3–35 (J. Beamer, ANSP). Palm Springs to Palm Canyon, IX–29–10, 800 ft. elevation, ANSP). SAN BERNARDINO CO.: Newberry, IX–9–24, 1831 ft. elevation (Rehn & Hebard, ANSP). Barstow, VIII–7–19 (Rehn & Hebard, ANSP). Cottonwood Station, IX–9–07, 2274 ft. elevation (ANSP). Cushenberry Ranch, VIII–31–19 (Rehn & Hebard, ANSP). Victorville, IX–1–19 (Rehn & Hebard, ANSP). SAN DIEGO CO.: 6 mi. E. Banner, VI–26–63 (R. L. Langston, CIS). Jacumba, VIII–12–14 (J. C. Bradley, ANSP). SAN LUIS OBISPO CO.: San Luis Obispo, VI–14–34 (E. D. Ball, ANSP).

Atypical Aeoloplides tenuipennis.—INYO CO.: Hole-in-the-Rock Springs, Boundary Canyon, Amargosa Range, VIII–18–19, 2900 ft. elevation (Rehn & Hebard, ANSP). Immigrant Wash, Panamint Range, VIII–14–19, 2000 ft. elevation (Rehn & Hebard, ANSP).



Map 12. California distribution of *Aeoloplides tenuipennis* (Scudder).

Genus *Agnostokasia* Gurney and Rentz, 1964
Agnostokasia sublima Gurney and Rentz

(Fig. 66)

Agnostokasia sublima Gurney & Rentz, 1964, Proc. Calif. Acad. Sci., 31(18):509. Holotype ♂, Mt. Barcroft, White Mts., Mono Co., Calif. 12,500 ft. elevation (CAS).

Dark gray-brown, occiput and prozone of pronotum blackish. Hind femur with two broad black cross-bars. Hind tibia and lower sulcus of hind femur carmine red. Tegmina about as long as pronotum, tapering from mid-length, narrowly rounded at apex. Body with conspicuous gray hairs.

Body 15–22; tegmen 4–6; hind femur 9–10.

Geographic range.—White Mountains, California.

California records.—(Map 13) MONO CO.: Mt. Barcroft, White Mts., 12,500 ft. elevation, VII–21–61 (D. C. Rentz, DCR); VII–1 to 21–61 (J. A. Powell, CIS); VII–27–62 (D. C. Rentz, C. D. MacNeill, DCR); VII–16–61 (J. S. Buckett, UCD); VII–26–64 (J. D. Birchim, JDB).

Discussion—This high altitude (12,000–13,000 feet) brachypterous grasshopper is the only known member of the genus. It inhabits the arctic–alpine cushion-type perennials growing on the granite slopes. They are active jumpers in contrast to related *Hypsalonia, Hebardacris* and *Bradynotes* (Gurney and Rentz, 1964).

Genus *Asemoplus* Scudder, 1897
Asemoplus sierranus Hebard

(Fig. 152)

Asemoplus sierranus Hebard, 1936, Trans. Amer. Ent. Soc., 62:188. Type ♂, Harkness Peak, Plumas Co., Calif. (ANSP #1301).

Slender, subcylindric. Dark olivaceous above, under surface and legs pale, hind femur without dark cross-bars, hind tibiae yellow. Tegmina narrow, more than twice as long as wide and separated by an interval twice as wide as a tegmen. Face rather strongly oblique. The male only is known in the literature, but we have additional locality data for two females.

Body 16; tegmen 2.5; hind femur 8.0.

Geographic range.—California.

California records.—(Map 13) PLUMAS CO.: Harkness Peak, lower south slopes, VIII–20–22, 6800 ft. elevation, paratype (Rehn & Hebard, CAS). SIERRA CO.: Gold Lake, VII–6–34 (L. S. Rose, 1 female, CAS). SISKIYOU CO.: 4 mi. E. Shasta City, McBride Campground, VII–23–62 (D. C. Rentz & C. D. MacNeill, 1 female, CAS).

Genus *Boonacris* Rehn and Randell, 1962

This nearctic genus of flightless acridids contains five species, one of which has three subspecies. The main area of distribution is in eastern and central North America, mostly in montane habitats (Rehn and Randell, 1962). A single species has recently been described from California.

Boonacris blanci Rehn

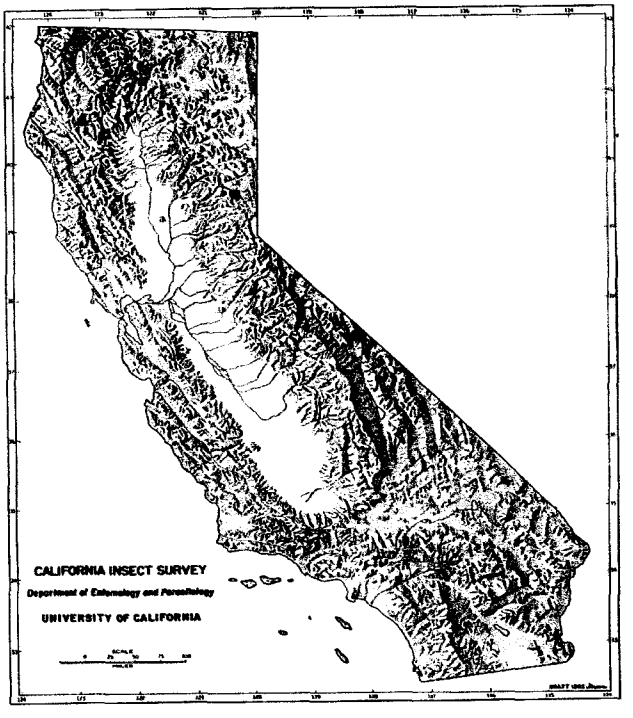
Boonacris (Karokia) blanci Rehn, 1964, Notul. Nat., Phila., 368:3–7. Holotype ♂, Weaver Bally, Trinity Co., Calif. (CDA).

Stout, but less so than *Bradynotes,* dark green or gray to dusky black, all femora blotched with dark markings. Hind tibiae blue. Fastigium abruptly declivent. Hind margin of pronotum weakly but plainly emarginate.

Body 17–22; hind femur 9.5–11.5.

Geographic range.—Northern California.

California records.—(Map 13) TRINITY CO.: holotype, allotype, paratypes, Weaver Bally, Trinity Mts., IX–25–63, 6900 ft. elevation, ex. slate on summit (G. M. Buxton & F. L. Blanc, CDA). Grizzly Lake, IX–11–64, ex. granite and serpentine (Buxton, Gurney, Forbes & Kamp, CDA).



Map 13. California distribution of: ●, *Agnostokasia sublima* Gurney and Rentz; ■, *Asemoplus sierranus* Hebard; ▲, *Boonacris blanci* Rehn.

Discussion—This unique species, which Rehn placed in the subgenus *Karokia,* is known only from the type series and only from the type locality. It was taken at the summit of a rocky knoll, sitting on slate which it matched in color.

KEY TO SOME CALIFORNIA GENERA OF THE BRADYNOTES COMPLEX
(Modified from Gurney and Eades, 1961)

1 With a well-developed tympanum on each side of first abdominal tergum; female subgenital plate with strongly angulate lateral lobes; aedeagus with dorsal valves not developed. (Widely, but locally distributed in far western United States and adjacent Canada) . *Bradynotes* Scudder (p. 29)

Without tympanum; female subgenital plate with lateral lobes not angulate or, if they are, broadly rounded or obtuse; aedeagus with dorsal valves well developed 2

2 Male supra-anal plate with strong dorsal protuberances; female supra-anal plate usually with a distinct transverse carina about midlength; metasternal interspace of male about as wide as a lateral lobe. (Sierran regions of California, from Placer to Inyo counties.) . . . . . *Hypsalonia* Gurney & Eades (p. 33)

Male supra-anal plate lacking dorsal protuberances; female supra-anal plate without a distinct transverse carina, though it sometimes is suggested at lateral margins; metasternal interspace of male narrower than lateral lobe. (Southern part of Sierra Nevada of California, mainly Inyo, Fresno and Tulare counties) . *Hebardacris* Rehn (p. 30)

Genus *Bradynotes* Scudder, 1880

In his recent review of this genus Rehn (1964*a*) recognized but a single species, of which two races and intermediates have been taken in California. Most of the material of the California Insect Survey was studied by Rehn.

KEY TO MALES OF CALIFORNIA RACES OF BRADYNOTES OBESA

1 Cercus regularly tapering to apex (fig. 156) . . *obesa opima* Scudder (p. 30)

Cercus slightly broader and spatulate at apex (fig. 157) . . . . . *obesa deplanata* Hebard (p. 29)

Bradynotes obesa deplanata Hebard
(Fig. 157)

Bradynotes deplanata Hebard, 1919, Trans. Amer. Ent. Soc., 45:278. Holotype ♂, Big Meadow of the Deschutes River, 18 mi. S.W. Bend, Crook Co., Ore. (ANSP).

Bradynotes obesa deplanata, Rehn, 1964, Trans. Amer. Ent. Soc., 90:172.

Very similar in all features, including size to *B. obesa opima.* Hind tibia paler, sometimes yellowish.

Geographic range.—California, Nevada, Oregon.

California records.—(Map 14) Extending into Siskiyou, Modoc, Lassen, and Sierra counties (Rehn, 1964*a*).

Discussion—Local in distribution, seemingly partial to lava or pumice areas. Intergrades with *B. o. opima* and is very difficult to identify.

Bradynotes obesa opima Scudder
(Fig. 156)

Bradynotes opimus Scudder, 1881, Rept. U.S. Ent. Comm., 2:24. Lectotype ♀, Mt. Shasta, Calif. Selected by Rehn, 1964 (ANSP).

Bradynotes pinguis Scudder, 1897, Proc. U.S. Nat. Mus., 20:81, 85.

Bradynotes compacta Morse, 1903, Psyche, 10:116.

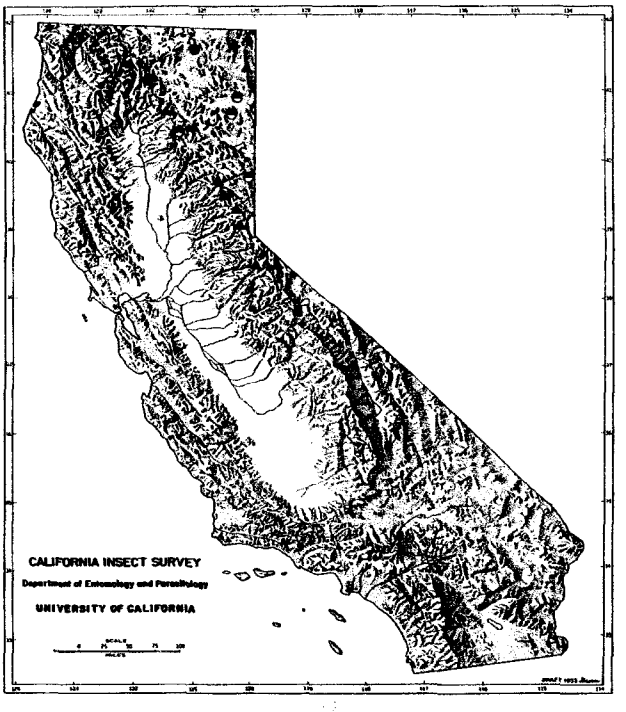
Bradynotes obesa opima, Rehn, 1964, Trans. Amer. Ent. Soc., 90:180.

Stout and of toadlike appearance. Pale to dark brown or almost black above, with ridges of fastigium and parts of frontal costa sometimes red. Hand tibia red, its external face often deep blue, especially proximad. Pronotum rather flat, its median carina low and narrow, lateral carinae strong and rugulose, hind margin truncate and often strongly emarginate.

Body 20–25; hind femur 10.2–10.5.

Geographic range.—California, Nevada, Oregon.

California records.—(Map 14) Rehn (1964*a*) records this subspecies as extending southward in the Trinity and associated ranges to at least Mendocino Pass on the Mendocino-Glenn county line and several localities in Glenn County east of Mendocino Pass; Cascade and Sierra Nevada ranges, in the former to the vicinity of Mt. Shasta and elevated areas in Lassen County; in the Sierras to Alpine and Mono counties; and down the east and west slopes of the Warner Mountains in Modoc and Lassen counties.



Map 14. California distribution of: ●, *Bradynotes obesa deplanata* Hebard; ▲, *Bradynotes obesa opima* Scudder; ◒, intermediates between *Bradynotes o. deplanata* and *Bradynotes o. opima.*

Discussion—Apparently partial to country of reasonable elevation, usually over 5000 feet.

Genus *Hebardacris* Rehn, 1952

Rehn (1964*b*) reviewed the two long-known species and described a third species from the vicinity of Mono Pass. Personnel of the University of California at Davis have taken yet another related form at high altitude in the White Mountains. The genus appears restricted to sites above 10,000 feet in California. Speciation in this group undoubtedly reflects the influence of Pleistocene glaciation.

KEY TO MALES OF GENUS HEBARDACRIS
(Condensed from Rehn, 1964*b*)

1 Cercus short-triangular, its apex remote from tip of epiproct (Mt. Whitney area) (fig. 153) . . *albida* Hebard (p. 30)

Cercus attaining tip of epiproct 2

2 Cercus rather stubby (Mono Pass to Mt. Lyell) *mono* Rehn (p. 31)

Cercus longer, its apex slightly decurved (Mt. Lyell area) (fig. 154) . . . . *excelsa* (Rehn) (p. 30)

Hebardacris albida (Hebard)
(Fig. 153)

Bradynotes albida Hebard, 1920, Trans. Amer. Ent. Soc. 46: 360. Type and allotype, Lone Pine Lake, Whitney Pass Trail, Sierra Nevada, Inyo Co., Calif. (ANSP).

Hebardacris albida, Rehn, 1952, Trans. Amer. Ent. Soc., 78: 113.

General colors buff and white, head with two postocular black stripes on each side, occiput flecked with black. Cercus of male hardly twice as long as its basal width.

Body 16–23; hind femur 8.5–10.

Geographic range.—California.

California records.—(Map 15) TULARE CO.: Top of Mt. Whitney, IX–21–48 (J. L. Edwards, CIS). Pinnacles of Mt. Whitney, IX–7–19, 13,770 ft. elevation (M. Hebard, ANSP). INYO CO.: Lone Pine Lake, Whitney Pass Trail, type and allotype, 10,000 to 10,100 ft. elevation. FRESNO CO.: Mount Gould, VII–9–10, 12,000 ft. elevation (E. C. Van Dyke, CAS).

Hebardacris excelsa (Rehn)
(Fig. 154)

Bradynotes excelsa Rehn, 1907, Ent. News, 18:352. Type and allotype, Mt. Tyndall, Tulare Co., Calif. (ANSP).

Hebardacris excelsa, Rehn, 1952, Trans. Amer. Ent. Soc., 78:115.

Transverse sulci of pronotum plainly impressed, not obsolete as in *albida.* In addition to differences in cerci the males differ in breadth of interocular area, which in *excelsa* is less than half the dorsal diameter of an eye.

Geographic range.—California.

California records.—(Map 15) TULARE CO.: Mt. Tyndall, 12,000 ft. elevation, allotype, paratype, and topotypes (ANSP, USNM and AMNH). Brewer Lake, IX–22–10 (E. C. Van Dyke, CAS). 3 mi. E. Mineralking, VIII–12–61, 11,000 ft. elevation (W. E. Simonds, CDA). Crystal Lake, nr. Mineralking, VIII–15–62, 10,750 ft. elevation (W. E. Simonds, CDA).

Hebardacris mono Rehn

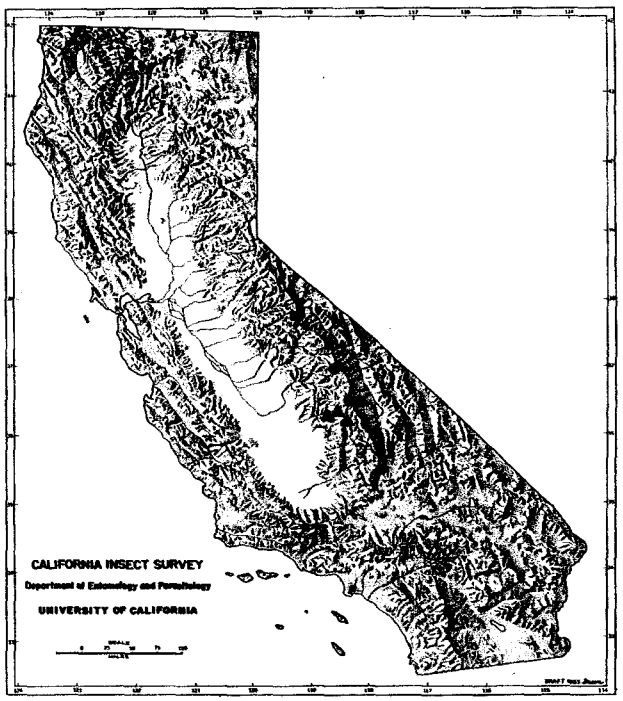
Hebardacris mono Rehn, 1964*b*, Notul. Nat., Phila., 368:11–16. Type ♂, near Mono Pass, N.W. Inyo Co., Calif. (No. 8915, CAS).

Differs from *H. excelsa*, according to Rehn, as follows: "Interantennal section of facial profile less produced, more broadly rounded. Caudal femora of male proportionately narrower and less robust as seen in lateral view; distal margin of genicular lobes of caudal femora oblique subtruncate as seen in profile. Male cerci short and stubby, reaching as far caudad as the apex of the supra-anal plate."

Body 17–19; hind femur 9.5–11.3.

Geographic range.—California.

California records.—(Map 15) INYO CO.: Near Mono Pass, VIII–8–59, holotype, 12,000 ft. elevation (CAS); VIII–9–59, allotype. (D. C. Rentz), originally incorrectly stated as deposited in USNM. Now in CAS. TUOLUMNE CO.: Mt. Lyell, VIII–6–59 (P. H. Benson, USNM, ANSP); VIII–7–35 (E. C. Zimmerman, CAS, ANSP).



Map 15. California distribution of: ●, *Hebardacris albida* (Hebard); ▲, *Hebardacris excelsa* (Rehn); ■, *Hebardacris mono* Rehn.

Genus *Hesperotettix* Scudder, 1875

Occurs over almost all the United States; in the east it is found characteristically on sandy soils. Two groups compose the genus. The Speciosus Group, while largely western, is not known to occur in California. The Viridis Group, ranging widely in the United States from the Atlantic to the Pacific comprises a number of species or races showing various degrees of reduction of wings and tegmina. The features of the tegmina, which have generally been used in taxonomy of the genus, may be of doubtful value, and other differences show many gradations.

The advice of Dr. H. S. Wallace has been sought on this group and his opinions are cited in the treatment of the species or forms.

KEY TO THE CALIFORNIA SPECIES OF THE GENUS HESPEROTETTIX

1 Tegmina reaching to or beyond apex of abdomen *v. viridis* (Thomas) (p. 33)
Tegmina falling far short of abdominal apex . . 2

2 Tegmina of medium length, lanceolate . . . . *n. nevadensis* Morse (p. 31)
Tegmina truncate or rounded at apex 3

3 Tegmina of medium length, truncate (east of Argus Mts.) . . . . . *n. terminus* Hebard (p. 32)
Tegmina short, rounded at apex 4

4 Femora ringed with orange-red . . . . . *p. pacificus* Scudder (p. 32)
Femora without orange-red annuli . . . . . *p. capillatus* Hebard (p. 32)

Hesperotettix nevadensis nevadensis Morse

Hesperotettix nevadensis Morse, 1903, Psyche, 10:113. Lectotype ♂, Ormsby Co., Nev., lower edge of Pine Zone, 1700 to 2000 m. W. of Carson City, designated by Morse & Hebard, 1915.

Hesperotettix viridis nevadensis, Hebard, 1945, Ent. News, 56:117.

Very similar to *H. viridis* in all features except tegminal length. Tegmina falling far short of apices of hind femora, tapering strongly in distal half with apex subacute.

Body 14–21; tegmen 5.5–7.5; hind femur 7.5–10.5.

According to Wallace this is a valid species. Hebard (1945) reports it "in southwestern Oregon east of the Sierras and a small adjacent area in California."

Geographic range.—Utah, to eastern California.

California records.—(Map 16) INYO CO.: Westgard Pass, Cedar Flat, VIII–19–63, 7310 ft. elevation (H. B. Leech, CAS). 1 mi. W. Aberdeen, VIII–15–51, 3900 ft. elevation (J. Rehn, ANSP). 11 mi. W. Lone Pine, VII–19–61 (D. C. Rentz, DCR); VII–22–64 (D. C. & K. A. Rentz, DCR). 9 mi. N. Lone Pine, VII–9–61 (D. C. Rentz, DCR). LASSEN CO.:

Litchfield, VIII–21–22, 4200 ft. elevation (Rehn & Hebard, ANSP). MODOC CO.: 10 mi. W. Alturas, VII–24–62 (D. C. Rentz & C. D. MacNeill, CAS). Warner Mts., Lake City, VII–27–22 (C. L. Fox, CAS). MONO CO.: 1 mi. S. Benton Station, VIII–14–51, 5175 ft. elevation (J. Rehn, ANSP). Benton, VII–20–64 (D. C. & K. A. Rentz, DCR).

Hesperotettix nevadensis termius Hebard

Hesperotettix nevadensis termius Hebard, 1918, Trans. Amer. Ent. Soc., 56:178. Type ♂, Milford, Beaver Co., Utah.

Resembles nominate *nevadensis* but of average smaller size and with tegmina minutely truncate. Wallace regards *termius* as a synonym of *nevadensis* but we here consider it distinct because it can be recognized by the characters given in the key. Hebard (1945) records it "from very widely separated localities in arid southern Nevada and California only as far west as the Argus Range."

Geographic range.—Utah, Nevada, eastern California.

California records.—INYO CO.: Argus Range, Indian Joe Springs, IX–9–22 (Rehn & Hebard, ANSP). Spring, Grape Line Mt., VIII–13–19, 4300 ft. elevation (Rehn & Hebard, ANSP). Panamint Range, Wild Rose Canyon, IX–8–22, 5500 ft. elevation (M. Hebard, ANSP).

Hesperotettix pacificus pacificus Scudder

Hesperotettix pacificus Scudder, 1897, Proc. U.S. Nat. Mus., 20:61. Lectotype ♂, Los Angeles Co., Calif., designated by Rehn & Hebard, 1912 (ANSP).

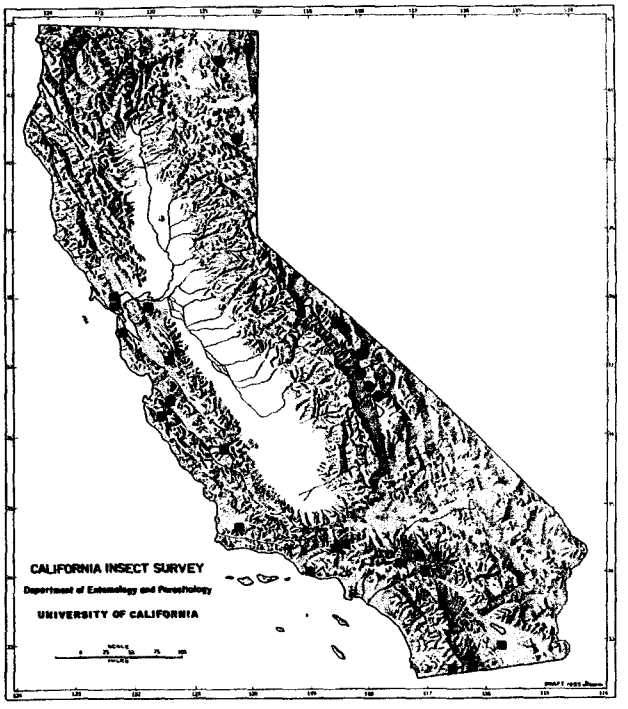
Hesperotettix pacificus pacificus, Hebard, 1919, Trans. Amer. Ent. Soc., 45:260.

Green or pale brown, head and pronotum often marked with white. The tegmina are small densely veined pads, shorter than the pronotum and widely separated.

Body 13–17; tegmen 3.5–3.5; hind femur 8.5–10.

Geographic range.—California.

California records.—(Map 16) MARIN CO.: 1 mi. N. Alpine Lake, VII–30–60 (F. J. Radovsky & R. Garcia, DCR). Fairfax, VII–19–58 (D. C. Rentz, DCR). SAN MATEO CO.: San Bruno Mts. VI–25–57 (D. C. Rentz, DCR). SANTA CLARA CO.: 22 mi. S. jct. Tesla and Mines roads, VIII–31–60 (P. Bensen, DCR). IMPERIAL CO.: Westmorland, IX–10–41 (K. Frick, CIS). CONTRA COSTA CO.: Mt. Diablo, VIII–21–35 (R. H. Beamer, ANSP). LOS ANGELES CO.: Saugus, VIII–23–09; VIII–22–1900. Acton, IX–27–10, 3700 ft. elevation (Coquillett, ANSP), 1 male and 1 female, both labeled as paratypes. MONTEREY CO.: Diablo Range, Priest Valley, VIII–31–22, 2700 ft. elevation (Rehn & Hebard, ANSP). Hastings Reservation, VIII–30–57, 1700 ft. elevation (J. Rehn, ANSP). Langley Canyon, Gabilan Range, VIII–10–37 (Rehn, Pate & Rehn, ANSP). RIVERSIDE CO.: Mt. San Jacinto, VIII–10–58 (D. M. Newell, CIS). Idyllwild, VIII–3–35 (R. H. Beamer, ANSP). SAN BERNARDINO CO.: Verdemont, Cajon Wash, IX–7–19, 1700 ft. elevation (Rehn & Hebard, ANSP). San Bernardino Mts., Caspers Flat, VIII–31–19, 1500 ft. elevation (Rehn & Hebard, ANSP). Cushenberry Ranch, VIII–31–19 (Rehn & Hebard, ANSP). San Bernardino, south rim of San Bernardino Mts., Calif. Highway 18, VIII–22–51, 5756 ft. elevation (J. Rehn, ANSP). SAN DIEGO CO.: Jacumba, IX–15–22, 2900 ft. elevation (Rehn & Hebard, ANSP). 10 mi. N.W. Jacumba, road summit, IX–15–22, 3500 ft. elevation. Nellie, VIII–29–17 (E. P. Hewlett, ANSP). Campo, IX–13–22, 3400 ft. elevation (Rehn & Hebard, ANSP); IX–13–22, 2400 ft. elevation (Rehn & Hebard, ANSP). Potrero, IX–21–22, 2323 ft. elevation (Rehn & Hebard, ANSP). Campo, VIII–10–35 (R. H. Beamer, ANSP). SANTA BARBARA CO.: Solomon Canyon, 12 mi. S.W. Santa Maria, VIII–12–37 (Rehn, Pate & Rehn, ANSP). Boca, VIII–12–37 (Rehn, Pate & Rehn, ANSP). VENTURA CO.: Mugu Point, salt marsh, VIII–13–37, at sea level (Rehn, Pate & Rehn, ANSP).



Map 16. California distribution of: ●, *Hesperotettix nevadensis* Morse; ■, *Hesperotettix pacificus pacificus* Scudder.

Hesperotettix pacificus capillatus Hebard

Hesperotettix pacificus capillatus Hebard, 1919, Trans. Amer. Ent. Soc., 45:260. Type ♂, Del Monte, Monterey Co., Calif. (No. 484, ANSP).

The distinguishing characters cited by Hebard are very finely drawn. Wallace regards *capillatus* as a synonym of *pacificus*, however, specimens with the characters given in the key can be recognized. This entire genus needs revision.

Geographic range.—California.

California records.—MONTEREY CO.: Del Monte, IX–10–10, paratype (ANSP); VIII–20–09, paratype (ANSP). SAN BENITO CO.: Idria, VIII–26–62 (D. C. Rentz & E. W. Kirschbaum, CAS). VENTURA CO.: Mt. Pinos, IX–4–22, 8000 feet elevation (Rehn & Hebard, ANSP).

Hesperotettix viridis viridis (Thomas)

Caloptenus viridis Thomas, 1872, Ann. Rept. U.S. Geol. Surv. Terr., 5:450. Type ♂, Colo., Wyo., Kan.; no type locality selected (type missing).

Hesperotettix festivus Scudder, 1897, Proc. U.S. Nat. Mus., 20:60.

Hesperotettix viridis pratensis Hebard (in part), 1945, Ent. News, 56:176.

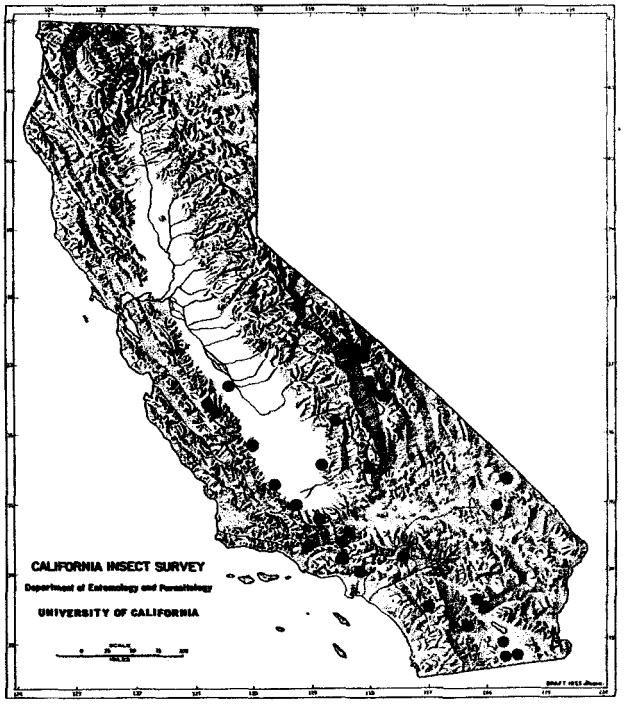
Hesperotettix viridis viridis, Roberts, 1947, Proc. Acad. Nat. Sci. Phila., 99:225.

Pale to bright green, usually fading to brown in dried specimens. Head often marked with white below and behind the eyes; pronotum with a median white stripe and a broad pale stripe on prozonal portion of lateral lobe; tegmina sometimes streaked with white. Hind tibiae pale blue.

Body 16–23; tegmen 14–15; hind femur 9–11.

Geographic range.—From South Dakota, Kansas and Texas to Washington and California, and south to Jalisco and Hidalgo.

California records.—(Map 17) FRESNO Co.: Firebaugh, VII–7–49 (A. D. Telford). IMPERIAL Co.: Holtville, X–18 to 20–36 (A. T. McClay, UCD). Westmorland, X–14–36 (A. T. McClay, UCD). El Centro, X–16–36 (A. T. McClay, UCD). INYO Co.: 3 mi. N. Lone Pine, VII–6–61 (W. A. Foster). 4 mi. S. E. Lone Pine, VIII–16–51, 3700 ft. elevation (J. Rehn, ANSP). 2 mi. E. Big Pine, VII–28–62 (D. C. Rentz & C. D. MacNeill, CAS). Big Pine, VIII–24–60 (D. Q. Cavagnaro, CAS). 1 mi. N. Laws, VIII–14–51, 4280 ft. elevation (J. Rehn, ANSP). 9 mi. N. Lone Pine, VII–9–61 (D. C. Rentz, DCR). Pine Creek, Round Valley, N.W. of Bishop, VIII–7–61 (D. C. Rentz, DCR). E. of Bishop, VIII–10–59 (D. C. Rentz, DCR). KERN Co.: Isabella Dam, IX–5–60 (C. W. O'Brien, DCR). Button Willow, VII–25–57 (C. W. O'Brien, DCR). Lebec, IX–5–61 (C. W. O'Brien, DCR); X–10–58 (J. W. MacSwain, CIS). 6 mi. E. Onyx, X–14–58 (W. E. Ferguson, CIS). 5 mi. W. Old River, VIII–18–51, 440 ft. elevation, J. Rehn, ANSP); VIII–18–51 (J. Rehn, ANSP). KINGS Co.: Kettleman City, X–3–56 (R. E. Graham). LOS ANGELES Co.: Pasadena, VIII–1– (Rehn & Hebard, ANSP). Palmdale, X–1–47 (G. P. Mackenzie, UCD); IX–7–56 (E. G. Linsley, CIS). Little Rock, IX–2–47 (G. P. Mackenzie, UCD). 2 mi. N. Lancaster, IX–8–56, *Chrysothamnus nauseosus mohavensis* (P. D. Hurd, CIS); 4 mi. N. Lancaster, IX–8–62 (J. T. Doyen, CIS). 2 mi. N.E. Vincent, VIII–20–51, 3500 ft. elevation (J. Rehn, ANSP). Mint Canyon, VI–26–58 (C. Cushner, DCR). MONO Co.: Shealy, VIII–14–51, 4200 ft. elevation (J. Rehn, ANSP). Leevining campgrounds, W. of Mono Lake, VII–1–61 (D. C. Rentz, DCR). RIVERSIDE Co.: Indio, VII–29– (Rehn & Hebard, ANSP). 5 mi. W. Sage, VII–2–63 (P. Welles, CIS). Coachella, V–13–28 (E. C. Van Dyke, CAS). SAN BENITO Co.: 4.8 mi. N. Idria on Idria Rd., VIII–15–58 (D. C. Rentz, DCR). Idria, VIII–15–58, on *Chrysothamnus* (D. C. Rentz, DCR). SAN BERNARDINO Co.: Cottonwood, IX–9– (Rehn & Hebard, ANSP). Hesperia, VIII–3–48, X–25–47 (G. P. Mackenzie). Ivanpah, IX–13–58, on *Chrysothamnus*. (J. A. Chemsak, CIS). SAN DIEGO Co.: Tighes (Scudder). Borego, X–14–48 (G. P. Mackenzie). SISKIYOU Co.: (Koebele Collection, CAS). Montague (Scudder). TULARE Co.: 18 mi. E. Kennedy Meadow campground, Nine-Mile Canyon, VII–22–61 (C. W. O'Brien, DCR). VENTURA Co.: Sespe Canyon, VII–10–59 (F. D. Parker).



Map 17. California distribution of *Hesperotettix viridis viridis* (Thomas).

Discussion—Recorded food plants of this species are *Bigelovia*, *Haplopappus*, *Chrysothamnus*, and *Gutierrezia*. While its habits, from the human viewpoint, are beneficial, its role in weed control has probably been exaggerated.

Genus *Hypsalonia* Gurney and Eades, 1961

Gurney and Eades (1961) erected this genus with species closely related to *Bradynotes*, *Hebardacris*, and the more northern *Nisquallia*. Determination of species must be based on a study of the concealed male genitalia. Tentative identifications may be made on the basis of locality; but the student should consult the keys and figures given by Gurney and Eades (1961).

KEY TO SPECIES OF CALIFORNIA HYPSALONIA, BASED ON MALES

(Modified from Gurney and Eades, 1961)

1 Aedeagus with dorsal valve shorter than ventral valve (fig. 43), and ventral valve not knobbed in lateral view; protuberances on supra-anal plate broadly transverse and dorsally inclined as a shelf-like ledge; small furcula present. (Vicinity of northern part of Lake Tahoe) . . . . . *satur* Scudder (p. 35)

Aedeagus with dorsal valve as long as or longer than ventral valve or, if not, the ventral valve is roundly knoblike; protuberances less clearly transverse, with maximum development near each lateral margin of disk, and without such a well-defined shelflike ledge; furcula absent or very small 2

2 Aedeagus with ventral valve expanded laterally, caplike; protuberances on supra-anal plate sharp and with their lateral margins virtually longitudinal; paraproct without submarginal apical carina. (Vicinity of Mono Pass, northwestern Inyo Co.) . . *petasata* Gurney & Eades (p. 34)

Ventral valve of aedeagus not caplike at apex; protuberances rounded and with their lateral margins not longitudinal; paraproct with a submarginal apical carina 3

3 Aedeagus with dorsal valve protruding anteriorly at apex (fig. 45); lateroposterior angle of pronotum broadly rounded; body densely pilose. (Vicinity of southeastern Tuolumne Co.) . . *tioga* Gurney & Eades (p. 35)

Aedeagus with dorsal valve not protruding anteriorly at apex; lateroposterior angle of pronotum more sharply rounded; body more sparsely pilose, or scarcely pilose 4

4 Aedeagus with ventral valve knobbed at apex, conspicuously longer than dorsal valve. (Vicinity of southern part of Lake Tahoe, southward to Alpine Co.) . . . . . *rentzi*, Gurney & Eades (p. 35)

Aedeagus with ventral valve not knobbed . . 5

5 Ventral valve of aedeagus forked . . . . . *merga* Gurney & Buxton (p. 34)

Ventral valve of aedeagus not forked, shorter than dorsal valve . . . . . *miwoki* Gurney & Eades (p. 34)

Hypsalonia merga Gurney and Buxton

Hypsalonia merga Gurney & Buxton, 1963, Bull. Brooklyn Ent. Soc., 58:68. Holotype ♂, Top Lake, Calif. (CDA).

Geographic range.—California.

California records.—(Map 18) EL DORADO CO.: Top Lake, 8 mi. W. Fallen Leaf Lake, VIII–22–62, ex: *Carex*, 8200 ft. elevation (G. M. Buxton & F. L. Blanc, CDA). Additional males and females, same data (CDA, USNM).

Discussion—Known only from the type locality. Appears to be associated with sedges, *Carex* sp., which grow abundantly around the lake.

Hypsalonia miwoki Gurney and Eades

Hypsalonia miwoki Gurney & Eades, 1961, Trans. Amer. Ent. Soc., 87:296. Holotype ♂, Sonora Pass, Tuolumne Co., Calif. (ANSP).

Geographic range.—California.

California records.—(Map 18) TUOLUMNE CO.: Upper Deadman Creek, W. side of Sonora Pass, holotype, allotype, VII–22–41, 9400 ft. elevation (Rehn & Rehn, ANSP). Sonora Peak, VIII–6–59, paratypes (D. C. Rentz, CAS); VIII–21–59, paratypes (C. W. O'Brien, CAS); VIII–2–57, paratypes, (M. J. D. White, CAS); VI–13–54, paratypes (M. Lundgren, CAS); VII–26–62 (D. C. Rentz & C. D. MacNeill, CAS). W. side Sonora Peak, VII–2–63, 9000 ft. elevation (C. W. O'Brien, CAS).

Discussion—Rehn and Rehn (Gurney and Eades, 1961) noted that the type series of *miwoki* were collected from "Hudsonian meadow with gentle slopes of broken rock and coarse gravel; chiefly granitic, along stream, local on broken rocks. Some were mating, jumping actively or hiding under rocks."

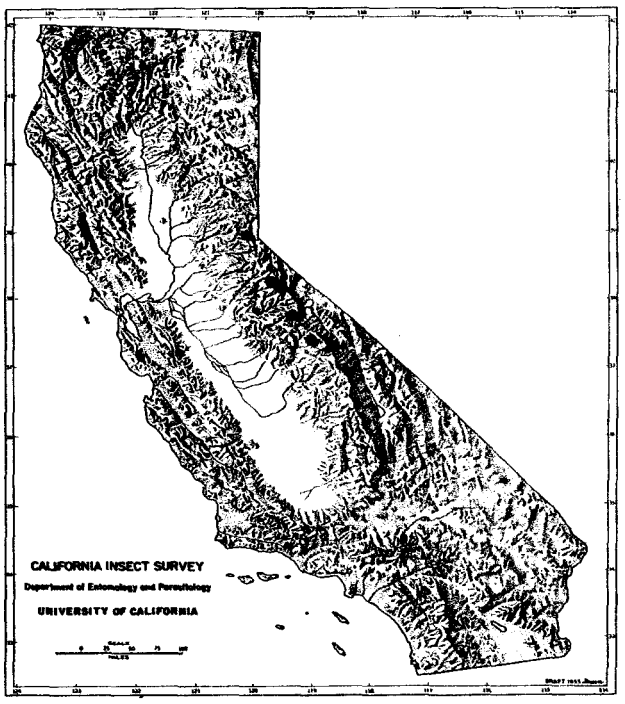
Hypsalonia petasata Gurney and Eades

Hypsalonia petasata Gurney & Eades, 1961, Trans. Amer. Ent. Soc., 87:303. Holotype ♂, near Mono Pass, Inyo Co., Calif. (CAS).

Geographic range.—California.

California records.—(Map 18) INYO CO.: Near Mono Pass, VII–9–59, 12,000 ft. elevation (D. C. Rentz, CAS); VIII–12–64 (J. D. Birchim & C. D. MacNeill, JDB).

Discussion—Known only from the type locality, an unglaciated tableland above timberline. Only a few plants present, and the ground mostly covered with loose granitic sand.



Map 18. California distribution of: ■, *Hypsalonia merga* Gurney and Buxton; ●, *Hypsalonia miwoki* Gurney and Eades; ▲, *Hypsalonia petasata Gurney and Eades.*

Hypsalonia rentzi Gurney and Eades

Hypsalonia rentzi Gurney & Eades, 1961, Trans. Amer. Ent. Soc., 87:288. Holotype ♂, Ralston Peak, El Dorado Co., Calif. (No. 65773, USNM).

Geographic range.—California.

California records.—(Map 19) ALPINE CO.: Winnemucca Lake, mating, VII–17–49 (R. M. Bohart, UCD). EL DORADO CO.: Mt. Ralston Peak, holotype, VIII–13–32 (C. C. Wilson, USNM); ♀, allotype, VII–24–31, 9200 ft. elevation (E. O. Essig, USNM). Fallen Leaf Lake, VII–19–15 (E. C. Van Dyke, CAS); VIII–1915 (L. S. Rosenbaum, CAS). Mt. Tallac, Lake Tahoe, VII–15–15, paratype (E. P. Van Duzee, CAS).

Hypsalonia satur (Scudder)

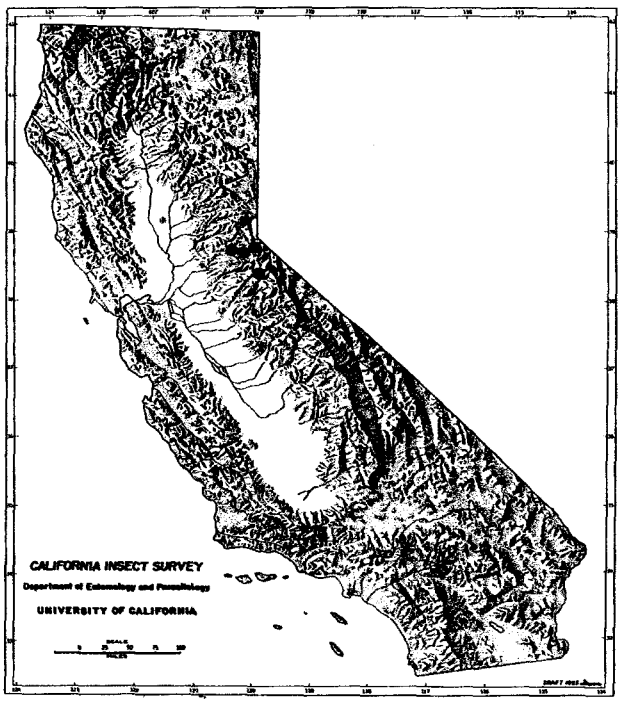
Bradynotes satur Scudder, 1897, Proc. U.S. Nat. Mus., 20:81. Lectotype ♂, Placer Co., Calif., designated by Rehn & Hebard (1912), (USNM).

Hypsalonia satur, Gurney & Eades, 1961, Trans. Amer. Ent. Soc., 87:294.

Geographic range.—California.

California records.—(Map 19) PLACER CO.: September, lectotype, lectoallotype (A. Koebele, USNM); same locality, no data (CAS). Squaw Peak, VIII–3–10, 8300–8950 ft. at summit (Rehn & Hebard, ANSP, USNM). Five Lakes Valley at foot of Squaw Peak, VII–31–10, 7700 ft. elevation (Rehn & Hebard, ANSP).

Discussion—This most northern species of *Hypsalonia* is known only from the mountains west of the northern half of Lake Tahoe. Rehn and Hebard collected it on almost bare ground but with a few alpine plants.



Map 19. California distribution of: ●, *Hypsalonia rentzi* Gurney and Eades; ■, *Hypsalonia satur* (Scudder); ▲, *Hypsalonia tioga* Gurney and Eades.

Hypsalonia tioga Gurney and Eades

Hypsalonia tioga Gurney & Eades, 1961, Trans. Amer. Ent. Soc., 87:299. Holotype ♂, saddle between Dana and Gibbs Peaks, Tuolumne Co., Calif. (UMMZ).

Geographic range.—California.

California records.—(Map 19) TUOLUMNE CO.: Saddle between Dana and Gibbs Peaks, VIII–5–48, holotype, allotype, 11,800 ft. elevation (R. Russell, UMMZ). A number of additional male and female paratypes collected at the same time and place as the holotype and allotype (ANSP, USNM). Several other adult specimens have been taken from an unspecified location in Yosemite Nat. Park at an elevation of 10–12,000 ft. (NMMZ, USNM).

Genus *Leptysma* Stal, 1873

This widely distributed genus occurs over much of North and South America where suitable aquatic habitats exist. Three species are recorded from the United States and Mexico. Only one species, *hebardi,* is found in California (Rehn and Eades, 1961).

Leptysma hebardi Rehn and Eades

(Fig. 174)

Leptysma mexicana Riley, 1893, N. Amer. Fauna, 7:252 (not *mexicana* of Saussure).

Leptysma marginicollis Scudder, 1900, Psyche, 9:116 (in part).

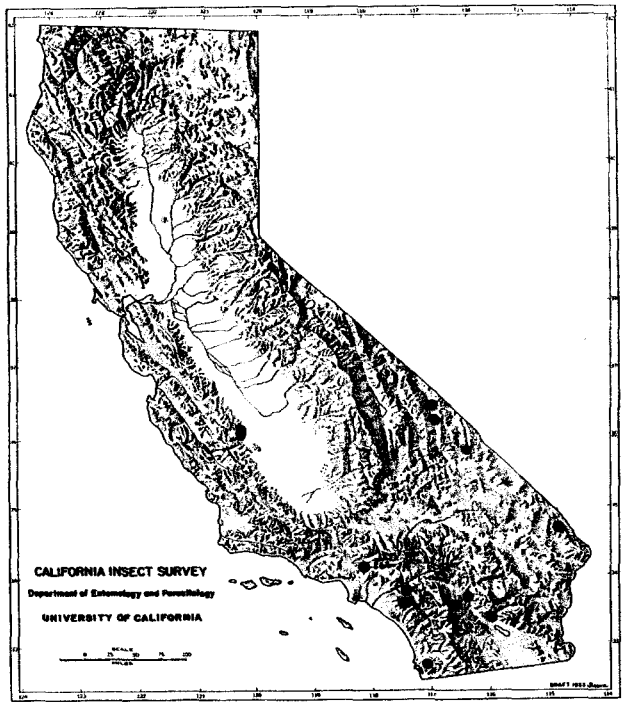
Leptysma hebardi Rehn & Eades, 1961, Proc. Acad. Nat. Sci., Phila., 113(5):102–108. Holotype ♂, allotype ♀, Bill Williams Fork of the Colorado River, Mohave-Yuma counties, Ariz.

Pale brown, often more or less greenish, with a white stripe on each side of head, this stripe continued across lateral lobe of pronotum, meso- and metapleura. Antennae broad and triangular in cross-section at base, gradually tapering to the acute apex. Tegmina much surpassing hind femoral apices, acuminate at apex.

Body 28–37; tegmen 25–32; hind femur 12.5–14.

Geographic range.—Southern Nevada, southern California, western half of Arizona and southward through western Mexico to Guanajuato and the tip of Baja California.

California records.—(Map 20) FRESNO CO.: Coalinga (ex: Rehn & Eades). INYO CO.: Panamint Valley (ex: Rehn & Eades). Shoshone (ex: Rehn & Eades). Furnace Creek, Death Valley (ex: Rehn & Eades). LOS ANGELES CO.: L. A. County (ex: Rehn & Eades). RIVERSIDE CO.: Saboda Springs (ex: Rehn & Eades). Riverside (ex: Rehn & Eades). Palm Springs (ex: Rehn & Eades). San Jacinto Mts. (ex: Rehn & Eades). Corona, IV–26–32 (A. T. McClay, CIS). Mecca, IV–4–58 (F. Colley, CIS). SAN BERNARDINO CO.: Needles (ex: Rehn & Eades), IX–12–58 (R. W. Thorp, CIS). SAN DIEGO CO.: San Diego (ex: Rehn & Eades). Alvarado Canyon, San Diego, IV–29–53 (J. A. Powell, CIS).



Map 20. California distribution of *Leptysma hebardi* Rehn and Eades.

Discussion—This species, in common with others in the genus, is found on vegetation growing in or about ponds, streams or lakes. *L. hebardi* is reported by Ball et al. (1942) as living on cattails along the margins of ponds and streams. Evidence indicates that it may hibernate beneath leaves or debris.

Long confused with *L. marginicollis* (Serville) and *L. mexicana* (Saussure), both of which occur outside the known range of *hebardi*.

Genus *Melanoplus* Stal, 1873

This is a very large genus with fifty or more species and subspecies recorded from California. It includes some of our most important agricultural pests, such as *devastator, femur-rubrum, sanguinipes, bivittatus* and *differentialis nigricans*. The species are for the most part dull colored and rather small in size; and many are very similar in size, color, and general appearance. A close examination of the male genitalia is necessary to separate most of the species. The females of many species are so similar that only an expert can distinguish them. Many high mountain and woodland species are brachypterous as adults, and those in open fields, grasslands, and cultivated areas are usually long-winged. In some cases, however, the wing length varies in the same species.

KEY TO CALIFORNIA SPECIES OF MELANOPLUS

1 Tegmina extending to or beyond apex of hind femora 2
Tegmina not reaching apex of hind femora . . . 16

2 Furcula present as finger-like lobes or long flattened processes 3
Lobes of furcula no longer than tenth tergite . . 11

3 Subgenital plate in lateral view broader at base than long, its apex not lobate or notched (fig. 77) . . . . . *femur rubrum, femur-rubrum* (DeGeer) (p. 47)
Subgenital plate in lateral view as long as or longer than its basal width; apex lobate, tuberculate or notched 4

4 Subgenital plate with apex spatulate produced and usually notched, mesosterum tumid or tuberculate 5
Subgenital plate not notched at apex; mesosterum flat 7

5 Cercus rather narrow, subequal in width throughout (figs. 80, 81) (tubercle of mesosterum low, rounded . . . . . *devastator* Scudder (p. 45)
Cercus broad, usually obliquely narrowed to apex but sometimes with apex rounded 6

6 Apex of subgenital plate moderately produced, notched at middle; mesosternal tubercle subconoid (figs. 78, 79) . . . . . *sanguinipes* (Fabricius) (p. 55)
Apex of subgenital plate strongly produced, entire; mesosternal tubercle rounded (figs. 82, 83) . . *borealis palaceus* Fulton (p. 41)

7 Lobes of furcula widely divergent from base, short, tapering, acute; apex of cercus rounded, spatulate (fig. 84) . . . . . *packardii* Scudder (p. 53)
Lobes of furcula half or more as long as epiproct, flattened and attingent for part of their length . 8

8 Furcula about half as long as epiproct (fig. 90), its lobes attingent throughout but obliquely cut off at apex (fig. 89) . . *herbaceus* Bruner (p. 48)
Furcula two-thirds as long as epiproct, its lobes tapering, digitiform or acute at apex 9

9 Cercus narrowed from base to middle, then expanded to the truncate apex, which is inflexed and spatulate (fig. 92) . . . . . *complanatipes* Scudder (p. 44)
Cercus abruptly bent mesad at middle (fig. 91), the apex then turned dorsad and truncate . . *cinereus cinereus* Scudder (p. 42)

10 Small (body 15–18 mm.), compressed; median carina of pronotum sharp throughout; cerci somewhat bulbous at apex and obliquely flattened (fig. 94) . . . . . *marginatus* Scudder (p. 51)
Larger; cercus not bulbous at apex 11

11 Cercus broadest near base, ear-shaped (fig. 93) . *rugglesi* Gurney (p. 54)
Cercus broadest at or near apex 12

12 Cercus symmetrically widened to apex 13
Apex of cercus asymmetric, foot-shaped 14

13 Cercus moderately widened to apex; lobes of furcula widely divergent, tapering, acute (fig. 84) *packardii* Scudder (p. 53)
Cercus much widened to the truncate apex; lobes of furcula triangular, minute (fig. 85) . . . . *yarrowii* (Thomas) (p. 57)

14 Toe of cercal apex decurved, slender, acute (fig. 88) *alpinus* Scudder (p. 38)
Toe of cercal apex upturned, broad 15

15 Foot-shaped apex of cercus obtuse-angulate at the "heel," the toe short and bluntly rounded; pronotum and tegmina with pale stripes (fig. 86) . . . *bivittatus* (Say) (p. 40)
Heel of cercal apex projecting; the toe long and narrowed; head and pronotum unstriped (fig. 87) *differentialis nigricans* Cockerell (p. 45)

16 Cerci in form of broad plates, no more than 1.5 times as long as maximum width 17
Cerci tapering from base to apex or from base to middle with apex somewhat widened 22

17 Tegmina strongly tapering*, lanceolate; body and legs stout; cerci broadly foot-shaped; furcula minute 18
Tegmina ovate; body slender; furcula distinct . . 20

18 Cercus slightly longer than its maximum width, its distal margin gently rounded (fig. 122) . . *chimariki* Gurney & Buxton (p. 41)
Length of cercus less than its maximum width, its distal margin truncate 19

19 Tegmina but little longer than pronotum (fig. 121) *keiferi* Gurney & Buxton (p. 49)
Tegmina nearly twice as long as pronotum . . . *lithophilus* Gurney & Buxton (p. 50)

20 Cercus as broad as long, its lower margin lobately convex (lobes of furcula short-digitiform) (fig. 123) . . . . . *platycercus* Hebard (p. 53)
Cercus longer than wide, its lower margin straight at base, oblique to apex 21

21 Furcula tapering, longer than tenth tergite (figs. 117, 118 . . *rileyanus rileyanus* Scudder (p. 54)
Lobes of furcula short-triangular . . . . . *harperi* Gurney & Buxton (p. 48)

22 Body compressed; median carina of pronotum sharp and equal throughout (lobes of furcula at least as long as tenth tergite) 23
Median carina of pronotum weaker on prozona, sometimes obsolete; lobes of furcula shorter than tenth tergite (except in Aridus Group and *wilsoni* Gurney) 34

23 Cercus bulbous at apex; tegmina longer than pronotum, much overlapped, acuminate (fig. 94) *marginatus* (Scudder) (p. 51)
Cercus not bulbous at apex; tegmina shorter than pronotum 24

24 Cercus elongate, slender, tapering from base to middle, thence gradually widened to near apex . 25
Cercus very broad at base, abruptly narrowed, not widened near apex (except feebly in *M. gracilipes*) 26

25 Outer face of cercus sulcate distally (figs. 105, 106) . . . . . *ligneolus* Scudder (p. 50)
Outer face of cercus convex distally (figs. 95, 96, 97) . . . . . *huporeus* Hebard (p. 49)

26 Epiproct without a tubercle or transverse carina on each side near mid-length 27
Epiproct with such tubercle or carina 30

27 Lobes of furcula much rounded at tips (figs. 107, 108) . . . . . *nanus* Scudder (p. 53)
Lobes of furcula tapering, acute 28

28 Cercus evenly tapering, tip acutely rounded (figs. 101, 102) . . . . *sonomaensis* Caudell (p. 56)
Apex of cercus blunt 29

29 Cercus feebly widened and subtruncate at apex, its lower margin nearly straight (fig. 111) . . . *gracilipes* Scudder (p. 48)
Cercus not widened at apex, its lower margin strongly undulate (fig. 114) . *aspasmus* Hebard (p. 39)

30 Lobes of furcula bluntly rounded at tips (figs. 115, 116) . . . . . *fultoni* Hebard (p. 47)
Lobes of furcula tapering acute 31

31 Lobes of furcula straight, almost parallel . . . 32
Lobes of furcula subangulately divergent . . . 33

32 Tip of cercus almost reaching apex of epiproct (figs. 98, 99) . . . . *fricki* Strohecker (p. 47)
Tip of cercus remote from apex of epiproct (figs. 112, 113) . . . . . *microtatus* Hebard (p. 52)

33 Apex of cercus narrowly rounded, subacuminate *muricolor* Strohecker (p. 52)
Apex of cercus rounded, not at all acuminate (fig. 100) . . . . . *hesperus* Hebard (p. 48)

34 Pronotum rounded, its carinae obsolete . . . Aridus Group (p. 39)
Carinae of pronotum distinct, the median sometimes obsolete between the sulci 35

35 Margins of epiproct straight or convex, not as below 36
Margins of epiproct "pinched" and concave distad, with an oblique carina on each side 46

36 Epiproct with side margins subequally elevated . 37
Side margins of epiproct strongly reflexed at base, abruptly lower at or beyond mid-length . . . 44

37 Cercus curved strongly downward and inward to apex (fig. 124) . . . . *ablutus* Scudder (p. 38)
Cercus spatulate or upturned to apex 38

38 Cercus elongate with apical third or more abruptly incurved (Del Norte Co.) . . . . . n. sp.
Cercus not over 2.5 times as long at its basal width, (abruptly incurved only in *M. eremitus*) . . 39

39 Cercus tapering distad, apex narrowly rounded (figs. 119, 120) . . . . . *olamentke* Hebard (p. 53)
Apex of cercus bluntly rounded or truncate . . . 40

40 Lobes of furcula very short and rounded (figs. 133, 134) . . . . . *eremitus* Strohecker (p. 46)
Lobes of furcula broad-triangular 41

41 Epiproct broader at base than long; furcula large for group, as long as tenth tergite (San Diego Co.) (fig. 128) . . . . *wilsoni* Gurney (p. 56)
Furcula shorter than tenth tergite (northern) . . 42

42 Hind tibia red; outer face of hind femur fasciate (fig. 125, 126) . *caroli* Gurney & Helfer (p. 41)
Hind tibia blue; hind femur unmarked . . . 43

43 Cercus not more than twice as long as its basal width; tegmina attingent or feebly overlapping (figs. 129, 130) . . . . . *wintunus* Strohecker & Helfer (p. 57)
Cercus more than twice as long as its basal width; tegmina longer than pronotum, much overlapped (figs. 131, 132) . . . *hupah* Strohecker (p. 49)

44 Cercus not reaching tip of epiproct, its apex not widened, obliquely truncate (southern) figs. 135, 136) . . . . . *bernardinae* Hebard (p. 40)

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* Tegmina of *M. marginatus*, in alternate category, may be described as lanceolate.

Cercus exceeding tip of epiproct, distally enlarged or tapering and acute (northern) 45

45 Cercus widened and inturned distad (figs. 137, 138) *lepidus* Scudder (p. 50)

Cercus continuously tapering, acute at tip . . . *buxtoni* Strohecker (p. 41)

46 Cercus not reaching tip of epiproct (southern) (figs. 135, 136 . *bernardinae* Hebard (p. 40)

Cercus reaching tip of epiproct (northern) . . . 47

47 Cercus not or very feebly widened at apex . . 48

Cercus distinctly widened at apex 49

48 Cercus with apex obliquely truncate . . . . . *elater* Strohecker (p. 46)

Cercus continuously tapering, acute at apex . . . *elaphrus* Strohecker (p. 46)

49 Lower distal angle of cercus extended, subacute* *ascensus* Scudder (p. 39)

Lower distal angle of cercus broadly rounded . . 50

50 Cercus but little narrowed at middle, the lower distal angle obtusely rounded; membrane of dorsal valve of aedeagus hyaline . . . . . *siskiyou* Strohecker (p. 56)

Cercus much narrowed at middle, lower distal angle rather narrowly rounded; membrane of dorsal valve of aedeagus sclerotized, dark (Del Norte Co.) . . . . . n. sp.

LIST OF THE SPECIES GROUPS OF MELANOPLUS

1. MARGINATUS GROUP
   - *M. aspasmus* Hebard
   - *M. fricki* Strohecker
   - *M. fultoni* Hebard
   - *M. gracilipes* Scudder
   - *M. hesperus* Hebard
   - *M. huporeus* Hebard
   - *M. ligneolus* Scudder
   - *M. marginatus* Scudder
   - *M. microtatus* Hebard
   - *M. muricolor* Strohecker
   - *M. nanus* Scudder
   - *M. sonomaensis* Caudell
2. SALTATOR GROUP
   - *M. ascensus* Scudder
   - *M. bernardinae* Hebard
   - *M. buxtoni* Strohecker
   - *M. elaphrus* Strohecker
   - *M. elater* Strohecker
   - *M. lepidus* Scudder
   - *M. siskiyou* Strohecker
3. IMMUNIS GROUP
   - *M. ablutus* Scudder
   - *M. caroli* Gurney & Helfer
   - *M. eremitus* Strohecker
   - *M. hupah* Strohecker
   - *M. olamentke* Hebard
   - *M. wilsoni* Gurney
   - *M. wintunus* Strohecker & Helfer
4. ARIDUS GROUP
   - *M. aridus* (Scudder)
5. RILEYANUS GROUP
   - *M. platycercus* Hebard
   - *M. rileyanus rileyanus* Scudder
   - *M. r. varicus* Scudder
6. PONDEROSUS GROUP
   - *M. differentialis nigricans* Cockerell
7. BIVITTATUS GROUP
   - *M. bivittatus* (Say)
   - *M. yarrowii* (Thomas)
8. INFANTILIS GROUP
   - *M. alpinus* Scudder
9. KEIFERI GROUP
   - M. *chimariki* Gurney & Buxton
   - *M. keiferi* Gurney & Buxton
   - *M. lithophilus* Gurney & Buxton
10. OCCIDENTALIS GROUP
    - *M. rugglesi* Gurney
11. HARPERI GROUP
    - *M. harperi* Gurney & Buxton
12. FEMUR-RUBRUM GROUP
    - *M. femur-rubrum femur-rubrum* (DeGeer)
13. MEXICANUS GROUP
    - *M. borealis palaceus* Fulton
    - *M. devastator* Scudder
    - *M. sanguinipes sanguinipes* (Fabricius)
    - *M. s. defectus* Scudder
14. HERBACEUS GROUP
    - *M. herbaceus* Bruner
15. PACKARDII GROUP
    - *M. packardii* Scudder
16. CINEREUS GROUP
    - *M. cinereus cinereus* Scudder
    - *M. c. cyanipes* Scudder
    - *M. c. dealbatus* Scudder
    - *M. complanatipes* Scudder

* In California specimens studied. Intergradation with Oregon populations, in which this angle is rounded, may occur.

Melanoplus ablutus Scudder

(Fig. 124)

Melanoplus ablutus Scudder, 1899, Proc. Dav. Acad. Nat. Sci., 7:185. Lectotype ♂, Wawona, Mariposa Co., Calif., designated by Rehn & Hebard, 1912 (MCZ).

Male cercus elongate, slightly narrowed toward middle, apex downwardly produced, and much inturned, not visible from lateral view. Aedeagus with ventral valves short, wide, broadly truncate.

Body 14.5–19.5; tegmen 4–5; hind femur 9–11.

Geographic range.—California.

California records: (Map 21) MARIPOSA CO.: Wawona, VIII–13–1897, paratype (ANSP). El Portal, VIII–30–07, 3200 ft. elevation (Rehn & Hebard, ANSP). Yosemite Nat. Park, VIII–1–40 (R. H. Beamer, ANSP). TULARE CO.: Lemoncove, VII–26–29 (R. H. Beamer, CAS).

Melanoplus alpinus Scudder

(Fig. 88)

Melanoplus alpinus Scudder, 1897, Proc. U.S. Nat. Mus., 20: 333. Lectotype ♂, Henry Lake, Idaho, designated by Rehn & Hebard, 1912. (USNM).

Dark gray with black postocular band continued along prozonal part of lateral lobe. Tegmina with a row of fuscous dots. Hind femur with three dark blotches on upper inner pagina, the outer face unmarked or vaguely clouded. Hind tibiae blue.

Body 20–22; tegmen 15–16; hind femur 11–12.

Geographic range.—Alberta, British Columbia, Colorado, Idaho, Montana, Oregon, Wyoming.

California records.—(Map 21) TUOLUMNE CO.: Sonora Peak, VIII–6–59 (D. C. Rentz, DCR); VIII–6–59 (C. E. Wemmer, DCR). Vicinity Sonora Peak, IX–5–60 (D. C. Rentz, DCR). Sonora Pass, IX–7–60 (C. D. MacNeil, DCR). Near Sonora Pass, VIII–5–62 (D. C. Rentz, DCR).

Discussion—Rentz (1962*b*) was the first to collect this northern species in California, near Sonora Pass during August of 1959, '60, '61 and '62. All were taken at an elevation of 9000 feet in treeless, moist meadows. Distribution was quite limited. It was in association with *sanguinipes (=bilituratus)*.

Melanoplus aridus (Scudder)
(Fig. 151, Map 21)

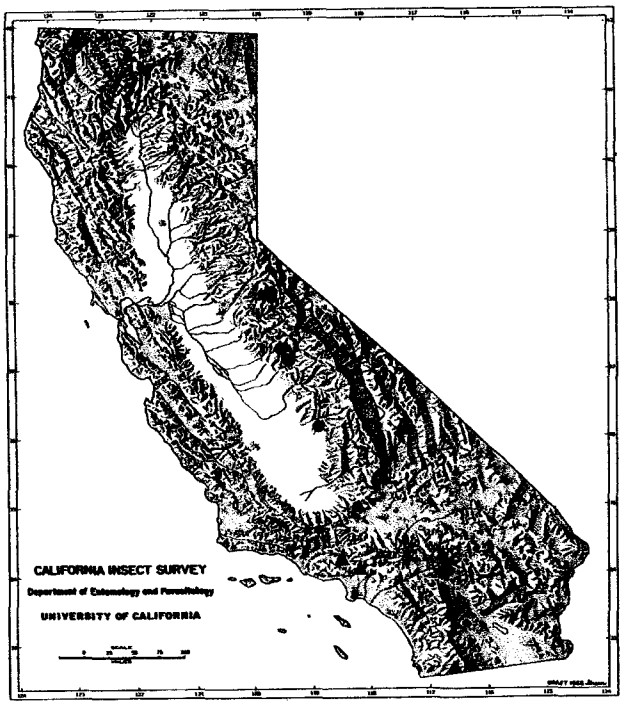
Pezotettix aridus Scudder, 1879, Proc. Bost. Soc. Nat. Hist., 20:84–85. Type ♀, San Carlos, Ariz. Selected by Hebard (1935) (USNM).

Melanoplus aridus, Scudder, 1897, Proc. U.S. Nat. Mus., 20:209.

Pronotum with carinae obsolete, the dorsum rounded into lateral lobes, hind margin weakly convex or truncate. Tegmina short, attingent to widely separated. Subgenital plate of male not elevated or tuberculate at apex.

Geographic range.—Widely distributed throughout the southwest from California to Texas.

California records.—(Map 21) INYO CO.: Wild Rose Canyon, Panamint Range, IX–6–22 (M. Hebard, ANSP). KERN CO.: Searles, IX–6–22, 3200 feet elevation (M. Hebard, ANSP). Warren, IX–17–10, 3500 feet elevation (ANSP). LOS ANGELES CO.: Acton, IX–27–10, 2700 feet elevation (ANSP). Parker Mt., S.E. end Ventura Mts., IX–27–10 (ANSP). SAN BERNARDINO CO.: Cima, VIII–12– (ex.: Rehn & Hebard). San Bernardino Mts., Cactus Flat, VIII–31–19, 5900 feet elevation, (ANSP). SAN DIEGO CO.: Wagon Pass, 8 mi. E. Jacumba, IX–16–22 (Rehn & Hebard, ANSP). Campo, VIII–10–35 (R. H. Beamer, ANSP).



Map 21. California distribution of: ●, *Melanoplus ablutus* Scudder; ■, *Melanoplus alpinus* Scudder; ▲, *Melanoplus aridus (Scudder).*

Discussion—This species is found from lower elevations in the Lower Sonoran deserts to the Canadian Zone, 9400 feet elevation. It is found in association with *Artemisia and Coleogyne* in Nevada. In other areas it is probably associated with *Larrea* and *Grayia-Lycium.*

According to A. B. Gurney at least three recognizable populations occur in southern California. The status of these has yet to be clarified.

Melanoplus ascensus Scudder
(Map 22)

Melanoplus ascensus Scudder, 1898, Proc. Dav. Acad. Nat. Sci., 7:196. Lectotype ♂, Mt. Shasta, California, designated by Rehn & Hebard, 1912 (MCZ).

Melanoplus ascensus ascensus, Hebard, 1937, Tran. Amer. Ent. Soc., 63:150.

Melanoplus ascensus calopooyae Hebard, 1937, Trans. Amer. Ent. Soc., 63:152.

Melanoplus ascensus, Strohecker, 1963, Pan-Pac. Ent., 39:171.

Coloration nondistinctive. Hind tibia blue or red. The form of the male cercus should suffice for identification of that sex. The cochleate portion of the dorsal valve of the aedeagus is coriaceous and semisclerotized.

Body 18–20; tegmen 3.5–4; hind femur 9–10.

Geographic range.—California.

California records.—(Map 22) LASSEN CO.: Westwood, VIII–21–22, 5000 ft. elevation (Rehn & Hebard, ANSP). PLUMAS CO.: Harkness Peak, VIII–20–22, 9200 ft. elevation (ANSP). SISKIYOU CO.: Mt. Shasta, IX–2–1897, paratype (ANSP). VIII–14–09, 5500 ft. elevation, topotype (ANSP). McCloud, VIII–29–60 (T. Gallion, CDA). Mt. Shasta, just below forest line, IX–2, lectotype (A. P. Morse) (ex: Scudder). 4 road mi. E. Shasta City, McBride Campground, VII–23–62 (D. C. Rentz & C. D. MacNeill, CAS). Bartle, VII–22–62 (D. C. Rentz & C. D. MacNeill, CAS).

Melanoplus aspasmus Hebard
(Fig. 114, Map 22)

Melanoplus aspasmus Hebard, 1919, Trans. Amer. Ent. Soc., 45:288. Type ♂, Paso Robles, San Luis Obispo Co., Calif. (No. 506, ANSP).

The distinctive form of the male cercus offers a ready feature for identification. The aedeagus, not figured by Hebard, indicates relationship with *M. rileyanus.* Lobes of furcula attingent at base, strongly divergent, tapering and acute. Tegmina shorter than pronotum, broadly rounded, but sharply rounded in some males.

Body 15–17; tegmen 3–3.2; hind femur 8.5–9.5.

Geographic range.—California.

California records.—(Map 22) ALAMEDA CO.: Berkeley, VIII–4–14, X–24–42, VII–9–17 (CAS); X–25–59 (F. X. Williams, CAS); X–9–18 (E. C. Van Dyke, CAS). CONTRA COSTA CO.: Danville, IX–1948 (F. X. Williams, CAS). FRESNO CO.: Diablo Range, Waltham Canyon, VIII–21–22, 1600 ft. elevation (Rehn & Hebard, CAS). Priest Valley, VIII–31–22, 2700 ft. elevation, Rehn & Hebard, CAS).

MADERA CO.: Raymond, IX–7–07, 940 ft. elevation (CAS). MONTEREY CO.: Jamesburg, VIII–1–39 (L. W. Hepner, CAS); VIII–1–39 (J. Russell, CAS). Hastings Reservation, VIII–30–57, 1700 ft. elevation (J. Rehn, CAS). Arroyo Seco River, VIII–8–38 (R. I. Sailer, CAS). Lockwood, VII–24–35 (J. Russell, CAS). Asilomar, IX–26–59 (C. W. O'Brien, CAS). Vicinity of Gorda, XI–13–58 (P. H. Arnaud, DCR). SAN BENITO CO.: Pinnacles Nat. Mon., Chalone Camp, XI–10–62, (D. C. Rentz, CAS); XI–21–64 (D. C. & K. A. Rentz, DCR). Pinnacles Nat. Mon., X–18–58 (D. C. Rentz, DCR). SAN FRANCISCO CO.: Twin Peaks, IX–12–10 CAS). SAN LUIS OBISPO CO.: Paso Robles, VIII–21–09, 1100 ft. elevation (ANSP). Atascadero, VII–19–32 (R. H. Beamer, CAS). SANTA CLARA CO.: San Jose, X–8–41 (K. Frick, CIS). SONOMA CO.: Sobre Vista, IX–23–10 (J. A. Kusche, CAS).

Discussion—This species was found in dry grass near oaks *(Quercus agrifolia)* late in the year at Pinnacles National Monument. The specimens were found at the base of a rocky hillside and seemed restricted to the habitat.

Melanoplus bernardinae Hebard
(Figs. 135, 136, Map 22)

Melanoplus bernardinae Hebard, 1920, Trans. Amer. Ent. Soc., 46:388. Holotype ♂, Vivian Creek, San Bernardino Co., Calif. (No. 544, ANSP).

Tegmina attigent or feebly overlapping, rather narrowly rounded at apex. Hind tibiae blue. Lateral margins of male epiproct strongly interrupted and lower beyond mid-length; cercus broad at base, abruptly narrowed near middle, the apical portion at most feebly widening distad.

Body 16–21; tegmen 3.8–5; hind femur 9–11.

Geographic range.—California.

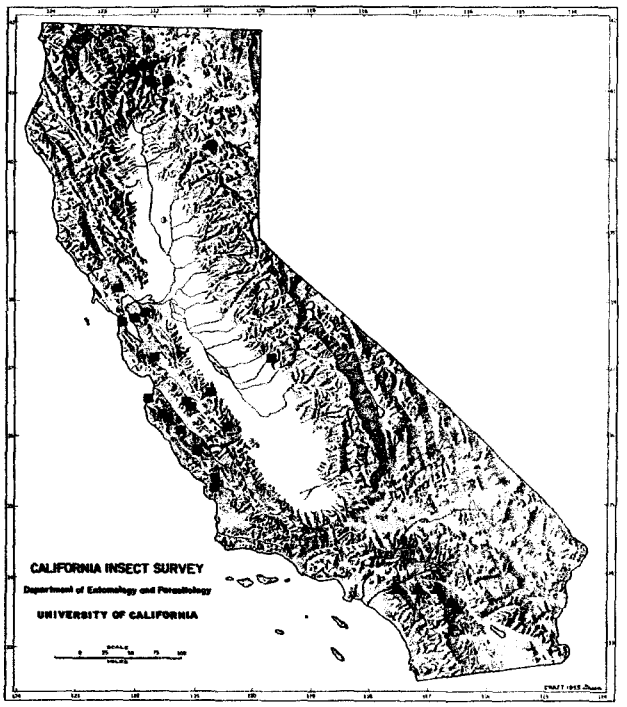
California records.—(Map 22) RIVERSIDE CO.: San Bernardino Mts., Santa Ana Canyon, VII–25–06, 6500 ft. elevation (J. Grinnell, ANSP); S. Fork, Santa Ana River, VII–6–06, 6200 ft. elevation (J. Grinnell, ANSP); High Creek, San Gorgonio Peak, VIII–29–19, 9000 ft. elevation (Rehn & Hebard, ANSP). San Jacinto Peak, VIII–20–14, 7000–10,000 ft. elevation (J. C. Bradley, ANSP). Tahquitz Valley, San Jacinto Mts., VII–6–50 (H. L. Hansen, ANSP). Tetley Park, VIII–18–47 (P. H. Timberlake).

Melanoplus bivittatus (Say)
two-striped grasshopper
(Fig. 86, Map 23)

Gryllus bivittatus Say, 1825, Jour. Acad. Nat. Sci., Phila., 4:308. "Arkansa" (Arkansas River, near Rocky Mts., Colo.).
Caloptenus femoratus Burmeister, 1838, Handbook Ent., 2:638.
Melanoplus bivittatus, Scudder, 1874, Hitchcock Rept. Geol. New Hampshire, 1:376.

Large, robust, Dark gray or olivaceous, dorsum of head, pronotum and tegmina with a pair of pale stripes. Hind femur with a longitudinal black band on upper half of outer face. Hind tibiae blue, greenish or red.

Body 26–36; tegmen 21–26; hind femur 16.5–21.



Map 22. California distribution of: ●, *Melanoplus ascensus* Scudder; ■, *Melanoplus aspasmus* Hebard; ▲, *Melanoplus bernardinae* Hebard.

Geographic range.—Widely distributed throughout the entire United States with the possible exception of Florida and Mississippi.

California records.—(Map 23) Widely distributed in nearly all irrigated, agricultural areas of the state. INYO CO.: Pine Creek, Round Valley, N.W. of Bishop, VIII–7–61 (D. C. Rentz, CAS). 5 mi. N. Big Pine, VII–29–64 (J. D. Birchim, JDB). West Bishop, VII–24–64 (J. D. Birchim, JDB). MARIN CO.: Point Reyes, VII–20–63 (C. W. O'Brien, DCR). MARIPOSA CO.: Mariposa Grove, IX–2–07, 7000 ft. elevation (ANSP). Yosemite Nat. Park, Sentinel, IX–1–07, 4000 ft. elevation (ANSP). MENDOCINO CO.: Ukiah IX–1–58 (E. W. Kirschbaum, DCR). MODOC CO.: Goose Lake, VII–24–22 (C. L. Fox, CAS). Alturas, VIII–23–22 (Rehn & Hebard, ANSP). MONO CO.: Leavitt Meadow, 7200 ft. elevation, VIII–10–62 (H. B. Leech, CAS). Travertine Hot Springs, 2 mi. S. E. Bridgeport, VIII–11–62, 6200 ft. elevation (H. B. Leech, CAS). Mono Lake, 10 mi. N. Leevining, VIII–6–61 (C. D. MacNeill, D. C. Rentz & M. R. Lundgren, CAS); VI–28–62 (D. C. Rentz, C. D. MacNeill, CAS). PLUMAS CO.: Road to Spencer Lakes, 7 mi. S.W. Johnsville, IX–9–60 (J. S. Buckett, CAS). 1 mi. N. Elephant Butte, IX–10–60 (J. S. Buckett, UCD). Mohawk, VII–8–57 (D. C. Rentz, DCR). Blairsden, VII–28–57 (D. C. Rentz, DCR). SHASTA CO.: Hat Creek, VIII–13–51 (G. S. Pronin, CAS). McArthur, VIII–1937 (J. J. DuBois). SIERRA CO.: Sierraville, VIII–26–58 (P. D. Hurd, CIS). SISKIYOU CO.: Mt. Shasta (Packard). Bartle, VII–22–62 (D. C. Rentz & C. D. MacNeill, CAS). Mt. Shasta, VIII–1885 (K. Behrens, ANSP). Castle Lake, VIII–28–16, 5434 ft. elevation (J. A. Kusche, ANSP). TUOLUMNE CO.: Dardanelle, VII–19–61 (D. C. Rentz, CAS).

Discussion—This large and very important crop species prefers lush vegetation such as is common in meadows, along ditch banks, marshy areas and alfalfa fields. Often very abundant and destructive in alfalfa, grains, fruit trees, and other cultivated crops. It is widely distributed throughout the United States.

Melanoplus borealis palaceus Fulton

(Figs. 82, 83, Map 23)

Melanoplus borealis palaceus Fulton, 1930, Ann. Ent. Soc. Amer., 23:619–620. Type ♂, Upper Klamath Marsh, Ore. (USNM).

Dark brown with postocular dark bar continued on prozonal part of lateral lobe. Meso- and metapleura and sides of abdomen blackish. Outer face of hind femur olivaceous, unmarked. Hind tibia red or reddish. Tegmina unmarked or with a few obscure dark points along midline, tapering to the narrow apex, hardly surpassing tips of hind femora in male, shorter in female. Mesosternum of male distinctly tumid but not tuberculate.

Body 19–22; tegmen 11–13; hind femur 10–12.

Geographic range.—California and Oregon.

California records.—(Map 23) GLENN CO.: Plaskett Meadows, VII–26–61 (J. R. Helfer, CDA). Plaskett Meadows Camp, VI–28–61 (J. R. Helfer, CAS); X–10–64, 6000 ft. elevation (D. C. & K. A. Rentz & J. D. Birchim, DCR, JDB). 6 mi. W. of Plaskett Meadows, X–10–64, 6200 ft. elevation (D. C. Rentz, DCR). MODOC CO.: Hackamore (L. G. Smith, UCD).

Discussion—Rentz (1965) noted frayed wings on female specimens from the Plaskett Meadows locality and suggested that males gnaw the wings during copulation. Specimens there were found in a marsh composed mostly of sedges *(Carex)*.

Melanoplus buxtoni Strohecker

(Map 24)

Melanoplus buxtoni Strohecker, 1963, Pan-Pac. Ent., 39(3): 168. Holotype ♂, allotype ♀, Plaskett Meadows, Glenn Co., Calif. (CDA).

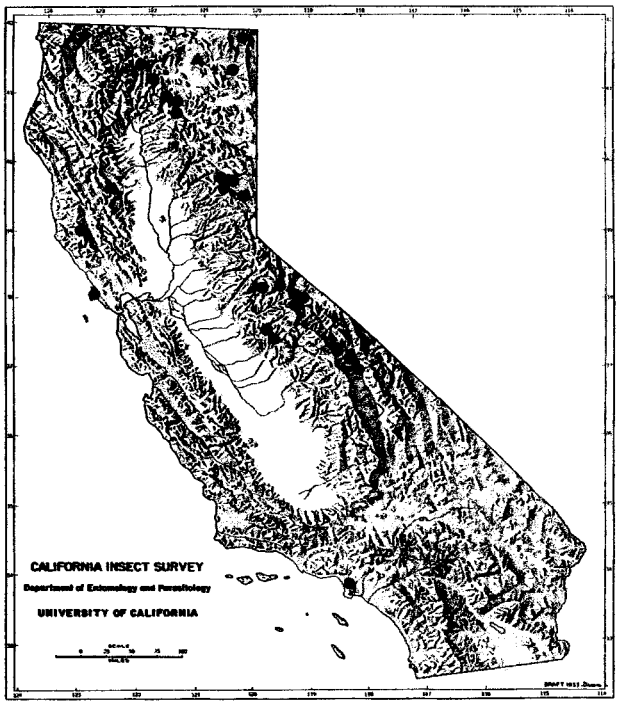
Males may be recognized by features of the terminal abdominal structures. Cercus continuously tapering and acute at apex. Epiproct with side margins undulately carinate in basal half or more, distal ridges parallel. Hind tibiae blue.

Body 18–21; tegmen 3.5–4; hind femur 9–11.

Geographic range.—California.

California records.—(Map 24) GLENN CO.: Plaskett Meadows, IX–14–60, holotype, allotype (G. M. Buxton, CDA). 6 mi. W. Plaskett Meadows, VIII–27–62 (D. C. Rentz, DCR).

Discussion—Collected on rangeland.



Map 23. California distribution of: ●, *Melanoplus bivittatus* (Say); ▲, *Melanoplus borealis palaceus* Fulton.

Melanoplus caroli Gurney and Helfer

(Figs. 125, 126, Map 24)

Melanoplus caroli Gurney & Helfer, 1960, Proc. Ent. Soc. Wash., 62 (3):150, 152–158. Type ♂, Mendocino, Mendocino Co., Calif. (USNM, 64729).

Dark brown with black bar behind eye and on lateral lobe of pronotum, abdomen with black areas on segments of basal half, apical half reddish-brown above, venter yellow. Hind tibiae red. Tegmina lobate, briefly attingent, rounded or feebly obtuse-angulate at apex.

Body 18.7–22; tegmen 3.5–4.5; hind femur 9.8–12.5.

Geographic range.—California.

California records.—(Map 24) HUMBOLDT CO.: Honeydew, VII–17– (J. R. Helfer, CAS). MENDOCINO CO.: Mendocino, VIII–1, 5; IX–27; X–3, 15, 30; XI–2–all 1958 (J. R. Helfer, CAS); VII–18–59 (D. C. Rentz, DCR). Willits, VII–23; IX–14; X–3–all 1958 (J. R. Helfer, CAS).

Discussion—This species is known only from a few localities along the coast where it can be collected in grassy exposed areas in association with *M. sanguinipes*, and *Oedaleonotus spp.*

Melanoplus chimariki Gurney and Buxton

(Fig. 122, Map 24)

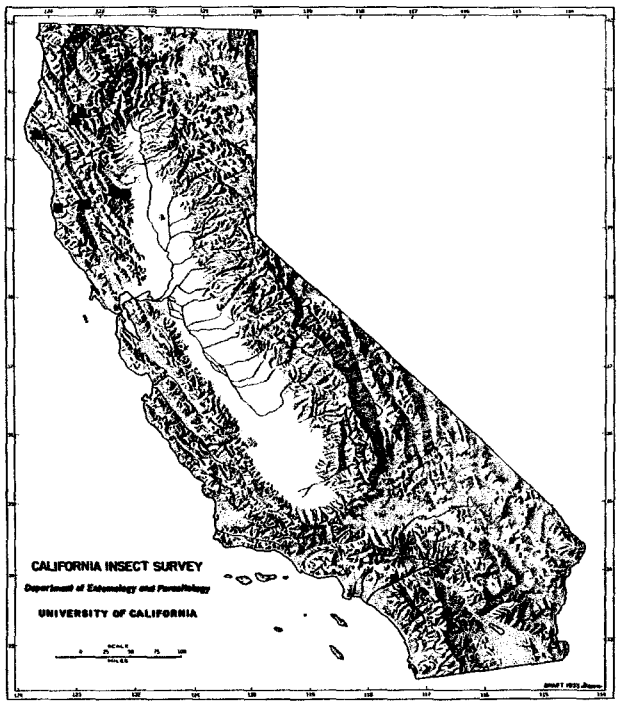
Melanoplus chimariki Gurney & Buxton, 1963, Bull. Brooklyn Ent. Soc., 58:65–67. Holotype ♂, South Fork Mountain, Trinity Co., Calif. (No. 66499, USNM).

Resembles the two preceding species in size and color. Tegmina lanceolate, intermediate in length, covering two-thirds or three-fourths of abdomen. Male cercus foot-shaped, the "heel" well rounded rather than subrectangulate as in *keiferi* and *lithophilus*. All specimens known have been taken at one site.

Body 16.6–21.3; tegmen 6.6–8.6; hind femur 10–11.8.

Geographic range.—California.

California records.—(Map 24) TRINITY CO.: South Fork Mountain, 4 mi. S.W. Hyampom, IX–14–60, 5700 ft. elevation, holotype (T. Gallion, USNM). South Fork Ridge, 5 mi. W.S.W. Hyampom, IX–26–63 (F. L. Blanc & G. M. Buxton, CDA).



Map 24. California distribution of: ●, *Meelanoplus buxtoni* Strohecker; ■, *Melanoplus caroli* Gurney and Helfer; ▲, *Melanoplus chimariki* Gurney and Buxton.

Discussion—Specimens were collected from serpentine rocks on summit of South Fork Mountain. See also discussion under *M. keiferi*.

Melanoplus cinereus cinereus Scudder
(Figs. 91, 161, 162, Map 25)

Melanoplus cinereus Scudder, 1878, Proc. Bost. Soc. Nat. Hist., 19:288, 290. Type ♂, Wallula, Walla Walla Co., Wash.

Melanoplus cinereus cinereus, Hebard, 1928, Proc. Acad. Nat. Ser. Phila., 80:289.

Gray or brown, tegmina with small black spots or points. Hind tibiae blue. The male cercus, in dorsal view, forms a distinct "elbow" in its turn mesad. It is then bent abruptly upward and somewhat expanded at apex. The usefulness of the trinomials *cyanipes* and *dealbatus* is questionable. Hebard (1928) selected Wallula, Washington as type locality; the nominate *cinereus* occurs in northern California.

Body 22–28; tegmen 18–22; hind femur 12–14.

Geographic range.—Oregon, Washington, Nevada, California.

California records.—(Map 25) LASSEN CO.: Reno Jct., VIII–17–49 (H. H. Keifer, CDA). Devil's Corral above Susanville, VIII–21–22, 4600 ft. elevation, in sagebrush (Rehn & Hebard, ANSP). Near Susanville, VIII–21–22, 3800 ft. elevation (Rehn & Hebard, ANSP). MARIPOSA CO.: Yosemite Nat'l. Park, Sentinel, VIII–31–07, 4000 ft. elevation (ANSP). MODOC CO.: Lassen Creek on Goose Lake, VIII–24–22, 5000 ft. elevation (Rehn & Hebard, ANSP). Alturas, VIII–23–22, 5000 ft. elevation, sagebrush on lava plain (Rehn & Hebard, ANSP). NEVADA CO.: Boca, VIII–30–41 (K. Frick, CIS). PLUMAS CO.: Chester, VIII–20–22, 4300 ft. elevation (Rehn & Hebard, ANSP). Harkness Peak, VIII–28–22, 9200 ft. elevation (Rehn & Hebard, ANSP). SISKIYOU CO.: Gazelle, IX–11–50 (A. T. McClay, UCD). Jct. Hwy. 97 and Military Pass Rd., VIII–27–65 (D. C. & K. A. Rentz, DCR).

Discussion—Specimens of this species were found on manzanita at the latter locality. They were quite active and readily flew when disturbed.

Atypical *Melanoplus cinereus cinereus*.—LASSEN CO.: Litchfield, VIII–21–22, 4200 ft. elevation (Rehn & Hebard, ANSP). Johnstonville, VIII–21–22, 4150 ft. elevation (ANSP). Susanville, VIII–21–22, 4190 ft. elevation (ANSP).

Melanoplus cinereus cyanipes Scudder
(Map 25)

Melanoplus cyanipes Scudder, 1897, Proc. U.S. Nat. Mus., 20: 295. Lectotype ♂, Pasadena, Los Angeles Co., Calif. designated by Rehn & Hebard, 1912 (MCZ).

Melanoplus cinereus cyanipes, Thompson and Buxton, 1964, Occas. Pap. Bur. Ent., Calif. Dept. Agr., 5:41.

Of average smaller size than the other two forms and of darker coloration but without cinereous flecks seen in the nominate form. Hind tibiae rather deep blue. According to Hebard the material reported by Scudder included other species of *Melanoplus*.

Body 18–23; tegmen 14–18; hind femur 10–13.

Geographic range.—California.

California records.—(Map 25) KERN CO.: Tehachapi Mts., Marcel (ANSP). LAKE CO.: Upper Lake, VII–16–35 (R. H. Beamer, ANSP). LOS ANGELES CO.: Recorded by Rehn and Hebard from Pasadena, Altadena, Rubio Canyon, Alamitos Bay and Santa Catalina Island. August (Koebele Collection, CAS). Universal City, VII–10–26 (C. D. Hicks, ANSP). Claremont, VII–25–15 (J. W. Rich, ANSP). Alamitos Bay, VII–1907 (Baker, ANSP). ¼ mi. N. Tanbark Flat, IX–4–65 (J. D. Birchim & R. Jones, JDB). Parker Mt., S.E. end of Ventura Mts. IX–27–10, 3100 ft. elevation (ANSP). Saugus, VIII–23–09 (ANSP). Roscoe, Tujunga Wash., VIII–23–09, 825 ft. elevation (ANSP). Echo Mt., IX–18–10 (ANSP). Altadena, VIII–8–07 (ANSP). Pasadena, VIII–1–07; VII–21–09 (F. Grinnell, ANSP). Verdugo Hills, VIII–23–09, 900

ft. elevation (ANSP). Los Angeles, VII–1886 (A. Koebele, ANSP); 1886, 1 male paratype (ANSP). Los Angeles, Coquillett, 1888 (ANSP). Santa Monica, VII–30–97 (ANSP). Santa Catalina Island, VIII–7–07. MARIPOSA CO.: Yosemite, VIII–1904 (F. M. Jones, ANSP); VIII–12–16 (G. B. Engelhardt, ANSP). El Portal, VIII–30–07, 3200 ft. elevation (ANSP). MONTEREY CO.: Del Monte, IX–10–10; VIII–20–09 (ANSP). MONO CO.: Mammoth Lake, VIII–8–23 (O. C. Poling, ANSP). ORANGE CO.: Corona, VII–31–19 (E. P. Hewlett, ANSP). RIVERSIDE CO.: 4 mi. W. Beaumont, IV–9–42; VII–26–32 (R. H. Beamer, ANSP). Coahuila, VIII–18–14 (J. C. Bradley, ANSP). SAN DIEGO CO.: Coronado Beach, VIII–1916 (Rehn & Hebard, ANSP). Tia Juana, VIII–1916 (Rehn & Hebard, ANSP). Oak Grove Ranger Station, VIII–29–58 (F. Raney). Palm City, VIII–7–35 (R. H. Beamer, ANSP). Road Summit, 10 mi. N.W. Jacumba, IX–15–22, 3500 ft. elevation (Rehn & Hebard, ANSP). Del Mar, X–2–19 (M. Hebard, ANSP). Resort P.O., Laguna Mts., IX–14–22, 6100 ft. elevation (Rehn & Hebard, ANSP). Jacumba, IX–15–22, 2900 ft. elevation (Rehn & Hebard, ANSP). Cuyamaca Peak, IX–14–22, 3500 ft. elevation (Rehn & Hebard, ANSP). Descanso, IX–13–22, 3400 ft. elevation (Rehn & Hebard, ANSP). Campo, IX–13–22, 2400 ft. elevation (Rehn & Hebard, ANSP). Potrero: IX–12–22, 2323 ft. elevation (Rehn & Hebard, ANSP). Jamacha, IX–12–22, 340 ft. elevation (Rehn & Hebard, ANSP). Dulzura, IX–12–22, 1500 ft. elevation (Rehn & Hebard, ANSP). Chula Vista, IX–11–22 (Rehn & Hebard, ANSP). San Felipe Valley, VII–28–20 (Rehn & Hebard, ANSP). La Jolla, VII–15–16 (G. B. Engelhardt, ANSP). Ocean Beach, XI–25–22 (O. C. Poling, ANSP). San Diego, XI–8–1890 (F. E. Blaisdell, ANSP). Coronado (F. E. Blaisdell, ANSP); IX–11–22 (Rehn & Hebard, ANSP); Coronado Beach, VIII–15–07 (ANSP). Tia Juana, IX–11–22 (Rehn & Hebard, ANSP). San Diego, VIII–7–35 (E. I. Beamer, ANSP). 6 mi. N. Warner's Springs, VII–8–56, on *Croton californicum* (R. M. Bohart & R. C. Bechtel, UCD). SANTA BARBARA CO.: Goleta, VI–30–59 (J. R. Russell, ANSP); VI–25–59 (W. A. Steffan, CIS). Santa Barbara, VIII–22–09 (M. Hebard, ANSP). SANTA CRUZ CO.: Santa Cruz, IX–28–41 (K. Frick, CIS, small, dark specimens). 2 mi. S. Felton, VIII–30–59 (D. C. Rentz, CAS). SAN BERNARDINO CO.: Colton, Santa Ana Wash, IX–2–19 (Rehn & Hebard, ANSP). San Bernardino Mts., VIII–3–30, 4800 ft. elevation (E. R. Tinkham, ANSP). Devore, Cajon Canyon, IX–2–19 (Rehn & Hebard, ANSP). LOS ANGELES CO.: Mint Canyon, VII–31–35 (J. Beamer, ANSP). San Bernardino Mts., Mill Creek, VIII–28–19, 5500 ft. elevation (Rehn & Hebard, ANSP). Harvey's Mill Creek, VIII–30–19, 3700 ft. elevation (ANSP). Verdemont, IX–2–19, 1700 ft. elevation (Rehn & Hebard, ANSP). TULARE CO.: Three Rivers, X–6–40. VENTURA CO.: Downer Ranch, Mt. Pinos, IX–3–22, 5400 ft. elevation (Rehn & Hebard, ANSP). Santa Paula, VII–23 (D. Burk).

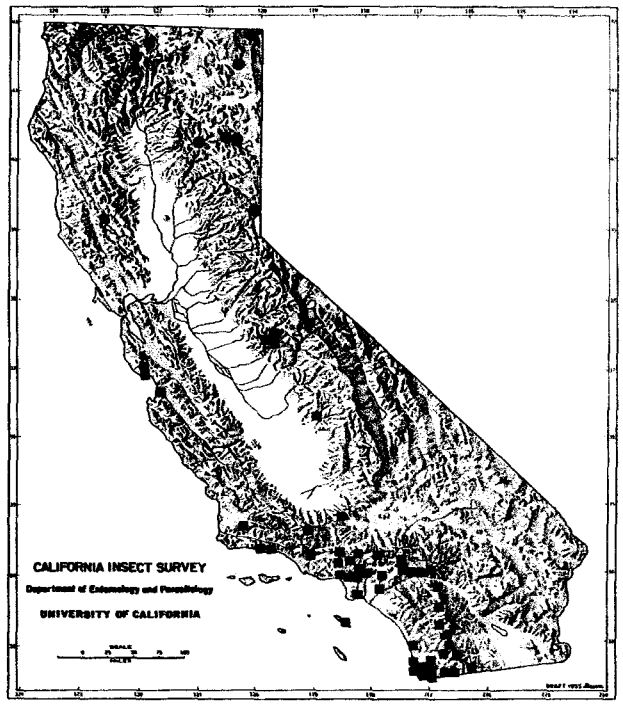
Melanoplus cinereus dealbatus Scudder

(Map 26)

Melanoplus dealbatus Scudder, 1899, Proc. Dav. Acad. Nat. Sci., 7:190. Lectotype ♂, Ceres, Stanislaus Co., Calif., designated by Rehn & Hebard, 1912 (MCZ).

Melanoplus cinereus dealbatus, Thompson and Buxton, 1964, Occas. Pap., Bur. Ent., Calif. Dept. Agr. 5:41.

Large for the species, pale brown with dark markings feeble or absent. Hind tibiae pale blue internally, greenish-yellow externally. Male cerci and aedeagus as in nominate *cinereus*.



Map 25. California distribution of: ●, *Melanoplus cinereus cinereus* Scudder; ■, *Melanoplus cinereus cyanipes* Scudder.

Body 23–28; tegmen 18–23; hind femur 13–15.

Geographic range.—Generally the middle portion of California.

California records.—(Map 26) ALAMEDA CO.: Tesla, X–15–48 (P. D. Hurd, CIS). CONTRA COSTA CO.: Antioch, VIII–3–53 (G. A. Marsh & R. O. Schuster, UCD); X–4–52 (R. O. Schuster, UCD); VIII–1937, VII–14–46 (E. S. Ross, CAS); XI–15–58 (R. W. Thorp, CAS); VII–19–62; VII–22–60 (D. C. Rentz, CAS); VIII–13–36 (E. C. Van Dyke, CAS); X–19–59 (C. W. O'Brien, CAS). Mt. Diablo, Pine Canyon, X–5–1893 (Eisen, ANSP). EL DORADO CO.: 1 mi. E. Coloma, X–22–65 (D. C. Rentz, DCR). FRESNO CO.: Coalinga, VIII–7–22, 700 ft. elevation (Rehn & Hebard, ANSP); VI–9–07 (J. C. Bradley, ANSP). Mt. Diablo Range, Alcalde, VIII–31–22, 950 ft. elevation (Rehn & Hebard, ANSP). Diablo Range, Waltham Canyon, VIII–31–22, 1600 ft. elevation (Rehn & Hebard, ANSP). Hospital Canyon, X–7–31. GLENN CO.: Hamilton City, X–6–19 (T. D. Urbahns, ANSP). KERN CO.: Walker Basin, IX–2–22, 3339 ft. elevation (Rehn & Hebard, ANSP). Bakersfield, Jewetta, IX–1–22, 450 ft. elevation (Rehn & Hebard, ANSP). Bakersfield, IX–15–10, 400 ft. elevation (ANSP). Bona, IX–2–22, 875 ft. elevation (Rehn & Hebard, ANSP). MERCED CO.: Atwater, VII–29–1885 (D. W. Coquillett, ANSP). SANTA CLARA CO.: San Jose, X–8–41 (K. Frick, CIS). STANISLAUS CO.: Ceres, VIII–17–1897, paratypes (ANSP). Turlock, VII–14–26 (C. C. Wilson, ANSP). TEHAMA CO.: VIII–28–1897 (ANSP). TULARE CO.:

Tulare, VIII–5–1897 (ANSP). Lemoncove, VII–26–29 (R. H. Beamer, ANSP). VENTURA Co.: Cuddy Canyon, IX–4–22, 3472 ft. elevation (Rehn & Hebard, ANSP). YOLO Co.: Davis, VIII–11–36; VIII–11–57 (W. T. Crites); IX–18–60 (D. Q. Cavagnaro, UCD).

Melanoplus complanatipes Scudder

(Figs. 92, 158, 159, 160, Map 26)

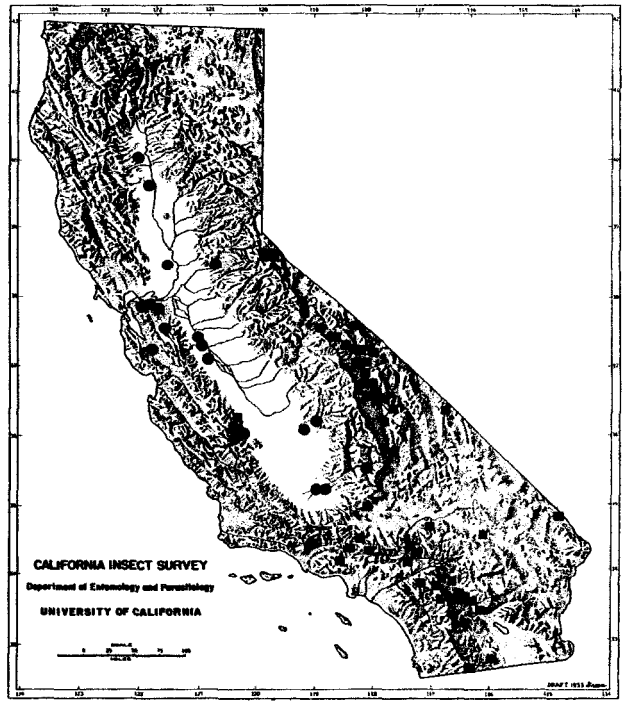
Melanoplus complanatipes Scudder, 1897, Amer. Phil. Soc., 36:26. Lectotype ♂, Cape San Lucas, Lower Calif., designated by Rehn & Hebard, 1912 (MCZ).

Elongate, slender. Gray or gray-brown with black bar behind the eye and on prozonal part of lateral lobe. Tegmina plain or with a median row of small dusky spots. Hind femora unmarked or transversely barred. Hind tibiae blue. Median carina of pronotum well raised on metazona, obsolete on prozona. Use of the racial name *canonicus* Scudder 1897 seems useless until complete analysis of the species can be done. Hebard (1935) notes the "extreme individual as well as striking geographic variation." Specimens from Mono County are very small and dark; a male has body length of 16 mm.; tegmen 15 mm.; hind femur 9 mm. The cerci of this specimen, and of some from farther south, are shorter and broader at apex than in typical specimens, more closely resembling the cerci of *M. cinereus*, but not showing, in dorsal view, the angulate inturning.

Body 23–26; tegmen 22–24; hind femur 13.5–15.

Geographic range.—California south to Mexico.

California records.—(Map 26) ALPINE Co.: Woodfords, X–9–65, 5630 ft. elevation (D. C. Rentz & J. D. Birchim, DCR). Carson Pass, IX–3–33 (G. & R. Bohart, CAS). FRESNO Co.: Jacalitos Canyon, VII–25–56, on *Lepidospartum squamatum* (R. O. Schuster, UCD). IMPERIAL Co.: 5 mi. W. Coyote Wells, IX–16–22, 500 ft. elevation (Rehn & Hebard, ANSP). INYO Co.: Olancha, VI–26–48 (H. E. Cott & L. W. Isaak, CIS). 10 mi. S.W. Tom's Place, VIII–8–61 (D. C. Rentz, CAS). Westgard Pass, Cedar Flat, 7300 ft. elevation, VIII–19–63 (H. B. Leech, CAS); VI–26–62, 7200 ft. elevation (C. D. MacNeill, D. C. Rentz & M. R. Lundgren, CAS). Antelope Springs, VIII–24–60 (D. Cavagnaro, CAS). 9 mi. W. Lone Pine, VIII–16–62 (C. W. O'Brien, CAS). Pine Creek, Round Valley, N.W. of Bishop, VIII–10–61 (D. C. Rentz, CAS). Hole-in-the-Rock Springs, Boundary Canyon, Amargosa Range, VIII–17–19, 2600 ft. elevation (Rehn & Hebard, ANSP). Indian Joe Springs, Argus Range, IX–9–22, 2600 ft. elevation (Rehn & Hebard, ANSP). Bishop, IX–9–19 (Rehn & Hebard, ANSP). Owen's Lake, VII–24–64 (J. D. Birchim, JDB). Near Owen's Lake, VII–1912 (ANSP). Independence, VII–17– (Wickham, ANSP); VII–1–64 (J. D. Birchim, JDB). 6 mi. W. Independence, VII–7–64 (J. D. Birchim, JDB). 8 mi. N. Independence, VII–27–64 (J. D. Birchim, JDB). Lone Pine, IX–3–17 (W. T. Davis, ANSP); IX–6–19 (M. Hebard, ANSP). 8 mi. N. Lone Pine, VII–24–64 (J. D. Birchim, JDB). 9 mi. W. Lone Pine, VII–23–64 (J. D. Birchim, JDB). 3 mi. E. Big Pine, VII–24–64 (J. D. Birchim, JDB). 9 mi. W. Big Pine, VII–21–64 (J. D. Birchim, JDB). KERN Co.: Warren, IX–17–10, 3500 ft. elevation (ANSP). LOS ANGELES Co.: Tanbark Flat, VI–18–50 (H. M. Graham). Palmdale, VI–22–47; VII–10–47 (L. W. Isaak); IX–26–47 (G. P. Mackenzie); IX–7–56 (E. I. Schlinger); VIII–1–30 (J. Beamer). Parker Mt., S.E. end Ventura Mts., IX–27–10, 3100 ft. elevation (ANSP). Acton, IX–27–10, 2700 ft. elevation (ANSP). MONO Co.: Mammoth



Map 26. California distribution of: ●, *Melanoplus cinereus dealbatus* Scudder; ■, *Melanoplus complanatipes* Scudder.

Lake, VIII–25–46 (G. P. Mackenzie). 1 mi. W. Tom's Place, VIII–13–57 (D. D. Linsdale, CIS); 1 mi. S. W. Tom's Place, VII–13–63. Hilltop Creek, IX–4–55 (R. M. Bohart, UCD). Mono Lake, 10 mi. N. Leevining, VIII–6–61 (D. C. Rentz, CAS). Benton, VII–20–64 (J. D. Birchim, JDB). Little Round Valley, VIII–7–30, 7400 ft. elevation (E. R. Tinkham, ANSP). RIVERSIDE Co.: Banning, VII–9–50 (J. D. Paschke); VI–21–52 (R. L. Anderson; VI–27–52 (J. J. Menn). Magnesia Canyon, VII–21–52 (D. E. Barcus); VII–18–52 (A. A. Grigarick, UCD); VI–28–52 (J. J. Menn). Beaumont, VII–23–63 (R. R. Snelling, CAS). Cathedral City, VII–16–50 (J. M. Hall & J. W. MacSwain, CIS). Whitewater, VII–9–50 (W. O. Marshall). Riverside, U.C. Campus, VIII–30–58 (D. M. Newell, CIS). 10 mi. N. E. Earp, VII–16–63 (C. A. Toschi, CIS). Oasis, IX–17–22, 186 ft. below sea level (Rehn & Hebard, ANSP). Palm Springs to Palm Canyon, IX–29–10, 800 ft. elevation (ANSP). Indio, VIII–7–32 (R. H. Beamer, ANSP). San Jacinto Mts., Tahquitz Canyon, IX–30–10 (ANSP). SAN BERNARDINO Co.: Cottonwood, IX–9– (Rehn & Hebard, ANSP). Victorville, X–22–47 (G. P. Mackenzie). Needles, VIII–4–19 (Rehn & Hebard, ANSP); VIII–1–26 (ANSP). Lyons, IX–1–09, 3000 ft. elevation (ANSP). Bagdad, VIII–6–19 (Rehn & Hebard, ANSP). Mojave River, VIII–8–36 (Timberlake, ANSP). Hesperia, IX–2–19 (Rehn & Hebard, ANSP). Daggett, IX–9–24, 2000

ft. elevation, (Rehn & Hebard, ANSP). Barstow, VII–26–11 (ANSP). Cottonwood Station, IX–9–07, 2274 ft. elevation. Victorville, IX–1–19 (Rehn & Hebard, ANSP). SAN DIEGO CO.: Borego, V–21–41 (E. C. Van Dyke, CAS). Wagon Pass, 8 mi. E. Jacumba, IX–15–22 (Rehn & Hebard, ANSP). Jacumba, VIII–12–35 (J. Russell, ANSP).

Melanoplus devastator Scudder
devastating grasshopper
(Figs. 80, 81)

Melanoplus devastator Scudder, 1878, Proc. Bost. Soc. Nat. Hist., 19:285, 287–288. Lectotype ♂, Sausalito, Calif. Selected by Gurney & Brooks, 1959 (ANSP).

Synonyms.—ater Scudder 1897; *consanguineus* Scudder (1897); *diminutus* Scudder (1897); *uniformis* Scudder (1897); *virgatus* Scudder 1897); *devastator affinis* Scudder (1897); *devastator conspicuous* Scudder (1897); *devastator obscurus* Scudder (1897); *devastator typicalis* Scudder (1897).

Pale to dark gray or brown. Hind femur usually with three dark bars. Hind tibiae blue, rarely pale red. Mesosternum of male weakly and roundly tumid; cerci much longer than their basal width. Female much like female of *sanguinipes* but with cerci rather narrowly triangular and upper valve of ovipositor more prolonged and upturned at tip.

Body 20–24; tegmen 18–20; hind femur 12–13.

Geographic range.—California, Nevada, Oregon, Washington.

California records.—The distribution of *devastator* in California is somewhat complementary to that of *sanguinipes*. *M. devastator* occurs in the central valley and along the western coastal region where *sanguinipes* is absent. It appears to be absent from the Inyo, Colorado and the more humid portions of the North Coast where *sanguinipes* occurs. Economic and biological data are contained in the reports of Coquillett (1892), Wilson (1947), Harper (1952), and Middlekauff (1958).

Has been recorded from the following counties:

ALAMEDA	MARIN	SAN DIEGO
CONTRA COSTA	MERCED	SAN LUIS OBISPO
ELDORADO	MODOC	SAN MATEO
FRESNO	MONTEREY	SANTA BARBARA
GLENN	NAPA	SANTA CLARA
HUMBOLDT	NEVADA	SANTA CRUZ
IMPERIAL	PLUMAS	SHASTA
KERN	RIVERSIDE	SISKIYOU
LAKE	SACRAMENTO	SONOMA
LOS ANGELES	SAN BENITO	YOLO
MADERA	SAN BERNARDINO	

Discussion—The most widespread, abundant and destructive range grasshopper in California. It is a typical inhabitant of the semi-arid foothill grass lands from near sea level to about 5,000 feet.

It feeds upon rangeland forbs and grasses and, during outbreak years, moves from the foothills into adjacent agricultural lands causing great financial losses. Outbreaks in 1957 and 1958 were most spectacular.

Emerging from overwintering eggs in late April or early May, most of the population in central California becomes adult by mid-July. Dissections of wild-caught females show that in favorable years 90 percent or more of the females will contain eggs from half to fully mature by early October. Egg laying seldom starts before early September. It has been shown (Middlekauff, 1964) that decreasing photoperiod induces oogenesis.

Adults can be collected until late in the year.

Melanoplus differentialis nigricans Cockerell
differential grasshopper
(Fig. 87, Map 27)

Melanoplus differentialis var. *nigricans* Cockerell, 1917, Ent. Record, 29:247. Type locality, Boulder, Colo.

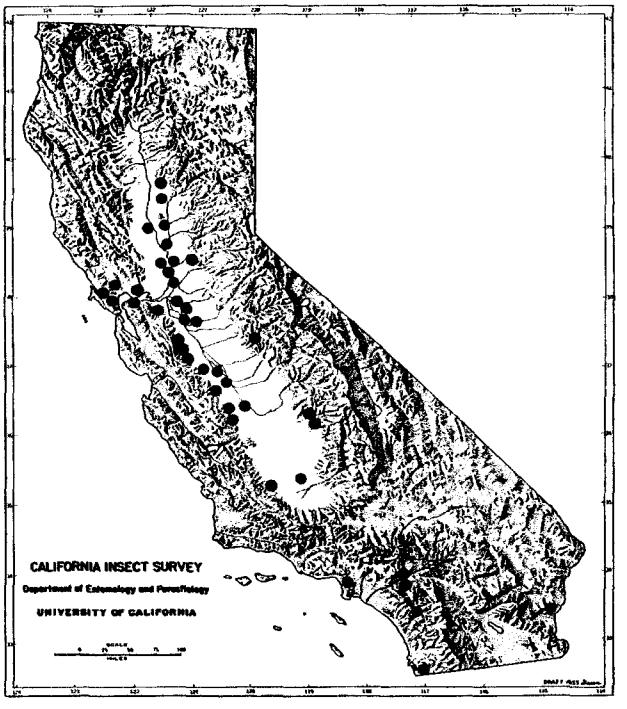
Very large for the genus, stout-bodied. Pale yellow to olivaceous, tegmina unmarked. Outer face of hind femur with herringbone black markings. Hind tibiae yellow or bright red. Roberts distinguished an eastern and western race on the basis of aedeagal differences and fixed the area of intergradation as a little west of the Mississippi River. The name *nigricans* is rather inappropriate for the western race, having been based on very dark specimens from Colorado.

Body 25–41; tegmen 29–30; hind femur 19–22.

Geographic range.—Scattered throughout the West, west of the Mississippi; south in Mexico nearly to Mexico City.

California records.—(Map 27) ALAMEDA CO.: Tesla Road, VIII–1959 (D. C. Rentz, CAS). Berkeley, (J. S. Hunter, ANSP). Altamont, VIII–8–37 (Rehn, Pate & Rehn, ANSP). BUTTE CO.: Oroville, VII–29–57 (C. A. Toschi, CIS); VII–20–60 (J. S. Buckett). Chico, VII–21–56 (D. C. Rentz, CAS). CALAVERAS CO.: Mokelumne Hill (F. E. Blaisdell, CAS). COLUSA CO.: Williams, VII–20–59 (J. R. Helfer, CAS). Colusa, VIII–15–55 (R. O. Schuster, UCD). Grimes, VII–31–31. CONTRA COSTA CO.: Antioch, X–4–52 (R. O. Schuster, UCD); VIII–9–22; VIII–27–38. Concord, IX–24–60 (R. Brown, CAS). FRESNO CO.: Firebaugh, VIII–7–48 (R.v.d. Bosch, CIS). San Joaquin, VII–7–60 (R. R. Snelling, CAS). Cantua Creek, VII–25–56 (R. O. Schuster, UCD). 3 mi. N. Helm, VII–27–60 (R. R. Snelling, DCR). Fresno, VIII–28–32 (H. Lund, ANSP). KERN CO.: Buttonwillow, VII–11–55 (J. A. Powell, CIS). Bakersfield, Jewetta, IX–1–22, 450 ft. elevation (Rehn & Hebard, ANSP). LOS ANGELES CO.: Los Angeles (Scudder). MARIN CO.: VIII–13–62 (D. C. Rentz, CAS). Corte Madera, VII–27–58 (D. C. Rentz, CAS); X–20–59 (C. S. Rentz, CAS). Mill Valley, X–29–62 (D. C. Rentz, K. A. Hale, CAS). Kentfield, VII–1964 (E. W. Kirschbaum, DCR). MARIPOSA CO.: Mariposa, X–1948 (P. H. Arnaud, CAS). MERCED CO.: Los Banos, IX–21–41 (K. Frick). Dos Palos, VII–23–47, in alfalfa (V. M. Stern); VII–17, VIII–8–49 (A. D. Telford); VII–17–41 (P. H. Arnaud, CAS). Gustine, VIII–23–15 (T. D. Urbahns, ANSP). RIVERSIDE CO.: Blythe, VIII–6–46, in alfalfa (W. F. Barr, CIS). Temecula, VII–2–63, immature (H. L. Griffin, CIS). Riverside, VIII–17–30 (Timberlake, ANSP). SACRAMENTO CO.:

Courtland, IX–7–41. Union Island, VI–1939 (C. D. Michener, CAS). Orange Vale, VII–22, IX–2–38 (Q. Tomich). Sacramento, IX–11–37 (A. T. McClay, UCD). SAN DIEGO CO.: Tia Juana, IX–11–22 (M. Hebard, ANSP). SAN BERNARDINO CO.: Colton, Santa Ana Wash, IX–2–19 (Rehn & Hebard, ANSP). SAN JOAQUIN CO.: Manteca, VIII–27–39 (K. S. Hagen, CIS). Tracy, VIII–24–58 (J. R. Powers, CIS). Ryer Is., VI–18–41 (K. Frick, CIS). Lodi, IX–1915 (I. McCracken, CAS). Stockton, VIII–19–19 (E. P. VanDuzee, CAS); VII–9–58 (J. R. Helfer, CAS). Union Island, VIII–19–31 (ANSP). SOLANO CO.: Mare Island, IX–28–31 (I. P. Collins, CAS). SONOMA CO.: Agua Caliente (Scudder). SUTTER CO.: Robbins, VIII–30–37 (T. G. H. Aitken, CIS). Yuba City, IX–28–35 (T. G. H. Aitken, CIS). TULARE CO.: Lindsay, VII–13–11 (C. Pemberton, ANSP). Lemoncove, IX–11–07 (J. C. Bradley, ANSP). YOLO CO.: Davis, X–18–15 (E. O. Essig, CIS); VIII–1937; VIII–1946 (H. H. Welsh); IX–2–32 (A. S. Harrison); X–13–51 (E. I. Schlinger, UCR); IX–13–56 (R. H. James); IX–18–60 (D. Q. Cavagnaro, UCD); X–18–13 (E. O. Essig, CAS).



Map 27. California distribution of *Melanoplus differentialis nigricans* Cockerell.

Discussion—This subspecies is our largest *Melanoplus,* occuring commonly in the Central Valley along fences, ditches, in alfalfa fields and uncultivated areas with succulent, rank vegetation. It is a serious pest in alfalfa and cotton as well as various other field and garden crops and deciduous fruit trees. Eggs are laid in midsummer in bare spots or in plant crowns, usually in raised, well-drained areas of the field.

Melanoplus elaphrus Strohecker

(Map 28)

Melanoplus elaphrus Strohecker, 1963, Pan-Pac. Ent., 39(3): 169. Holotype ♂, allotype ♀, 3 mi. E. Kneeland, Humboldt Co., Calif. (CDA).

Male cercus similar to that of *buxtoni* but stouter, continuously tapering to the acute apex; epiproct with side margins flat basally, the distal ridges high, rapidly convergent from side margins caudad so that they become subparallel in their distal portion.

Body 20–23; tegmen 3.5–4; hind femur 11–13.

Geographic range.—California.

California records.—(Map 28) HUMBOLDT CO.: 3 mi. E. Kneeland, XI–1–60, holotype, allotype, paratypes (T. R. Haig, CDA). Ferndale, XI–2–60 (T. R. Haig, CDA). TRINITY CO.: Cold Springs, IX–18–62, range grasses (Buxton & Blanc, CDA).

Discussion—Strohecker (1963) notes that the female is undistinguishable from *saltator.*

Melanoplus elater Strohecker

(Map 28)

Melanoplus elater Strohecker, 1963, Pan-Pac. Ent., 39(3): 166–167. Holotype ♂, allotype ♀, 5 mi. N. E. Zenia, Trinity Co., Calif. (CDA).

Dorsum, including first three abdominal tergites, dusky. Colors not distinctive, head and lateral lobe of prozona of pronotum with black bar. Hind tibiae blue. Hind femur yellow with two dark clouds on outer face.

Body 19–22; tegmen 3.5–4.8; hind femur 9.5–11.

Geographic range.—California.

California records.—(Map 28) TRINITY CO.: 5 mi. N.E. Zenia, IX–19–62, holotype, allotype, paratypes, from range (G. M. Buxton & F. L. Blanc, CDA). 2 mi. S. E. Wildwood, IX–18–62 (G. M. Buxton & F. L. Blanc, CDA). 2 mi. S.W. Ruth, IX–19–62, (G. M. Buxton & F. L. Blanc, CDA).

Melanoplus eremitus Strohecker

(Figs. 133, 134, Map 28)

Melanoplus eremitus Strohecker, 1963, Pan-Pac. Ent., 39(3): 162–164. Holotype ♂, allotype ♀, Top Lake, El Dorado Co., Calif. (CDA).

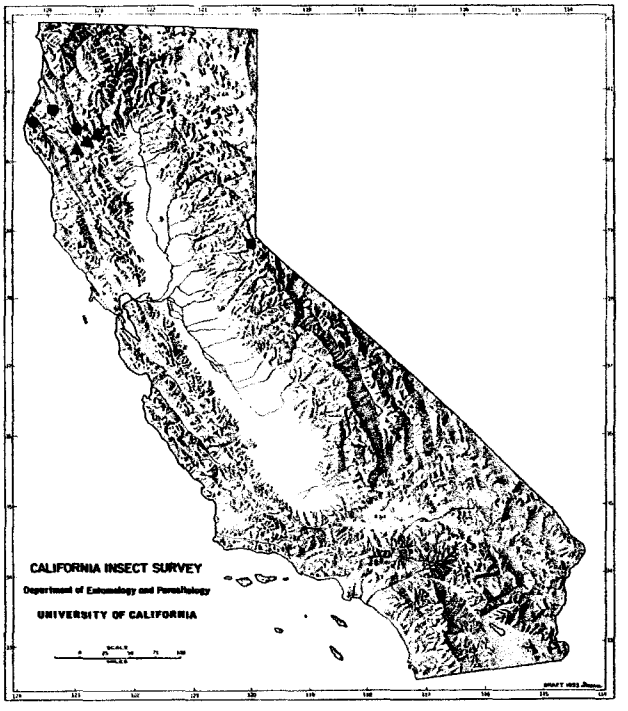
Dorsum, including abdomen, blackish, with small buff markings behind eyes and along lateral carinae of pronotum. Face and cheeks olive. Antennae orange-red. Hind tibiae blue.

Body 17–21; tegmen 3–4; hind femur 8.5–11.

Geographic range.—California.

California records.—(Map 28) EL DORADO CO.: Top Lake, VIII–22–62, holotype, allotype, paratypes (G. M. Buxton, CDA); VIII–27–50 (P. C. Ting, CDA).

Discussion—This species is associated with *Carex*.



Map 28. California distribution of: ●, *Melanoplus elaphrus* Strohecker; ▲, *Melanoplus elater* Strohecker; ■, *Melanoplus eremitus* Strohecker.

Melanoplus femur-rubrum femur-rubrum (DeGeer) red-legged grasshopper

(Fig. 77)

Acrydium femur rubrum DeGeer, 1773, Mem. Hist. Nat. Ins., 3:498. Type ♂, Pennsylvania.

Pezotettix (Melanoplus) femur-rubrum, Stal, 1873, Recensio Orth., 1:79.

Melanoplus femur-rubrum, Scudder, 1874, Rep. Geol. N. Hamp., 1:375.

Pale brown or somewhat olivaceous with black bar behind eye and along prozonal part of lateral lobe of pronotum. Tegmina immaculate or nearly so. Hind tibia and lower outer pagina of hind femur red. Subgenital plate of male, in dorsal view, semicircular; in lateral view its upper margin is abruptly elevated at base.

Body 17–26; tegmen 16–19; hind femur 11–15.

Geographic range.—Has been reported from every state in the United States except Hawaii and possibly Alaska.

California records:—Widely distributed in California. Reported from nearly every county. ALAMEDA CO.: Berkeley, X–2–04. 1 mi. E. Mission Peak, VIII–19–59 (W. W. Middlekauff, CIS). INYO CO.: Antelope Springs, VIII–24–60 (J. W. MacSwain, CIS); VII–8–60 (H. K. Court). Bishop, VIII–17–63 (J. A. Froebe). Pine Creek, Round Valley, N. W. of Bishop, VIII–7–61 (D. C. Rentz & C. D. MacNeill, CAS). Near Westgard Pass, VIII–10–61 (D. C. Rentz, DCR). Deep Springs, VIII–10–59 (D. C. Rentz, DCR). E. of Bishop, VIII–10–59 (D. C. Rentz, DCR). Bishop, IX–9–19 (ANSP). Pine Creek Canyon, X–17–22 (ANSP). Lone Pine, IX–1–19 (M. Hebard, ANSP). LAKE CO.: Lakeport, VIII–23–51 (S. M. Fidel). S. W. end of Clear Lake, VIII–3–59 (D. C. Rentz, DCR). LASSEN CO.: Milford, IX–1918 (R. E. DeOng, ANSP). Westwood, VIII–21–22 (Rehn & Hebard, ANSP). Amedee, VIII–22–22, 3960 ft. elevation (Rehn & Hebard, ANSP). MODOC CO.: Warner Mts., 3 mi. E. Davis Creek, VII–26–22 (A. W. Lindsay, ANSP). Alturas, VIII–23–22 (Rehn & Hebard, ANSP). Cedarville, VII–30–46. PLACER CO.: Colfax, VIII–2–10, 2450 ft. elevation (ANSP). PLUMAS CO.: Buck's Lake, VII–1–49 (E. I. Schlinger, UCD). 6 mi. E. Chester, VII–14–54 (J. A. Powell, CIS). Lake Almanor, VIII–28–21 (ANSP). 1.3 mi. E. Quincy, VIII–18–63 (W. J. Turner, DCR). SACRAMENTO CO.: Orange Vale, IX–10–38 (Q. Tomich, CIS). SAN JOAQUIN CO.: Stockton, V–1–49, in grass (D. Cox). SISKIYOU CO.: Echo Lake, VIII–29–16 (ANSP). Castle Lake, VIII–28–16, 5434 ft. elevation (J. A. Kusche, ANSP). Sisson, VIII–16–09, 3550 ft. elevation (Rehn & Hebard, ANSP); VIII–14–08 (J. C. Bradley, ANSP). Mt. Shasta (Sisson) (ex: Scudder). Gazelle, IX–22–51 (J. Hall & E. I. Schlinger, UCD); IX–11–50 (A. T. McClay, UCD). YOLO CO.: Davis, X–18–15 (E. O. Essig, CIS); VII–1937 (J. J. DuBois). Clarksburg, X–10–31.

Discussion—Over much of its range it is considered to be one of the five most important species of grasshoppers damaging agricultural crops, especially alfalfa and sweet clover. In California, Wilson and Keifer (1941) cite this species as an important pest in alfalfa. Shotwell (1941) considers it as a secondary pest.

A trinominal is sometimes used to designate the nominate form since a race, *propinquus* Scudder, occurs in southeastern United States.

Melanoplus fricki Strohecker

(Figs. 98, 99, Map 29)

Melanoplus fricki Strohecker, 1960, Pan-Pac. Ent., 36:33. Holotype ♂, allotype ♂, King's Mountain, San Mateo Co., Calif. (CAS).

Males of *fricki* and *hesperus* are of almost identical appearance even to the shape of the cerci. The lobes of the furcula are more slender and less divergent in *fricki* but until the range of individual variation is determined from more material of both species this feature is of dubious value for distinguishing them. The aedeagi, however, are distinctly different.

Body 16–19; tegmen 3–3.5; hind femur 9–9.5.

Geographic range.—California.

California records.—(Map 29) SAN MATEO CO.: King's Mt., IX–28–41, holotype, allotype, paratypes (K. Frick, CAS).

Melanoplus fultoni Hebard

(Figs. 109, 110, 115, 116, Map 29)

Melanoplus fultoni Hebard, 1922, Trans. Amer. Ent. Soc., 48: 63. Type ♂, Lagunitas, Marin Co., Calif. (No. 832, ANSP).

Tegmina subattingent in male, narrowly separated in female, broadly rounded at apex.

Body 14–18; tegmen 2.8–4; hind femur 8–10.

Geographic range.—California.

California records.—(Map 29) MARIN CO.: Lagunitas, VIII–7–21 (B. B. Fulton, ANSP). Mt. Tamalpais, IX–8–58 (J. R. Helfer, CAS). 8 mi. N. Point Reyes Station, VIII–20–61 (D. C. Rentz, DCR). SANTA CRUZ CO.: Santa Cruz, IX–11–41 (K. Frick, CIS). Felton, VIII–12–59 (D. C. Rentz & C. E. Wemmer, DCR). Zyante, VII–30–59 (D. C. Rentz & C. E. Wemmer, DCR, CAS).

Melanoplus gracilipes Scudder

(Fig. 111, Map 29)

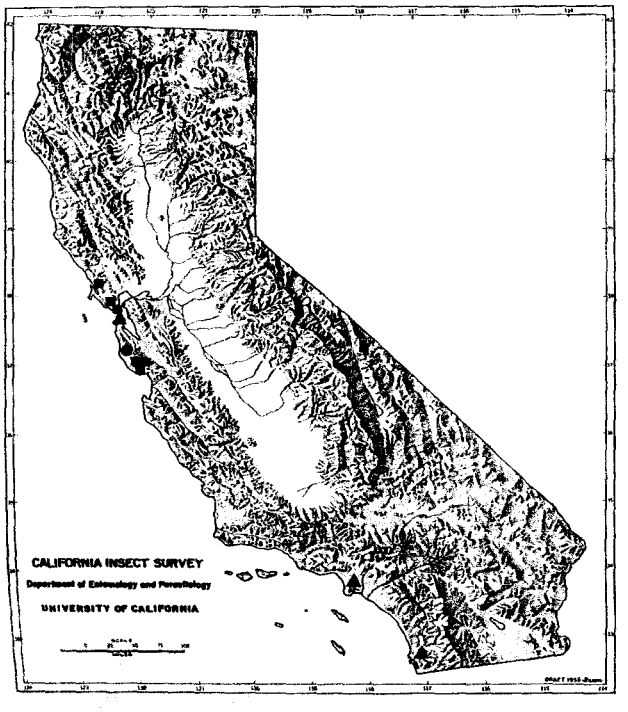
Melanoplus gracilipes Scudder, 1897, Proc. U.S. Nat. Mus., 20:238. Lectotype ♂, Los Angeles Co., Calif., designated by Rehn & Hebard, 1912 (ANSP).

In the present state of our knowledge the form of the male cercus is an adequate character for recognizing this species. The tegmina are broadly ovate, attingent, angulate at apex.

Body 14–18; tegmen 4–4.5; hind femur 9–10.

Geographic range.—California.

California records.—(Map 29) LOS ANGELES CO.: Los Angeles (Scudder). SAN DIEGO CO.: Miramar (Rehn & Hebard). SAN FRANCISCO CO.: San Francisco, VIII, IX–12–09 (F. X. Williams, det. M. Hebard, CAS).



Map 29. California distribution of: ●, *Melanoplus tricki* Strohecker; ■, *Melanoplus fultoni* Hebard; ▲, *Melanoplus gracilipes* Scudder.

Melanoplus harperi Gurney and Buxton

(Fig. 164, Map 30)

Melanoplus harperi Gurney & Buxton, 1965, Calif. Dept. Agric. Occ. Papers No. 7:4–6. Holotype ♂, allotype ♀, East Weaver Lake, Trinity Co., Calif. (CDA).

Dorsum of head and pronotum gray-brown with dark and yellow areas. Hind femur with external face tinged with orange. Hind tibia dull yellow. Male with lobes of furcula distinct but short and blunt; cercus less than twice as long as its greatest width, its lower margin strongly oblique to the bluntly rounded apex. Tegmina narrowly separated.

Body 17–25; tegmen 3.7–5; hind femur 9.5–12.2.

Geographic range.—California.

California records.—(Map 30) TRINITY CO.: East Weaver Lake, IX–25–63, ex. *Boykinia major* (G. M. Buxton & F. L. Blanc, CDA).

Melanoplus herbaceus Bruner

(Figs. 89, 90, Map 30)

Melanoplus herbaceus Bruner, 1893, U.S.D.A. Div. Ent. Bull., 28:25–26. Lectotype ♂, El Paso, Texas, designated by Rehn & Hebard, 1912 (ANSP).

Melanoplus flavescens Scudder, 1897, Proc. U.S. Nat. Mus., 20:155.

Of elongate, graceful form, with long tegmina. Pale green or brown, prozonal portion of lateral lobe of pronotum with an indefinite dusky bar, sutures of meso- and metapleura dark brown or black. Hind femur unmarked on outer face, hind tibia blue.

Body 24–28; tegmen 22–25; hind femur 13–15.

Geographic range.—Arizona, California, Nevada, New Mexico, Texas, Mexico.

California records.—(Map 30) IMPERIAL CO.: Colorado Desert, IX–1–10, 120 ft. elevation (ANSP). Brawley, VIII–9–14 (J. C. Bradley, ANSP). INYO CO.: Death Valley, Furnace Creek (P. D. Hurd, CIS). RIVERSIDE CO.: Indio, VII–29– , in alfalfa field (Rehn & Hebard, ANSP); VII–29–07, 28 ft. below sea level (ANSP). Ripley, VIII–16–46, in alfalfa field (W. F. Barr). Blythe, VIII–20–27 (ANSP); VII–8–37 (J. W. MacSwain, CIS). SAN BERNARDINO CO.: Bagdad, VIII–6–19 (Rehn & Hebard, ANSP). Needles, VIII–4–19 (Rehn & Hebard, ANSP). Daggett, IX–9–24, 2000 ft. elevation (Rehn & Hebard, ANSP). Barstow, VIII–7–19 (Rehn & Hebard, ANSP).

Discussion—Ball et al. (1942) report it on arrowweed, *Pluchea sericea*, along streams and arroyos in Lower Sonoran Zone. It has also been reported from such irrigated crops as alfalfa.

Melanoplus hesperus Hebard

(Fig. 100, Map 30)

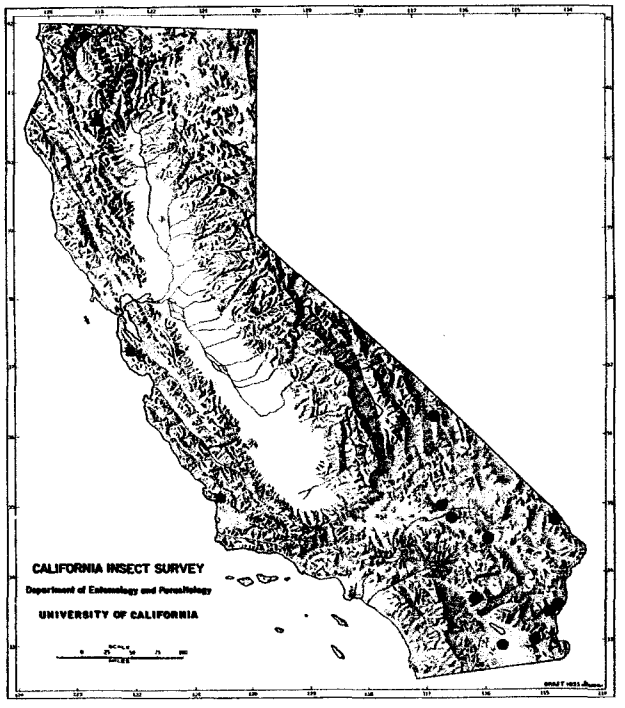
Melanoplus hesperus Hebard, 1919, Trans. Amer. Ent. Soc., 45:282. Type ♂, San Luis Obispo, San Luis Obispo Co., Calif. (No. 504, ANSP).

Very little material of this species has been seen in the course of this study. The aedeagus, after treatment with KOH, appears much as it does after inflation with ammonia; the dorsal valve has a sclerotized rod in its anterior edge similar in size and shape to the darkly sclerotized ventral valve. In caudal view the sclerite of the dorsal valve is exactly eclipsed by the ventral valve. Cercus very similar to that of *M. fricki.*

Body 17–19; tegmen 3.8–4.0; femur 9.5–12.

Geographic range.—California.

California records.—(Map 30) SAN LUIS OBISPO CO.: San Luis Obispo, VIII–21–09 (M. Hebard, ANSP). SAN MATEO CO.: King's Mt., IX–13–28 (K. Frick, CIS); VIII–17–36 (E. S. Ross, CAS).



Map 30. California distribution of: ▲, *Melanoplus harperi* Gurney aand Buxton; ●, *Melanoplus herbaceus* Bruner; ■, *Melanoplus hesperus* Hebard.

Melanoplus hupah Strohecker and Helfer
(Figs. 131, 132, Map 31)

Melanoplus hupah Strohecker and Helfer, 1963, Pan-Pac. Ent., 39(3):159–160. Holotype ♂, allotype ♀, Kneeland, Humboldt Co., Calif. (No. 65994, USNM).

Similar to *wintunus* but larger. The only clear-cut differences to be found are in the male genitalia.

Body 19–22; tegmen 5–6; hind femur 11–13.

Geographic range.—California.

California records.—(Map 31) HUMBOLDT CO.: Kneeland, VI–11–60, holotype, allotype, paratypes (J. R. Helfer, USNM).

Discussion—Type series collected on damp, subirrigated land associated with white clover.

Melanoplus huporeus Hebard
(Figs. 95, 96, 97, Map 31)

Melanoplus huporeus Hebard, 1919, Trans. Amer. Ent. Soc., 45:280. Type ♂, Colfax, Placer Co., Calif., 2450 ft. elevation (No. 503, ANSP).

Large for the group. Tegmina attingent or feebly overlapping. Male cerci are different in Hopland and topotypic (Colfax) specimens but the aedeagi seem identical.

Body 18–20; tegmen 3–3.5; hind femur 9–10.

Geographic range.—California.

California records.—(Map 31) MENDOCINO CO.: Hopland Field Station, VIII–17–56 (W. W. Middlekauff, CIS). Hopland, VIII–19–31, 488 ft. elevation (Rehn & Rehn, ANSP). PLACER CO.: Colfax, VII–2–10, 2450 ft. elevation (ANSP). SONOMA CO.: Occidental, VIII–16–38 (E. R. I. Sailer, ANSP). VENTURA CO.: Mugu Point, VIII–13–31 (Rehn, Pate & Rehn, ANSP).

Discussion—The Hopland specimens were taken in a wet, seep area with numerous *Carex* and *Juncus.*

Melanoplus keiferi Gurney and Buxton
(Fig. 121, Map 31)

Melanoplus keiferi Gurney and Buxton, 1963, Bull. Brooklyn Ent. Soc., 58:62–65. Holotype ♂, 4.5 mi. S. Mendocino Pass, Calif. (No. 66,498, USNM).

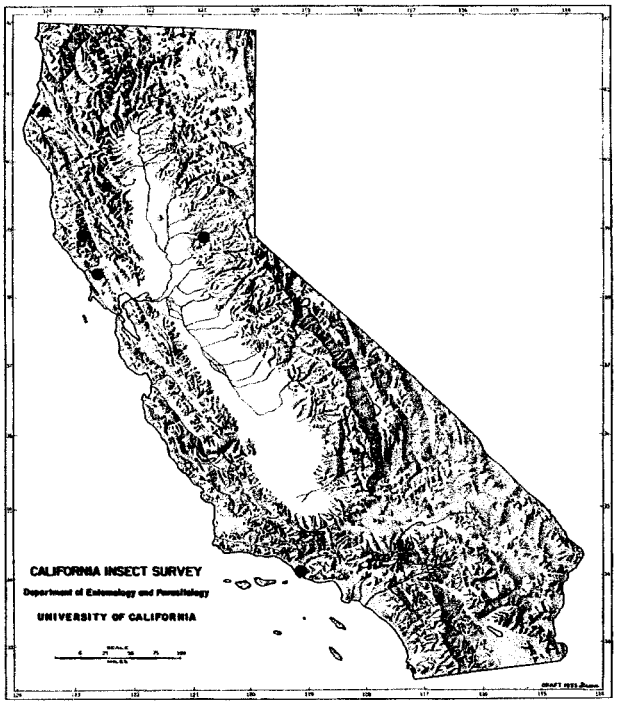
Three species compose this group as now known, *keiferi, lithophilus,* and *chimariki.* All three are of similar size and stout form; pronotum with three transverse sulci complete and rather deeply impressed, its hind margin broadly obtuse-angulate. Epiproct almost equilateral. Cerci of male grossly foot-shaped, broad. According to present knowledge the species may be distinguished on the basis of tegminal length.

Gray-brown, ventral surface and abdomen yellow; hind femur with three transverse dark bars; hind tibiae blue-gray. Tegmina lanceolate, overlapping, covering about half of abdomen.

Measurements of holotype and allotype. Body 17–21.5; tegmen 5.9–7; hind femur 9.7–11.

Geographic range.—California.

California records.—(Map 31) GLENN CO.: N.W. corner Glenn Co., 4.5 mi. S. Mendocino Pass, VII–29–60, holotype, allotype, in copulo, 6500 ft. elevation (H. B. Leech, USNM). A considerable number of paratypes with same data. 4 mi. W. Plaskett Meadows Station, X–10–64, 6400 ft. elevation (D. C. & K. A. Rentz, DCR). Plaskett Meadows, IX–14–60 (G. M. Buxton, CDA); VIII–27–60 (D. C. Rentz, DCR). Mendocino Pass, VII–26–61 (J. R. Helfer). Telephone campground, IX to X–1963 (G. M. Buxton, CDA).



Map 31. California distribution of: ▲, *Melanoplus hupah* Strohecker and Helfer; ●, *Melanoplus huporeus* Hebard; ■, *Melanoplus keiferi*.

Discussion—The presently known members of the Keiferi Group are found in a similar characteristic habitat. Any bald, exposed hilltop, from 5000 to 7000 feet elevation in the north coast ranges of California may be expected to be an area suitable for members of this species group. The vegetation in these exposed ridges is sparse and dwarfed. It includes manzanita, *Arctostaphylos;* bitter cherry, *Prunus emarginata;* and buckthorn, *Rhamnus*. The soil type is serpentine, and little grass is evident. The bluish-gray grasshoppers, which tend to change to brownish-gray after pinning, blend well with the ground. Late fall is the only time for effective collecting for adult members of this group. (Gurney and Buxton, 1963).

Melanoplus lepidus Scudder

(Figs. 137, 138, Map 32)

Melanoplus lepidus Scudder, 1897, Proc. U.S. Nat. Mus., 20:321. Lectotype ♂, Truckee, Nevada Co., Calif., designated by Rehn & Hebard, 1912 (MCZ).

Similar to *bernardinae* in most features, including structure of male epiproct. Cerci elongate, widened and down-turned at apex. Dorsal valves of aedeagus elongate, projecting far beyond other parts of aedeagus.

Body 17.5–21; tegmen 4–4; hind femur 9–10.5.

Geographic range.—California.

California records.—(Map 32) MODOC CO.: Sugar Hill, Goose Lake, 5300 ft. elevation, VIII–24–22 (Rehn & Hebard, ANSP). NEVADA CO.: Truckee, male lectotype, X–10– (ex: Scudder); Mts. near Lake Tahoe, X–14– (ex: Scudder). PLACER CO.: Lake Tahoe, X–14–1876, paratypes (Henshaw, ANSP); VIII–30–30, 7500 ft. elevation (E. R. Tinkham, ANSP); VIII–30–10, 7000 ft. elevation (CAS). Blue Canyon, VIII–29–10, 5000 ft. elevation (CAS). Colfax, VIII–2–10, 2800 ft. elevation (CAS). PLUMAS CO.: Johnsville, IX–26–59 (W. R. Bauer & J. S. Buckett, UCD). 9 mi. N.W. Canyon Dam, X–3–63 (T. R. Haig, CAS).

Melanoplus ligneolus Scudder

(Figs. 105, 106, Map 32)

Melanoplus ligneolus Scudder, 1890, Proc. Dav. Acad. Nat. Sci., 7:188. Lectotype ♂, Benicia, Solano Co., Calif., designated by Rehn & Hebard, 1912 (MCZ).

The features of the male illustrated and cited in the keys are the only good characters for identification. Determination of females of this group is at present impossible except by association with males.

Body 14–17; tegmen 2.7–3; hind femur 8–9.5.

Geographic range.—California.

California records.—(Map 32) ALAMEDA CO.: Berkeley Hills, IX–11–10, 800 ft. elevation (CAS). Hayward, Palomares Creek, VIII–8–37 (Rehn, Pate & Rehn, ANSP). Berkeley, X–14–16 (E. C. Van Dyke, CAS). MARIN CO.: Mt. Tamalpais, 2100 ft. elevation (Rehn & Hebard, ANSP). Novato, X–21 to 28–62 (D. C. Rentz, DCR). MONTEREY CO.: Langley Canyon, Gabilan Range, VIII–10–37 (Rehn, Pate & Rehn, ANSP). SAN FRANCISCO CO.: Lone Mountain, X–26–09 (F. X. Williams, CAS). Lobos Creek, VIII–13–62 (D. C. Rentz, CAS). San Francisco, VIII–22–09 (F. X. Williams, CAS); X–10–20 (E. P. Van Duzee, CAS). Lake Merced, IX–12–09 (F. X. Williams, CAS). SOLANO CO.: Benicia, holotype, VIII–26– (Scudder).

Melanoplus lithophilus Gurney and Buxton

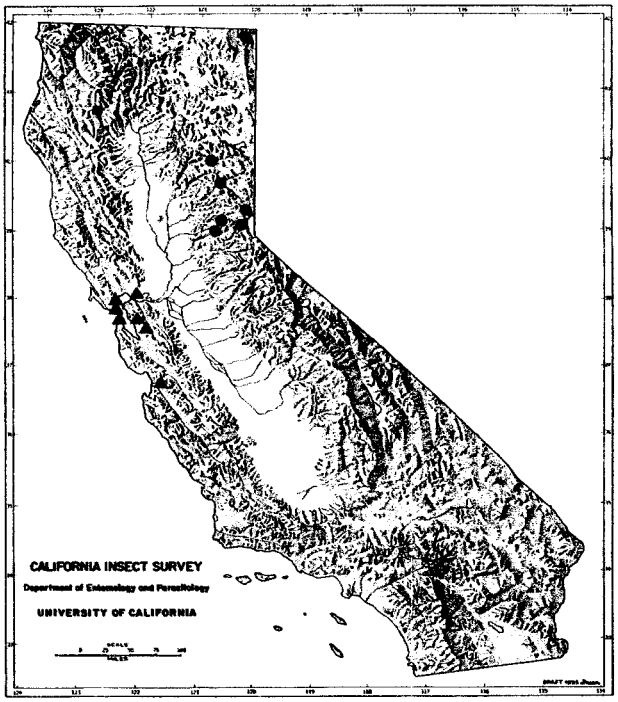
(Map 32)

Melanoplus lithophilus Gurney & Buxton, 1965, Calif. Dept. Agric. Occ. Papers No. 7:1–3. Holotype ♂, Weaver Bally, Trinity Co., Calif. (CAS).

Male similar to male of *keiferi*, including form of cercus, but with tegmina attaining middle of epiproct. The aedeagi of the two indicate distinct species. All specimens known are from the type locality. Measurements of holotype and allotype (Gurney and Buxton): Body 16.9–23; tegmen 7.7–9.4; hind femur 9.7–11.5.

Geographic range.—California.

California records.—(Map 32) TRINITY CO.: Weaver Bally, IX–25–63, holotype, allotype, paratypes (G. M. Buxton & F. L. Blanc, CAS, CDA).



Map 32. California distribution of: ●, *Melanoplus lepidus* Scudder; ▲, *Melanoplus ligneolus* Scudder; ■, *Melanoplus lithophilus* Gurney and Buxton.

Discussion—Specimens were collected from serpentine rocks on summit of Weaver Bally. Adults were not observed flying, but their wings approach flight capability. See discussion under *M. keiferi*.

Melanoplus marginatus (Scudder)
(Fig. 94, Map 33)

Pezotettix marginatus Scudder, 1876, Ann. Rept. Chief Engr., appendix JJ:504. Holotype ♂, allotype ♀, Fort Tejon, Kern Co., Calif.

Melanoplus marginatus, Scudder, 1897, Proc. U.S. Nat. Mus., 20:330.

Melanoplus marginatus pauper Scudder, 1897, Proc. U.S. Nat. Mus., 20:330.

Melanoplus marginatus amplus Scudder, 1897, Proc. U.S. Nat. Mus., 20:330.

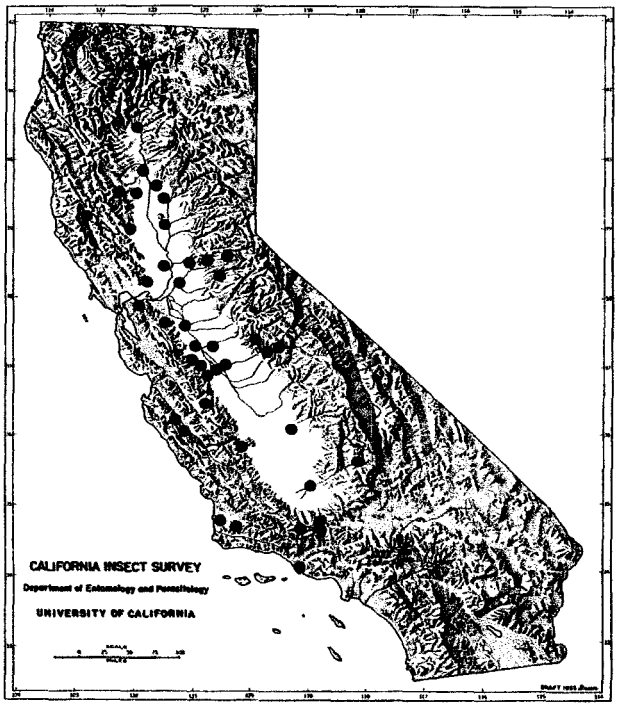
Two forms, apparently without intergrades, occur. In one of these the tegmina are somewhat longer than the pronotum and subacute at apex; in the other form the tegmina reach to or beyond the hind femoral apices.

The varietal names *pauper* and *amplus* Scudder have been discarded. Body 18–26; tegmen 4.5–6, 14–17; hind femur 9.5–13.

Geographic range.—California.

California records.—(Map 33) ALAMEDA Co.: Dyar Rd., VI–8–59 (W. W. Middlekauff, CIS). Berkeley, X–9–35 (G. G. Aitken, CIS). Altamont, VIII–8–37 (Rehn, Pate & Rehn, ANSP). AMADOR Co.: Fiddletown, VIII–4–58 (W. E. Simonds, CDA). BUTTE Co.: Chico (ex: Caudell). Oroville, IX–6–56 (W. W. Middlekauff, CIS). Stockdale, IX–2–58 (J. R. Helfer, CAS). COLUSA Co.: Wilbur Springs, VII–13–60, VI–22–61, VII–14–60 (D. C. Rentz, CAS). Grimes, VII–31–31 (ANSP). CONTRA COSTA Co.: Antioch, X–1–52 (R. O. Schuster, CIS). EL DORADO Co.: Caldor, on Dogtown Creek, VIII–1–64 (D. C. & K. A. Rentz, CAS). Shingle Springs, VI–7–60 (D. C. Rentz, CAS). FRESNO Co.: Mercy Mines, VIII–15–58 (D. C. Rentz, CAS). GLENN Co.: Elk Creek, VI–27–61 (D. C. Rentz, CAS). Artois, VI–20–52 (H. L. Hansen, CIS). KERN Co.: Ft. Tejon, VII–26–(ex: Scudder). Kern City (Bakersfield), VIII–4– (A. P. Morse). Mill Potrero, VII–8–59 (R. M. Bohart, UCD). Bakersfield, IX–15–10 (ANSP). Bakersfield, Jewetta, IX–1–22, 450 ft. elevation (Rehn & Hebard, ANSP). Onyx, VIII–31–33 (R. F. Smith, CIS). LOS ANGELES Co.: Gorman, VII–13–56 (E. G. Linsley, CIS). De Valle, X–19–50, in alfalfa (Myers-Keifer, CDA). MADERA Co.: Sugar Pine, VIII–23–13, 5000 ft. elevation (J. C. Bradley, ANSP). Ahwahnee, IX–30–07, 5700 ft. elevation (ANSP); IX–3– , in tarweed (Rehn & Hebard, ANSP). MARIPOSA Co.: 2 mi. S. Mormon Bar (G. I. Stage & R. R. Snelling, DCR). MENDOCINO Co.: Ukiah, VI–29–59 (J. R. Helfer, CAS). MERCED Co.: Atwater, VII–27– (ex: Scudder). Los Banos, IX–21–41 (K. Frick, CIS). Dos Palos, VIII–9–41 (R.v.d. Bosch, CIS). Volta, VIII–21–41 (Rehn & Rehn, ANSP). MONTEREY Co.: Greenfield, VIII–11–37 (Rehn, Pate & Rehn, ANSP). San Lucas, VIII–11–37 (Rehn, Pate & Rehn, ANSP). SACRAMENTO Co.: Folsom, VIII–21–65 (D. C. Rentz, J.D.B.); April (ex: Scudder). Sacramento, X–1923 (B. C. Thompson, ANSP). SAN BENITO Co.: 25 mi. N. E. Idria, VI–28–60 (D. C. Rentz, CAS). SAN JOAQUIN Co.: Vernalis, VII–11–33. Stockton, VIII–7–58 (J. R. Helfer, CAS). SANTA BARBARA Co.: Guadalupe, on sugar beets (ex: Caudell). Los Alamos Valley, VIII–19–51 (J. Rehn, ANSP). Cuyama, VII–26–35 (R. Beamer, ANSP). SHASTA Co.: Redding, VI–28–35 (R. H. Beamer, ANSP). SOLANO Co.: Teal, VIII–16–19 (ANSP). STANISLAUS Co.: Near the San Joaquin River between Crow's Landing and Turlock, VIII–21–31, 58 ft. elevation (Rehn & Rehn, ANSP). 5 mi. E. Crow's Landing, VII–23–60 (R. W. Thorp, CIS). SUTTER Co.: Meridian, VII–30–31 (ANSP). TEHAMA Co.: Tehama, VIII–16–09, 218 ft. elevation (Rehn & Hebard, ANSP). TULARE Co.: Tulare, IX–13–10, 282 ft. elevation (ANSP). Lindsay, VIII–4–11 (W. C. Faure, ANSP). VENTURA Co.: Mt. Pinos, IX–3–22, 6400 ft. elevation (Rehn & Hebard, ANSP). Mugu Point, Salt Marsh, VIII–13–37 (Rehn, Pate & Rehn, ANSP). YOLO Co.: Davis, VIII–37 (J. J. DuBois, CIS); VIII–1937 (CIS); VI–10–59 (J. R. Helfer, CAS); VII–16–31 (ANSP).

Discussion—Although differences in the phallic structure indicate the inclusion of two distinct groups in the Marginatus Group, general external resemblance makes their association convenient. The body is slenderer with compressed appearance, the pronotum with lateral carinae blunt but evident, straight or almost so, the median carina cut only by the principal sulcus, not high but sharp throughout. All the species are drab brown; only in *marginatus* do some specimens show green colors. The dark postocular



Map 33. California distribution of *Melanoplus marginatus* (Scudder).

bar and dusky band on the lateral lobe of pronotum are well developed to evanescent. The sides of the abdomen may have dark areas.

M. marginatus thrives best at low elevations, from 58 to 450 feet above sea level, and seldom occurs in damaging numbers at high elevations, although it has been collected as high as 3300 feet. It is not often found in areas outside alfalfa fields except through local movement usually following the cutting of alfalfa. However, it has been found occasionally in orchards, vineyards, and grassy areas. In most places where it abounds the soil is a heavy river loam or sandy loam, typical of alfalfa and other cultivated areas in California. It is seldom found in the dry foothills or on adobe soils. Other than alfalfa, where it is frequently the dominant species, it has no special host-plant preference but will feed readily on field and truck crops and fruit trees, occasionally doing considerable economic damage.

Melanoplus microtatus Hebard

(Figs. 112, 113, 163, Map 34)

Melanoplus microtatus Hebard, 1919, Trans. Amer. Ent. Soc., 45:285. Type ♂, Del Monte, Monterey Co., Calif. (No. 505, ANSP).

Male cercus similar to that of *nanus* but shorter. The transverse ridges of the epiproct vary, being very strong in some specimens, rather feeble in others. The "smallest species of the genus *Melanoplus* known" (Hebard).

Body 13–18; tegmen 2.3–3; hind femur 7.5–9.5.

Geographic range.—California.

California records.—(Map 34) MONTEREY CO.: Del Monte, VIII–20–09 (M. Hebard, ANSP); IX–9, IX–10–10 (Rehn & Hebard, ANSP); VII–18–65 (D. C. & K. A. Rentz, DCR). Monterey, VII–4–16 (G. P. Englehardt, ANSP). SANTA CRUZ CO.: Santa Cruz, VIII–28–07 (M. Hebard, ANSP). This record may be based on *M. fultoni*.

Melanoplus muricolor Strohecker

(Figs. 103, 104, Map 34)

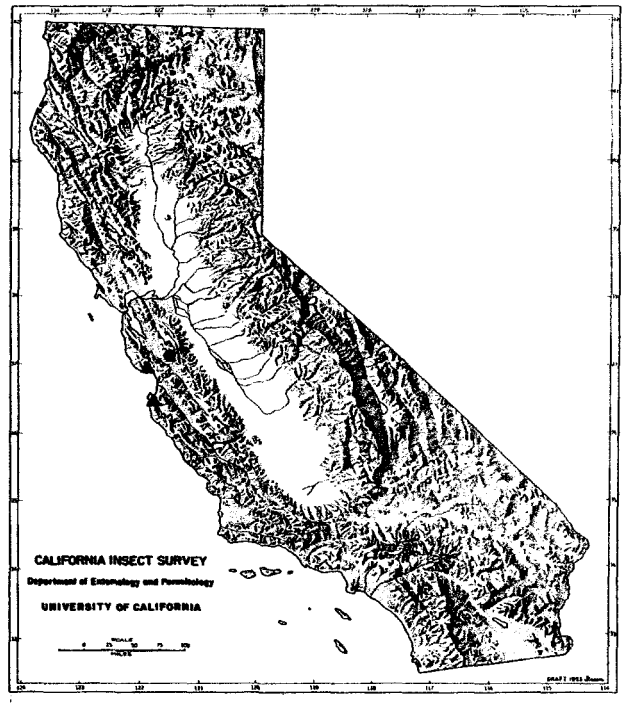
Melanoplus muricolor Strohecker, 1960, Pan-Pac. Ent., 36:33–34. Holotype ♂, allotype ♀, Santa Clara Co., Calif. (CAS).

Similar to *M. nanus*, *sonomaensis*, and *fultoni*. From *nanus* and *fultoni* it differs in having the lobes of the furcula acutely rounded at apex, from *sonomaensis* in having transverse tubercles on the epiproct. The features cited pertain, of course, only to males.

Body 14; hind femur 8.5.

Geographic range.—California.

California records.—(Map 34) SANTA CLARA CO.: No locality given, IX–11–41, holotype, allotype (K. Frick, CAS).



Map 34. California distribution of: ▲, *Melanoplus microtatus* Hebard; ●, *Melanoplus muricolor* Strohecker.

Melanoplus nanus Scudder
(Figs. 107, 108, Map 35)

Melanoplus nanus Scudder, 1899, Proc. Dav. Acad. Nat. Sci., 7:187. Lectotype ♂, Berkeley, Alameda Co., Calif., designated by Rehn & Hebard, 1912 (MCZ).

The keys and figures exhaust the features of ready usefulness for recognition. The tegmina are short-ovate, broadly rounded at apex or with a feeble obtuse angulation in some specimens.

Body 15–20; tegmen 2.7–4; hind femur 8.5–11.

Geographic range.—California.

California records.—(Map 35) ALAMEDA Co.: Berkeley, VI–21– (ex: Scudder). MARIN Co.: Mill Valley, VIII–22– (ex: Scudder); VIII–23– (Rehn & Hebard, ANSP); X–29–62 (D. C. Rentz & K. A. Hale, DCR). SAN FRANCISCO Co.: San Francisco, VIII–19– (ex: Scudder). SAN MATEO Co.: Baden (Colma), VIII–24– (ex: Scudder). SANTA CLARA Co.: San Jose, X–8–41 (K. Frick, CIS).

Melanoplus olamentke Hebard
(Figs. 119, 120, Map 35)

Melanoplus olamentke Hebard, 1920, Trans. Amer. Ent. Soc., 46:391. Type ♂, southern Sonoma Co., Calif. (No. 556, (ANSP).

Coloration not distinctive, grayish brown, darker dorsally, the sides of the proximal abdominal segments black. Hind tibiae blue or bluish green. The shape of the male cercus should enable recognition of that sex.

Body 15–19; tegmen 3.5–4; hind femur 9–10.

Geographic range.—Northern California.

California records.—(Map 35) MENDOCINO Co.: Hopland Field Station, XII–7–63 (W. W. Middlekauff, CIS). NAPA Co.: 9 mi. S.E. Pope Valley on Chiles and Pope Valley roads, VII–20–65 (D. C. Rentz, DCR). SONOMA Co.: Southern Sonoma Co., XII–4–10 (J. A. Kusche, ANSP). Triniti (Glen Ellen), XII–20–37 (N. W. Frazier, CIS).

Discussion—The Hopland specimen was collected at an elevation of about 800 feet on a dry, grassy, open hillside on the west border of the Station. It was in association with *M. devastator*.

Melanoplus packardii Scudder
Packard grasshopper
(Fig. 84, Map 35)

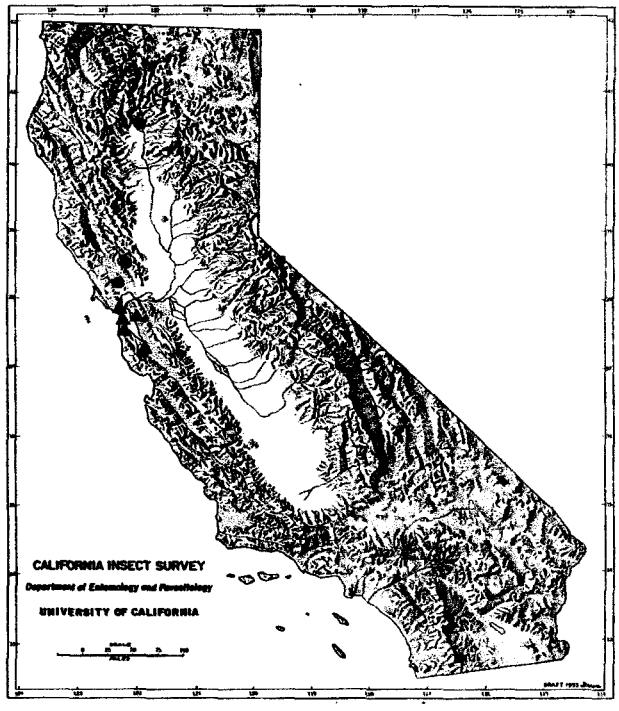
Melanoplus packardii Scudder, 1878, Proc. Bost. Soc. Nat. Hist., 19:287. Type Locality: Wallula, Wash.; British Columbia; Great Salt Lake; and southern Colo.; Neb.; Tex. (No lectotype selected.)

Size large for genus. Light brown, tegmina gray without definite markings. Pronotum more or less trifasciate with fuscous. Hind femur plain or with a narrow dark stripe along upper edge. Hind tibia red or blue; red in California and Nevada specimens seen. Subgenital plate of male rather narrowly subtuberculate at apex. Lobes of furcula widely divergent, slender, acute.

Body 28–34; tegmen 25–26; hind femur 15–18.

Geographic range.—West of Mississippi River, north to Saskatchewan, Alberta, and British Columbia.

California records.—(Map 35) MONO Co.: Topaz Lake, VI–26, VII–11 to 13–51 (T. R. Haig, CIS). SAN DIEGO Co.: Laguna Mts. VIII–1922 (ANSP). Warner's, IX–1920 (ANSP). SISKIYOU Co.: Mt. Shasta City, VIII–26–65 (D. C. & K. A. Rentz, DCR).



Map 35. California distribution of: ▲, *Melanoplus nanus* Scudder; ●, *Meelanoplus olamentke* Hebard; ■, *Melanoplus packardii* Scudder.

Discussion—A range land species which on occasion invades cultivated areas and causes economic damage, especially in the northern more sandy mountain valleys of Modoc and Siskiyou counties.

Egg deposition takes place on open ledges of soil washed down from banks or ridges, on blown soil along fences, around rock piles, or on bare spots along checks or dikes (Harper, 1952).

Melanoplus platycercus Hebard
(Fig. 123, Map 36)

Melanoplus platycercus Hebard, 1920, Trans. Amer. Ent. Soc., 46:377. Type ♂, Lone Pine Canyon, Sierra Nevada, Inyo Co., Calif., 8000 to 8371 ft. elevation (ANSP).

Very similar to *rileyanus*. According to Hebard males of *platycercus* may be distinguished from

males of *rileyanus* "by the much shorter and broader cerci, in which the length approximates the greatest width, as well as by the shorter subgenital plate, which has the free margin almost semicircular in dorsal aspect."

Body 15–20; tegmen 3.5–3.9; hind femur 9–10.5.

Geographic range.—California.

California records.—(Map 36) INYO CO.: Lone Pine Canyon, Sierra Nevada, 8000–8371 ft. elevation, X–5 to 8–19 (Rehn & Hebard, ANSP). Whitney Portal, IX–8–66 (D. C. & K. A. Rentz, DCR).

Melanoplus rileyanus rileyanus Scudder

(Figs. 117, 118, Map 36)

Melanoplus rileyanus Scudder, 1897, Proc. U.S. Nat. Mus., 20:151. Lectotype ♂, Placer Co., Calif., designated by Rehn & Hebard, 1912 (USNM).

Melanoplus blandus Scudder, 1899, Proc. Dav. Acad. Nat. Sci., 7:161.

Melanoplus rileyanus rileyanus, Gurney, 1960, Proc. Ent. Soc. Wash., 62(3):164.

Rather dark gray-brown with dark bar behind eye and on lateral lobe of pronotum, weaker on metazonal portion. Tegmina bicolored. Hind tibiae blue. Male with lobes of furcula digitiform, about one-fourth to one-third as long as epiproct, rounded at apex, cercus very broad, the upper distal portion strongly twisted inward. In some specimens this torsion is so great that the cercus in lateral view shows the distal margin v-excised (Gurney, 1960).

Body 18–20; tegmen 3–4; hind femur 10–11.

Geographic range.—California.

California records.—(Map 36) ALPINE CO.: Woodfords, X–7–65, 5630 ft. elevation (D. C. Rentz & J. D. Birchim, DCR). PLACER CO.: October (Henshaw, ANSP).

Melanoplus rileyanus varicus Scudder

(Map 36)

Melanoplus varicus Scudder, 1899, Proc. Dav. Acad. Nat. Sci., 7:168. Lectotype ♂, Tehachapi, Kern Co., Calif., designated by Rehn & Hebard, 1912 (MCZ).

Melanoplus rileyanus varicus, Gurney, 1960, Proc. Ent. Soc. Wash., 62(3):164.

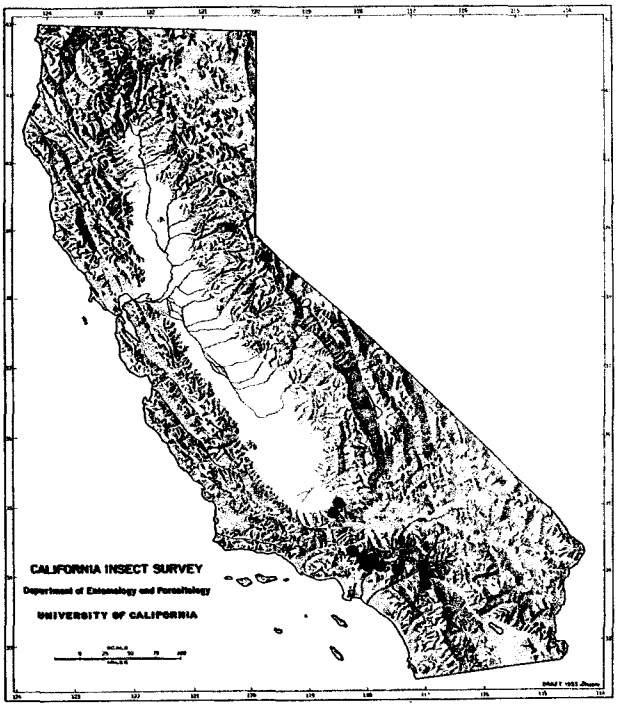
Comparison of single topoparatypes of *M. rileyanus* and *M. varicus* shows little difference. The latter is somewhat the smaller with the male cercus slightly narrower and less incurved apically.

Body 16.5–20; tegmen 3–5; hind femur 9–11.

Geographic range.—California.

California records.—(Map 36) KERN CO.: Tehachapi, VIII–2– (ex: Scudder). Tehachapi Mts., Marcel, IX–16–10, 3700 ft. elevation (ANSP). Tejon, IX–3–22, 3300 ft. elevation (Rehn & Hebard, ANSP). LOS ANGELES CO.: V, IX, Coquillett (ex: Scudder). Claremont, VII–28–35 (R. H. Beamer, ANSP). Mt. Lowe, IX–25–10 (ANSP); VIII–8–25, 4000–5600 ft. elevation (Rehn & Hebard, ANSP). Altadena, Mt. Wilson, VII–28–1897 (ANSP). Summit Mt. Wilson, VII–28– (A. P. Morse, ANSP). Pasadena, San Rafael Hills, VIII–1– (Rehn & Hebard, ANSP). Verdugo Hills, VIII–23–09, 900 ft. elevation (ANSP). RIVERSIDE CO.: Mill Creek, VIII–1–46 (P. H. Timberlake, CDA). SAN BERNARDINO CO.: Tetley Park, VIII–1–46 (P. H. Timberlake, CDA). San Bernardino Mts., Mill Creek, VIII–29–19 (Rehn & Hebard, ANSP); Santa Ana River, Bear Lake Rd., VIII–30–19, 3300 ft. elevation (Rehn & Hebard, ANSP). Cucamonga Canyon, Upland, XIII–21–17.

Melanoplus rileyanus varicus—Atypical. VENTURA CO.: Mt. Pinos, IX–4–22, 8500 ft. elevation (Rehn & Hebard, ANSP); Bear Trap, IX–3–22, 6400 ft. elevation (Rehn & Hebard, ANSP).



Map 36. California distribution of: ▲, *Melanoplus platycercus* Hebard; ■, *Melanoplus rileyanus rileyanus* Scudder; ●, *Melanoplus rileyanus varicus* Scudder.

Melanoplus rugglesi Gurney
Nevada sage grasshopper

(Fig. 93, Map 37)

Melanoplus rugglesi Gurney, 1949, Proc. Ent. Soc. Wash,, 51:268. Type Locality, Skull Creek Canyon, 20 mi. N. of Fields, Ore. (USNM, #59370).

Gray or gray-brown with the usual black bar behind the eye and along prozonal part of lateral lobe. Hind femur with two oblique dark bars on outer face and upper paginae, these sometimes vague. Cerci of male ear-shaped. Gurney has noted two forms, a solitary and a large, longer-winged migratory phase.

Body 23–28; tegmen 21–24; hind femur 11–14.

Geographic range.—California, Idaho, Montana, Nevada, Oregon, Utah, Wyoming, British Columbia.

California records.—(Map 37) INYO CO.: Wild Rose Canyon, Panamint Range (ex: Gurney). MODOC CO.: Cedarville, VII–8–50, migratory phase (L. White). E. side of Middle Lake, VI–13–51 (H. H. Keifer, CAS).

Discussion—Gurney and Buxton (1965): "the solitary phase of *rugglesi* is not known farther west than Arco, Idaho; Battle Mt., Nevada; and the Panamint Range, California." It is uncertain if this species occurs permanently in northern California.

Melanoplus sanguinipes sanguinipes (Fabricius) migratory grasshopper

(Fig. 78, Map 37)

Gryllus sanguinipes Fabricius, 1798, Supp. Ent. Sys., p. 195. Lectotype ♂, America Sept., selected by Gurney, 1962 (Zoological Museum, Copenhagen).

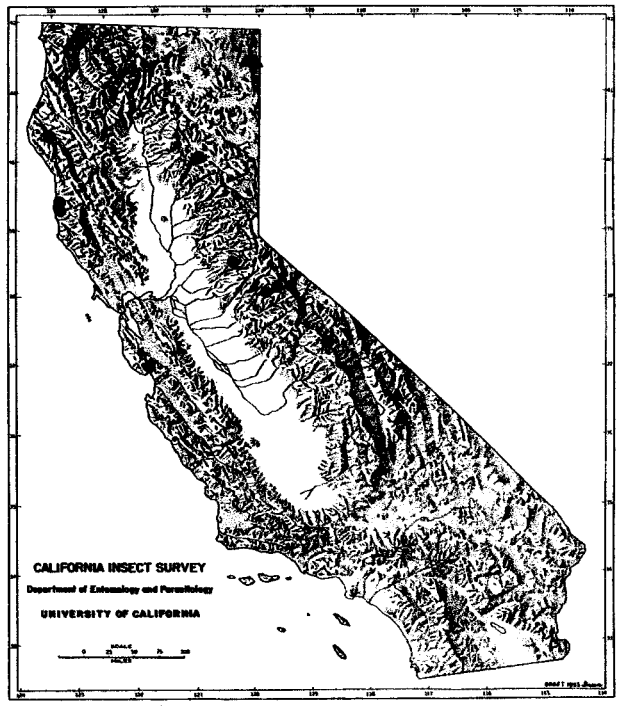
Synonyms.—(see Gurney, 1962) *Caloptenus bilituratus* Walker, 1870; *Caloptenus scriptus* Walker, 1870; *Caloptenus arcticus* Walker, 1870; *Caloptenus atlanis* Riley, 1875; *Melanoplus atlanis* var. *coeruleipes* Cockerell, 1888; *Melanoplus affinis* Scudder, 1897; *Melanoplus angelicus* Scudder, 1897; *Melanoplus intermedius* Scudder, 1897; *Melanoplus sierranus* Scudder, 1897; *Melanoplus m. mexicanus* (of authors, not Saussure); *Melanoplus bilituratus bilituratus*, Gurney and Brooks, 1959.

Similar in general appearance to *M. femur-rubrum* but tegmina usually with a longitudinal row of black dots; these may be obscure in dark specimens. Hind tibiae blue or red. The subgenital plate of the male is produced at apex, truncate and minutely notched at middle. Mesosternum of male with a subconical tubercle. The nominate race differs from *M. sanguinipes defectus* in average smaller size and shorter tegmina, narrower cerci (male), and the anterior margin of the dorsal valve of the aedeagus is more evenly rounded in profile, not sinuate.

Body 18–24; tegmen 14–18; hind femur 10.5–13.

Geographic range.—Widespread across Canada and the northern states.

California records.—(Map 37) The following records are apparently not indicated on the map of Gurney and Brooks (1962): EL DORADO CO.: 3 mi. S. Caldor on Middle Dry Creek, VIII–1–64 (D. C. & K. A. Rentz, DCR). INYO CO.: Near Mono Pass, VIII–9–59, 11,000 ft. elevation (D. C. Rentz, DCR). MENDOCINO CO.: Fort Bragg, VIII–25–50 (J. M. Linsley, CIS). Shively, VIII–21–56 (P. D. Hurd, CIS). Mendocino, VIII–4–58 (J. R. Helfer, CIS). MONO CO.: 8 mi. E. Sonora Pass, IX–5–64 (D. C. Rentz, DCR). White Mts., Mt. Barcroft, VII–7–61, 12,500 ft. elevation (D. C. Rentz, DCR, CAS). PLUMAS CO.: Butt Valley, VIII–3–60 (D. C. Rentz, DCR). SANTA CLARA CO.: Near Holy City, VIII–21–59 (D. C. Rentz, DCR). TUOLUMNE CO.: Dardanelle, VIII–9–61 (D. C. Rentz, DCR). Sonora Pass, VIII–21–59 (C. W. O'Brien, DCR). Sonora Peak, VIII–6–59 (C. E. Wemmer, DCR). 1 mi. N. Dardanelle, VII–19–64 (D. C. & K. A. Rentz, DCR). Vicinity Sonora Peak, IX–1–60 (D. C. Rentz, DCR).



Map 37. California distribution of: ▲, *Melanoplus rugglesi* Gurney; ●, *Melanoplus sanguinipes sanguinipes* (Fabricius).

Discussion—A chronic major agricultural pest in large areas of North America, especially in south central Canada and in the northern tier of midwestern United States. It is migratory at times, frequently with two generations per year. Environments occupied by *s. sanguinipes* are extremely variable with a general preference for light, sandy soils. It is a grass and forb feeder usually restricting itself to relatively few hosts in any one locality.

Labels on specimens in the Insect Survey Collections record *sanguinipes* as taken on alfalfa and *Melilotus*. Gurney and Brooks (1959) used many of these specimens in mapping the distribution of the species.

Melanoplus sanguinipes defectus Scudder

Melanoplus defectus Scudder, 1897, Proc. Amer. Phil. Soc., 36:30, 32. Lectotype ♂, Grand Jct., Mesa Co., Colo., designated by Rehn & Hebard, 1912 (ANSP).

Melanoplus bilituratus defectus, Gurney and Brooks, 1959, Proc. U. S. Nat. Mus., 110:38.

Melanoplus sanguinipes defectus, Gurney, 1962, Proc. Biol. Soc. Wash,, 75:189.

Of average larger size and with broader cerci (male) than the nominate subspecies. According to

the diagnosis of Gurney and Brooks (1959), the most distinctive feature is the dorsal valve of the aedeagus which, in lateral view, has the interior margin decidedly sinuate. The distribution map presented by these authors shows typical *defectus* as occurring in Ventura, Kern, and Imperial Counties; specimens intermediate between *defectus* and the nominate race are recorded from San Diego, Los Angeles, San Bernardino and Inyo counties. The economic importance and some aspects of the ecology of the species are discussed in articles by Harper (1952) and Barnes (1955).

Body 25–28; tegmen 21–23; hind femur 14–16.

Intermediates between *M. sanguinipes* (Fabricius) and *M. sanguinipes defectus* Scudder.—INYO CO.: Big Pine, VII–23–64 (J. D. Birchim, JDB). 2 mi. E. Big Pine, VII–23–64 (J. D. Birchim, JDB). Near Westgard Pass, VII–21–64 (J. D. Birchim, JDB). West Bishop, VII–24–64 (J. D. Birchim, JDB). Independence, VII–4–64 (J. D. Birchim, JDB).

Melanoplus siskiyou Strohecker
(Map 38)

Melanoplus siskiyou Strohecker, 1963, Pan-Pac. Ent., 39(3): 170–171. Holotype ♂, allotype ♀, Ft. Jones, Siskiyou Co., Calif. (CDA).

Outer face of hind femur mostly dark with yellow areas on basal third and yellow bar at mid-length. Hind tibia blue or red. Tegmina actuely rounded at apex, extending to apex of second abdominal tergite. Male with hind tibia rather deeply sulcate below, the distal oblique ridges of epiproct separated from the side margins by a depression.

Body 20–23; tegmen 4.5–5; hind femur 10.3–11.6.

Geographic range.—California.

California records.—(Map 38) SISKIYOU CO.: Ft. Jones, IX–3–42, holotype (H. W. Graves, CDA); VIII–18–48, allotype (E. Gammon, CDA). Mt. Shasta City, VIII–28–65 (D. C. & K. A. Rentz, DCR). 4 mi. E. Mt. Shasta City, VIII–26–65 (D. C. & K. A. Rentz, DCR). TRINITY CO.: Cold Springs, IX–19–62 (Buxton & Blanc, CDA). S. Fork Mt., 5 mi. W. Hyampom, IX–25–63 (F. L. Blanc & G. M. Buxton, CDA). Weaver Bally, IX–25–63 (F. L. Blanc & G. M. Buxton, CDA).

Discussion—Collected by Blanc and Buxton in growths of the mint, *Monardella odoratissima*.

Melanoplus sonomaensis Caudell
(Figs. 101, 102, Map 38)

Melanoplus sonomaensis Caudell, 1906, Proc. Ent. Soc., Wash., 7:124. Type ♂, Glen Ellen, Sonoma Co., Calif. (USNM).

Resembling closely other small species of the *marginatus* group and probably not determinable by external features even in the male sex. Tegmina short, rounded, narrowly separated. Cerci of male rapidly tapering, tip very narrowly rounded, subacuminate.

Body 13–15; tegmen 2–2.5; hind femur 8–8.5.

Geographic range.—California.

California records.—(Map 38) LAKE CO.: Mt. St. Helena, IX–12–60, on *Cordylanthus pringlei* Gray (J. H. Helfer, CAS). SANTA CRUZ CO.: SANTA CRUZ, VIII–28– (Rehn & Hebard, ANSP), determination should be verified. SONOMA CO.: Glen Ellen (ex: Caudell).

Melanoplus wilsoni Gurney
(Figs. 127, 128, Map 38)

Melanoplus wilsoni Gurney, 1960, Proc. Ent. Soc. Wash., 62 (3):158–163. Type ♂, Lyons Peak (?) San Diego Co., Calif. (USNM #64730).

Known from holotype and allotype only. "General ground color dull reddish brown; postocular bar on head, its extension on lateral lobe of pronotum, and mesepimeral stripe blackish brown; abdominal terga II–VIII each with a pair of pale basal areas; basal two-thirds of abdomen blackish along sides; ventral surfaces pale yellowish brown; hind femur dull red along ventral margin of external paginal area, ventral surface yellowish brown; hind tibia weak reddish brown, spines black."

Body 19–24; tegmen 4.2–4.9; hind femur 11.2–14.

Geographic range.—California.

California records.—(Map 38) SAN DIEGO CO.: Lyons Peak (Lyonshill), V–16–40 (C. C. Wilson, USNM).

Map 38. California distribution of: ●, *Melanoplus siskiyou* Strohecker; ▲, *Melanoplus sonomaensis* Caudell; ■, *Melanoplus wilsoni*.

Melanoplus wintunus Strohecker and Helfer

(Figs. 129, 130, Map 39)

Melanoplus wintunus Strohecker & Helfer, 1963, Pan-Pac. Ent., 39(3):160. Holotype ♂, Plaskett Meadows, Glenn Co., Calif. (CDA).

Front and cheeks olive; occiput and dorsum of pronotum brown, lateral lobe with black area on prozona. Femora without dark markings. Hind tibiae pale green. Some females are largely green. Tegmina attingent, subacute at apex.

Body 17–22; tegmen 3.5–5; hind femur 8.5–11.

Geographic range.—California.

California records.—(Map 39) GLENN CO.: Plaskett Meadows, VII–26–61, holotype, allotype, paratypes (J. R. Helfer, CDA); VIII–22–52 (F. L. Blanc, CDA).

Discussion—Collected in bushy, well watered, meadow area.

Melanoplus yarrowii (Thomas)

(Figs. VII, VIII, 85, Map 39)

Caloptenus yarrowii Thomas, 1875, Rept. Geol. Expl. 100th Mer., 5:894. Wheeler Expedition (type missing).

Melanoplus yarrowii, Scudder, 1897, Proc. U.S. Nat. Mus., 20:369.

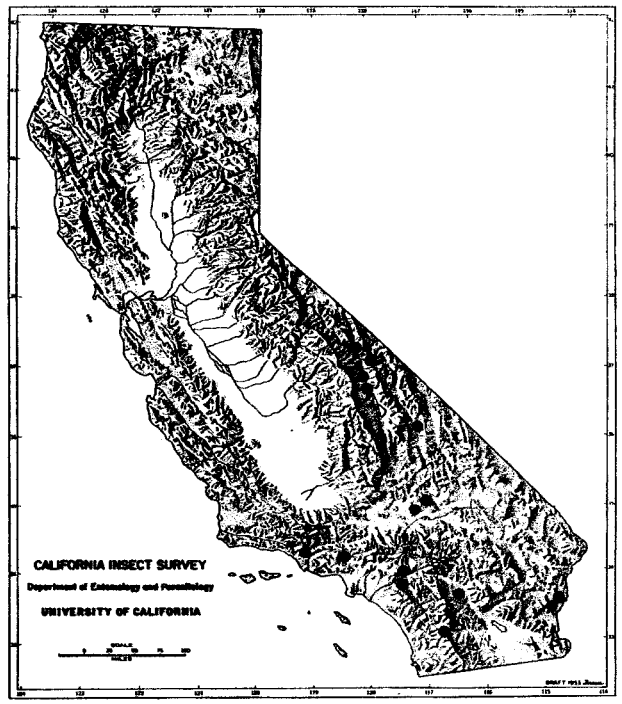
Melanoplus olivaceus, Scudder, 1897, Proc. U.S. Nat. Mus., 20:370.

Pale brown to olivaceous, head with a narrow black postocular band, continued on the prozonal part of lateral lobe of pronotum in some specimens. When present the dark color follows the sutures of the lateral lobe ventrad. Hind femur plain or with some vague dark suffusions. Hind tibiae red. Small, dark specimens from Los Angeles County were given the name *M. olivaceus* by Scudder.

Body 28–36; tegmen 24–29; hind femur 16–20.

Geographic range.—Arizona, California, Colorado, New Mexico, Utah.

California records.—(Map 39) INYO CO.: Wild Rose Canyon, Panamint Range, IX–8–22, 3616 ft. elevation (Rehn & Hebard, ANSP). Bishop, IX–9–19 (Rehn & Hebard, ANSP). Near Westgard Pass, VIII–10–61 (D. C. Rentz, DCR). Independence, VII–3–64, VII–24–64, VII–26–64 (J. D. Birchim, JDB). 8 mi. N. Independence, VII–29–64 (J. D. Birchim, JDB). Bishop, VII–11–65 (J. D. Birchim, JDB). LOS ANGELES CO.: (ex: Scudder). Saugus, X–19–50 (H. H. Keifer & Meyers, CDA). RIVERSIDE CO.: Ripley, VIII–13–46, in alfalfa field (W. F. Barr, CIS). Blythe, VIII–28–46, in alfalfa field (W. F. Barr, CIS); Riverside, X–30–55, X–2–55 (R. L. Bender); VIII–8–30 (Timberlake, ANSP). Chino Canyon, XI–24–63 (R. L. Westcott). SAN BERNARDINO CO.: Barstow, VII–7–19 (Rehn & Hebard, ANSP). E. Victorville, IX–1–19 (Rehn & Hebard, ANSP). Colton, Santa Ana Wash, IX–2–19 (ANSP). SAN DIEGO CO.: Warner's, IX–1920 (ANSP). VENTURA CO.: Santa Paula, VII–23 (D. Burk, CIS).



Map 39. California distribution of: ▲, *Melanoplus wintunus* Strohecker and Helfer; ●, *Melanoplus yarrowii* (Thomas).

Discussion—Normally inhabits rich vegetation in washes, but occasionally injurious to cultivated crops. At times one of the most injurious species on alfalfa, clover, and cotton in the Yuma area (Ball et al., 1942).

Genus *Oedaleonotus* Scudder, 1897

Satisfactory treatment of the forms of this genus will require comprehensive study not feasible at present. Specimens from widely separated localities appear to represent quite distinct species but many intermediate forms occur and we have not been able to find sets of characters consistent enough to be regarded as of specific worth. Certainly the number of species is less than the number of applied names. *Oedaleonotus fratercula* Hebard and *Melanoplus fuscipes* Scudder, transferred to this genus by Hebard, have been placed in *Aeoloplides*. *O. pacificus* (Scudder) has been raised to full species rank.

KEY TO THE SPECIES OF OEDALEONOTUS

(based largely on males)

1 Hind margin of pronotum truncate and notched at middle; tegmina narrow and widely separated 2
Hind margin of pronotum convex or, if truncate, not notched 3

2 Lateral lobe of pronotum with buffy spot near first sulcus and lateral carina (Monterey Co.) . . *phryneicus* Hebard (p. 62)
Lateral lobe of pronotum without buffy spot . . *tenuipennis* (Scudder) (p. 63)
3 Male epiproct abruptly narrowed near base, longer than its basal width, its side margins strongly reflexed; ventral valves of aedeagus without lateral process (fig. 70) . . *pacificus* (Scudder) (p. 61)
Male epiproct triangular, its length less than its basal width; ventral valves of aedeagus with prominent process 4
4 Hind margin of pronotum truncate (Mendocino Co.) (figs. 69, 72) . . . *borckii?* (Stal) (p. 58)
Hind margin of pronotum convex 5
5 Tegmina tapering, more or less acute at apex; intervals between pronotal sulci convex . . . 6
Tegmina rounded or truncate at apex; intervals rather flat 8
6 Tegmina reaching to apex of abdomen aedeagus (fig. 71) . . . . *enigma* (Scudder) (p. 59)
Tegmina not reaching apex of abdomen . . . 7
7 Tegmina slightly longer than pronotum. Aedeagus gus (fig. 71) . . . *enigma* (Scudder) (p. 59)
Tegmina covering half or more of abdomen aedeagus (fig. 71) . . . . *enigma* (Scudder) (p. 59)
8 Tegmina well separated (east side of Sierra) . *orientis* Hebard (p. 60)
Tegmina attingent or overlapping (males) (fig. 68) 9
9 Region of San Diego . *pinctus* (Scudder) (p. 62)
Region of San Francisco 10
10 Color dark; median carina of pronotum strongly raised on prozona; male cercus twice as long as broad at base (figs. 75, 76) . . . . . sp.
Color largely umber; median carina distinct but little elevated on prozona; male cercus less than twice as long as its basal width (figs. 69, 72) . *borckii* (Stal) (p. 58)

Oedaleonotus borckii (Stal)

(Figs. 69, 72, Map 40)

Acridium (*Podisma*) *borckii* Stal, 1861, Eugenies Resa, Orth., p. 332. Type ♀, San Francisco, Calif. (Stockholm Museum).

Melanoplus borckii, Scudder, 1897, Proc. Amer. Phil. Soc., 36:12.

Oedaleonotus borckii, Hebard, 1919, Trans. Amer. Ent. Soc., 45:266.

Oedaleonotus borckii borckii, Hebard, 1920, Ibid., 46:358.

Acridium (Podisma) borckii, Sjöstedt, 1931, Arkiv. Zool., 24A:44, Pl. 19, Fig. 5 (type).

The female monotype is overall umber color, the front, including costa, dusky. Pronotum without dark markings even in the sulci. Outer face of hind femur with alternate pearly and dark chevrons, the pale areas broader. The pearly color may be due to detachment of underlying tissues. Lower external pagina and ventral sulcus vivid orange-red; upper paginae pale brown with orange tint. Hind tibia blue, the outer face greenish, the spines and calcars yellow with black tips. Eye deeper than infra-ocular sulcus (14:11). Outer face of mandible with ridges strongly raised. Prosternal spine broad, well rounded at apex. Pronotum with median carina sharply raised on metazona, feeble but evident between sulci, distinct but low on anterior lobe of prozona; hind margin angulate, broadly obtuse; metazona abruptly widened, the lateral lobe flared. Tegmina attingent, cycloid, the left one covering basal third of second abdominal tergite and subtruncate, the right one slightly longer and broadly rounded at apex. Cerci broad at base, evenly and rapidly tapering, acute. Dorsal valves of ovipositor (dorsal view) rapidly narrowed caudad, apex bluntly rounded. Ventral valves more gradually tapering, rather narrowly rounded at apex.

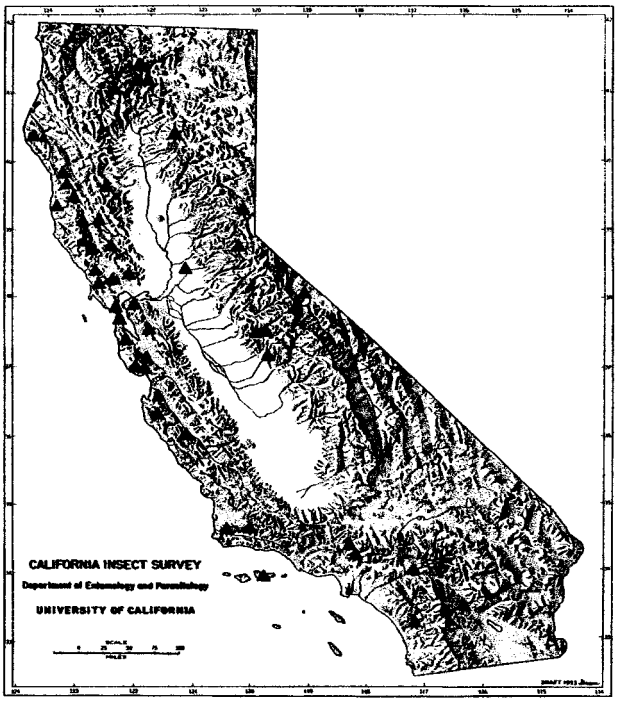
No specimen agreeing in all features with the monotype has been found, but similar specimens from San Francisco and Contra Costa counties have been seen. Specimens from Hopland indicate transition from *borckii* to the smaller form with truncate pronotum which occurs in the vicinity of Mendocino. The dark-colored form taken in San Francisco is similar in most features but is smaller, with median carina strong on anterior lobe of prozona, tegmina hardly surpassing first abdominal tergite and, in female, well separated.

Body 24; tegmen 3.7; hind femur 15.

Geographic range.—California.

California records.—(Map 40) ALAMEDA CO.: 1 mi. E. Mission Peak, VI–9, VII–5–59 (W. W. Middlekauff, CIS). Mines Rd., VII–11–59 (D. C. Rentz, DCR). CONTRA COSTA CO.: Mt. Diablo, V–21–59 (J. H. Helfer, CAS). Pleasant Hill, VII–6–55 (E. G. Linsley, CIS). EL DORADO CO.: Strawberry Valley, VIII–4–12 (E. C. Van Dyke, CAS). GLENN CO.: Telephone Campground, VIII–20–58 (P. Arnaud, CAS). 1 mi. W. Low Gap Station, VII–26–61 (D. C. Rentz, CAS). HUMBOLDT CO.: Petrolia, VII–17–58 (J. R. Helfer, CAS). LAKE CO.: Upper Lake, VII–16–35 (R. H. Beamer, ANSP). Middletown, VI–5–60 (D. C. Rentz(CAS). Loch Lomond, IX–16–48 (W. E. Hazeltine, CIS). LOS ANGELES CO.: Tanbark Flat, VII–8–50 (F. X. Williams, CAS). Mt. Lowe, VIII–8–07 (ANSP). Camp Baldy, VII–11–50 (H. L. Hansen, CIS). MADERA CO.: VIII–23–46 (T. L. Thatcher, CIS). MARIPOSA CO.: El Portal, VIII–7–37, 1850 ft. elevation (Rehn, Pate & Rehn, ANSP). Yosemite Valley, VI–13–21 (E. C. Van Dyke, CAS). Yosemite Nat. Park, Eight-mile Camp, IX–1–07 (ANSP); Sentinel, VIII–31–07 (ANSP). Wawona, VIII–6–37, 4090 ft. elevation (Rehn, Pate & Rehn, ANSP). MARIN CO.: Lake Lagunitas, V–15–59 (D. C. Rentz (CAS); V–10–59 (E. W. Kirschbaum, CAS). Cypress Ridge, VI–4–60 (D. C. Rentz, CAS). Bon Tempe Lake, VI–24–59 (D. C. Rentz, CAS). 1 mi. N. Alpine Lake, VII–30–60 (F. J. Radovsky & R. Garcia, CAS). 8 mi. N. Point Reyes Station, VIII–20–61 (D. C. Rentz, CAS). Cypress Ridge, IX–21–30 (E. P. Van Duzee, CAS). Mt. Tamalpais, VIII–12–04, 1500 ft. elevation (ANSP). Corte Madera, VII–27–58 (D. C. Rentz, CAS). Novato, VII–10–65 (D. C.

Rentz, CAS). San Geronimo, VIII–28–40 (H. W. Graves, CDA). San Francisco Bay, Angel Island, VI–1–44 (E. R. Helwig, ANSP). MENDOCINO Co.: Hopland Field Station, VIII–17–56, VII–24–57, VI–10–58 (W. W. Middlekauff, CIS). Mill Creek Dam, VII–19–59 (D. C. Rentz, DCR). Mendocino, VIII–1–58 (J. R. Helfer, CAS). 8 mi. W. Cummings, VIII–18–41 (Rehn & Rehn, ANSP). 4 mi. N. Laytonville, VIII–18–41 (Rehn & Rehn, ANSP). Willets, VI–29–59, VII–23–58 (J. R. Helfer, CAS). Mendocino, IX–1–58, VIII–15–58, VI–20–59, V–12–59, VI–30–59 (J. R. Helfer, CAS); VII–18–59 (D. C. Rentz, CAS). Hansen, VI–11–59 (D. C. Rentz, CAS). Yorkville, VI–29–59 (J. R. Helfer, CAS). MONO Co.: Coleville, Antelope Valley, VIII–22–41, 5200 ft. elevation (Rehn & Rehn, ANSP). 17 mi. E. Leevining, VIII–15–56, 8500 ft. elevation (J. Rehn, ANSP). MONTEREY Co.: San Lucas, VIII–11–37 (Rehn, Pate & Rehn, ANSP). S.W. side Salinas, VIII–3–57 (J. Rehn, ANSP). Hastings, Natural History Reservation, IX–2–57 (J. Rehn, ANSP). NAPA Co.: Mt. St. Helena, VI–9–18 (E. P. Van Duzee, CAS); IX–5–48 (G. N. Chamberlain, CAS); VI–27–61 (D. C. Rentz, CAS). PLACER Co.: 3 mi. S. Truckee, VIII–1–49 (M. J. D. White, ANSP). RIVERSIDE Co.: San Jacinto Mts., 2 mi. S.E. Pinyon Flat, VI–1–40 (C. D. Michener, CIS). SACRAMENTO Co.: 2 mi. W. Loomis, VI–20–61 (D. C. Rentz, CAS). SAN BERNARDINO Co.: S. rim San Bernardino, on Calif. Highway 18, VIII–22–51, 5756 ft. elevation (J. Rehn, ANSP). SAN DIEGO Co.: Mary Canyon above Mission Valley, VIII–19–37 (Rehn, Pate & Rehn, ANSP). SAN



Map 40. California distribution of *Oedaleonotus borckii* (Stal).

FRANCISCO Co.: San Francisco, San Miguel Hills, VIII–19–09, 800 ft. elevation (ANSP); V–1960, V–14–60 (D. C. Rentz, CAS). SAN MATEO Co.: Crystal Lake, VIII–27–49 (H. H. Keifer, CDA). Palo Alto, VII–13–49 (K. Frick, CIS). Redwood City, VII–21–46 (E. S. Ross, CAS). SANTA BARBARA Co.: Zaca, VIII–12–37, 900 ft. elevation (Rehn, Pate & Rehn, ANSP). Lompoc, VIII–6–38 (L. W. Hepner, CAS). Santa Cruz Island, VI–15–22 (CIS). SANTA CLARA Co.: Alma, VIII–20–41 (Rehn & Rehn, ANSP). SANTA CRUZ Co.: Mt. Hermon, VI–1–47 (W. Hazeltine, CIS). 4 mi. N. Boulder Creek, VIII–20–61 (C. E. Wemmer, CAS). SHASTA Co.: Viola, VI–27–47 (T. O. Thatcher, CIS). SONOMA Co.: 4 mi. W. Kenwood, VI–17–61 (D. C. Rentz, CAS). Cloverdale, V–8–59, V–15–59 (J. R. Helfer, CAS). Cazadero, VII–13–60 (R. Wilson, CAS). Eldridge, X–10–15 (ANSP). SISKIYOU Co.: Mt. Shasta, VI–30–47 (T. S. Leigh, CIS). Dunsmuir, VIII–14–31 (CAS). Sisson, VIII–15–15 (CAS). McCloud, VI–20–14 (E. C. Van Dyke, CAS). TRINITY Co.: Carrville, VI–28–31 (E. C. Van Dyke, CAS).

Oedaleonotus enigma (Scudder)

(Figs. 67, 71, Map 41)

Pezotettix enigma Scudder, 1876, Ann. Rep. Chief Eng., p. 505.

Pezotettix jucundus Scudder, 1876, loc. cit.

Melanoplus collaris Scudder, 1878, Proc. Boston Soc. Nat. Hist., 19:286.

Caloptenus flavolineatus Bruner, 1893, Bull. Div. Ent. U.S. Dept. Agr., 28:33.

Oedaleonotus enigma, 1897, Scudder, Proc. U.S. Nat. Mus., 20:391.

General color yellow with orange tints in some specimens. Dorsum of pronotum dusky at middle and often with small tubercles. Black color confined to sulci but prozonal part of lateral lobe may have dark bar. Black markings of sides of abdomen variably developed. Outer face of hind femur yellow with black markings variably developed. Hind tibia blue, paler on lateral face. Tegmina about as long as pronotum and angulate to elongate at apex, surpassing apices of hind femora. The long-winged form *(collaris)* is not a race but occurs with shorter winged forms in California and Idaho.

Although *jucundus* has line priority, Scudder, in his 1897 treatment, subordinated it to *enigma*, which is too appropriate a name to discard. The species is highly variable in size, tegminal length and to some degree in form of male cerci.

Body 22–24; tegmen 6–6; hind femur 14–16.

Geographic range.—Northern Utah and Nevada, southeastern Oregon to southwestern Arizona and California.

California records.—(Map 41) ALAMEDA Co.: Patterson Pass, VI–9–58 (G. D. Kelly, CIS); VI–22–57 (W. W. Middlekauff, CIS). BUTTE Co.: Oroville, VII–24–57, IX–6–56 (W. W. Middlekauff, CIS). CONTRA COSTA Co.: Diablo Range, Priest Valley, VIII–31–22, 2700 ft. elevation (Rehn & Hebard, ANSP). Clayton, VII–20–35 (J. Beamer, ANSP). Mt. Diablo, VII–21–35 (J. Beamer, ANSP). KERN Co.: Woody, VI–4–38 (F. D. Horn, CIS). Caliente, VII–14–53 (E. I. Schlinger, CIS). Mill Potrero, VII–8–59 (R. M. Bohart, UCD). Marcel, Tehachapi Mts., IX–16–10, 3700 ft. elevation (ANSP). Tehachapi, IX–16–10, 3595 ft. elevation (ANSP); IX–16–10, 3200

ft. elevation (ANSP). Walker Basin, IX–2–22, 3339 ft. elevation (Rehn & Hebard, ANSP). Bakersfield, Jewetta, IX–1–22 (Rehn & Hebard, ANSP). Delano, VIII–2–40 (E. R. Helwig, ANSP). FRESNO Co.: Jacalitos Canyon, VII–25–56 (R. O. Schuster, CIS). Mercy Mines, VII–16, VIII–28–58, V–23–60 (D. C. Rentz, CAS); VI–13–61 (D. C. Rentz & K. A. Hale, CAS); VIII–26–62 (D. C. Rentz & E. W. Kirschbaum, CAS). Coalinga, IV–22–39 (CIS). 4 mi. N.E. Oilfields, V–9–54 (J. Rehn, ANSP). Waltham Canyon, VIII–31–22 (Rehn & Hebard, ANSP). GLENN Co.: Orland, VII–2–52 (H. L. Hansen, CIS); V–28–54 (Wells & Wells, ANSP). LASSEN Co.: Litchfield, VIII–21–22, 3200 ft. elevation (Rehn & Hebard, ANSP). Johnsonville, VIII–21–22, 3150 ft. elevation (Rehn & Hebard, ANSP). Susanville, VIII–21–22, 3190 ft. elevation (Rehn & Hebard, ANSP). Reno Jct., VIII–17–49 (H. H. Keifer, CDA). 4 mi. N. Doyle, VIII–22–56 (J. D. Lattin, CIS). LOS ANGELES Co.: Saugus, VIII–23–09 (ANSP). MERCED Co.: Atwater, VII–29 (ex: Scudder). Los Banos, IX–21–41 (K. Frick, CIS). Dos Palos, V–18–50 (A. E. Michelbacher, CIS). MODOC Co.: Lookout, XI–1923 (F. H. Wymore, CIS). Stronghold, IX–5–40 (H. W. Graves, CDA). MONO Co.: Topaz Lake, VI–26–57 (J. W. MacSwain, CIS). MONTEREY Co.: Carmel, VII–8–23 (L. S. Slevin, CAS). Hastings Reservation, IX–9–57, 1700 ft. elevation (J. Rehn, ANSP). Lockwood, VII–11–23 (F. H. Wymore, ANSP). ORANGE Co.: VII–13–29 (R. H. Beamer, ANSP). RIVERSIDE Co.: Anza, VIII–6–35 (R. H. Beamer, ANSP). Banning, VII–22–52 (S. Mujagawa); VI–27–52 (E. M. Evans, J. K. Hester, & Tinglof); VII–16–52 (A. T. McClay, UCD); VI–27–52 (J. J. Menn, CIS). Hemet, VI–21, VII–31–58 (D. M. Newell, CIS). San Jacinto Mts., VII–21–29 (R. H. Beamer, ANSP). Banning, VIII–20–37 (Rehn, Pate & Rehn, ANSP). 3 mi. E. Banning River, VIII–23–51 (J. Rehn, ANSP). SAN BENITO Co.: New Idria, VIII–18–58 (D. C. Rentz, DCR). Panoche, V–15–54 (Wells & Wells, ANSP). SAN BERNARDINO Co.: Verdemont, IX–2–19, 2300 ft. elevation (Rehn & Hebard, ANSP). Devore, Cajon Canyon, IX–2–19 (Rehn & Hebard, ANSP). SAN DIEGO Co.: San Felipe Valley, VI–7–40 (C. D. Michener, CIS). Tighes Station, E. Palmer (ex: Scudder). San Diego (E. Palmer) (ex: Scudder). Aguas Calientes (E. Palmer) (ex: Scudder). Santa Ysabel, VII–13–63 (J. A. Powell, CIS). Warner's Springs, IX–5–41 (H. W. Graves, CDA). Palm City, VIII–7–35 (J. Russell, ANSP). San Diego, VIII–7–35 (J. Russell, ANSP). Tia Juana, IX–11–22 (Rehn & Hebard, ANSP). Bonsall, VIII–6–35 (ANSP). La Jolla, VII–21–40 (E. R. Helwig, ANSP); VI–18–16 (G. B. Engelhardt, ANSP). Warner's, VI–1922 (ANSP). Jamacha, IX–12–22, 340 ft. elevation (Rehn & Hebard, ANSP). Dulzura, IX–12–22, 1500 ft. elevation (Rehn & Hebard, ANSP). SAN LUIS OBISPO Co.: 5 mi. S. Creston, VI–20–59 (P. M. Marsh, UCD). San Miguel, VIII–11–37 (Rehn, Pate & Rehn, ANSP). SANTA BARBARA Co.: Santa Barbara, VII–1 (H. W. Henshaw) (ex: Scudder). San Buenaventura, VIII–18 (ex: Scudder). Figueroa Mt., VI–21–59 (P. M. Marsh, UCD). SIERRA Co.: Calpine, VIII–27–48 (R. E. Smith, CIS). SISKIYOU Co.: Ft. Reading, Shasta Valley (ex: Scudder). Walker Basin, VII–15 (ex: Scudder). Tule Lake, IX–9–41 (H. W. Graves, CDA). TULARE Co.: Lemoncove, VIII–2–40 (E. R. Helwig, ANSP); VII–23–29 (R. H. Beamer, ANSP). Goshen, VI–1–07 (J. C. Bradley, ANSP). VENTURA Co.: Quatal Cyn., V–9–59 (G. I. Stage, CIS). Cuyama, VII–25–35 (J. A. Russell, ANSP). Mount Pinos, IX–4–22, 8500 ft. elevation (Rehn & Hebard, ANSP). YOLO Co.: Davis, IX–1–59 (G. E. Harmon, CIS).

Discussion—Often found in association with *Melanoplus devastator*, though outbreaks have been more localized as a rule. It is an important and abundant range land species, especially in the eastern foothills of the coast range. It hatches two to three weeks before *devastator*, becoming adult in early June. It has been found ovipositing in central California from July to October. Favored oviposition sites include around and under rocks, under turkey mullein or adjacent to the basal growth of such weeds as thistles, milkweed, poverty weed and salt bush.

It occurs in both the long winged and short winged forms. A number of long winged specimens were taken in the Patterson Pass area of Alameda county in June, 1958, during an outbreak year. Only short winged specimens had been taken in this same locality in previous years.

Oedaleonotus orientis Hebard

(Fig. 168, Map 41)

Oedaleonotus borckii orientis Hebard, 1920, Trans. Amer. Ent. Soc., 46:358, Pl. 16. Fig. 1. Type ♂, Lee Canyon, Spring Mts., Clark Co., Nev., 7000 ft. elevation (No. 552, ANSP).

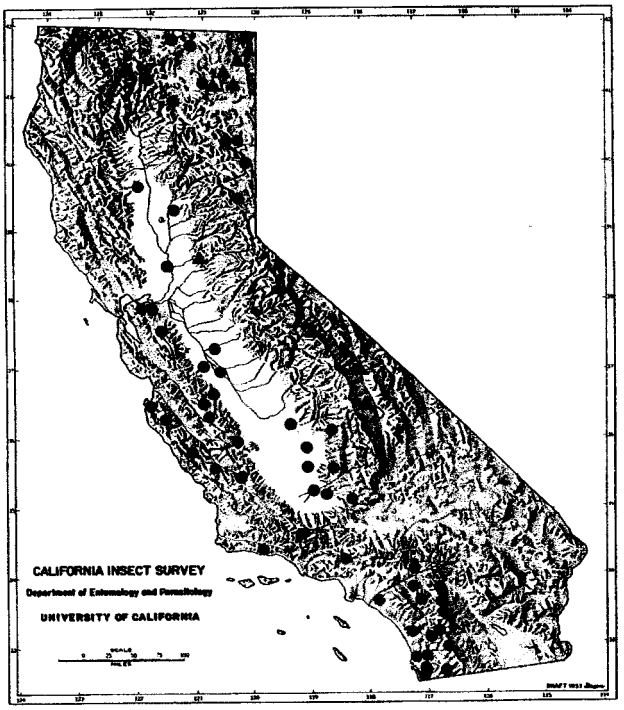
General color gray-brown, occiput (especially in males), prozona of pronotum and sides of abdominal tergites dusky. Prozonal part of lateral lobe of pronotum with a dark bar, which may be vaguely continued on metazonal portion especially along lateral carina. Hind femur yellow-brown with variable dark markings. Hind tibia blue, yellowish externally. Tegmina much longer than wide, extending over basal fourth or third of second abdominal tergite in male, shorter in female, well separated in male, more widely so in female. Ventral valves of aedeagus with conspicuous lateral processes.

Body 17–19; tegmen 2.8–3; hind femur 8.8–11.

Geographic range.—Eastern California and Nevada.

California records.—(Map 41) INYO Co.: Lone Pine Canyon, Whitney Pass, IX–8–19 (Rehn & Hebard, ANSP). Pine Creek, Round Valley, N.W. of Bishop, VIII–10–61 (D. C. Rentz, CAS). 10 mi. W. Big Pine, VII–20–64 (D. C. & K. A. Rentz, DCR). LASSEN Co.: Lassen Creek, VIII–22–22 (ANSP). MODOC Co.: Sugar Hill, VII–5–50 (H. E. Cott, CIS). Likely Distr., VI–14–51 (H. H. Keifer, CDA). Alturas, IX–9–62 (J. S. Buckett, UCD); VIII–23–22, 3500 ft. elevation (Rehn & Hebard, ANSP). Warner Mts., Cedar Pk., VIII–23–22 (Rehn & Hebard, ANSP). Goose Lake, Sugar Hill, VIII–24–22, 5350 ft. elevation (Rehn & Hebard, ANSP). Goose Creek, Lassen Creek area, VIII–24–22 (Rehn & Hebard, ANSP). Warner Mts., 3 mi. E. Davis Creek, VII–26–22 (A. W. Lindsey, ANSP). Adin Summit, VII–24–62, 5000 ft. elevation (D. C. Rentz & C. D. MacNeill, CAS). Warner Mts., near Cedar Pass, VII–25–62, 6000 ft. elevation (D. C. Rentz & C. D. MacNeill, CAS). Warner Mts., 9 mi. W.

Fandango Pass, VI–20–60 (D. C. Rentz, CAS). MONO CO.: Sonora Bridge Camp, near Sonora Jct., VII–28–62 (D. C. Rentz & C. D. MacNeill, CAS). Near Sonora Pass Jct., VII–19–64 (D. C. & K. A. Rentz, DCR). Little Round Valley, VIII–7–30, 7400 ft. elevation (E. R. Tinkham, ANSP). Mammoth Lake, VIII–8–21 (A. C. Poling, ANSP). PLUMAS CO.: Harkness Pk., VIII–20–22, 8000 ft. elevation (Rehn & Hebard, ANSP). SISKIYOU CO.: Gazelle, X–11–50 (A. T. McClay, UCD).



Map 41. California distribution of: ●, *Oedaleonotus enigma* (Scudder); ▲, *Oedaleonotus orientis* Hebard.

Oedaleonotus pacificus (Scudder)

(Figs. 70, 73, 74, 167, Map 42)

Pezotettix pacificus Scudder, 1880, Rep. U.S. Ent. Comm. 2:24, Type ♂, Sissons, Calif. (MCZ?).

Melanoplus pacificus, Scudder, 1897, Proc. Amer. Phil. Soc., 36:12.

Oedaleonotus borckii pacificus, Hebard, 1920, Trans. Amer. Ent. Soc., 46:358, footnote.

Brown, dorsum of head and pronotum dusky and often with numerous dark points. Lateral carinae of pronotum evident but not elevated. Hind margin of pronotum feebly convex to truncate.

Rehn and Hebard selected Mt. Shasta (Sissons) as type locality. Topotypes have the black band of the lateral lobe of pronotum continued and widened on the metazona but specimens from Glenn, Trinity and Humboldt counties have this black band confined to the prozonal part of the lateral lobe. Topotypes seem to represent intermediates between the form occurring in Humboldt County, which is robust (males up to 23 mm.), with tegmina well separated and ventral valves of aedeagus acute and recurved without lateral processes, and a form occurring along the west side of the Sierra Nevada down to Tuolumne and Tulare counties. These southern specimens, reported by Rehn and Hebard as *M. pacificus,* resemble topotypes of *pacificus* but have the tegmina longer and ventral valves of aedeagus with well-developed lateral processes.

Measurements of topotypes are: Body 18–20; tegmen 3.5–3.5; hind femur 11–11.

Geographic range.—California.

California records.—(Map 42) COLUSA CO.: Wilbur Springs, VI–11–64 (D. C. & K. A. Rentz, CAS). EL DORADO CO.: Strawberry Valley, VIII–4–12 (E. C. Van Dyke, ANSP). FRESNO CO.: King's River Canyon, VIII–4–49 (E. R. Helwig, ANSP). GLENN CO.: 4 mi. W. Plaskett Meadow Station, VIII–27–61 (D. C. Rentz, CAS); 6 mi. W. Plaskett Meadows, VIII–27–61 (D. C. Rentz, CAS). Plaskett Meadow Station, VI–28–61 (J. R. Helfer, CAS). Plaskett Meadows, VII–28–60, 6000 ft. elevation (H. B. Leech, CAS). 25 mi. E. Covelo, VI–28–61 D. C. Rentz, DCR). Elk Creek, VII–27–61 (D. C. Rentz, CAS). HUMBOLDT CO.: 3 mi. E. Kneeland, IX–1–60 (T. R. Haig, CDA). Near Kneeland, VII–11–60, 3000 ft. elevation (J. R. Helfer, CAS). Honeydew, VII–17–58 (D. C. Rentz, DCR). South Fork Mt., VI–22–59 (J. R. Helfer, CAS). Buck Mt., VI–22–59 (J. R. Helfer, CAS). LAKE CO.: Lucerne, VII–27–35 (R. H. Beamer, ANSP). LASSEN CO.: Devil's Corral, above Susanville, VIII–21–21 (Rehn & Hebard, ANSP). Mt. Lassen, VI–24–59 (J. R. Helfer, CAS). MADERA CO.: Sugar Pine, VIII–31–14, 5000 ft. elevation (J. C. Bradley, ANSP). MARIPOSA CO.: Yosemite Nat. Park, VIII–31–07, 4000 ft. elevation (ANSP). Yosemite Nat. Park, Grouse Creek, IX–1–07, 6000 ft. elevation (ANSP). Yosemite Nat. Park, Eight-mile Camp, IX–1–07, 5000 ft. elevation (ANSP). MENDOCINO CO.: Booneville, VI–10–59 (D. C. Rentz, DCR). MODOC CO.: 10 mi. W. Alturas, VII–24–62 (D. C. Rentz & C. D. MacNeill, CAS). Adin Summit, VII–24–62, 5000 ft. elevation (D. C. Rentz & C. D. MacNeill, CAS). PLACER CO.: Blue Canyon, VIII–29–10, 5500 ft. elevation (ANSP). Lake Tahoe, VIII–30–10, 7000 ft. elevation (ANSP). Squaw Peak at Summit, VIII–31–10, 8950 ft. elevation (ANSP). Colfax, VIII–27–10, 2800 ft. elevation (ANSP). PLUMAS CO.: Harkness Pk., lower south slopes, VIII–20–22, 5800 ft. elevation (Rehn & Hebard, ANSP). Chester, VIII–20–22, 4300 ft. elevation (Rehn & Hebard, ANSP). Mohawk, VII–3–60 (D. C. Rentz, CAS). SHASTA CO.: Old Station, VIII–20–49 (H. H. Keifer, CDA). Near Platina, VI–18–60 (D. C. Rentz, CAS). SISKIYOU CO.: Echo Lake, VIII–29–16 (J. A. Kusche, ANSP). Mt. Shasta, VI–29–35 (J. Beamer, ANSP); VIII–13–09, 5500 ft. elevation (ANSP). Weed, VI–29–35 (J. Beamer, ANSP). Sisson, VIII–15–09, 3550 ft. elevation (Rehn & Hebard, ANSP). Dunsmuir, VI–28–35 (E. I. Beamer, ANSP). Shasta Springs, IX–1–42 (H. W. Graves, CDA). Ft. Jones, IX–3–42 (CDA). Dorris, VIII–19–48 (E. Gammon, CDA). Fowler's Camp, 5 mi. E. McCloud, VII–22–62 (D. C. Rentz & C. D. MacNeill, CAS).

Ski Bowl, 14 road mi. E. Shasta City, VII–23–62, 7800 ft. elevation (D. C. Rentz & C. D. MacNeill, CAS). 4 road mi. E. Shasta City, McBride Campground, VII–23–62 (D. C. Rentz & C. D. MacNeill, CAS). 3 mi. E. Bartle, VII–22–62 (D. C. Rentz & C. D. MacNeill, CAS). 3 mi. E. Bartle, VII–22–62 (D. C. Rentz & C. D. MacNeill, CAS). STANISLAUS Co.: Empire, VII–11–35 (J. Beamer, ANSP). TRINITY Co.: Mad River, 6 mi. S. Ruth, VII–31–60 (H. B. Leech, CAS). Weaverville, VI–25–59 (J. H. Helfer, CAS). Sid's Place, Highway 36, IX–19–62 (G. M. Buxton & F. L. Blanc, CDA). 8 mi. S. Hyampom, IX–18–62, range grasses (G. M. Buxton & F. L. Blanc, CDA). 2 mi. S.E. Wildwood, IX–18–62, range grasses (G. M. Buxton & F. L. Blanc, CDA). Cold Springs, IX–18–62 (G. M. Buxton & F. L. Blanc, CDA). Lamb Gap, S. Fork Mt., IX–19–62 (G. M. Buxton & F. L. Blanc, CDA). TULARE Co.: Monache Meadows, VIII–6–17, 8300 ft. elevation (W. T. Davis, ANSP). Sequoia Nat. Park, Hockett Meadow, VII–25–15, 9700 ft. elevation (ANSP). Sequoia Nat. Park, VIII–3–40 (E. R. Helwig, ANSP). Kern Lake, VII–27–15, 7000 ft. elevation (ANSP). Rattlesnake, VIII–2–15, 9000 ft. elevation (ANSP). Redwood Meadow, VIII–3–15, 6000 ft. elevation (ANSP).

Oedaleonotus phryneicus Hebard

(Map 42)

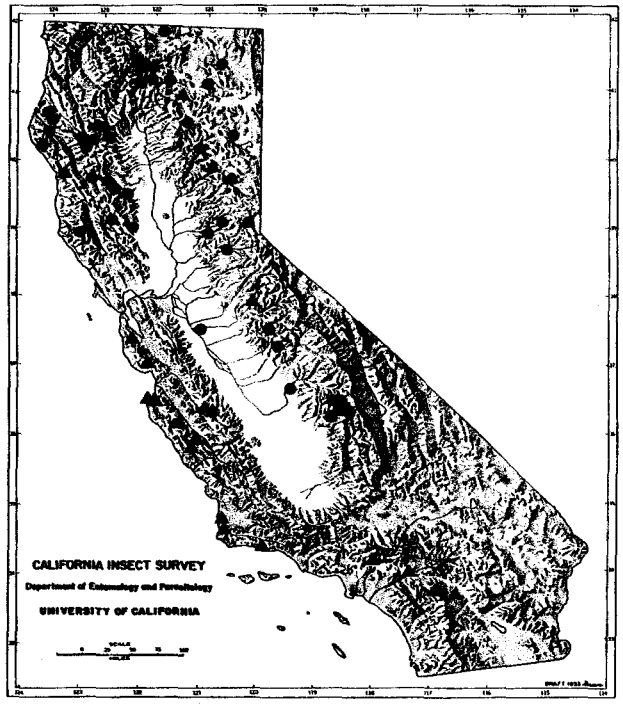
Oedaleonotus phryneicus Hebard, 1919, Trans. Amer. Ent. Soc., 45:266, Pl. 29, Figs. 5, 6. Type ♂, Del Monte, Monterey Co., Calif. (No. 486, ANSP).

Melanoplus tenuipennis Caudell (not of Scudder), 1918, Proc. U.S. Nat. Mus., 34:78.

Very much like *O. tenuipennis* and of similar size although the San Benito County specimens reported below are much smaller than topotypes; their determination must be considered questionable. The presence of the pale callus on the lateral lobe of the pronotum is the only consistent difference between *phryneicus* and *tenuipennis*. Differences in male cerci and aedeagus have not been noted.

Geographic range.—California.

California records.—(Map 42) LOS ANGELES Co.: Tanbark Flat, VII–2–50 (E. G. Linsley, CIS); VI–24–50 (P. D. Hurd, CIS); VI–25–50 (J. W. MacSwain, CIS); VI–20–50 (H. L. Hansen, CIS). Manhattan Beach, VIII–16–26 (ANSP). MENDOCINO Co.: Twin Rocks, VII–10–29 (E. C. Van Dyke, CAS). MONTEREY Co.: Del Monte, VIII–20–09 (M. Hebard, ANSP). Monterey, VIII–4–16 (G. P. Englehardt, ANSP). 14 mi. W. Jolon, VI–28–60 (C. D. MacNeill, CAS). Pacific Grove, VIII–21–31 (ANSP). 15 mi. E. N.E. San Lucas, VI–28–60 (C. D. MacNeill, CAS). Santa Lucia Mts., tributary to Santa Lucia Creek, east slope, VIII–13–56, 5000 ft. elevation (H. B. Leech, CAS). PLUMAS Co.: Quincy, VII–12–49 (R. G. Howell, CIS). RIVERSIDE Co.: Gilman Hot Springs, VI–10–41 (E. C. Van Dyke, CAS). San Jacinto Mts., V–30–40 (C. D. Michener, CIS). SAN BENITO Co.: Pinnacles Nat. Mon., V–28–60, VI–13–64 (D. C. Rentz, CAS). Hernandez Valley, V–28–60 (D. C. Rentz, CAS). SAN BERNARDINO Co.: Lytle Creek, VI–7–28 (E. C. Van Dyke, CAS). SAN MATEO Co.: King's Mt., VII–19–41 (K. Frick, CIS). SANTA BARBARA Co.: Guadalupe, VI–24–06, on sugar beets (A. N. Caudell, USNM). Santa Barbara, VIII–27–19 ANSP). SANTA CRUZ Co.: 2 mi. S. Felton, VIII–30–59 (D. C. Rentz, CAS). Santa Cruz Mts. (A. Koebele, CAS). SHASTA Co.: Lake Britton, VI–29–47 (T. S. Leigh, CIS). TUOLUMNE Co.: Lost Claim Camp, VIII–13–50 (M. J. D. White, ANSP).



Map 42. California distribution of: ●, *Oedaleonotus pacificus* (Scudder); ▲, *Oedaleonotus phryneicus* Hebard.

Oedaleonotus pinctus (Scudder)

(Fig. 68, Map 43)

Melanoplus pinctus Scudder, 1899, Proc. Davenport Acad. Sci., 7:175, Pl. 7, Fig. 7. Lectotype ♂, San Diego, Calif., designated by Rehn & Hebard, 1912 (MCZ).

Slender for genus. Brownish yellow, head with postocular black band which is continued on prozonal part of lateral lobe of pronotum. Occiput and median area of pronotum dusky and sprinkled with small black points. Hind femur indefinitely trifasciate with black. Hind tibia blue, paler externally. Tegmina cycloid, but little surpassing first abdominal tergite, overlapping.

Body 16–18; tegmen 3.5–4.5; hind femur 9.5–12.

Geographic range.—California.

California records.—(Map 43) SAN DIEGO Co.: San Diego (ex: Scudder). Pt. Loma (ex: Scudder). Coronado (ex: Scudder). Descanso Distr., X–13–50, dry grass (H. H. Keifer, CDA). San Vicente Valley, VII–14–58 (CAS). Resort P.O., Laguna Mts., IX–13–22, 6100 ft. elevation (Rehn & Hebard, ANSP). 10 mi. N.W. Jacumba, IX–15–22, 3500 ft. elevation (ANSP). Jacumba, IX–15–22, 2900 ft. elevation (Rehn & Hebard, ANSP). Descanso, VIII–7–14 (J. C. Bradley, ANSP);

IX–13–22 (Rehn & Hebard, ANSP). Campo, IX–1–22, 2400 ft. elevation (Rehn & Hebard, ANSP); VIII–10–35 (C. D. Michener, ANSP). Potrero, IX–12–22 (Rehn & Hebard, ANSP).

Oedaleonotus tenuipennis (Scudder)

(Map 43)

Melanoplus tenuipennis Scudder, 1897, Proc. Amer. Phil. Soc., 36:12. Lectotype ♂, Los Angeles, Calif., designated by Rehn & Hebard, 1912 (ANSP).

Melanoplus missionum Scudder, 1897, op. cit., p. 246.

Oedaleonotus truncatus Rehn, 1907, Ent. News, 18:353.

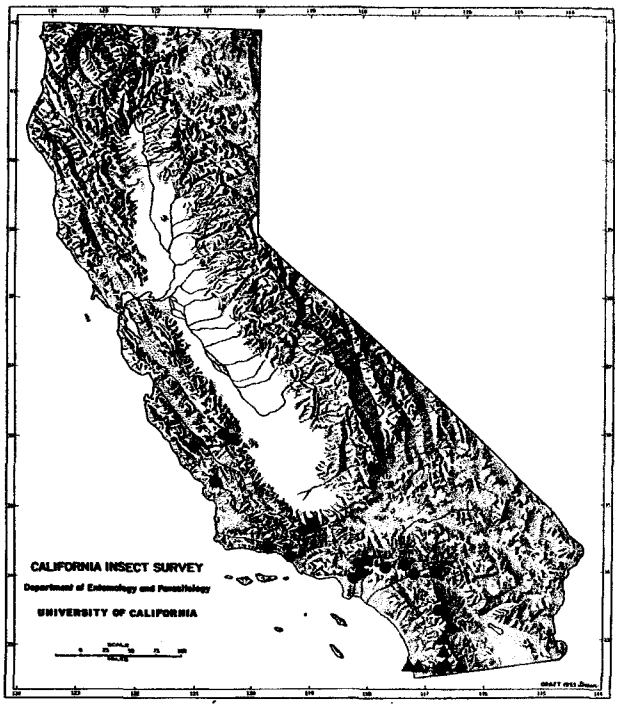
Oedaleonotus tenuipennis, Hebard, 1919, Trans. Amer. Ent. Soc., 45:266.

Brown, with broad postocular black bar. Lateral lobe of pronotum broadly black on prozonal part, the black area sometimes narrowly continued on metazonal portion, median area of pronotum dusky, the elevated lateral carinae pale. Thoracic pleura and sides of abdomen black. Hind femur with vaguely delimited dark areas, hind tibiae blue. Tegmina twice as long as wide, well separated in both sexes.

Body 20–24; tegmen 3–4; hind femur 11.5–13.5.

Geographic range.—California.

California records.—(Map 43) Reported by Scudder from Kern, Los Angeles and San Bernardino counties. FRESNO CO.: Diablo Range, Priest Valley, VIII–31–22, 2700 ft. elevation (Rehn & Hebard, ANSP). Diablo Range, Waltham Canyon, VIII–31–22, 1600 ft. elevation (Rehn & Hebard, ANSP). KERN CO.: summit of ridge south of Walker Basin, IX–2–22, 4000 feet elevation (Rehn & Hebard, ANSP). Tejon, IX–3–22, 3300 feet elevation (Rehn & Hebard, ANSP). LOS ANGELES CO.: Arroyo Seco, Pasadena, VII–20 to VII–1 (Rehn & Hebard, ANSP). Altadena, VIII–8 (Rehn & Hebard, ANSP). Mt. Lowe, 4000 to 5600 ft. elevation, VIII–8 (Rehn & Hebard, ANSP). San Gabriel Mts., X–8, 3000 ft. elevation (Rehn & Hebard, ANSP). Camp Baldy, VI–26–50 (A. T. McClay, UCD); VI–26–50 (J. L. Nickel, UCD). Crystal Lake, VI–29–50 (A. T. McClay, UCD). Tanbark Flat, VI–15–50 (J. L. Nickel, UCD). Parker Mt. S.E. end Ventura Mt., IX–27–10 (ANSP). MONTEREY CO.: Lockwood, VI–21–35 (R. H. Beamer, ANSP). RIVERSIDE CO.: 8.6 mi. S.W., Nat. Forest, VI–21–58 (D. M. Newell, CIS). SAN BERNARDINO CO.: S. Fork, Santa Ana River, 6200 ft. elevation (Rehn & Hebard, ANSP). Crestline, IX–27–32 (W. Brandler, CIS). Mt. San Gorgonio, IX–14–58 (D. M. Newell, CIS). Lake Arrowhead, VI–16–60 (P. E. Paige, UCD). SAN DIEGO CO.: Mt. Palomar, VI–28–63 (H. L. Griffin, CIS). SAN LUIS OBISPO CO.: Atascadero, VII–19–33 (R. H. Beamer, ANSP). SANTA BARBARA CO.: Santa Barbara, VIII–22–09, sea level (M. Hebard, ANSP). VENTURA CO.: Downer Ranch, Mt. Pinos, IX–3–22, 6400 ft. elevation (Rehn & Hebard, ANSP). Mt. Pinos, Bear Trap, IX–3–22, 6400 ft. elevation (Rehn & Hebard, ANSP). Mt. Pinos, IX–4–22, 8500 ft. elevation (Rehn & Hebard, ANSP). Ventura, VII–20–33 (R. H. Beamer, ANSP). Cuddy Canyon, IX–4–22, 4472 ft. elevation (Rehn & Hebard, ANSP).



Map 43. California distribution of: ▲, *Oedaleonotus pinctus* (Scudder); ●, *Oedaleonotus tenuipennis* (Scudder).

Genus *Oedomerus* Bruner, 1908

Oedomerus corallipes Bruner

(Map 44)

Oedomerus corallipes Bruner, 1908, Biol. Centr.-Amer., Orth., 2:293. Lectotype ♀, San José del Cabo, Lower California. Designated by Rehn & Hebard, 1912. (ANSP?).

Body tawny to fuscous, somewhat mottled. Vertex very narrow between the eyes, fastigium declivent and rather deeply sulcate. Tegmina short and narrow, widely separated. Pronotum with metazona very short, transverse sulci deep and continuous, carinae obsolete.

Bruner gives the following measurements for the female type: Body 20; tegmen 4; hind femur 11.

Geographic range.—California, Mexico.

California records.—(Map 44) RIVERSIDE CO.: Palm Springs, Andreas Canyon, X–22–52 (E. G. Linsley, CIS).

Genus *Phoetaliotes* Scudder, 1897

Phoetaliotes nebrascensis (Thomas)

(Map 44)

Pezotettix nebrascensis Thomas, 1872, Prel. Rept. U.S. Geol. Surv. Mont. & Terr., 5:455. Type ♀, Neb. (type missing).

Melanoplus phoetaliotiformis Scudder, 1899, Proc. Dav. Acad. Nat. Sci., 7:179.

Phoetaliotes nebrascensis, Hebard, 1925, Proc. Acad Nat. Sci. Phila., 77:123.

Gray-brown, head with postocular black band. Prozonal part of lateral lobe of pronotum with irregular black lines which in some specimens coalesce into a black band. Hind femur with two, sometimes three, dark spots on upper inner pagina, the upper outer pagina and outer face plain. Hind tibiae blue. Pronotum with median carina low but evident throughout, lateral carinae obtuse but evident, subparallel or slightly convergent near middle. Tegmina about as long as pronotum, tips narrowly rounded to acute. Occasional specimens have the tegmina and wings fully developed. Male with epiproct longer than its basal width and without notable topography, furcula hardly evident, cercus simple, tapering, styliform.

Body 20–26; tegmen 5–6.5; 17–20; hind femur 11–14.

Geographic range.—Canada to Mexico, west to California and British Columbia, east to Indiana, Illinois and Oklahoma.

California records.—(Map 44) SISKIYOU CO.: Gazelle, IX–5 (ex: Scudder).

Discussion—Found on grasslands and prairies. The brachypterous form is more common than the long-winged form.

Genus *Poecilotettix* Scudder, 1897

Poecilotettix sanguineus Scudder

(Map 44)

Poecilotettix sanguineus Scudder, 1897, Proc. U.S. Nat. Mus., 20:387. Lectotype ♂, Bradshaw Mt., Ariz., designated by Rehn & Hebard, 1912. (ANSP).

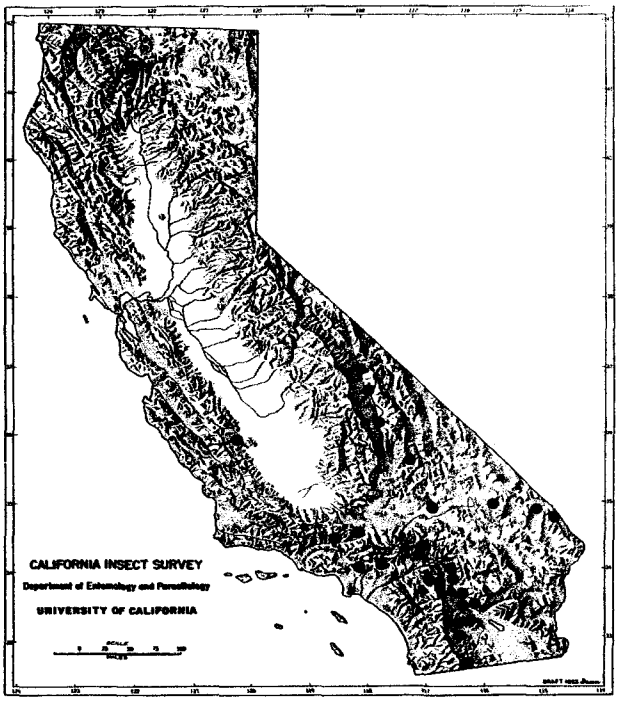
Poecilotettix coccinatus Scudder, 1897, Proc. U.S. Nat. Mus., 20:359.

Head and body light brown, meso- and metapleura purplish. Dorsum of head and pronotum with a bright red median stripe. Fronto-clypeal suture and hind margin of pronotum (usually) edged with red. Red spots may be on labrum, face, sides of head and pronotum, meso- and metapleura and femora. Tegmina rich, dark green. Hind tibiae blue.

Body 18–25; tegmen 17–25; hind femur 9–14.

Geographic range.—Lower and Upper Sonoran Life Zones of California, Nevada, Utah and Arizona.

California records.—(Map 44) FRESNO CO.: Jacalitos Canyon near Coalinga, VII–31–56 (R. O. Schuster, CIS). INYO CO.: Olancha, VI–26–49 (H. E. Cott). 3 mi. E. Big Pine, VIII–24–64 (D. C. Rentz & J. D. Birchim, DCR, JDB). Independence, VII–17– (Wickham, ANSP). LOS ANGELES CO.: Mint Canyon, VII–3–33 (R. H. Beamer, ANSP). Palmdale, VIII–1–35 (J. Russell, ANSP). Claremont, VII–29–36 (R. H. Beamer, ANSP). RIVERSIDE CO.: Banning, VI–20 to 28–52 (B. Tinglof & A. A. Grigarick, J. K. Hester, J. W. MacSwain, A. T. McClay, J. J. Menn & W. V. Garner, CIS, UCD). Banning, VII–9–50 (J. W. MacSwain & E. G. Linsley, CIS); VII–9–50 (H. L. Hansen, J. D. Paschke & H. M. Graham); VII–22–52 (S. Mujigama & H. L. Mathis, UCD). Palm Springs, VI–23–52 (H. Graham). Palms to Pine Hgwy., VI–29–58, 3000 ft. elevation (D. M. Newell, CIS). Indio, VI–22–51 (J. A. Powell, CIS); VIII–7–32 (R. H. Beamer, ANSP). Whitewater, VII–13–35 (ANSP). Near Beaumont, VII–28–63 (R. R. Snelling, DCR). San Gorgonio Pass, V–28–41 (E. C. Van Dyke, CAS). Cabazon, VI–1–41 (E. C. Van Dyke, CAS). Santa Rosa Mt., VI–25 and VII–4–46; VI–15–48 (D. J. & J. N. Knull, CIS). SAN BERNARDINO CO.: Hesperia, VIII–3–48 (G. P. Mackenzie). Victorville, VI–24–49 (H. E. Cott). Barstow, V–22–47 (G. P. Mackenzie). Morongo Valley, VIII–3–52 (N. K. Lewis, CIS). Goffs, VIII–5–19 (Rehn & Hebard, ANSP). Bagdad, VIII–6–19 (Rehn & Hebard, ANSP). Needles, VIII–3–19 (Rehn & Hebard, ANSP); VIII–5–26 (ANSP). Trona, IX–9–22, 1800 feet elevation (Rehn & Hebard, ANSP). San Bernardino Mts., VIII–3–30, 3800 ft. elevation (E. R. Tinkham, ANSP). SAN DIEGO CO.: Borrego, IV–27–54 (M. Wasbauer); IV–28–54 (P. D. Hurd, CIS). Jacumba, VIII–12–35 (E. I. Beamer, ANSP). Collins Valley, VIII–10–59 (G. A. Marsh, CIS). San Felipe Valley, VI–7–40 (C. D. Michener, CIS). VENTURA CO.: Cuddy Canyon, IX–4–22, 4472 ft. elevation (Rehn & Hebard, ANSP).



Map 44. California distribution of: ▲, *Oedomerus corallipes* Bruner; ■, *Phoetaliotes nebrascensis* (Thomas); ●, *Poecilotettix sanguineus* Scudder.

Genus *Schistocerca* Stal, 1873

Members of this large genus are mostly confined to the New World. The genotype, *S. tatarica* L., is

found in Africa and is one of several species found outside North and South America.

A number of very important economic species are in this genus. *S. gregaria*, the desert locust of Africa, and Southeast Asia and *S. paranensis*, the South America plague locust, are two of the world's most destructive grasshoppers.

KEY TO CALIFORNIA SPECIES OF SCHISTOCERCA

1 Color gray-brown; hind tibia blackish dorsally, paler below; sugenital plate of male deeply V-emarginate . . *vaga vaga* (Scudder) (p. 65)
Color green or greenish-brown; hind tibia red; subgenital plate of male U-emarginate . . . *shoshone* (Thomas) (p. 65)

Schistocerca shoshone (Thomas)

Acridium shoshone Thomas, 1873, Proc. Acad. Nat. Sci. Phila., 25:295. Type lost. Neotype locality, Logan, Cache Co., Utah, selected by Dirsh, 1965.

Schistocerca shoshone, Bruner, 1894, Rept. Nebr. Hort. Soc., p. 163.

Schistocerca venusta Scudder, 1899, Proc. Amer. Acad. Arts & Sci., 34:467.

S. venusta has long been considered the dorsally vittate phase of *S. shoshone* but the matter needs further study.

Body 30–50; tegmen 35–50; hind femur 19–27.

Geographic range.—Arizona, California, Colorado, Nevada, New Mexico, Oregon, Texas, Utah, Washington; south to Chiapas and Baja California.

California records.—Widely distributed in California. BUTTE CO.: Oroville, VII–29–57 (C. A. Toschi, CIS). COLUSA CO.: Colusa, VIII–1–57 (D. Burdick, CIS). CONTRA COSTA CO.: Antioch, IX–27–58 (J. R. Powers, CIS). INYO CO.: Darwin Falls, 4 mi. W. Panamint Springs, VII–14–62 (W. A. Foster). KERN CO.: Shafter, VII–25–55 (J. A. Powell, CIS). LAKE CO.: Lakeport, VII–30–59 (S. M. Fidel). LOS ANGELES CO.: San Gabriel Mts., 3000 ft. elevation (Grinnell, ANSP). RIVERSIDE CO.: Palm Springs, VII–12, VII–13 (A. P. Morse, ANSP). Indio, VII–9 (A. P. Morse, ANSP). Colorado Desert (Scudder, ANSP). SACRAMENTO CO.: Sacramento, IX–13–37 (A. T. McClay, UCD). SAN DIEGO CO.: San Diego and Cuyamaca (Rehn & Hebard, ANSP). SAN JOAQUIN CO.: Manteca, VIII–27–38 (K. S. Hagen, CIS). Stockton, IX–20–30 (A. T. McClay, UCD). Tracy, VIII–24–58 (J. R. Helfer, CIS). SISKIYOU CO.: Gazelle, IX–5 (A. P. Morse, ANSP). TRINITY CO.: Big Bar, VIII–13–63 (J. S. Buckett, UCD). TULARE CO.: Tulare, VIII–5 (A. P. Morse, ANSP). YOLO CO.: Davis, VI–27–37 (J. J. DuBois, UCD); X–5–60 (D. Q. Cavagnaro, UCD).

Discussion—Often found in rank vegetation along streams and ditches, as well as in fields, gardens, hillside brush and other habitats. Sometimes common and destructive.

Schistocerca vaga vaga (Scudder)

Acridium vagum Scudder, 1876, Proc. Bost. Soc. Nat. Hist., 18:269. Type ♀, Guadalupe Is., off Lower California.

Schistocerca vaga, Bruner, 1890, Proc. U.S. Nat. Mus., 12:187.

Schistocerca vaga vaga, Hebard, 1925, Trans. Amer. Ent. Soc., 25:285.

Brown, tegmina with small fuscous spots. Dorsum of head and pronotum often with a median longitudinal buffy stripe. Hind tibiae light brown below, blackish above.

Body 34–57; tegmen 35–58; hind femur 20–29.

Geographic range.—Arizona, California, New Mexico, Texas; south to Nicaragua.

California records.—Widely distributed in California. FRESNO CO.: Fresno, IV–27– (ex: Scudder); IV–5–57 (R. O. Schuster). INYO CO.: Surprise Canyon, Panamint Range, VI–4–56 (J. M. Burns, CIS). KERN CO.: Bakersfield, IV–13–49 (R.v.d. Bosch, CIS); 18 mi. E., IV–3–60 (J. W. MacSwain, CIS). Shafter, V–21–40 (C. G. Lewis). Inyokern, IV–11–62 (J. W. MacSwain, CIS). LOS ANGELES CO.: Pasadena, June (ex: Scudder); IV–23, VI–18 (Rehn & Hebard, ANSP). Los Angeles, March (ex: Scudder, ANSP). Santa Monica, VII–30 (ex: Scudder, ANSP). Altadena, VIII–8 (Rehn & Hebard, ANSP). San Marino, II–21–46 (G. P. Mackenzie). Tanbark Flat, VI–21–50 (H. F. Robinson). Southgate, IX–18–51 (J. W. Hinerman). Whittier, V–7–49; VIII–3 to 28–50 (H. M. Graham). MONTEREY CO.: Arroyo Seco, V–5–56 (D. Burdick, CIS). ORANGE CO.: Laguna Beach, VI–20–39 (B. Brookman, CIS). Fullerton, VIII–3–57 (C. A. Toschi, CIS). RIVERSIDE CO.: Palm Springs, VII–12 (ex: Scudder). Neighbor, VIII–24. Magnesia Canyon, VII–2–52 (R. L. Anderson). Cathedral City, VII–20–50 (L. W. Isaak). Hopkins Well, IV–16–58 (P. D. Hurd, CIS); X–11–58 (R. W. Thorp, CIS). Riverside, IV–7–55, on *Encelia* (E. Cardiff); IX–4 to X–22–55 (R. L. Bender); IV–2–55 (R. Humer); IV–19–59 (W. E. Foster). Indio, VIII–8 to 27–53 (J. T. Brooks). 6 mi. W. Indio, IV–30–49, in *Melilotus* (E. G. Linsley, R. F. Smith & J. W. MacSwain, CIS). Blythe, VIII–6–46, in alfalfa (W. F. Barr, CIS); VI–15–47, in alfalfa (J. W. MacSwain, CIS); VII–4–51 (R. F. Smith & J. W. MacSwain, CIS). SANTA BARBARA CO.: Santa Barbara, XII–18–15. Carpenteria, VII–1936, VIII–1937. Goleta, VI–25, VII–3–59 (C. A. Campbell). SAN BENITO CO.: 5 mi. E. Paicines, IV–8–61 (D. C. Rentz, DCR). SAN BERNARDINO CO.: Colton, VII–17– (ex: Scudder); III–22–55 (C. O. Hensel). San Bernardino, VII–15– (ex: Scudder). Mohave Desert (ex: Scudder). Mentone, VI–2–55 (H. S. McGill). Fontana, III–29 to V–20–59 (R. J. Jeffrey). 10 mi. N.E. Earp, IV–17–61 (R. L. Langston, CIS). SAN DIEGO CO.: San Diego (ex: Scudder); VII–1–46 (G. A. Marsh); II–12–47 (J. A. Powell, CIS). Borrego Valley, IV–19–57 (R. C. Bechtel). Borrego, V–3–56 (B. J. Adelson, CIS). Borrego, Palm Canyon, VI–8–40 (C. D. Michener, CIS); IV–27–54 (P. D. Hurd, CIS). Centenac Cyn. III–28–53 (J. A. Powell, CIS). King City, IV–1–57 (R. P. Allen). Warners Spring, IX–24–57 (H. Ruckes, Jr., CIS). Chula Vista, VII–25–22 (S. E. Flanders). Borrego Park, Coyote Creek, III–24–59 (C. A. Toschi, CIS). VENTURA CO.: Santa Paula, IV–2–05; IV–8–1897, VI–29–26, VI–1, VII–23–23 (D. Burk). YOLO CO.: Rumsey, IV–11–57 (C. G. Moore). Davis, IV–9–57 (R. E. Rice).

Discussion—A large powerful flier. Sometimes destructively common.

Subfamily ACRIDINAE
slant-faced grasshoppers

Many, but not all, of the members of this subfamily have an oblique face, which gives them their common name. The feebly developed or absent median carina of the pronotum and the lack of color in the hind wings help distinguish most of them from the Oedipodinae or band-winged grasshoppers.

Several genera, difficult of placement, because of their nearly colorless wings and weak pronotal carina, such as *Ligurotettix* and *Xeracris* are keyed in both the Acridinae and Oedipodinae. *Ligurotettix*, is considered to be more appropriately placed in the Acridinae, on the basis of general appearance and the stridulatory ridge on the costal area of the male tegmina.

Most members of this group are grass feeders and many are cryptically colored, and shaped to render them inconspicuous in their habitat. Many are important rangeland species, but mostly in areas outside of California. They are usually rather local in their distribution and are relatively poorly known.

KEY TO GENERA AND SOME SPECIES OF CALIFORNIA ACRIDINAE

1 Lateral foveolae perpendicular, invisible from above (figs. 12–17) 2
Lateral foveolae oblique (sometimes represented by a row of punctures), visible from above (figs. 18–22) 10

2 Antennae very wide at base and strongly flattened 3
Antennae slender, at most moderately flattened . 5

3 Form elongate-linear; face very oblique; tegmina not reaching apex of hind femur . . . . . *Paropomala calamus* Scudder (p. 79)
Form hardly linear; tegmina reaching apex of hind femur 4

4 Prosternum with acute tubercle; body 27–45 mm., tegmen with subcostal pale stripe . . . . . *Mermiria maculipennis* Bruner (p. 76)
Prosternal tubercle low, rounded; body 20–30 mm.; tegmen without pale subcostal stripe . . . . *Eremiacris pallida* Bruner (p. 72)

5 Color oily-green with nacreous marks on pleura; pronotum strongly sellate, without lateral carinae *Bootettix punctatus* (Scudder) (p. 68)
Color gray, brown or pale green, if green, pronotum has strong lateral carinae; pronotum at most weakly sellate 6

6 Fastigium convex, its marginal impression interrupted 7
Fastigium concave, or flat with marginal impression entire 8

7 Internal calcars of hind tibia equal (fig. 13) . . *Amphitornus coloradus ornatus* McNeill (p. 67)
Internal calcars of hind tibia unequal (fig. 12) . *Opeia obscura* (Thomas) (p. 78)

8 Stout; fastigium concave with median carina (fig. 17) . . . . . *Esselenia* (p. 73)
Slender; fastigium flat with marginal impression 9

9 Internal calcars of hind tibia equal (fig. 15) . . *Orphulella* (p. 78)
Internal calcars of hind tibia unequal (fig. 14) . *Cordillacris* (p. 70)

10 Lateral carinae of pronotum continuous, parallel or nearly so; lateral foveolae very narrow, linear (fig. 18) . . . . . *Napaia* (p. 77)
Lateral carinae, if present, convergent near mid-length 11

11 Antennae much flattened basally (fig 19) . . . *Horesidotes cinereus Scudder* (p. 75)
Antennae terete or nearly so 12

12 Costal area of male tegmen broadly fenestrate, the cross-veins perpendicular to costal margin . . 13
Costal area of male tegmen at most narrowly fenestrate, the cross-veins then strongly oblique . 15

13 Internal calcars of hind tibia subequal; body compressed (fig. 20) . . . . . *Chorthippus curtipennis* (Harris) (p. 70)
Internal calcars very unequal; body subcylindric . 14

14 Tegmina short; lateral carinae of pronotum prominent on prozona (northern, montane) (fig. 21) *Bruneria shastana* (Scudder) (p. 69)
Tegmina long; prozona without carinae (desert) . *Ligurotettix* (p. 75)

15 Internal calcars of hind tibia very unequal, the ventral longer and abruptly curved 16
Internal calcars of hind tibia subequal, evenly curved 18

16 Frontal costa sulcate throughout (fig. 22) . . . *Eupnigodes* (p. 74)
Frontal costa flat above median ocellus . . . 17

17 Transverse sulcus of pronotum before middle . . . *Psoloessa* (p. 80)
Transverse sulcus behind mid-pronotum . . . . *Ageneotettix deorum* (Scudder) (p. 66)

18 Frontal costa flat, obtuse at summit (fig. 24) . *Xeracris minima* (Scudder) (p. 132)
Frontal costa sulcate, acute at summit 19

19 Dorsum of pronotum straight in profile, carinae sharp, the lateral ones strongly convergent . . . . *Psoloessa* (p. 80)
Pronotum weakly sellate, carinae feeble . . . *Aulocara elliotti* (Thomas) (p. 68)

Genus *Ageneotettix* McNeill, 1897

Ageneotettix deorum (Scudder)
(Fig. IV, Map 45)

Chrysochraon deorum Scudder, 1876, Bull. U.S. Geol. Survey Territ., 2:262. Type ♂, Garden of the Gods, Colo.

Eremnus deorum, McNeill, 1897, Proc. Dav. Acad. Sci., 6:268.

Ageneotettix deorum, McNeill, 1897, Psyche, 8:71.

Ageneotettix australis Bruner, 1905, Biol. Centr.-Amer., Orth., 2:110.

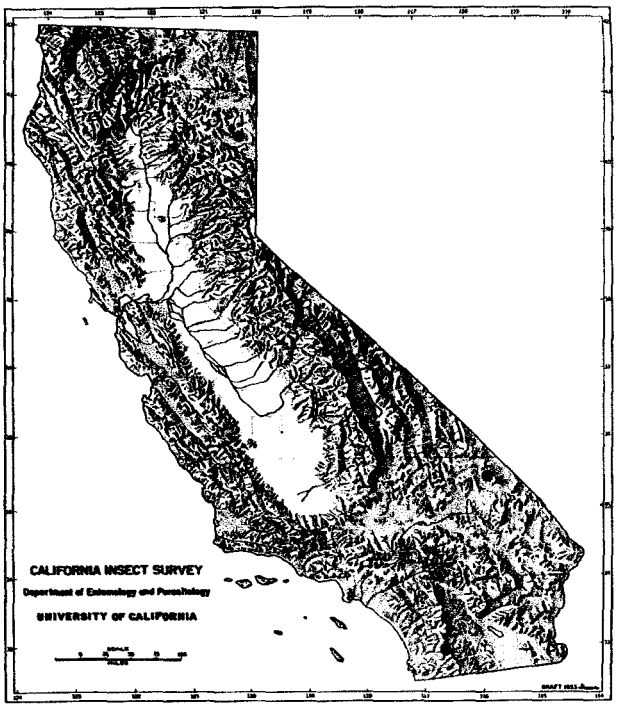
Ageneotettix occidentalis Bruner, op. cit., p. 109.

Gray-brown, lateral carinae of pronotum raised on metazona, indicated by color on prozona. Upper paginae of hind femur with two or three large dark blotches. Hind tibiae red. A form with abbreviate tegmina, found at high altitudes, has been cited under the name *A. deorum curtipennis* Bruner.

Geographic range.—Great plains and North Central States to eastern California; Canada to Texas.

California records.—(Map 45) ALPINE CO.: Woodfords, X–9–65, 5630 ft. elevation (D. C. Rentz & J. D. Birchim, DCR). INYO CO.: 2 mi. E. Big Pine, VII–28–62 (D. C. Rentz & C. D. MacNeill, DCR). LASSEN CO.: Standish, VIII–27–60 (Gantenbein, CIS). SAN BERNARDINO CO.: Cima, VIII–12– (Rehn & Hebard, ANSP). SAN DIEGO CO.: Cuyamaca, X–1–1900 (ex: Scudder).

Discussion—This is one of the important range land grasshoppers in the west, in areas where it is abundant. It feeds on grasses and low forbs. It is difficult to collect because of its rapid movement and cryptic coloration which makes it difficult to see on the ground.



Map 45. California distribution of *Ageneotettix deorum* (Scudder).

Genus *Amphitornus* McNeill, 1897

Amphitornus coloradus ornatus McNeill

(Fig. 13, Map 46)

Apmhitornus ornatus McNeill, 1897, Proc. Davenport Acad. Sci., 6:225. Type ♀, Los Angeles, Calif.

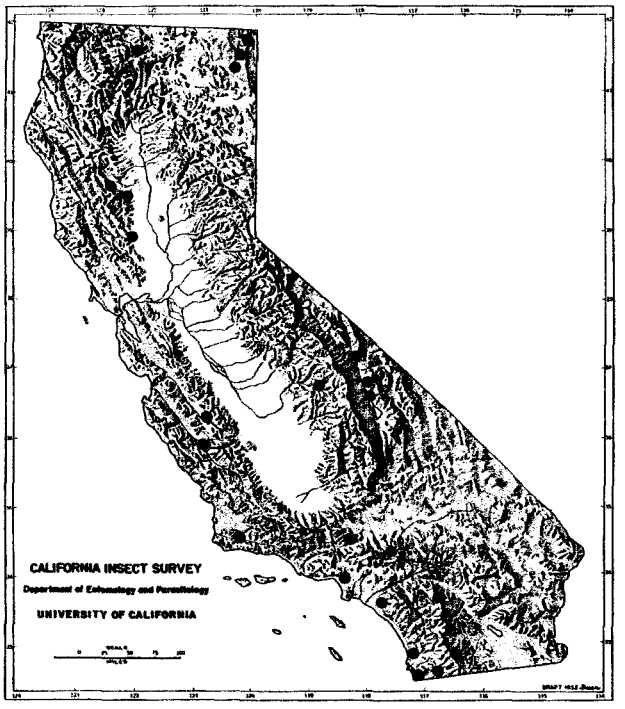
Amphitornus coloradus ornatus, Hebard, 1937, Trans. Amer. Ent. Soc., 63:357.

Pale brown with sharply defined dark stripes on head, pronotum and tegmina. Hind tibiae blue. Pronotum with a supplementary carina on each side of median carina.

Body 18–23; tegmen 14–15; hind femur 11–12.

Geographic range.—Widely distributed throughout western North America, in the Lower Sonoran, Upper Sonoran and Transition Life Zones.

California records.—(Map 46) COLUSA CO.: Wilbur Springs, VII–14–60 (D. C. Rentz, DCR). Stonyford, VI–27–61 (J. R. Helfer, CAS). FRESNO CO.: King's River Canyon, VIII–4–40 (E. R. Helwig, ANSP). GLENN CO.: Elk Creek, VI–27–61 (D. C. Rentz, CAS). 6 mi. W. Plaskett Meadows Station, VIII–27–61 (D. C. Rentz, CAS). INYO CO.: 9 mi. N. Lone Pine, VII–9–61 (D. C. Rentz, DCR). 4 mi. W. Lone Pine, VII–22–65 (J. D. Birchim, JDB). Bishop, VII–11–64 (J. D. Birchim, JDB). 2 mi. E. Big Pine, VII–28–62 (D. C. Rentz & C. D. MacNeill, CAS). Pine Creek, Round Valley, N. W. Bishop, VIII–10–61 (D. C. Rentz, CAS). 2 mi. N. Bishop, VII–17–53 (J. D. Lattin, CIS). 5 mi. N. Big Pine, VI–29–64 (J. D. Birchim, JDB). Independence, VII–24–64 (J. D. Birchim, JDB). LOS ANGELES CO.: Tanbark Flat, VII–15–50 (W. O. Marshall, CIS). Los Angeles (ex: McNeill). Pasadena, VIII–1–22. Mt. Lowe, 4000–4800 ft. elevation, VIII–8–22 (Rehn & Hebard, ANSP). Lancaster, VIII–1– , Los Angeles, VII–25– (ex: Scudder). MODOC CO.: Alturas, IX–5–62 (J. S. Buckett, CIS). Lake City, Warner Mts., VII–27–22 (C. C. Fox, CAS). Davis Creek, Warner Mts., VII–14–22 (C. C. Fox, CAS). 10 mi. W. Alturas, VII–24–62 (C. D. MacNeill & D. C. Rentz, CAS). Adin Summit, VII–24–62, 5000 ft. elevation (C. D. MacNeill & D. C. Rentz, CAS). 10 mi. N.N.W. Ft. Bidwell, Warner Mts., VII–25–62 (C. D. MacNeill & D. C. Rentz, CAS). MONTEREY CO.: 15 mi. N.E. San Lucas, VI–28–60 (C. D. MacNeill, DCR). ORANGE CO.: El Toro, VIII–20–20 (Rehn & Hebard, ANSP). RIVERSIDE CO.: Mt. San Jacinto, VIII–10–58 (D. M. Newell, CIS). SAN BENITO CO.: Jct. Clear Creek and Coalinga Rds., V–28–60, teneral (D. C. Rentz, DCR). 10 mi. E. Bitterwater Jct., VIII–14–58 (D. C. Rentz, DCR). Idria, VIII–26–61 (D. C. Rentz & E. W. Kirschbaum, CAS). SAN BERNARDINO CO.: Cajon Pass, VII–19–(ex: Scudder). Near Wrightwood, VII–1–56, 6500 ft. elevation (G. I. Stage, CIS). SAN DIEGO CO.: Point Loma, VII–23–(ex: Scudder). La Jolla, VI–27–64 (J. D. Birchim, JDB). Nellie, VIII–11–17 (E. P. Hewlett, ANSP). Resort Post Office, Laguna Mts., IX–14–22, 5100 ft. elevation (Rehn & Hebard, ANSP). Laguna Mts., VII–6–29 (R. H. Beamer, ANSP). Dulzura, VII–9–35 (J. Beamer, ANSP). La Jolla, VI–15–16 (G. P. Engelhardt, ANSP); VIII–3–34 (Timberlake, ANSP). Torrey Pines, VII–23–16 (G. P. Engelhardt, ANSP). San Diego, VI–24–21 (ANSP). Otay, VII–9–35 (J. Beamer, ANSP). Tiajuana, IX–11–22 (Rehn & Hebard, ANSP). SANTA BARBARA CO.: Santa Ynez, VI–24–59 (P. E. Paige, CIS). SISKIYOU CO.: Gazelle, IX–5– (ex: Scudder).



Map 46. California distribution of *Amphitornus coloradus ornatus* McNeill.

Discussion—Found in meadows and adjacent to water courses, as well as at moderate to high altitudes in grasslands. At times may be locally abundant. Frequently associated with *Trimerotropis* spp.

Genus *Aulocara* Scudder, 1876

Aulocara elliotti (Thomas)
(Map 47)

Stauronotus elliotti Thomas, 1870, Proc. Acad. Nat. Sci. Phila., p. 82. Lectotype ♀, eastern Colo., designated by Hebard, 1927 (USNM).

Aulocara coeruleipes Scudder, 1876, Bull. Geol. Surv. Terr., 2:266.

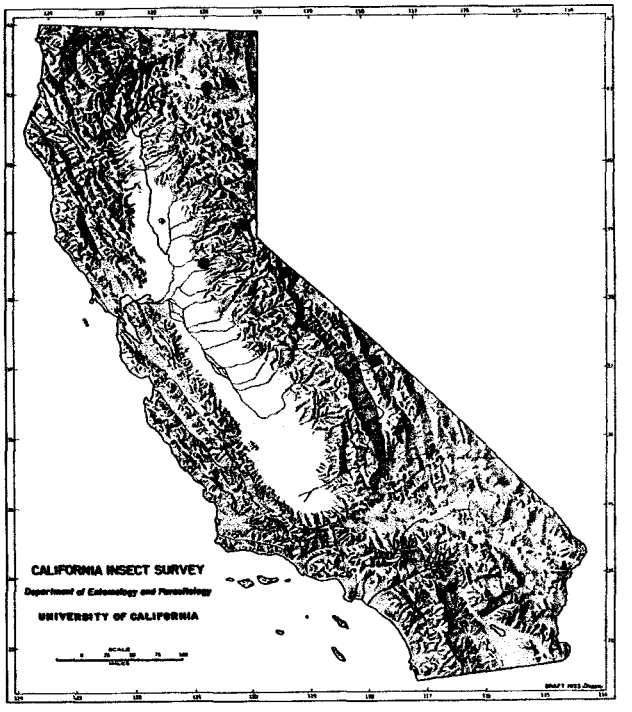
Aulocara elliott, Bruner, 1885, Can. Ent., 17:10.

Head large, antennae very long especially in male. Gray or gray-brown, lateral lobe of pronotum more or less infuscate. Lateral carinae of pronotum very obtuse on prozona but usually sharply indicated by color. Outer face and upper paginae of hind femur with three dark blotches, these sometimes absent. Hind tibiae blue. Tegmina variable in length, usually reaching to apex of abdomen.

Body 17–24; tegmen 10–16; hind femur 11–15.

Geographic range.—British Columbia to Manitoba, and south to Texas and California.

California records.—(Map 47) INYO Co.: Deep Spring, VII–16–53 (E. I. Schlinger, UCD). Independence, VII–4–64 (J. D. Birchim, JDB). LASSEN Co.: Hallelujah Jct., VII–12–54 (R. M. Bohart, UCD); VII–12–62 (J. F. Lawrence, UCD). Honey Lake, VI–11–62 (J. S. Buckett, UCD). Herlong, VII–11–50 (R. W. Harper, CDA). MODOC Co.: Sugar Hill, VII–1–50 (H. E. Cott, CIS). Likely Distr., VI–14–51 (H. H. Keifer, CDA). Adin Summit, VII–24–62, 5000 ft. elevation (D. C. Rentz & C. D. MacNeill, DCR). MONO Co.: Topaz Lake, VII–11–51 (T. R. Haig, CIS). NEVADA Co.: Sagehen, VIII–23–56 (E. G. Linsley, CIS). PLACER Co.: W. Roseville, VI–24–49 (CDA). RIVERSIDE Co.: Anza, VII–5–56 (H. W. Michalk, CIS).



Map 47. California distribution of *Aulocara elliotti* (Thomas).

Reported by Pfadt (1949) from Kern, Los Angeles, San Diego, San Luis Obispo, and Ventura counties.

Discussion—In the short grass prairie states west of the Mississippi from Arizona to Canada, this species is frequently destructively common. It feeds on grasses such as western wheat grama, Sandberg bluegrass, and dandelion. In outbreak years it can completely denude large grazing areas.

It is of no economic concern in California.

Genus *Bootettix* Bruner, 1890

Bootettix punctatus (Scudder)
creosote bush grasshopper
(Fig. 74, Map 48)

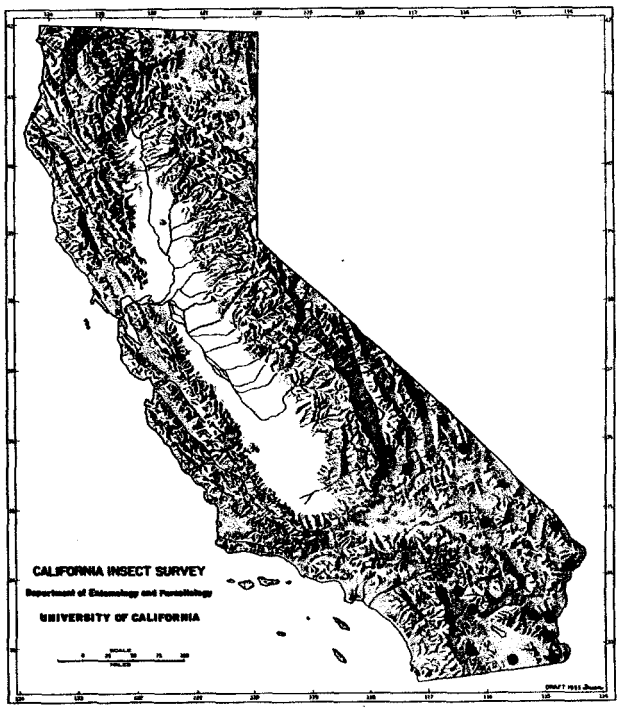
Gymnes punctatus Scudder, 1890, Psyche, 5:440. Type ♀, Tighes.

Bootettix punctatus, Caudell, 1908, Proc. U.S. Nat. Mus., 34:73.

Fastigio-facial angle sharp in profile. Male tegmen with costal area broadly fenestrate. An easily recognized insect, apparently confined to *Larrea*. It may prove to be a race of *B. argentatus* Bruner.

Geographic range.—Most of Sonoran Desert in Arizona and California.

California records.—(Map 48) KERN CO.: Brown, VIII–2–37, 2900 ft. elevation (Rehn, Pate & Rehn, ANSP). Warren, IX–17–10 (ANSP). IMPERIAL CO.: Palo Verde, VIII–21, 22–46 (P. D. Hurd, CIS). 20 mi. W. Winterhaven, IV–14–61 (C. W. O'Brien, DCR). Near Blythe, VII–8–58 (C. Cushner, DCR). Holtville, VI–23–46 (E. C. Van Dyke, CAS). Palm Desert, VII–2–58 (C. Cushner, DCR). Coachella, V–16–17, immature (E. C. Van Dyke, CAS). Coyote Wells, VIII–11–14 (J. C. Bradley, ANSP). 5 mi. W. Coyote Wells, IX–16–22, 500 ft. elevation (Rehn & Hebard, ANSP). Sand Hills, 20 mi. W. Yuma, Arizona, IX–11–24, 250 ft. elevation (Rehn & Hebard, ANSP). INYO CO.: Little Lake, VIII–5–61 (D. C. Rentz, DCR). Hole-in-the-Rock Springs, Boundary Canyon, Amargosa Range, 2500–2900 ft. elevation, VIII–15–19 (Rehn & Hebard, ANSP). Daylight Springs, Grape Vine Mt., VIII–13–19, 4350 ft. elevation (Rehn & Hebard, ANSP). Funeral Range, near Daylight Springs, Summit, VIII–17–19, 5000 ft. elevation (M. Hebard, ANSP). Shoshone, VIII–8–19 (M. Hebard, ANSP). Death Valley near Hell's Gate, VIII–19–56, 2000 ft. elevation (J. Rehn, ANSP). Death Valley, gradual slope opposite Boundary Canyon, VIII–16–19, 1000 ft. elevation (J. Rehn, ANSP). Emigrant Wash, Panamint Range, Death Valley, VIII–14–19, 2000 ft. elevation (Rehn & Hebard, ANSP). Panamint Valley, at mouth of Wild Rose Canyon, IX–6–22, 3000 ft. elevation (M. Hebard, ANSP). Tallara, Panamint Valley, IX–8–22, 1067 ft. elevation (Rehn & Hebard, ANSP). Juncture of Slate and Argus Ranges, IX–8–22, 2750 ft. elevation (ANSP). Indian Joe Springs, Argus Range, IX–9–22, 2600 ft. elevation (Rehn & Hebard, ANSP). RIVERSIDE CO.: Indio, VII–9– (ex: Scudder). Palm Springs, VII–12– (ex: Scudder). Blythe, VII–26–50 (D. J. & J. N. Knull). Hemet, VI–28–46 (W. F. Barr, CIS). Indio, VII–11–56 (M. Wasbauer, CIS). Hopkins Well, X–11–58 (R. W. Thorp & W. E. Ferguson, CIS). Palm Springs, VI–20–46 (D. J. & J. N. Knull); VI–28–52 (A. A. Grigarick & J. K. Hester). 5 mi. E. Indio, VIII–21–37 (Rehn, Pate & Rehn, ANSP). Indio, VIII–7–32 (R. H. Beamer, ANSP); IX–17–22, 50 ft. elevation (Rehn & Hebard, ANSP). Oasis, IX–17–22, 186 ft. below sea level (Rehn & Hebard, ANSP). Palm Springs to Palm Canyon, IX–29–10, 450–800 ft. elevation (ANSP). Tahquitz Canyon, San Jacinto Mts., IX–30–10, 500–1290 ft. elevation (ANSP). Yucca Grove, VIII–8–36 (M. B. Jackson, ANSP). SAN BERNARDINO CO.: Needles, VIII–25–46 (P. D. Hurd, CIS). 7 mi. D. Kramer Jct., VIII–2–37 (Rehn, Pate & Rehn, ANSP). Dumont, VIII–8–19 (M. Hebard, ANSP). Needles VIII–3, 4–19 (ANSP). Lyons, IX–1–09, 2800–3000 ft. elevation, on greasewood (ANSP). Foothills Bird Spring Mt., McCullough Range, VIII–11–07 (ANSP). Kelso, VIII–12–07, 2118 ft. elevation, on greasewood (ANSP). Goffs, VIII–5–19 (Rehn & Hebard, ANSP). Bagdad, VIII–6–19 (Rehn & Hebard, ANSP). Trona, IX–5–22, 1650–1800 ft. elevation (Rehn & Hebard, ANSP). Searles, IX–4–19 (M. Hebard, ANSP). Newberry, IX–9–24, 1831 ft. elevation (Rehn & Hebard, ANSP). Barstow, VIII–7–19 (Rehn & Hebard, ANSP). Mojave Desert, Cottonwood Station, IX–9–07, 2274 ft. elevation, on greasewood (ANSP). Victorville, IX–1–19 (Rehn & Hebard, ANSP). Cushenberry Ranch, VIII–31–19 (Rehn & Hebard, ANSP). SAN DIEGO CO.: Anza Desert, VII–21–48 (D. J. & J. N. Knull, CIS).



Map 48. California distribution of *Bootettix punctatus* (Scudder).

Discussion—This colorful insect can be found on the leaves of creosote bush *(Larrea tridentata)* almost everywhere the bush occurs. It buzzes during the day and most of the night. Its strong affinity for its host plant can be tested readily. When taken from the plant and released it flies back immediately.

Genus *Bruneria* McNeill, 1897

Bruneria shastana (Scudder)

(Fig. 21, Map 49)

Gomphocerus shastanus Scudder, 1880, Rept. U.S. Ent. Comm., App. 22:25. Type locality, Mt. Shasta, Calif.

Bruneria shastana, McNeill, 1897, Proc. Dav. Acad. Sci., 6:265.

Stout, wood-brown, pronotum and dorsum of head fuscous. Lateral carinae of pronotum moderately convergent, marked by a pale stripe. Upper inner pagina of hind femur with three large dark blotches. Hind tibiae red.

Body 15–20; tegmen 7.3–5.5; hind femur 9.5–10.

Geographic range.—High mountains of California.

California records.—(Map 49) ALPINE Co.: Ebbett's Pass, VI–30–60, 8730 ft. elevation (Powers, CIS). LASSEN Co.: Lassen Peak, VIII–22–49, 8000 ft. elevation (H. H. Keifer, CDA). Westwood, VIII–21–22, 5000 ft. elevation (Rehn & Hebard, ANSP). MODOC Co.: Hackamore, VII–12–47 (T. O. Thatcher, CIS). Swoba, VI–19–51 (R. W. Harper, CIS). Applegate, Lassen Trail, Fandango Pass, VI–20–60 (D. C. Rentz, DCR). Cedar Pass, Warner Mts., VI–25–62, 5000 ft. elevation (D. C. Rentz, DCR). Warner Mts., Cedar Pk. summit, VIII–25–22, 8400 ft. elevation (Rehn & Hebard, ANSP). Lassen Creek, Goose Lake, VIII–24–22, 5000 ft. elevation (Rehn & Hebard, ANSP). MONO Co.: Sheep Mt., White Mts., VII–12–61, 11,000 ft. (W. A. Foster, UCD). Leavitt Meadow (S. M. Kappos, UCD). Tioga Crest, VII–22–56, 11,000 ft. (J. A. Powell, CIS). Mt. Barcroft, VII–16–61, 12,500 ft. elevation (J. S. Buckett, CIS); VII–21–61 (D. C. Rentz, DCR). Ellery Lake, Upper Leevining, VIII–4–37, 1125 ft. elevation (Rehn, Pate & Rehn, ANSP). Near Owens River, VIII–8–37, 7400 ft. elevation, Rehn, Pate & Rehn, ANSP). PLUMAS Co.: Harkness Peak, VIII–20–22, 9200 ft. elevation (ANSP). SISKIYOU Co.: 3 mi. E. Bartle, VII–22–62 (D. C. Rentz & C. D. MacNeill, CAS). Mt. Shasta timberline, VII–14–09, 8000 feet elevation (Topotypes, ANSP). Weed, VI–29–55 (J. Beamer, ANSP). TUOLUMNE Co.: Blue Canyon, Sonora Pass, VIII–30–60 (P. D. Hurd, M. E. Irwin, CIS). Sonora Peak, VIII–6–59 (D. C. Rentz, DCR). Near Sonora Pass, VII–29–62 (D. C. Rentz, DCR). Sonora Pass, VII–17–65 (J. D. Birchim, JDB). Upper Dead Man Creek, western side of Sonora Pass, VIII–22–51, 9400 ft. elevation (Rehn and Rehn, ANSP).

Genus *Chorthippus* Fieber, 1852

Chorthippus curtipennis (Harris)

(Fig. 20; Map 50)

Locusta (Chloealtis) curtipennis Harris, 1841, Rept. Ins. Mass., p. 149. Neotype ♂. Waltham, Mass., designated by Vickery, 1964 (UM).

Stenobothrus longipennis Scudder, 1862, Jour. Boston Soc. Nat. Hist., 7:457.

Stenobothrus coloradensis McNeill, 1897, Proc. Dav. Acad. Nat. Sci., 6:262.

Stenobothrus oregonensis Scudder, 1899, Proc. Amer. Acad. Arts & Sci., 35:50.

Stenobothrus acutus Morse, 1903, Psyche, 10:115.

Chorthippus longicornis (*nec.* Latreille), Hebard, 1935, Trans. Amer. Ent. Soc., 61:283.

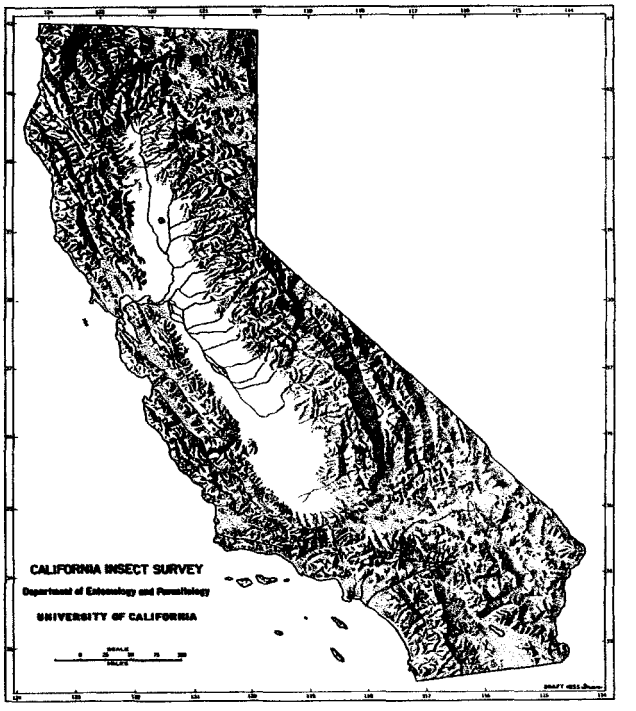
Chorthippus curtipennis, Vickery, Canad. Ent., 96:1545.

Pale brown but often with sides of head and body and upper paginae of hind femur green. Lateral carinae of pronotum strongly convergent on prozona, bordered with black. Hind tibiae pale brown. Hind femur immaculate.

Body 15–20; tegmen 11–9; hind femur 11–12.

Geographic range.—Throughout North America with the exception of dry desert areas. It occurs from the edge of the tree-line in the north southward to 40°N.

California records.—(Map 50) FRESNO Co.: Shaver Lake, VII–14–46 (C.D.A.). McArthur, VI–30–36 (J. J. DuBois, CDA). HUMBOLDT Co.: Trinidad, IX–3–59 (Forbes & Haig, CDA). 9 mi. N. Trinidad, IX–23–59 (Forbes & Haig, CDA). INYO Co.: Pine Creek, Round Valley, N. W. Bishop, VIII–7–61. 10 mi. S.W. Tom's Place, VIII–8–61 (D. C. Rentz, CAS). MARIN Co.: Novato, VII–10–65 (D. C. Rentz, DCR). MENDOCINO Co.: Mendocino, VIII–8–58 (J. R. Helfer, CAS). MODOC Co.: Canby, (E. I. Schlinger & J. Hall, UCD). MONO Co.: Leavitt Meadow, VIII–10–62, 7200 ft. elevation (H. B. Leech, CAS). PLUMAS Co.: 4 mi. W. Quincy, (R. C. Bechtel & E. I. Schlinger, UCD). SAN MATEO Co.: San Bruno Mts., VI–29–61 (D. C. Rentz, DCR). SIERRA Co.: Webber Lake, VIII–20–62 (W. G. Ellis, CDA). SONOMA Co.: 2 mi. S. Steward's Point, IX–9–61 (D. C. Rentz, DCR). 4.5 mi. N.W. Sebastopol, VIII–3–62 (C. W. O'Brien, CAS). TRINITY Co.: Cold Springs, S. Fork Mt., IX–16–62 (F. L. Blanc & G. M. Buxton, CDA). TUOLUMNE Co.: Leland Meadows, VIII–5–60 (R. R. Montanucci, CIS).



Map 49. California distribution of *Bruneria shastana* (Scudder).

Genus *Cibolacris* Hebard, 1937

Cibolacris parviceps (F. Walker)

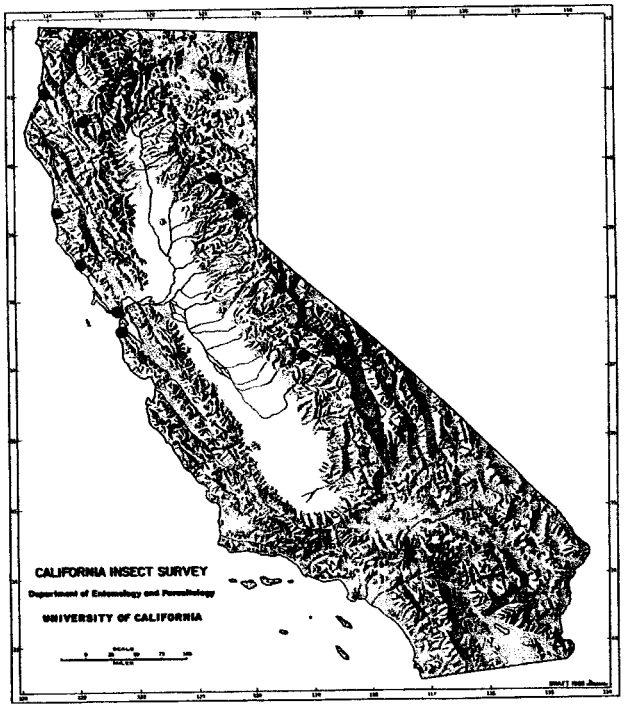
(see page 95)

Genus *Cordillacris* Rehn, 1901

KEY TO CALIFORNIA SPECIES OF CORDILLACRIS

1 Tegmina not reaching tip of abdomen . . . *grinnelli* Rehn & Hebard (p. 71)

Tegmina reaching to or beyond tip of abdomen . 2



Map 50. California distribution of *Chorthippus curtipennis* (Harris).

2 Lateral foveolae of vertex open below; tegmina with a row on confluent dark spots; body 11–17 mm . . . . . *crenulata pima* Rehn (p. 71)
Lateral foveolae bordered below; tegmina with many small spots; body 16–22 mm. (fig. 14) . *occipitalis cinerea* (Bruner) (p. 71)

Cordillacris crenulata pima Rehn

(Map 51)

Cordillacris pima Rehn, 1907, Proc. Acad. Nat. Sci. Phila., 59: 69. Type ♀, Baboquivari Mts., Beaver and Piute Cos., Utah, 8000–10,000 ft. elevation, designated by Rehn & Hebard, 1912 (Univ. of Kansas).

Cordillacris abache Rehn & Hebard, 1909, Proc. Acad. Nat. Sci., Phila., 61:139.

Cordillacris crenulata pima, Hebard, 1935, Trans. Amer. Ent. Soc., 61:281.

This insect is very similar in form and general color to *C. occipitalis* but is much smaller and the tegmen has a serrate row of large black blotches.

Boody 12–18; tegmen 10.2–13; hind femur 8.3–10.

Geographic range.—California.

California records.—(Map 51) SAN BERNARDINO CO.: 6 air mi. S. Ivanpah, New York Mts., VII–12–64 (C. D. MacNeill, & J. D. Birchim, CAS).

The type material of *apache* was collected at Cima, San Bernardino County in tumbleweed on August 12.

Cordillacris grinnelli Rehn & Hebard

Cordillacris grinnelli Rehn & Hebard, 1910, Proc. Acad. Nat. Sci. Phila., 61:425. Type ♀, S. Fork, Santa Ana River, San Bernardino Mts., Calif. 6200 ft. elevation (ANSP).

The only material assignable to this form seen in this study is at Philadelphia. From the description it seems to differ from *C. occipitalis* mainly in the shortness of the tegmina.

Geographic range.—San Bernardino County, California.

California records.—(Map 51) SAN BERNARDINO CO.: South Fork, San Bernardino Mts., VII–6–06 (J. Grinnell, ANSP). San Bernardino Mts., Big Bear Lake Cavern, VIII–30–19 (Rehn & Hebard, ANSP).

Cordillacris occipitalis cinereus (Bruner)

(Fig. 14, Map 51)

Ochrilidia (?) *cinera* Bruner, 1899, Proc. U.S. Nat. Mus., 12:52.

Cordillacris affinis, Morse, 1903, Psyche, 10:115. Lectotype ♂, Ormsby Co., Nev., W. of Carson City, 1700–2000 meters, designated by Morse and Hebard, 1915.

Cordillacris occipitalis cinerea, La Rivers, 1948, Amer. Midl. Nat., 39(3):665.

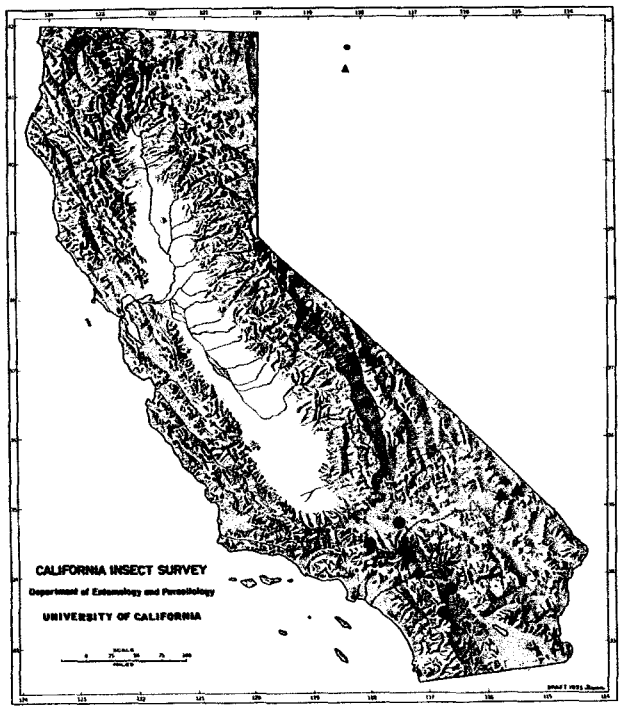
Gray or gray-brown, side of head and lateral lobe of pronotum with a broad, dark stripe. Tegmina pale with a number of small dark flecks. Hind tibiae pink.

Body 18–22; tegmen 14–18; hind femur 10–12.

Geographic range.—Utah, Arizona, Nevada, Oregon, California.

California records.—(Map 51) ALPINE CO.: Fredericksburg, VI–19–58 (G. I. Stage, CIS). INYO CO.: Wyman Canyon, White Mts., VI–27–61, 10,000 ft. elevation (W. A. Foster, CIS). 7 mi. N. Parcher's Camp, VI–30–61 (W. A. Foster, CIS). Sage Flat Camp, 10 mi. W. Big Pine, VII–20–64 (D. C. Rentz, DCR). 11 mi. W. Lone Pine, VII–22–64 (D. C. Rentz, DCR). 2 mi. W. Bishop, VIII–1–59 (D. C. Rentz, DCR). Pine Creek, Round Valley, N.W. Bishop, VIII–10–61 (D. C. Rentz, CAS). 10 mi. S.W. Tom's Place, VIII–8–61 (D. C. Rentz, CAS). Westgard Pass, VIII–10–61; VII–26–62 (D. C. Rentz, CAS). 9 mi. W. Big Pine, VII–21–64 (J. D. Birchim, JDB). LOS ANGELES CO.: Little Rock, VI–22–47 (G. P. Mackenzie, CIS). 1 mi. W. Little Rock, V–13–57 (E. G. Linsley, CIS). 2.5 mi. N.W. Desert Springs, V–25–55 (Timberlake, ANSP). Neenach, V–17–28 (J. O. Martin, CAS). MONO CO.: Convict Lake, VIII–9–46 (G. P. Mackenzie, CIS). Mammoth Lakes, VIII–28–46 (G. P. Mackenzie, CIS). Topaz Lake, VI–26–27 (J. W. MacSwain, CIS). Flat on Dead Man's Creek, tributary of Upper Owens River, VIII–3–37 (Rehn, Pate & Rehn, ANSP). Near Mono Lake, 10 mi. N. Leevining, VIII–26–62 (D. C. Rentz, C. D. MacNeill & M. R. Lundgren, CAS); VIII–9–61 (D. C. Rentz, DCR). 10 mi. W. Bald Mtn. Lookout, VII–2–61 (C. W. O'Brien, CAS). RIVERSIDE CO.: Anza, VII–5–56 (H. W. Michalk, CIS). Near Palm Springs, Andreas Canyon, X–22–52 (Timberlake, ANSP). SAN BERNARDINO CO.: Kramer Hills, IV–25–57 (G. I. Stage, CIS). Hesperia, V–20–48 (G. P. Mackenzie, CIS). Lucerne Valley, VI–5–48 (D. J. & J. N. Knull). Phelan, VI–27–52 (Timberlake, ANSP). TULARE CO.: 9

Mile Canyon, VII–22–61, 7500 ft. elevation (C. W. O'Brien, DCR). Troy Meadow, VII–22–61 (C. W. O'Brien, DCR). 5 mi. E. Smith Meadow, 9 Mile Canyon, VII–22–61, 7850 ft. elevation (C. W. O'Brien, CAS).



Map 51. California distribution of: ●, *Cordillacris crenulata pima* Rehn; ■, *Cordillacris grinnelli* Rehn & Hebard; ●, *Cordillacris occipitalis cinereus* (Bruner)

Discussion—This name may be applied to the above California specimens, but the differentiation from the nominate subspecies is slight.

Genus *Eremiacris* Hebard, 1929

Eremiacris pallida (Bruner)

Paropamala pallida Bruner, 1864, Biol. Centr.-Amer., Orth., 2:40. Lectotype ♀, Indio, Calif., designated by Rehn & Hebard, 1912 (ANSP).

Paropomala dissimilis Bruner, 1904, Biol. Centr.-Amer., Orth., 2:41.

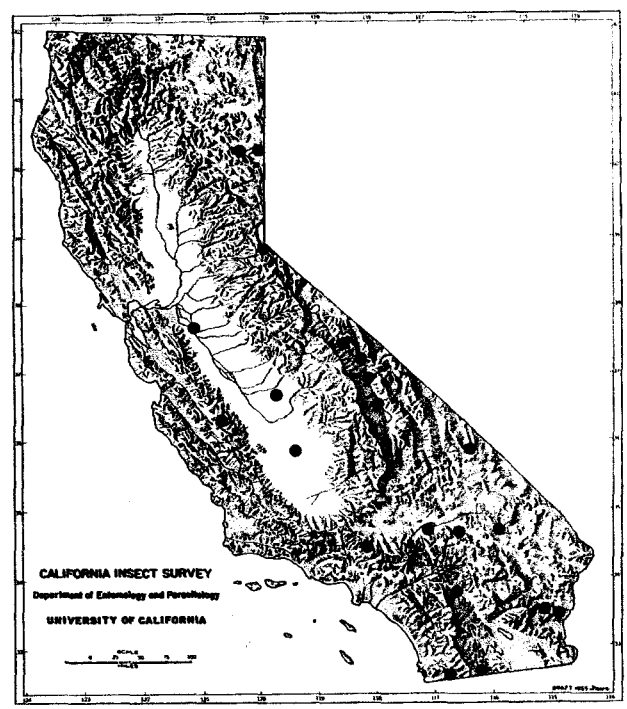
Eremiacris pallida, Hebard, 1935, Trans. Amer. Ent. Soc., 61: 298.

Pale brown, some females green, side of head, lateral lobe of pronotum, meso- and metapleura with a broad white stripe which is bordered above by a dark brown stripe of about equal width. Fastigium strongly protruding and with a horseshoe-shaped impression, lateral foveolae elongate.

Body 18–27; tegmen 13–20; hind femur 8–12.

Geographic range.—From north-central New Mexico, west to California.

California records.—(Map 52) EL DORADO CO.: 3 mi. N. Fallen Leaf Lake, VII–27–62 (W. A. Foster, CIS). FRESNO CO.: Diablo Range, Waltham Canyon, VIII–31–22, 1600 ft. elevation (Rehn & Hebard, ANSP). San Joaquin, VII–29–60 (R. R. Snelling, DCR). Tranquillity, VII–14–60 (R. R. Snelling, DCR). INYO CO.: Shoshone, VIII–8–19 (M. Hebard, ANSP). Tecopa, VIII–8–19 (ANSP). 3 mi. N. Lone Pine, VII–6–61 (W. A. Foster, CIS). 2 mi. N. Bishop, VII–17–53 (J. D. Lattin, CIS). E. of Bishop, VIII–10–59 (D. C. Rentz, DCR). W. of Bishop, VII–24–64 (J. D. Birchim, JDB). Bishop, VII–11–64 (J. D. Birchim, JDB). 9 mi. N. Lone Pine, VII–9–61 (D. C. Rentz, DCR). 2 mi. E. Big Pine, VII–28–62 (D. C. Rentz & C. D. MacNeill, CAS). 4 mi. W. Lone Pine, VII–11–65 (J. D. Birchim, JDB). 7 mi. N. Big Pine, VII–24–65 (J. D. Birchim, JDB). Big Pine, VIII–24–60 (D. Q. Cavagnaro, CAS). Independence, VII–24–64 (J. D. Birchim, JDB). LASSEN CO.: Standish, VIII–27–60 (T. H. Gantenbein, CIS). Litchfield, VIII–21–22 (Rehn & Hebard, ANSP). Amedee, VIII–22–22, 3950 ft. elevation (Rehn & Hebard, ANSP); VII–4–47 (C. H. Spitzer, DCR). LOS ANGELES CO.: Parker Mt., S.E. end Ventura Mts., IX–27–10, 4100 ft. elevation (ANSP). Vincent, VII–24–47 (G. P. Mackenzie, CIS). MONO CO.: Paradise Camp, VIII–16–61 (C. D. MacNeill, CAS). RIVERSIDE CO.: Indio, IX–17–22, 50 ft. elevation (Rehn & Hebard, ANSP). 25 mi. W. Blythe, VIII–18–27 (ANSP). San Jacinto Mts., Tahquitz Canyon, IX–30–10 (ANSP). Hopkins Well, X–11–58 (R. W. Thorp, CIS). Whitewater, VII–9–50 (J. W. MacSwain, CIS). SAN BENITO CO.: 26.8 mi. N. Idria, VII–15–58 (D. C. Rentz, DCR). SAN BERNARDINO CO.: Cottonwood, IX–9– (Rehn & Hebard, ANSP). Cima, VII–12– (Rehn & Hebard, ANSP). Bird Spring Mts., VIII–11– (Rehn & Hebard, ANSP). Mountain Pass, VII–29–49 (D. J. & J. N. Knull). Bagdad, VIII–6–19 (Rehn & Hebard, ANSP). Newberry,



Map 52. California distribution of *Eremiacris pallida* (Bruner).

IX–9–24, 1831 ft. elevation (Rehn & Hebard, ANSP). Barstow, VIII–7–19 (Rehn & Hebard, ANSP). Cottonwood Station, IX–9–07, 2274 ft. elevation (ANSP). Lyons, IX–1–09, 3000 ft. elevation (ANSP). Cima, VIII–12–07, 4190 ft. elevation (ANSP). Goffs, VIII–5–19 (Rehn & Hebard, ANSP). Trona, IX–1–22, 1800 ft. elevation (Rehn & Hebard, ANSP). Foothils, Bird Spring Mts., McCullough Range, VIII–11–07 (ANSP). Clark Mts., VIII–13–65 (J. D. Birchim & C. D. MacNeill, JDB). SAN DIEGO CO.: Jacumba, VII–20–49 (D. J. & J. N. Knull). Mt. Spring, VII–6–52 (D. J. & J. N. Knull). Jacumba, IX–15–22, 2900 ft. elevation (Rehn & Hebard, ANSP). Potrero, IX–12–22, 2323 ft. elevation (ANSP). SAN JOAQUIN CO.: Lathrop, VIII–26–14. TULARE CO.: Angiola, VIII–3–58 (DCR).

Discussion—Inhabits tall grass. Aligns with stems dodging behind them when disturbed, as does *Leptysma*. Agile and difficult to see.

Genus *Esselenia* Hebard, 1920

KEY TO SUBSPECIES OF ESSELENIA

1 Hind tibiae and sides of abdomen brilliant orange in life (male), legs of female lighter orange, abdomen yellow. Dorsal ovipositor valves less elongate when viewed from above . . . . *Esselenia vanduzeei violae* Rentz (p. 73)

2 Hind tibiae of male specimens black. Sides of abdomen yellowish, never orange. Hind tibiae of female also black. Dorsal ovipositor valves elongate when viewed from above . . . . . *Esselenia vanduzeei vanduzeei* Hebard (p. 73)

Esselenia vanduzeei vanduzeei Hebard

(Fig. 17, Map 53)

Esselenia vanduzeei Hebard, 1920, Proc. Cal. Acad. Sci., 10:73. Fig. 1. Type ♀. Bryson, Monterey Co., Calif. (CAS).

A highly distinctive genus and species. The stout form with hind margin of pronotum undulate-lobate and abbreviate tegmina enable quick recognition.

Body 16–24; tegmen 4.5–7.5; hind femur 11–14.

Geographic range.—South Central Valley of California.

California records.—(Map 53) FRESNO CO.: Coalinga, III–7–58 (H. L. Wilson, CDA); II–1–64 (D. C. Rentz, DCR). KERN CO.: Antelope, IV–10–31 (A. C. Browne, CDA). McKittrick, V–3–41 (K. Frick, CIS). LOS ANGELES CO.: Gorman, IV–13–60 (G. Berry, CDA). MADERA CO.: No specific locality, VI–1–55 (R. M. Thompson, CDA). MONTEREY CO.: Bryson, V–18–20 (E. P. Van Duzee, CAS). San Ardo, IV–9–61 (O. Schwab, CDA). SAN BENITO CO.: Vicinity of Pinnacles Nat. Mon., IV–9–60, V–28–60, III–31–62 (D. C. Rentz, DCR). 1 mi. N. entrance Pinnacles Nat. Mon., IV–8–61 (D. C. Rentz, DCR). 2 mi. N. entrance Pinnacles Nat. Mon., IV–15–60 (D. C. Rentz, DCR). 9 mi. N. Pinnacles Nat. Mon., IV–15–60 (D. C. Rentz, DCR). 15 mi. E. Gonzales, IV–15–60, V–12–62, V–19–62 (C. D. MacNeill, CDM). Hernandez Valley, V–28–60 (D. C. Rentz, DCR). SAN LUIS OBISPO CO.: Chalome, IV–10–60 (H. M. Armitage, CDA); V–1955 (R. M. Drake, CDA). 10 mi. S. Creston, V–1–62 (J. A. Powell, CIS). San Luis Obispo, III–28–36, IV–18–39 (C. C. Wilson, CDA). 5 mi. N.E. Santa Margarita, V–1962 (C. A. Toschi, CIS). 10 mi. W. Simmler, V–3–62 (J. A. Powell, R. W. Thorp & J. K. Drew, CIS). SANTA BARBARA CO.: Cuyama, IV–9–49 (J. S. Rowell, CDA); III–22–61 (Gallion & Tabor, CDA). Cuyama Valley, IV–5–61 (T. Gallion, CDA).

Intermediates between the two subspecies.—SAN BENITO CO.: 2 mi. W. Jct. of Cienega and Lime Kiln Rds., III–30–63 (D. C. Rentz, & K. A. Hale, CAS). 3 airline mi. S.W. of Paicines, V–12–62 (D. C. Rentz & C. D. MacNeill, CAS).

Esselenia vanduzeei violae Rentz

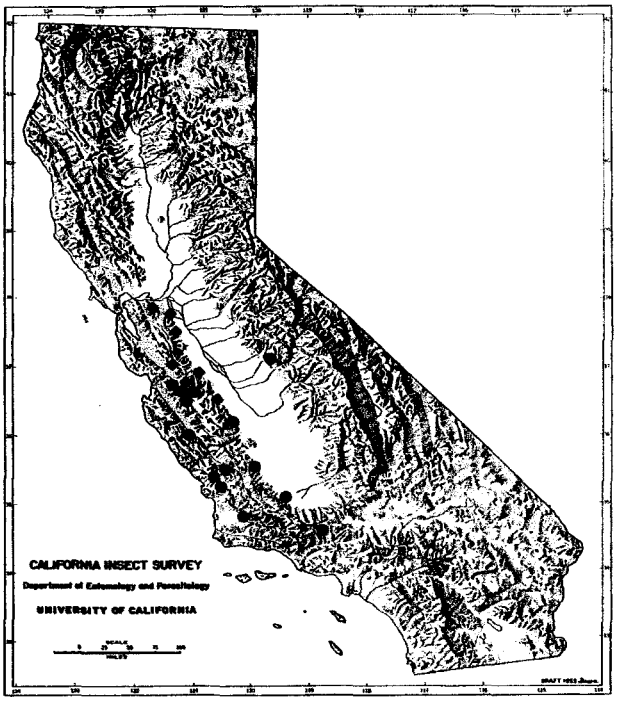
(Map 53)

Esselenia vanduzeei violae Rentz, 1966, Calif. Acad. Sci. Occ. papers, 54:1–10. Type ♂, allotype ♀, Russelman Park, N.E. slope Mt. Diablo, Contra Costa Co., Calif. (CAS).

Easily recognized by the red hind tibiae (males, females) and reddish sides of the abdomen (males).

Geographic range.—Central California.

California records.—(Map 53) CONTRA COSTA CO.: Russelmann Park, E. slope Mt. Diablo, IV–24–32 (E. C. Van Dyke, CAS); IV–30–32 (E. C. Van Dyke, CAS). Russelmann Park, Mt. Diablo, V–12–62 (C. O'Brien, CAS). Vicinity of Clayton, V–24–58 (W. E. Simonds, CDA). The area represented by the above localities is located on the N.E. slope of Mt. Diablo. FRESNO CO.: Panoche Canyon, IV–29–22 (E. C. Van Dyke, CAS). MERCED CO.: Merced Falls, V–6–40 (C. C. Wilson, CDA). 9 mi. W. Los Banos (F. L. Blanc, CDA). SAN BENITO CO.: 5 mi. E. Paicines, IV–30–60 (D. C. Rentz, CAS); IV–8–61, V–13–61 (D. C. Rentz, CAS). SAN JOAQUIN CO.:



Map 53. California distribution of: ●, *Esselenia vanduzeei vanduzeei* Hebard; ■ *Esselenia vanduzeei violae* Rentz.

Tracy, IV–15–31 (C. C. Wilson, CDA). Corral Hollow, IV–3–60 (D. C. Rentz, DCR). Hospital Canyon, IV–7–31 (S. Lockwood, CDA). SANTA CLARA CO.: Mt. Hamilton, VI–9–22, V–25–22 (E. O. Essig, CIS); V–27–61 (D. C. Rentz, CAS).

Discussion—This subspecies overwinters in the nymphal stages, becoming adult early in April and May, usually disappearing by early June. The species has been fully reviewed by Rentz (1966). Linsley (1936) studied two small colonies on the north side of Mt. Diablo finding them on dry, barren hillsides about three-quarters of a mile apart. The soil was scanty, derived from serpentine and was covered with sparse grass. Extensive search revealed no other colonies. This localized distribution appears to be typical. Linsley also reported that the larvae of a clerid, *Aulicus terrestris*, probably feed upon the eggs of *Esselenia*.

Genus *Eupnigodes* McNeill, 1897

KEY TO THE SPECIES OF EUPNIGODES

1 Hind tibiae red; tegmina abbreviate. Head and pronotum (fig. 22) . *megocephala* McNeil (p. 74)
Hind tibiae blue; tegmina extending beyond body *sierranum* (Rehn & Hebard) (p. 74)

Eupnigodes megocephala (McNeill)

(Fig. 22, Map 54)

Pnigodes megocephala McNeill, 1897, Proc. Dav. Acad. Sci., 6:267. Type locality, Yuba and Butte counties, Calif.
Eupnigodes megocephala, McNeill, 1897, Psyche, 8:71.

Light to dark brown. Lateral carina of pronotum very strongly convergent on prozona, marked by a black-bordered pale line. Upper paginae of hind femur with three large dark blotches. Hind tibiae red.

Body 12–17; tegmen 4.7–5.5; hind femur 8.5–12.

Geographic range.—California.

California records.—(Map 54) ALAMEDA CO.: 2 mi. N. Mt. House, VIII–19–59 (W. W. Middlekauff, CIS). Dyar Rd., VIII–19–59 (W. W. Middlekauff, CIS). Patterson Pass, VIII–19–59 (W. W. Middlekauff, CIS). Patterson Pass, VIII–19–59 (W. W. Middlekauff, CIS). Altamont Hills, VII–22–57 (W. W. Middlekauff, CAS). BUTTE CO.: Oroville, IX–6–56 (W. W. Middlekauff, CIS). Table Mt. Ranch, 3 mi. N. Oroville, VII–18–57 (W. W. Middlekauff, CIS). CONTRA COSTA CO.: Mt. Diablo, Russelmann Park, VII–29–60 (D. C. Rentz, DCR). Antioch, X–24–59; VII–22–60 (D. C. Rentz, DCR). KERN CO.: 4 mi. N.E. Buttonwillow, VI–29–61 (C. W. O'Brien, CAS). RIVERSIDE CO.: Idyllwild, VII–29–38 (J. Russell, ANSP). Hemet Lake, VII–27–35 (M. Gyger, ANSP). Anza, VII–29–38 (R. H. Beamer, ANSP). SACRAMENTO CO.: Sacramento, VIII–27–10 (ANSP). Slough House, X–17–22 (B. G. Thompson, ANSP). SAN MATEO CO.: Jasper Ridge, IX–28–41 (K. Frick, CIS). SONOMA CO.: Eldridge, X–10–15 (J. A. Kusche, ANSP).

Discussion—May be locally abundant on salt-grass flats in the bottom of and bordering small watercourses.

Eupnigodes sierrana (Rehn and Hebard)

(Map 54)

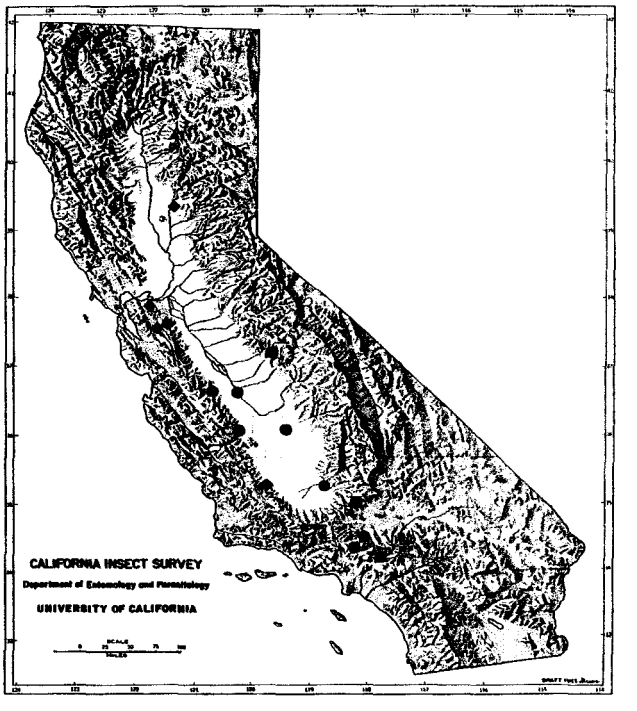
Ageneotettix sierranus Rehn & Hebard, 1910, Proc. Acad. Nat. Sci. Phila., 61:429. Lectotype ♂, Summit House, Madera Co., Calif., designated by Rehn & Hebard, 1912 (ANSP).
Eupnigodes sierranus, Thompson & Buxton, 1964, Occas. Pap., Bur. Ent. Calif. Dept. Agr., 5:11.

Gray, dorsum of pronotum largely pale, the lateral carinae bordered with black, laterally on prozona, medially on metazona. Upper paginae of hind femur with three dark blotches. Hind tibiae blue.

Body 13–15; tegmen 10–12; hind femur 9–10.

Geographic range.—California.

California records.—(Map 54) FRESNO CO.: Coalinga, VIII–30–22, 700 ft. elevation. Alcalde Canyon, Diablo Range, VIII–31–22, 950 ft. elevation (Rehn & Hebard, ANSP). Waltham Canyon, Diablo Range, VIII–31–22, 1600 ft. elevation. San Joaquin, VII–14–60 (R. R. Snelling, CAS). Mercy Hot Springs, VIII–26–62 (D. C. Rentz & E. W. Kirschbaum, CAS). Hospital Canyon, X–7–31. McClure Valley, IX–2–31 (ANSP). San Joaquin, VII–29–60 (R. R. Snelling, DCR). Mercy Mines, VIII–16–58 (D. C. Rentz, DCR). KERN CO.: Mill Potrero, VIII–8–59 (P. M. Marsh, CIS); VII–6–59 (P. E. Paige, CIS). Bakersfield, IX–1–22 (Rehn & Hebard, ANSP); VIII–20–19, IX–15–10 (ANSP). Bona, IX–2–22



Map 54. California distribution of: ■, *Eupnigodes megocephala* (McNeill); ● *Eupnigodes sierrana* (Rehn and Hebard).

(ANSP). Tehachapi Mts., Marcel, IX–16–10, 3700 ft. elevation; IX–16–10, 4200 ft. elevation (ANSP). MADERA CO.: Raymond, IX–3–07, in stubble (Rehn & Hebard, ANSP). Summit House, IX–3–07, 3200 ft. elevation, in short, dry grass and tarweed (Rehn & Hebard, ANSP). LOS ANGELES CO.: Palmdale, X–14–47 (G. P. Mackenzie, CIS). Solemint, X–19–51 (G. P. Mackenzie, CIS). Mint Canyon, VII–31–35 (E. I. Beamer, ANSP). Ventura Mts., S.E. end Parker Mt., IX–27–10, 2800–4100 ft. elevation (ANSP). Acton, IX–29–10, 2700 ft. elevation (ANSP). Ravenna, IX–27–10, 2440 ft. elevation (ANSP). Cajon Pass Hills, desert side, IX–1–19 (Rehn & Hebard, ANSP). Sierra Madre Range, Rubio Canyon, 2000–3000 ft. elevation (O. C. Poling, ANSP). TULARE CO.: Goshen Jct., VIII–30–22 (M. Hebard, ANSP); IX–14–10, 282 ft. elevation (ANSP). VENTURA CO.: Cuddy Canyon, IX–4–22, 4472 ft. elevation (Rehn & Hebard, ANSP).

Genus *Horesidotes* Scudder, 1899

Horesidotes cinereus cinereus Scudder
(Fig. 19, Map 55)

Horesidotes cinereus Scudder, 1899, Proc. Amer. Acad. Arts & Sci., 35:49. Lectotype ♂, Palm Canyon, Palm Springs, Calif., designated by Rehn & Hebard, 1912 (MCZ).

Horesidotes cinereus cinereus, Hebard, 1935, Trans. Amer. Ent. Soc., 61:282.

Gray-brown, lower part of lateral lobe of pronotum yellowish, head and pronotum with a broad median pale stripe in some specimens. Pronotum with lateral carinae low but sharp, strongly convergent on prozona, hind margin obtusely rounded. Lateral foveolae shallow, obsolete in some specimens.

Body 16–22; tegmen 13–17; hind femur 10.5–13.

Geographic range.—California, Arizona, Mexico.

California records.—(Map 55) RIVERSIDE CO.: Palm Canyon and West Canyon, on grasses (ex: Scudder). Chino Canyon, IX–29–63 (L. A. Stange, CIS); IX–29–63 (R. L. Westcott, UCD). Whitewater Canyon, IX–11–35 (Timberlake, ANSP). Beaumont, IX–28–10, 2700 ft. elevation (ANSP). Tahquitz Canyon, San Jacinto Mts., IX–30–10, 500 ft. elevation (ANSP). San Jacinto Mts., IX–29–10, 800 ft. elevation (topotypes, ANSP). SAN DIEGO CO.: Descanso District, X–12–50 (H. H. Keifer, CDA).

Discussion—Ball et al. (1942) collected this species on grass, often under shrubs such as mesquite on rocky hillsides, but noted it feeding on other plants such as *Calliandra* and *Haplopappus*.

Horesidotes cinereus saltator Hebard
(Map 55)

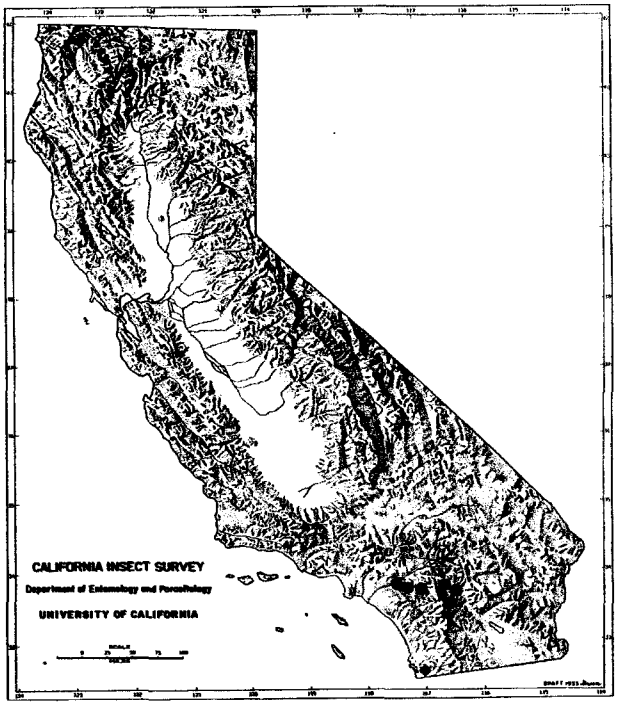
Horesidotes cinereus saltator Hebard, 1931, Trans. Amer. Ent. Soc., 57:116. Type ♂, Tia Juana, San Diego Co., Calif. (#1171, ANSP).

Short winged, incapable of flight. Wing three-fifths as long as posterior femur. In size, smaller than *c. cinereus*. Coloration variable from straw brown to dark brown.

Geographic range.—Baja California north to San Diego County.

California records.—(Map 55) SAN DIEGO CO.: Tiajuana, IX–1–22 (ANSP).

Discussion—Type series collected on hillsides overlooking the Pacific in low, thick chaparral where individuals were found either on the ground or in the low brush. Most specimens made several jumps with no pause.



Map 55. California distribution of: ●, *Horesidotes cinereus cinereus* Scudder; ■ *Horesidotes cinereus saltator* Hebard.

Genus *Ligurotettix* McNeill, 1897

In his study of this genus Rehn (1923) used but one specific name, *L. coquilletti* McNeill, but recognized divergence into three races, all of which occur in California. Delineation of these races requires rather lengthy treatment; many specimens show intermediate characters. Rehn's detailed treatise should be used if segregation of material according to racial features is to be attempted.

Ligurotettix coquilletti coquilletti McNeill
(Fig. IX, Map 56)

Ligurotettix coquilletti McNeill, 1897, Proc. Dav. Acad. Sci., 6:198, 257. Type ♂, Los Angeles Co., Calif. (USNM #3675).

Ligurotettix coquilletti Rehn, 1923, Trans. Amer. Ent. Soc., 49:56.

Gray with two dusky spots on upper paginae of

hind femur. In some specimens these spots are continued across the outer face of the femur. The head, lateral lobes of pronotum and meso- and metapleura may be more or less infuscated. The tegmen has weak intercalary vein and the prosternum a large bulbous tubercle. The ranges of the races recognized by Rehn seem to interdigitate in an intricate fashion. The nominate race is recorded from Inyo, Los Angeles, Kern, Riverside, San Bernardino and San Diego counties. This species is often found on *Larrea* but is apparently not confined to that plant.

Geographic range.—Sonoran Desert.

California records.—(Map 56) KERN Co.: Mohave, IX–15–10, 27 ft. elevation (Rehn & Hebard, ANSP). LOS ANGELES Co.: Palmdale, VIII–1–35 (J. Beamer, ANSP). Acton, IX–27–10, 2700 ft. elevation (ANSP).

Ligurotettix coquilletti cantator Rehn

Ligurotettix coquilletti cantator Rehn, 1923, Trans. Amer. Ent. Soc., 49:64, Type ♂, Mason, Lyon Co., Nev. (ANSP #898).

Geographic range.—Inyo, Kern, Mono and San Bernardino counties; southwestern Nevada.

California records.—(Map 56) INYO Co.: Olancha, VI–26–49 (H. E. Cott, CIS). Antelope Springs, VII–10–62 (W. A. Foster, CIS); VII–16–60 (H. K. Court, CIS). Eureka Valley, VIII–6–60 (H. K. Court, CIS). Little Lake, VIII–5–61 (C. W. O'Brien, DCR). 14 mi. N. Little Lake, VIII–7–61 (C. W. O'Brien, DCR). 2 mi. W. Bishop, VIII–10–59 (D. C. Rentz, DCR). Independence, VII–2–64 (J. D. Birchim, JDB). Owen's Lake, VII–2–64 (J. D. Birchim, JDB). Mazourka Canyon Rd., VII–13–65 (J. D. Birchim, JDB). KERN Co.: Freeman Gulch, N.E. Ricardo, X–14–58, on *Larrea* (W. E. Ferguson, CIS). MONO Co.: 10 mi. N. Bald Mt. Lookout, VII–2–61 (C. W. O'Brien, DCR). SAN BERNARDINO Co.: Baker, VI–24–30 (F. H. Wymore, CIS).

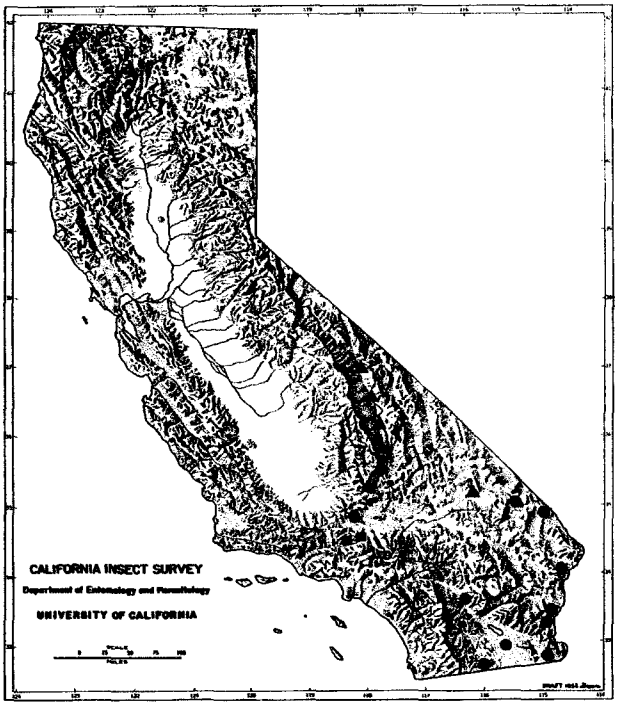
Ligurotettix coquilletti kunzei Caudell
(Map 56)

Ligurotettix kunzei Caudell, 1903, Proc. Ent. Soc. Wash., 5:162. Type ♂, Phoenix, Ariz., designated by Caudell & Hebard, 1912 (USNM).

Ligurotettix coquilletti kunzei, Rehn, 1923, Trans. Amer. Ent. Soc., 49:82.

Geographic range.—California.

California records.—(Map 56) IMPERIAL Co.: Coyote Wells, IX–16–22 (Rehn, ANSP). Palo Verde, on *Larrea*, VIII–26–46 (W. F. Barr, CIS). Coyote Wells, VII–16–49 (D. J. & J. N. Knull). Westmorland, IX–2–41 (K. Frick, CIS). 5 mi. E. Bond's Corner, X–27–52 (E. G. Linsley, CIS). 20 mi. W. Winterhaven, IX–4–61 (C. W. O'Brien, DCR). 5 mi. W. Coyote Wells, IX–16–22, 500 ft. elevation (Rehn & Hebard, ANSP). RIVERSIDE Co.: Blythe, X–2–54 (J. C. Hall, CIS). Indio, IX–17–22, 50 ft. elevation (Rehn & Hebard, ANSP). SAN BERNARDINO Co.: Vidal, VII–6–51 (K. Frick, CIS). Mojave Desert, Mammoth Tank (L. LaForge, ANSP). Needles, VIII–1–26 (ANSP); VIII–4–19 (Rehn & Hebard, ANSP). Goffs, VIII–5–19 (Rehn & Hebard, ANSP).



Map 56. California distribution of: ■, *Ligurotettix coquilletti* McNeill; ▲, *Ligurotettix coquilletti cantator* Rehn; ●, *Ligurotettix coquilletti kunzei* Caudell.

Genus *Mermiria* Stal, 1873

Mermiria maculipennis maculipennis Bruner
(Map 57)

Mermiria maculipennis, Rehn, 1919, Proc. Acad. Nat. Sci. 12:54. Type locality, San Antonio, Tex. Lectotype ♀, designated by Rehn & Hebard, 1912 (ANSP).

Mermiria maculipennis, Rehn, 1919, Proc. Acad. Nat. Sci. Phila., 71:102.

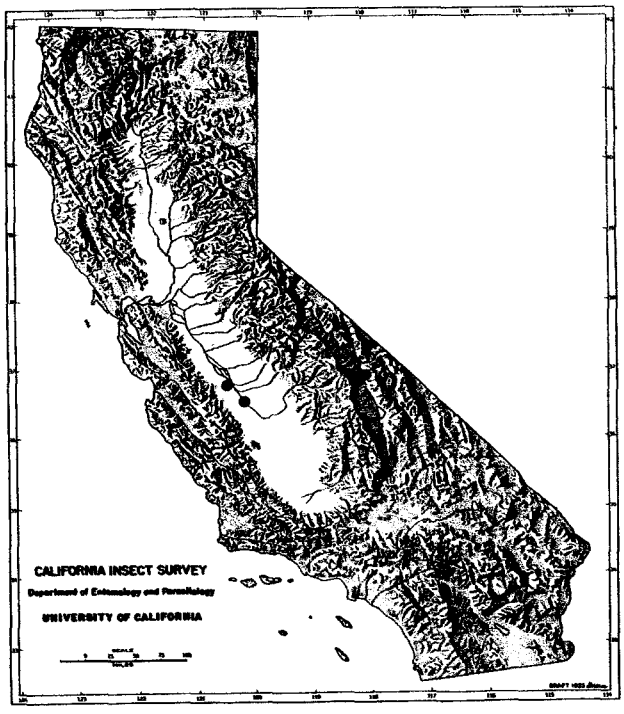
General color yellow-brown, head and pronotum with a pair of dark stripes, tegmen with pale subcostal and anal stripes, hind tibiae red.

Body 30–45; tegmen 21–34; hind femur 18–28.

Rehn recognized a race, *M. maculipennis macclungi*, occupying the northwestern portion of the range of the species but the decision to introduce the trinomial was based in part on McClung's demonstration of chromosomal differences in populations. The few California specimens seen resemble topotypic (San Antonio, Texas) material rather closely.

Geographic range.—Great Plains west to California.

California records.—(Map 57) FRESNO Co.: San Joaquin, VII–7–60 (R. R. Snelling, DCR). Tranquillity, VII–14–60 (R. R. Snelling, DCR). INYO Co.: Big Pine, VII–21–64 (D. C. & K. A. Rentz, DCR). 2 mi. E. Big Pine, VII–23–64 (J. D. Birchim, JDB). W. of Bishop, VII–29–64 (J. D. Birchim, JDB).



Map 57. California distribution of *Mermiria maculipennis maculipennis* Bruner.

Discussion—In parts of its range it is sometimes destructively common in the tall grasses and in cultivated areas. It jumps, dodges, and flies actively in tall, rank grass and is hard to catch. Uncommon and localized in California.

Genus *Napaia* McNeill, 1897

N. aspasma (Rehn and Hebard) has not been recorded from California but has been taken at Siskiyou, Oregon.

KEY TO SPECIES OF NAPAIA

1 Lateral carinae of pronotum almost straight and parallel; third article of antenna much wider at apex than at base (San Francisco southward) (fig. 18) . . . . . *gracilis McNeill* (p. 77)

Lateral carinae of pronotum usually arcuate on prozona, diverging on metazona; third antennal article but little wider distad (Santa Clara Co. northward) 2

2 Lateral carinae of pronotum evenly, gently arcuate on prozona; dorsal valve of ovipositor with sharp teeth near base . . . . . *dianae* Gurney, Strohecker and Helfer (p. 77)

Lateral carinae strongly and often unevenly arcuate on prozona; dorsal valve of ovipositor with broad, blunt teeth near base (not recorded from California) . . . . . *aspasma* (Rehn & Hebard)

Napaia dianae Gurney, Strohecker and Helfer

(Map 28)

Napaia dianae Gurney, Strohecker & Helfer, 1964, Trans. Amer. Ent. Soc., 89:125. Type ♂, Mill Creek, Mendocino Co., Calif. (USNM #66277).

Coloration similar to but more intensive than that of *N. gracilis*. The dark lateral band is wider and covers all the lateral lobe of the pronotum; the median carina is also dark. Hind tibiae red. Gurney, Strohecker and Helfer report this species from the following counties; Colusa, Glenn, El Dorado, Humboldt, Mendocino, Santa Clara and Trinity. It inhabits grassy areas.

Geographic range.—California.

California records.—(Map 58) COLUSA CO.: Wilbur Springs, VII–14–60 (D. C. Rentz, CAS); VI–27–61 (J. R. Helfer, CAS). EL DORADO CO.: Shingle Springs, VI–7–60 (D. C. Rentz, CAS). GLENN CO.: 6 mi. W. Plaskett Meadows Station, VIII–27–61 (D. C. Rentz, CAS). 15 mi. E. Plaskett Meadows, VI–27–61 (J. R. Helfer, CAS). Elk Creek, VII–27–61 (D. C. Rentz, CAS). HUMBOLDT CO.: South Fork Mt., VI–22–59 (J. R. Helfer, CAS). Buck Mt., VI–22–59 (J. R. Helfer, CAS). MENDOCINO CO.: Mill Creek Dam, VI–10–59 (D. C. Rentz, CAS); VI–27–60 (J. R. Helfer, CAS). SANTA CLARA CO.: Mt. Hamilton, VI–20–22 (J. F. Lamiman, CAS).

Napaia gracilis McNeill

(Map 58)

Napaia gracilis McNeill, 1897, Proc. Dav. Acad. Sci., 6:213. Lectotype ♂, Los Angeles Co., Calif., designated by Gurney, Strohecker and Helfer, 1964.

Oeonomus altus Scudder, 1899, Proc. Amer. Acad. Arts & Sci., 35:47.

Napaia gracilis, Gurney et al., 1964, Trans. Amer. Ent. Soc., 89:129.

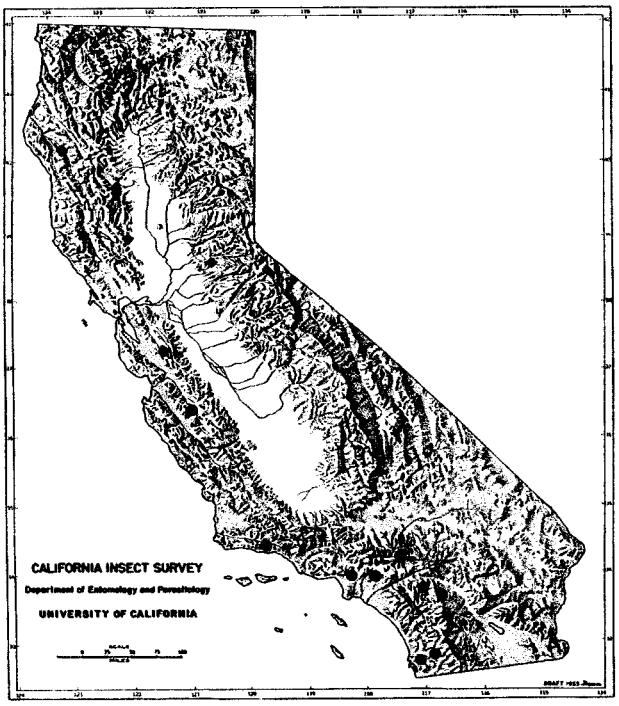
Pale brown with dark stripe on each side of head, which is continued along lateral lobe of pronotum, abdomen, and costal area of tegmen. Hind tibiae pale brown. Antennae of male strongly flattened and broadened basad.

Body 17–21; tegmen 8–7; hind femur 11–12.

Geographic range.—California.

California records.—(Map 58) LOS ANGELES CO.: Tanbark Flat, VII–1–57 (C. L. Wiley, CIS); VII–8–50 (F. X. Williams, CAS). Pasadena (CAS). Burbank, IV–18–50 (T. P. Kingsella, CAS). Los Angeles, VI–10–01 (C. E. Hutchinson, CAS). Mt. Lowe, Sierra Madre Range, VIII–8–07, 4300 ft. elevation. Mountains near Claremont (Baker, ANSP). RIVERSIDE CO.: San Jacinto Mts., 2 mi. S.E. Poppet Flat, VI–1–40 (C. D. Michener, CIS). 4 mi. W. Beaumont, IV–9–43 (H. R. Roberts, ANSP). San Jacinto Mts., VII–21–29 (P. W. Oman, ANSP). SAN BENITO CO.: 2 mi. W. San Benito, V–13–61 (D. C. Rentz, CAS). SAN BERNARDINO CO.: Camp Baldy, VI–30–56 (C. L. Wiley, CIS). Arrowhead Lake, IV–16–28 (Craig, CAS). SAN DIEGO CO.: Nellie, VIII–4–17

(E. P. Hewlett, ANSP); VII–25–17, VIII–9–17, VII–5–17 (ANSP). San Diego, VI–24–21, VI–16–21, VI–6–21 (ANSP). San Vicente, 3 mi. N. Lakeside, V–I–54, 480 ft. elevation (J. Rehn, ANSP). SANTA BARBARA CO.: Canon de Refugio, VII–9–59 (C. A. Campbell, CIS). Sea level to 200 ft. elevation, VIII–22–09 (M. Hebard, ANSP), collected on dense bushes and grasses. San Marcos Pass, VIII–15–40 (E. R. Helwig, ANSP).



Map 58. California distribution of: ■, *Napaia dianae* Gurney and Helfer; ●, *Napaia gracilis* McNeill.

Genus *Opeia* McNeill, 1897

Opeia obscura (Thomas)

(Fig. 12, Map 59)

Oxycoryphus obscurus Thomas, 1872, Rept. Geol. Surv. Montana, p. 466. Lectotype ♀, Ft. Fetterman, Wyo., designated by Hebard, 1927 (USNM).

Opeia obscura, McNeill, 1897, Proc. Davenport Acad. Sci., 6:214.

Opeia testacea Scudder, 1899, Proc. Amer. Acad. Arts & Sci., 35:46.

Opeia obscura Hebard, 1937, Trans. Amer. Ent. Soc., 63:354.

Pale brown or green, median carina and lateral lobes of pronotum sometimes dark brown, hind tibia gray to bluish.

Body 15–22; tegmen 9.5–18; hind femur 10–16.

Geographic range.—Most states west of the Great Plains.

California records.—(Map 59) FRESNO CO.: San Joaquin, VII–29–60 (R. R. Snelling, DCR). IMPERIAL CO.: 3–4 mi. W. Yuma, IV–17–42 (H. R. Roberts, ANSP). INYO CO.: Wild Rose Canyon, Panamint Range, IX–8–22, 5500 ft. elevation (Hebard, ANSP). Big Pine, VIII–24–60 (M. E. Irwin, CIS). E. of Bishop, VIII–10–54 (D. C. Rentz, DCR). KERN CO.: 2 mi. S.E. Tupman, VIII–18–51, 315 ft. elevation (J. Rehn, ANSP). 5 mi. W. Old River, VIII–18–51, 340 ft. elevation (J. Rehn, ANSP). Kern City, VIII–4–1897 (ANSP). Bakersfield, IX–14–10, 400 ft. elevation. Mojave, IX–15–10, 2750 ft. elevation (ANSP). LASSEN CO.: Susanville, VIII–21–22 (ANSP). Devil's Corral, above Susanville, VIII–21–22, 4800 ft. elevation (Rehn & Hebard, ANSP). LOS ANGELES CO.: 4 mi. N. Lancaster, IX–9–62 (J. T. Doyen, CIS). Lancaster, VIII–1–1897 (ANSP). Mt. Lowe, Sierra Madre Range, VIII–8–07, 4300 ft. elevation (ANSP). Pasadena, VIII–1–07, 824 ft. elevation (ANSP). Coquillett (paratype female, ANSP). MODOC CO.: Alturas, VIII–23–22, 4500 ft. elevation (Rehn & Hebard, ANSP). RIVERSIDE CO.: Strawberry Valley, San Jacinto Mts., VIII–26–09, 5500 ft. elevation (ANSP). Hemet Lake, VIII–27–35 (M. Gyger, ANSP). Beaumont, IX–28–10, 2700 ft. elevation (ANSP). SAN BERNARDINO CO.: Newberry, IX–9–24, 1831 ft. elevation. Barstow, VIII–7–19 (Rehn & Hebard, ANSP). Victorville, IX–1–19 (Rehn Hebard, ANSP). Cushenberry Ranch, VIII–31–19 (Rehn & Hebard, ANSP). Twenty-nine Palms, VIII–3–33 (Timberlake, ANSP). San Bernardino Mts., Santa Ana River, Bear Lake Rd., VIII–30–19, 4300 ft. elevation (Rehn & Hebard, ANSP). Oro Grande, IV–16–62 (D. C. Rentz, DCR). SAN JOAQUIN CO.: Lathrop (Rehn & Hebard, ANSP). STANISLAUS CO.: Near San Joaquin River, between Crow's Landing and Turlock, VIII–21–42 (Rehn & Rehn, ANSP). TULARE CO.: Goshen Jct., VIII–30–22 (M. Hebard, ANSP); IX–14–10, 282 ft. elevation (ANSP).

Genus *Orphulella* Giglio-Tos, 1894

KEY TO CALIFORNIA SPECIES OF ORPHULELLA

1 Lateral carinae of pronotum incurved on prozona; apex of fastigium rectangularly (male) to obtusely (female) narrowed (northern) . . . *pelidna desereta* (p. 79)

Lateral carinae parallel to prozona; fastigium acutely narrowed, its impressed line far from apex (southern) (fig. 15) . . *compta* Scudder (p. 78)

Orphulella compta Scudder

(Fig. 15, Map 60)

Orphulella compta Scudder, 1899, Canad. Ent., 31:178. Lectotype ♂. Palm Springs, California, designated by Gurney, 1940. (MCZ, No. 15223).

Orphulella affinis Scudder, 1899, Canad. Ent., 31:178, 183.

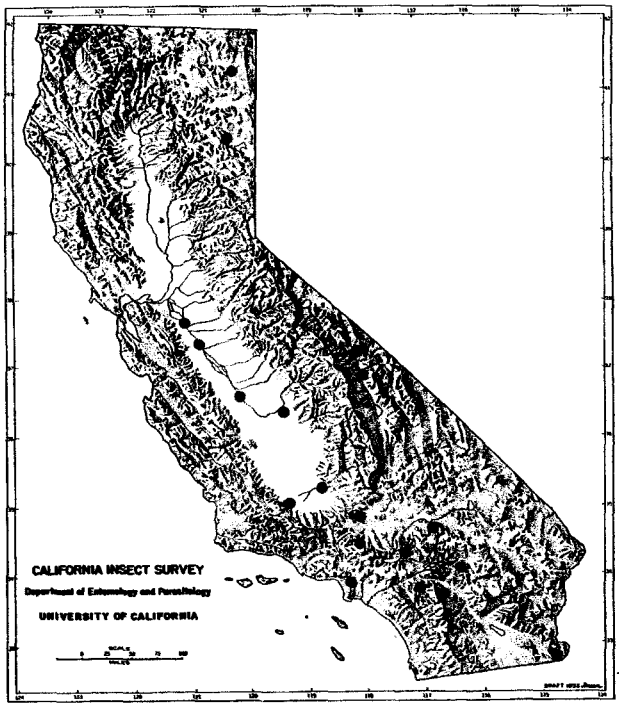
Orphulella graminea Bruner, 1904, Biol. Cent.-Amer., Orth. 2:75, 78.

Orphulella compta, Gurney, 1940, Ent. Amer., New Ser., 20:104.

Pale brown but some specimens in large part green, head and lateral lobe of pronotum with dark stripe, hind tibiae pale brown.

Body 18–24; tegmen 15–18; hind femur 11–14.

Geographic range.—Arizona, South Dakota, Nevada and southern California.



Map 59. California distribution of *Opeia obscura* (Thomas).

California records.—(Map 60) FRESNO Co.: Tranquility, VII–14–60 (R. R. Snelling, DCR). IMPERIAL Co.: Holtville, VII–2–29 (P. W. Oman, ANSP); VIII–10–14 (J. C. Bradley, ANSP). El Centro, IX–16–22, 50 ft. below sea level (Rehn & Hebard, ANSP). Calexico, V–12–31 (H. W. Capps, ANSP). Kane Spring, IX–17–22, 75 ft. below sea level (Rehn & Hebard, ANSP). Brawley, VI–30–37 (A. T. McClay, UCD). Imperial Valley, X–30–37 (A. T. McClay, UCD). El Centro, VI–30–17 (E. O. Essig). INYO Co.: Little Lake, VII–14–60 (H. K. Court, CIS). Shoshone, VIII–8–19 (M. Hebard, ANSP). Pine Creek, Round Valley, N.W. of Bishop, VIII–7–61 (D. C. Rentz, C. D. MacNeill & M. L. Lundgren, DCR, CAS). Lone Pine, VII–14–64 (J. D. Birchim, JDB). 7 mi. N. Big Pine, VII–26–64 (J. D. Birchim, JDB). KERN Co.: Bakersfield, IX–14–10, 400 ft. elevation (ANSP). LOS ANGELES Co.: Alamitos Bay, VII–31–07 (ANSP). Corona, VII–25–40 (E. R. Helwig, ANSP). ORANGE Co.: Huntington Beach, VII–30–32 (R. H. Beamer, ANSP). RIVERSIDE Co.: Thermal, VIII–27–57 (E. I. Schlinger, CIS). Indio, VII–29–07, 26 ft. below sea level in irrigated field (ANSP). Riverside, VIII–17–30 (Timberlake, ANSP). SAN BERNARDINO Co.: Needles, X–1917 (O. C. Poling, ANSP). Newberry, IX–9–24, 1831 ft. elevation (Rehn & Hebard, ANSP). SAN DIEGO Co.: Del Mar, X–2–19 (M. Hebard, ANSP). San Diego (Blaisdell, ANSP). Coronado, IX–11–22 (Rehn & Hebard, ANSP). Coronado Beach, VIII–6–07. La Puerta, IX–9–22 (ANSP). Campo, IX–13–22, 2400 ft. elevation (ANSP). Dulzura, VIII–9–35, (E. I. Beamer, ANSP). Tiajuana, IX–11–22 (ANSP). Mountain Springs, IX–16–22, 2543 ft. elevation (Rehn & Hebard, ANSP). La Mesa, VII–1959 (F. X. Williams, CAS). Borrego, X–10–50, in alfalfa (Pierce & Keifer, CDA). TULARE Co.: IX–14–10, 282 ft. elevation (ANSP). VENTURA Co.: Mugu Point, VIII–13–37 (Rehn, Pate & Rehn, ANSP).

Discussion—Replaces *desereta* in lower Austral Life Zone of Arizona, Nevada and California and penetrates extreme southwestern Utah (Gurney, 1940).

Orphulella pelidna desereta Scudder

(Map 60)

Orphulella desereta Scudder, 1899, Can. Ent., 31:168. Lectotype ♂. Salt Lake Valley, Utah, designated by Gurney, 1940 (MCZ No. 15220).

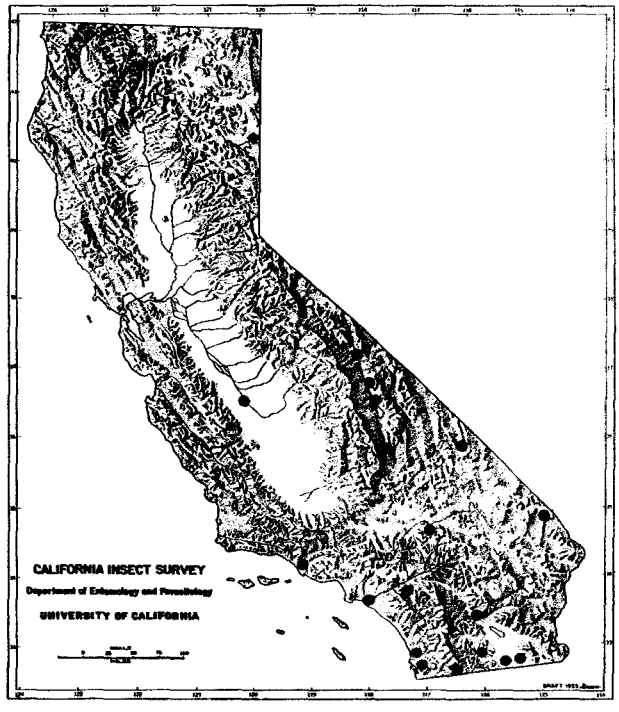
Orphulella salina Scudder (ibid.) p. 179.

Orphulella pelidna desereta Gurney, 1940, Ent. Amer. new ser., 20:125.

For descriptive notes see Gurney (1940).

Geographic range.—California to Utah.

California records.—(Map 60) LASSEN Co.: Amedee, N.E. Honeylake (ex: Gurney). Earthquake Valley, X–10–50 (Pierce & Keifer, CDA). SISKIYOU Co.: Gazelle (ex: Gurney).



Map 60. California distribution of: ●, *Orphulella compta* Scudder; ■, *Orphulella pelidna desereta* Scudder.

Genus *Paropomala* Scudder, 1899

Paropomala calamus Scudder

(Map 61)

Paropomala calamus Scudder, 1899, Psyche, 8:437. Type locality, Lancaster, Los Angeles Co., Calif.

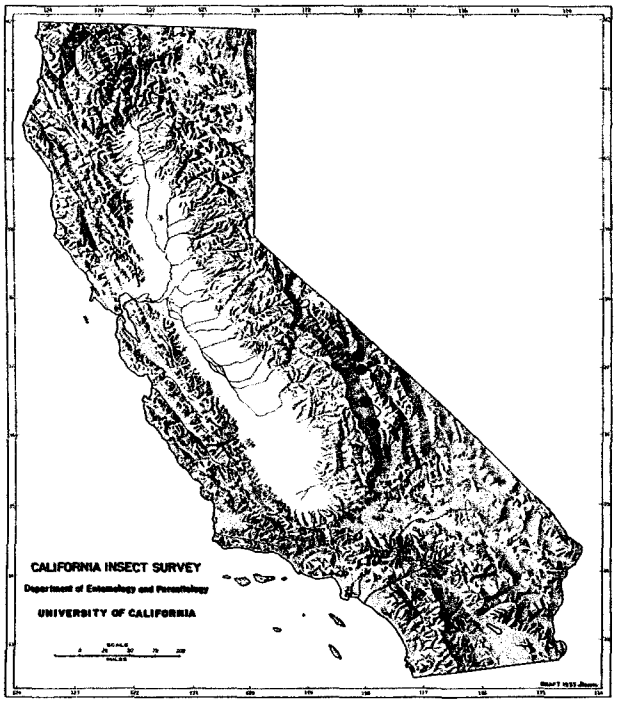
Very slender, face very strongly oblique, the head in side view narrowly conical. Subgenital plate of male long-conical, much longer than preceding sternite. Pale brown, some females green, with a white stripe below the eye continued along lower edge of lateral lobe of pronotum. Size smaller, more robust than *P. wyomingensis* (Thos.).

Body 21–29; tegmen 9.5–13; hind femur 9–12.

Geographic range.—East side of Sierra Nevada from Bishop south and west to Los Angeles County, California.

California records.—(Map 61) INYO CO.: E. of Bishop, VIII–16–59 (D. C. Rentz, DCR). 2 mi. E. Big Pine, VII–28–62 (D. C. Rentz & C. D. MacNeill, CAS). W. of Lone Pine, VII–24–65 (D. C. Rentz, DCR, immature). Olancha, VIII–10–59 (J. R. Helfer, DCR, CAS).

Discussion—The above records extend the known range for this species which is found in grasses along roadsides, and near irrigation ditches. It occurs with *Eremiacris pallida* but is never as abundant.



Map 61. California distribution of *Paropomala calamus* Scudder.

Genus *Psoloessa* Scudder, 1875

KEY TO CALIFORNIA SPECIES OF PSOLOESSA

1 Fastigium acutely narrowed in front; fastigio-facial junction (profile) subangulate . . . . . *thamnogaea* Rehn (p. 80)

Front angle of fastigium but little less than 90°; fastigio-facial junction broadly rounded . . . *delicatula delicatula* (Scudder) (p. 80)

Psoloessa delicatula delicatula (Scudder)
(Map 62)

Scyllina delicatula Scudder, 1876, Bull. U. S. Geol. Surv. Terr., 2:263. Lectotype ♂, Garden of the Gods, Colo., designated by Rehn, 1942.

Psoloessa delicatula delicatula, Rehn, 1942, Trans. Amer. Ent. Soc., 68:207.

Rather stout, especially female. Gray, head and pronotum with dark stripes, tegmen with a row of black spots, upper paginae with lateral carinae raised, strongly convergent on prozona, pale, bordered on each side by black. Frontal costa shallowly sulcate above antennae.

Geographic range.—All states from the Great Plains westward.

California records.—(Map 62) ALPINE CO.: Leviathan Peak, VI–23–62, 8900 ft. elevation (C. D. MacNeill, CAS). INYO CO.: Bishop (W. D. McLellan, UCD). Wildrose Canyon, Panamint Mts., VI–7–56 (J. M. Burns, CIS). Telescope Peak, Panamint Mts., VI–8–61 (R. P. Allen, CDA). Skidoo, Death Valley area, VI–6–61 (R. P. Allen, CDA). 4 mi. N. Schulman Grove, White Mts., VII–27–62 (D. C. Rentz & C. D. MacNeill, CAS). LOS ANGELES CO.: Camp Baldy, VII–11–60 (K. G. Whitesell, CIS). Tanbark Flat, VII–13–50 (W. O. Marshall, CIS). MONO CO.: White Mts., 8200–10,600 ft. elevation (Rehn, ANSP). White Mts., 10,000 ft. elevation (W. H. Lange, CIS). Crooked Creek, White Mts., VI–23, VII–4, 16, 28–61, 10,150 ft. elevation (W. A. Foster, CIS). Cottonwood Creek, VII–10–61, 9300 ft. elevation (W. A. Foster, CIS). Near Monitor Pass, VI–23–62 (J. A. Powell, CIS); VI–23–62 (C. D. MacNeill, CAS). Blanco's Corral (W. D. McLellan, UCD). 5 mi. S. Walker, VI–24–62 (C. D. MacNeill, CAS). White Mts., Research Station, VII–4–61, 10,150 ft. elevation (D. C. Rentz, CAS). RIVERSIDE CO.: Pinon Flat, San Jacinto Mts., V–24–39 (E. G. Linsley, CIS). Idyllwild, V–19–39 (E. S. Ross, CAS). Herkey Creek, VI–4–40 (C. D. Michener, CIS). Pinyon Flat, IV–20–62, C. D. MacNeill, D. C. Rentz & R. Brown, CAS). SAN BERNARDINO CO.: Ord Mts., IV–18–60 (J. R. Powers, CIS). 12 mi. S. E. Ivanpah, V–1–56 (J. A. Powell, CIS). 3 mi. N. E. Cajon Pass, IV–16–62 (C D. MacNeill, D. C. Rentz & R. Brown, CAS). SAN DIEGO CO.: Jacumba, IV–23–60 (Klopfer & Clifton, CDA).

Discussion—This widely distributed species is a common inhabitant of the western grasslands especially where the growth is sparse and the soil thin. A very active jumper, frequently flying into or near shrubs when disturbed. In the northern part of its range it may pass the winter in the nymphal stage, buried in vegetation or occasionally in the soil.

Psoloessa thamnogaea Rehn
(Map 62)

Psoloessa thamnogaea Rehn, 1942, Trans. Amer. Ent. Soc., 68:175. Type ♀, Murray Canyon, above Mission Valley, San Diego Co., Calif. (ANSP, No. 5661).

Body coloration similar to that of *P. delicatula*, which it resembles generally but is of smaller size and slenderer form, with frontal costa flat above antennae. The hind tibiae are pale yellow.

Body 14–19; tegmen 12–15; hind femur 8.8–12.

Geographic range.—California to Baja California.

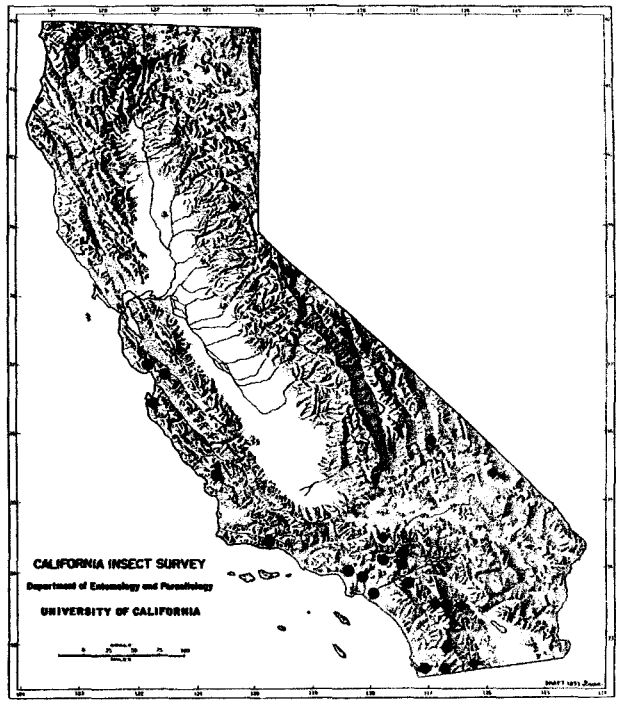
California records.—(Map 62) Rehn (1942) has listed listed material from many localities in the following counties: Fresno, Los Angeles, Monterey, Orange, Riverside, San Bernardino, San Diego, San Luis and Santa Barbara. LOS ANGELES CO.: August (A. Koebele, CAS). Whittier Hills, XI–28–19 (G. R. Pilate, CAS). Roscoe, VIII–23–09 (ANSP). Los Angeles River, VIII–1907 (O. C. Poling, ANSP). Saugus, VIII–23–09 (ANSP). Miramar, VII–31–07 (ANSP). Mountains near Claremont, ANSP). Foothills of Claremont, VII–25–15 (J. W. Rich, ANSP). Echo Mts., Sierra Madre Range, IX–18–10, 3500 ft. elevation (Rehn & Hebard, ANSP). Altadena, VIII–8–07 (ANSP). Pasadena, VIII–1–07, 824 ft. elevation (Rehn & Hebard, ANSP). Glendale (E. I. Schlinger, UCD). MONTEREY CO.: Del Monte, IX–9–10 (Rehn & Hebard, ANSP); IX–10–10 (ANSP). Monterey, Hastings Reservation, IX–6–57 (J. Rehn, ANSP). Carmel, X–30–19 (L. S. Slevin, CAS). ORANGE CO.: Anaheim (Coquillett, ANSP). RIVERSIDE CO.: Keen Camp (E. I. Schlinger, UCD). 5 mi. E. Hemet, VIII–31–58 (D. M. Newell). Citrus Expt. Station, III–12–58 (J. A. Chemsak, CIS). Riverside, XI–8–33 (Timberlake, ANSP). Corona, IX–2–19 (ANSP). SAN DIEGO CO.: Alpine, X–13–50 (H. H. Keifer, CDA). Descanso Distr., X–12–50 (H. H. Keifer, CDA); IX–13–22, 2400 ft. elevation (Rehn & Hebard, ANSP). Potrero, IX–12–22, 2333 ft. elevation (Rehn & Hebard, ANSP). Jamacha, IX–12–22, 340 ft. elevation (Hebard, ANSP). Dulzura, IX–12–22, 1500 ft. elevation (ANSP). Chula Vista, IX–11–22 (Rehn & Hebard, ANSP). Otay, VII–9–35 (R. H. Beamer, ANSP). Ocean Beach, IX–20–22 (O. C. Poling, ANSP). Coronado Beach, VIII–16–07. Tiajuana, IX–11–22. Mission Valley (J. I. Madigan, UCD). Kearny Mesa (J. I. Madigan, UCD). SANTA BARBARA CO.: Santa Barbara, VIII–22–09 (Hebard, ANSP). SAN BERNARDINO CO.: San Bernardino Mts., Harvey's Mill Creek, VIII–30–19 (ANSP). Verdemont, Cajon Wash, IX–2–19, 1700 ft. elevation (Rehn & Hebard, ANSP). SANTA CLARA CO.: Stevens Creek, IX–8–41 (K. Frick, CIS). Lick Hill, IX–4–41 (K. Frick, CIS). Holy City, IX–14–41 (K. Frick, CIS). SANTA CRUZ CO.: Santa Cruz, IX–9–28 (K. Frick, CIS); XI–4–20 (E. P. VanDuzee, CAS). Felton, VIII–13–59 (D. C. Rentz, DCR). 2 mi. S. Felton, VII–30–59 (D. C. Rentz, DCR). SAN LUIS OBISPO CO.: Paso Robles, VIII–21–09, 1000 ft. elevation.

Genus *Xeracris* Caudell, 1915

(see page 132)

Subfamily OEDIPODINAE
(band-winged grasshoppers)

Many species of this subfamily have the hind wings colored red, orange, yellow, yellow-green, black, purple, or with a black band giving the common name of band-winged grasshoppers.



Map 62. California distribution of: ■, *Psoloessa delicatula delicatula* (Scudder); ●, *Psoloessa thamnogaea* Rehn.

Dirsh (1956) and Rehn and Grant (1960a) consider this subfamily to be of lesser rank, and include it as a "group" in the subfamily Acridinae. This placement was principally based upon Dirsh's study of the male phallic complex, where he found no differences upon which to base their separation into subfamilies. While we do not disagree with this consolidation, certain external characters which are easily seen, and possessed by so many of our species, render it a convenient group for our purposes.

Uvarov (1966) recognizes the subfamily as a valid unit and this was followed recently by Hewitt and Barr (1967) who studied this subfamily in Idaho.

The tegmina are nearly always long, except in some females of *Agymnastus;* the face is usually vertical and rounded at the vertex; the median carina of the pronotum is raised into a sharp, sometimes very conspicuous ridge or crest, and is usually cut by one or more transverse sulci. A few of our genera *(Anconia, Cibolacris, Coniana,* and *Xeracris)* lack colorful wings and pronotal carinae, but have usually been considered in the Oedipodinae. *Ligurotettix* is keyed in both subfamilies, but is considered to be more acridine than oedipodine.

The band-winged grasshoppers are found in greatest abundance in the more arid parts of the

west such as deserts, stony dry arroyos, and sparse grassy areas. Very few are of significant economic concern, but since many of the species are abundant on sparsely vegetated land, they may be important competitors for what little forage is available. *Camnula pellucida* is without question our most important economic species.

KEY TO THE CALIFORNIA GENERA AND SOME SPECIES OF OEDIPODINAE

1 Pronotal carinae absent, or weakly elevated, hind wing clear to lightly infuscated, not colored or banded with black 2
Pronotal carinae, at least the median, well developed; wing in most species colored, banded with black or both 6

2 Costal field of the tegmen broadly expanded by one series (in males) or by two series (in females) of enlarged hyaline cells . . *Ligurotettix* (p. 75)
Costal field of the tegmen not broadly expanded . 3

3 Body small (12–19 mm.) 4
Body larger (20–40 mm.) 5

4 Metasternal interspace linear in male, quadrate in female, posterior ventral angle of pronotum not produced (fig. 24) . . . . . *Xeracris minimas* (Scudder) (p. 132)
Metasternal interspace quadrate to transverse in male; transverse in female; posterior ventral angle of pronotum produced (fig. 25) . . . *Coniana snowi* Caudell (p. 98)

5 Inner apical spurs of hind tibia subequal to outer spurs; fastigial impression of head elongate in both sexes; metazona of pronotum not greatly expanded; ground dwelling species . . . . *Cibolacris parviceps* (Bruner) (p. 95)
Inner apical spurs of hind tibia nearly twice as long as outer spurs; fastigial impression of head broadly rounded in both sexes; metazona (fig. 26); bush inhabiting species . . . . . *Anconia integra* Scudder (p. 86)

6 Median pronotal carina entire or cut by one sulcus . 7
Median carina cut by two sulci 16

7 Metasternal interspace of ♂♂ linear; metasternal interspace of ♀♀ quadrate, and at least as wide as long, but narrower than mesosternal interspace 8
Metasternal interspace of ♂♂ at least as wide as long; metasternal interspace of ♀♀ at least 1½ times wider than long 11

8 Wings deeply colored, vertex of head rugose . . *Arphia* (p. 87)
Wings pellucid or faintly colored, vertex not as above 9

9 Intercalary vein midway between the median and ulnar veins, only apically approaching the latter . . . . . *Chortophaga* (p. 95)
Intercalary vein nearer the ulnar vein 10

10 Median carina elevated on the pronotum; carina distinct on vertex . . . *Chimarocephala* (p. 92)
Median carina not elevated on the pronotum; carina indistinct on the vertex . . . . . *Encoptolophus* (p. 108)

11 Lateral carinae of pronotum traversed by principal sulcus, but continuing anterior to it 12
Lateral carinae not continuing anterior to point traversed by sulcus 14

12 Wings pellucid . *Camnula pellucida* (Scudder) (p. 91)
Wings colored 13

13 Lateral lobe of pronotum weakly, or not at all produced . . . . . (in part) *Cratypedes neglectus* (Thomas) (p. 102)
Lateral lobe of pronotum weakly, or not at all produced . . . . . (in part) *Sticthippus californicus* (Scudder) (p. 112)

14 Tegmina with distal fifth (or more) of costal region membranous; fastigium bisected by continuous longitudinal carina . . . . . *Dissosteira* (p. 105)
Tegmina with costal area coriaceous to tip; fastigum with interrupted carina 15

15 Head rugose; fastigium truncate . *Lactista* (p. 109)
Head smooth; fastigium trigonal . . . . . *Microtes occidentalis* (Bruner) (p. 111)

16 Lateral carinae of pronotum traversing principal sulcus 17
Lateral carinae of pronotum interrupted by principal sulcus 20

17 Hind wing disc blue or blue-green . . . . *Leprus intermedius* Saussure (p. 110)
Hind wing disc not as above 18

18 Vertex of head broadly rounded, smooth, and prominent 19
Vertex of head not prominent, slightly rugose, quite flattened . . . . . *Xanthippus* (p. 128) (incl. Agymnastus) (p. 128)

19 Lateral lobe of pronotum distinctly produced produced . . . . (in part) *Cratypedes* (p. 102)
Lateral lobe of pronotum weakly, or not at all produced . . . . (in part) *Sticthippus* (p. 112)

20 Posterior angle of pronotal lateral lobes rounded (oblique), with or without a tooth 21
Posterior angle of pronotal lateral lobes acutely produced 25

21 Posterior angle of pronotal lateral lobes with a tooth 22
Posterior angle of pronotal lateral lobes without a tooth 23

22 Median pronotal carina distinct and elevated on the metazona; fasciations on tegmina extending no further than ulnar vein . . . . *Conozoa* (p. 99)
Carina weak on metazona; fasciations extending across whole of tegmina . . . . . (in part) *Trimerotropis* (p. 99)

23 Hind wing anal veins strongly reinforced (fig. 61) 24
Hind wing anal veins not strongly reinforced . 25

24 Some of superjacent radiate veins swollen (fig. 61); *Circotettix* (p. 96)
All superjacent radiate veins swollen . . . . *Aerochoreutes* (p. 83)

25 Black band strongly present on hind wing . . . 26
Black band absent on hind wing or only faintly indicated as a broad smoky area . . . . . *Trepidulus* (p. 112)

26 Inner face on hind femur blue; wing disk red;

median carina of pronotum elevated . . . . *Metator nevadensis* (Bruner) (p. 111)
Without above combination 27
27 Lateral lobes of pronotum broadly rounded . . 28
Lateral lobes of pronotum acutely produced . . 29
28 Metazona 1½ times (often twice) as long as prozona . . . (in part) *Trimerotropis* (p. 99)
Metazona and prozona of nearly equal length, the metazona never 1½ times as long as prozona; small grasshoppers with protruding eyes and tuberculate pronotum . . . *Derotmema* (p. 103)
29 Lateral foveolae of vertex small, margins rounded; wing disk yellow or reddish . . . . . *Mestobregma impexum* Rehn (p. 110)
Lateral foveolae of vertex large, margins straight; wing disk yellow . . . . . *Trachyrhachys kiowa kiowa* (Thomas) (p. 112)

Genus *Aerochoreutes* Rehn, 1921

KEY TO CALIFORNIA SPECIES OF AEROCHOREUTES

1 Wing deep black with hyaline apex . . . . . *maculatus* (p. 83)
Wing not black but sometimes with blackish suffusions 2
2 Wing colorless, swollen veins dusky to black (Great Basin) *carlinianus* . . *carlinianus* (p. 83)
Wing yellow, swollen veins yellow (Coast Range) *stenometopus* (p. 84)

Aerochoreutes carlinianus carlinianus (Thomas)

(Map 63)

Oedipoda carliniana Thomas, 1870, Proc. Acad. Nat. Sci. Phila., p. 81. Lectotype ♂, Colo., designated by Hebard, 1927 (USNM).

Oedipoda carliniana, Thomas, 1876, Ann. Rep. U.S. Geol. Surv. Terr., 2:275.

Circotettix carlinianus, Thomas, 1876, Proc. Davenport Acad. Sci., 1:254.

Aerochoreutes carlinianus, Rehn, 1921, Trans. Amer. Ent. Soc., 47:173, Pl. 11, Figs. 1–3.

California specimens studied are brown, tegmina with a number of small dark spots, more or less aggregated into nubeculae. Hind femur inconspicuously cross-banded, hind tibia yellow-brown. Wing clear, swollen radiate veins black with a narrow black band on each side. Fastigium broader than long, even in male. Pronotum with median carina very low on metazona, a little elevated on prozona, hind margin rectangulate.

Body 25–28; tegmen 23–27; hind femur 13–13.

Geographic range.—Rocky Mountains and northern Great Basin west to California.

California records.—(Map 63) MONO CO.: The Hot Springs, 3 mi. S.S.E. Bridgeport, Hot Springs Canyon, VIII–, 12–62, 6600 ft. elevation (H. B. Leech, CAS). Above Ellery Lake, VIII–11–15, 9600 ft. elevation (M. J. D. White, ANSP). NEVADA CO.: Grass Valley, VIII–4–48 (CDA). PLUMAS CO.: Mt. Ingalls, X–12–61 (J. S. Buckett, UCD).

Discussion—California specimens conform more closely with the nominate subspecies than with *A. carlinianus strepitus* Rehn.

Aerochoreutes maculatus (Scudder) new combination

(Fig. 173, Map 63)

Circotettix maculatus Scudder, 1880, Sec. Rep. U.S. Ent. Comm., App. 2:26. No lectotype designation. 3 ♂♂, summit Sierra Nevada (probably vicinity Donner Pass).

Circotettix maculatus, Scudder, 1900, Psyche, 9:137.

Gray, often with brown tints on the head and pronotum, thickly mottled with black, outer face and upper paginae of hind femur with two black bands. Hind tibia yellow-brown. Wing black, the apical third fuliginous in male, clear in female. Pronotum with hind margin obtuse to rectangular, median carina very little elevated on prozona. Cheeks and sides of thorax clothed with long, white hairs.

Body 22–24; tegmen 21–25; hind femur 11–12.

Geographic range.—Higher elevations of Sierra Nevada and San Bernardino Mountains of California.

California records.—(Map 63) ALPINE CO.: Winnemucca Lake, VII–30–59 (P. M. Marsh, UCD). Blue Lakes, VII–17–60 (C. G. Moore, UCD). Lake Alpine, VI–21–60 (R. W. Thorp, DCR). EL DORADO CO.: Upper Echo Lake, VII–10–24 (E. O. Essig, CIS). Echo Lake, VII–17 to 25–55; VI–30–59; VII–1 to 15–58; VII–6–60 (W. W. Middlekauff, CIS); VI–26–59, immatures (W. W. Middlekauff, CIS); VIII–3–42 (P. H. Arnaud, DCR). Fallen Leaf Lake, VII–19–15 (E. C. Van Dyke, CAS); VIII–19–15 (L. S. Rosenbaum, ANSP). FRESNO CO.: Heart Lake, IX–1–52, 10,500 ft. elevation (E. I. Schlinger, UCR). Kaiser Pass, VII–24–37 (A. T. McClay, UCD). Bubbs Creek Canyon, Kings River, VII–9–10, 10,500 ft. elevation (E. C. Van Dyke, ANSP). Huntington Lake, VII–23–19 (F. C. Clark, ANSP). INYO CO.: Mono Pass, VIII–13–57 (J. A. Powell & D. D. Linsdale). Near Mono Pass, VIII–9–59, 12,000 ft. elevation (C. D. MacNeill, DCR). Ruby Lake, VIII–13–57, 11,250 ft. (D. D. Linsdale & J. A. Powell). Lone Pine Creek, VII–7–61, 10,250 ft. elevation (W. A. Foster). Upper meadows, Whitney Pass Trail, IX–6–19, 10,700 ft. elevation (Rehn & Hebard, ANSP). Lone Pine Lake, Whitney Pass Trail, IX–6–19 (Rehn & Hebard, ANSP). Mono Pass, IX–6–60, 12,000 ft. elevation (D. C. Rentz, DCR); VIII–12–64; VIII–22–65 (J. D. Birchim, JDB). North of Mono Pass, VIII–8–61 (D. C. Rentz, C. D. MacNeill & M. R. Lundgren, CAS). Whitney Portal, VII–2–61 (D. C. Rentz, CAS). Big Pine Creek, VIII–20–20 (I. McCracken, CAS). MADERA CO.: Shadow Lake, VIII–4–36 (G. & R. Bohart, CAS). MONO CO.: Ellery Lake, VII–28–50 (M. J. D. White, ANSP); IX–12–62 (J. T. Doyen, CIS). Sonora Pass, VIII–10–57 (R. R. Montanucci, CIS). Mammoth Lake, VII–11–58 (C. Cushner, DCR). Virginia Lakes, Ridge, VIII–10–64, 11,000 ft. elevation (J. D. Birchim & C. D. MacNeill, JDB). Mammoth Lake, VII–27–33 (G. & R. Bohart, CAS). Mountains S.E. of Red Lake, VIII–16–62, 11,400 ft. elevation (H. B. Leech, CAS). MARIPOSA CO.: Yosemite Nat. Park,

Sentinel Dome, VIII–8–40 (E. R. Helwig, ANSP). Glacier Point Rd., VIII–7–40 (E. R. Helwig, ANSP). Clouds' Rest, VIII–12– A. P. Morse (ex: Scudder). Yosemite, V–22–31, 3880–4000 ft. elevation (E. O. Essig). Kerrick Meadows, VII–28–34 (CIS). McCabe Lakes, VIII–30–39, 11,000 ft. elevation (R. L. Usinger). Boundary Hill, VII–7–54 (R. P. Allen, CDA). Tioga Pass, IX–7–59 (D. W. Price). 7 mi. N.E. Fish Camp, VII–6–46 (H. P. Chandler, CAS). PLACER Co.: Squaw Peak, VIII–31–10, 8500 ft. elevation, summit, (ANSP). Lake Tahoe, August (CAS). Five Lakes Valley, foot of Squaw Peak, VIII–31–10, 7500 ft. elevation (ANSP). Donner Pass, VII–31–59 (J. R. Helfer, CAS). SAN BERNARDINO Co.: San Bernardino Mts., Mt. San Gorgonio, VIII–20–15, 11,485 ft. elevation (J. Grinnell, ANSP). Near San Gorgonio Peak, IX–9–15, 9,000 ft. elevation (J. W. Rich, ANSP). San Gorgonio Peak Summit, VIII–29–19, 11,200 ft. elevation (Rehn & Hebard, ANSP). TULARE Co.: Mineralking, VIII–15–56 (W. Simonds, CDA). Siberian Outpost, VII–31–15, 9500 ft. elevation (CIS). TUOLUMNE Co.: Tuolumne Meadows, VII–13–15 (C. L. Fox, ANSP). Sonora Pass, VIII–1–50, 9650 ft. elevation (M. J. D. White); VIII–4–48 (P. D. Hurd & J. W. MacSwain, CIS); VIII–10–57 (D. D. Linsdale). Blue Canyon, VIII–30–60 (P. D. Hurd, J. W. MacSwain & A. S. Menke, CIS); VIII–10–63 (C. A. Toschi, CIS). Sonora Peak, VIII–10–57 (J. A. Powell, CIS); VIII–6–59 (D. C. Rentz, DCR). Bennit's Juniper, VII–7–58 (W. H. Lange, UCD). Tuolumne Meadows, VIII–19–55 (J. W. MacSwain, CIS). Chipmunk Flat, VIII–9–60 (G. W. Colliver). Sonora Pass, VII–18–61 (M. Lundgren, DCR). Sonora Pass, VIII–14–62 (C. W. O'Brien, CAS); VIII–6–59 (D. C. Rentz, CAS); VII–26–62 (D. C. Rentz & C. D. MacNeill, CAS).

Discussion—This interesting black-winged grasshopper is commonly heard in the higher elevations of the Sierra Nevada and the San Bernardino Mountains. It frequents granitic slopes and its loud rattling-type stridulation is startling at first to the unsuspecting hiker since the grasshopper's sound is not greatly unlike that of a rattlesnake. Males can be seen hovering for short periods in stridulation above resting females.

In ejecting this species from *Circotettix* in 1921, Rehn suggested no alternate placement. The closest affinities of this insect are certainly with *Aerochoreutes* but more refined taxonomy may require the definition of a new genus for *maculatus*.

Aerochoreutes stenometopus
Strohecker and Buxton

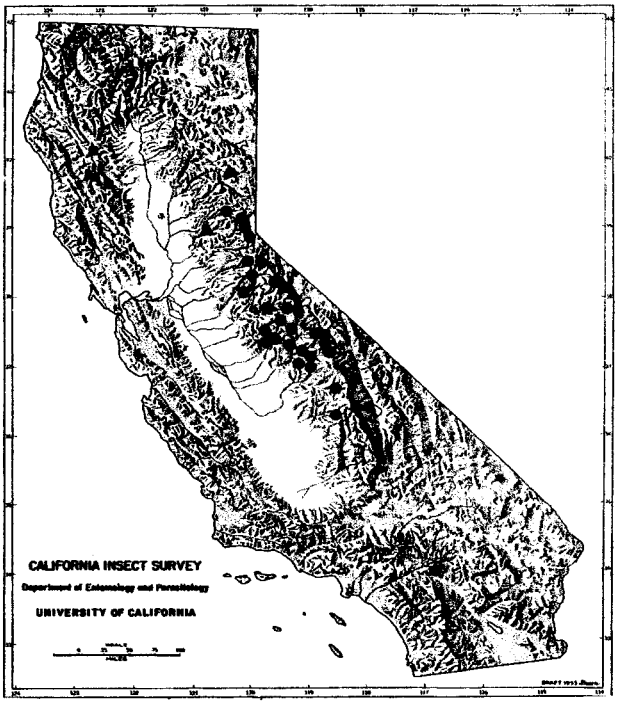
(Map 63)

Aerochoreutes stenometopus Strohecker & Buxton, 1963, Pan-Pac. Ent., 39:261, Figs. 1, 2. Holotype ♂, Telephone Campgrounds, Glenn Co., Calif.

Gray, tegmen with fuscous spots aggregated into faint bands. Wing yellow, the radiate anal veins yellow basad, dark distad, apex clear, middle of costal area with a small dusky cloud. Hind tibia yellow. Fastigium longer than wide in male, but little wider than long in female. Pronotum with hind margin acute-angulate, median carina about as in *A. carlinianaus*.

Geographic range.—California.

California records.—(Map 63) GLENN Co.: Plaskett Meadows, IX–14–60 (G. M. Buxton, CDA). 3 mi. W. Plaskett Meadows Station, VIII–1–62 (G. M. Buxton, CDA). Telephone Campground, VIII–20–58 (P. H. Arnaud & H. H. Keifer, CDA). 4 mi. W. Plaskett Meadows Station, X–10–64, 6400 ft. elevation (D. C. & K. A. Rentz, DCR) topotypes. MENDOCINO Co.: 3.5 mi. N. Black Butte Mts., VIII–27–53 (F. L. Blanc, CDA). TRINITY Co.: Cold Springs, S. Fork Mt. IX–18–62 (F. L. Blanc & G. M. Buxton, CDA).



Map 63. California distribution of: ▲, *Aerochoreutes carlinianus* (Thomas); ●, *Aerochoreutes maculatus* (Scudder); ■, *Aerochoreutes stenometopus* Strohecker and Buxton.

Discussion—The statements by Strohecker and Buxton (1963:263) concerning the similarity of the stridulatory habits of this species and the sympatric *Circotettix undulatus thalassinus* are incorrect. *A. stenometopus* possesses a buzzing type of stridulation not greatly unlike that of *A. maculatus*, and does not "snap at irregular intervals" as was stated. It flies rather close to the ground seldom exceeding ten to twenty feet, another feature in which it differs from the higher flying *Circotettix*.

Genus *Agymnastus* Scudder, 1897

(For key to species see *Xanthippus*, page 128)

Agymnastus ingens (Scudder)

(Fig. VI, Map 64)

Leprus ingens Scudder, 1877, Proc. Boston Soc. Nat. Hist., 19:32. Type ♀, Sauzalito (sic), Calif. (MCZ?).

Xanthippus? ingens, Saussure, 1884, Mem. Soc. Genève, 28:93.

Xanthippus vitellinus Saussure, 1884, Psyche, 6:90.

Agymnastus ingens, Scudder, 1897, Can. Ent. 29:75.

Hippiscus (Xanthippus) aurilegulus Scudder, 1892, Psyche, 6:362.

Hippiscus (Xanthippus) stigmosus Scudder, 1892, op. cit., p. 363.

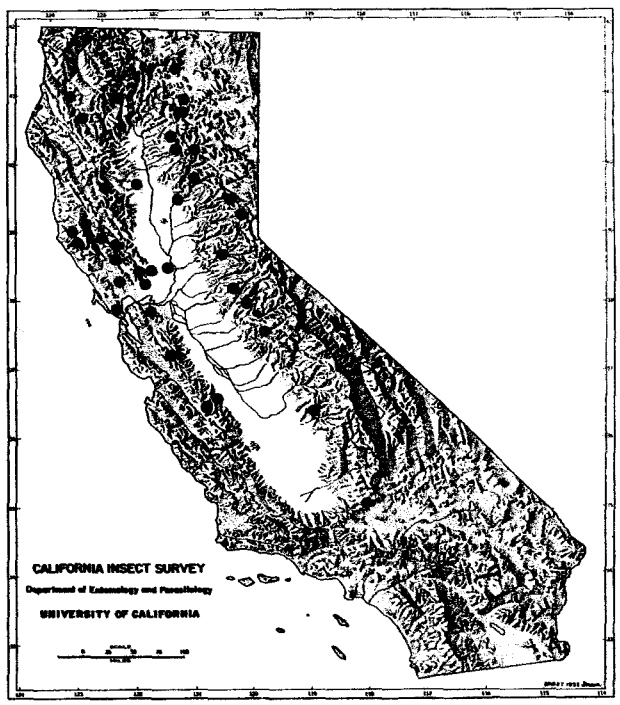
Dark brown, tegmina often with pale dorsal stripe, inner face and lower sulcus of hind femur blue-black, hind tibiae usually coral red. Pronotum rough, hind margin acute (male), rectangular to obtuse (female). Antennae short and stout.

Females of the many populations including Mt. Hamilton, Marin County, and Lake County are obese with short tegmina; elsewhere females conform more closely to the normal robustness of the group but are usually broader through the thorax than are the species here referred to *Xanthippus*. Males may closely resemble *X. calthulus* but are separable by the bright red hind tibiae. The dorsal edge of the epiphallic lophi is straight in *ingens*, rather deeply emarginate in *calthulus*.

Body 24–38; tegmen 24–20, 30; hind femur 13–19.

Geographic range.—California.

California records.—(Map 64) BUTTE Co.: Jarboe Pass, V–12–49 (J. W. MacSwain). Oroville, VII–20–28 (H. H. Keifer, CAS). CALAVERAS Co.: Camp Wolfboro, V–28–39; VII–22–37 (G. Spurlock). CONTRA COSTA Co.: Mt. Diablo, VI–11–61 (W. E. Ferguson). EL DORADO Co.: Snowline Camp, VI–24–48 (D. Carter); VI–20–48 (J. W. MacSwain); VI–25–48 (R. C. Bynum). FRESNO Co.: Panoche, IV–29–22 (E. C. Van Dyke, CAS). Mercy Hot Springs, VIII–26–62 (D. C. Rentz & E. W. Kirschbaum, CAS). GLENN Co.: 25 mi. E. Covelo, VI–28–61 (D. C. Rentz, DCR). 1 mi. W. Low Gap, VIII–26–61 (D. C. Rentz, CAS). 4 mi. W. Plaskett Meadows, VI–28–62 (J. R. Helfer, CAS). HUMBOLDT Co.: Willow Creek, VII–19–29 (E. C. Van Dyke, CAS). KERN Co.: Tehachapi, VII–6–28 (T. Craig, CAS). LAKE Co.: IV–30–62 (J. T. Doyen, CIS). Clear Lake, V–25–41, V–24–41 (K. Frick, CIS). Kelseyville, V–2–39. Hobergs, V–25–41 (K. Frick, CIS). Middletown, V–14–40 (K. Frick, CIS). Anderson Springs, IV–4–59 (J. S. Buckett, CAS). MARIN Co.: Mt. Tamalpais, VII–9–11 (C. P. Gooding, ANSP); V–10–56 (F. X. Williams, CAS). Cypress Ridge, XII–18–59, 3rd instar, V–14–60 (D. C. Rentz, DCR); V–21–62 (C. D. MacNeill, DCR); IV–19–30, IV–30–22 (E. C. Van Dyke, CAS); IV–19–30 (E. P. Van Duzee, CAS). Fairfax, V–11–19 (E. P. Van Duzee, CAS). Ross, IV–28–18 (E. P. Van Duzee, CAS). Muir Woods, V–21–16 (E. P. Van Duzee, CAS). MARIPOSA Co.: Sand Flat, Yosemite Nat. Park, VI–7–30, 5500 ft. elevation (E. O. Essig). MENDOCINO Co.: Ukiah, IV–1885 (ex: Scudder). Bonneville Grade, VI–10–59 (D. C. Rentz, DCR). Yorkville, VI–29–59 (J. R. Helfer, CAS). NAPA Co.: (ex: Scudder). Monticello, IV–28–36. NEVADA Co.: Sagehen Creek, VII–5–62 (C. A. Toschi); VI–27–64 (M. J. Tauber & C. A. Toschi). PLACER Co.: June (ex: Scudder). PLUMAS Co.: Meadow Valley, VI–12–24, 3500–4000 ft. elevation (W. H. Nelson). Mt. Ingalls (I. LaRivers). Chester, VI–23 to 30–48; VI–10–54 (D. J. & J. N. Knull, CIS). SANTA CLARA Co.: Mt. Hamilton, V–25, VI–9–22 (E. O. Essig & S. E. Flanders); VI–9, 20–22 J. Lamiman); V–27–61 (D. C. Rentz, DCR). SHASTA Co.: Hat Creek, VI–4–48 (C. W. Anderson); VI–17–48, VII–7–48 (L. G. Smith); VI–20–55 (R. D. Browning). Viola, V–20–41. Fall River Mills, VII–11–23. Lassen N. P., VII–9–23 (F. H. Wymore). Shingletown, VI–5–41 (E. G. Linsley). Lake Eiler, VII–9–47 (C. A. Hanson). Lake Britton, VI–29–47 (T. F. Leigh). SIERRA Co.: Packer Creek, V–28–49 (R. M. Bohart, UCD). SISKIYOU Co.: Medicine Lake, VI–19–51 (R. W. Harper). SOLANO Co.: Green Valley Falls, IV–27–41 (K. Frick, CIS). SONOMA Co.: Eldridge, Mt. Hood, V–2–17 (J. A. Kusche, ANSP). Cloverdale, VI–12–59 (J. R. Helfer, CAS). TEHAMA Co.: 35 mi. W. Orland, V–13–61 (D. R. Miller). Mineral, VI–25–48 (D. J. & J. N. Knull, CIS). TRINITY Co.: Eagle Creek, V–28–49 (A. T. McClay, UCD). Carrville, June (F. E. Blaisdell, CAS). North Fork, VI–7–33 (R. P. Allen, CAS). TULARE Co.: Dinuba, VIII–2–57 (R. E. Rice). TUOLUMNE Co.: Strawberry, VI–22 to VII–1–51 (E. G. Linsley, A. T. McClay, J. W. MacSwain, D. P. Lawler & S. M. Kappos, CIS, UCD). YOLO Co.: Davis, VI–10–59 (J. R. Helfer, CAS).



Map 64. California distribution of *Agymnastus ingens* Scudder.

Discussion—The robust female resembles a pebble or a lump of soil and is reluctant to move. The coastal

ones do not fly, but the Sierran ones do. They are usually found as localized populations on hillsides with short grass and exposed soil.

Genus *Anconia* Scudder, 1876
Anconia integra Scudder
(Map 65)

Anconia integra Scudder, 1876, Ann. Rept. Chief Eng., App. JJ:514. No lectotype designation. ♂, ♀ "Mojave Desert, Southern California" (MCZ?).

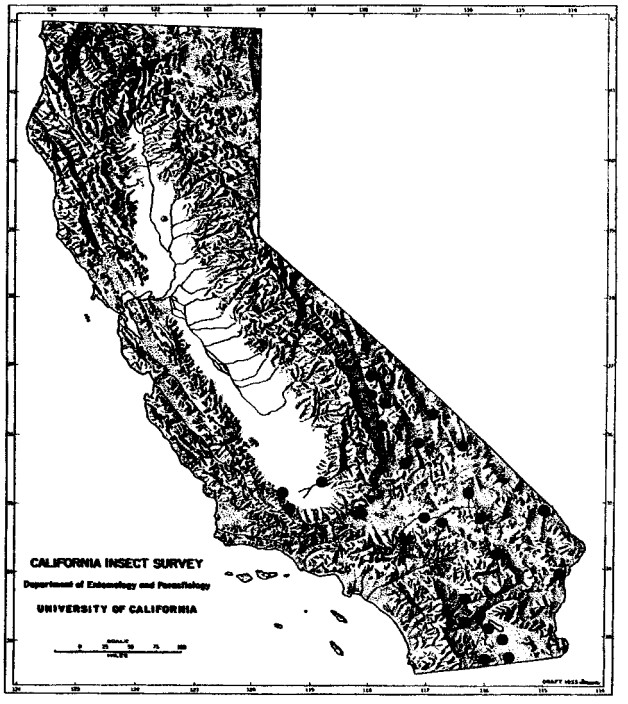
Anconia grisea Bruner, 1906, Biol. Cent.-Amer. Orth., 2:186.

Elongate, head very small, thorax stout especially in female. Pronotum with hind margin obtusely subangulate, carinae obsolete but lateral ones obtuse on metazona. Whitish to pale green, usually mottled with brown or olivaceous on tegmina, but sometimes plain. Upper paginae of hind femur with two black spots, hind tibia yellow. Wing entirely clear.

Body 22–23; tegmen 23–34; hind femur 12–18.

Geographic range.—Western Nevada and eastern California, south to desert regions of California, Arizona and Mexico.

California records.—(Map 65) IMPERIAL CO.: Palo Verde, VIII–17–46 (W. F. Barr). Obsidian Butte, III–26–59 (C. A. Toschi, CIS). 3 mi. S. Palo Verde, IV–8, 9–63 (P. D. Hurd & J. A. Powell, CIS). Salton Sea, IV–4–58 (C. A. Toschi, CIS). Kane Springs, 75 ft. below sea level, IX–17–22 (Rehn & Hebard, ANSP). Colorado Desert, X–1–10, 130 ft. elevation. Salton Sea, VII–20–40 (E. R. Helwig, ANSP). Calexico, VIII–11–14 (J. C. Bradley, ANSP). Coyote Wells, IX–16–22, 270 ft. elevation (Rehn & Hebard, ANSP). El Centro, VIII–25–31 (E. R. Tinkham, ANSP). INYO CO.: 9 mi. N. Shoshone, V–5–60 (J. W. MacSwain, CIS). Furnace Creek, Death Valley, IV–1–51 (E. G. Linsley & P. D. Hurd, CIS); III–29–53 (J. W. MacSwain, CIS). 3 mi. S. Olancha, VIII–6–48 (J. W. MacSwain, CIS). Bennet's Well, III–30–52 (A. E. Michelbacher, CIS). Shoshone, IV–2–51 (P. D. Hurd, CIS); IV–11–60 (J. R. Helfer, CAS). Keeler, IV–28–53 (R. O. Schuster & G. A. Marsh, UCD). 15 mi. N. Ballarat, IV–7–61 (R. P. Allen, CDA). Searles Valley, VI–6–56 (J. M. Burns, CIS). Keeler, VII–6–14 (Wickham, ANSP). Death Valley, IX–8–24, 2037 ft. elevation (M. Hebard, ANSP); IV–1926 (J. B. Gunner, CAS); gradual slope opposite Boundary Canyon, VIII–16–19, sea level (M. Hebard, ANSP); near Boundary Canyon, VIII–16–19, 150 ft. below sea level (Rehn & Hebard, ANSP); Salt Well, foot of Emigrant Wash, VIII–14–19, 20 ft. below sea level (Rehn & Hebard, ANSP). Acme, VIII–8–19 (ANSP). 3 mi. E. Independence, VII–27–64 (J. D. Birchim, JDB). 5 mi. N. Lone Pine, VII–7–64 (J. D. Birchim, JDB). 4 mi. N. Lone Pine, V–27–54 (J. Rehn, ANSP). Owen's Lake, VII–14–64 (J. D. Birchim, JDB). Wild Rose Canyon, IX–8–22, 5500 ft. elevation (M. Hebard, ANSP). Panamint Valley, opposite Hall Canyon, IX–6–22, 1500 ft. elevation (ANSP); Ballarat, IX–8–22, 1067 ft. elevation (ANSP); IX–6–22, 1067 ft. elevation (Rehn & Hebard, ANSP). Goodale Creek, N. of Lone Pine, IV–3–53 (H. B. Leech, CAS). Sand dunes near Stovepipe Wells, IV–2– (CAS). 3 mi. E. Big Pine, VII–21–64 (D. C. & K. A. Rentz, DCR). Kearsarge Station, VII–5–65 (J. D. Birchim, JDB). Tecopa, VIII–8–19 (M. Hebard, ANSP). KERN CO.: McKittrick, V–5–41 (K. Frick, CIS). 10 mi. N.E. Ford City, V–4–54 (J. Rehn, ANSP). Mojave, IX–15–10, 2750 ft. elevation (ANSP). Bakersfield, IX–15–10 (ANSP). RIVERSIDE CO.: Indio, VII–29– (Rehn & Hebard, ANSP); IX–17–22, 150 ft. elevation (Rehn & Hebard, ANSP); VII–29–07, 26 ft. below sea level (ANSP); VI–28–37 (A. T. McClay, UCD); X–15–57 (R. P. Allen, CDA); IV–5–51 (P. D. Hurd, CIS); IV–14–61 (J. R. Helfer, CAS); Salton Depression, VII–29–07, 26 ft. below sea level, all labeled as topotypes. Salton Sea, VII–22–52 (J. K. Hester); II–17–51 (W. D. Murray); V–3–52 (H. M. Graham). Deep Canyon, Palm Desert, III–20–58 (D. M. Newell, CIS). Ripley, IV–4–51 (E. G. Linsley, CIS). Coachella, III–25–33 (C. D. Duncan, CIS); V–24–28 (E. C. Van Dyke, CAS). Rancho Mirage, VII–21–52 (R. L. Anderson). Oasis, IX–17–22, 186 ft. below sea level (Rehn & Hebard, ANSP). 1 to 3 mi. S. Oasis, near the Riverside and Imperial County line, IV–11–42, 100 ft. below sea level (H. R. Roberts, ANSP). Palm Springs to Palm Canyon, IX–29–10, 500 ft. elevation (ANSP); IX–29–10, 800 ft. elevation (ANSP). Thermal, VIII–17–27, 100 ft. below sea level. SAN BERNARDINO CO.: Barstow, IV–7–42 (H. R. Roberts, ANSP); VIII–7–19 (Rehn & Hebard, ANSP). Mt. Aston, E. of Barstow, IV–7–42, 2000 ft. elevation (H. R. Roberts, ANSP). Needles, XI–27–21 (J. A. Kusche, CAS); VIII–4–19 (Rehn & Hebard, ANSP). Cottonwood, IX–9 (Rehn & Hebard, ANSP). Cottonwood Station, IX–9–07, 2774 ft. elevation (ANSP). Kelso, VIII–12 (Rehn & Hebard, ANSP); VIII–12–07, 2018 ft. elevation (ANSP). Cronise Valley, IV–29–56 (M. Wasbauer & P. D. Hurd, CIS). Yermo, IV–28–49 (E. G. Linsley, J. W. MacSwain & R. E. Smith, CIS); V–23–40 (G. E. Bohart, CAS). Goldstone Lake, IV–25–53 (R. O. Schuster, UCD). Victorville, V–1–53 (R. O. Schuster & G. A. Marsh, UCD). Baker, IV–16–64 (R. L. Langston, CIS); IV–5–63 (C. W. O'Brien, CAS). 5 mi.



Map 65. California distribution of *Anconia integra* Scudder.

N. Baker, III–29–53 (J. W. MacSwain, CIS). 10 mi. N.E. Earp, VIII–16–63 (C. A. Toschi, CIS). Bagdad, VIII–6–19 (Rehn & Hebard, ANSP). Newberry, IX–9–24, 1831 ft. elevation (Rehn & Hebard, ANSP). Trona, IX–5–22, 1700 ft. elevation (Rehn & Hebard, ANSP); IX–5–22, 1800 ft. elevation (Rehn & Hebard, ANSP). Silver Lake, VIII–8–19 (M. Hebard, ANSP). Amboy, VIII–9–59 (J. R. Helfer, DCR). Hopeville, VI–23–46 (E. C. Van Dyke, CAS). SAN DIEGO CO.: Borrego, V–3–56 (B. J. Adelson); X–10–50 (H. H. Keifer, CDA); V–1–52 (P. D. Hurd & G. A. Marsh, UCD); IV–25–54, in *Croton californicum* (P. D. Hurd, CIS); IV–26, 27–54 (J. G. Rogers); X–24–55 (M. S. Wasbauer, CIS). San Felipe Creek, V–3–59 (H. W. Cramer, Jr., CIS); VII–4–29 (P. W. Oman, ANSP). Anza-Borrego Park, Clark Dry Lake, III–23–59 (D. C. Rentz, DCR).

Discussion—This common inhabitant of the Sonoran Desert is one of the most ubiquitous grasshoppers present. It flushes readily usually coming to rest on creosote bush where it may be easily collected.

Several color phases exist, the commonest of which is a dull gray. A brilliant green form is rather striking when seen in life but this fades shortly after death. The least abundant color phase is a brownish one with whitish spots on the tegmina.

Genus *Arphia* Stal, 1873

A critical review of the many specific names which have been combined with *Arphia* is needed.

KEY TO THE CALIFORNIA SPECIES AND SUBSPECIES OF ARPHIA

1 Frontal costa very little narrowed above, its junction with fastigium broad; cheeks tumid, the head but little narrower than metathorax; wing scarlet with wide black band which often covers entire apex . . *pseudonietana* (Thomas) (p. 90)

Frontal costa considerably narrowed above, its junction with fastigium narrowly truncate to acute; cheeks rather flat, head narrower than metathorax; wing yellow or orange, rarely pink, the black band narrow and often not reaching front margin 2

2 Wing yellow . *conspersa behrensi* Saussure (p. 88)

Wing orange or pink 3

3 Frontal costa acutely narrowed to fastigium . . *conspersa ramona* Rehn (p. 89)

Frontal costa truncate at fastigium . . . . *conspersa conspersa* Scudder (p. 87)

Arphia conspersa conspersa Scudder

(Map 66)

Arphia conspersa Scudder, 1875, Proc. Boston Soc. Nat. Hist., 17:514. Type Locality, Dallas, Tex.

Arphia frigida Scudder, 1875, Rep. Geol. Res. 49th Par., App. D, p. 344.

Arphia arcta Scudder, 1876, Bull. U.S. Geol. Surv. Terr., 2:263.

Arphia teporata Scudder, 1876, Ann. Rep. Chief Eng., p. 508.

Arphia canora Rehn, 1904, Proc. Acad. Nat. Sci. Phila., p. 564.

Arphia pulchripennis Bruner, 1905, Biol. Centr.-Amer., Orth., 2:131.

Arphia conspersa, Hebard, 1937, Trans. Amer. Ent. Soc., 63:361.

Frontal costa abruptly narrowed above antennae, truncate at fastigium, where it is usually bifoveolate or with a median carina. Fastigium longer than broad in male; about as long as wide in female. Hind femur unusually stout for the genus, usually less than 3.5 times as long as its greatest width. Wings polychromatic over much of the wide range of the species, yellow, orange, or various shades of red.

In California typical *conspersa* is known from northern Del Norte County and Owens Valley in Inyo County. Through Kern and San Bernardino counties its seems to grade into southern populations having the characters of *ramona*, that is, fastigium in profile subhorizontal, frontal costa acutely narrowed above. Occasional southern specimens, however, have the frontal costa much as in typical *conspersa*.

In Tulare County on the western side of the Sierra *ramona* apparently intergrades with *behrensi;* specimens from Johnsdale and Posey are intermediate. In the coastal region specimens assignable to *ramona* have been taken as far north as San Joaquin (Hospital Canyon) and Contra Costa (Mt. Diablo) counties, while material identifiable as *behrensi* has been collected at Pinnacles National Monument in San Benito County. In this area of overlap the form named *koebelei* by Bruner occurs; its intermediate characters suggest hybridization between *ramona* and *behrensi*. Northward *behrensi* occurs over the state, maintaining its identity into Siskiyou and Modoc counties and Washoe County, Nevada.

It appears, from these observations, that *behrensi* is an old race of *conspersa*, differentiated in California and probably isolated during pluvial periods, and is now in the process of integration with genetic complexes evolved in the southern Rocky Mountain and high plains. The pink-winged phase, which in California is known only from Inyo County (except for Bruner's *pulchripennis* from the "vicinity of Los Angeles"), seems to be the most recent genome, accumulated in the southern high plains and spreading centrifugally. It is distributed from Texas to eastern Arizona, northward to southern Alberta and Idaho and in Nevada at least as far west as Fallon. From Nevada it has entered California via Owens Valley.

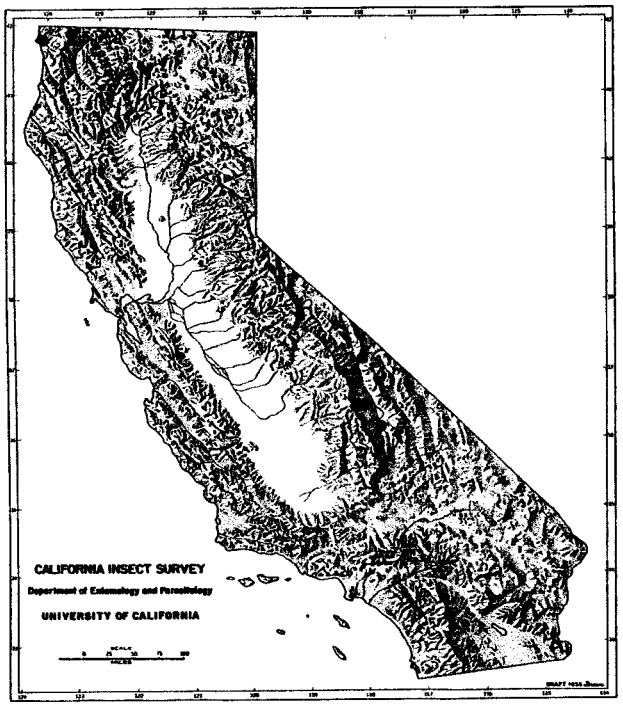
According to the ideas expressed, the name *behrensi* would be given trinomial status and the name *ramona* suppressed as representing intermediates but this matter is worth much more study.

Our arrangement may be of provisional usefulness until a thorough revision of *Arphia* becomes available.

Body 21–28; tegmen 21.5–24; hind femur 11.5–14.

Geographic range.—Alaska to eastern Texas and Mexico.

California records.—(Map 66) DEL NORTE CO.: N.E. corner, IX–6–60 (T. R. Haig, CDA). Crescent City, Madrone Forest Camp, VI–1937 (CDA). INYO CO.: Olancha, VI–26–48 (K. Frick, CIS). Whitney Portal, VIII–6–48 (P. D. Hurd & J. W. MacSwain, CIS). Lone Pine Creek, VII–7–61, 10,250 ft. elevation (J. S. Buckett, UCD); VII–5–63 (CIS). 7 mi. N. Parcher's Camp, VI–30–61 (W. A. Foster, CIS). Big Pine, VIII–24–60 (T. H. Gantenbein [wing pink] UCD). 6 mi. W. Big Pine, VI–20–62 (W. H. Lange [wing pink], UCD). Mazourka Canyon, VII–2–53 (W. D. McLellan [wing pink], UCD). Westgard Pass, VII–26–62, 7200 ft. elevation (D. C. Rentz, DCR). SAN BERNARDINO CO.: Lyons, IX–1–09, 3000 ft. elevation, on volcanic slopes (wing pink, ANSP).



Map 66. California distribution of *Arphia conspersa conspersa* Scudder.

Arphia conspersa behrensi Saussure

(Map 67)

Arphia behrensi Saussure, 1884, Prodome Oedip. pp. 66, 71. No lectotype designation. ♂♂, ♀♀, Calif. (Geneva, Switzerland?)

Arphia behrensi, Bruner, 1905, Biol. Centr.-Amer., Orth., 2:134.

Arphia koebelei Bruner, 1905, op. cit., p. 133.

Dark brown, tegmina usually with pale anal stripe; hind tibiae blue. Wing pale to deep yellow, with orange tint in some specimens from Tulare County, the yellow area along costa very narrow. In the form named *koebelei* by Bruner the yellow costal area is rather broad and extends into the apical third of the wing.

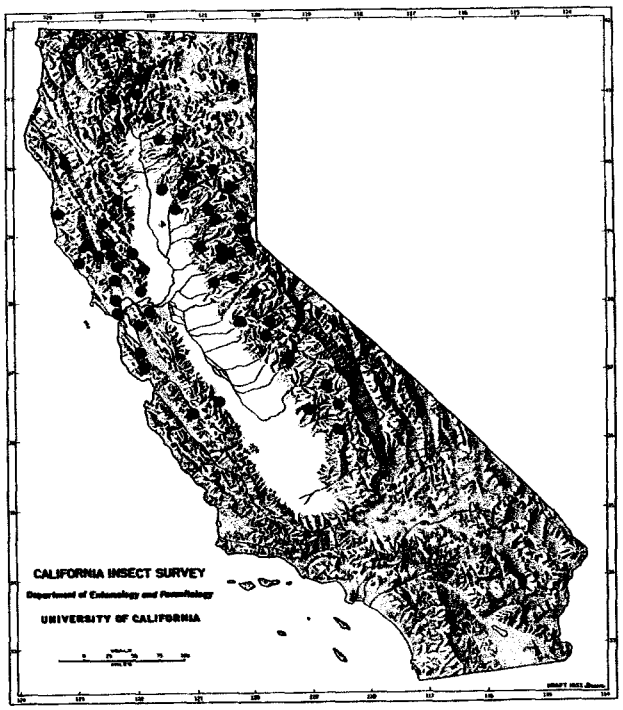
Intermediate specimens occur.

Body 19–30; tegmen 22–30; hind femur 12–15.

Geographic range.—California.

California records.—(Map 67) ALAMEDA CO.: Berkeley, VII–20–30. Oakland, IV–10–30 (W. C. Bentinck, CIS). ALPINE CO.: Hope Valley, VII–9–48 (J. W. MacSwain & L. W. Quate, CIS); VII–18–48 (S. A. Sher, CIS); VIII–18–48 (K. W. Tucker, R. A. Smith & V. M. Stern, CIS); VII–22–55 (E. E. Gilbert & N. A. Walker, CIS). AMADOR CO.: Volcano, V–5–57 (R. M. Bohart, UCD). Upper Lake, IV–18–57 (S. M. Fidel, UCD). BUTTE CO.: Jarboe Pass, V–12–49 (J. W. MacSwain, CIS); V–12–49 (P. D. Hurd, CIS). Richardson Springs, V–11–44 (E. C. Van Dyke, CAS). Oroville, III–13–28 (H. H. Keifer, CAS). Yankee Hill, III–20–28 (H. H. Keifer, CAS). CALAVERAS CO.: Avery, V–1–60 (J. R. Helfer, CAS). CONTRA COSTA CO.: Mt. Diablo, IV–22–34; IV–18–37 (A. T. McClay, UCD). EL DORADO CO.: Fallen Leaf Lake, VI–13–30 (A. T. McClay, UCD). Angora Peak, VII–11–15 (CIS). Snowline Camp, VI–20 to 27–48 (J. W. MacSwain, CIS); VI–21–48 (D. Carter, CIS); VI–20–48 (P. D. Hurd, CIS); VI–21–48 (S. A. Sher, CIS). Echo Lake, VI–21–48 (R. C. Bynum, CIS). 3 mi. S. Camino, VI–23–48 (J. W. MacSwain, CIS). Pollock Pines, VI–27–48 (S. A. Sher, CIS). Placerville, IV–21–55 (D. J. Burdick, CIS); V–20–13 (E. O. Essig, ANSP). Strawberry Valley, VIII–13–12 (E. C. Van Dyke, CAS). FRESNO CO.: Paradise Valley, Kings River, VII–15–10, 7000 ft. elevation (E. C. Van Dyke, ANSP). Panoche Canyon, IV–29–22 (E. C. Van Dyke, CAS). Wood Creek, VII–22–10 (E. C. Van Dyke, CAS). GLENN CO.: 8.5 mi. S.W. Elk Creek (R. M. Brown, CAS). HUMBOLDT CO.: Ft. Seward, V–22 to 27–35 (E. O. Essig & P. Schultes, CIS). LAKE CO.: Clear Lake, V–23 to 25–41 (K. Frick, CIS). Middletown, V–12–40 (K. Frick, CIS). Anderson Springs, IV–21–59 (J. S. Buckett, CAS). Lower Lake, V–25–59 (T. R. Haig, CDA). Upper Lake, V–17–22 (E. P. Van Duzee, CAS). Middletown, V–29–49 (H. B. Leech, CAS). MADERA CO.: Bass Lake, V–4–47 (H. H. Welsh, CIS). MARIN CO.: Ross, IV–16–24 (F. H. Wymore, CIS). Phoenix Lake, V–23–57 (J. A. Powell, CIS). Alpine Lake, IV–25–58 (J. A. Powell, CIS). Inverness, IV–30–60 (C. A. Toschi, CIS). Lake Lagunitas, IV–2–59 (C. A. Toschi, CIS); IV–22–16 (E. C. Van Dyke, CAS); V–15–59, IV–19–58, II–24–61 (D. C. Rentz, DCR). Mt. Tamalpais, IV–13–17 (F. E. Blaisdell, CAS). Cypress Ridge, IV–2–22 (E. C. Van Dyke, CAS); III–30–21 (J. O. Martin, CAS); II–30–60, IV–8–61, XII–20–59 (last instars) (D. C. Rentz, DCR). Ross, III–31–18 (E. P. Van Duzee, CAS). Mill Valley, III–15–25 (H. H. Keifer, CAS); IV–4–08 (F. X. Williams, CAS); IV–17–49 (R. Leech, CAS). Fairfax, V–9–20, V–11–19 (E. P. Van Duzee, CAS). 2 mi. S.W. Fairfax, near Meadow Club, IV–7–61 (D. C. Rentz, CAS). Vicinity of Phoenix Lake, V–3–62 (D. C. Rentz, CAS). Novato, VI–12–63, 11–10–63 (D. C. Rentz, CAS). MARIPOSA CO.: VI–10–14 (F. W. Nunenmacher, CIS). Yosemite Nat. Park, V–25–38 (N. A. Olson, CIS); V–17 to 31–38 (N. F. Hardman, CIS); VII–17–46 (R. L. Usinger, CIS). Miami Ranger Station, V–23–42 (E. G. Linsley, CIS); V–16, 23, 26–42 (C. Kennett, CIS). Yosemite Valley, V–22–21 (E. C. Van Dyke, CAS). Yosemite, VI–26–28 (E. O. Essig, ANSP); V–16–21 (E. C. Van Dyke,

ANSP). Mirror Lake, V–25–15 (J. W. Rich, ANSP). MENDOCINO Co.: Ryan Creek, IX–30–57 (immature); IV–17–38 (N. F. Hardman, CIS); III–8–54 (P. D. Hurd, CIS). North



Map 67. California distribution of *Arphia conspersa behrensi* Saussure.

Fork (R. P. Allen, CAS). Yorkville, IV–27–28 (E. P. Van Duzee, CAS). Willets, III–13–59 (J. R. Helfer, CAS). Mendocino, V–4–63 (D. C. Rentz, CAS); V–12–59, III–4–59 (J. R. Helfer, CAS). Glencoe, V–1–60 (J. R. Helfer, CAS). MODOC Co.: VI–7–39, 4500 ft. elevation (K. D. Snyder, CIS). Jess Valley, VI–14–51 (H. H. Keifer, CDA). NAPA Co.: Calistoga, III–8–34 (CIS). Mt. St. Helena, III–12–32 (CIS). Mt. Veeder, IV–6–47 (C. W. Anderson, CIS). Conn Lake, IV–20–52 (W. W. Middlekauff, CIS). Samuel Springs, V–9 to 13–56 (R. M. Bohart, UCD); IV–28–56 (C. G. Moore, CIS). Putah Canyon, IV–1–59 (C. G. Moore, CIS). Wooden Valley, IV–6–57 (J. A. Powell, CIS); IV–12–31 (E. C. Van Dyke, CAS). NEVADA Co.: Sagehen Creek, VI–25–54 (R. H. Goodwin & R. M. Bohart, UCD); VI–16–54 (J. A. Powell, CIS). Nevada City, IV–28–50 (R. T. Martin, CIS); IV–29–54 (J. T. Brooks, UCD). PLACER Co.: Colfax, V–20–52 (E. M. Evans, CIS). Auburn, V–9–59 (T. H. Gantenbein, CIS); IV–5–57 (T. D. Parker, UCD). Penryn, IV–9–30. Carnelian Bay, VI–24–64 (D. F. Veirs, DCR). Lake Tahoe, Angora, VI–4–15 (E. C. Van Dyke, CAS). 2 mi. W. Loomis, VI–20–61 (D. C. Rentz, CAS). PLUMAS Co.: Blairsden, V–29–62 (J. S. Buckett, UCD). Quincy, VI–21 to 25–49 (J. W. MacSwain, P. D. Hurd & C. I. Smith, CIS). Storrie, IV–14–60 (A. Forbes, CDA). SAN BENITO Co.: Pinnacles Nat. Mon., IV–24–48 (J. W. MacSwain, CIS). SANTA CLARA Co.: Palo Alto, VI–7–22. SANTA CRUZ Co.: Alma, V–12–46 (G. Pollard, CIS). Santa Cruz, VI–7–36 (A. T. McClay, UCD). Glenwood, VI–4–60 (P. H. Arnaud, DCR). SHASTA Co.: Lassen Nat. Park, VII–9–23 (F. H. Wymore, CIS). Castella, IV–25–46 (G. Pollard, CIS). Ingot, VI–23–48 (L. C. Smith, CIS). Hat Creek, VI–1–41 (P. D. Hurd, CIS). Shingletown, V–22 to VI–2–41 (C. D. Michener & C. W. Anderson, CIS). Burney, VI–22–48 (L. G. Smith, CIS). SIERRA Co.: Grass Valley, IV–16–58 (L. Johns, CDA). SISKIYOU Co.: Yreka, V–10–32 (E. O. Essig, CIS). Eden, V–11–32 (S. Lockwood, CIS). Dunsmuir, IV–27–58 (C. L. Rothman, DCR). Shasta City, VI–20–29 (C. C. Wilson, DA). SOLANO Co.: Lake Curry, IV–13–50 (J. N. Simons, CIS). Glenn Valley Falls, IV–27–41 (K. Frick, CIS). SONOMA Co.: Glen Ellen, VI–18–37 (A. T. McClay, UCD). 4 mi. W. Plantation, IV–6–57 (D. Burdick, CIS). Geyserville, IV–25–57 (R. P. Allen, CIS). Kenwood, V–14–60 (T. K. Gantenbein, CIS). Monticello, V–18–58 (B. N. Chamotis, CIS). Kenwood, III–26–38 (E. C. Johnston, CAS). Glen Ellen, III–9–12 (J. A. Kusche, CAS). Pine Flat Rd., IV–4–64 (D. C. & K. A. Rentz, CAS). Cloverdale, V–15–59 (J. R. Helfer, CAS). Eldridge, Spreckles Mt., IV–4–17 (J. A. Kusche, CAS). 4 mi. W. Kenwood, VI–17–61 (D. C. Rentz, DCR). TRINITY Co.: Carrville, VI–9–34 (R. & G. Bohart, CAS). TULARE Co.: Sequoia Nat. Park, V–24 to VI–11–29, VI–12–37 (A. T. McClay, UCD); VI–20–47 (W. D. Murray, CIS). Kaweah River, N. Fork, V–16–48 (W. D. Murray, CIS). 2 mi. N. E. Posey, V–14–63 (J. A. Powell, CIS). Johnsdale, IV–27–64 (W. Turner, CIS). Mineral King, VIII–1–23 (C. L. Fox, CAS). Sequoia Nat. Park, Paradise Valley, V–22–29, 4000 ft. elevation (E. C. Van Dyke, CAS). TUOLUMNE Co.: Strawberry, VI–18–51 (J. W. MacSwain, CIS); VI–23–61 (C. A. Downing, CIS). Ackerson Meadow, 3 mi. S. Mather, VI–11–60 (D. C. Rentz, DCR.) N. Fork Tuolumne River, 3 mi. N.E. Tuolumne City, III–31–61, V–1–61 (C. D. MacNeill & M. R. Lundgren, DCR). YOLO Co.: Rumsey, IV–11–57 (C. G. Moore & R. H. James, UCD). 5 mi. E. Monticello Dam, V–21–61 (D. C. Rentz, DCR).

Arphia conspersa ramona Rehn

(Map 68)

Arphia ramona Rehn, 1902, Can. Ent., 34:142. Lectotype ♂, San Diego, Calif., designated by Rehn & Hebard, 1912 (ANSP).

Brown, usually dark, tegmina often with pale anal (dorsal) stripe. Hind tibiae deep blue. Wing orange. Body 21–35; tegmen 23–22; hind femur 14–20.

Geographic range.—California.

California records.—(Map 68) ALAMEDA Co.: Cedar Ridge, V–3–31 (E. C. Van Dyke, CAS). CONTRA COSTA Co.: Mt. Diablo, IV–4–50 (R. S. Beal, CIS); IV–23–48, 1700–2000 ft. elevation (C. Smith, CIS); V–7–60 (J. A. Powell, CIS). Mt. Diablo, Russelmann Pk., V–16–59; V–7–60 (D. C. Rentz, DCR). Mt. Diablo State Park, Juniper Camp, VI–27–64, 2900 ft. elevation (D. C. & K. A. Rentz, CAS). FRESNO Co.: Los Gatos, divide to mouth of Mt. Diablo Range, VI–8–07 (J. C. Bradley, ANSP). INYO Co.: Upper Meadows, Whitney Pass Trail, IX–6–19, 10,700 ft. elevation (Rehn & Hebard, ANSP). Hog Lake, VIII–17–35 (M. Gyger, ANSP). Lone Pine Canyon, IX–5–10 (Rehn & Hebard, ANSP). Whitney Portal, VII–2–61 (D. C. Rentz, CAS). KERN Co.: Mt. Pinos, VI–6–04 (Rehn & Hebard, ANSP). 3 mi. N.E. Havilah, V–15–63 (S. W. Earnshaw, CIS). Lebec, V–15–28, 1000 ft. elevation (J. O. Martin, CAS). LOS ANGELES Co.: Pasadena, VII–6–1899. Mt. Lowe, 4700–5600 ft. elevation, VIII–

8– (Rehn & Hebard, ANSP). Camp Baldy, VII–11–50 (P. D. Hurd, CIS). Tanbark Flat, VI–19 to 30–50 (T. R. Haig, J. L. Nickel, J. W. MacSwain, M. J. Stebbins, H. M. Graham & W. C. Bentinck, CIS); VI–23 to VII–13–52 (J. W. MacSwain & W. V. Garner, CIS); VI–25–56 (C. L. Wiley, A. T. McClay, H. L. Mathis, B. M. Bartesh, R. W. Bushing, E. M. Evans, .J K. Hester & A. A. Grigarick, CIS, UCD). Mt. Wilson, V–23–46 (G. P. Mackenzie, UCD). San Antonio Canyon, Sierra Madre Mts., VI–12–15 (J. W. Rich, ANSP). Pasadena, VIII–6–1899 (F. Grinnell, ANSP). San Gabriel Mts., Long Canyon, VII–10–10 (F. Grinnell, ANSP). Sierra Madre Mts., San Antonio Canyon, VI–12–15 (J. W. Rich, ANSP). Pasadena, Arroyo Seco, VII–19–10 (F. Grinnell, ANSP). Los Angeles, V–1910 (F. M. Jones, ANSP). San Gabriel Mts., Long Canyon, VI–6–10, 3000 ft. elevation (F. Grinnell, ANSP). Santa Anita Canyon, VIII–3–04 (F. Grinnell, ANSP). San Gabriel Mts., Switzer's Trail, VI–10–14, 3500 ft. elevation (F. Grinnell, ANSP). Claremont, IV–10–26 (P. Craig, CAS). Tanbark Flat, VI–23–50 (F. X. Williams, CAS). MONO Co.: Rock Creek, 1 mi. W. Tom's Place, VIII–7–59 (D. C. Rentz, DCR). MONTEREY Co.: Arroyo Seco, V–11–58 (R. M. Bohart, CIS); V–1–60 (F. D. Parker, UCD). Paloma Creek, 5 mi. N.W. Arroyo Seco, V–8–60 (G. I. Stage, DCR). 12 mi. E. Lucia, VI–28–60 (C. D. MacNeill, DCR). ORANGE Co.: Corona, VII–1922 (E. P. Hewlett, ANSP). San Bernardino Mts., Santa Ana, VI–1914, 5500 ft. elevation (F. Grinnell, ANSP). RIVERSIDE Co.: Pinon Flat, San Jacinto Mts., V–18–39 (B. Brookman, CIS); V–27–39 (E. S. Ross, CAS); IV–20–62 (C. D. MacNeill, D. C. Rentz & R. Brown, CAS). Keen Camp, VI–23–52 (H. Graham, CIS); VI–5–39 (B. Brookman, CIS); VI–11–17 (E. P. Van Duzee, CAS). Kenworthy, San Jacinto Mts., VI–3, 4500–5000 ft. elevation; VI–3, 4500 ft. elevation (F. Grinnell, ANSP). Ribbonwood, San Jacinto Mts., V–20–39 (E. S. Ross, CIS); VI–21–40 (C. D. Michener, CIS). Saunders, San Jacinto Mts., V–25–39 (B. Brookman, CIS). Herkey Creek, San Jacinto Mts., VI–10–40 (C. D. Michener, CIS); VI–20–40 (C. G. Lewis, CIS). Idyllwild, (J. K. Hester); V–19–39, V–30–39 (E. S. Ross, CIS); VI–3 to 7–39 (B. Brookman, CIS); VI–21–58 (CIS); V–19–39, VI–1936 (E. S. Ross, CAS). Strawberry Valley, 6000 ft. elevation (F. Grinnell, ANSP). Banning, V–28–28 (E. C. Van Dyke, CAS). 4 mi. W. Beaumont, IV–9–42 (H. R. Roberts, ANSP). San Gabriel Canyon, San Jacinto Mts., VII–18–13 (F. Grinnell, ANSP). Pinyon Park, San Jacinto Mts., IV–14–42 (H. R. Roberts, ANSP). Hemet Lake, San Jacinto Mts., VII–4–35 (ANSP). San Jacinto Mts., VII–18. SAN BENITO Co.: Pinnacles Nat. Mon., IV–9–60, VI–13–64 (D. C. Rentz, DCR). 11 mi. E. Gonzales, IV–15–60 (D. C. Rentz, DCR). 15 mi. E. Gonzales, V–12–62 (C. D. MacNeill, CAS). 8 mi. S.W. Idria, VIII–25–62 (D. C. Rentz & E. W. Kirschbaum, CAS). 2 mi. W. Jct. of Cienega and Lime Kiln Rds., III–30–63, IV–18–64 (D. C. & K. A. Rentz, CAS). SAN BERNARDINO Co.: San Bernardino Mts., VII–14– , 5500–6200 ft. elevation; VI–17, VII–10 , 6500–7200 ft. elevation. Mill Creek, VIII–28–19, 5500 ft. elevation (Rehn & Hebard, ANSP). Lake Arrowhead, VII–5–46 (G. P. Mackenzie, UCD); VI–3–28 (E. C. Van Dyke, CAS). Cajon, VI–6–48 (D. J. & J. N. Knull, CIS). Dollar L Trail, VII–10–56 (C. L. Wiley, CIS). Snow Crest Camp, VII–7–52 (W. V. Garner, CIS). Crestline, V–13–34 (P. H. Timberlake, CDA). Fish Wash, VI–22–05, 6500 ft. elevation, VII–10–06, VI–17–05 (J. Grinnell, ANSP). Oak Glenn Ridge, VII–19–13, 5000 ft. elevation (CAS). Oak Glenn Lodge, 5000 ft. elevation (ANSP). Forest Home, VI–19–28 (E. C. Van Dyke, CAS). Baxter Flats, VI–23–36 (CAS). SAN DIEGO Co.: San Luis Rey Camp, IV–23–51 (E. I. Schlinger, CIS). Agua Caliente Creek, VI–13–49 (J. A. Powell, CIS). San Diego, IV–25–48 (J. A. Powell, CIS); VI–19–48 (G. A. Marsh, CIS). 15 mi. N.W. Mt. Laguna, VI–29–62 (J. F. Lawrence, CIS). Warner Springs, V–2–59 (H. W. Cramer, Jr., UCD). Storm Canyon, 5 mi. N. Mt. Laguna, VI–29–62 (J. F. Lawrence, CIS). Mt. Laguna, VI–21–63 (P. D. Hurd, CIS); VII–5–63 (H. L. Griffin, CIS). 20 mi. S. Anza, IX–14–49 (R. P. Allen, CIS). Nellie, VI–7–17 (E. P. Hewlett, ANSP). Pine Valley, V–31–20 (ANSP). Laguna Mts., VI–30–21 (ANSP). Cuyamaca Peak, IX–14–22 (Rehn & Hebard, ANSP). San Diego, VII–6–21 (ANSP). 4 mi. W. Jacumba, IV–15–42 (H. R. Roberts, ANSP). Mt. Laguna, VI–21–63 (J. D. Birchim, JDB). SAN JOAQUIN Co.: Hospital Canyon, IV–18–48 (V. M. Stern, CIS). SANTA BARBARA Co.: Figueroa Mts., VII–3–1959 (R. M. Bohart, UCD). Santa Ynez Mts., VI–24–59 (R. M. Bohart, UCD); VI–24–59 (W. A. Steffan). SANTA CLARA Co.: Mt. Hamilton, V–25, VI–8–22 (E. O. Essig, CIS); VI–20–22 (J. F. Lamiman). Mt. Hamilton, VI–17–63 (G. I. Stage, CAS); VI–6–64 (D. C. & K. A. Rentz, CAS). Alma, IV–22–28 (J. O. Martin, CAS). Palo Alto, VII–12–15 (E. C. Van Dyke, CAS). SANTA CRUZ Co.: Santa Cruz, VI–27–41, VIII–1942 (E. S. Ross, CAS). Highland District, VI–17–56 (S. M. Fidel, CIS). Big Basin, VI–1–41 (K. Frick, CIS). Santa Cruz Mts., Bear Valley (F. D. Clark, ANSP). STANISLAUS Co.: Adobe Creek (*Baccharis* sp.), V–6–48 (R. F. Smith & J. W. MacSwain, CIS). TULARE Co.: Lemoncove, IV–20, V–20–50 (J. W. MacSwain, CIS). VENTURA Co.: Mt. Pinos, IX–4–22 (Rehn & Hebard, ANSP), 8500 ft. elevation. VI–6–04 (F. Grinnell, ANSP). Wegis Ranch, V–9–63 (R. L. Langston, CIS). Hungry Valley, 5 mi. S. Gorman, V–6–59 (J. R. Powers, CIS). Quatal Canyon, V–9–59 (J. A. Powell, CIS). Lockwood Creek near Stauffer P.O., V–5–59 (G. I. Stage, CIS).

Arphia pseudonietana (Thomas)

(Map 68)

Tomonotus pseudo-nietanus Thomas, 1870, Proc. Acad. Nat. Sci. Phila., p. 82. Lectotype ♂, near Canyon City, Colo., designated by Hebard, 1927 (USNM).

Oedipoda tenebrosa Scudder, 1871, Rep. U.S. Geol. Surv. Nebr., p. 251.

Arphia sanguinaria Stal, 1873, Recensio Orth., 1:119.

Arphia sanguinaria Saussure, 1884, Prodome Oedip., p. 68.

Arphia saussureana Bruner, 1890, Proc. U.S. Nat. Mus., 12:63.

Arphia pseudonietana, Caudell, 1903, Proc. U.S. Nat. Mus., 26:786.

Fastigium elliptical, as long as broad in male, transverse in female. Frontal costa broadly truncate at fastigum and often with a short median carina.

Apparently two incursions into California by this species have taken place. In the northern portion of the state is the form having the abdomen yellow and the hind tibiae bluish or blue to yellow-brown. The very dark southwestern form with abdomen and hind tibiae intensely black occurs in Mono, Inyo and Tuolumne counties. Whether the trinomial *crassa* Bruner

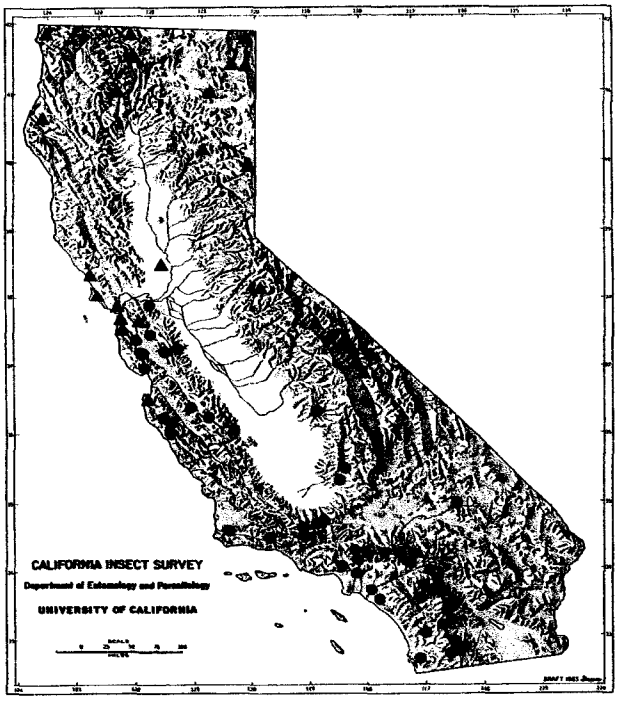
is applicable to these must await revisionary studies.

Specimens from the region of San Francisco are smaller than the measurements given below, those from Mono, Inyo, and Tuolumne counties larger.

Body 18–27; tegmen 19–23; hind femur 12–15.

Geographic range.—From British Columbia to Michigan, Mexico, and California.

California records.—(Map 68) ALAMEDA Co.: (Koebele Collection, CAS). DEL NORTE Co.: 10 mi. S. Takima, Ore., V–15–59 (T. R. Haig, CDA). HUMBOLDT Co.: Kneeland, VIII–28–51 (R. W. Harper, CDA). INYO Co.: Rock Creek, IX–11–56 (P. D. Hurd, CIS); V–3–61 (T. Bolton, CIS). Bishop, VIII–18–63 (J. A. Froebe, UCD). Antelope Springs, VIII–24–60 (T. H. Gantenbein, CIS). Bishop, VIII–26–44 (R. P. Allen, CDA); VIII–20–22 (O. C. Poling, ANSP). Round Valley, VII–28–22 (O. C. Poling, ANSP). Pine Creek, Round Valley, N.W. of Bishop, VIII–7–61 (D. C. Rentz, CAS). 7 mi. N. Big Pine, VII–27–64 (J. D. Birchim, JDB). 5 mi. N. Big Pine, VII–29–64 (J. D. Birchim, JDB). LASSEN Co.: S. of Adin, IX–20–51 (R. W. Harper, CDA). Doyle, VIII–9–59 (J. R. Powers, CIS). Westwood, VIII–21–22, 5000 ft. elevation (Rehn & Hebard, ANSP). MARIN Co.: Cypress Ridge, IX–21–30 (E. P. Van Duzee, CAS). Inverness, IX–29–46 (E. S. Ross, CAS); VII–22–54 (C. A. Toschi, CIS). 4 mi. N. Marshall, IX–5–50 (R. W. Harper, UCD). Manzanita, X–27–06 (J. C. Bradley, ANSP). MODOC Co.: Mason Creek, R. S., X–12–53 (E. I. Schlinger, UCD). Goose Lake, VIII–22–63 (J. S. Buckett, UCD). Alturas, V–5–62 (J. S. Buckett, UCD); VIII–23–22, 4500 ft. elevation (Rehn & Hebard, ANSP). MONO Co.: Pickel Meadow, VIII–11–60 (D. Q. Cavagnaro, UCD); VIII–16–60 (A. A. Montanucci, UCD). Sierra Range, VIII–19–58 (G. E. Harmon, CIS). Mill Creek, IX–6–58 (E. I. Schlinger, UCD). Mammoth Lake, VIII–8–21 (O. C. Poling, ANSP). MONTEREY Co.: Del Monte, IX–9–10 (ANSP). PLUMAS Co.: Lake Almanor, VIII–28–21 (ANSP). SAN MATEO Co.: San Bruno Hills, IX–29–12 (E. C. Van Dyke, CAS). San Francisco, XI–1887, paratypes of *Arphia saussureana* Bruner. San Miguel Hills, San Francisco, VIII–19–09, 800 ft. elevation (ANSP); IX–12–10 (ANSP). SISKIYOU Co.: Hilt, IX–20–50 (R. W. Harper, CDA). Grenada, IX–20–50 (R. W. Harper, CDA). Gazelle, IX–5–1897 (ANSP); IX–22–51 (J. Hall & E. I. Schlinger, UCD). SONOMA Co.: Bodega Bay, VIII–24–50 (H. H. Keifer, CDA). TRINITY Co.: Carrville, VIII–24–51 (R. W. Harper, CDA). TUOLUMNE Co.: Chipmunk Flat, VIII–9–60 (R. R. Montanucci, UCD). YOLO Co.: Davis, VIII–3–49 (E. I. Schlinger, UCD).



Map 68. California distribution of: ●, *Arphia conspersa ramona* Rehn; ▲, *Arphia pseudonietana* (Thomas).

Discussion—This form occurs in the western part of California very late in the year and apparently supplants *A. c. behrensi* over much of its range.

Genus *Camnula* Stal 1873

Camnula pellucida (Scudder)
clear-winged grasshopper

Oedipoda pellucida Scudder, 1862, Jour. Boston Soc. Nat. Hist., 7:472. Type locality, Mass., Me., Vt., Conn.

Stenobothrus obionus Thomas, 1871, Rept. U.S. Geol. Surv. Wyoming, p. 266.

Oedipoda atrox Scudder, 1872, Rept. U.S. Geol. Surv. Nebraska, p. 253.

Camnula tricarinata Stal, 1873, Recensio Orth., p. 120.

Camnula pellucida Scudder Hitchcock Geol. New Hampshire, 1:378.

Pronotum with disc smooth, all three carinae low but sharp and continuous, the lateral ones divergent caudad from point near front margin. Tegmina with large dark spots. Hind tibiae pale yellow.

Body 20–23; tegmen 17–19; hind femur 11–12.

Geographic range.—Widespread, Newfoundland to British Columbia, south to Virginia, Texas, and California. Absent over much of the south central and southeastern United States.

California records.—Material collected in the course of the California Insect Survey has come from the following counties:

ALAMEDA	MENDOCINO	SHASTA
ALPINE	MERCED	SIERRA
CONTRA COSTA	MODOC	SISKIYOU
EL DORADO	MONO	SOLANO
FRESNO	NAPA	SONOMA
GLENN	NEVADA	STANISLAUS
HUMBOLDT	PLACER	TEHAMA
KERN	PLUMAS	TRINITY
LOS ANGELES	RIVERSIDE	TUOLUMNE
LASSEN	SAN BENITO	VENTURA
MADERA	SAN DIEGO	YUBA
MARIN	SANTA CLARA	
MARIPOSA	SANTA CRUZ	

Discussion—*C. pellucida* occurs very abundantly in California, and in many areas, especially where

grasses are more luxuriant, may outnumber *Melanoplus devastator*. It is found in grasslands of mountain meadows, foothills and valleys throughout California to elevations exceeding 7000 feet. When *pellucida* becomes abundant, immatures as well as adults tend to move into adjacent agricultural areas causing serious damage to vegetables and other crops, particularly grains.

In central California, over-wintering eggs begin to hatch in late April–early May, becoming adults in late May—early June. Oviposition usually begins the latter part of July, and continues through August. It has definite oviposition areas, and according to Wilson (1936) goes back and forth between 10 A.M. and 3 P.M. between the egg bed areas and the feeding grounds. These oviposition sites are usually on uncultivated grassy knolls, are small in area, and well defined, two to twenty acres in size. Males attend the ovipositing females and may greatly outnumber them. Eggs may be concentrated in vast numbers in these areas, each female laying about one egg pod per week containing from 15 to 40 eggs per packet, for an average of about 200 eggs per female.

Genus *Chimarocephala* Scudder, 1876

KEY TO CALIFORNIA SPECIES AND SUBSPECIES OF CHIMAROCEPHALA

1 Median carina high and strongly compressed, not or but feebly notched by principal sulcus . . *pacifica pacifica* (Thomas) (p. 93)
Median carina of moderate height, distinctly cut by principal sulcus 2

2 Occiput and pronotum rough; lateral carinae uneven, much broken in front of principal sulcus; hind femur stout, little more than 3 times greatest width . . *pacifica incisa Caudell* (p. 94)
Occiput and pronotum smooth; lateral carinae even, continuous; hind femur 3.5 times or more as long as greatest width . . *californica* (Bruner) (p. 92)

Chimarocephala californica (Bruner) new combination

(Figs. I, II, III, Map 69)

Encoptolophus californicus Bruner, 1905, Biol. Centr.-Amer., Orth., 2:142. Type locality, Los Angeles Co., Calif.

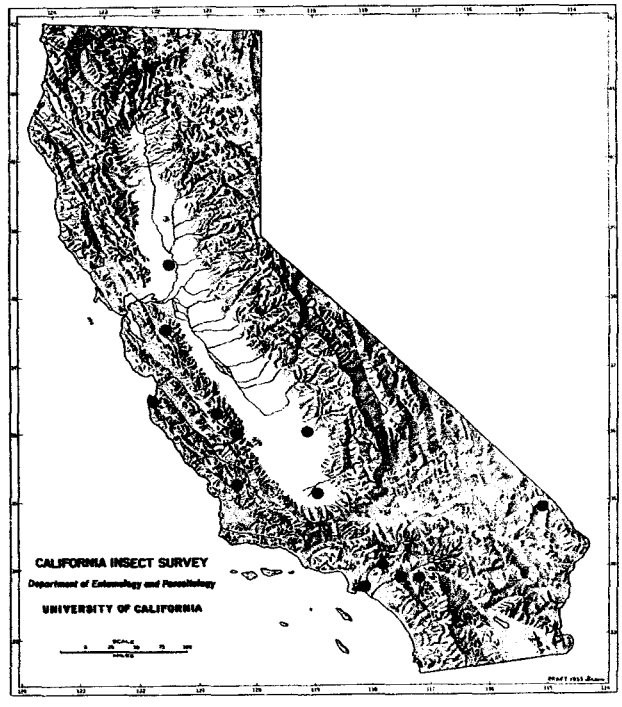
Brown, females in part or wholly green; pronotal carinae dark brown; tegmina with pale anal stripe; hind femur and tegmina plain or with a pair of incomplete fuscous bands. Fastigium narrowly triangular, much longer than broad even in female, deeply sulcate. Antennae moderately long, blunt or abruptly tapering at apex, this feature sometimes exaggerated in dried specimens by a longitudinal fold. Occipital carina strong. Pronotum with median carina but moderately elevated, distinctly but shallowly cut by principal sulcus. Lateral carinae smoothly callous, minutely cut by principal sulcus and not interrupted in front of it. Male cerci flattened basad, long, much surpassing apex of epiproct.

Body 18–27; tegmen 17–21.5; hind femur 10.7–14.6.

Northward, length of body, fastigium and hind femora is progressively larger, especially in males.

Geographic range.—California.

California records.—(Map 69) ALAMEDA CO.: 3 mi. N. E. Livermore, VI–19–60 (CIS). FRESNO CO.: Alcalde Canyon, IV–2–32 (E. L. Donohue, UCD). KERN CO.: 4 mi. S. Greenfield, III–11–63 (J. A. Powell, CIS). LOS ANGELES CO.: 1888 (Coquillett, female paratype, ANSP). III–1886 (ANSP). Alamitos Bay, VIII–31–07 (ANSP). MONTEREY CO.: Carmel, V–30–22 (L. S. Slevin, CAS). SAN BERNARDINO CO.: Santa Ana River, S. of Ontario, IV–20–27 (P. Craig, CAS). Cottonwood Station, Mojave Desert, IX–19–07, 2274 ft. elevation (ANSP). RIVERSIDE CO.: Riverside, III–18–34 (Timberlake, ANSP). SAN BENITO CO.: 2 mi. N.E. New Idria, IV–24–64 (W. Turner, CIS). SAN LUIS OBISPO CO.: Simmler, III–20–40 (J. W. Tilden & G. S. Mansfield, CIS). TULARE CO.: Tulare, VIII–5–1897 (ANSP). YOLO CO.: Davis, IV–12–58 (C. G. Moore, UCD); IV–30–48 (E. I. Schlinger, UCD); IV–12–52 (J. I. Madigan, UCD).



Map 69. California distribution of *Chimarocephala californica* (Bruner).

Chimarocephala pacifica pacifica (Thomas)
(Map 70)

Tragocephala pacifica Thomas, 1873, Syn. Acrid. N. A. (Rept. U.S. Geol. Surv. Terr.), 5:101. Lectotype ♂, Calif., designated by Hebard, 1927 (USNM).

Chimarocephala pacifica, Scudder, 1875, Proc. Bost. Soc. Nat. Hist., 17:484.

Tragocephala brevipennis Scudder, 1875, op. cit., p. 483.

Chimarocephala behrensi Saussure, 1884, Prodrome Oedip., p. 74.

Chimarocephala pacifica, Caudell, 1906, Proc. Ent. Soc. Wash., p. 123.

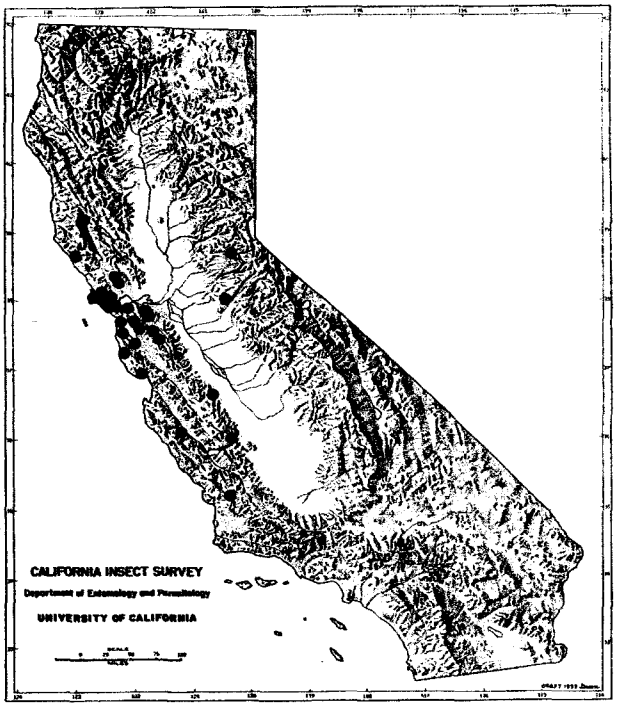
Chimarocephala pacifica obtusa, Caudell & Hebard, 1912, Proc. Acad. Nat. Sci. Phila.: 160.

Wood-brown, sometimes mottled with green. Fastigium elongate, deeply sulcate, subacuminate in front. Antennae very short. Tegmina variable in length, especially in female. Specimens from Yolo, Fresno and San Luis Obispo counties suggest greater differentiation in the genus than has been recognized.

Body 16–24; tegmen 13–11 to 22; hind femur 9.5–13.5.

Geographic range.—California, west of the Sierra Nevada.

California records.—(Map 70) ALAMEDA CO.: 3 mi. N.E. Livermore, VI–19–60. Strawberry Canyon, III–24–57 (W. A. Nisbet, CIS). Berkeley, IV–5–62 (J. T. Doyen, CIS); IV–23–56 (J. M. Burns, CIS); II–17–48, II–20–48 (J. W. MacSwain, CIS); III–11–32, III–15–49 (E. G. Linsley, CIS); IV–18–54 (J. A. Powell, CIS); III–29– (R. C. Orr, UCD); III–24–21 (J. O. Martin, ANSP); III–31–19, IV–4–21 (E. C. Van Dyke, CAS); III–31–61 (W. A. Foster, CIS). 3 mi. S.E. Berkeley, IV–14–22, on grassy hilltop (T. I. Storer, UCD). Oakland, III–12–55 (D. L. Dahlsten, UCD). Hills in back of Oakland, IV–16–11 (E. C. Van Dyke, ANSP). Mission San Jose, XII–30–57 (immature) (W. W. Middlekauff, CIS). CALAVERAS CO.: Avery, V–1–60 (J. R. Helfer, CAS). CONTRA COSTA CO.: Richmond, II–29–48 (R. C. Bynum, CIS). 4 mi. N.E. Orinda, Russell Property, III–25–63 (D. C. Rentz, DCR). Tilden Park, IV–20–58 (P. Opler, DCR). EL DORADO CO.: Riverton, V–20–55 (D. J. Burdick, CIS). FRESNO CO.: Coalinga (Alcalde Canyon), IV–1–32 (E. L. Donohoe, CIS). Panoche, IV–29–22 (E. C. Van Dyke, CAS). MARIN CO.: Point Reyes, IV–7–57 (J. F. Lawrence, CIS); IV–21–57 (D. Burdick, CIS). Point Reyes Station, III–25–51 (J. S. Buckett, CAS). Olema, III–18–60 (L. A. Stange, UCD). Near Olema, III–19–60 (D. C. Rentz, DCR). S. P. Taylor State Park, III–19–60 (D. C. Rentz, DCR). 2 mi. S. W. Fairfax, near Meadow Club, IV–7–61 (D. C. Rentz, DCR). 8 mi. S.W. Fairfax, IX–20–64 (D. C. Rentz & A. B. Gurney, 2nd instar nymphs). Fairfax, V–11–19 (E. P. Van Duzee, ANSP). Lake Lagunitas, IV–27–58, IV–16–59 (D. C. Rentz, DCR). Alpine Lake, N. W. Mt. Tamalpais, V–1–60 (J. M. Burns, DCR). West Novato, IV–23–60, V–19–61 (D. C. Rentz, DCR); V–12–63, III–10–63 (D. C. Rentz, CAS). Sausalito, III–16–22 (W. W. Sargent, CAS). Ross, IV–28–18 (E. P. Van Duzee, CAS). Carson Ridge, V–6–62 (C. W. O'Brien, CAS). Cypress Ridge, IV–6–21 (J. O. Martin, ANSP); IV–6–21 (E. C. Van Dyke, CAS). Mill Valley, III–15–25 (H. H. Keifer, CAS); IV–4–08 (F. X. Williams, CAS). MENDOCINO CO.: Ryan Creek, XI–30–57 (immature). Ukiah, (H. Burke, ANSP). MONTEREY CO.: Pine Canyon, III–19–20 (L. S. Slevin, CAS). SAN FRANCISCO CO.: Presidio, III–13–54, IV–3–54 (W. H. Lange, UCD). Twin Peaks, IV–3–54 (W. H. Lange, UCD); II–4–61 (D. C. Rentz, DCR). San Miguel Hills, near Twin Peaks, XII–26–59, XII–16–60, I–17–60, II–12–60, XII–8–59, III–19–60 (D. C. Rentz, DCR). Lake Merced, III–22–08 (F. X. Williams, CAS). San Francisco, II–4–61 (R. Brown, CAS). SAN LUIS OBISPO CO.: Simmler, III–20–40 (J. W. Tilden & G. S. Mansfield, CIS). SAN MATEO CO.: San Bruno, II–26–51 (E. I. Schlinger, UCR). San Bruno Mts., II–28–63 (J. A. Powell, CIS); II–9–58 (D. C. Rentz, DCR); IV–16–60 (D. C. Rentz, CAS); III–18–61 (H. B. Leech, CAS); III–24–63 (C. Slobodchikoff, CAS); II–22–63 (D. C. & K. A. Rentz, CAS). Milbrae, III–8–50 (R. P. Allen, CIS); II–23–57 (D. C. Rentz, DCR). Sand Hill Rd., III–8–61 (P. H. Arnaud, DCR). Palo Alto, IV–6–1892 (CAS). Moss Beach, II–12–34 (H. L. Mackenzie, ANSP). SANTA CRUZ CO.: Mt. Hermon, III–10–43 (K. Frick, CIS). Felton, III–11–43 (K. Frick, CIS); V–24–07, 500 ft. elevation (J. C. Bradley, ANSP). Santa Cruz Mts. (Koebele Collection, CAS). SONOMA CO.: Stillwater Cove, V–25–54 (E. I. Schlinger, UCD); V–12–56 (H. R. Moffett, UCD). 4 mi. W. Kenwood, VI–17–61 (D. C. Rentz, DCR). Eldridge, Spreckles Mt., IV–4–17 (J. A. Kusche, ANSP).



Map 70. California distribution of *Chimarocephala pacifica pacifica* (Thomas).

Discussion—This is one of the earliest grasshoppers to appear in the spring throughout its range. Eggs hatch in late summer and the nymphs overwinter. During a warm spell in December, 1960, and in January and February, 1961, many adults were taken on Twin Peaks in San Francisco.

Males stridulate with a low buzzing sound and fly short distances not more than three to four feet above the ground. The females are incapable of flight due to their short wings and bulky size of the abdomen. *Ceracia dentata,* a tachinid parasite, has recently been reared from nymphs of this species (Arnaud and Rentz, 1965).

Chimarocephala pacifica incisa Caudell
(Map 71)

Chimarocephala pacifica incisa Caudell, 1906, Proc. Ent. Soc. Wash., 7:124. Lectotype ♀, Calif., designated by Caudell & Hebard, 1912 (USNM).

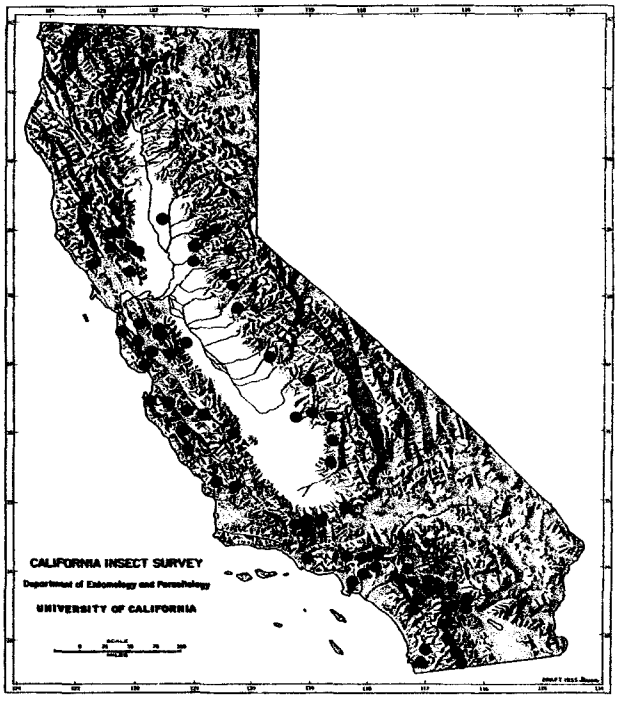
Chimarocephala incisa Rehn & Hebard, 1909, Proc. Acad. Nat. Sci. Phila., 61:435.

Chimarocephala pacifica incisa Hebard, 1931, Trans. Amer. Ent. Soc., 57:119.

The distinct notch in the median carina of the pronotum seems to be the most obvious feature for distinguishing this from the nominate form. The fastigium probably averages shorter in *incisa* but measurements have not been made.

Geographic range.—California.

California records.—(Map 71) ALAMEDA CO.: Moraga Valley, IV–28–57 (W. A. Nisbet, CIS). 1 mi. E. Mission Peak, V–15–58 (W. W. Middlekauff, CIS). Oakland, IV–1–55 (B. Hudson, CIS). AMADOR CO.: Volcano, V–5–57 (C. G. Moore & R. M. Bohart, UCD). CONTRA COSTA CO.: South fork of Stony Creek, V–7–54 (H. P. Chandler, CAS). EL DORADO CO.: Snowline Camp, VI–23–48 (J. W. MacSwain, CIS). Near Applegate, V–30–61 (C. D. MacNeill, DCR). FRESNO CO.: Auberry Rd., II–28–32 (UCD); V–22–32 (E. L. Donohoe, UCD). King's River Canyon, IV–10–32 (E. L. Donohoe, UCD). Coalinga (Alcalde Canyon), IV–2–32 (H. Fincher, UCD). Waltham Canyon, Coalinga, III–19–59 (R. P. Allen). Coalinga, III–19–31 (E. P. Van Duzee, CAS). Los Gatos Canyon, and divide to mouth of Mt. Diablo, VI–8–07 (J. C. Bradley, ANSP). KERN CO.: Woody, IV–25–64 (P. Rude, CIS); V–3–64 (J. A. Powell, CIS). 1 mi. W. Bodfish, IV–19–60, 2700 ft. elevation (J. N. & S. N. Burns, DCR). Lebec, VI–10–57 (DCR). 1 mi. N.E. Posey, V–14–63 (J. A. Powell, CIS). 15 mi. S. Havilah, V–15–63 (J. A. Powell, CIS). Miracle Springs, V–2–64 (R. L. Langston, CIS). Frazier Park, (R. M. Bohart, UCD). Tehachapi Mt. Park, 6 mi. S.W. Tehachapi, IV–21–62 (MacNeill, Brown & Lundgren, CAS). Isabella, V–6–31 (E. C. Van Dyke, CAS). LAKE CO.: Clear Lake, IV–22–38 (G. Pollard, CIS). 4 mi. W. Finley, IV–2–62 (J. A. Powell, CIS). 3 mi. N.W. Cobb, IV–3–62 (J. A. Powell, CIS). W. Fork Cache River, Hwy. 20, IV–19–54 (R. C. Bechtel, UCD). LOS ANGELES CO.: Claremont, IV–10–26 (P. Craig, CAS). Pomona, III–23–27 (P. Craig, CAS). Westwood Hills, III–20–36 (E. S. Herald, CAS). Whittier, III–28–12 (Timberlake, ANSP). Los Angeles, III–4–87 (Coquillett, ANSP). Saugus, III–23–26 (F. H. Wymore, UCD). MADERA CO.: San Joaquin, Expt. Station, V–17–52, IV–2, 23–53 (H. E. Childs, CIS). MENDOCINO CO.: Willits, IV–3–59 (J. R. Helfer, CAS). MONTEREY CO.: Arroyo Seco, V–11–58 (R. M. Bohart, CIS); V–5–56 (D. J. Burdick, CIS); V–1–60 (T. D. Parker, CIS); V–1–60 (R. C. Bechtel, UCD). Bryson, (E. P. Van Duzee, ANSP). Carmel, II–12–11 (E. C. Van Dyke, ANSP). NAPA CO.: 7 mi. E. Rutherford, IV–25–54 (R. M. Bohart, UCD). Samuel Springs, III–29–56 (R. M. Bohart, UCD). PLACER CO.: Dutch Flat, V–20–50 (A. T. McClay, UCD). Applegate, IV–11–51 (J. C. Hall, UCD). 2 mi. W. Loomis, VI–20–61 (D. C. Rentz, CAS). RIVERSIDE CO.: Andreas Canyon (R. C. Bechtel, CIS). Temecula (R. C. Bechtel, CIS); III–16–53 (J. A. Powell, CIS). Pinyon Flat, IV–7–63 (D. E. Bright, CIS); VII–12–56 (immature) (M. Wasbauer, CIS). Riverside, III–22–59 (F. Zaebst, CIS). Citrus Expt. Station, III–12–63 (J. A. Chemsak, CIS). Idyllwild, San Jacinto Mts., V–21–39 (B. Brockman, CIS). Murrieta, IV–18–50 (E. G. Linsley, CIS). 5 mi. S. Hemet, IV–24–56 (R. M. Bohart, UCD). Temecula, IV–24–51 (R. C. Bechtel, UCD). Andreas Canyon, IV–21–51 (R. C. Bectel, UCD). Pinyon Park, San Jacinto Mts., IV–14–42, 4000 ft. elevation (H. R. Roberts, ANSP). 4 mi. W. of Beaumont, IV–9–42 (H. R. Roberts, ANSP). Riverside, XII–31–29 (Timberlake, ANSP). Santa Rosa Summit, IV–18–62 (C. D. MacNeill, D. C. Rentz & R. Brown, CAS). SACRAMENTO CO.: Folson, V–19–55 (P. D. Hurd, CIS). SAN BENITO CO.: 2 mi. W. Junction of Cienega and Lime Kiln Rds., IV–17–64 (D. C. & K. A. Rentz, CAS). Pinnacles Nat. Mon., IV–17–64 (D. C. & K. A. Rentz, CAS); IV–24–48 (J. W. MacSwain, CIS). 5 mi. E. Pinnacles, IV–8–61 (D. C. Rentz, DCR). 5 mi. S. Bitterwater, III–31–59 (C. W. O'Brien, DCR). SAN BERNARDINO CO.: Santa Ana River, San Bernardino Mts., VI–1914 (Rehn & Hebard, ANSP). SAN DIEGO CO.: Warner Springs, IV–19–50 (J. W. MacSwain, CIS). Warner's Mt., 1–31–53 (J. A. Powell, CIS). San Diego, II–27–53 (J. A. Powell, CIS). Cuyamaca, III–27–57 (R. P. Allen, CIS). Fairmount Canyon, San Diego, III–30–61 (J. A. Powell, CIS). Alpine, III–31–61 (J. A. Powell, CIS). Descanso Ranger Station,



Map 71. California distribution of *Chimarocephala pacifica incisa* Caudell.

III–31–61 (R. L. Langston, CIS). Laguna P.O., III–27–61 (P. D. Hurd, CIS). Mt. Laguna, VI–21–63 (P. D. Hurd, CIS). Lakeside, III–18–63 (J. A. Chemsak, CIS). 4 mi. E. Campo, III–26–61 (P. D. Hurd, CIS). Adobe Falls, IV–3–49. 4 mi. W. Jacumba, IV–15–42, 3000 ft. elevation (H. R. Roberts, ANSP). 1 mi. S. Julian, IV–15–42, 4500 ft. elevation (H. R. Roberts, ANSP). Pine Valley, VI–1921 (ANSP). Nellie, VI–7– (ANSP). 8 mi. W. Ramona, III–26–61 (C. A. Toschi, CIS). Pine Valley, IV–24–20 (E. C. Van Dyke, CAS). SAN LUIS OBISPO CO.: Black Mt., 6 air mi. N.E. Pozo, V–1–62 (C. A. Toschi, CIS). 7 mi. S.W Atascadero, IV–4–63 (C. A. Toschi, CIS). SAN MATEO CO.: San Bruno Mts., II–7–64 (J. A. Powell, CIS). SANTA CLARA CO.: San Antonio Ranger Station, III–19–51 (E. G. Linsley, CIS). San Antonio Valley, II–23–64 (J. A. Powell, CIS). San Jose, II–19, 20–47 (K. Hughes & E. G. Meyers, CIS). Evergreen, IV–11–43 (C. D. Duncan, CIS). Vicinity Smith Creek, IV–23–60 (D. C. Rentz, DCR). SANTA CRUZ CO.: Alma, III–18–46 (G. Pollard, CIS). Glenwood, V–27–08 (J. C. Bradley, ANSP). SONOMA CO.: Cazadero, IV–12–18 (E. P. Van Duzee, ANSP). STANISLAUS CO.: Del Puerto Canyon, 20 mi. W. Patterson, IV–30–63 (J. A. Powell, CIS). SUTTER CO.: Marysville Buttes, IV–28–28 (H. H. Keifer, CAS). TULARE CO.: Ash Mt., Sequoia Nat. Park, IV–26–51 (R. C. Bechtel, UCD); (R. C. Bechtel, CIS). Sequoia Nat. Park, V–12–37 (A. T. McClay, UCD). Lemoncove, VI–27–48 (J. W. MacSwain, CIS). Johnsondale, IV–27–64 (W. Turner, CIS). Visalia, V–15–55 (J. T. Doyen, CIS). TUOLUMNE CO.: 4 mi. E. Twain Harte, VII–14–62 (J. T. Doyen, CIS). Twain Harte, V–1960, 4000 ft. elevation (M. Lundgren, CAS). Tuolumne City, III–31–61 (M. Lundgren, DCR). VENTURA CO.: Santa Paula, VI–3–27. Lockwood Valley near Stauffer P.O., in *Phacelia* ciliata, V–2–59 (J. R. Powers, CIS). Mt. Pinos, V–8–59, 7500 ft. elevation (C. W. O'Brien, CIS). YOLO CO.: 5 mi. E. Guinda, VI–3–60 (R. O. Schuster, UCD). Rumsey, IV–2–57 (R. F. Schoeppner, UCD).

Discussion—This subspecies is similar to *C. p. pacifica* but occurs more frequently in the brown phase. Females of this race are longer-winged and fly quite readily when approached. Although *C. p. incisa* occurs in the spring, its peak abundance is somewhat later than that of the nominate form.

Genus *Chortophaga* Saussure, 1884

Chortophaga viridifasciata (DeGeer)

Acrydium viridi-fasciatum DeGeer, 1773, Mem. His. Nat. Ins., 3:498. Type ♀, Penn.

Tragocephala viridifasciata, Thomas, 1873, Rept. U.S. Geol. Surv. Terr., 5:103.

Chorotophaga viridfasciata, Saussure, 1884, Prodome Oedip., p. 72.

Acrydium (Chorotophaga), viridifasciata Sjöstedt, 1932, Arkiv. Zool., 24A(1):18.

Recently females, possibly this secies, were collected in California, but until males are taken, the identification cannot be certain.

Geographic range.—British Columbia and Ontario, to Arizona, Mexico and Florida.

California records.—SHASTA CO.: Highway 89, near Hat Creek, V–25–67, in alfalfa (Allen & Webber, CDA, CIS).

Genus *Cibolacris* Hebard, 1937

Cibolacris parviceps (F. Walker)
(Fig. 27, Map 72)

Oedipoda parviceps Walker, 1870, Cat. Derm. Salt. Brit. Mus., 4:735. Type ♀, "west coast of America" (likely Baja California) (BMNH).

Thrincus californicus Thomas, 1874, Bull. U.S. Geol. Surv. Terr., 1:66.

Heliastus californicus, Scudder, 1897, Can. Ent., 34:75.

Thrincus? aridus Bruner, 1890, Proc. U.S. Nat. Mus., 12:78.

Heliastus californicus, Rehn & Hebard, 1909, Proc. Acad. Nat. Sci. Phila., 61:461.

Heliastus aridus, Rehn & Hebard, 1909, *op. cit.*, p. 460.

Cibolacris parviceps, Hebard, 1937, Trans. Amer. Ent. Soc., 63:374.

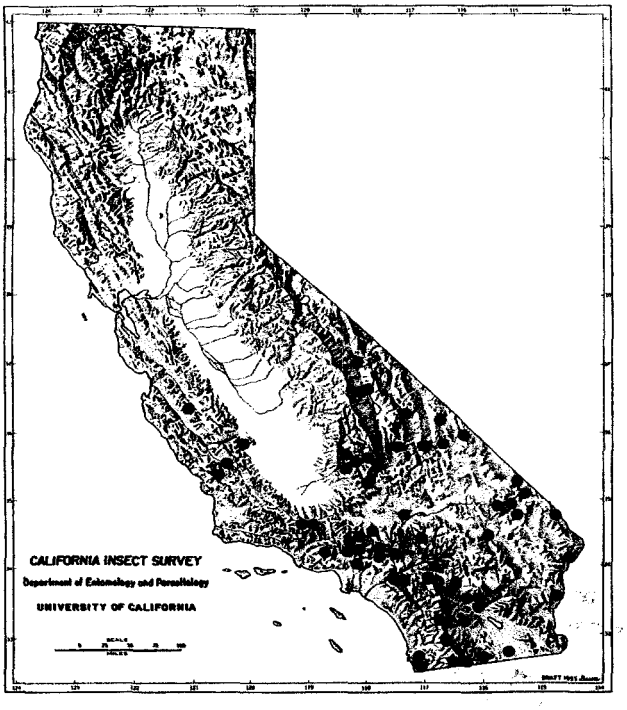
Hebard, in his 1937 paper, discussed the possible racial status of *californicus* Thomas and *aridus* Bruner. The color of the insect is variable, almost white to rusty red or even plumbeous; two or more of these shades may be combined on a single specimen. The species is notable for the great difference in size between the sexes. Specimens, especially female, from the region of San Diego are very stout through the thorax, tapering rapidly forward to the relatively narrow head, but the attempt to sort material according to racial names is futile until precise study of the species over its entire range is done.

Body 15–28; tegmen 15–26; hind femur 9–14.

Geographic range.—Southwestern Texas and northern Chihuahua, Mexico, to southern California, and north to southern Nevada and Utah.

California records.—(Map 72) Hebard in 1937 recorded much material from Los Angeles, Imperial, Inyo, Kern, Orange, Riverside, San Bernardino, San Diego and Ventura counties. Many specimens have been examined in the present study. IMPERIAL CO.: Coyote Wells, VII–16–49 (D. J. & J. N. Knull); IX–16–22, 270 ft. elevation (Rehn & Hebard, ANSP). 5 mi. W. Coyote Wells, IX–16–22, 500 ft. elevation (Rehn & Hebard, ANSP). El Centro, VIII–25–31 (E. R. Tinkham, ANSP). INYO CO.: Homewood, Argus Mts., VI–3–57 (J. M. Burns). Furnace Creek Camp, Death Valley, III–30–49 (A. C. Browne). Panamint, Townes Pass, VIII–23–40 (E. R. Helwig, ANSP). Salisbury Pass, W. of Shoshone, IV–4–42, 3500 ft. elevation (H. R. Roberts, ANSP). Hole-in-the-Rock Springs, Boundary Canyon, Amargosa Range, VIII–13–19, 3000 ft. elevation (Rehn & Hebard, ANSP). Panamint Valley opposite Hall Canyon, IX–6–22, 1500 ft. elevation (Rehn & Hebard, ANSP). 11 mi. N. Independence, V–27–54, 3900 ft. elevation (J. Rehn, ANSP). Independence, VII–4–64 (J. D. Birchim, JDB). 4 mi. E. Independence, VII–25–64 (J. D. Birchim, JDB). 7 mi. N. Big Pine, VII–28–64 (J. D. Birchim, JDB). 9 mi. W. Big Pine, VII–21–64 (J. D. Birchim, JDB). KERN CO.: Inyokern, Short Canyon, IV–16–54, immature (R. F. Smith, CIS); IV–18–54 (J. W. Mac-

Swain, CIS). 16 mi. S. Weldon, IV–26–64 (J. T. Doyen, CIS). Havilah, IV–28–64, 3000 ft. elevation (J. A. Powell, CIS). Red Rock Canyon, 1 mi. S. Ricardo, V–24–59 (E. G. Linsley, CIS). 5 mi. N.W. Dove Well, V–1–64, incl. immature (R. L. Langston & C. A. Toschi, CIS). Kernville, IV–24–64 (J. T. Doyen, CIS). Walker Pass, V–26–64, incl. immature (C. A. Toschi, CIS). Frazier Park, VI–8–51 (P. H. Arnaud, CAS). Warren, IX–17–10, 3400 ft. elevation (ANSP). Mojave, IX–15–10, 2750 ft. elevation (ANSP). KING'S CO.: Avenal, III–18–59 (R. P. Allen). LOS ANGELES CO.: 1 mi. W. Littlerock V–13–56 (E. G. Linsley & J. W. MacSwain, CIS); IV–26–56 (E. G. Linsley, CIS). Desert Springs, VI–23–55 (P. D. Hurd, CIS). Agua Caliente Springs, IV–17–46 (W. A. Redelings). Vincent, VII–10, 24–47 (G. P. Mackenzie). Sunland, III–13–32 (A. T. McClay, UCD). Claremont, 1909 (Baker, ANSP). Arroyo Seco Canyon, San Gabriel Mts., V–14–16 (S. Grinnell, ANSP). Pasadena, V–5–10 (S. Grinnell, ANSP). RIVERSIDE CO.: Sunnymead, VI–1957 (H. R. Moffett). Cathedral City, VII–16–50 (K. G. Whitesell). Magnesia Canyon, VI–28–52 (J. J. Menn, CIS). Anza, VI–24–56 (G. I. Stage, CIS); VII–3–56 (C. L. Wiley, CIS); VIII–5–56 (H. W. Michalk). Riverside, II–24–58 (D. Goodcase). Santa Rosa Mts., V–27 to VII–4–46, V–15–48 (D. J. & J. N. Knull). Temecula, IV–14–46 (D. J. & J. N. Knull). Indio, VI–28–37 (A. T. McClay, UCD). Citrus Expt. Station, III–12–63 (J. A. Chemsak, CIS). Blythe, VII–18–40 (E. R. Helwig, ANSP). Indio, IX–17–22, 50 ft. elevation (Rehn & Hebard, ANSP). Palm Springs to Palm Canyon, IX–29–10, 500 ft. elevation (ANSP). 4 mi. W. Beaumont (H. R. Roberts, ANSP). Idyllwild, VII–3–30, IV–10–26 (Timberlake, ANSP). Anza, VIII–1–32 (J. Russell, ANSP). SAN BENITO CO.: Pinnacles Nat. Mon., IV–9–58, V–30–60, V–28–60 (D. C. Rentz, CAS, DCR). 2 mi. N. Pinnacles Nat. Mon., IV–8–61 (D. C. Rentz, CAS). SAN BERNARDINO CO.: Nipton, VII–19–42 (R. P. Allen). 25 mi. S. Ivanpah, X–12–58, small immatures (W. E. Ferguson, CIS). Victorville, IX–1–19 (Rehn & Hebard, ANSP). Barstow, VIII–7–19 (Rehn & Hebard, ANSP). Needles, VIII–3–19 (ANSP). Goffs, VIII–5–19 (Rehn & Hebard, ANSP). Earp, near the Colorado River, VI–31–42 (H. R. Roberts, ANSP). North Range Providence Mts., VIII–12–07, 2300 ft. elevation (Rehn & Hebard, ANSP). Kelso, VIII–12–07, 2118 ft. elevation. Bagdad, VIII–6–19 (ANSP). Lucerne Valley, V–5–48 (D. J. & J. N. Knull, CIS). SAN DIEGO CO.: Borrego Valley, IV–19–57 (R. M. Bohart, UCD). Borrego, IV–25–55 (P. D. Hurd, CIS); V–3–56 (B. J. Adelson, CIS). 2 mi. N. Warner Springs, VII–4–56 (C. E. Wiley, CIS); III–15–41 (G. A. Marsh, CIS). Chula Vista, III–13–63 (J. A. Powell, CIS). San Felipe Valley, VII–24–28 (ANSP). 4 mi. W. Jacumba, IV–16–42, 8000 ft. elevation (H. R. Roberts, ANSP). Campo, IX–13–22, 2400 ft. elevation (Rehn & Hebard, ANSP). SAN LUIS OBISPO CO.: 5 mi. N.E. Santa Margarita, VI–9–62 (G. I. Stage, CIS). VENTURA CO.: Quatal Canyon, V–9–59 (C. W. O'Brien, J. R. Powers & P. D. Hurd, CIS). Hungry Valley, V–4–59 (C. W. O'Brien, J. R. Powers & P. D. Hurd, CIS); VI–6–59 (G. I. Stage, CIS). Lockwood Creek near Stauffer P.O., V–5–59 (C. W. O'Brien, CIS). Piru Creek, Alamo Mt., V–3–59 (C. W. O'Brien, CIS). Downer Ranch, Mt. Pinos, IX–3–22, 5400 ft. elevation (Rehn & Hebard, (ANSP).



Map 72. California distribution of *Cibolacris parviceps* (F. Walker).

Discussion—A widely distributed, common species in southern California. It is found on thin, rocky soils and overgrazed range land, desert pavement, and gravelly washes in the desert. It possesses a remarkable ability to blend in with its environment, a fact which makes it very difficult to detect until it moves. It overwinters in the nymphal stage, and adults are found from February to September. Barnum (1964) considers this species to be a faunal indicator of the Lower Sonoran Life Zone.

Genus *Circotettix* Scudder, 1876

KEY TO CALIFORNIA SPECIES AND SUBSPECIES OF CIRCOTETTIX

1 Wing sky-blue to bluish green . . . . . *undulatus thalassinus* Saussure (p. 97)
  Wing lemon yellow 2
2 Wing with posterior axillary vein thin, sometimes fused with anterior axillary (fig. 171); color almost uniform dark gray (northern counties) . *shastanus* Bruner (p. 96)
  Posterior axillary vein as thick as the anterior, prominent; color mottled with white (fig. 172) (Los Angeles Co.) . . . . . *splendidus* Rehn & Hebard (p. 97)

Circotettix shastanus Bruner

(Fig. 61, Map 73)

Circotettix shastanus Bruner, 1890, Proc. U.S. Nat. Mus., 12:76. Type ♂, Hazel Creek, Shasta Co., Calif. (USNM).

Dark gray, tegmina plain or somewhat mottled

with paler areas but not in strongly contrasting pattern. Hind tibia blue. Wing pale yellow, without black band but with fuscous clouds. Pronotum with median carina low throughout. In this species, as in other *Circotettix*, the tegmina are not narrowed distad and the wing is very broad with three of the radiate veins in the anal field much enlarged, especially in the male.

Body 24–29; tegmen 27–30; hind femur 12–14.

Geographic range.—California and Oregon.

California records.—(Map 73) DEL NORTE CO.: Crescent City, VII–20–23 (E. O. Essig, CIS). EL DORADO CO.: Caldor, VIII–7–39 (Q. Tomich, CIS). 3 mi. S. of Caldor, on middle Dry Creek, VIII–1–64 (D. C. & K. A. Rentz, DCR). FRESNO CO.: Paradise Valley, King's River, VII–16–19, 7000 ft. elevation (E. C. Van Dyke, CAS). GLENN CO.: 4 mi. W. Plaskett Meadows Station, X–10–64, 6400 ft. elevation (D. C. & K. A. Rentz, DCR). MARIPOSA CO.: Yosemite Valley, IX–1–19, 4800 ft. elevation (Rehn & Hebard, ANSP); VI–30–21 (E. C. Van Dyke, CAS). 7 mi. N.W. Fish Camp, VII–6–46 (H. P. Chandler, CAS). NEVADA CO.: Sagehen Creek, Hobart Mills, VII–21–54 (J. A. Powell, CIS). PLACER CO.: Squaw Peak, VIII–31–10, 8800 ft. elevation (ANSP). Five Lakes Valley, foot of Squaw Peak, VIII–31–10, 8200 ft. elevation (ANSP). Donner Pass, VII–31–59 (J. R. Helfer, CAS). PLUMAS CO.: Crescent Mills, VII–8–32 (CIS). 4 mi. W. Quincy, VII–3–49 (E. I. Schlinger, UCR). Johnville, VII–8–54. Eureka Peak, VIII–9–59, 5500 ft. elevation (W. Bauer, CAS). near Twain, VII–3–60 (D. C. Rentz, DCR). SHASTA CO.: Hazel Creek (ex: Bruner). Lassen Park, IX–9–41 (E. C. Van Dyke, CAS). SIERRA CO.: Gold Lake, VII–8–54 (J. A. Powell, CIS). SISKIYOU CO.: Mt. Shasta, VIII–14–09, 5500 ft. elevation, on lava beds (ANSP). Stewart Springs, China Mt., IX–2–54 (E. R. Helwig, ANSP). TRINITY CO.: East Weaver Lake, IX–25–63 (F. L. Blanc & G. M. Buxton, CDA). TUOLUMNE CO.: Sonora Peak, VIII–6–59 (D. C. Rentz, DCR).

Circotettix splendidus Rehn and Hebard
(Map 73)

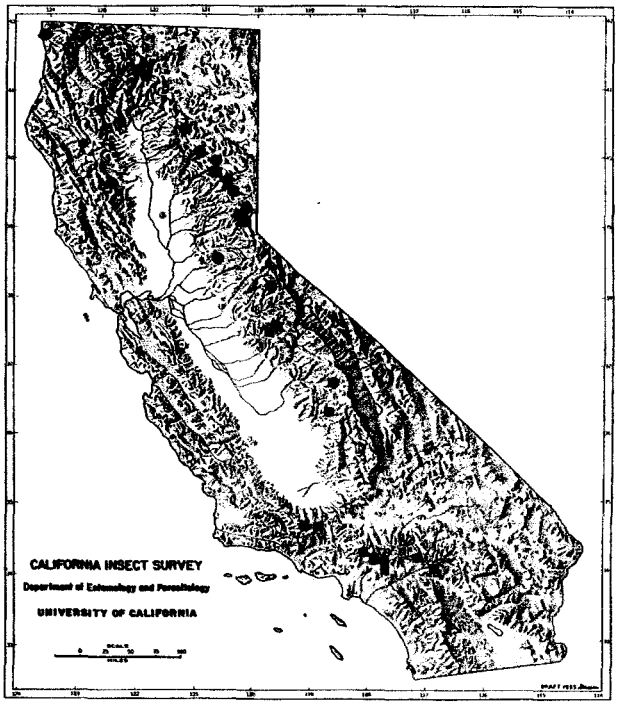
Circotettix splendidus Rehn & Hebard, 1909, Proc. Acad. Nat. Sci. Phila., 61:456, Figs. 13, 14. Type ♂, Mt. Lowe, San Gabriel Mts., Los Angeles Co., Calif., 3500 ft. elevation (ANSP).

Differs from *C. shastanus* in slightly larger size, its gray color strongly mottled with white and in the strong development of the second axillary vein.

Body 29–32; tegmen 31–31; hind femur 14–15.

Geographic range.—California.

California records.—(Map 73) LOS ANGELES CO.: Mt. Lowe, San Gabriel Mts., VIII–8–07, 5300–5600 ft. elevation (Rehn & Hebard, ANSP). Mt. San Antonio, VIII–5–48 (W. E. Kelser, CIS). Crystal Lake, VI–29–50 (A. T. McClay & P. D. Hurd, UCD, CIS). Camp Baldy, VII–11–50 (P. D. Hurd & H. L. Hansen, CIS). Lebec, VIII–1–40 (E. R. Helwig, ANSP). MARIPOSA CO.: Glacier Point Road, Yosemite Nat. Park, VIII–7–40 (E. R. Helwig, ANSP). SAN BERNARDINO CO.: Big Pines Camp, VII–4–36 (Timberlake, ANSP). San Bernardino Mts., High Creek, VIII–29–19, 9000 ft. elevation (ANSP). San Bernardino Mts., Vivian Creek, VIII–29–19, 7200 ft. elevation, in heavy forest (ANSP). TULARE CO.: Sequoia Nat. Park, VIII–3–40 (E. R. Helwig, ANSP). VENTURA CO.: Downer Ranch, Mt. Pinos, IX–3–22, 5300 ft. elevation (Rehn & Hebard, ANSP). Cuddy Canyon, IX–4–22, 4472 ft. elevation (Rehn & Hebard, ANSP). Mt. Pinos, IX–4–22, 8000 ft. elevation (Rehn & Hebard, ANSP).



Map 73. California distribution of: ●, *Circotettix shastanus* Bruner; ■, *Circotettix splendidus* Rehn and Hebard.

Circotettix undulatus thalassinus Saussure, new combination
(Map 74)

Oedipoda undulata Thomas, 1872, U.S. Geol. Sur. Terr.: 460.
Circotettix thalassinus Saussure, 1884, Prodrome Oedip., p. 177. Type Locality, Nev.

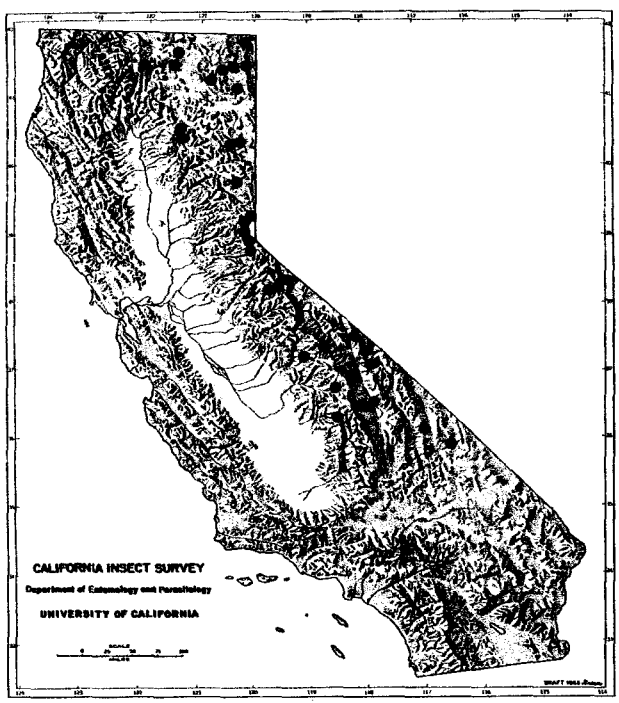
Very much like *C. shastanus* in size and appearance, gray, sometimes mottled with darker gray. Hind tibia blue. Wing pale green to azure, without dusky suffusions.

Body 24–29; tegmen 28–29; hind femur 12–13.

Geographic range.—California and Nevada.

California records.—(Map 74) EL DORADO CO.: Echo Lake, VII–26–59, 7400 ft. elevation (immature) (W. W. Middlekauff, CIS); VII–28–59, VII–23–60 (W. W. Middlekauff, CIS). Fallen Leaf Lake, VIII–19–15 (L. S. Rosenbaum, ANSP); VII–19–15 (E. C. Van Dyke, ANSP); VIII–30–54 (E. R. Helwig, ANSP). FRESNO CO.: Bubbs Creek Canyon, King's River, VII–9–10, 10,500 ft. elevation (E. C. Van Dyke, ANSP). Huntington Lake, VII–23–19 (F. C. Clark, ANSP).

INYO Co.: Silver Canyon Trail, IX–10–19, 9500 ft. elevation (Rehn & Hebard, ANSP). Upper meadows, Whitney Pass Trail, IX–6–19, 10,700 ft. elevation (Rehn & Hebard, ANSP). Lone Pine Lake, Whitney Pass Trail, IX–6–19, 10,000 ft. elevation (Rehn & Hebard, ANSP). Glacier Lodge, VIII–20–46 (G. P. Mackenzie, UCD). Whitney Portal, VIII–6–48 (J. W. MacSwain & P. D. Hurd, CIS). Westgard Pass, VIII–25–54 (P. D. Hurd, CIS); IX–11–62 (J. T. Doyen, CIS). Telescope Peak, Panamint Mts., VI–8–61 (R. P. Allen, CDA). Wyman Canyon, White Mts., VI–27–61 (W. A. Foster, CIS). Big Pine, VIII–1929 (CAS). Deep Springs, VIII–9–59 (D. C. Rentz, DCR). LASSEN Co.: 10 mi. N. Litchfield, VI–19–59 (R. W. Thorp, CIS). Susanville, VIII–21–22, 4190 ft. elevation (ANSP). MODOC Co.: Canby, VII–13–50 (R. W. Harper, CDA). Likely District, VI–14–51 (H. H. Keifer, CDA). Cedar Peak, Warner Mts., VIII–25–22, 7200 ft. elevation (Rehn & Hebard, ANSP). Lassen Creek, Goose Lake, VIII–24–22, 5000 ft. elevation (Rehn & Hebard, ANSP). Westwood, VIII–18–26 (C. C. Wilson, ANSP). Sugar Hill, Goose Lake, VIII–24–22 (Rehn & Hebard, ANSP). Cedar Peak, VIII–25–22, 8400 ft. elevation (Rehn & Hebard, ANSP). Mammoth, VII–17–33 (G. & R. Bohart, CAS). Alturas, VIII–23–22, 4500 ft. elevation (Rehn & Hebard, ANSP). MONO Co.: Sonora Pass, VII–6–51, 9624 ft. elevation (J. W. MacSwain, CIS); VII–13–51 (S. M. Kappos, CIS). S.E. of Red Lake, VIII–15–62, 11,000 ft. elevation (H. B. Leech, CAS). Leavitt Meadow, VIII–10–62, 7200 ft. elevation (H. B. Leech, CAS). Sonora Pass, VIII–13–60 (R. W. Thorp, CAS). Pickel Meadow, VIII–16–60 (D. Q. Cavagnaro, CIS). Blanco's Corral, White Mts., VIII–25–60 (M. E. Irwin, UCD). Crooked Creek, White Mts., VII–16–61 (W. A. Foster, CIS). Slinkard Canyon, 6 mi. N. Coleville, VII–24–62 (J. A. Powell, CIS). 8 mi. E. Sonora Pass, IX–5–60 (D. C. Rentz, DCR). NEVADA Co.: Truckee, VII–10–54 (J. A. Powell, CIS). Boca, VII–3–54 (P. D. Hurd, CIS); VIII–1–59 (F. D. Parker, UCD). 3 mi. N. Truckee, VII–3–60 (G. M. Buxton, CDA). Boca, VIII–29–54 (E. R. Helwig, ANSP). PLACER Co.: Carnelian Bay, Lake Tahoe, VII–16–60 (T. Gantenbein). Lake Tahoe, VII–19–24 (E. O. Essig, CIS). PLUMAS Co.: Portola, VII–20–49 (H. H. Keifer, CDA). SHASTA Co.: Old Station, VIII–20–49 (H. H. Keifer, CDA). Lassen Park, VIII–22–49 (H. H. Keifer, CDA). SISKIYOU Co.: Mt. Hoffman, VII–19–51 (R. W. Harper, CDA). Grass Lake, VIII–12–57, 7700 ft. elevation (H. P. Chandler, CAS). Lava Beds Nat. Mon., VII–8–59 (J. R. Helfer, DCR). TULARE Co.: Mineralking, VIII–5–35 (G. & R. Bohart, CAS). TUOLUMNE Co.: Sonora Pass, VIII–21–59 (J. R. Powers, CIS). Blue Canyon, VIII–18–60 (A. S. Menke, UCD); VIII–30–60 (M. E. Irwin, UCD). Vicinity of Sonora Peak, IX–5–60 (D. C. Rentz, DCR). Sonora Pass, IX–5–60 (C. D. MacNeill, DCR). Leavitt Meadows, VI–11–59 (M. Lundgren, DCR). Sonora Pass, VIII–21–59 (C. W. O'Brien, DCR). Sonora Peak, VIII–6–59 (D. C. Rentz, DCR).



Map 74. California distribution of *Circotettix undulatus thalassinus* Saussure.

Discussion—Quite certainly *C. undulatus* presents a cline from Montana through southern Idaho, northern California and Nevada to Inyo County, California. The Idaho form, with yellow-green wings was described as *C. lapidicola* by Bruner and the Nevada form with blue-green wings as *thalassinus* by Saussure. Specimens from Mono, Inyo and Tuolumne counties have the wings smaller than northern individuals and less lobate in the axillary region. The median area of the wing is also much narrowed by the forward curvature of the ulnar vein, whereas in typical *undulatus* the median and ulnar areas are subequal. Specimens from the region of Lake Tahoe are intermediate both in wing color and venation.

C. undulatus thalassinus is one of the most frequently seen grasshoppers when in the higher elevations of the state. It flies very high and frequently hovers over slopes where females are likely to be resting. The stridulation is a high snapping or crackling, audible for considerable distances.

Genus *Coniana* Caudell, 1915

Coniana snowi Caudell
(Fig. 25, Map 75)

Coniana snowi Caudell, 1915, Proc. U.S. Nat. Mus., 49:26. Type ♀, Bill Williams Fork, Arizona (USNM No. 18483).

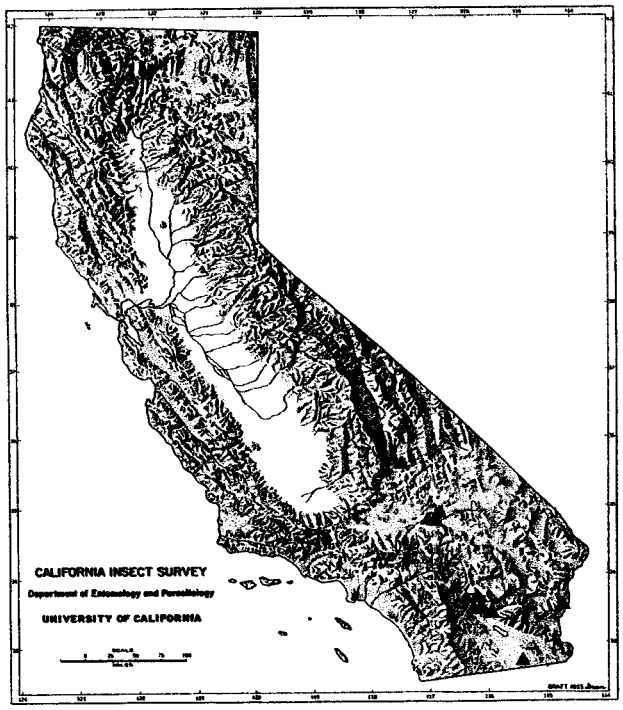
Small, slender, white, dorsum of head, pronotum and upper paginae of hind femora with many small black dots; tegmina with numerous quadrate dark spots. Hind tibia yellow. Pronotum sellate, its hind margin broadly rounded, all carinae obsolete. Thoracic pleura coarsely pitted.

Body 14–19; tegmen 15–19; hind femur 10–12.

Geographic range.—Arizona and California.

California records.—(Map 75). RIVERSIDE Co.: Whitewater, VII–9–50 (E. G. Linsley, CIS). Palm Springs Station, VI–

26–52 (J. W. MacSwain, CIS); VI–11–54 (J. C. Hall); VI–22–55 (P. D. Hurd, CIS); X–9–55 (J. W. MacSwain, CIS); VIII–27–52 (H. Graham, CIS). 8 mi. N.W. Palm Springs, VII–31–56 (M. Wasbauer, CIS). Magnesia Canyon, VI–28–52 (J. J. Menn, CIS). Mecca, VIII–15–56, on *Croton californicum* (M. Wasbauer, CIS). Rancho Mirage, VI–15–58 (D. M. Newell). Thousand Palms, VIII–23–58 (D. M. Newell). Blythe, VII–18–40 (E. R. Helwig, ANSP). Sand Hills, 4 mi. E. Palm Springs, VIII–20–37 (Rehn, Pate & Rehn, ANSP). SAN BERNARDINO CO.: Lyons, IX–1909 (ANSP); VIII–11–07 (ANSP). Trona, IX–5–22, 1800 ft. elevation (Rehn & Hebard, ANSP). Daggett, IX–9–24, 2000 ft. elevation (Rehn & Hebard, ANSP). Barstow, VIII–7–19 (Rehn & Hebard, ANSP). Yermo, 6 mi. E., VIII–27–52 (H. B. Leech, CAS). IMPERIAL CO.: Gray's Wells, VIII–26–31 (E. R. Tinkham, ANSP).



Map 75 California distribution of *Coniana snowi Caudell.*

Discussion—Sometimes common in sandy areas of the Colorado and Mohave (Lower Sonoran) areas in association with the low growing plant *Coldenia palmeri.* Helfer (1963) states that adults sometimes bury themselves in the desert sand overnight.

Genera *Conozoa* Saussure, 1884 and *Trimerotropis* Stal, 1873

After proposing the genus *Conozoa* in 1884, Saussure in 1888 commented that it was "more necessary than natural." Certainly the partition of species between the two genera which McNeill set up in 1901 cannot stand detailed analysis. Probably additional genera must be devised to accomplish a satisfactory taxonomy of the complex. Loss of the McNeill (and some other) types raises troublesome obstacles to the study of this group. The following key does not include *Trimerotropis porrecta* McNeill, a name of uncertain status.

KEY TO THE CALIFORNIA SPECIES OF CONOZOA AND TRIMEROTROPIS

1 Hind tibiae red 2
Hind tibiae not red 6

2 Black band of wing broad. Lower sulcus and inner face of the hind femur red . . . . . *T. latifasciata* Scudder (p. 120)
Without above combination of characters . . . 3

3 Dark tegminal cross-bands complete, sometimes faint 4
Dark cross-bands only on anterior half of tegmen . 5

4 Black band of wing narrow, interrupted near costa (fig. 46) . . . . *californica* Bruner (p. 116)
Black wing band broad, uninterrupted . . . . . *T. strenua* McNeill (p. 125)

5 Pronotum smooth; lower posterior angle of lateral lobe much produced and acute (fig. 39) . . . *C. sulcifrons sulcifrons* (Scudder) (p. 101)
Pronotum usually verruculate; lower posterior angle of lateral lobe rectangular to obtuse (fig. 38) . *C. wallula* (Scudder) (p. 102)

6 Hind tibiae yellow, brown or greenish yellow . . 7
Hind tibiae blue 24

7 Junction of posterior and lower margin of lateral lobe of pronotum angulate or with an adjacent dentation 8
Lower hind angle of lateral lobe broadly rounded . 17

8 Median carina of pronotum cristate-bilobate on prozona 11
Median carina low or tectate on prozona . . . 9

9 Ground color dark gray (northern) . . . . *T. munda* (Scudder) (p. 120)
Ground color very pale or white 10

10 Black wing-band feeble or absent (Monterey Co.) *T. titusi Caudell* (p. 128)
Black wing-band distinct (southern) (fig. 45) . *T. pacifica* Bruner (p. 122)

11 Lower hind angle of pronotal lateral lobe rectangular to obtuse-angulate 12
Lower hind angle rectangular to (usually) acute . 16

12 Ventral sulcus of hind femur dark with two pale bands (occurs in extreme south of state) (fig. 43) . . . . . *T. cristata* McNeil (p. 117)
Ventral sulcus of hind femur pale with one black band 13

13 Pronotum (dorsal view) more than one and one-half times as long as head; metazona gradually widened behind 14
Pronotum less than one and one-half times as long as head; metazona rapidly widened 15

14 Occiput strongly ascending; occiput and pronotum with a pair of pale stripes (fig. 41) . . . . *T. rebellis* (Saussure) (p. 124)

Occiput and pronotum not as above . . . . . *C. wallula* (Scudder) (p. 102)

15 Median carina compressed-cristate on metazona . *C. occidentalis* (Bruner) (p. 100)

Median carina low and linear on metazona (fig. 40) *T. hyalina* McNeil (p. 119)

16 Slender; head and pronotum with white stripes; hind femur more than four times as long as wide (fig. 41) . . . *T. rebellis* (Saussure) (p. 124)

Robust; hind femur less than four times as long as its greatest width (fig. 40) . . . . . *T. hyalina* McNeil (p. 119)

17 Wing disc yellow with or without black band . . 18

Wing disc not yellow 21

18 All carinae of pronotum sharp on metazona . . *T. gracilis gracilis* (Thomas) (p. 118)

Median carina linear on metazona, lateral carinae rounded 19

19 Tegmina without distinct cross-bands . . . . *T. coquilletti* McNeil (p. 116)

Tegminal cross-bands distinct 20

20 Median carina of pronotum low throughout (fig. 48) . . . . . *T. inconspicua* Bruner (p. 119)

Median carina of pronotum tectate on prozona . *T. pallidipennis pallidipennis* (Burmeister) (p. 122)

21 Wing disc pale blue (fig. 60) . . . . . *T. sparsa* (Thomas) (p. 125)

Wing disc colorless 22

22 Slender; median carina of pronotum sharp on metazona; dark gray; tegmina without cross-bands . *T. gracilis gracilis* (Thomas) (p. 118)

Stout; median carina low and linear on metazona . 23

23 Smaller (body 13–18 mm.); tegmina hardly surpassing apices of hind femora (fig. 52) . . . *T. poogonata* Strohecker (p. 123)

Larger (body 18–25 mm.); tegmina greatly surpassing apices of hind femora (northern coast) (fig. 53) . . . . *T. helferi* Strohecker (p. 118)

24 Wing disc blue or blue-green 35

Wing disc yellow, greenish-yellow or colorless . 25

25 Wing yellow, or tinged with yellow 26

Wing colorless 34

26 Very slender; median carina of pronotum high, compressed and bidentiform on prozona (fig. 42) *T. bilobata* Rehn and Hebard (p. 115)

Median carina low or tectate on prozona . . 27

27 Lower margin of pronotal lateral lobe with a sharp tooth adjacent to hind angle (fig. 46) . . . *T. californica?* Bruner (p. 116)

Lower margin of lateral lobe at most obtuse-angulate behind 28

28 Ground color white; lateral lobe of pronotum flared (fig. 44) . . . . *T. albescens* McNeill (p. 114)

Ground color gray or brown; lateral lobe hardly flared 29

29 Prozona of pronotum without lateral carinae, rounded into the lateral lobes; fastigium short and shallow (fig. 47) . . . . . *T. bifasciata* Bruner (p. 115)

Prozona with short lateral carinae near front margin; fastigium sulcate, its margins distinctly elevated 30

30 Antennae pale, not annulate; pronotum very smooth, the median carina low throughout, lower margin of lateral lobe usually subdentate at hind angle (fig. 40) . . . . . *T. thalassica* Bruner (p. 127)

Antennae annulate with fuscous; prozona of pronotum with median carina elevated, usually scutellate 31

31 Color dark brown; tegmina without cross-bands; wing yellow with black band and infuscate apex (fig. 57) . . . . *T. suffusa* Scudder (p. 126)

Tegmina with cross-bands, these sometimes faint or limited to anterior half 32

32 Head small; metathorax very wide; lower posterior angle of lateral lobe of pronotum usually obtusely pointed; salt-and-pepper coloration (fig. 51) . *T. arenacea* Rehn (p. 115)

Head and thorax normal for genus; lower posterior angle of lateral lobe usually rounded 33

33 Cross-bands of tegmina limited to anterior half; head usually with black band through eyes (fig. 56) . . . . . *T. koebelei* (Bruner) (p. 119)

Tegminal cross-bands complete; eyes not banded (fig. 55) . . . . *T. fontana* Thomas (p. 117)

34 Smaller (body 18–26 mm.); lower posterior angle of lateral lobe of pronotum broadly rounded (fig. 50) . . . . *T. occidentalis* (Bruner) (p. 121)

Larger (body 24–30 mm.); lower posterior angle of lateral lobe usually subdentate (median carina of pronotum high and tectate-cristate on prozona) (fig. 58) . . *T. pseudofasciata* Scudder (p. 123)

35 Prozona of pronotum with median carina tectately elevated; posterior lobe of prozona uneven, scutellate 36

Pronotum smooth, the prozona with median carina low, the posterior lobe not or but feebly scutellate 37

36 Smaller (body 18–26 mm.); lower posterior angle of lateral lobe of pronotum broadly rounded (fig. 50) . . . . *T. occidentalis* (Bruner) (p. 121)

Larger (body 24–30 mm.); lower posterior angle of lateral lobe usually subdentate (median carina of pronotum high and tectate-cristate on prozona) (fig. 58) . *T. pseudofasciata* Scudder (p. 123)

37 Antennae annulate with fuscous; metazona of pronotum rarely twice as long as prozona, its posterior margin rectangulate to obtuse; lower margin of lateral lobe rounded into hind margin (fig. 59) . . *T. cyaneipennis* Bruner (p. 117)

Antennae pale, not annulate, flattened; metazona twice or more as long as prozona; its posterior margin rectangulate to acute; lower margin of lateral lobe usually subdentate behind; body compressed, deep (coastal) (fig. 49) . . . *T. thalassica* Bruner (p. 127)

Conozoa occidentalis (Bruner)

(Map 76)

Trachyrhachis occidentalis Bruner, 1905, Biol. Centr.-Amer., Orth., 2:174. Lectotype ♂, high stony hilltops to the southwest of San Francisco, designated by Rehn & Hebard, 1912 (ANSP).

Conozoa occidentalis Gurney & Strohecker, 1959, Bull. Brooklyn Ent. Soc., 54:78.

Bruner included this form in a key but without further description. The type is from San Francisco, and at least one competent orthopterist considers *Trachyrhachys occidentalis* Bruner a synonym of *Conozoa wallula* Scudder. The name is here used for specimens from Santa Barbara and San Luis Obispo counties which agree with the type except in color.

Dark gray, bands of tegmina indistinct. Hind tibia yellow. Slender, pronotum with median carina well elevated throughout, lateral carinae elevated and compressed on metazona, hind margin of metazona rectangulate, lower hind angle of lateral lobe subrectangulate.

Body 17–19; tegmen 16–19; hind femur 9–10.5.

Geographic range.—Central and southern coastal California.

California records.—(Map 76). SAN FRANCISCO CO.: San Francisco, IX–12–09 (F. X. Williams, CAS); IX–9–22 (E. P. Van Duzee, CAS). Lone Mountain, VI–1925 (F. X. Williams, CAS). San Francisco, Lobos Creek, VIII–13–62 (C. D. MacNeill & D. C. Rentz, CAS). SAN LUIS OBISPO CO.: Grover City, dunes, VII–4–56 (E. G. Linsley, P. D. Hurd, CIS). Oso Flaco Lake, VII–13–59 (R. M. Bohart & W. A. Steffan, CIS). SANTA BARBARA CO.: San Marcos Ranch, Santa Ynez Mts., VII–5–56 (P. D. Hurd, CIS).

Conozoa sulcifrons sulcifrons (Scudder)

(Fig. 39, Map 76)

Psinidia sulcifrons Scudder, 1876, Ann. Rept. Chief Eng., p. 513. Type ♂. Mohave River, San Bernardino Co., Calif. (MCZ).

Conozoa sulcifrons Saussure, 1884, Prodrome Oedip., p. 166.

Pale brown, tegmen with two or three dark blotches in costal half. Hind tibia red. Pronotum elongate, smooth, median carina rather low, hind margin slightly acute to slightly obtuse, lower hind angle of lateral lobe usually acute, but subrectangular in occasional specimens.

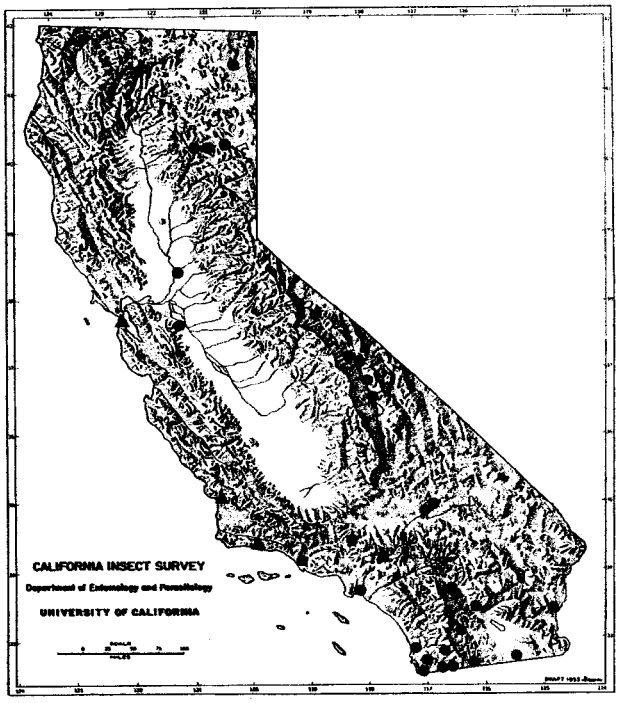
The use of a trinominal is due to the recognition of a more eastern race.

Body 18–26; tegmen 21–29; hind femur 10–14.5.

Geographic range.—Arizona, California, Nevada and Utah.

California records.—(Map 76) IMPERIAL CO.: El Centro, IX–3–48. INYO CO.: Bishop, IX–9–19 (Rehn & Hebard, ANSP). Lone Pine, IX–5–19 (M. Hebard, ANSP). W. Bishop, VII–24–64 (J. D. Birchim, JDB). Independence, VII–4–64 (J. D. Birchim, JDB). Pine Creek, Round Valley, N.W. of Bishop, VIII–7–61 (C. D. MacNeill, D. C. Rentz & M. R. Lundgren, CAS). Bishop, VII–11–64 (J. D. Birchim, JDB). LASSEN CO.: Johnstonville, VIII–21–22, 4150 ft. elevation (ANSP). Amedee, VIII–22–22, 3960 ft. elevation (Rehn & Hebard, ANSP). Westwood, VIII–21–22, 5000 ft. elevation (Rehn & Hebard, ANSP). LOS ANGELES CO.: Ravenna, IX–27–16 (ANSP). Alamitos Bay, VII–31–07 (ANSP). MODOC CO.: Alturas, VIII–23–22, 3500 ft. elevation (Rehn & Hebard, ANSP). MONO CO.: Mono Lake, 10 mi. N. Leevining, VII–6–61 (C. D. MacNeill, D. C. Rentz & M. R. Lundgren, CAS). PLUMAS CO.: Chester, VIII–20–22, 3300 ft. elevation (ANSP). Lake Almanor, VIII–28–31. RIVERSIDE CO.: Indio (ex: Scudder, Caudell); VI–28–37 (A. T. McClay, UCD); VI–7–56 (M. Wasbauer, CIS). Thermal, VII–10–56 (M. Wasbauer, CIS). Ripley, VIII–13–46, in alfalfa (W. F. Barr, CIS). 6 mi. N. Indio, IV–30–49, in *Melilotus* (E. G. Linsley, J. W. MacSwain & R. F. Smith, CIS). Blythe, VIII–6–46, in alfalfa (W. F. Barr, CIS). San Jacinto Mts., VII–21–29 (P. W. Oman, ANSP). Hemet Lake, VII–27–35 (M. Gyger, ANSP). SACRAMENTO CO.: Sacramento, (E. O. Essig, ANSP). SAN BERNARDINO CO.: Barstow, VIII–7–19 (Rehn & Hebard, ANSP). Victorville, IX–1–19 (Rehn & Hebard, ANSP). SAN DIEGO CO.: Borrego, X–14–48 (G. P. Mackenzie, CIS); X–10–50 (H. H. Keifer, CDA). Jacumba, VIII–20–49 (D. J. & J. N. Knull, CIS). San Felipe Creek, VI–5–15 (ANSP). Jacumba, VIII–12–13 (J. C. Bradley, ANSP). Descanso, IX–13–22, 3400 ft. elevation (Rehn & Hebard, ANSP). Campo, IX–13–22, 2100 ft. elevation (Rehn & Hebard, ANSP). Potrero, IX–12–22, 2323 ft. elevation (Rehn & Hebard, ANSP). Jamacha, IX–12–22, 340 ft. elevation (Rehn & Hebard, ANSP). Tiajuana, VIII–16–07 (ANSP); IX–11–22 (Rehn & Hebard, ANSP). SAN JOAQUIN CO.: Tracy, VIII–30–07 (ANSP). SISKIYOU CO.: Sisson, VIII–16–09, 3550 ft. elevation (Rehn & Hebard, ANSP). VENTURA CO.: Montalvo, VIII–23–09 (ANSP).

Discussion—Common in the Lower Sonoran zone, especially in cultivated areas, low flats, and arroyos. Usually on alluvial fans but sometimes in areas of shallow soil and often in very dry situations.



Map 76. California distribution of: ▲, *Conozoa occidentalis* (Bruner); ●, *Conozoa sulcifrons sulcifrons* (Scudder).

Conozoa wallula (Scudder)
(Fig. 38)

Psinidia wallula Scudder, 1880, Second Report, U.S. Ent. Comm., App., 2:27. Lectotype ♂, Sissons [Mt. Shasta] Calif. (USNM, No. 4259), designated by Gurney & Strohecker, 1959.

Conozoa wallula Saussure, 1884, Prod. Oedip., p. 166.

Gray or brown, tegmen with dark bands confined to costal half. Wing yellow with black band. Hind tibia red or yellow. Pronotum with median carina well elevated on metazona as well as prozona, lower hind angle of lateral lobe usually subacute but variable.

Body 19–22; tegmen 18–24; hind femur 11–14.

Geographic range.—From southern California to Washington, east to Utah and Wyoming.

California records.—Probably occurs in suitable habitats over the whole state. Many specimens from the following counties have been seen:

ALAMEDA	MODOC	SAN DIEGO
COLUSA	MONO	SAN JOAQUIN
CONTRA COSTA	MONTEREY	SANTA BARBARA
FRESNO	ORANGE	SHASTA
HUMBOLDT	PLUMAS	SIERRA
INYO	RIVERSIDE	SISKIYOU
KERN	SACRAMENTO	STANISLAUS
LASSEN	SAN BENITO	VENTURA
LOS ANGELES	SAN BERNARDINO	YOLO

Discussion—A common inhabitant of drier habitats with sparse grass. Often found on dusty roads.

Genus *Cratypedes* Thomas, 1876

Cratypedes neglectus neglectus (Thomas)
(Fig. 29, Map 77)

Oedipoda neglecta Thomas, 1870, Proc. Acad. Nat. Sci. Phila, p. 81. Type ♂, New Mex. (USNM).

Cratypedes putnami Thomas, 1876, Proc. Davenport Acad. Sci., 1:257, Pl. 36, Fig. 6.

Hippiscus neglectus, Rehn & Hebard, 1909, Proc. Acad. Nat. Sci. Phila., 61:438.

Cratypedes neglectus, Hebard, 1928, Proc. Acad. Nat. Sci. Phila., 80:246.

Pronotum with median carina deeply cut by principal sulcus and usually undulate at anterior sulcus, hind margin acute to rectangular, posterior margin of lateral lobe decidedly retroarcuate. Hind tibiae red or yellow, blue in the race *glaucipes*.

Body 23–32; tegmen 24–38; hind femur 13–16.

Geographic range.—New Mexico to Montana and Manitoba, and all states and provinces to the west.

California records.—(Map 77) ALPINE CO.: Fredericksburg, VI–19–58 (W. W. Middlekauff, CIS). EL DORADO CO.: Fallen Leaf Lake, VII–4–30 (A. C. Browne, CDA). Lake Tahoe, Fallen Leaf Lake, VIII–1915 (L. S. Rosenbaum, ANSP); VII–11–15 (E. C. Van Dyke, ANSP). FRESNO CO.: Wood Creek, VIII–22–10, 10,000 ft. elevation (E. C. Van Dyke, ANSP). Paradise Valley, King's River, VII–16–10, 7000 ft. elevation (E. C. Van Dyke, ANSP). GLENN CO.: 4 mi. W. Plaskett Meadows, VI–28–61 (J. R. Helfer, CAS). 1 mi. W. Low Gap, VIII–26–61 (D. C. Rentz, CAS). 25 mi. E. Covelo, VI–28–61 (D. C. Rentz, DCR). 2 mi. W. Plaskett Meadows Station, VIII–27–61 (D. C. Rentz, DCR). HUMBOLDT CO.: Buck Mt., VI–22–59 (J. R. Helfer, CAS). INYO CO.: Sage Flat Camp, 10 mi. W. Big Pine, VII–20–64 (D. C. & K. A. Rentz, DCR). Mono Pass, VIII–10–59 (D. C. Rentz & C. D. MacNeill, DCR). KERN CO.: Frazier Park, V–3–59 (C. W. O'Brien, CIS). LASSEN CO.: Bridge Creek Camp, VII–14–54 (R. H. Goodwin, CIS). Standish, VI–15–51 (H. H. Keifer, CDA). MADERA CO.: Buck Camp, VIII–3–58 (M. E. Irwin, UCD). MARIPOSA CO.: Yosemite Valley, VIII–11–1897, cotypes. Yosemite Nat. Park, VIII–1–40 (L. J. Lipovsky, ANSP). MODOC CO.: 6 mi. N.W. Cedarville, VII–3–62 (J. S. Buckett, UCD). Likely Distr., VI–14–51 (H. H. Keifer, CDA). Davis Creek, Warner Mts., VII–10–22 (C. L. Fox, CAS). Warner Mts., Lake City, VII–28–22 (C. L. Fox, CAS); Duck Creek, VII–20–22 (C. L. Fox, CAS). MONO CO.: Tom's Place, VI–27–49 (H. E. Cott, CIS); VII–13–61 (W. A. Foster, CIS). Convict Lake, VIII–9–46 (G. Pollard, CIS). Mammoth Lakes, VIII–25–46 (G. P. Mackenzie, UCD); VIII–10–21 (O. C. Poling, ANSP). Crooked Creek, White Mts., VII–16–61 (W. A. Foster, CIS). Wyman Canyon, White Mts., VII–11–62, 10,000 ft. elevation (W. H. Lange, UCD). Cottonwood Creek, VII–10–61, 9300 ft. elevation (J. S. Buckett & W. A. Foster, CIS). Spring Canyon, 3 mi. N.E. Walker, VI–24–62 (J. A. Powell, CIS). Mt. Barcroft, White Mts., VII–21–61, 12,500 ft. elevation (D. C. Rentz, DCR). NEVADA CO.: Sagehen Creek, VII–21–54 (R. H. Goodwin & J. A. Powell, CIS); VII–9 to 16–54 (J. A. Powell, CIS); VIII–24–52 (R. F. Smith, CIS). 3 mi. S. Truckee, VII–2–49 (ANSP). PLACER CO.: Lake Forest, VIII–25–55 (CIS). Lake Tahoe, vicinity of Alpine Creek, VII–16–16 (ANSP). PLUMAS CO.: Chester, VII–14–54 (J. A. Powell, CIS). Lake Almanor, VII–15–57 (J. A. Powell, CIS). Greenville, VII–11–59 (L. A. Stange, UCD). 8 mi. S.W. of Johnsville, VIII–11–61 (J. S. Buckett, UCD). Mt. Ingalls, VII–16–41 (I. LaRivers, CIS). Mohawk, VIII–10–57; VII–3–62 (D. C. Rentz, DCR). Johnsville, VII–4–59 (W. R. Bauer & J. S. Buckett, CAS). Meadow Valley, VII–7–24 (E. C. Van Dyke, CAS). SAN BERNARDINO CO.: San Bernardino Mts., VII–6 to VIII–26 (Rehn & Hebard, ANSP). Big Bear Lake, VII–26–32 (J. D. Beamer, ANSP). SHASTA CO.: Hat Creek, VII–3–51 (G. Pronin, CAS). SIERRA CO.: Independence Lake, VII–20–54 (J. A. Powell, CIS). Sierraville, VII–9–54 (J. A. Powell, CIS). SISKIYOU CO.: VII–14–35 (R. H. Beamer, ANSP). Lava Beds Nat. Mon., VII–2–59 (J. R. Helfer, CAS). TRINITY CO.: 10 mi. N. Coffee Creek Ranger Station, VII–15–55 (J. W. MacSwain, CIS). Coffee Creek Ranger Station, VII–14–55 (J. C. Wells, CIS). Cold Springs, IX–8–62 (Blanc & Buxton, CDA). TULARE CO.: Redwood Meadow, VIII–3–15, 6000 ft. elevation (CIS). Funston Meadow, VII–28–15 (ANSP). TUOLUMNE CO.: Strawberry, VII–5–58 (W. H. Lange, UCD). Eagle Meadow, VII–28–61 (M. Lundgren, (DCR). Leavitt Meadow, VII–12–59 (M. Lundgren, DCR). Vicinity Sonora Peak, VIII–6–59; IX–5–60 (D. C. Rentz, DCR). Dardanelles, VIII–9–61 (D. C. Rentz, CAS). VENTURA CO.: Frazier Mt., Chuchupate Ranger Station, V–1–59 (J. R. Powers, CIS). Lockwood Valley near Stauffer P.O., V–2–59 (G. I. Stage, CIS).

Discussion—A common inhabitant of sunny, grassy slopes, especially at higher elevations in the Sierra Nevada. Often associated with *Trimerotropis*.

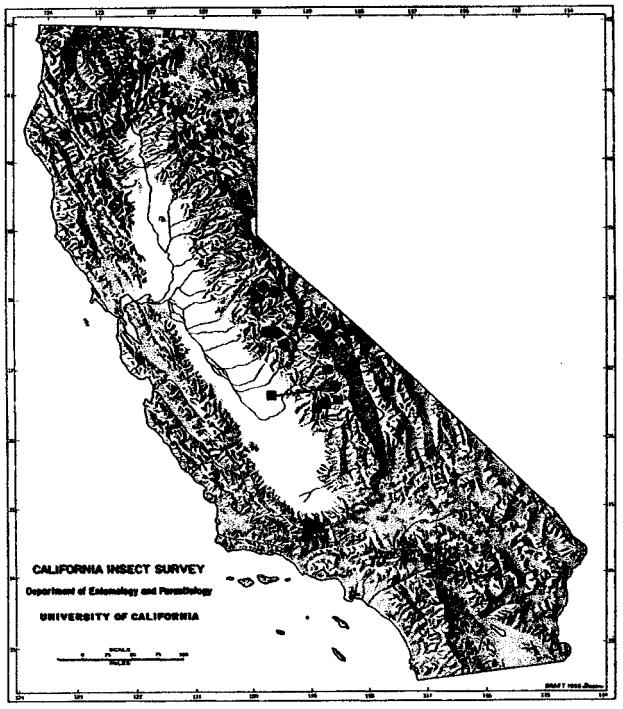
Cratypedes neglectus glaucipes (Scudder)

(Map 77)

Hippiscus glaucipes Scudder, 1901, Can. Ent., 33:89.
Cratypedes neglectus glaucipes, Hebard, 1928, Proc. Acad. Nat. Sci. Phila., 80:238. Type locality, Yosemite Valley, Calif.

Geographic range.—California.

California records.—(Map 77) FRESNO CO.: Leconte Canyon, VIII–27–46 (G. Pollard, CIS). Paradise Valley, King's River, VII–16–10 (E. C. Van Dyke, CAS). MARIPOSA CO.: Yosemite, Sentinel Dome, VIII–8–30 (E. R. Helwig, ANSP). TULARE CO.: Sequoia Nat. Park, VIII–2–29, 7000–9000 ft. elevation (A. T. McClay, UCD).



Map 77. California distribution of: ●, *Cratypedes neglectus neglectus* (Thomas); ■, *Cratypedes neglectus glaucipes* Hebard.

Genus *Derotmema* Scudder, 1876

KEY TO CALIFORNIA SPECIES OF DEROTMEMA

1 Median carina of pronotum obsolete between the sulci 2
Median carina dentiform between sulci . . . . *saussureanum* Scudder (p. 104)

2 Dark band of wing broader than pronotal metazona, reaching hind margin, leaving three free anal lobes . . . *laticinctum* Scudder (p. 104)
Dark band of wing narrower than metazona, leaving four free anal lobes . . . . . *delicatulum* Scudder (p. 103)

Derotmema delicatulum Scudder

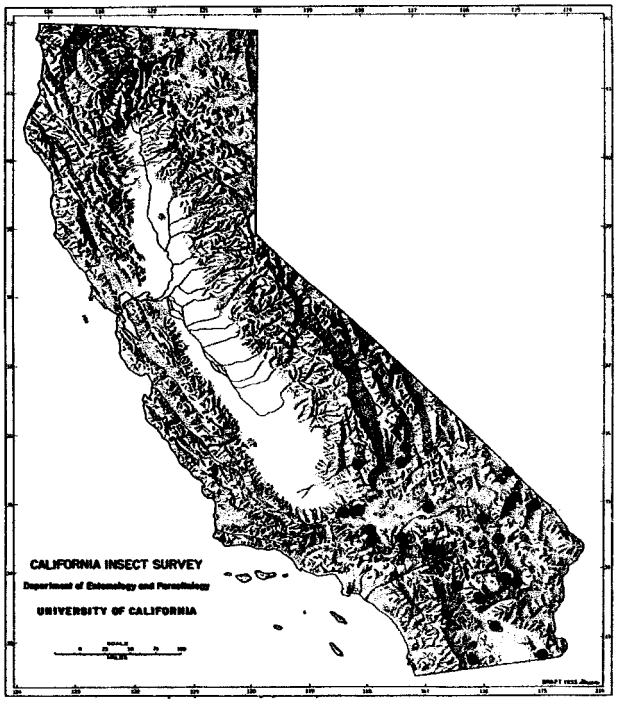
(Map 78)

Derotmema delicatulum Scudder, 1900, Proc. Amer. Acad. Arts Sci., 35:390. Lectotype ♂, Lancaster, Calif., designated by Rehn & Hebard, 1912 (MCZ).

Similar in size and appearance to *D. laticinctum* but pronotum with median carina completely obliterated between the sulci, its caudal margin broadly rounded. Black band of wing rather narrow and incomplete.

Geographic range.—Arizona, California and Nevada.

California records.—(Map 78) IMPERIAL CO.: sand hills, 20 mi. W. Yuma Arizona, IX–11–24 (Rehn & Hebard, ANSP). Salton Sea, VII–20–40 (E. R. Helwig, ANSP). 5 mi. W. Coyote Wells, IX–16–22, 500 ft. elevation (Rehn & Hebard, ANSP). INYO CO.: Shoshone, VIII–8–19 (M. Hebard, ANSP). Juncture of Slate and Argus ranges, IX–8–22, 2750 ft. elevation (ANSP). KERN CO.: Mojave, VIII–1 (ex: Scudder). Tehachapi, VIII–12–52 (R. W. Harper, CDA). Searles, IX–5–22 (M. Hebard, ANSP). N. of Pilot Knob, IX–11–24 (Rehn & Hebard, ANSP). LOS ANGELES CO.: Lancaster, VII–31– (ex. Scudder). Palmdale, X–14–47 (G. P. Mackenzie, UCD); VIII–1–35 (J. Russell, ANSP). RIVERSIDE CO.: Magnesia Canyon, VII–21–52 (E. Linsley, CIS). Palm Springs, VI–24–56 (G. I. Stage, CIS); VIII–28–34 (Timberlake, ANSP). Palm Springs to Palm Canyon, IX–29–10 (ANSP). Indio,



Map 78. California distribution of *Derotmema delicatulum* Scudder.

IX–17–22, 50 ft. elevation (ANSP). Blythe, VIII–27–33 (R. H. Beamer, ANSP). SAN BERNARDINO Co.: Cottonwood, IX–9– (Rehn & Hebard, ANSP). Goffs, IX–10– (Rehn & Hebard, ANSP). Kelso, VIII–12 (Rehn & Hebard, ANSP). N. Range, Providence Mts., VIII–12 (Rehn & Hebard, ANSP). Lucerne Valley, VII–27–49 (D. J. & J. N. Knull, CIS). Nipton, VIII–19–42 (R. P. Allen, CDA). Lyons, IX–1–09, 3000 ft. elevation. Bagdad, VIII–6–19 (Rehn & Hebard, ANSP). Barstow, VIII–7–19 (Rehn & Hebard, ANSP). Cottonwood Station, VIII–12–07, 2300 ft. elevation. Trona, IX–5–22, 1800 ft. elevation (Rehn & Hebard, ANSP). Mojave River, Hesperia, VII–28–40 (E. R. Helwig, ANSP). SAN DIEGO Co.: Mountain Springs, IX–16–22, 2540 ft. elevation (Rehn & Hebard, ANSP).

Discussion—Restricted to very dry desert areas on hard, bare soil with sparse vegetation. Very active, sometimes attracted to lights.

Derotmema laticinctum Scudder

(Map 79)

Derotmema laticinctum Scudder, 1900, Proc. Amer. Acad. Arts. Sci., 35:389. Lectotype ♂, Mesilla, New Mex., designated by Rehn & Hebard, 1912.

Pronotum with median carina prominent on anterior lobe of prozona, low but evident on posterior lobe, obsolete on metazona, hind margin very broadly obtuse-angulate. Wing yellow with broad black band. Hind tibia yellow. Regarded by some orthopterists as a race of *D. haydenii* (Thos.).

Body 14–19; tegmen 15–21; hind femur 9–11.5.

Geographic range.—California.

California records.—(Map 79). INYO Co.: Bishop, VII–11–64 (J. D. Birchim, JDB). Independence, VI–30–64 (J. D. Birchim, JDB). KERN Co.: Mojave, IX–15–10, 2750 ft. elevation (ANSP). Warren, IX–17–10, 3500 ft. elevation (ANSP). LOS ANGELES Co.: Acton, IX–27–10, 2700 ft. elevation (ANSP). Palmdale, VIII–1–35 (R. H. Beamer, ANSP). SAN BERNARDINO Co.: Cima, VIII–12–07, 4192 ft. elevation (ANSP). Goffs, VIII–5–19 (Rehn & Hebard, ANSP). Newberry, IX–9–24, 1831 ft. elevation (Rehn & Hebard, ANSP). Barstow, VIII–7–19 (Rehn & Hebard, ANSP). Victorville, IX–1–19 (Rehn & Hebard, ANSP). New York Mts., VIII–12–64 (J. D. Birchim & C. D. MacNeill, JDB).

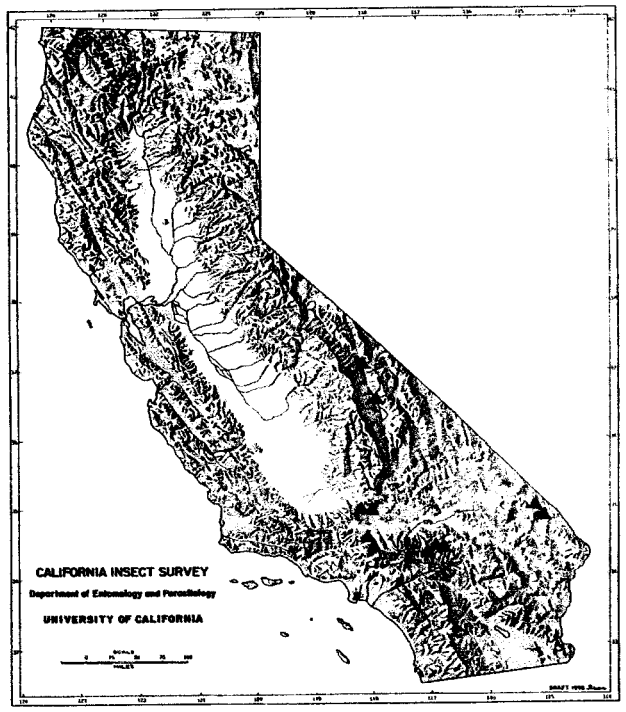
Derotmema saussureanum Scudder

(Map 80)

Derotmema saussureanum Scudder, 1900, Proc. Amer. Acad. Arts Sci., 35:391. Lectotype ♂, San Bernardino, Calif., designated by Rehn & Hebard, 1912 (MCZ).

Fastigium abruptly narrowed in front and rapidly descending, eyes very prominent. Hind margin of pronotum obtuse-angulate. Tegmina with a row of close-set dark spots along basal half of costa. Hind tibia yellowish. Wing pale yellow or blue with black band.

Body 16–20; tegmen 19–20; hind femur 11–12.

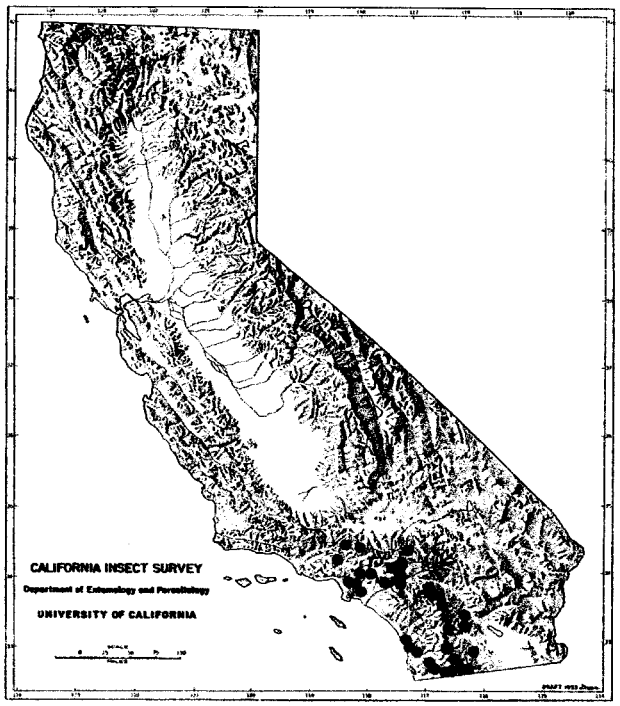


Map 79. California distribution of *Derotmema laticinctum* Scudder.

Geographic range.—California.

California records.—(Map 80) Scudder, Rehn and Hebard have reported this species from a number of localities in Los Angeles, Riverside, San Bernardino and San Diego counties. LOS ANGELES Co.: Vincent, VIII–20–47 (G. P. Mackenzie, CIS). Claremont, VIII–5–15 (J. W. Rich, ANSP). Echo Mt., Sierra Madre Range, IX–18–10,350 ft. elevation (ANSP). Pasadena, VII–1–07, VIII–6–26, 824 ft. elevation (ANSP). Los Angeles River, VIII–24–07 (ANSP). Acton, IX–27–10, 2700 ft. elevation (ANSP). Ravenna, IX–27–10, 2400 ft. elevation (ANSP). Saugus, VIII–23–09 (ANSP). Roscoe, Tujunga Wash, VIII–23–09 (ANSP). Anaheim (Coquillett). RIVERSIDE Co.: Box Spring Canyon, VII–7–56 (J. E. Gillaspy, UCD). Hemet-Idyllwild Road, VI–22–58 (D. M. Newell, CIS). 5.3 mi. S. Hemet, VIII–31–58 (D. M. Newell, CIS). U.C.R. Campus, VIII–30–58 (D. M. Newell, CIS). Beaumont, VII–30–07, IX–28–10, 2700 ft. elevation (ANSP). Perris, VIII–3–14 (J. C. Bradley, ANSP). SAN BERNARDINO Co.: Hesperia, VIII–3–48 (G. P. Mackenzie, UCD). Rialto, VIII–11–55, IX–22–55 (J. C. Hall, CIS); VIII–15–56 (E. G. Linsley, CIS). Summit, Cajon Pass, IX–9–07 (ANSP). San Bernardino Mts., VIII–3–30, 3900 ft. elevation (E. R. Tinkham, ANSP). Claremont, VII–26–40 (E. R. Helwig, ANSP). SAN DIEGO Co.: Boulder Oaks, VIII–6–30 (T. S. Windburn & R. H. Painter, CIS); X–13–50 (H. H. Keifer, CDA). Warner Springs, X–10–50 (H. H. Keifer, CDA). Jacumba, VII–20–49, VII–3–56 (D. J. & J. N. Knull, CIS). Carrizo Creek, VIII–17–58 (E. I. Schlinger, CIS). Sunshine Summit, VIII–17–58 (E. I. Schlinger, CIS). 1 mi. S. Del Mar, VI–1–63 (P. D. Hurd, CIS). Sorrento Beach, VII–1–63 (J. A. Powell, CIS). Road Summit, 10 mi. N.W. Jacumba, IX–15–22, 3500 ft. elevation (Rehn & Hebard,

ANSP). Jacumba, IX–15–22, 2900 ft. elevation (Rehn & Hebard, ANSP). Descanso, IX–13–22, 3400 ft. elevation (Rehn & Hebard, ANSP). Campo, IX–13–22, VIII–10–35 (J. Russell, ANSP); VIII–10–35 (E. I. Beamer, ANSP). Pine Valley, VII–7–59 (F. X. Williams, CAS). Potrero, IX–12–22 (Rehn & Hebard, ANSP). Jamacha, IX–12–22 (Rehn & Hebard, ANSP). Dulzura, VIII–9–35 (J. Beamer, ANSP). Torrey Pines, VII–23–16 (G. P. Engelhardt, ANSP). Anza, VIII–6–35, VIII–7–35 (J. Russell, ANSP).



Map 80. California distribution of *Derotmema saussureanum* Scudder.

Genus *Dissosteira* Scudder, 1876

KEY TO CALIFORNIA SPECIES OF DISSOSTEIRA

1 Wing red with black band . . . . . *pictipennis* Bruner (p. 106)
Wing mostly black or colorless 2
2 Wing deep black with yellow margin . . . . *carolina* (Linnaeus) (p. 105)
Wing colorless with weak fuscous band . . . . *spurcata* Saussure (p. 107)

Dissosteira carolina (Linnaeus)

(Map 81)

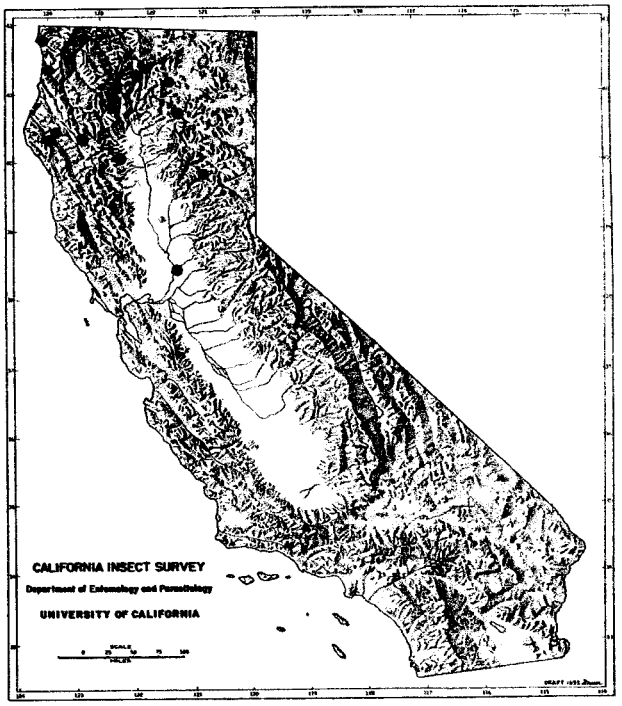
Gryllus (Locusta) carolina Linnaeus, 1758, Syst. Nat., ed. 10:433. Type locality, America.
Dissosteira carolina, Scudder, 1877, Proc. Boston Soc. Nat. Hist., 19:89.

Entirely dark gray, without pattern. Hind tibia yellow-brown or dusky. Wing deep back with rather narrow yellow border. An easily recognized grasshopper. Its range in California is probably more extensive than indicated by the records. It occurs over almost all the United States.

Body 26–34; tegmen 32–39; hind femur 14–19.

Geographic range.—Widespread. British Columbia to Nova Scotia, and every state except Hawaii.

California records.—(Map 81) DEL NORTE CO.: Crescent City, VI–24–22 (E. C. Van Dyke, ANSP). HUMBOLDT CO.: Van Duzen River, VII–16–29 (E. C. Van Dyke, CAS). Weott, VII–12–29 (E. C. Van Dyke, CAS). Prairie Creek, VIII–15–58 (W. Lange, CAS). MENDOCINO CO.: Ukiah, IX–1–58 (D. C. Rentz, DCR); IX–1–59 (E. W. Kirschbaum, CAS). MODOC CO.: Lassen Creek, VIII–20–58 (J. R. Helfer, CAS). PLUMAS CO.: Meadow Valley, VII–7–24 (E. C. Van Dyke, CAS). SACRAMENTO CO.: (E. O. Essig). SHASTA CO.: Mt. Bradley, IX–1–16 (J. A. Kusche, ANSP), Hat Creek, VIII–15–56 G. F. Pronin, CAS). SISKIYOU CO.: Mt. Shasta City, VIII–14–47 (J. A. Powell, CIS). Echo Lake, VIII–29–16 (J. A. Kusche, ANSP). Castle Lake, VIII–28–18, 3500 ft. elevation (ANSP). Bartle, VII–22–62 (D. C. Rentz & C. D. MacNeill, CAS). TRINITY CO.: 12 mi. S. Trinity Center, VII–13–55 (K. Bowers, CIS). 7 mi. S. Trinity Center, VII–26–54 (J. A. Powell, CIS). Mad River, 6 mi. S. Ruth, VII–31–60 (H. B. Leech, CAS). Carrville, VI–28–31 (E. C. Van Dyke, CAS).



Map 81. California distribution of *Dissosteira carolina* (Linnaeus).

Discussion—*D. carolina* is uncommon in California, but when found is usually in cultivated areas, pastures, and along dusty roads. It oviposits in soft, dry soil of valley floors. Most common in the Great

Plains and Rocky Mountain states where it occasionally causes economic damage to row crops.

Dissosteira pictipennis Bruner
(Map 82)

Dissosteira pictipennis Bruner, 1905, Biol. Centr.-Amer., Orth., 2:163. Type ♀, California "probably near Indio" (ANSP).

Oedipoda venusta Stal, 1861 (not of Fieber), Kongl. Svenska Eug. Resa., Zool., 5:344.

Dissosteira venusta Saussure, 1884, Prodrome Oedip., p. 138.

Spharagemon venustum, Scudder, 1900, Cat. U.S. Orth., p. 37,

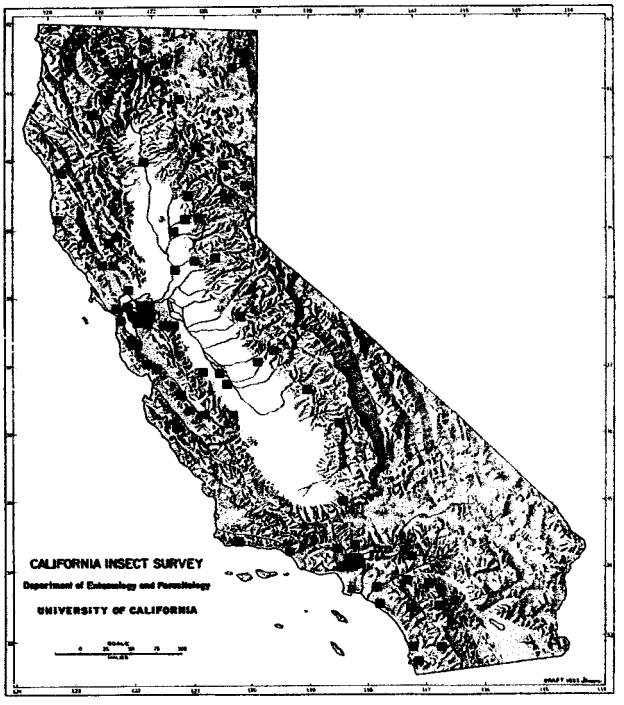
Dissosteira pictipennis, Rehn, 1945, Ent. News, 56:132.

Gray or brown, tegmina with three dusky crossbands, these sometimes obsolete. The very high pronotal carina, and rosy wing with black band make this species distinctive.

Body 18–25; tegmen 18–25; hind femur 10–14.

Geographic range.—California and Oregon, Baja California.

California records.—(Map 82). ALAMEDA CO.: Oakland, IX–8–36 (K. S. Hagen, CIS). Berkeley, IX–7–36 (K. S. Hagen, CIS); IX–9–17 (E. P. Van Duzee, ANSP). Berkeley Hills, IX–11–10 (ANSP). 2 mi. N. Calaveras Reservoir, VI–29–65 (W. W. Middlekauff, CIS). BUTTE CO.: Feather Falls, VIII–17–57 (T. R. Haig, CIS). Big Bend Mt., V–28–28 (H. H. Keifer, CAS). CONTRA COSTA CO.: Mt. Diablo, VII–16–33 (R. H. Beamer, ANSP); V–21–59 (J. R. Helfer, CAS); VIII–15–62, 3800 ft. elevation (U. Kinet, CAS). EL DORADO CO.: 2 mi. E. Camino, VIII–12–62 (J. T. Doyen, CIS). FRESNO CO.: Firebaugh, IV–13–48 (V. M. Stern, CIS). Dunlap, VIII–7–57 (R. P. Allen, CDA). King's River Canyon, VIII–4–40 (E. R. Helwig, ANSP). HUMBOLDT CO.: 7 mi. N.E. Honeydew, IX–2–60 (C. D. MacNeill, CAS). KERN CO.: Tehachapi, IX–16–10, 3900 ft. elevation (ANSP). 8 mi. E. Glennville, VIII–13–61 (C. W. O'Brien, CAS). LAKE CO.: Upper Lake, VII–16–35 (R. H. Beamer, ANSP). LOS ANGELES CO.: Claremont (Baker, CDA). Tanbark Flat, VI–18–56 (C. L. Wiley); VI–24–50 (J. L. Nickel, CIS). Rubio Canyon, Sierra Madre Range, VIII–8–07, 3000 ft. elevation (ANSP). Pasadena, VIII–1–07 (ANSP). Claremont, VII–14–15 (J. W. Rich, ANSP). Miramar, VII–31–07 (ANSP). Verdugo Hills, VIII–23–09, 900 ft. elevation (ANSP). Mt. Wilson, VII–31–40 (E. R. Helwig, ANSP). MADERA CO.: Raymond, IX–3– (Rehn & Hebard, ANSP). Ahwahnee, IX–3–07, 3700 ft. elevation (Rehn & Hebard, ANSP). Summit House, IX–3–07 (ANSP). Coarsegold, VIII–5–40 (E. R. Helwig, ANSP). MARIN CO.: Mill Valley, VIII–23–07, 300 ft. elevation (ANSP). Fairfax, X–15–11 (E. C. Van Dyke, ANSP). Alpine Lake, VII–25–59 (C. D. MacNeill, DCR). Fairfax, VII–19–58 (D. C. Rentz, DCR). Bon Tempe Lake, VII–24–59 (D. C. Rentz, DCR). Fairfax, V–11–19 (E. P. Van Duzee, CAS). 2 mi. N. Alpine Lake, V–15–60 (CAS). Mill Valley, V–9–49 (H. B. Leech, CAS). MARIPOSA CO.: Miami, IX–3–07 (Rehn & Hebard, ANSP). Sentinel, Yosemite Nat. Park (Rehn & Hebard, ANSP). MENDOCINO CO.: Hopland Field Station, VII–11–55. Mendocino, VIII–5–58 (J. R. Helfer, CIS); VIII–18–59 (D. C. Rentz, DCR). MERCED CO.: Dos Palos, VIII–7–48 (V. M. Stern, CDA). Los Banos, VII–10–48 (V. M. Stern, CDA); VIII–9–40 (E. R. Helwig, ANSP). MODOC CO.: Alturas, VIII–23–22, 4500 ft. elevation (Rehn & Hebard, ANSP). 7 mi. N.E. Alturas, IX–5–62 (J. S. Buckett, UCD). MONTEREY CO.: Arroyo Seco, VI–5–57 (R. M. Bohart, UCD). Del Monte, VIII–20–09, IX–10–10 (ANSP). Elko Creek between Del Monte and Salinas, VIII–11–40 (E. R. Helwig, ANSP). NAPA CO.: Pope Valley, V–11–59 (W. Bauer, CAS). PLACER CO.: Colfax, VIII–27–10, 2800 ft. elevation (ANSP). PLUMAS CO.: Lake Almanor, VIII–16–47 (J. A. Powell, CIS). RIVERSIDE CO.: U. C. Campus, VII–4–58 (D. M. Newell, CIS). Anza, VI–24–56 (CIS). Temecula, VII–2–63 (H. L. Griffin, CIS). Pinyon Flat, 16 mi. S.W. Palm Desert (R. L. Langston, CIS). Boxspring Mts., VII–7–56 (J. E. Gillaspy, CIS). Beaumont, IX–28–10, 2700 ft. elevation (Rehn & Hebard, ANSP). Blythe, VII–18–40 (E. R. Helwig, ANSP). Corona, VII–31–19 (E. P. Hewlett, ANSP); VII–25–40 (E. R. Helwig, ANSP). SACRAMENTO CO.: Folsom, VIII–29–35 (A. T. McClay, UCD). SAN BENITO CO.: 12 mi. S. Paicines, VI–15–63 (H. L. Griffin, CIS). Pinnacles Nat. Mon., VII–2–56 (P. D. Hurd, CIS). 4 mi. E. Clear Creek Road, VIII–14–58 (D. C. Rentz, DCR). SAN BERNARDINO CO.: Lake Arrowhead, VIII–7–46 (G. P. Mackenzie, UCD). Claremont, VII–26–40 (E. R. Helwig, ANSP). SAN DIEGO CO.: 1 mi. S. Del Mar, VII–1–63. La Jolla, VI–17–63; VII–21–40 (E. R. Helwig, ANSP); VII–8–16 (G. P. Engelhardt, ANSP). San Diego, V–25–01 (ANSP); (Wickham, ANSP); VII–21–21 (ANSP). Campo, IX–13–22, 2400 ft. elevation (Rehn & Hebard, ANSP). SAN JOAQUIN CO.: Corral Hollow, IV–29–56 (immature) (J. M. Burns, CIS). SAN LUIS OBISPO CO.: Paso Robles, VIII–21–09, 800 ft. elevation (ANSP). Nipomo, VII–24–35 (E. I. Beamer, ANSP). 5 mi. N.E. Santa Margarita, VI–24–63 (G. I. Stage, CAS). SANTA BARBARA CO.: Tucker's Grove, VII–6–56 (E. G. Linsley, CIS). Santa Barbara, VIII–22–09, 200 ft. elevation (M. Hebard, ANSP). Santa Catalina Island, VIII–3–07 (ANSP).



Map 82. California distribution of *Dissosteira pictipennis* Bruner.

SANTA CLARA CO.: Near Holy City, VIII–29–59 (D. C. Rentz, DCR). Mt. Hamilton, VI–9–22 (J. F. Lamiman, CAS). Santa Cruz Island, VII–1901 (R. E. Snodgrass, ANSP). SANTA CRUZ CO.: Alma, VIII–21–46 (G. Pollard, CIS). SHASTA CO.: Cassel, VII–15–47 (C. A. Hanson, UCD). Cayton, VII–15–18 (E. P. Van Duzee, CAS). SIERRA CO.: Sierra City, VII–19–49 (H. H. Keifer, CDA). SISKIYOU CO.: Thrall (ex: Caudell). Callahan, IX–21–50, range grasses (R. W. Harper, CDA). SOLANO CO.: 2 mi. N.E. Vallejo, VIII–22–63 (J. A. Powell, CIS). SONOMA CO.: Eldridge, X–10–15 (J. A. Kusche, ANSP). Sobre Vista, IX–23–10 (J. A. Kusche, ANSP). Petaluma, VII–23–60 (J. S. Buckett, CAS). Cloverdale, V–8–59 (J. R. Helfer, CAS). STANISLAUS CO.: VIII–26–53, VI–30–57 (C. G. Moore, CIS). Three Rivers, VII–14–07 (J. C. Bradley, ANSP). TEHAMA CO.: Red Bluff, VI–27–35 (J. Beamer, ANSP). TRINITY CO.: Douglas City, IX–18–58, range grasses (R. W. Harper, CDA). Trinity Center, VII–26–54 (J. A. Powell, CIS). TULARE CO.: Lemoncove, VIII–2–40 (E. R. Helwig, ANSP). TUOLUMNE CO.: Groveland, VII–27 to VIII–8–54 (R. H. Goodwin, CIS). VENTURA CO.: Goster Park, VII–1–59 (C. A. Campbell, CIS). YUBA CO.: Marysville, VII–27–54 (P. D. Hurd, CIS); VII–9–36 (A. T. McClay, UCD). Browns Valley, VII–11–36 (A. T. McClay, UCD).

Discussion—This common, distinctive, red-winged species is widely distributed in the grassy range lands of California except in the Inyo, Mohave, and Colorado subdivisions. In general it favors a higher habitat than does *spurcata*. In the coastal ranges of central California it is commonly encountered in the oak-grassland biome.

Dissosteira spurcata Saussure

(Map 83)

Dissosteira spurcata Saussure, 1884, Prodrome Oedip., p. 137. "Amer. boreal, California," type locality. ♀ (Geneva, Switz.?).

Oedipoda obliterata Thomas, 1880, Can. Ent., 12:22 (not of Germar).

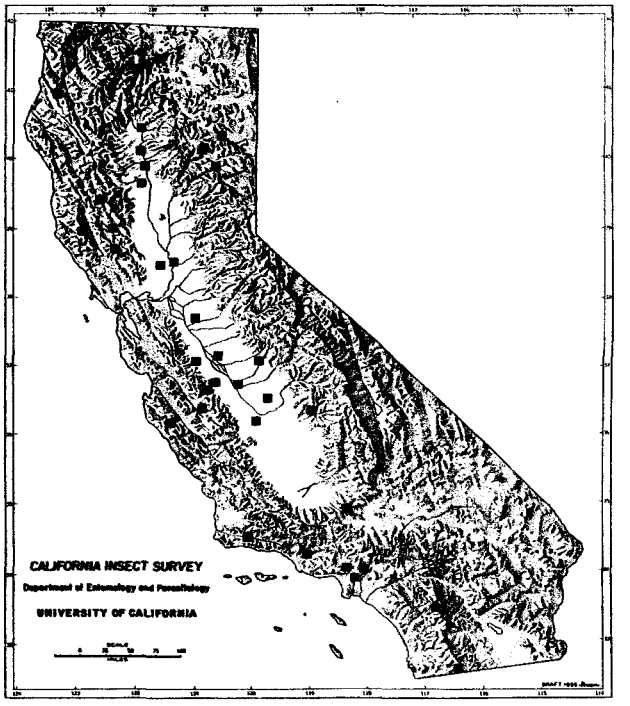
Dissosteira spurcata, Rehn & Hebard, 1909, Proc. Acad. Nat. Sci. Phila., 61:439.

Variable in color but usually whitish mottled with brown or fuscous, sometimes entirely dust-gray. Wing clear with dusky cloud along posterior margin. Hind tibia yellow.

Body 27–33; tegmen 31–33; hind femur 15–18.

Geographic range.—Utah, Nevada, Idaho, Washington, Oregon and California.

California records.—(Map 83) FRESNO CO.: VI–18–57 (R. P. Allen, CDA). Mercy Hot Springs, VIII–16–58 (D. C. Rentz, DCR). Waltham Canyon, VIII–31–22 (Rehn & Hebard, ANSP). GLENN CO.: Orland, VII–15–52 (R. F. Smith & E. G. Linsley, CIS); VII–13–55 (E. I. Schlinger, CIS). KERN CO.: Tehachapi,, IX–16–10, 4200 ft. elevation (ANSP). LAKE CO.: 15 mi. W. Pillsbury Lake, VIII–14–55 (W. C. Bentinck, CIS). Southwestern Clear Lake, VIII–3–59 (D. C. Rentz, DCR). Middletown, VII–14–60 (D. C. Rentz, DCR). MADERA CO.: Raymond, IX–3– (Rehn & Hebard, ANSP). MENDOCINO CO.: Hopland, VIII–30–30 (W. W. Middlekauff, CIS). MERCED CO.: Merced, VIII–30– (Rehn and Hebard, ANSP). Gustine, VII–2–56 (C. H. Moore, CIS). Newman, VII–11–54 (C. H. Moore, CIS). PLUMAS CO.: Quincy, VII–19–40 (P. D. Hurd, CIS). Chester, VIII–20–22 (Rehn & Hebard, ANSP). SACRAMENTO CO.: Sacramento, VII–22–26 (F. H. Wymore, CIS). SAN JOAQUIN CO.: Manteca, VIII–21–38 (K. S. Hagen, CIS). SHASTA CO.: Redding, VI–6–26 (F. H. Wymore, CIS). TEHAMA CO.: Red Bluff, VIII–6–37. TULARE CO.: Three Rivers, VII–28–07 (J. C. Bradley, ANSP). YOLO CO.: Davis, VIII–10–37 (J. J. DuBois, CIS); VIII–13–56 (R. M. Bohart, UCD); VI–16–59 (J. R. Helfer, DCR).



Map 83. California distribution of *Dissosteira spurcata* Saussure.

Discussion—According to Kelly and Middlekauff (1961), *D. spurcata* prefers a well-drained, hot and dry area that contains sparse or spotty vegetation with a rocky or graveled layer over the soil. It appears to be most abundant on deteriorated, overgrazed ranges. They are almost always associated with several other species of range land grasshoppers in central and northern California, particularly *Melanoplus devastator, Oedaleonotus enigma, Camnula pellucida* and one or more species of *Trimerotropis*.

While absent from the Inyo, Mohave and Great Basin subdivisions in California, they are quite common in much of the lower foothill belt and valley zones where rainfall averages between 7 and 15 inches per year. For details on the bionomics and distribution of this species see Kelly and Middlekauff (1961).

Genus *Encoptolophus* Scudder, 1875

KEY TO CALIFORNIA SPECIES OF ENCOPTOLOPHUS

1 Median carina of pronotum compressed and strongly elevated, subcristate; lateral carinae compressed and elevated especially near front of prozona (southwest) . . . . . *robustus* Rehn & Hebard (p. 108)

Median carina at most moderately elevated; lateral carinae low, broadly interrupted at middle (southeast) 2

2 Head as deep as metathorax, the fastigio-frontal junction subangulate in profile; median carina of pronotum very low, in profile depressed at sulcus . . . *pallidus pallidus* Bruner (p. 108)

Head not as deep as metothorax, fastigio-frontal junction rounded; median carina well elevated, its profile straight . *subgracilis* Caudell (p. 108)

Encoptolophus pallidus pallidus Bruner

(Map 84)

Encoptolophus pallidus Bruner, 1893, N. A. Fauna, 7:266. Lectotype ♂, Panamint Valley, Calif. designated by Rehn & Hebard, 1912.

Encoptolophus pallidus pallidus, Hebard, 1935, Trans. Amer. Ent. Soc., 61:287.

Pale yellow-brown with two or three dark patches on costal area of tegmen. Hind tibiae blue. Pronotum usually weakly but plainly depressed at principal sulcus, its median carina but feebly raised, lateral carinae represented by low, rounded callosities. Cerci stout, more so in female.

Body 20–29; tegmen 17–21; hind femur 11.5–14.

Geographic range.—California, Arizona, and Navada.

California records.—(Map 84). INYO CO.: Panamint Valley, IV–1881 (A. Koebele, ANSP). 5 mi. N. Ballarat, April , in *Distichlis* (R. P. Allen, CIS). Death Valley Nat. Mon., Telescope Peak, VI–8–61 (R. P. Allen, CIS). Saratoga Springs, III–24–61 (M. E. Erwin, UCD). Shoshone, VIII–8–19 (Rehn & Hebard, ANSP); IV–11–60 (J. R. Helfer, DCR). Saline Valley, V–3–60 (J. Sedlacek, DCR). Owen's Lake, VII–31–52 (N. K. Lewis, SJS). RIVERSIDE CO.: Blythe, VIII–27–33, VII–4–29 (R. H. Beamer, ANSP). SAN BERNARDINO CO.: Newberry, IX–9–24, 1831 ft. elevation (Rehn & Hebard, ANSP).

Encoptolophus robustus Rehn and Hebard

(Map 84)

Encoptolophus robustus Rehn & Hebard, 1909, Proc. Acad. Nat. Sci. Phila., 61:435. Type ♀, Los Angeles River, near Los Angeles, Calif. (ANSP).

Dark gray, tegmina with two or three dark crossbars, these sometimes incomplete. Hind tibiae blue. Pronotum with median carina sharply elevated, straight in profile, deeply notched by the principle sulcus. Lateral carinae strong, cut by two sulci, the anterior of which is not continued on the dorsum. Wing hyaline, sometimes weakly infumate at apex.

Body 16–20; tegmen 14–17; hind femur 10.5–13.

Geographic range.—California.

California records.—(Map 84). LOS ANGELES CO.: Los Angeles River near Los Angeles (Rehn & Hebard, ANSP). S. Pasadena, XII–31–44 (R. C. Osburn, CIS). Whittier, VII–27–50 (H. M. Graham, CIS). ORANGE CO.: Laguna Beach, XI–7–16 (ANSP). SAN DIEGO CO.: Santa Margarita River, on range, IX–5–41 H. W. Graves, CDA). Otay, VIII–9–35 (R. H. Beamer, ANSP). La Jolla, VIII–3–34 (Timberlake, ANSP). Chula Vista, IX–11–22 (Rehn & Hebard, ANSP). Tia Juana, IX–11–22 (Rehn & Hebard, ANSP). SAN LUIS OBISPO CO.: Nipomo, XI–18–37 (M. Drake, ANSP).

Encoptolophus subgracilis Caudell

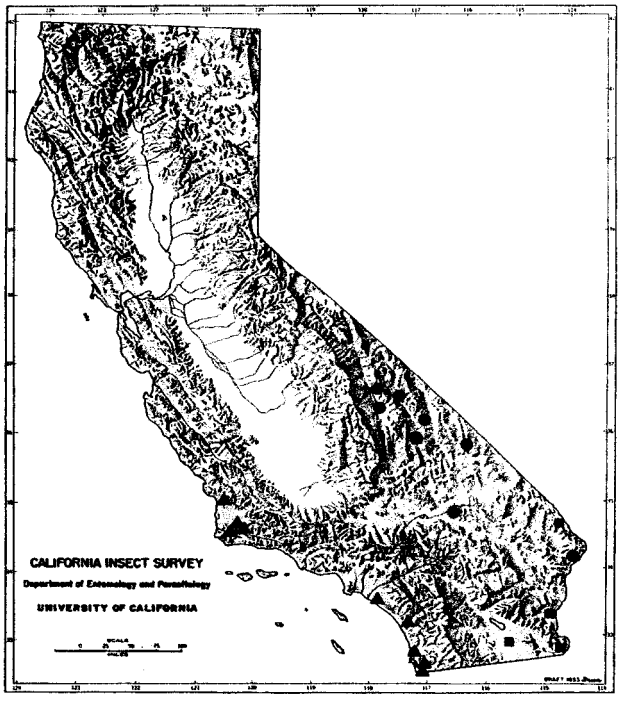
(Map 84)

Encoptolophus subgracilis Caudell, 1903, Proc. Ent. Soc. Wash., 5:163. Lectotype ♂, Phoenix, Ariz., designated by Caudell & Hebard, 1912 (USNM).

Encoptolophus pallidus subgracilis, Hebard, 1935, Trans. Amer. Ent. Soc., 61:287.

Encoptolophus subgracilis, Thompson & Buxton, 1964, Occas. Pap., Bur. Ent., Calif. Dept. Agr., 5:21.

Pale brown, tegmina with two or three incomplete dark bands. Hind tibiae blue. Pronotum with median carina elevated, the prozona somewhat tectate, lateral



Map 84. California distribution of: ●, *Encoptolophus pallidus* Bruner; ▲, *Encoptolophus robustus* Rehn and Hebard; ■, *Encoptolophus subgracilis* Caudell.

carinae broadly interrupted at middle, often sharp but low on front of prozona. Head smaller than in *E. pallidus*, its dorsal length but little more than length of pronotal metazona; fastigium shallow. Cerci slenderer than in *E. pallidus*. In his last comments on *subgracilis*, Hebard regarded it as a weakly defined race of *pallidus*, but the two forms differ in a number of features as noted here and are likely separate species.

Body 19–24; tegmen 16–23; hind femur 10–13.

Geographic range.—South Dakota, Nebraska, Kansas, Oklahoma, Texas, Arizona, New Mexico, Colorado and Southern California.

California records.—(Map 84) IMPERIAL CO.: Brawley, VI–30–37 (A T. McClay, UCD). Palo Verde, VIII–17–46 (W. F. Barr, UCD). Calipatria, V–27–56 (UCD). Bard, X–15–50, in alfalfa (H. H. Keifer, CDA). SAN BERNARDINO CO.: Needles, VIII–25–46 (P. D. Hurd, CIS).

Discussion—Restricted to the Colorado and Mohave subdivision in California where it has been taken in alfalfa fields. Ball et al. (1942) report it as common in southern Arizona in cultivated fields where it may damage alfalfa and truck crops.

Genus *Lactista* Saussure, 1884

KEY TO SPECIES OF LACTISTA

1 Size small, yellow band of wing distinctly translucent. Hind tibiae deep blue . . . . . *gibbosus* Saussure (p. 109)

Size large, yellow band of wing hardly translucent. Hind tibiae light blue to brown . . . . . *oslari* Caudell (p. 109)

Lactista gibbosus Saussure

(Map 85)

Lactista gibbosus Saussure, 1884, Prodrome Oedip., p. 143. Type locality, Calif. (Vienna?)

Arphia hesperiphila Rehn, 1902, Can. Ent., 34:143.

Lactista gibbosus, Bruner, 1905, Biol. Centr.-Amer., Orth., 2:168.

Dark gray, without distinct maculations. Tegmina with small inconspicuous fuscous spots. Wing transparent yellow with black band which covers most of apex. Hind tibia blue. Median carina of pronotum high, arcuate in profile, weakly notched.

Body 14–20; tegmen 16–20; hind femur 8–11.

Geographic range.—California.

California records.—(Map 85) Reported by Bruner, Caudell, Rehn and Hebard from various localities in Los Angeles and San Diego counties. FRESNO CO.: Friant, X–21–61 (D. Justus, CAS). LOS ANGELES CO.: Rubio Canyon, Altadena, VII–24–40 (E. R. Helwig, ANSP). Altadena, IV–29–43 (R. C. Osburn, CDA). Whittier Hills, X–28–09 (G. R. Pilate, CAS). MONTEREY CO.: Vicinity Gorda, IX–13–58 (P. H. Arnaud, DCR). ORANGE CO.: Brea, VII–23–58 (D. Ahlefeld, CDA). San Juan Capistrano, VII–23–40 (E. R. Helwig, ANSP). RIVERSIDE CO.: San Jacinto Mts., VII–21–29 (L. D. Anderson, CIS). Riverside, IV–23–34 (J. C. Hall, CIS). Andreas Canyon, III–8–56 (J. C. Hall, CIS). Beaumont, VII–3–57 (J. E. Gillaspy, CIS). U.C. Campus, VIII–30–58 (D. M. Newell, CIS). 7 mi. N. Temecula, X–19–60 (J. A. Powell, CIS). Citrus Expt. Station, III–12–63 (J. A. Chemsak, CIS). Elsinore, VIII–19–37, 1400 ft. elevation (Rehn, Pate & Rehn, ANSP); VIII–2–37, 3650 ft. elevation (Rehn, Pate & Rehn, ANSP). SAN DIEGO CO.: S. Indian Canyon, VIII–6–48 (G. A. Marsh, UCD). Carlsbad, VIII–16–51 (T. R. Haig, CIS). Anza Desert, VII–21–49 (D. J. & J. N. Knull, CIS). Borrego Valley, IV–19–57 (R. M. Bohart, UCD). San Diego, IV–17, VI–12–49 (J. A. Powell, CIS). 1 mi. S. Del Mar, VIII–1–63 (H. L. Griffn, CIS). 3 mi. N. Poway, VI–24–63 (J. A. Powell, CIS). La Jolla, VI–20–63 (J. A. Powell, CIS). 2 mi. N. E. Lakeside, III–13–63 (J. A. Chemsak, CIS). La Mesa, II–28–59 (P. Rude, CIS). Sorrento Beach, VII–1–63 (J. A. Powell, CIS). Murray Canyon, above Mission Valley, VIII–19–37 (Rehn, Pate & Rehn, ANSP).

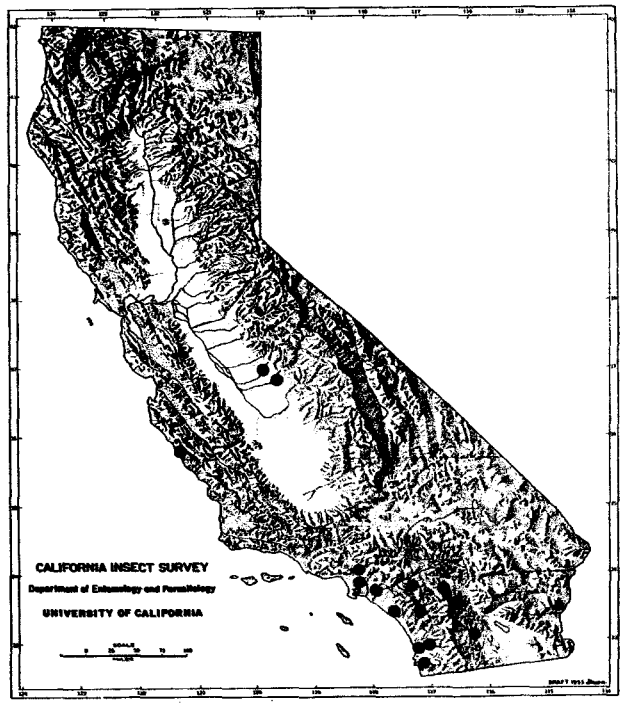
Lactista oslari Caudell

(Map 85)

Lactista oslari, Caudell, 1905, Proc. U.S. Nat. Mus., 28:468. Type ♂, Nogales, Ariz.

Larger than *L. gibbosus*. Wing not translucent, black band very distinct. Hind tibiae very pale, bluish to brownish.

Body 20–24; tegmen 21–24; hind femur 11–14.



Map 85. California distribution of: ●, *Lactista gibbosus* Saussure; ▲, *Lactista oslari* Caudell.

Geographic range.—The Sonoran Desert from southern New Mexico and Arizona, north to Phoenix and into California. Also reported from Mexico.

California records.—(Map 85) RIVERSIDE Co.: Blythe, VII–18–40 (E. R. Helwig, ANSP).

Discussion—This is the first record for this species in the state. It is a fairly common resident of the western portion of the Sonoran desert in the palo verde-saguaro cactus association. Eastern California will likely prove to be the western limit of its range.

Genus *Leprus* Saussure, 1861

Leprus intermedius Saussure
(Map 86)

Leprus intermedius Saussure, 1884, Prodrome Oedip., p. 96. Type ♀, Calif.

Leprus glaucipennis Scudder, 1900, Psyche, 9:76.

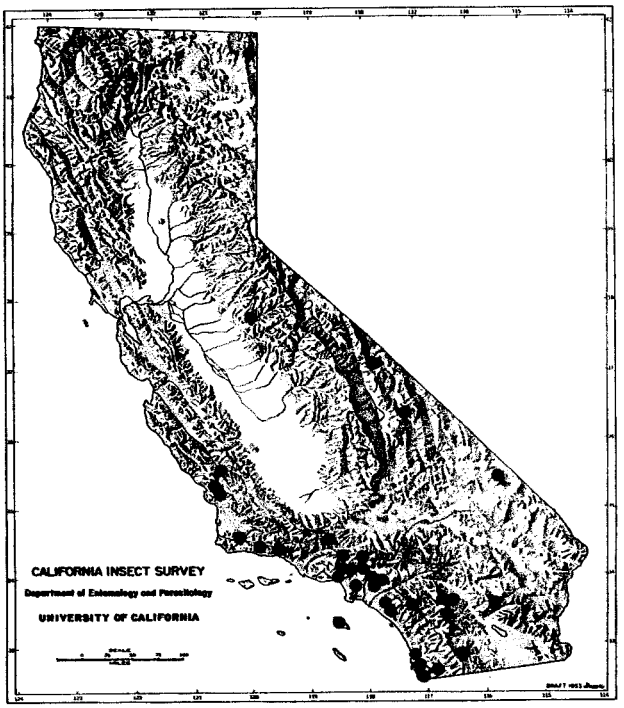
Blue-gray to dark gray, tegmina banded with black and white, head and thorax sometimes mottled with white, wing blue with black along hind margin. Pronotum with median carina low but distinct, metazona with a few shining tubercles, its hind margin acute to rectangular. Hind femora very stout.

Although Saussure described *intermedius* as having yellow wings, his type is quite plainly dried from alcohol. Treatment of the blue wings of *Leprus* sp. with alcohol will result in rapid fading of the blue to pale yellow.

Body 23–32; tegmen 23–26; hind femur 14–18.

Geographic range.—From southern California, Nevada and Arizona south into Mexico.

California records.—(Map 86). INYO Co.: Westgard Pass, VIII–10–61, 7200 ft. elevation (D. C. Rentz, DCR); VII–26–62 (D. C. Rentz & C. D. MacNeill, DCR); VII–21–64 (D. C. & K. A. Rentz, DCR); VII–23–65 (J. D. Birchim, JDB). Townes Pass, Panamint Mts., VIII–23–40 (E. R. Helwig, ANSP). LOS ANGELES Co.: Santa Catalina Island, VIII–3– (Rehn & Hebard, ANSP). Pasadena, VIII–1– (Rehn & Hebard, ANSP). Claremont, VII–25–15 (J. W. Rich, ANSP). Echo Mt., San Gabriel Range, VIII–8– (Rehn & Hebard, ANSP). Mint Canyon, VII–31–35 (J. Beamer, ANSP). Camp Rincon, VI–28–56 (G. I. Stage, CIS). Verdugo Hills, VIII–23–09, 750 ft. elevation (ANSP). Topanga Canyon, VIII–5–38 (R. I. Sailer, ANSP). Santa Monica (S. C. Clark, CAS). Pomona, VII–1931 (E. S. Ross, CAS). Parker Mt., S.E. end Ventura Mts., IX–27–10, 4100 ft. elevation. Echo Mt., VIII–2–07 (ANSP). Universal City, VII–8–26 (C. H. Hicks, ANSP). Griffith Park, VII–20–26 (C. H. Hicks, ANSP). San Gabriel Wash, Azusa, VII–24–40 (E. R. Helwig, ANSP). Rubio Canyon, Altadena, VII–24–40 (E. R. Helwig, ANSP). Mt. Wilson, VII–31–40 (E. R. Helwig, ANSP). MODOC Co.: Warner Mts., Lake City, VII–28–22 (C. L. Fox, CAS). ORANGE Co.: El Toro, VIII–20– (Rehn & Hebard, ANSP). Irvine Park, VIII–11–50 (R. W. Harper, CDA). RIVERSIDE Co.: 5 mi. S.W. Nat. Forest Boundary, VI–21–58 (D. J. Newell, CIS). Mt. San Jacinto, VIII–10–58 (D. J. Newell, CIS). San Jacinto Mts., Palm Canyon, VI–1917 (S. Grinnell, ANSP). 1700 ft. elevation (Rehn, Pate & Rehn, ANSP). 20 mi. E. Desert center, VIII–21–37 (Rehn, Pate & Rehn, ANSP). Elsinore, IX–25–35 (ANSP). SAN BERNARDINO Co.: 4 mi. N. Rose, VIII–14–47, 1000 ft. elevation (J. Rehn, ANSP). Clark Mts., VIII–12–64 (J. D. Birchim, JDB). SAN DIEGO Co.: Tia Juana, VIII–16– (Rehn & Hebard, ANSP). San Diego, VIII–29–48 (J. A. Powell, CIS). La Jolla, VI–18–16 (ANSP). Mission Gorge, VII–7–63 (J. A. Powell, CIS). Dulzura, VIII–9–35 (J. Beamer, ANSP). Mt. Laguna, VII–5–63 (R. L. Langston, CIS). SAN LUIS OBISPO Co.: 8 mi. W. Atascadero, VII–3–56 (P. D. Hurd, CIS). Paso Robles, VIII–27–09, 1100 ft. elevation (ANSP). San Luis Obispo, VIII–14–34 (E. D. Ball, ANSP). SANTA BARBARA Co.: 3 mi. W. Cachuma Lake, VII–6–59) C. A. Campbell, F. D. Parker & W. A. Steffan, CIS). Santa Ynez Mts., VI–24–59 (W. A. Steffan, CIS). Carpenteria, VI–18–37. San Marcos Pass, VIII–15–40 (E. R. Helwig, ANSP). TUOLUMNE Co.: Priest Grade, 3 mi. W. Big Oak Flat, VI–11–60 (C. D. MacNeill, DCR).



Map 86. California distribution of *Leprus intermedius* Saussure.

Discussion—This large, robust, and sluggish grasshopper is found in desert wastelands, rocky ridges, and hillsides where vegetation is sparse.

Genus *Ligurotettix* McNeill, 1897
(see page 75)

Genus *Mestobregma* Scudder, 1876

Mestobregma impexum Rehn
(Fig. 37, Map 87)

Mestobregma impexum Rehn, 1919, Trans. Amer. Ent. Soc., 45:239. Type ♂, Milford, Beaver Co., Utah (ANSP).

Gray, a black band across face, another on side of pronotum and two large black blotches on tegmen. Hind tibia blue. Wing yellow or red with black band. Pronotum with median carina distinct but not high, caudal margin rectangulate, lower hind angle of lateral lobe rounded-lobate. Frontal costa abruptly wider at median ocellus.

Body 18–26; tegmen 19–24; hind femur 9–13.

Geographic range.—Northern Arizona, southern Nevada and eastern and southern California through Utah and into Idaho.

California records.—(Map 87) INYO CO.: Independence, VII–19–65 (J. D. Birchim, JDB). KERN CO.: 2 mi. S.E. Tupman, VIII–18–51, 315 ft. elevation (J. Rehn, ANSP). MONO CO.: Mono Lake, VIII–25–46 (G. P. Mackenzie, UCD). Grant Lake, VIII–5–48 (P. D. Hurd & J. W. MacSwain, CIS). Mono Lake, 10 mi. N. Leevining, VIII–6–61 (C. D. MacNeill, D. C. Rentz & M. R. Lundgren, CAS); VIII–9–61 (D. C. Rentz, CAS); VII–28–62 (D. C. Rentz & C. D. MacNeill, CAS). 4 mi. S. of south end of Topaz Lake, VIII–12–51, 5400 ft. elevation (J. Rehn, ANSP). 7 mi. S. Leevining, VIII–13–51, 7100 ft. elevation (J. Rehn, ANSP). SAN BERNARDINO CO.: Cima, VIII–12–07 (Rehn & Hebard, ANSP). Bird Spring Mts., VIII–11–07 (Rehn & Hebard, ANSP). New York Mts., VIII–12–64 (J. D. Birchim, JDB).

Discussion—Ball et al. (1942) and Barnum (1964) report this as a rare species, found in sandy or dry soil with scattered clumps of short grass in the sage-brush desert, or in contiguous sandy areas with scattered *Eriogonum*, and small annuals and perennials. An active species, flying some distance when disturbed, the red-winged forms are conspicuous, the yellow-winged ones may be confused with associated yellow-winged *Trimerotropis*.

Genus *Metator* McNeill, 1901

Metator nevadensis (Bruner)
(Fig. 23, Map 87)

Trachyrhachis nevadensis Bruner, 1905, Biol. Centr.-Amer., Orth., 2:175. No information concerning type or locality. (ANSP?).

Metator nevadensis, Hebard, 1928, Proc. Acad. Nat. Sci. Phila., 80:250.

Gray, tegmen with a row of large dusky spots. Hind tibia yellow. Wing yellow, usually with complete black band. Pronotum with median carina elevated throughout and sharply compressed, caudal margin acute-angulate, lower hind angle of lateral lobe rectangulate.

Body 23–34; tegmen 23–28; hind femur 14–17.

Geographic range.—California, Idaho, south to Arizona.

California records.—(Map 87) LASSEN CO.: Amedee, VIII–22–22, 3960 ft. elevation (Rehn & Hebard, ANSP). MODOC CO.: Alturas, VIII–23–22, 4500 ft. elevation (Rehn & Hebard, ANSP). PLUMAS CO.: Vinton, VII–6–39, on range (Lockwood, CDA). SISKIYOU CO.: Little Shasta, IX–20–50, range (R. W. Harper, CDA).

Discussion—According to LaRivers (1948) this distinctively marked, red-winged species is associated with the similarly red-winged *Arphia pseudonietana* in well watered meadow bottoms, but unlike *Arphia* seldom calls attention to its presence by flying when disturbed, preferring to drop unobtrusively to the ground and lose itself in dense vegetation. It is thus frequently overlooked in a locality well populated with the flashy and noisy *Trimerotropis*.

Genus *Microtes* Scudder, 1900

Microtes occidentalis (Bruner)
(Map 87)

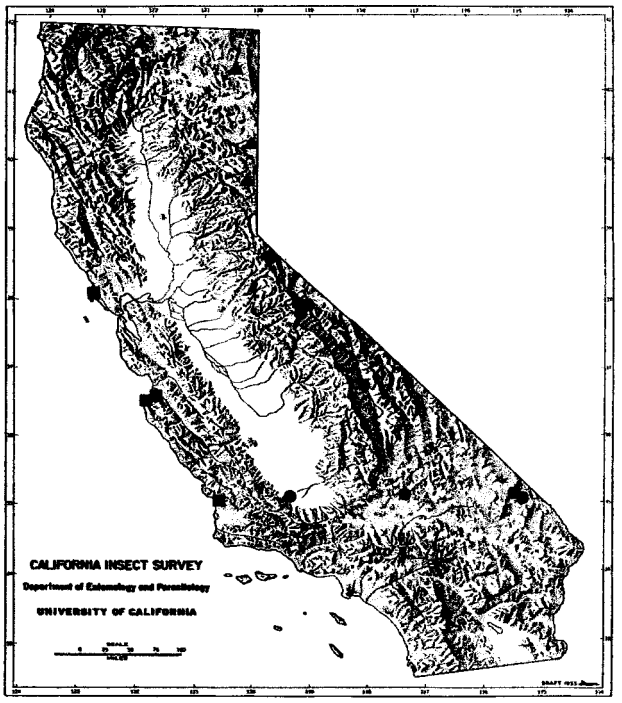
Scirtetica occidentalis Bruner, 1893, N. A. Fauna, 7:267. Type ♀, Argus Mts., Calif. (USNM, No. 1071).

Microtes nubila Scudder, 1900, Canad. Ent., 32:330.

Dissosteira planipennis Bruner, 1905, Biol. Centr.-Amer., Orth., 2:164.

Microtes occidentalis, Caudell, 1915, Proc. U. S. Nat. Mus., 49:28.

Dark gray, tegmina with two or three dark blotches. Wing very pale yellow with apical half lightly infuscate. Hind tibia yellowish or pale glaucous. Median carina of pronotum straight in profile.



Map 87. California distribution of: ●, *Mestobregma impexum* Rehn; ▲, *Metator nevadensis* (Bruner); ■, *Microtes occidentalis* (Bruner).

Body 14–20; tegmen 13–19; hind femur 8.5–12.

Geographic range.—California.

California records.—(Map 87) MARIN CO.: Inverness, IX–1–54 (C. A. Toschi, CIS). 2 mi. N. Drake's Beach, VIII–18–62 (CIS). 8 mi. N. Point Reyes Light Station, VIII–20–61 (D. C. Rentz, DCR). MONTEREY CO.: Asilomar, V–22–59 (J. R. Powers, CIS); IX–26–57 (P. H. Arnaud, DCR). Carmel, VIII–17–35 (Timberlake, CDA); XII–4–21 (E. C. Van Dyke, CAS). Pacific Grove, VIII–27–57 (R. M. Bohart, UCD). Point Pinos, Pacific Grove, VI–13–59 (P. H. Arnaud, DCR). Monterey, VI–16–16 (Doane, ANSP). Marina, VI–29–31 (E. P. Van Duzee, CAS). Del Monte, VIII–10–40 (E. R. Helwig, ANSP); VIII–20–09, IX–10–10 (ANSP). SAN LUIS OBISPO: Grover City, X–13–62, sand dunes (P. H. Arnaud, CAS). Pismo, VII–9–28 (E. C. Van Dyke, CAS). SANTA BARBARA CO.: Guadalupe, VIII–12–40 (E. R. Helwig, ANSP).

Discussion—Occurs commonly in coastal sand dunes from Santa Barbara north to Marin County. The male buzzes in flight. Gurney & Strohecker (1959) discuss the taxonomic status of this species.

Genus *Sticthippus* Scudder, 1892

Sticthippus californicus (Scudder)
(Map 88)

Hippiscus (Sticthippus) californicus Scudder, 1892, Psyche, 6:317. Type locality, Gilroy, Santa Clara Co., Calif. (MCZ?).

Hippiscus (Sticthippus) marmoratus Scudder, op. cit., p. 318.

Pronotum with posterior lobe of prozona inflated and scutellate, the median carina strong, weakly undulate at the anterior sulcus, hind margin of lateral lobe at most feebly retroarcuate. Fastigium shallow, broad, deflexed and broadly rounded into frontal costa. Hind tibiae red.

Body 24–36; tegmen 21–38; hind femur 14–17.

Geographic range.—California.

California records.—(Map 88) ALAMEDA CO.: Cedar Ridge, V–3–31 (E. C. Van Dyke, CAS). BUTTE CO.: Paradise Springs, IV–15–34 (L. S. Slevin, CAS). FRESNO CO.: Firebaugh, V–19–51 (W. W. Middlekauff, CIS). Panoche Canyon, IV–24–26 (E. C. Van Dyke, CAS). Panoche, V–15–30 (E. C. Van Dyke, CAS). Friant, V–24–36 (E. S. Ross, CAS). 5 mi. N.E. Coalinga, V–9–54 (J. Rehn, ANSP). GLENN CO.: Orland, V–19–19 (T. Urbahns, CAS). KERN CO.: Lebec, V–15–28 (J. O. Martin, CAS). Democrat Springs, IV–24–52 (G. A. Marsh, UCD). LASSEN CO.: Lassen Nat. Park, VII–9–23 (F. H. Wymore, CIS). LOS ANGELES CO.: Antelope Valley, V–21–31 (L. J. Muchmore, CIS). 4 mi. E. Gorman, VII–2–58 (E. I. Schlinger, CIS). MARIN CO.: Lake Lagunitas, V–15–59 (D. C. Rentz, DCR). MODOC CO.: Lookout, VII–11–23 (F. H. Wymore, CIS). Warner Mts., Davis Creek, VII–10–22 (C. L. Fox, CAS). SAN BENITO CO.: Tres Pinos Creek, Antelope School, IV–24–32 (E. L. Donohoe, CIS); V–24–34 (CIS). Jct. Clear Creek and Coalinga Rds., V–28–60 (D. C. Rentz, DCR). SAN DIEGO CO.: Warner Springs, V–22–56 (H. Ruckes, Jr. & B. J. Adelson, CIS). SANTA CLARA CO.: Gilroy (ex: Scudder). Mt. Hamilton, VI–20–22 (J. F. Lamiman, CIS); V–27–61 (D. C. Rentz, CAS); VI–17–63 (G. I. Stage, CAS). TEHAMA CO.: S.W. corner, Sugar Spring, VII–29–60 (H. B. Leech, CAS). TULARE CO.: Lemoncove, IV–14–50 (J. W. MacSwain, CIS). VENTURA CO.: Hungry Valley, 5 mi. S. Gorman, VI–6–59 (J. R. Powers, CIS); V–4–59 (G. I. Stage, CIS).

Discussion—This species is typically an inhabitant of dry grassland areas of canyons and foothill regions, being closely associated with *Oedaleonotus enigma* over much of its range. It is sometimes of economic importance, especially in the western foothill area of the Central Valley from Merced south to Mendota in Fresno County, in the Cuyama Valley of Santa Barbara County and in the Panoche Valley of San Benito County.

It appears early in the spring, somewhat earlier than do other economic species, hatching commencing in early March. Adults predominate by May, when egg laying starts. Adults disappear in July as a result of natural mortality. A series of dry years is thought to be conducive to outbreaks.

Genus *Trachyrhachys* Scudder, 1876

Trachyrhachys kiowa kiowa (Thomas)
(Map 89)

Oedipoda kiowa Thomas, 1872, Rept. U. S. Geol. Surv. Terr., 5:461. Lectotype ♂, Colo. east of the mountains, designated by Hebard, 1927 (USNM).

Trachyrhachis kiowa, Saussure, 1884, Prodrome Oedip., p. 164.

Similar to *Metator nevadensis*, but smaller, and with median carina of pronotum low on metazona. Wing yellow.

Geographic range.—Principally Great Plains, west to California, but the species is recorded eastward to Pennsylvania, south to Georgia.

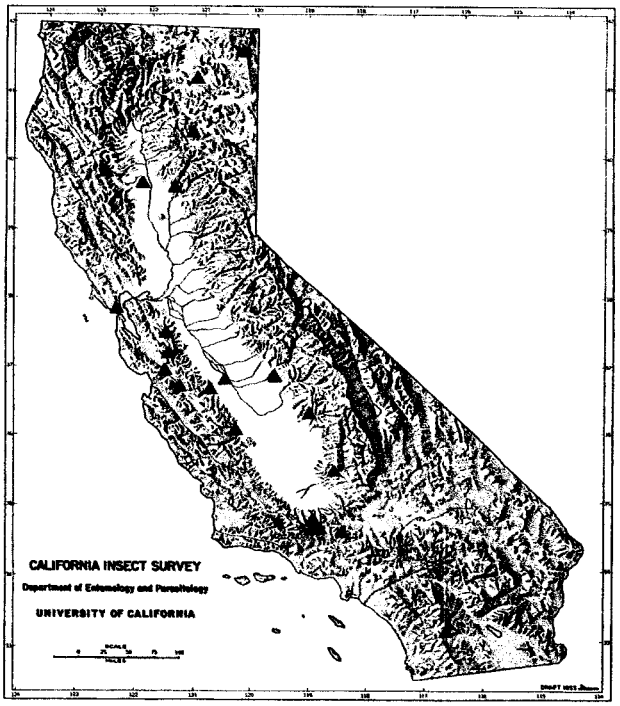
California records.—(Map 89) LASSEN CO.: Amedee, VIII–22–22, 3960 ft. elevation (Rehn & Hebard, ANSP). SISKIYOU CO.: (Reported by Scudder.)

Discussion—This Great Basin species is a very important range grasshopper in the Great Plains, especially in sparse stands of grama grass, *Bouteloua* spp. It is rarely taken in California.

Genus *Trepidulus* McNeill, 1901

KEY TO CALIFORNIA SPECIES OF TREPIDULUS

1 Pronotum with median carina low but distinct on prozona; wing usually roseate, sometimes colorless (fig. 35) . . *rosaceus* (Scudder) (p. 113)
Median carina cristate on prozona; wing colorless (fig. 36) . . . . *hyalinus* (Scudder) (p. 113)



Map 88. California distribution of *Sticthippus californicus* Scudder.

Trepidulus hyalinus (Scudder)

(Fig. 36, Map 89)

Mestobregma hyalinum Scudder, 1900, Psyche, 9:92. Type locality, Lathrop, Lancaster and Kern City, Calif.

Wing colorless, hind tibia yellow. Pronotum with median carina high and compressed on anterior lobe of prozona.

Body 15–25; tegmen 16–23; hind femur 9.5–13.5.

Geographic range.—California.

California records.—(Map 89) ALAMEDA CO.: Altamont Pass, VII–22–57 (W. W. Middlekauff, CIS). Altamont Hills, VII–22–57 (W. S. Sibray, CIS); VIII–8–37, 340 elevation (Rehn, Pate & Rehn, ANSP). Mountain House Creek, near Altamont, VIII–8–37 (Rehn, Pate & Rehn, ANSP). FRESNO CO.: Coalinga, VIII–30–22, 700 ft. elevation (Rehn & Hebard, ANSP). San Joaquin, VII–14, 29–60 (R. R. Snelling, DCR). KERN CO.: Kern City, VIII–4– (ex: Scudder). Shafter, VIII–13–52, roadside (R. W. Harper, CDA). Bakersfield, VIII–20–09 (ANSP); IX–15–10 (ANSP). LOS ANGELES CO.: Lancaster, VII–31– (ex: Scudder). MERCED CO.: Los Banos, VIII–9–40 (E. R. Helwig, ANSP). SAN JOAQUIN CO.: Lathrop, VIII–17– (ex: Scudder). Stockton, VIII–24–50, meadow grasses (R. W. Harper, CDA). SANTA BARBARA CO.: Cuyama Ranch, VII–25–35 (J. Russell, ANSP). SOLANO CO.: Fairfield, IX–19–62 (C. G. Moore, CIS). TULARE CO.: Goshen Jct., VIII–30–22 (M. Hebard, ANSP).

Discussion—Occurs in dry grassy areas.

Trepidulus rosaceus (Scudder)

(Fig. 35, Map 89)

Mestobregma rosaceum Scudder, 1900, Psyche, 9:91. Type locality, Tehachapi and Palm Springs, Calif. and Yuma, Ariz.

Trepidulus rosaceus McNeill, 1901, Proc. U.S. Nat. Mus., 23: 398.

Araeopteryx penelope Caudell, 1901, Can. Ent., 33:102.

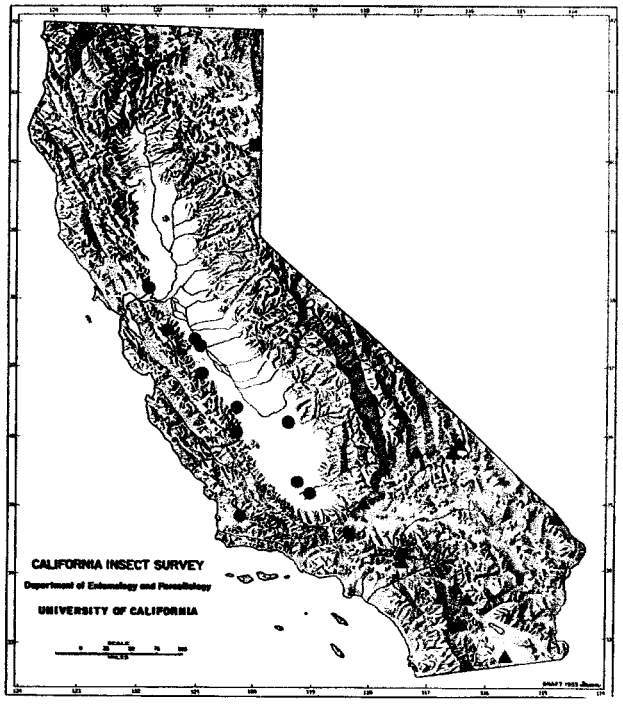
Trepidulus rosaceus, Hebard, 1935, Trans. Amer. Ent. Soc., 61:293.

Antennae black with pale annuli, the first two joints reddish. Generally dust gray or brown, the costal area of tegmen darker. Lateral lobe of pronotum with an oblique dark band, paler below. Hind tibia yellowish or pale blue. Wing narrow, pink without black band. Specimens with colorless wings occur in Nevada but this variety has not been seen in the California material examined.

Body 16–22; tegmen 18–24; hind femur 10.5–12.

Geographic range.—California, Arizona, Nevada, and Utah.

California records.—(Map 89) IMPERIAL CO.: El Centro, VII–24–38 (L. W. Hepner, ANSP). INYO CO.: Panamint Mts., Townes Pass, VIII–23–40 (E. R. Helwig, ANSP). Shoshone, VIII–8–19 (ANSP). Juncture of Slate and Argus Ranges, IX–8–22, 2750 ft. elevation (Rehn & Hebard, ANSP). Tecopa, VIII–8–19 (M. Hebard, ANSP). Lone Pine, IX–5–19, 4500 ft. elevation (Rehn & Hebard, ANSP). KERN CO.: Mojave, IX–16–10, 2750 ft. elevation (ANSP). RIVERSIDE



Map 89. California distribution of: ■, *Trachyrhachys kiowa* (Thomas); ●, *Trepidulus hyalinus* (Scudder); ▲, *Trepidulus rosaceus* (Scudder).

Co.: Palm Springs, VII–13– (ex: Scudder); VIII–12–07 (ANSP). Indio, VIII–7–32 (R. H. Beamer, ANSP). Tahquitz Canyon, San Jacinto Mts., IX–30–10, 1200 ft. elevation (ANSP). Palm Springs, to Palm Canyon, IX–29–10, 800 ft. elevation (ANSP). SAN BERNARDINO CO.: Mojave River, Hesperia, VII–28–40 (E. R. Helwig, ANSP). Victorville, IX–1–19 (ANSP). Needles, VIII–4–19 (Rehn & Hebard, ANSP). Dry lake bed near Box S Ranch, VIII–31–19 (Rehn & Hebard, ANSP). SAN DIEGO CO.: Borrego, X–14–48 (G. P. Mackenzie, CIS). Jacumba, VIII–12–35 (J. Russell, ANSP).

Discussion—This alert and quick grasshopper is a fairly common inhabitant of the Sonoran Desert flats.

Genus *Trimerotropis* Stal, 1873

(for key to species, see page 99)

This large genus, with over thirty species in California, is closely related to *Conozoa*. It is widely distributed over the west, especially on the bare soil of the desert, rocky hillsides, arroyo beds, and other sparsely vegetated areas. Several species become very abundant at times on range lands and in agricultural crops.

White (1948) studied the chromosome patterns of a number of species.

Trimerotropis albescens McNeill

(Fig. 44, Map 90)

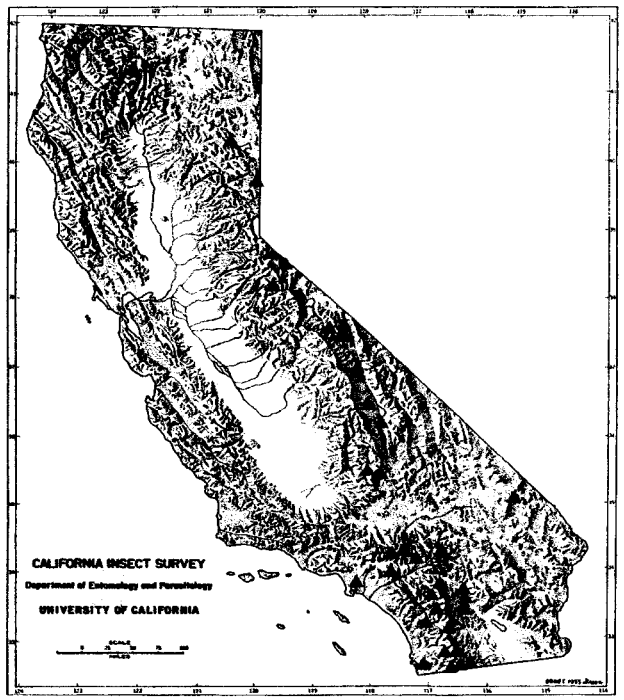
Trimerotropis albescens McNeill, 1900, Psyche, 9:30.
Trimerotropis albescens McNeill, 1901, Proc. U.S. Nat. Mus., 23:418.

Pale, almost white, head and pronotum sometimes with rusty red suffusions, lateral lobe of pronotum with angulate black band, tegmina with two or three bold black bars. Lower sulcus of hind femur pale with a broad black band. Hind tibia blue. Pronotum very short, median carina very low on metazona, well elevated on prozona, hind margin widely obtuse. Lateral lobe flaring outward at lower hind angle which is subdentate.

Body 15–21; tegmen 15–21; hind femur 9–12.

Geographic range.—California and Nevada.

California records.—(Map 90) ALPINE CO.: Near Woodford's Canyon, W. fork of Carson River, VIII–11–51, 5640 ft. elevation (J. G. Rehn, ANSP). INYO CO.: 9 mi. W. Lone Pine, VII–8–61 (W. A. Foster, CIS). 11 mi. W. Lone Pine, VII–22–64 (D. C. & K. A. Rentz, DCR). Lone Pine Camp, Whitney Pass Trail, IX–8–19 (Rehn & Hebard, ANSP). Sage Flat Camp, 10 mi. W. Big Pine, VII–20–64 (D. C. & K. A. Rentz, DCR). Olancha, VIII–15–17 (ANSP). Big Pine Creek, VIII–1929 (I. McCracken, CAS). 9 mi. W. Big Pine, VII–21–65 (J. D. Birchim, JDB). KERN CO.: 15 mi. S.E. Onyx, X–14–58, in *Chrysothamnus* (R. W. Thorp, CIS). Walker Pass (H. E. Cott, CIS). LASSEN CO.: Hallelujah Jct., VI–12–50 (R. W. Harper, CDA). Johnstonville, VIII–21–22, 4150 ft. elevation (ANSP). LOS ANGELES CO.: Los Angeles, Coquillett (ex: McNeill) topotypes. MARIPOSA CO.: 9 mi. E. Kennedy Meadows Camp, VIII–19–61, 7700 ft. elevation (C. W. O'Brien, DCR). MONO CO.: Topaz Lake, VI–26–57 (J. W. MacSwain, CIS). Benton, VII–20–64 (D. C. & K. A. Rentz, DCR). Rock Creek, 1 mi. W. Tom's Place, VIII–7–59 (D. C. Rentz, DCR). Rock Creek Canyon, IX–11–19, 7200 ft. elevation (Rehn & Hebard, ANSP). 4 mi. S. of the south end of Topaz Lake, VIII–12–51, 5400 ft. elevation (J. Rehn, ANSP). Mono Lake, 10 mi. N. Leevining, VIII–6–61 (C. D. MacNeill, D. C. Rentz & M. R. Lundgren, CAS). Convict Lake, VII–17–33 (G. & R. Bohart, CAS). RIVERSIDE CO.: San Jacinto Mts., VI–30–33 (R. G. Beamer, ANSP). Anza, VII–3–56 (C. L. Wiley); VII–5–56 (R. M. Bohart, UCD). Strawberry Valley, San Jacinto Mts., IX–26–09, 5500 ft. elevation (ANSP). Idyllwild, VIII–3–35 (E. I. Beamer, ANSP); VII–29–38 (J. Russell, ANSP). 11 mi. S. Hemet, VIII–31–58 (D. M. Newell, CIS). Banning, V–30–28 (E. C. Van Dyke, CAS). Coahuila, VIII–18–11 (J. C. Bradley, ANSP). SAN BERNARDINO CO.: Near Wrightwood, VII–1–56, 6500 ft. elevation (G. I. Stage, CIS). Cima, VIII–12–07, 4192 ft. elevation (ANSP). Hesperia, VII–28–40 (E. R. Helwig, ANSP). Mojave River, VIII–19–36 (Timberlake, ANSP). San Bernardino Mts., Mill Creek, VIII–30–19 (Rehn & Hebard, ANSP). Harvey's Mill Creek, VIII–30–19, 3700 ft. elevation (Rehn & Hebard, ANSP). Cactus Flats, VIII–31–19, 5900 ft. elevation (Rehn & Hebard, ANSP). Ontario (T. Craig, CAS). SAN DIEGO CO.: Jacumba, VI–16–54 (D. J. & J. N. Knull, CIS). San Diego, (J. A. Powell, CIS). 2 mi. N. Warner Springs, VII–4–56 (C. L. Wiley, G. I. Stage & R. W. Bushing, CIS); VII–8–56 (E. G. Linsley & R. M. Bartosh, CIS). Laguna Mts., Resort P.O., IX–14–22, 6100 ft. elevation (Rehn & Hebard, ANSP). 10 mi. W. Jacumba, IX–15–22, 3500 ft. elevation (Rehn & Hebard, ANSP). Descanso, IX–13–22,



Map 90. California distribution of *Trimerotropis albescens* McNeil.

3400 ft. elevation (Rehn & Hebard, ANSP). Campo, IX–13–22, 2400 ft. elevation (Rehn & Hebard, ANSP). Nellie, VIII–28–17 (E. P. Hewlett, ANSP). Pine Valley, VII–7–59 (F. X. Williams, CAS). Mt. Palomar, VI–28–63 (J. D. Birchim, JDB).

Discussion—This small, pale, active desert species varies in color according to the color of the sand upon which it is usually found. It has a distinctive undulating flight during which it loudly stridulates. It is a difficult species to see and collect.

Trimerotropis arenacea Rehn

Trimerotropis arenaceus Rehn, 1910, Proc. Acad. Nat. Sci. Phila., 62:13, Figs. 1, 2.

Gray, thickly sprinkled with small black spots, tegminal cross-bands incomplete and poorly defined, sometimes not evident. Lower sulcus of hind femur pale with a preapical black band, the basal half slightly darkened. Hind tibia pale blue. Pronotum with hind margin obtuse-angulate, median carina very low on metazona, moderately elevated on prozona. The unusually small head and broad metathorax are distinctive.

Body 17–24; tegmen 19–25; hind femur 10–12.

Geographic range.—California and Nevada.

No California specimens have been seen but the insect occurs in Lake County, Oregon (M. J. D. White) and Humboldt County, Nevada (T. R. Haig).

Discussion—Helfer (1963) reports this species inhabiting sand dunes.

Trimerotropis bifasciata Bruner

(Fig. 47, Map 91)

Trimerotropis bifasciata Bruner, 1890, Proc. U.S. Nat. Mus., 12:70. Type ♂, Los Angeles, Calif., designated by McNeill (1901) Proc. U.S. Nat. Mus., 23:419.

Light gray to lead color, tegmina with two sharply defined black bands in basal two-thirds and an indistinct band in distal third. Hind femur with a single black band on outer face at distal third, lower sulcus black with two pale bands. Hind tibia blue. Wing greenish yellow with moderately wide black band. Fastigium broad and shallow. Pronotum with hind margin obtuse, median carina very low on metazona and but little elevated on prozona, lateral carinae obtuse on metazona, completely absent on prozona. Specimens referred to *T. bifasciata* in this study show considerable variation in size, the eastern and northern being smaller and with shorter tegmina.

Kern Co.: Body 22–28; tegmen 21–28; hind femur 12–16.

Mono Co.: Body 16–20; tegmen 18–20; hind femur 9–10.

Geographic range.—California.

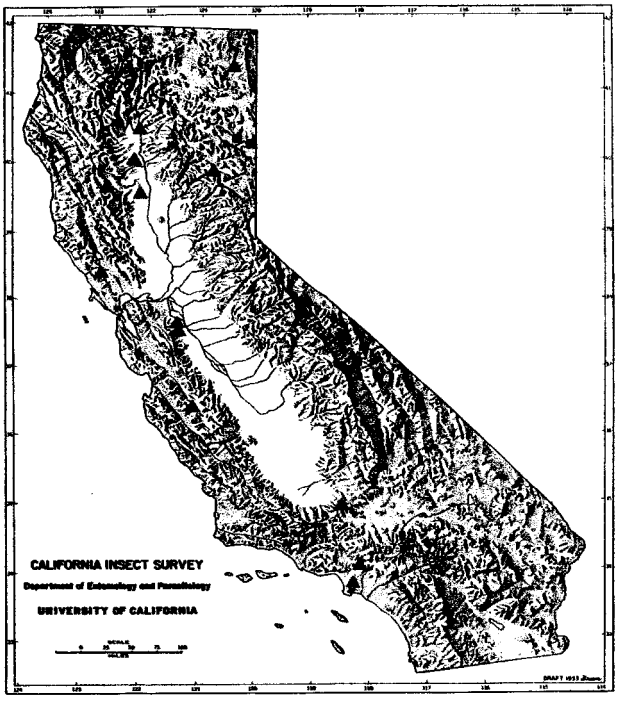
California records.—(Map 91) GLENN CO.: Artois, VIII–22–51, range grasses (R. W. Harper, CDA). 4 mi. W. Plaskett Meadows Station, VIII–27–61 (D. C. Rentz, DCR). KERN CO.: Tehachapi, VII–31–50 (R. W. Harper, CDA). LOS ANGELES CO.: Los Angeles, Coquillett (ex: Bruner). Between Rubio Canyon and Altadena (Rehn & Hebard, ANSP). MODOC CO.: Pine Creek, VIII–12–46 (G. P. Mackenzie, CIS). MONO CO.: Mono Lake, VIII–25–46 (G. P. Mackenzie, CIS). June Lake, VI–30–49 (H. E. Cott, CIS). Hilton Creek (R. M. Bohart, UCD). Grant Lake, VIII–5–48 (P. D. Hurd & J. W. MacSwain, CIS); VIII–3–50 (J. W. MacSwain, CIS). PLUMAS CO.: 4 mi. W. Quincy (L. W. Isaak, CIS). SAN BENITO CO.: Pinnacles Nat. Mon., VIII–18–58 (D. C. Rentz, DCR). SAN JOAQUIN CO.: Vernalis, VII–24–51, range (R. W. Harper, CDA). SHASTA CO.: 15 mi. N.E. Redding, VI–19–60 (D. C. Rentz, DCR). SONOMA CO.: Camp Meeker, IX–5–50 (H. H. Keifer, CDA). STANISLAUS CO.: Patterson, VI–7–24 (R. P. Allen, CDA). TEHAMA CO.: (ex: McNeill).

Trimerotropis bilobata Rehn and Hebard

(Fig. 42, Map 91)

Trimerotropis bilobata Rehn & Hebard, 1906, Proc. Acad. Nat. Sci. Phila., p. 382, Figs. 11, 12. Lectotype ♀, Antlers, Mesa Co., Colo., designated by Rehn & Hebard, 1912 (ANSP).

Gray, tegmina with two or three incomplete dark cross-bands. Wing pale yellow with narrow black band. Inner face and lower sulcus of hind femur black with two pale cross-bars. Pronotum with median carina high and compressed on prozona, low but



Map 91. California distribution of: ▲, *Trimerotropis bifasciata* Bruner; ■, *Trimerotropis bilobata* Rehn & Howard.

sharp on metazona. LaRivers' record from Nevada is based on material misidentified by Strohecker.

Body 17–23; tegmen 19–25; hind femur 9.5–13.

Geographic range.—E. Washington and California to central and southern Rocky Mt. states.

California records.—(Map 91) INYO Co.: Big Pine, VII–21–64 (D. C. & K. A. Rentz, DCR). LASSEN Co.: Standish, VIII–27–60 (T. H. Gantenbein, CIS). Litchfield, VIII–21–22 (Rehn & Hebard, ANSP). Amedee, VIII–22–22 (Rehn & Hebard, ANSP).

Discussion—Inhabits sandy desert areas on bare ground.

Trimerotropis californica Bruner

(Fig. 46, Map 92)

Trimerotropis californica Bruner, 1890, Proc. U.S. Nat. Mus., 12:71. Lectotype ♂, San Louis Valley, Calif., designated by Rehn & Hebard, 1912 (ANSP).

Pale gray or brown, tegmen with sharply defined bands, wing pale yellow with complete but rather narrow black band. Pronotum with lateral carinae low on metazona, tumidly elevated but little compressed on prozona.

The form with blue hind tibiae has the tegminal bands less sharply defined.

Body 19–28; tegmen 20–28; hind femur 11–15.

Geographic range.—California.

California records.—(Map 92) HUMBOLDT Co.: Kneeland, VIII–16–61 (T. R. Haig, CAS). INYO Co.: Olancha, VII–31–63 (W. J. Turner, DCR). Gilbert Pass, VIII–10–59 (D. C. Rentz, DCR). Whitney Portal, VII–10–62 (C. W. O'Brien, DCR). 5 mi. N. Big Pine, VI–24–64 (J. D. Birchim, JDB). 5 mi. W. Lone Pine, VII–22–65 (J. D. Birchim, JDB). KERN Co.: Weldon, VIII–12–52 (R. W. Harper, CDA). Mill Potrero, VII–8–59 (G. M. Marsh, UCD). 4 mi. N.E. Buttonwillow, VI–29–61 (C. W. O'Brien, DCR). LOS ANGELES Co.: Los Angeles (Coquillett) (ex: McNeill). Pasadena, VII–14– (F. Grinnell, ANSP); VIII–1–07 (Rehn & Hebard, ANSP). Los Angeles River, VIII–24– (Rehn & Hebard, ANSP). San Gabriel Mts., VIII–8– , 1000–1600 ft. elevation (Rehn & Hebard, ANSP). Altadena, VIII–8– (Rehn & Hebard, ANSP). Saugus, X–19–50 (Myers & Keifer, CDA). Solemint, X–19–50 (H. H. Keifer, CDA). Littlerock, VII–20–47 (G. P. Mackenzie, UCD). Palmdale, VII–10–47 (G. P. Mackenzie, UCD). Vincent, VII–24 to VIII–8–47 (G. P. Mackenzie, UCD); VIII–20–48 (G. P. Mackenzie, UCD). Acton, IX–27–10, 2700 ft. elevation. Parker Mt., S.E. end of Ventura Mts., IX–27–10, 3000 ft. elevation. Roscoe, Tujunga Wash, VIII–23–09, 825 ft. elevation, sandy wash with cactus and yucca. Claremont, VIII–5–15 (J. W. Rich, ANSP), (Baker, ANSP). Pasadena, Arroyo Seco, VIII–1–07 (ANSP); VIII–21–09, 1100 ft. elevation (F. Grinnell, ANSP). Rubio Canyon, Sierra Madre Range, VIII–8–07, 8600 ft. elevation (ANSP). RIVERSIDE Co.: Palm Springs, VIII–27–52 (H. Graham, CIS). Anza, VII–8–56 (C. L. Wiley, CIS); VII–5–56 (H. W. Michalk, CIS). 2 mi. W. Beaumont, VIII–19–50 (H. M. Graham, CIS). Corona, VII–30–19 (E. P. Hewlett, ANSP). SAN BERNARDINO Co.: Rialto, VII–11–55 (J. C. Hall, CIS). Mouth of Deep Creek, VIII–11–56 (E. I. Schlinger, UCR). Colton, VII–6–57 (J. E. Gillaspy, CIS); VII–5–51 (J. C. Hall, CIS). Devore, Cajon Canyon, IX–2–10 (Rehn & Hebard, ANSP). Verdemont, IX–2–19; Cajon Wash (ANSP). San Bernardino Mts., VIII–8–30, 3800 ft. elevation (E. R. Tinkham, ANSP). Harvey's Mill Creek, VIII–30–19, 3700 ft. elevation (ANSP). SAN DIEGO Co.: Warner Hot Springs, X–9–47, X–13–48 (G. P. Mackenzie, UCD). Carrizo Springs, VIII–17–58 (E. I. Schlinger, UCR). Borrego, X–14–48 (G. P. Mackenzie, UCD).

Trimerotropis coquilletti McNeill

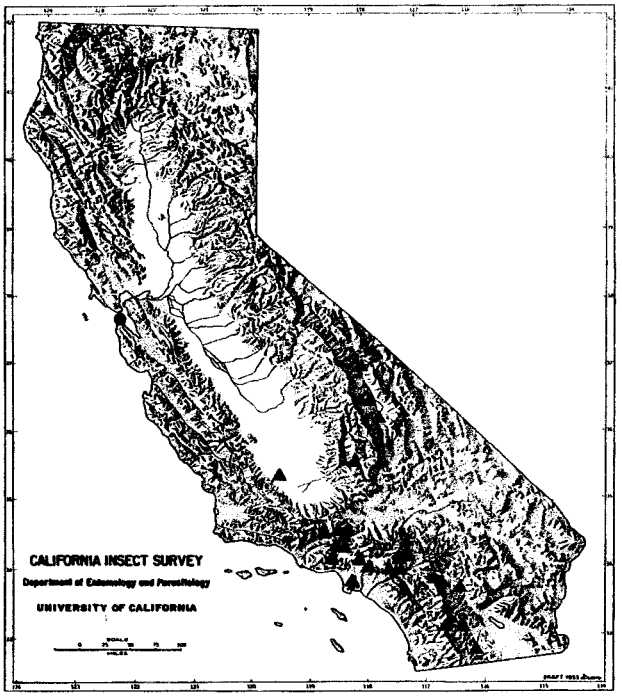
(Map 92)

Trimerotropis coquilletti McNeill, 1900, Psyche, 9:29. Type locality, San Francisco Co., Calif.

"Size medium. Color dark brown, nearly plain.... Pronotum with the prozona elevated somewhat and the median carina cristate and slightly bilobate; lateral carinae obsolete on the metazona, visible on the front margin of the prozona....Disk (of wing) light yellow, with a narrow distinct fuscous band extending along the posterior margin nearly to the anal angle, with a spur reaching half way toward the base; apex hyaline. Posterior femora with . . . the lower sulcus black with one (white band). Posterior tibiae obscure yellow" (McNeill).

Female: Body 20; tegmen 30; hind femur 14.

Geographic range.—San Francisco Bay Region of California.



Map 92. California distribution of: ▲, *Trimerotropis californica* Bruner; ●, *Trimerotropis coquilletti* McNeil.

California records.—(Map 92) SAN FRANCISCO CO.: San Francisco, Bernal Heights, XII–8–59 (D. C. Rentz, DCR).

Discussion—Found on exposed red-rock hillsides.

Trimerotropis cristata McNeill
(Fig. 43, Map 93)

Trimerotropis cristata McNeill, 1900, Psyche, 9:28. Type ♀, San Julio, Baja California.

Pronotum with metazona about twice as long as prozona, lower hind angle of lateral lobe briefly but distinctly dentate.

Body 18–26; tegmen 19–25; hind femur 9.5–13.

Geographic range.—California to Baja California, Arizona, Utah.

California records.—(Map 93) RIVERSIDE CO.: Palm Springs, III–24–33 (C. D. Duncan, SJS). SAN DIEGO CO.: Coronado, IX–11–22 (Rehn & Hebard, ANSP).

Discussion—First known records from California; recorded from southwestern Arizona by Ball et al. (1942), and taken at Descanso, Baja California by R.M. Bohart, July 14, 1952. Recorded from Las Vegas, Nevada by Rehn and Hebard in 1909 but these specimens are now considered to be *T. bilobata* Rehn and Hebard. Occurs in extreme desert areas.

Trimerotropis cyaneipennis Bruner
(Map 93)

Trimerotropis cyaneipennis Bruner, 1890, Proc. U.S. Nat. Mus., 12:68. Lectotype ♂, near mouth Ogden Canyon on the upper shore of Ancient Lake, Bonneville, Salt Lake Valley, Utah, designated by Rehn & Hebard, 1912 (ANSP).

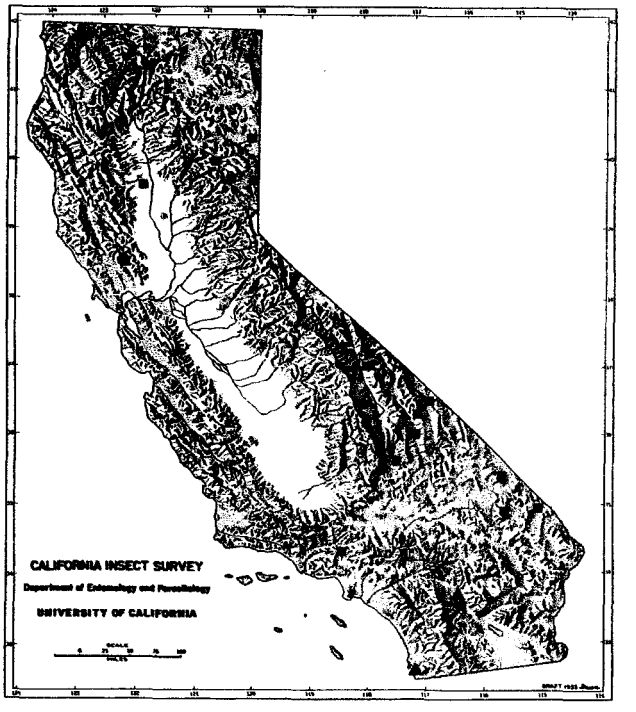
Trimerotropis cyaneipennis, Rehn & Hebard, 1909, Proc. Acad. Nat. Sci. Phila., 61:455.

Gray or brown, cross-bands of tegmina variable, well defined to obsolete. Wing blue, the black band bold and complete in some specimens, reduced to small patches in others. Abdominal tergites and distal sternites blue (in well-preserved specimens). Lower sulcus of hind femur black with a preapical pale band. Hind tibia rich blue.

Body 22–25; tegmen 22–28; hind femur 11–13.

Geographic range.—Western Texas west to California and north to southern Idaho.

California records.—(Map 93) GLENN CO.: Orland, VII–13–55 (W. H. Lange, UCD). INYO CO.: Rock Creek Gorge, VII–28–54 (J. A. Powell, CIS). 9 mi. E. Big Pine, VII–15–61 (J. S. Buckett, UCD). Surprise Canyon, 6 mi. W. Panamint, VII–15–62. 11 mi. W. Lone Pine, VII–19–61 (D. C. Rentz, DCR). White Mt., Silver Canyon, IX–10–19, 6600 ft. elevation (Rehn & Hebard, ANSP). Hole-in-the-Rock Springs, Boundary Canyon, Amargosa Range, VIII–17–19, 2600 ft. elevation (Rehn & Hebard, ANSP). Panamint Range, Wild Rose Canyon, IX–8–22, 5500 ft. elevation (M. Hebard, ANSP). IX–8–22, 3617 ft. elevation (Rehn & Hebard, ANSP). IX–5–19, 6000 ft. elevation (ANSP). LASSEN CO.: Hot Spring Mt., VII–13–54 (J. A. Powell, CIS). Hallelujah Jct., VII–12–54 (R. M. Bohart, UCD). LOS ANGELES CO.: Mint Canyon, VI–28–56 (C. Cushner, DCR). MODOC CO.: Cedar Peak, VIII–25–22, 7200 ft. elevation (Rehn & Hebard, ANSP). NAPA CO.: Samuel Springs, VII–20–51 (R. C. Bechtel, UCD). PLUMAS CO.: 8 mi. W. Johnsville, VIII–11–61. Crescent Mills, VII–8–32 (UCD). RIVERSIDE CO.: Magnesia Canyon, VII–2–42 (A. A. Grigarick, UCD). SAN BERNARDINO CO.: New York Mts., IX–11– (R. C. Osburn, CIS). Trona, IX–5–22, 1800 ft. elevation (Rehn & Hebard, ANSP). Providence Mts., North Range, VIII–12–07, 2300 ft. elevation. New York Mts., VIII–13–64 (J. D. Birchim, JDB). Goffs, VIII–5–19 (Rehn & Hebard, ANSP).



Map 93. California distribution of: ▲, *Trimerotropis cristata* McNeill; ■, *Trimerotropis cyaneipennis* Bruner.

Discussion—Occurs in canyons, on rocky slopes, and on gravelly soil in forested areas from 3000 to 8500 feet. It is wary and difficult to collect, crackling loudly in flight.

Trimerotropis fontana Thomas
(Fig. 55)

Trimerotropis fontana Thomas, 1876, Proc. Davenport Acad. Sci., 1:255, Type locality, Spring Lake, Utah Co., Utah.

Trimerotropis coeruleipes Scudder, 1881, Sec. Rep. U.S. Ent. Comm. App. 2:27.

Trimerotropis calignosa McNeill, 1900, Psyche, 9:30.

Trimerotropis fontana, Hebard, 1928, Proc. Acad. Nat. Sci. Phila., 80:259.

The concept of the species *T. fontana* as defined by Hebard includes specimens which vary in color

from very pale brown to almost black; the dark specimens have lighter areas on the tegmina between the dark cross-bands. Wing pale greenish-yellow with narrow black band, apical third "smoky" especially in male. Junction of fastigium and frontal costa subangulate in profile. Pronotum with lateral carinae sharp on front of metazona and near front margin of prozona, median carina low on metazona, well elevated on prozona, hind margin slightly obtuse.

Body 20–28; tegmen 21–29; hind femur 11–16.

Geographic range.—All states of the Rocky Mountain area west to the Pacific, and north into British Columbia and Vancouver Island.

California records.—Scudder, McNeill, Caudell, Rehn and Hebard have reported specimens from the following counties: El Dorado, Los Angeles, Marin, Mariposa, Riverside, San Diego and Siskiyou. A large number of specimens examined in the present study were collected in many counties.

ALAMEDA	MODOC	SANTA BARBARA
CALAVERAS	MONO	SANTA CLARA
EL DORADO	NEVADA	SANTA CRUZ
FRESNO	PLACER	SHASTA
HUMBOLDT	PLUMAS	SIERRA
INYO	RIVERSIDE	SISKIYOU
LASSEN	SAN BENITO	TEHAMA
LOS ANGELES	SAN BERNARDINO	TRINITY
MARIN	SAN DIEGO	TUOLUMNE
MARIPOSA	SAN LUIS OBISPO	VENTURA

Discussion—Found on rocky slopes in grassy area, on bare spots, in vacant lots, along roads and in other dry habitats. Crackles loudly in flight which is rather short and low. It is very wary and hard to collect.

Trimerotropis gracilis gracilis (Thomas)
(Map 94)

Oedipoda gracilis Thomas, 1872, Rept. U.S. Geol. Surv. Montana, p. 461. Lectotype ♂, Colo., designated by Hebard, 1927 (USNM).

Trimerotropis gracilis, Saussure, 1884, Prodrome Oedip., p. 171.

This insect, as it occurs in California, is dark gray, unmarked except for small black streaks on the tegmina. The wing is a pale yellow, without black band but showing a weak dark cloud in some specimens. Pronotum with median carina well elevated throughout, sharp but not cristate. Lower sulcus of hind femur black with preapical pale band. Hind tibia pale brown.

Body 21–28; tegmen 22–29; hind femur 10.5–13.

Geographic range.—California, and from southern Idaho south to Utah and east to South Dakota. A second subspecies *T. g. sordida* Walker is a more northern form.

California records.—(Map 94) INYO CO.: Westgard Pass, VIII–25– (P. D. Hurd, CIS). White Mts., near Goat Springs, IX–10–19, 10,700 ft. elevation (Rehn & Hebard, ANSP). Big Pine, VIII–1929 (R. McCracken, CAS). 4 mi. N. Schulman Grove, White Mts., VII–27–62 (C. D. MacNeill, D. C. Rentz, & M. R. Lundgren, CAS). LASSEN CO.: Red Rock, VII–11–51, range grasses (R. W. Harper, CDA). Hallelujah Jct., VII–12–62 (R. M. Bohart, CIS). Amedee, VIII–22–22 (Rehn & Hebard, ANSP). Susanville, VIII–21–22, 4190 ft. elevation (Rehn & Hebard, ANSP). Johnstonville, VIII–21–22, 4150 ft. elevation (ANSP). MODOC CO.: Alturas, VIII–23–22, 4500 ft. elevation (Rehn & Hebard, ANSP). MONO CO.: Convict Lake, VIII–9–46 (G. P. Mackenzie, UCD). Mono Lake, VIII–25–48 (G. P. Mackenzie, UCD). Blanco's Corral, White Mts., VIII–25–60, 10,150 ft. elevation (R. R. Montanucci, CIS). Crooked Creek, White Mts., VII–17–61, 10,150 ft. elevation (W. A. Foster, CIS). Rock Creek Canyon, IX–11–19, 7280 ft. elevation (Rehn & Hebard, ANSP). White Mts., Mt. Barcroft, VII–21–61, 12,500 ft. elevation (D. C. Rentz, DCR). 10 mi. N. of Leevining, VII–7–61 (D. C. Rentz, DCR). Conway Summit, VIII–12–51, 8106 ft. elevation (J. Rehn, ANSP). W. of Long Valley Reservoir, VIII–13–51, 7200 ft. elevation (J. Rehn, ANSP). 1 mi. S. Leevining, VIII–13–51 (J. Rehn, ANSP). White Mts. Research Station, VII–7–61, 10,150 ft. elevation (D. C. Rentz, CAS). Near Mono lake, 10 mi. N.E. Leevining, VII–28–62 (D. C. Rentz & C. D. MacNeill, CAS). The Hot Springs, 3 mi. S.S.E. Bridgeport, Hot Springs Canyon, VIII–12–52 (H. B. Leech, CAS). Mammoth, VII–8–33 (G. & R. Bohart, CAS).

Discussion—Occurs in sagebrush areas where it blends quite well.

Trimerotropis helferi Strohecker
(Fig. 53, Map 94)

Trimerotropis helferi Strohecker, 1960, Pan-Pac. Ent., 36:32, 35, Fig. 2. Type ♂, Cleone, Mendocino Co., Calif. (USNM #64567).

Gray, thickly mottled with black, tegmina without distinct bands. Lower sulcus of hind femur pale with preapical black band. Hind tibia yellow. Pronotum with median carina low on metazona, moderately elevated on prozona. Wing colorless with faint indication of black band.

Body 18–25; tegmen 18–24; hind femur 9.5–14.

Geographic range.—Northwestern California.

California records.—(Map 94) HUMBOLDT CO.: Mouth Mad River, VII–1919 (E. C. Van Dyke, CAS). Eureka, VI–24–24 (J. M. Aldrich, CIS); VI–11–35 (E. O. Essig, CIS). Arcata, VII–1919 (E. C. Van Dyke, CAS). Petrolia, VII–17–58 (J. R. Helfer, CAS). Samoa, VIII–12–63 (J. S. Buckett, UCD). 4 mi. S. Orick, VIII–25–62 (J. S. Buckett, UCD). MENDOCINO CO.: Cleone, VIII–6–58 (J. R. Helfer, CAS). 5 mi. N. Ft. Bragg, VIII–10–63 (J. S. Buckett, UCD). Ten Mile, VII–4–58 (N. B. Hall, DCR). MacKerricher State Park, VII–18–59 (D. C. Rentz, DCR).

Discussion—This insect is apparently restricted to our northern coastal dunes where it can be found in abundance. Specimens greatly resemble their background and fly readily when approached. They oc-

cupy the same ecological niche as does *Microtes occidentalis* which occurs in central and southern California.

Trimerotropis hyalina McNeill
(Map 94)

Trimerotropis hyalina McNeill, 1900, Psyche, 9:28. Type ♀, Calif. (USNM #5370).

Trimerotropis gratiosa Scudder, 1900, Can. Ent., 32:330.

Trimerotropis hyalina, McNeill, 1901, Proc. U.S. Nat. Mus., 23:405.

Stout for genus, pronotum with median carina very high and deeply bilobate on prozona, lower hind angle of lateral lobe much produced and acutely rounded. Pale brown to almost white, tegmina with incomplete dark bands or only a few dark spots in median area, wing clear or pale yellow with black band varying from complete to absent (in females). Lower sulcus of hind femur pale with one black cross-band before apex, hind tibia yellow.

The specimens from Antioch are smaller than the Scudder specimens with darker color and greater development of the wing band, but otherwise conform closely.

Antioch specimens: Body 23–27; tegmen 22–25; hind femur 13–15.

Geographic range.—California.

California records.—(Map 94) California: (ex: McNeill). STANISLAUS CO.: Ceres (ex: Scudder). Turlock, 1903 (ANSP). CONTRA COSTA CO.: Antioch, VI–15–41 (W. F. Barr, CIS); VII–14–53 (W. H. Lange, UCD).

Trimerotropis inconspicua Bruner
(Fig. 48, Map 95)

Trimerotropis inconspicua Bruner, 1904, Colorado Agr. Exp. Sta. Tech. Bull., 94:59. Lectotype ♂, Palisade, Colo., designated by Rehn & Hebard, 1912 (ANSP).

Trimerotropis inconspicua, Rehn & Hebard, 1909, Proc. Acad. Nat. Sci. Phila., 61:452.

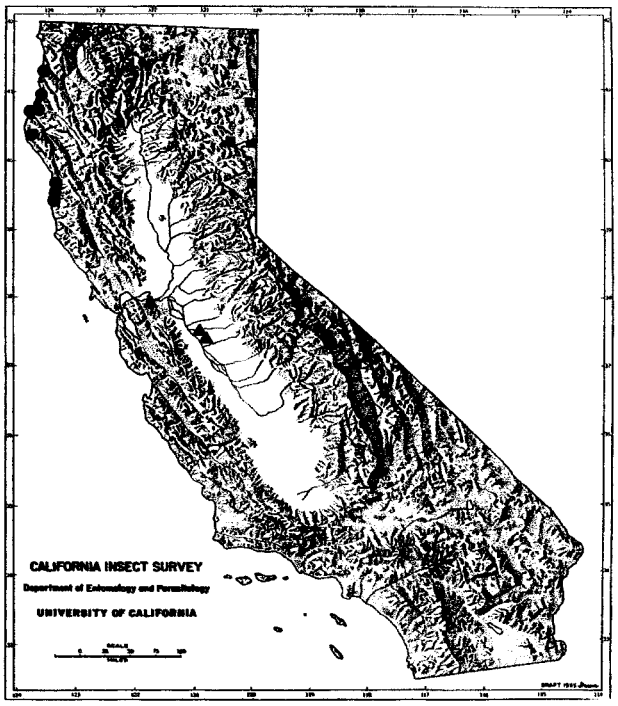
?*Trimerotropis titusi*, Tinkham, 1947 (not of Caudell), Amer. Midl. Nat., 38:141, Hualapai Mts., Ariz.

Pale gray or buffy, tegminal cross-bands rather narrow. Lower sulcus of hind femur black with two pale bars. Hind tibia yellow or greenish-yellow. Median carina of pronotum low and linear throughout, occiput elevated, eyes very prominent.

Body 18–25; tegmen 19–25; hind femur 10–12.

Geographic range.—Colorado, Utah, Arizona, Nevada, and California.

California records.—(Map 95) INYO CO.: Panamint Range, Wild Rose Canyon, IX–8–22, 5500 ft. elevation (ANSP). Grape Vine Mts., Daylight Springs, VIII–13–19, 4550 ft. elevation (Rehn & Hebard, ANSP). Panamint Mts., Townes Pass, VIII–23–40 (E. R. Helwig, ANSP). Juncture of Slate and Argus Ranges, IX–8–22, 2750 ft. elevation (Rehn & Hebard, ANSP). White Mts., Silver Canyon Trail, IX–10–19, 8200 ft. elevation (Rehn & Hebard, ANSP). KERN CO.: Warren, IX–17–10, 3360 ft. elevation (ANSP). Tehachapi, IX–16–10, 4200 ft. elevation (ANSP). SAN BERNARDINO CO.: San Bernardino Mts., Baldwin Lake, VIII–31–19, 6700 ft. elevation (Rehn & Hebard, ANSP). Cima, VIII–12–07, 4100 ft. elevation (ANSP). Yucca Grove, VIII–7–35 (W. D. Field, ANSP). MONO CO.: Mammoth Lake, VIII–5–21 (O. C. Poling, ANSP).



Map 94. California distribution of: ■, *Trimerotropis gracilis* (Thomas); ●, *Trimerotropis helferi* Strohecker; ▲, *Trimerotropis hyalina* McNeil.

Discussion—Not an active or wary species. Females may not attempt to move before capture while the males may only fly a few feet.

Trimerotropis koebelei (Bruner)
(Map 95)

Conozoa koebelei Bruner, 1890, Proc. U.S. Nat. Mus., 12:67. Lectotype ♂, Placer Co., Calif., designated by Rehn & Hebard, 1912.

Trimerotropis koebelei, McNeill, 1901, Proc. U.S. Nat. Mus., 23:420.

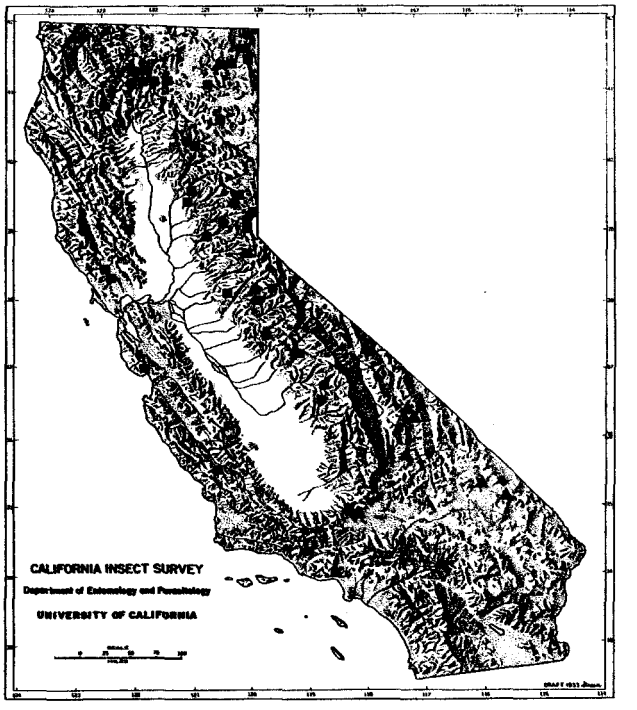
Pale gray or brown, tegmen with dark cross-bands confined to costal half. Face usually with a black band through the lower half of the eyes. Pronotum short, hind margin obtuse, carinae as in *T. fontana*. *T. koebelei* has been regarded by some as a color

phase of *T. fontana* but seems to maintain its differential features in areas where typical *fontana* occurs.

Body 16–24; tegmen 17–24; hind femur 9.7–13.

Geographic range.—California and Oregon.

California records.—(Map 95) BUTTE CO.: Forbestown, VIII–19–57 (T. R. Haig, CDA). Feather Falls, VII–17–57 (T. R. Haig, CDA). CALAVERAS CO.: VI–3–54 (R. P. Allen, CDA). COLUSA CO.: Wilbur Springs, VI–21–64 (D. C. Rentz, CAS). EL DORADO CO.: Strawberry Valley, VIII–4–12 (E. C. Van Dyke, ANSP). FRESNO CO.: Kaiser Pass, VIII–9–49 (H. H. Keifer, CDA). Kings River, Paradise Valley, VII–23–10 (E. C. Van Dyke, ANSP). Kings River Canyon, VIII–4–40 (E. R. Helwig, ANSP). LASSEN CO.: VIII–21–22, 4190 ft. elevation (ANSP). LOS ANGELES CO.: Topanga Canyon, VIII–5–38 (J. Russell, ANSP). MARIPOSA CO.: Yosemite Nat. Park, Sentinel, VIII–31, IX–1 (Rehn & Hebard, ANSP); IX–1–07, 4000 ft. elevation (ANSP); VIII–12–16 (G. P. Engelhardt, ANSP). Yosemite Valley, VIII–10–1897 (A. P. Morse, ANSP). MENDOCINO CO.: Hopland Field Station, VIII–6–59 (W. W. Middlekauff, CIS). MODOC CO.: Sugar Hill, Goose Lake, VIII–24–22, 5360 ft. elevation (Rehn & Hebard, ANSP). Alturas, VIII–23–22 (Rehn & Hebard, ANSP). Davis Creek, VII–10–22 (CAS). Lake City, VII–31–22 (C. L. Fox, CAS). Adin Summit, VII–24–62, 5000 ft. elevation (D. C. Rentz & C. D. MacNeill, CAS). 10 mi. W. Alturas, VII–24–62 (D. C. Rentz & C. D. MacNeill, CAS). NEVADA CO.: Red Dog, IX–7–53 (J. T. Brooks, UCD). Boca Dam, IX–11–57 (E. G. Linsley, CIS). PLACER CO.: County (ex: Bruner). 3 mi. S. Truckee, VIII–2–49 (M. J. D. White, ANSP). Colfax, VIII–27–10, 2800 ft. elevation (ANSP). Blue Canyon, VIII–29–10, 4800 ft. elevation (ANSP). Lake Tahoe, VIII–30–10, 7000 ft. elevation (ANSP). Squaw Peak, VIII–31–10 (ANSP). Five Lakes Valley, foot of Squaw Peak, VIII–31–10, 8000 ft. elevation (ANSP). PLUMAS CO.: Chester, VII–11– (D. J. & J. N. Knull, CIS). 8 mi. N.W. Chester, VIII–18–58 (J. A. Powell, CIS). SANTA BARBARA CO.: Lompoc, VIII–6–38 (L. W. Hepner, ANSP). SAN LUIS OBISPO CO.: Paso Robles, VIII–21–09 (ANSP). SANTA CRUZ CO.: Santa Cruz Mts., VIII–13–38 (J. Russell, ANSP). Mt. Hermon, VIII–16–35 (Timberlake, ANSP). SIERRA CO.: Sierraville, VII–20–49 (H. H. Keifer, CDA). Webber Lake, VIII–25–46 (R. M. Bohart, UCD). SISKIYOU CO.: Dunsmuir, Caudell. Edgewood, IX–20–50, range (R. W. Harper, CDA). Weed, VII–24–50, range grasses (R. W. Harper, CDA). 3 mi. E. Bartle, VII–22–62 (D. C. Rentz & C. D. MacNeill, DCR). Echo Lake, VIII–29–16 (J. A. Kusche, ANSP). Mt. Shasta, VIII–14–09, 5500 ft. elevation (ANSP). Sisson, VIII–15–09, 3550 ft. elevation (ANSP). Weed, VI–29–35 (E. I. Beamer, ANSP). Fowler's Camp, 5 mi. E. McCloud, VII–2–62 (D. C. Rentz & C. D. MacNeill, CAS). 4 mi. E. Shasta City, McBride Campground, VII–23–62 (D. C. Rentz & C. D. MacNeill, CAS). SONOMA CO.: Eldridge, X–10–15 (J. A. Kusche, ANSP). Santa Rosa, VIII–16–38 (D. W. Craik, ANSP). TRINITY CO.: Weaverville, VI–25–59 (J. R. Helfer, CAS). TULARE CO.: Nine Mile Canyon, VIII–6–61, 7850 ft. elevation (C. W. O'Brien, DCR). Sequoia Nat. Park, VIII–3–40 (E. R. Helwig, ANSP). TUOLUMNE CO.: Mather, VIII–1–49 (H. H. Keifer, CDA). Spring Gap, VII–27–61 (M. Lundgren, DCR). Sonora Pass, VII–4–34, 9600 ft. elevation (G. & R. Bohart, CAS). VENTURA CO.: Downer Ranch, IX–3–22, 5400 ft. elevation (Rehn & Hebard, ANSP).



Map 95. California distribution of: ▲, *Trimerotropis inconspicua* Bruner; ■, *Trimerotropis koebelei* (Bruner).

Discussion—A common inhabitant of bare patches in grassy areas usually at moderate elevations.

Trimerotropis latifasciata Scudder
(Map 96)

Trimerotropis latifasciata Scudder, 1881, 2nd Rept. U.S. Ent. Comm., 2:26. Type locality, Wallula, Wash., and Lake Point, Utah.

Geographic range.—Great Basin, Alberta to Washington and California, Arizona, Texas to North Dakota and Iowa.

California records.—(Map 96) INYO CO.: Lone Pine Creek, IX–5–19, 4500 ft. elevation (Rehn & Hebard, ANSP). Owen's Valley, VIII–19–15 (C. H. Kennedy, ANSP). Keeler, VII–6–14 (Wickham, ANSP). LASSEN CO.: Amedee, VIII–22–22, 3960 ft. elevation (Rehn & Hebard, ANSP). LOS ANGELES CO.: Roosevelt, VIII–1–40 (E. R. Helwig, ANSP). SAN BERNARDINO CO.: Newberry, IX–9–24, 1831 ft. elevation (Rehn & Hebard, ANSP).

Discussion—A wary and vigorous species on bare or rock areas and desert grasslands. An important rangeland species in Arizona. Brooks (1968) reports this species to be a mixed feeder, preferring bunch grasses.

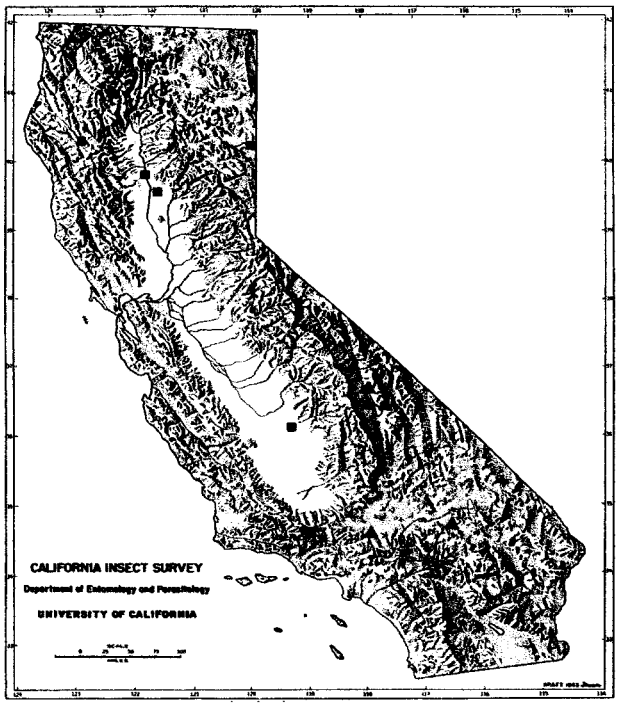
Trimerotropis munda (Scudder)
(Map 96)

Hadrotettix mundus Scudder, 1900, Psyche, 9:68. Type locality, Gazelle (?Siskiyou Co.); Tehama, Tulare, Calif.

The dark gray ground color of this form seems to be the only feature separating it from *T. pacifica*. The black bands of the tegmina are intense and sharply defined.

Geographic range.—California.

California records.—(Map 96) GLENN CO.: Chico, IX–24–62 (T. R. Haig, CDA). SISKIYOU CO.: Gazelle, IX–4, 5– (ex: Scudder). TEHAMA CO.: Tehama, VIII–28– (ex: Scudder); VIII–28–1897 (A. P. Morse, MCZ). TRINITY CO.: Trinity Center, VII–25–54 (J. A. Powell, CIS). Mad River, 6 mi. S. Ruth, VII–31–60 (H. B. Leech, CAS). TULARE CO.: Tulare, VIII–5–(ex: Scudder). VENTURA CO.: Cuddy Canyon, IX–4–22, 4472 ft. elevation (Rehn & Hebard, ANSP).



Map 96. California distribution of: ▲, *Trimerotropis latifasciata* Scudder; ■, *Trimerotropis munda* (Scudder).

Trimerotropis occidentalis (Bruner)

(Fig. 50, Map 97)

Oedipoda? occidentalis Bruner, 1890, Proc. U.S. Nat. Mus., 12:77. Lectotype, San Francisco, Calif., designated by Rehn & Hebard, 1912 (ANSP).

Circotettix occidentalis, Caudell, 1911, Ent. News, 22:163.

Trimerotropis occidentalis, Gurney & Strohecker, 1959, Bull. Brooklyn Ent. Soc., 54:80.

Dark gray or brown, tegmina dimly banded, wing greenish yellow to pale glaucous with black band barely indicated to almost complete. Lower sulcus of hind femur black with preapical pale band. Apparently this species has been confused at times with *T. thalassica*, but can be distinguished by the short thin antennae and very short posterior lobe of pronotal metazona.

Body 20–24; tegmen 19–24; hind femur 10.5–12.5.

Geographic range.—California to Idaho, Utah and Texas.

California records.—(Map 97) ALAMEDA CO.: Berkeley Hills, VIII–2–58 (J. R. Powers, CIS). AMADOR CO.: 5 mi. N. Ione, III–15–62 (J. T. Doyen, CIS). COLUSA CO.: Arbuckle, V–24–17 (T. G. Urbahns, ANSP). CONTRA COSTA CO.: Mt. Diablo, VII–21–35 (J. Beamer, ANSP). Russelmann Park, X–15–60 (D. C. Rentz, CAS). EL DORADO CO.: Chile Bar, VII–5–48 (S. A. Sher, CDA). Shingle Springs, VI–7–60 (D. C. Rentz, CAS). FRESNO CO.: Fresno, 1911 (R. S. Wagner, ANSP). Diablo Range, Los Gatos Canyon, VIII–8–07 (J. C. Bradley, ANSP). Kings River Canyon, VIII–4–40 E. R. Helwig, ANSP). Mercy Mines, VIII–19–58 (D. C. Rentz, CAS). HUMBOLDT CO.: Mouth of Redwood Creek, VII–11–37 (E. C. Van Dyke, CAS). KERN CO.: Oiler Canyon, IX–2–22 (Rehn & Hebard, ANSP). Summit of ridge S. of Walker Basin, IX–2–22, 4000 ft. elevation (Rehn & Hebard, ANSP). Tehachapi, IX–16–10, 4200 ft. elevation (ANSP). Marcel, Tehachapi Mts., IX–16–10, 3700 ft. elevation (ANSP). Tejon, IX–3–22, 3300 ft. elevation (Rehn & Hebard, ANSP). LAKE CO.: Upper Lake, VII–16–35 (R. H. Beamer, ANSP). LASSEN CO.: Devil's Corral, above Susanville, VIII–21–22, 4800 ft. elevation (Rehn & Hebard, ANSP). MADERA CO.: Coarsegold, VIII–5–40 (E. R. Helwig, ANSP). MARIN CO.: Lake Lagunitas, VI–24–58 (D. C. Rentz, CAS). VII–15–55 (C. A. Toschi, CIS). Corte Madera, VII–7–58 (D. C. Rentz, CAS). Bon Tempe, XI–8–59 (D. C. Rentz, CAS). Alpine Lake, VII–25–59 (C. D. MacNeill, CAS). Mt. Tamalpais, V–28–22 (C. L. Fox, CAS). Novato, VII–12–61, VII–1–62, X–29–62 (D. C. Rentz, CAS). Cypress Ridge, VI–15–60 (D. C. Rentz, CAS). Fairfax, VII–9–11 (E. C. Van Dyke, ANSP). MARIPOSA CO.: Feliciana Mt., VII–25–46, 4000 ft. elevation (H. P. Chandler, CIS). Yosemite Nat. Park, Sentinel, VIII–31–07, 4000 ft. elevation (ANSP). Yosemite Valley, VIII–5–40 (E. R. Helwig, ANSP). Mariposa, VIII–9–40 (E. R. Helwig, ANSP). MENDOCINO CO.: 10 mi. E. Calpella, IX–16–59 (T. R. Haig, CIS). Hopland Field Station, VIII–6–59, VIII–30–63 (W. W. Middlekauff, CIS). Squaw Rock, VI–5–59 (J. R. Helfer, CAS). Boonville, VI–10–59 (D. C. Rentz, CAS). Willets, VI–29–59 (J. R. Helfer, CAS). Ukiah, VI–29–59 (J. R. Helfer, CAS). Georgeville, VI–29–59 (J. R. Helfer, CAS). MODOC CO.: Lassen Creek, Goose Lake, VIII–24–22, 5000 ft. elevation. (Rehn & Hebard, ANSP). Alturas, VIII–23–22, 4500 ft. elevation, (Rehn & Hebard, ANSP). Adin Summit, VII–24–62, 5000 ft. elevation (D. C. Rentz & C. D. MacNeill, CAS). MONTEREY CO.: 15 mi. E.N.E. San Lucas, VI–28–60 (C. D. MacNeill, CAS.) 14 mi. W. Jolon, VI–28–60 (C. D. MacNeill, CAS). NAPA CO.: Pope Valley, IX–13–57 (W. Bauer, CAS). PLACER CO.: Donner Pass, VII–31–59 (J. R. Helfer, CAS). SAN BENITO CO.: Pinnacles Nat. Mon., VI–13–64 (D. C. & K. A. Rentz, CAS). Idria, VIII–26–62 (D. C. Rentz & E. W. Kirschbaum, CAS). SAN FRANCISCO CO.: San Francisco (ex: Bruner); XI–25–59 (CDA); XI–1887 (all paratype ♀♀). San Miguel Hills, IX–12–10, VIII–1–09, 820 ft. elevation (ANSP); V–1960 (D. C. Rentz, DCR). SAN LUIS OBISPO CO.: Paso Robles, VIII–21–09, 900 ft. elevation (ANSP). SAN MATEO CO.: Redwood City, VII–21–46 (E. S. Ross, CAS). SANTA CLARA CO.: Lick Hill, XI–4–41 (K. Frick, CIS). San Antonio Valley, IX–11–63 (R. L. Langston, CIS). 1 mi. W. Mt. Hamilton, VII–

8–61 (CIS). Almaden, VI–17–41 (K. Frick, CIS). Mt. Hamilton, VI–6–64 (D. C. & K. A. Rentz, CAS); X–20–56 (R. Wilson, CAS). Near Holy City, VIII–29–59 (D. C. Rentz, CAS). SANTA CRUZ Co.: Alma, VII–6, 21–46 (G. Pollard, CIS). Felton, VIII–13–59 (D. C. Rentz, CAS). SHASTA Co.: 5 mi. N. Cassel, VII–15–47. Cassel Distr., VIII–21–49 (H. H. Keifer, CDA). Near Plantina, VI–18–60 (D. C. Rentz, CAS). Shingletown, VI–23–59 (J. R. Helfer, CAS). 15 mi. N.E. Redding, VI–19–60 (D. C. Rentz, CAS). SISKIYOU Co.: Sisson (Mt. Shasta City), August (Dyar & Caudell, ANSP). Klamath River, IX–21–51 (R. W. Harper, CDA). Edgewood, IX–20–50 (R. W. Harper, CDA). Lava Beds Nat. Mon., VII–8–59 (J. R. Helfer, CAS). SONOMA Co.: Sobre Vista, XII–23–10 (J. A. Kusche, ANSP). Forestville, X–18–61 (R. M. Brown, CAS). Hacienda, VIII–9–62 (C. Slobodchikoff, CAS). Williams, VII–10–59 (J. R. Helfer, CAS). Cloverdale, V–15–59 (J. R. Helfer, CAS). 4 mi. W. Kenwood, VI–17–61 (D. C. Rentz, CAS). STANISLAUS Co.: Empire, VII–11–35 (J. Beamer, ANSP). Adobe Creek, X–2–47 (R. E. Beer, CIS). TEHAMA Co.: Red Bluff, VI–27–35 (J. Beamer, ANSP). 5 mi. N.W. Red Bluff, VI–18–60 (C. E. Wemmer, CAS). TULARE Co.: Sequoia Nat. Park, VIII–2–40 (E. R. Helwig, ANSP). Three Rivers, VIII–5–49 (E. E. Kenaga, ANSP); VII–28–07 (J. C. Bradley, ANSP). TUOLUMNE Co.: Hetch Hetchy, Yosemite Nat. Park, IX–20–51 (R. O. Schuster, UCD). Priest Grade, VIII–13–51 (M. J. D. White, ANSP). Groveland, VIII–8–54 (R. H. Goodwin, CIS). Ackerson Meadow, 3 mi. S. Matcher, VI–11–60 (D. C. Rentz, CAS). TRINITY Co.: Mad River, 6 mi. S. Ruth, VII–31–60 (H. B. Leech, CAS). Scott's Mt., Summit, VIII–24–36 (CAS).

Discussion—A common species. Found in all counties except those from Santa Barbara south, and those east of the Sierra Nevada from Alpine south.

Trimerotropis pacifica Bruner

(Fig. 45, Map 98)

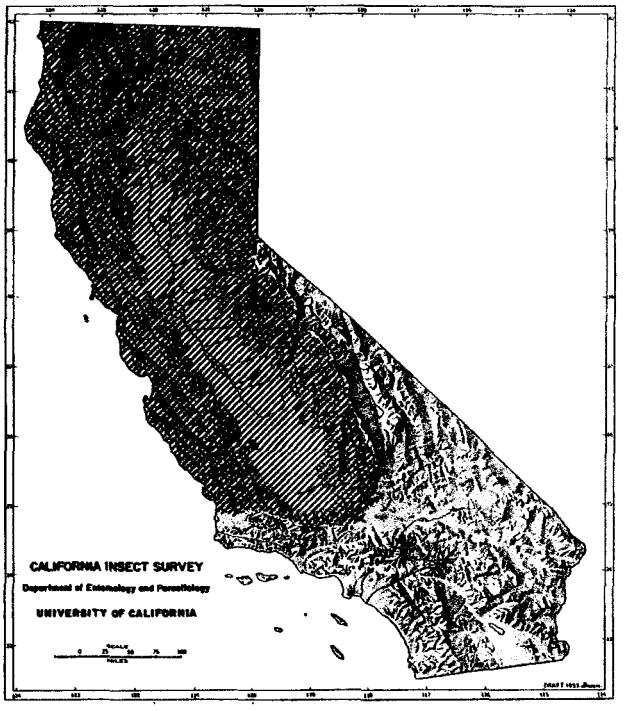
Trimerotropis pacifica Bruner, 1890, Proc. U.S. Nat. Mus., 12:73. Type ♂, Los Angeles, Calif.

The elongate, smooth pronotum with median carina low throughout and the acutely toothed lower margin of the lateral lobe, together with the yellow hind tibiae make this one of the most distinctive California *Trimerotropis*. Bruner commented on its resemblance to *Hadrotettix*, which, however, is superficial. Wing pale yellow with moderately broad black band. Lower sulcus of hind femur pale with preapical black bar.

Body 20–26; tegmen 20–27; hind femur 11–14.

Geographic range.—California.

California records.—(Map 98) FRESNO Co.: Friant, X–18–57 (D. W. Meldorff, DCR). Piedra, X–17–57 (C. W. McCance, DCR). Jacalitos Canyon, VII–25–56, in *Lepidospartum squamatum* (R. O. Schuster, UCD). Fresno, VIII–28–18 (C. M. Packard, CIS); IX–18–23 (C. D. Duncan, ANSP). Alcalde Canyon, Diablo Range, VIII–31–22, 950 ft. elevation (Rehn & Hebard, ANSP). Coalinga, VIII–30–22 (Rehn & Hebard, ANSP). KERN Co.: Bakersfield, Jewetta, IX–1–22, 450 ft. elevation (Rehn & Hebard, ANSP). Bena, IX–2–22, 875 ft. elevation (Rehn & Hebard, ANSP). TULARE Co.: Lemoncove, VII–26–29 (L. D. Anderson & P. W. Oman). Three Rivers, VIII–7–27, 800 ft. elevation (Rehn & Hebard, ANSP). SAN BENITO Co.: 24 mi. S.W. Idria, VIII–25–62 (D. C. Rentz & E. W. Kirschbaum, DCR).



Map 97. General distribution of *Trimerotropis occidentalis* Bruner in California.

Trimerotropis pallidipennis pallidipennis (Burmeister)

(Fig. 54)

Oedipoda pallidipennis Burmeister, 1838, Handb. Ent., 2:641. Type locality, Zimapan, Mexico.

Trimerotropis vinculata Scudder, 1876, Proc. Boston Soc. Nat. Hist., 18:270.

Trimerotropis similis Scudder, 1880, Sec. Rep. U.S. Ent. Comm. App., 2:27.

Trimerotropis pallidipennis, Saussure, 1884, Prodrome Oedip., p. 168.

?*Trimerotropis pilosa* McNeill, 1900, Psyche, 9:34.

Trimerotropis pallidipennis, Rehn, 1939, Trans. Amer. Ent. Soc., 65:399.

Gray or brown, tegmina with conspicuous black cross-bands. Hind femur with one or two dark bars on outer face, lower sulcus black with preapical pale bar. Hind tibia yellow or yellow-brown. Pronotum with median carina tumidly elevated on prozona, low on metazona, which is twice or more as long as prozona, hind margin rectangulate to obtuse. The tegmina of this species are notably elongate but speci-

mens with tegmina but little surpassing the tips of the hind femora have been seen.

Body 23–28; tegmen 26–32; hind femur 12–14.

Geographic range.—The species has an enormous range from southern Canada over all the United States west of the 100th meridian, and southward through Mexico to Bolivia and Argentina. There are two racial components, of which the nominate form occurs in California, probably throughout the state. This ubiquitous grasshopper is abundantly represented in Survey collections.

California records.—Specimens have been seen from the following counties:

ALAMEDA	MENDOCINO	SANTA CRUZ
ALPINE	MERCED	SHASTA
CONTRA COSTA	MODOC	SISKIYOU
COLUSA	MONO	SOLANO
FRESNO	NAPA	SONOMA
GLENN	NEVADA	STANISLAUS
INYO	PLACER	SUTTER
KERN	RIVERSIDE	TEHAMA
LASSEN	SACRAMENTO	TULARE
LOS ANGELES	SAN BENITO	TUOLUMNE
MADERA	SAN BERNARDINO	VENTURA
MARIN	SAN JOAQUIN	YOLO
MARIPOSA	SANTA BARBARA	YUBA

Discussion—This large, flashy, yellow-winged species is found in many habitats throughout California where the soil is thin and vegetation sparse. It crackles loudly in flight and usually flies high and far when pursued. It frequently comes to lights at night. In southern California and Arizona it may have two to three generations per year, and lacks an obligatory diapause in the egg stage. It may cause economic damage in agricultural areas adjacent to range lands.

Trimerotropis pogonata Strohecker

(Fig. 52, Map 98)

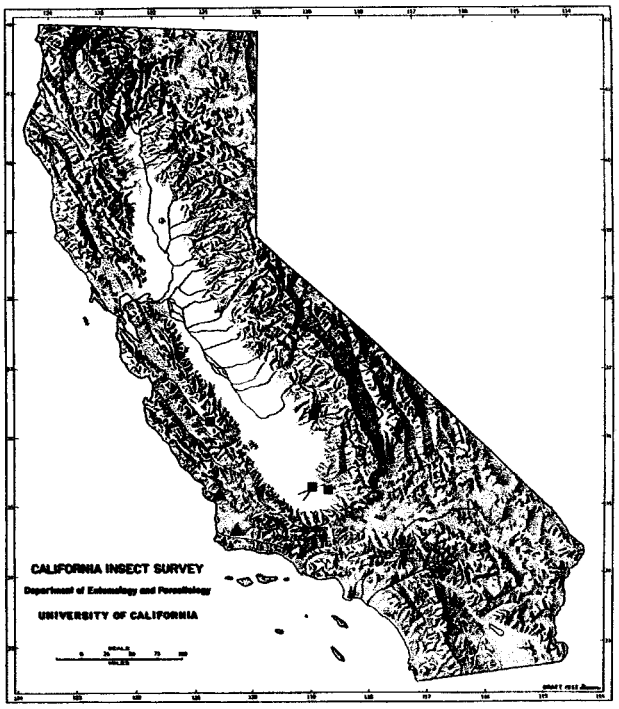
Trimerotropis pogonata Strohecker, 1963, Pan-Pac. Ent., 39: 157. Holotype ♂, Grover City, San Luis Obispo Co., Calif. (CAS).

Short and stout, in appearance much like *Microtes* and probably more related to that genus than to *Trimerotropis* species, but with median carina of pronotum twice intersected. Gray, mottled with black, tegmina with two or more or less distinct black bands. Lower sulcus of hind femur dark with two pale bands. Hind tibia pale yellow, internal calcars as long as metatarsus.

Body 14–17; tegmen 13–16; hind femur 9.5–12.

Geographic range.—Coastal California.

California records.—(Map 98) SAN LUIS OBISPO CO.: Grover City, VII–4–56 (E. G. Linsley, CIS). Oso Flaco Lake, VII–13–59 (A. E. Menke, R. M. Bohart, W. A. Steffan, R. W. Spore, F. D. Parker & P. M. Marsh, CIS, UCD). SANTA BARBARA CO.: San Marcos Ranch, Santa Ynez Mts., VII–5–56 (P. D. Hurd, CIS).



Map 98. California distribution of: ■, *Trimerotropis pacifica* Bruner; ▲, *Trimerotropis pogonata* Strohecker.

Trimerotropis porrecta McNeill

Trimerotropis porrecta McNeill, 1900, Psyche, 9:28. Type ♂, Calif.

This form has not again been recognized since its description. The "hardly perceptibly intersected" median carina of the pronotal prozona and "entirely obsolete" lateral carinae of the pronotum do not suggest the genus *Trimerotropis*. California, Koebele, one male (McNeill).

Geographic range.—California.

Trimerotropis pseudofasciata Scudder

(Fig. 58, Map 99)

Trimerotropis pseudofasciata Scudder, 1876, Ann. Rep. Chief Eng., App. JJ, p. 514.

Trimerotropis caeruleipennis Bruner, 1885, Can. Ent., 17:10.

Trimerotropis pseudofasciata, White, 1951, Genetics, 36:32.

Light brown or pale to dark gray, tegminal bands strongly marked to faint but discernible. Wing almost colorless or pale blue, the black band, when present, narrow and interrupted, often absent. Lower sulcus of hind femur black with preapical pale bar. Hind tibia pale to dark blue. Pronotum with median carina

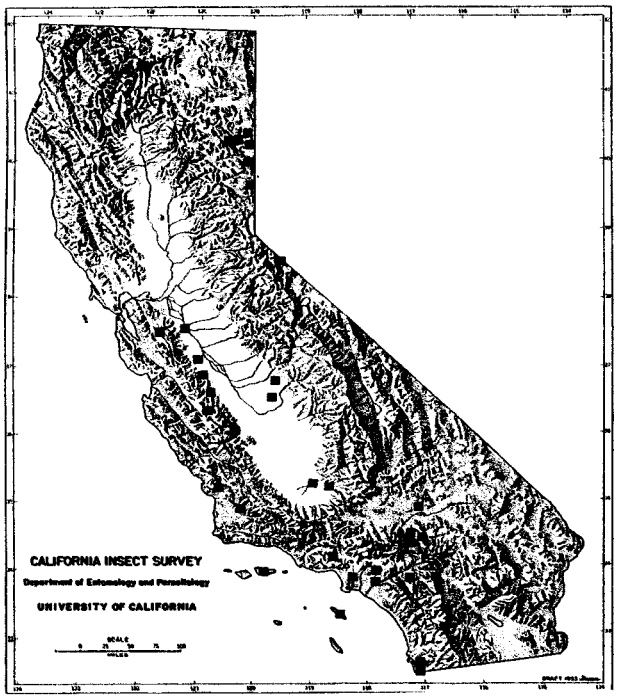
tumidly elevated except in the deep depression of the principal sulcus, hind margin slightly acute to slightly obtuse.

Body 23–30; tegmen 24–32; hind femur 12–16.

Geographic range.—Washington to Montana and Wyoming, south to southern California and Arizona.

California records.—(Map 99) ALAMEDA Co.: Midway Rd., VIII–16–57 (W. W. Middlekauff, CIS). FRESNO Co.: Coalinga, VIII–30–22 (Rehn & Hebard, ANSP); VIII–30–22, 750 ft. elevation; VI–5–32. Coalinga, Jacalitos Canoyn, VII–31–56 (R. O. Schuster, UCD). Del Rey, VIII–31–58 (R. P. Allen, CIS). Mercy Hot Springs, VIII–16–58 (D. C. Rentz, DCR). Friant, VIII–1–40 (E. R. Helwig, ANSP). KERN Co.: Bena, IX–2–22 (Rehn & Hebard, ANSP). Mojave, IX–15–10, 2750 ft. elevation. Bakersfield, VI–12–21 (C. D. Duncan, ANSP); IX–14–10, III–20–09. Jewetta, 450 ft. elevation, IX–1–22 (Rehn & Hebard, ANSP). Arvin, VIII–1–50 (R. W. Harper, CDA). LASSEN Co.: Susanville, VIII–21–22, 4190 ft. elevation (ANSP). Litchfield, VIII–21–22, 4200 ft. elevation (Rehn & Hebard, ANSP). Amedee, VIII–22–22 (Rehn & Hebard, ANSP). Hot Springs Mt., VIII–13–54 (J. A. Powell, CIS). Doyle, VII–16–52, range (R. W. Harper, CDA). Reno Jct., VIII–17–48 (H. H. Keifer, CDA). Hospital Canyon, IX–7–31 (ANSP). LOS ANGELES Co.: Los Angeles (ex: Bruner). Claremont, VII–15–15 (J. W. Rich, ANSP). Santa Catalina Island, VIII–7–07 (Rehn & Hebard, ANSP). Parker Mt., S.E. end Ventura Mts., IX–27–10, 2800 ft. elevation (ANSP). MERCED Co.: Los Banos, IX–21–41 (K. Frick, CIS); VIII–9–40 (E. R. Helwig, ANSP). Gustine, VII–2–56 (C. G. Moore, CIS). MONO Co.: Topaz Lake, VI–26–57 (J. W. MacSwain, CIS). ORANGE Co.: Anaheim (D. W. Coquillett, ANSP). RIVERSIDE Co.: Banning, VII–9–50 (J. D. Paschke, CIS); VII–16–50 (J. W. MacSwain, CIS). Univ. of Calif. Campus, VII–4–58 (D. M. Newell, CIS). Riverside III–8–33 (Timberlake, ANSP). SAN BERNARDINO Co.: Deadman Point, Mojave Desert, VIII–31–19 (ANSP). Victorville, IX–1–19 (J. Rehn, ANSP). Hesperia, VII–28–40 (E. R. Helwig, ANSP); IX–2–19 (Rehn & Hebard, ANSP); X–25–41 (G. P. Mackenzie, UCD). Barstow, VIII–7–19 (Rehn & Hebard, ANSP). Cottonwood Station, Mojave Desert, IX–9–07, 2274 ft. elevation (ANSP). San Bernardino, VI–26–37 (A. T. McClay, UCD). Verdemont, IX–2–19 (Rehn & Hebard, ANSP). San Bernardino Mts., VIII–3–30 (E. R. Tinkham, ANSP). SAN BENITO Co.: Idria, VIII–26–62 (D. C. Rentz & E. W. Kirschbaum, DCR). SAN DIEGO Co.: San Diego, collected by Palmer, paratypes (ANSP). Coronado Beach (Rehn Hebard, ANSP). 2 mi. N. Warner Springs, VII–4–56 (H. R. Moffett). Tiajuana, IX–11–22 (Rehn & Hebard, ANSP). SAN JOAQUIN Co.: Vernalis, VII–24–51, range grasses (R. W. Harper, CDA). SAN LUIS OBISPO Co.: San Luis Obispo, VII–26– (G. H. Vansell). SANTA BARBARA Co.: Cuyama Valley, VII–10–50, range (R. W. Harper, CDA). Santa Cruz Island, VII–1901 (R. E. Snodgrass, ANSP). SISKIYOU Co.: Mt. Shasta (Caudell).

Discussion—A widespread, wary, and often noisy species in flight.



Map 99. California distribution of *Trimerotropis pseudofasciata* Scudder.

Trimerotropis rebellis (Saussure)

(Fig. 41, Map 100)

Conozoa rebellis Saussure, 1888, Add. Prodrome Oedip., p. 61. Type locality, Calif. (Vienna?)

Conozoa albolineata Bruner, 1890, Proc. U.S. Nat. Mus., 23:66.
Trimerotropis rebellis, McNeill, 1900, Psyche, 9:28.

Slender. Grayish, tegmina with longitudinal fuscous streaks. Occiput and lateral carinae of pronotum marked with a pair of dark lines, cheeks and lateral lobes of pronotum marked with white. In some specimens the pronotum has a dark median streak separated from the dark lateral carinae by a pair of white lines. Hind femur strikingly marked with two or three oblique dark bands. Hind tibia yellow or faintly greenish.

Body 20–29; tegmen 22–36; hind femur 12–16.

Reported by Bruner, McNeill, Rehn and Hebard, and Caudell from localities in Los Angeles, Riverside, San Bernardino and San Diego Counties.

Geographic range.—California.

California records.—(Map 100) FRESNO Co.: Jacalitos Canyon in *Lepidospartum squamatum*, VII–25–56 (R. O. Schuster, UCD). Alcalde Canyon, Diablo Range, VIII–31–22, 950 ft. elevation (Rehn & Hebard, ANSP). Tranquillity, VII–14–60 (R. R. Snelling, CAS). INYO Co.: Olancha (L. W. Isaak, CIS). KERN Co.: Shafter (T. R. Haig, CIS). 10 mi. E. McKittrick, VI–16–57 (DCR). LOS ANGELES Co.: Tanbark Flat, VI–18 to VII–1 (CIS). Vincent, VII–12 to 24– (G. P. Mackenzie, UCD). Azusa, VII–22–02 (CIS). Roscoe, Tujunga Wash, VIII–26–09, 825 ft. elevation. Claremont, VI–14–15 (J. W. Rich, ANSP). Eocoima Wash, VI–23–13 (ANSP). Pasadena, VI–15–07 (J. Grinnell, ANSP). Verde-

mont, Cajon Wash, X–2–19, 1700 ft. elevation (Rehn & Hebard, ANSP). Saugus, VIII–23–09 (ANSP). MARIPOSA Co.: 6 mi. E. Mormon Bar, VII–4–60 (DCR). MONTEREY Co.: Del Monte, IX–10–10 (ANSP). RIVERSIDE Co.: Banning, VI–21, VII–9. Pinon Flat, San Jacinto Mts., VI–27–52 (J. K. Hester, CIS). 8 mi. W. Keen Camp, VI–19–39 (E. S. Ross, CIS). Beaumont, VII–3–57 (J. E. Gillaspy, CIS). 2 mi. N. Whitewater Jct., VI–15–58 (D. M. Newell, CIS). Anza (R. M. Bohart & R. W. Bushing, UCD); VII–5–56 (R. W. Michalk, CIS); VII–3–56 (C. L. Wiley, CIS). Hopkins Well, X–11–58 (R. W. Thorp). Palm Springs (D. L. Dahlsten, CIS). The Gavilan (R. C. Bechtel, CIS). Santa Rosa Mts., VI–1–58 (C. Cushner, DCR). Palm Springs, V–21–17 (E. P. Van Duzee, CAS). Cabazon, VI–1–41 (E. C. Van Dyke, CAS). Whitewater, VI–21–39 (R. P. Allen, CAS). SAN BENITO Co.: 4 mi. E. Pinnacles Nat. Mon., VI–10–63 (H. L. Griffin, CIS). Vicinity Pinnacles Nat. Mon., V–30–60 (D. C. Rentz, DCR). Chalone Camp, VIII–24–62 (D. C. Rentz & E. W. Kirschbaum, CAS). SAN BERNARDINO Co.: San Bernardino Mts., VIII–8–30, 3800 ft. elevation (E. R. Tinkham, ANSP). Hesperia, VIII–3–48 (G. P. Mackenzie, CIS). Cajon, VI–24–49 (H. E. Cott, CIS). Victorville, VI–24–49 (H. E. Cott, CIS). 7 mi. W. Kramer Jct., 2830 ft. elevation (ANSP). SAN DIEGO Co.: San Diego, V–18–01 (J. Rehn, ANSP); V–3–1899 (J. W. Dunn, ANSP). SANTA CRUZ Co.: Felton, VIII–30–59, on dunes (D. C. Rentz, DCR). Ben Lomond, V–30–43 (P. H. Arnaud, DCR).

Discussion—A widespread species in desert waste areas.

Trimerotropis sparsa (Thomas)

(Fig. 60, Map 100)

Oedipoda sparsa Thomas, 1875, Wheeler's Rep. Expl. west 100th Merid., 5:883, Pl. 45, Fig. 6. Lectotype ♂, New Mexico, designated by Hebard, 1927 (USNM).

Circotettix sparsus, Scudder, 1876, Bull. U.S. Geol. Surv. Terr., 2:265.

Trimerotropis sparsa, Hebard, 1928, Proc. Acad. Nat. Sci., Phila., 80:252.

Very similar in appearance to *T. cyaneipennis* but with metazona of pronotum longer, tegminal bands absent or very faintly indicated. Hind tibiae yellow. Wing pale blue without black band.

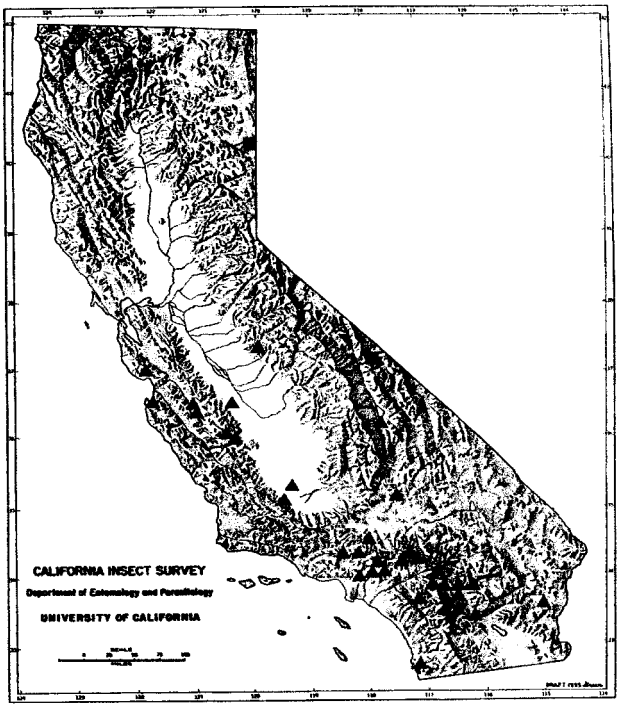
White (1951) has given an account of the variable chromosomal pattern of this species. "*T. sparsa* appears to be a complex species in which much local differentiation has taken place."

Body 19–27; tegmen 21–28; hind femur 10–13.

Geographic range.—Widely distributed in all the western states from Washington, Alberta and North Dakota, south to west Texas, and west to California. Predominantly Great Basin.

California records.—(Map 100) INYO Co.: Westgard Pass, VII–26–62, 7200 ft. elevation (D. C. Rentz & C. D. MacNeill, CAS). LASSEN Co.: Amedee, VIII–22–22, 3960 ft. elevation (Rehn & Hebard, ANSP).

Discussion—On bare, eroded desert areas and alkali flats. A wary species which whirrs or crackles in flight sometimes just before landing. The principal food plants appear to be *Astragalus* spp., and *Agropyron* spp. Hewitt and Barr (1967).



Map 100. California distribution of: ▲, *Trimerotropis rebellis* (Saussure); ■, *Trimerotropis sparsa* (Thomas).

Trimerotropis strenua McNeill

(Map 101)

Trimerotropis strenua McNeill, 1900, Psyche, 9:32. Type locality, Salt Lake Valley, Utah.

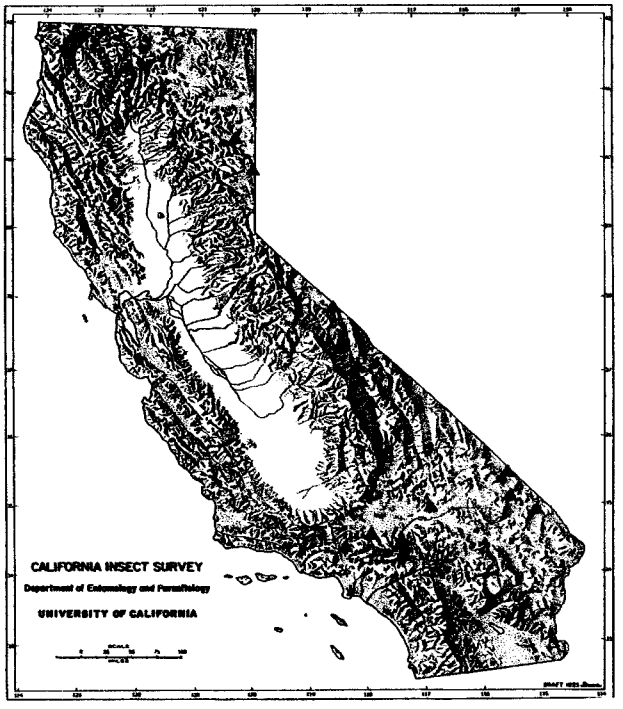
Larger than *T. californica* and with broader band.

Body 23–33; tegmen 26–32; hind femur 11.5–16.

Geographic range.—From Oregon and Idaho south and east to western Colorado, New Mexico and western Texas, and into northern Chihuahua, Mexico.

California records.—(Map 101) INYO Co.: (May be *T. californica.*) Near Owen's Lake, VII–1912 (ANSP). Bishop, IX–9–19 (Rehn & Hebard, ANSP). 7 mi. S. Big Pine, VIII–15–51, 4000 ft. elevation (J. Rehn, ANSP). KERN Co.: Mojave (ANSP). LASSEN Co.: 10 mi. N. Hallelujah Jct., IX–6–57 (E. G. Linsley, CIS). Litchfield, VIII–21–22 (Rehn & Hebard, ANSP). LOS ANGELES Co.: Between Lancaster and Palmdale, VIII–21–51, 2600 ft. elevation (J. Rehn, ANSP). Near Honby, Soledad Canyon, 1500 ft. elevation (J. Rehn, ANSP). MONO Co.: Sherwin Hill, 5 mi. N. Round Valley, VIII–8–37, 5500 ft. elevation (Rehn, Pate & Rehn, ANSP). California-Nevada state line, 7 mi. N.E. Benton Station, VIII–14–51, 6000 ft. elevation (J. Rehn, ANSP). SAN BERNARDINO Co.: Lyons, IX–1–09, 3000 ft. elevation (ANSP). Cima, IX–1–09. Barstow, VIII–7–19 (Rehn & Hebard, ANSP). Hesperia, IX–2–19 (Rehn & Hebard,

ANSP). Victorville, IX–1–19 (Rehn & Hebard, ANSP). Goffs, VIII–5–19 (Rehn & Hebard, ANSP). Ivanpah Mt., Lakeview, VIII–1–37, 3500 ft. elevation (Rehn, Pate & Rehn, ANSP).



Map 101. California distribution of *Trimerotropis strenua* McNeil.

Discussion—Barnum (1964) reports it from sandy areas. A mixed feeder preferring sandy or gravelly soils where bunch grasses and *Chrysothamnus* prevail.

Trimerotropis suffusa Scudder

(Fig. 57, Map 102)

Trimerotropis suffusa Scudder, 1876, Bull. U.S. Geol. Surv. Terr., 2:265. Type locality, Vancouver Island, British Columbia. Selected by Hebard (1928).
Trimerotropis fallax Saussure, 1884, Prodrome Oedip., p. 170.
Trimerotropis obscura Scudder, 1876, Ann. Rep. Surv. W. 100th meridian, App. JJ, p. 294.
Circotettix suffusus, Scudder, 1900, Psyche, 9:140.
Trimerotropis conspersa McNeill, 1900, Psyche, 9:34.
Trimerotropis variegata McNeill, 1900, Psyche, 9:34.

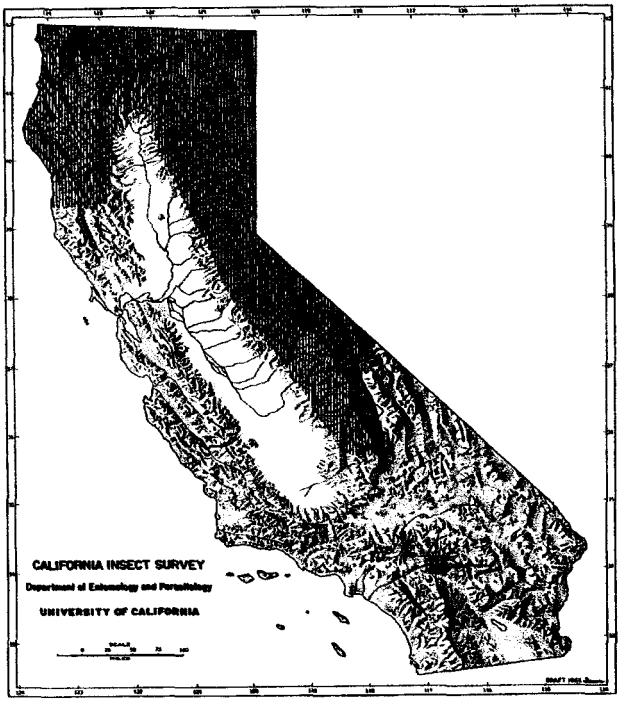
Dark brown, pronotum often in part reddish, tegmina with many small fuscous spots, unbanded. Wing rather deep yellow with broad black band, apex infuscate especially in male. Lower sulcus of hind femur black with preapical pale band. Hind tibia rich blue. Pronotum somewhat elongate, hind margin rectangulate, median carina low on metazona, moderately elevated on prozona.

Body 22–30; tegmen 25–30; hind femur 13–14.

Geographic range.—British Columbia and Alberta to New Mexico, Arizona, and California.

California records.—(Map 102) ALPINE CO.: Winnemucca Lake, VII–30–59 (P. M. Marsh, UCD). Ebbett's Pass, VIII–23–59 (E. Mezger, UCD). Forestdale Meadow, VII–17–60 (C. G. Moore, CIS). Pacific Valley, VIII–29–57 (E. Metzger, UCD). CALAVERAS CO.: Camp Wolfboro, VII–20–37 (G. Spurlock, UCD). EL DORADO CO.: 3 mi. N. Fallen Leaf Lake, VII–27–62. Echo Lake, VII–1–62, 7400 ft. elevation; VII–21–55 (W. W. Middlekauff, CIS). Echo Lake (F. H. Wymore); VII–13–60 (W. W. Middlekauff, CIS). Echo Summit, VIII–4–57 (T. R. Haig). Fallen Leaf Lake, IX–1–50 (H. H. Keifer, CDA). 1.5 mi. E. Camp Richardson (E. I. Schlinger, CIS). Strawberry Valley, VIII–9–12 (E. C. Van Dyke, ANSP). Pyramid Ranger Station, VIII–1–49 (J. W. MacSwain, CIS). FRESNO CO.: Leconte Canyon, VIII–17–46 (G. Pollard, CIS). Kaiser Pass, VII–20–36 (A. T. McClay, CIS). HUMBOLDT CO.: Scotia, VII–15–35 (J. Beamer, ANSP). INYO CO.: Near Mono Pass, VIII–4–59, 12,000 ft. elevation (D.C. Rentz, DCR). Upper Meadows, Whitney Pass, IX–6–19 (Rehn & Hebard, ANSP). Glass Creek, IX–10–21, 10,000 ft. elevation (O. C. Poling, ANSP). Pine Creek Canyon, X–17–22 (ANSP). Lone Pine Canyon, IX–5–19, 8000 ft. elevation (Rehn & Hebard, ANSP). LASSEN CO.: Silver Lake, VII–13–41 (I. LaRivers, CIS). McCoy Flat Res., VII–24–54 (J. A. Powell, CIS). Westwood, VIII–21–22 (ANSP). Juniper Lake, VIII–20–22, 7600 ft. elevation (Rehn & Hebard, ANSP). MADERA CO.: Ahwahnee, X–3– (Rehn & Hebard, CIS). Minaret Falls, VIII–20–59 (M. E. Irwin, UCD). MARIPOSA CO.: Miami, IX–3– (Rehn & Hebard, ANSP). 6 mi. N. Fish Camp, VII–2–62 (J. F. Lawrence, CIS). Yosemite Nat. Park, VIII–12–16 (G. P. Engelhardt, ANSP); Sentinel, IX–1–07, 4000 ft. elevation (ANSP); Grouse Creek, IX–1–07, 6000 ft. elevation (ANSP); Eight-Mile Canyon, IX–1–07 (ANSP); Sentinel Dome, VIII–8–40 (E. R. Helwig, ANSP). MENDOCINO CO.: Castle Peak, IX–6–58 (S. M. Fidel, CIS). Mendocino, VIII–5–58 (J. R. Helfer, CIS); VII–16–59 (D. C. Rentz, DCR); VI–29–55. MODOC CO.: Sugar Hill, Goose Lake, VIII–24–22 (Rehn & Hebard, ANSP). Warner Mts., Cedar Peak, VIII–25–22, 8300 ft. elevation (Rehn & Hebard, ANSP). Warner Mts., near Davis Creek, VIII–18–22 (Rehn & Hebard, ANSP). Warner Mts., VII–19–22 (O. C. Poling & A. W. Lindsey, ANSP). MONO CO.: White Mts., VIII–25–60 (M. E. Irwin, CIS). Crooked Creek, White Mts., VII–5–61, 9500 ft. elevation (W. A. Foster, CIS); VII–16–61, 10,150 ft. elevation (W. A. Foster, CIS). Tioga Pass, IX–12–62 (J. T. Doyen, CIS). Convict Lake, VIII–9–46 (G. Pollard, CIS). Sardine Creek, VI–27–57 (W. T. Crites, CIS). Mammoth Lake, VIII–13–21 (O. C. Poling, ANSP). 2 mi. E. Convict Lake, VII–23–64 (D. C. & K. A. Rentz, DCR). Rock Creek Canyon, IX–11–19, 7280 ft. elevation (Rehn & Hebard, ANSP). NEVADA CO.: Boca, VIII–1–59 (F. D. Parker, UCD); VII–3–54 (J. A. Powell, CIS). Sagehen Creek, VII–2 to 21–54 (G. A. Schaefers & J. A. Powell, CIS); IX–5–57 (E. G. Linsley, CIS). PLACER CO.: Blue Canyon, VIII–29–10, 5000 ft. elevation (ANSP). Lake Tahoe, VIII–30–10, 7000 ft. elevation (ANSP). Squaw Peak, VIII–31–10, 8950 ft. elevation (ANSP). Foot of Squaw Peak (ANSP). Colfax, VIII–27–10, 2800 ft. elevation (ANSP). PLUMAS CO.: Blairsden, VII–2–60 (J. S. Buckett, UCD). Johnsville, VII–8–54 (J. A. Powell, CIS); 8 mi. S.W., VIII–10–61 (J. S. Buckett, UCD). 8 mi. N.W. Chester, VIII–18–58 (J. A. Powell, CIS). Graeagle

VII–20–49 (H. H. Keifer, CDA). Chester, VIII–20–22, 4300 ft. elevation (Rehn & Hebard, ANSP). Harkness Peak, VIII–20–22, 9200 ft. elevation (Rehn & Hebard, ANSP). SAN BERNARDINO CO.: Santa Ana River, San Bernardino Mts., VI–28 to VII–4– , 6200–6700 ft. elevation (Rehn & Hebard, ANSP). Mt. San Gorgonio, IX–14–58 (D. M. Newell, CIS). SHASTA CO.: Hat Creek P.O., VII–10–55 (J. C. Wells, CIS). Lassen Nat. Park, VII–18–42 (J. W. MacSwain, CIS). Hat Creek, VI–20–52 (G. Pronin, DCR). SIERRA CO.: Sierraville, VII–9–54 (J. A. Powell & G. A. Schaefers, CIS). Independence Lake, VII–26–59 (A. E. Menke, CIS). Yuba Pass, VII–9–54, 6700 ft. elevation. SISKIYOU CO.: Mt. Shasta, VII–7–57, 8000 ft. elevation (J. A. Powell, CIS); IX–1885 (J. Behrens, ANSP); VII–14–09, timberline, 8000 ft. elevation (ANSP). TEHAMA CO.: Post Pile Camp, VIII–30–60 (R. O. Schuster, CIS). TRINITY CO.: Coffee Creek Ranger Station, VII–14–55 (A. O. Novoa, UCD). TULARE CO.: Mineralking, VIII–13–56 (W. Simonds, CDA). TUOLUMNE CO.: Tuolumne Meadows, VIII–19–51 (J. W. MacSwain, CIS). Groveland, VIII–8 to 18–54 (R. H. Goodwin, CIS). Mather, VIII–7–48 (H. H. Keifer, CDA). Chipmunk Flat, VIII–9–60 (G. W. Colliver, CIS); VIII–9–60 (T. Gantenbein, UCD). Sonora Pass, VIII–21–59 (D. D. Linsdale, CIS); IX–1–55 (W. Simonds, CDA); VIII–30–60 (M. E. Irwin, UCD). Strawberry, VIII–27–60 (M. E. Irwin, UCD); VIII–1–60 (R. R. Montanucci, CIS). Pinecrest, VII–2–51 (R. L. Usinger, CIS). YUBA CO.: Church Meadow, VII–20–49 (H. H. Keifer, CDA).



Map 102. California distribution of *Trimerotropis suffusa* Scudder.

Discussion—A common mountain species which inhabits open rocky areas, and dry slopes. Especially common in the high Sierra. Often found on floor of coniferous forests.

Trimerotropis thalassica Bruner

(Fig. 49, Map 103)

Trimerotropis thalassica Bruner, 1890, Proc. U. S. Nat. Mus., 12:72. Lectotype ♂, Los Angeles, Calif., designated by Rehn & Hebard, 1912 (USNM, missing).

Trimerotropis thalassica, Rehn & Hebard, 1909, Proc. Acad. Nat. Sci. Phila., 61:449.

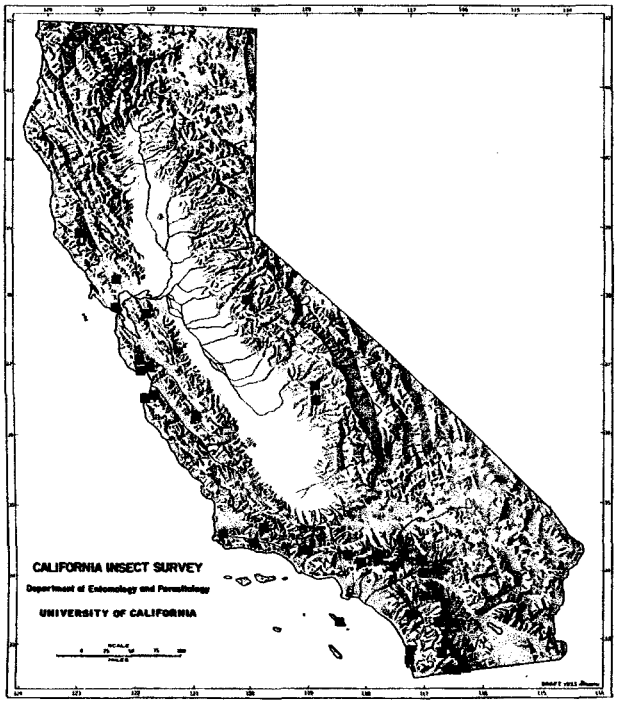
Slender and compressed, especially in males. Tegmina in repose showing a sharp angle between the anal (dorsal) and median (lateral) fields. Pronotum long and smooth, median carina low throughout, posterior margin acute to rectangulate, tooth at lower hind angle of lateral lobe variable, usually distinct. Pale gray or brown, tegmina with two or three narrow cross-bars, these sometimes obsolete. Face and thoracic pleura with many small round dark spots or pits. Wing pale blue to blue-green, black band well developed to obsolete.

Body 19–25; tegmen 21–27; hind femur 11–13.

Geographic range.—California.

California records.—(Map 103) CONTRA COSTA CO.: Orinda, V–3–53 (R. H. Goodwin, UCD). FRESNO CO.: King's River Canyon, VIII–4–40 (E. R. Helwig, ANSP). LOS ANGELES CO.: Mt. Lowe, VIII–8–24, 4300–5600 ft. elevation (Rehn & Hebard, ANSP); IX–1–07, 6000 ft. elevation (O. Poling, ANSP). Mt. Wilson, IX–15– , 5000 ft. elevation (Rehn & Hebard, ANSP); VII–31–49 (E. R. Helwig, ANSP). San Gabriel Mts., VII–3–14 (F. Grinnell, ANSP). Arroyo Seco, San Gabriel Range, X–8– , 3000 ft. elevation (Rehn & Hebard, ANSP). Santa Catalina Island, VIII–3– (Rehn & Hebard, ANSP). Tanbark Flat, VI–21–56 (R. M. Bohart, UCD). Verdugo Valley Hills, VIII–23–09 (ANSP). MARIN CO.: Mt. Tamalpais, VIII–17–09, 2500 ft. elevation (ANSP); IX–19–09 (E. C. Van Dyke, CAS). MENDOCINO CO.: Hopland Field Station, VIII–6–59 (W. W. Middlekauff, CIS). MONTEREY CO.: Monterey, VII–22–35 (E. I. Beamer, ANSP); VIII–10–38 (J. Russell, ANSP). Del Monte, VIII–20–09, IX–9–10 (ANSP). RIVERSIDE CO.: Herkey Creek, San Jacinto Mts., VI–14–40 (CIS). 11 mi. S. Hemet, VIII–31–58 (D. M. Newell, CIS). Temecula, VII–2–63 (H. L. Griffin, CIS). Strawberry Valley, San Jacinto Mts., VIII–28–09 (ANSP). Idyllwild, VIII–2–35 (E. I. Beamer, ANSP); IX–29–38 (J. Russell, ANSP). Beaumont, IX–28–10, 2700 ft. elevation (ANSP). SAN BENITO CO.: Pinnacles Nat. Mon., VIII–18–58 (D. C. Rentz, DCR). SAN BERNARDINO CO.: Barton Flats, San Bernardino Mts., VII–11–56 (H. W. Michalk, CIS). San Bernardino Mts., Santa Ana River, Bear Lake Road, VIII–30–19, 4300 ft. elevation (ANSP). San Bernardino Mts., Mill Creek, VIII–30–19, 4200 ft. elevation (Rehn & Hebard, ANSP). Harvey's Mill Creek, San Bernardino Mts., VIII–30–19 (ANSP). Cajon Pass, hills on desert side, IX–1–19, 4000 ft. elevation (Rehn & Hebard, ANSP); VII–28–40 (E. R. Helwig, ANSP). SAN DIEGO CO.: Newton, VII–14–49 (D. J. & J. N. Knull, CIS). Cuyamaca Peak, IX–14–22, 5500 ft. elevation (ANSP). Descanso, IX–13–22 (Rehn & Hebard, ANSP). Campo, VIII–10–35 (J. Russell, ANSP); IX–13–22, 2400 ft. elevation (Rehn & Hebard, ANSP). Resort P.O., Laguna Mts., IX–14–22, 6100 ft. elevation (Rehn & Hebard, ANSP). 8 mi. E. Jacumba, Wagon Pass, IX–15–22 (Rehn

& Hebard, ANSP). 10 mi. N.W. Jacumba, IX–15–22 (Rehn & Hebard, ANSP). Anza, VII–29–38 (L. W. Hepner, ANSP). Coahuila, VIII–18–14 (J. C. Bradley, ANSP); IX–12–22, 2323 ft. elevation (Rehn & Hebard, ANSP). La Jolla, VI–18–16 (G. P. Engelhardt, ANSP). Torrey Pines, VII–23–16 (G. P. Engelhardt, ANSP). SANTA BARBARA CO.: Bluff Camp, San Rafael Mts., VI–29–59 (F. D. Parker, UCD). Lompoc, VIII–6–38 (L. W. Hepner, ANSP). San Marcos Pass, VIII–15–40 (E. R. Helwig, ANSP). SANTA CRUZ CO.: Santa Cruz, IX–28–41 (K. Frick, CIS). Alma, VIII–31–46 (G. Pollard, CIS). Santa Cruz Mts., VIII–13–38 (J. Russell, ANSP). Empire Grade, VIII–30–59 (D. C. Rentz, DCR). SONOMA CO.: Sobre Vista, IX–23–60 (J. A. Kusche, CAS). TULARE CO.: Sequoia Nat. Park, VIII–2–40 (E. R. Helwig, ANSP). TUOLUMNE CO.: Groveland, VIII–8–54 (R. H. Goodwin, ANSP). VENTURA CO.: Downer Ranch, Mt. Pinos, IX–3–22, 5300 ft. elevation (Rehn & Hebard, ANSP).



Map 103. California distribution of *Trimerotropis thalassica* Bruner.

Discussion—Common in the coastal mountains, often with manzanita. Rather tame, flying only a short distance when disturbed.

Trimerotropis titusi Caudell
(Map 104)

Trimerotropis titusi Caudell, 1906, Proc. Ent. Soc. Wash., 7:125. Type ♂, Spreckles, Monterey Co., Calif., designated by Caudell & Hebard, 1912 (USNM).

Differs from *T. pacifica* only in lesser development of the black wing band.

Body 17-; tegmen 21-; hind femur 11-. (No females measured.)

Geographic range.—California.

California records.—(Map 104) MONTEREY CO.: Spreckles, IX–20– , in sugar beets (E. S. G. Titus, ex: Caudell). Hastings Nat. Hist. Res., IX–6–41 (J. M. Linsdale, CIS). Jamesburg, VII–11–38 (L. W. Hepner, ANSP). SAN BENITO CO.: Pinnacles Nat. Mon., VIII–24–62 (D. C. Rentz & E. W. Kirschbaum, DCR). SAN LUIS OBISPO CO.: Paso Robles, VIII–21–09, 1100 ft. elevation (ANSP). SANTA BARBARA CO.: Santa Ynez Mts., VI–24–59 (R. M. Bohart, UCD).

Discussion—A light colored species inhabiting dry washes with sparse vegetation.

Genera *Xanthippus* Saussure, 1884 and *Agymnastus* Scudder, 1897

The taxonomy of this group of large grasshoppers is a complex problem which will require study of series collected over a wide area, including Mexico. Samples of California populations present characters in bewildering combinations and the treatment which follows must be considered more as an account of the names used than as a sound diagnosis of species. The usefulness of the generic name *Agymnastus* is best left to comprehensive revisionary studies.

KEY TO CALIFORNIA SPECIES OF AGYMNASTUS AND XANTHIPPUS

1 Wing yellow 2
  Wing red or pink 5

2 Inner face of hind femur black with a single preapical pale band; hind tibia usually coral red (fig. VI) . . . . . *A. ingens* (Scudder) (p. 85)
  Inner face of hind femur red, or dark with two pale bands; hind tibia yellow, sometimes pink internally 3

3 Inner face of hind tibia blackish with two yellow or red bands . . *X. calthulus* Saussure (p. 129)
  Inner face of hind femur bright red 4

4 Tegmen with contrasting pale and dark markings . *X. corallipes corallipes* (Haldeman) (p. 129)
  Tegmen dusky with indistinct dark annuli . . . *X. lateritius* Saussure (p. 130)

5 Inner face of hind femur black with two pale bands 6
  Inner face of hind femur red, or black with one pale band 7

6 Hind tibia red; pronotum with large verrucae . . *X. montanus* (Thomas) (p. 130)
  Hind tibia yellow; pronotum fairly smooth . . *X. sierra* (Rehn) (p. 131)

7 Inner face of hind femur black (fig. 31) . . . *X. olancha* (Caudell) (p. 131)
  Inner face of hind femur bright red 8

8 Tegmen contrastingly marked . . . . . *X. corallipes miniatus* Strohecker (p. 130)
  Tegmen dusky with indistinct dark annuli . . . *X. lateritius* Saussure (p. 130)

Xanthippus calthulus Saussure
(Map 104)

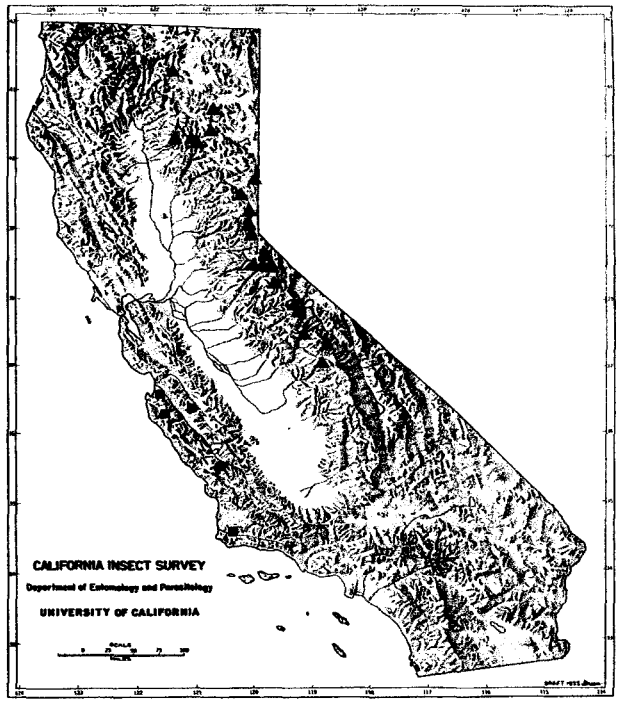
Xanthippus calthulus Saussure, 1884, Prodrome Oedip., p. 93. Type locality, Nev. (Geneva?).

Tegmina of males often dark brown; typical coloration of tegmina brown with many darker spots. The specimens reported as *X. calthulus* in this study all have yellow wings but the hind femur and tibia show variations in coloration. In the Saussure types the internal face of the hind femur is blackish with two pale cross-bands and the hind tibia is yellow, weakly suffused externally with pink. Specimens from California show this condition, but among them are specimens with the internal face of the hind femur red and black and the hind tibia red except externally.

Body 23–25; tegmen 26–32; hind femur 13–16.

Geographic range.—California and Nevada.

California records.—(Map 104) ALPINE Co.: Hope Valley, VII–9–48, VII–18–48 (J. W. MacSwain, CIS); VII–18–48 (R. F. Smith & V. M. Stern, CIS). Carson Pass, VI–29–57 (J. A. Powell, CIS); VII–17–62 (E. J. Montgomery, CIS). Ebbett's Pass, VI–30–60, 8730 ft. elevation (J. A. Chemsak & J. R. Powers, CIS); VI–21–62 (J. A. Powell, CIS); VI–8–60 (G. I. Stage, CIS). Blue Lakes, VI–17–60 (C. G. Moore, CIS). EL DORADO Co.: Echo Lake, VI–30–59, VII–7–54, VIII–21–55, VI–26–52, VII–14–53 (W. W. Middlekauff, CIS). Mt. Ralston, VIII–6–42, 9000 ft. elevation (P. H. Arnaud, DCR). FRESNO Co.: Heart Lake, IX–1–52, 10,500 ft. elevation (E. I. Schlinger, CIS). INYO Co.: Near Mono Pass, VIII–10–59 (D. C. Rentz, DCR). LASSEN Co.: Summit Camp, VI–28–49 (J. W. MacSwain & R. G. Howell, CIS, UCD). Bridge Creek Camp, VII–14–54 (R. M. Bohart, UCD). Hallelujah Jct., VII–4–49 (R. G. Howell, UCD). McCoy Flat Res., VII–24–54 (J. A. Powell, CIS). MADERA Co.: Devil's Postpile, VII–1–61 (S. F. Bailey, UCD). NEVADA Co.: Truckee, VI–22–43 (P. H. Arnaud, DCR). MONO Co.: Sonora Pass, VII–6–61 (P. M. Marsh, UCD); VII–11–51 (A. T. McClay & J. W. MacSwain, UCD, CIS); VII–6–51 (J. W. MacSwain, CIS); VII–11–57 (J. W. MacSwain, A. E. Pritchard & W. T. Crites, CIS). PLACER Co.: Tamarack, Lake Tahoe, VII–8–15 (CIS). Alpine Creek, Lake Tahoe, VII–14–15 (CIS). Mt. Tallac, Lake Tahoe, X–30–30 (A. T. McClay, UCD). PLUMAS Co.: 8 mi. N.W. Chester, VIII–18–58 (J. A. Powell, CIS). Chester, VI–28 to 30–48 (D. J. & J. N. Knull, CIS); VII–10–54 (D.J. & J.N. Knull, CIS). SHASTA Co.: Lake Eiler, VII–9–47 (T. O. Thatcher, CIS). SIERRA Co.: VI–18–13 (F. W. Nunenmacher). TEHAMA Co.: Mineral, VI–25–48 (D. J. & J. N. Knull, CIS). TUOLUMNE Co.: Sonora Pass, VI–27–51, 9624 ft. elevation (A. T. McClay & C. A. Downing, UCD, CIS); VII–13–50 (D. Davis, CIS); VIII–21–59 (J. R. Powers, CIS); VIII–30–60 (P. D. Hurd, CIS); VII–30–60 (M. E. Irwin, UCD); VIII–6–59, VI–23–60 (D. C. Rentz, DCR); VIII–16–60 (R. R. Snelling, DCR); VIII–18–61 (M. R. Lundgren, DCR). Boundary Heights, VII–7–54 (R. Palden, UCD). Kerrick Meadows, VII–28–34 (CIS). Tioga Pass, VIII–7–59 (D. W. Price, UCD). Mt. Conness, VII–23–36 (CIS).



Map 104. California distribution of: ■, *Trimerotropis titusi* Caudell; ▲, *Xanthippus calthulus* Saussure.

Discussion—A common Sierran species in dry, rocky habitats.

Xanthippus corallipes corallipes (Haldeman)
(Map 105)

Oedipoda corallipes Haldeman, 1852, Stansb. Exp. Utah, p. 371, Pl. 10, Fig. 2. Type locality, Salt Lake Valley, Utah.

Hippiscus corallipes, Scudder, 1876, Bull. U.S. Geol. Surv. Terr., 2:264.

Xanthippus corallipes, Saussure, 1884, Prodrome Oedip., 90.

Hippiscus (Xanthippus) corallipes, Scudder, 1892, Psyche, 6:270.

Stout-bodied, robust. Pale gray, pronotum with disc and lateral lobes dusky leaving a pale line along lateral carinae. Tegmina with large sharply defined dark blotches which distally assume the form of cross-bars. Wing yellow with black band. Inner face and lower sulcus of hind femur bright red. Hind tibia yellow on external face, red internally. Pronotum with metazona strongly tuberculate, median carina strong but suppressed between the transverse sulci.

Body 30–38; tegmen 30–35; hind femur 17–20.

Geographic range.—Utah and Nevada south through Arizona, New Mexico, and into Mexico.

California records.—(Map 105) SAN BERNARDINO Co.: 12 mi. S. E. Ivanpah, V–1–56 (P. D. Hurd & J. A. Powell, CIS). Bear Valley, VI–2–28 (E. C. Van Dyke, CAS). Argus

Mts., V–1891 (A. Koebele, CAS). Lucerne Valley to Big Bear Lake, IV–13–60 (J. R. Helfer, CAS, DCR).

Discussion—Hewitt and Barr (1967) consider this species complex to consist of ten subspecies, many of which have a two-year life cycle.

Xanthippus corallipes miniatus Strohecker
(Map 105)

Xanthippus corallipes miniatus Strohecker, 1952, Amer. Midl. Nat., 48:686. Type ♂, June Lake, Mono Co., Calif.

Pale brown, tegmina with large contrasting dark areas, lower sulcus and inner face of hind femur bright red, hind tibia yellow with a few small tubercles, its hind margin slightly acute to slightly obtuse. A more robust insect than *X. sierra* and occurring at lower altitudes.

Body 29–42; tegmen 28–36; hind femur 15–20.

Geographic range.—Eastern California.

California records.—(Map 105) INYO Co.: Crooked Creek, White Mts., VI–13–54, VII–16–61, 8500 ft. elevation (W. A. Foster, CIS). Wildrose Canyon, Panamint Mts., VI–7–56 (J. M. Burns, CIS). Telescope Pk., VI–8–61 (R. P. Allen, CDA). MONO Co.: June Lake, VI–20–48 (G. P. Mackenzie, UCD). Mono Lake, VI–14–47 (G. P. Mackenzie, UCD). Mammoth Lakes, VI–10–47 (G. P. Mackenzie, CIS). Grant Lake, VIII–5–48 (P. D. Hurd & J. W. MacSwain, CIS). Blanco's Corral, White Mts., VI–21 to 24–53, 10,000 ft. elevation (D. D. Linsdale & J. T. Brooks, CIS); VIII–25–60 (R. R. Montanucci, CIS). White Mts., VI–26, 28–62, 10,000 ft. elevation (J. S. Buckett, UCD); VI–19–62 (W. H. Lange, CIS). Crooked Creek, White Mts., VI–20–53, 9000 ft. elevation (J. W. MacSwain, CIS); VI–26–61 (J. S. Buckett, UCD). Mt. Barcroft, VII–21–61 (D. C. Rentz, DCR). 6 mi. S. Coleville, VI–25–54, 5900 ft. elevation (J. Rehn, ANSP).

Xanthippus lateritius Saussure
(Map 106)

Xanthippus lateritius Saussure, 1884, Prodrome Oedip., p. 92. Type locality, Amer. Borealis, Nev.

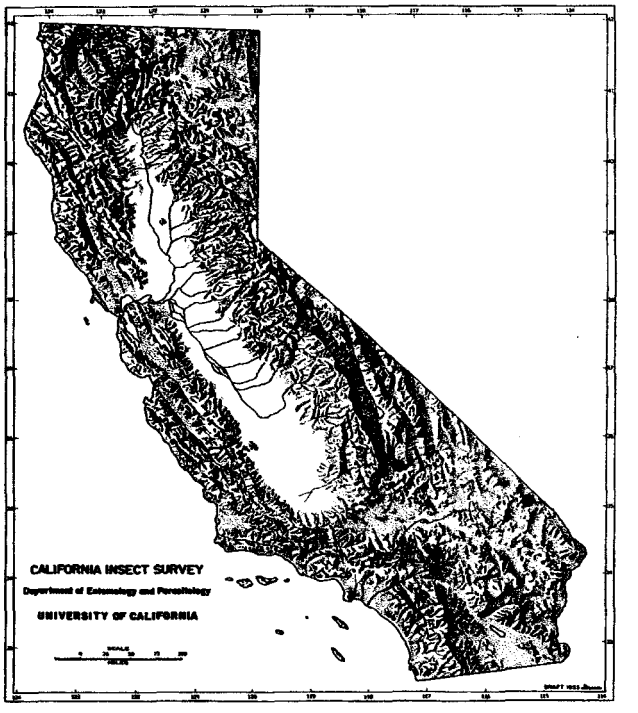
Much like *X. montanus* in size and coloration. Pronotum smoother and with hind margin less sharp. Internal face and lower sulcus of hind femur bright red; hind tibia yellow internally, suffused with pink on external and extensor surfaces.

Body 23–37; tegmen 25–35; hind femur 13–16.

Geographic range.—California and Nevada.

California records.—(Map 106) ALPINE Co.: VI–23–60, 8700 ft. elevation (G. I. Stage, DCR). INYO Co.: Westgard Pass Plateau, VI–25–37. LASSEN Co.: Hallelujah Jct., VII–13–49 (E. I. Schlinger, UCD). NEVADA Co.: Truckee, VI–22–43 (P. H. Arnaud, DCR). TUOLUMNE Co.: Sonora Pass, VII–18–61 (M. R. Lundgren, DCR). Vicinity Sonora Peak, VI–23–60 (D. C. Rentz, DCR). Chipmunk Flat, VI–12–64 (J. D. Birchim, JDB).

Discussion—According to Hewitt and Barr (1967) this species has a two-year life cycle. It prefers gravelly soil and is found where sagebrush extends into timbered mountainous areas. It is a mixed feeder.



Map 105. California distribution of: ●, *Xanthippus corallipes corallipes* (Haldeman); ▲, *Xanthippus corrallipes miniatus* Strohecker.

Xanthippus montanus (Thomas)[4]
(Map 106)

Oedipoda montana Thomas, 1872, Rep. U.S. Geol. Surv. Montana, p. 462. Type ♀, Upper Snake River plains, and southern Montana.

Hippiscus (Xanthippus) montanus, Scudder, 1901, Can. Ent., 33:91.

Tegmina dark with darker small spots, these fused in places into irregular clouds. Hind femur with internal face black with two pale cross-bands. Hind tibia red with external face sometimes yellowish. Metazona with a number of large tubercles, its hand margin acute to rectangulate. *X. calthulus* and *X. lateritius* seem to be closely related.

Body 23–40; tegmen 26–32; hind femur 13–18.

Geographic range.—Localized. Montana, Wyoming, South Dakota, Nebraska, Colorado, Kansas, Oklahoma, New Mexico, Arizona, and California.

[4]After going to press, Hewitt and Barr (1967) placed this species as a subspecies of *X. corallipes*.

California records.—(Map 106) ALPINE CO.: Blue Lake, VII–17–60 (C. G. Moore, CIS). LASSEN CO.: 5 mi. E. Madeline, VI–14–51, some with yellow wings (H. H. Keifer, CDA). Red Rock, VII–11–50, range (J. S. Buckett & R. W. Harper, CDA). Terma, VII–30–52, range (R. W. Harper, CDA). Doyle, III–25–53 (R. W. Harper, CDA). MODOC CO.: Cedar Pass, VI–29, VII–2–62 (J. W. MacSwain & K. Bowers, CIS). PLUMAS CO.: Peavine Quar. Station, range (R. W. Harper, CDA).

Xanthippus olancha (Caudell)

(Fig. 31, Map 106)

Hippiscus olancha Caudell, 1921, Ent. News, 32:149. Holotype ♂, Olancha, Inyo Co., Calif.

Agymnastus haemopterus Strohecker, 1952, Amer. Midl. Nat., 48:685, new synonymy.

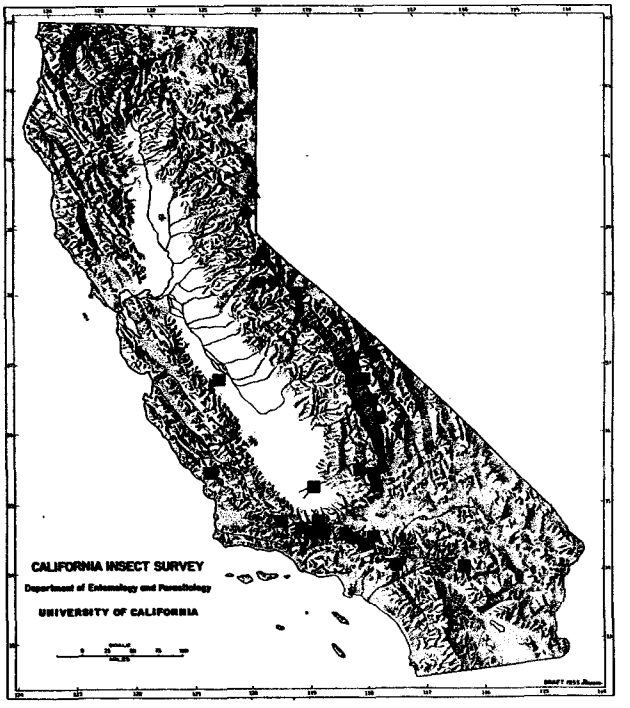
Usually very pale, almost white in color, the tegmina dotted and streaked with gray or dotted and streaked with gray or black. Some specimens, however, are mostly dark. Hind femur very broad, its inner face deep blue-black with preapical annulus of yellow or red. Hind tibia red, sometimes with external face yellowish. Stout, antennae short and stout. Pronotum strongly verrucose, its hind margin acute to rectangulate. This is probably the insect referred to as *Xanthippus pardalinus* by Rehn and Hebard (1909).

Body 24–40; tegmen 27–37; hind femur 13.5–15.

Geographic range.—California.

California records.—(Map 106) FRESNO CO.: Foothills near Ora Loma, IV–11–19. INYO CO.: Olancha (ex: Caudell). 8 mi. N. Independence, V–7–60 (A. S. Menke, UCD). 8 mi. W. Independence, VI–9–65 (J. D. Birchim, JDB). Mazourka Canyon, Inyo Mts., VI–1–37. Lone Pine, VI–30–37. Pine Creek, VI–22–22, 8000 ft. elevation (O. C. Poling, ANSP). KERN CO.: 1 mi. W. Walker Pass, IV–26–64 (P. Rude & J. Doyen, CIS). Dove Spring Canyon, N. Ricardo, IV–15–60 (C. A. Toschi, CIS). Lebec, V–15–28 (J. O. Martin, CAS). Bakersfield, IV–9–36 (E. C. Van Dyke, CAS). 58 mi. E. Bakersfield, III–26–47 (P. H. Arnaud, CAS). LOS ANGELES CO.: Desert Springs, V–5–56 (P. D. Hurd, CIS). 2 mi. E. Llano, IV–9–42 (H. R. Roberts, ANSP). Gorman, IV–10–60 (G. I. Stage, CIS). 5 mi. S. Pearblossom, IV–23–56 (E. G. Linsley, CIS). 1 mi. W. Littlerock, IV–26–56 (E. G. Linsley, CIS). Palmdale, V–8–41 (E. C. Van Dyke, CAS). 1 mi. E. Little Rock, V–3–54, 3400 ft. elevation (J. Rehn, ANSP). MONO CO.: Spring Canyon, 3 mi. N.E. Walker, VI–24–62 (J. A. Powell, CIS). 6 mi. W. Big Pine, VI–20–62 (W. H. Lange, UCD). Tom's Place, VI–27–49 (H. E. Cott, CIS). Mono Lake, 10 mi. N. Leevining, VIII–9–61 (D. C. Rentz, CAS). RIVERSIDE CO.: Pinon Flats, 22 mi. S.W. Palm Desert, V–2–62 (Grant & Amen, ANSP). SAN BERNARDINO CO.: Mojave Desert, VIII–4–37 (H. F. Hardman, CIS). Phelan, V–21–57 (E. I. Schlinger, UCR). 2 mi. S. Phelan, V–7–63 (P. D. Hurd, CIS). Hesperia, IV–14–48 (G. P. Mackenzie, UCD). San Bernardino Mts., VII–1 to 24– (Rehn & Hebard, ANSP). Cajon Pass, IV–15–60 (J. R. Helfer, DCR). 3 mi. N.E. Cajon Pass, V–1962 (Grant & Amen, ANSP). Desert Springs, 12 mi. N.W. Cajon, V–3–54, 4000 ft. elevation (J. Rehn, ANSP). SAN LUIS OBISPO CO.: Templeton, III–22–31 (E. P. Van Duzee, CAS). SANTA BARBARA CO.: Cuyama Valley, 5.5 mi. S. Jct. U.S. Highway 399 and California 166, V–4–54 (J. Rehn, ANSP). VENTURA CO.: Hungry Valley, 5 mi. S. Gorman, V–6–59 (J. R. Powers, CIS). Lockwood Creek near Stauffer P.O., V–7–59 (P. D. Hurd, CIS). Mt. Pinos, IX–4–22, 8500 ft. elevation (Rehn & Hebard, ANSP).

Discussion—Not uncommon in the central and western desert areas of southern California.



Map 106. California distribution of: ●, *Xanthippus lateritius* Saussure; ▲, *Xanthippus montanus* (Thomas); ■, *Xanthippus olancha* (Caudell).

Xanthippus sierra (Rehn)

(Map 107)

Hippiscus sierra Rehn, 1906, Ent. News, 18:350. Type ♀, Mt. Tyndall, Tulare Co., Calif., designated by Rehn & Hebard, 1912 (ANSP).

Tegmina dusky with darker annuli and irregular spots. Internal face and lower sulcus of hind femur black with two pale cross-bands. Hind tibia yellow, sometimes with outer face more or less pink. Metazona of pronotum rather smooth, with a few small tubercles, its hind margin acute to slightly obtuse.

Specimens from Gaylor Lakes with orange wing disc suggest intergradation with *X. calthulus*.

Body 25–32; tegmen 25–31; hind femur 13–15.

Geographic range.—California.

California records.—(Map 107) FRESNO CO.: Bullfrog Lake, VIII–12–14, 10,634 ft. elevation (F. Grinnell, ANSP); VII–11–10 (E. C. Van Dyke, ANSP). INYO CO.: Ruby Lake,

VIII–13–57, 11,250 ft. (J. A. Powell, CIS). Lone Pine Lake, Whitney Pass Trail, IX–6–19 (Rehn & Hebard, ANSP). Upper Rock Creek, VIII–14–63, 10,000 ft. elevation (M. J. Tauber & C. A. Toschi, CIS). Mono Pass, VIII–11–63, 12,000 ft. elevation (M. J. Tauber & C. A. Toschi, CIS); VIII–9–59 (D. C. Rentz & C. D. MacNeill, DCR); IX–2–60 (D. C. Rentz & C. D. MacNeill, DCR). MONO CO.: Saddlebag Lake, VIII–14–51, 10,500 ft. elevation (M. J. D. White, ANSP); VII–27–54 (J. A. Powell, CIS). Mt. Barcroft, White Mts., VII–21–61, 12,400 ft. (D. C. Rentz, DCR). White Mtn., VI–21 to 24–53, 14,000 ft. elevation (J. W. MacSwain, J. T. Brooks & D. D. Linsdale, CIS); VIII–9–62, 13,500 ft. elevation (L. A. Stange & A. S. Menke, UCD). Piute Mt., VIII–9–53 (R. F. Smith, CIS). Tioga Crest, VII–22–56, 11,000 ft. (J. A. Powell, CIS). TULARE CO.: 3 mi. E. Mineralking, VIII–12–61, 11,000 ft. elevation (W. E. Simonds, CDA). Siberian Outpost, VII–31–15, 9000 ft. elevation (ANSP). TUOLUMNE CO.: Yosemite Nat. Park, Mt. Dana, VII–1940 (D. L. Dow, CIS). Gaylor Lakes, Yosemite Nat. Park (H. P. Chandler, ANSP); VII–18–49 (L. L. Jensen, CIS). Tuolumne Meadows, VII–30–15 (C. L. Fox, ANSP).

Genus *Xeracris* Caudell, 1915

Xeracris minima (Scudder)

(Map 107)

Heliastus minimus Scudder, 1900, Psyche, 9:46. Type locality, Palm Springs, Riverside Co., Calif.

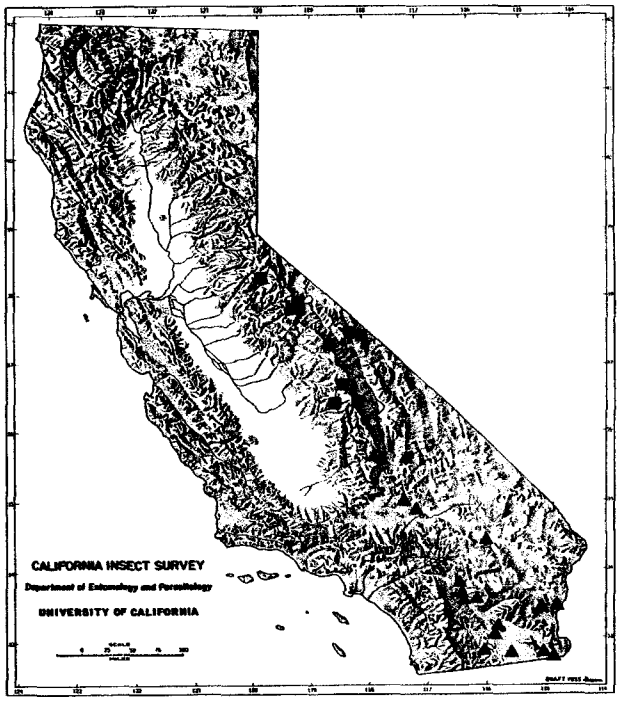
Xeracris minimus, Caudell, 1915, Proc. U.S. Nat. Mus., 49:25.

Among the smallest of the Acrididae. White, sometimes with rusty red suffusions, sides of pronotal prozona marked with black. Upper paginae of hind femur with two black bars. Hind tibia yellow. Tegmina marked with a few to many small black spots. Wing colorless. Pronotum with hind margin broadly rounded, carinae absent except median one feebly indicated on metazona.

Body 10.5–17; tegmen 9.5–14.5; hind femur 7–10.

Geographic range.—Southern California, Nevada and Utah.

California records.—(Map 107) IMPERIAL CO.: sand hills, 20 mi. W. Yuma, Arizona, IX–11–24, 250 ft. elevation (ANSP). Salton Sea, V–30–30 (Timberlake, ANSP). El Centro, VIII–25–31 (E. R. Tinkham, ANSP). 5 mi. W. Coyote Wells, IX–16–22, 500 ft. elevation (Rehn & Hebard, ANSP). Kane Spring, IX–17–22, 75 ft. below sea level (Rehn & Hebard, ANSP). Gray's Wells, VIII–26–31 (E. R. Tinkham, ANSP). KERN CO.: Brown, VIII–2–37, 2394 ft. elevation (Rehn, Pate & Rehn, ANSP). N. of Pilot Knob, IX–11–24 (Rehn & Hebard, ANSP). RIVERSIDE CO.: White Water, VI–26–37 (A. T. McClay, UCD); VII–9–50 (J. D. Paschke, CIS). 3 mi. W. Indio, VII–11–56 (M. Wasbauer, CIS). 3 mi. S. Palm Desert, VI–29–58 (D. M. Newell, CIS). Hopkins Well, X–11–58 (R. W. Thorp, CIS). Blythe, VII–18–40 (E. R. Helwig, ANSP). Palm Springs to Palm Canyon, IX–29–10, 1800 ft. elevation (ANSP). Palm Desert, VII–2–58 (C. Cushner, DCR). Indio, VIII–7–32 (R. H. Beamer, ANSP). SAN BERNARDINO CO.: Foothills, Bird Spring Mts., VIII–11–07 (Rehn & Hebard, ANSP). Trona, IX–9–22, 1800 ft. elevation (Rehn & Hebard, ANSP). Bagdad, VIII–6–19 (Rehn & Hebard, ANSP). Victorville, VIII–15–27 (ANSP).



Map 107. California distribution of: ■, *Xanthippus sierra* (Rehn); ▲, *Xeracris minima* (Scudder).

LITERATURE CITED

ANDERSON, N. L.

1964. Some relationships between grasshoppers and vegetation. Ann. Ent. Soc. Amer., 57:736–742.

ARNAUD, PAUL H. and DAVID C. RENTZ

1965. *Ceracia dentata* a parasite of *Chimarocephala pacifica pacifica* in California. Pan-Pac. Ent., 41:204–206.

BALL, E. D., E. R. TINKHAM, ROBERT FLOCK, and C. T. VORHIES

1942. The grasshoppers and other Orthoptera of Arizona. Univ. Ariz. Tech. Bull., 93:257–373.

BARNES, O. L.

1955. Effect of food plants on the lesser migratory grasshopper. Jour. Econ. Ent., 48:119–124.

BARNUM, ANDREW H.

1964. Orthoptera of the Nevada Test Site. Brigham Young Univ. Sci. Bull. Ser., 4:1–134.

BODINE, J. H. and J. H. ROBBIE

1940. Physiological characteristics of the diapause grasshopper egg (1) the stability of diapause condition. Physiol. Zoo., 13:391–397.

BROOKS, A. R.

1958. Acridoidea of southern Alberta, Saskatchewan, and Manitoba. Canad. Ent., 90:1–92.

BRUNER, LAWRENCE

1906. Acridiidae. Biol. Cent.-Amer. Orth., II:196–197.

BUCKLIN, D. H.

1953. Termination of diapause in grasshopper embryos cultured in *vitro*. Anat. Rec., 117:539.

BUXTON, G. M.

1964. A new locality record of *Mohavacris timberlakei* Rehn, at Bishop, Inyo County, California. Pan-Pac. Ent., 41:132.

CAROTHERS, E.

1923. Notes on the taxonomy, development and life history of certain Acrididae. Trans. Amer. Ent. Soc., 49:7–24.

CAUDELL, A. N. and M. HEBARD

1912. Fixation of single type (lectotypic) specimens of species of North American Orthoptera. Proc. Acad. Nat. Sci. Phila., 64:157–168.

COQUILLETT, D. W.

1892. Report on the locust invasion of California in 1891. U. S. Dept. Agric., Div. Ent. Bull., 27:34–57.

CRIDDLE, N.

1930. Life history of the cow grasshopper *Chrysochraon abdominalis* Thos. in Manitoba. Canad. Ent., 1:25–28.

DIRSH, V. M.

1955. Tanaoceridae and Xyronotidae, two new families of Acridoidea (Orthoptera). Ann. Mag. Nat. Hist., 12(8):285–288, Pl. 2.

1956. The phallic complex in Acridoidea (Orthoptera) in relation to the taxonomy. Trans. Ent. Soc. Lond., 108:223–356.

1961. A preliminary revision of the families and subfamilies of Acridoidea. Bull. Brit. Mus. Nat. Hist., 10:349–414.

1965. Preliminary note for the revision of the genus *Schistocerca* Stal, 1873, Rev. Espan. Ent., 41:31–43.

EADES, D. C.

1961. The terminology of phallic structures in the Cyrtacanthacridinae. Ent. News, 72:141–149.

EARDLEY, A. J.

1951. Structural geology of North America. Harper's Science Series, New York. 624 pp.

EDWARDS, R. L. and H. T. EPP

1965. Influence of soil moisture and soil type on the oviposition behavior of the migratory grasshopper, *Melanoplus sanguinipes* (Fab.). Canad. Ent., 97: 401–409.

FAURE, J. C.

1932. The phases of locusts in South Africa. Bull. Ent. Res., 23:293–405.

GANGWERE, S. K.

1961. A monograph on food selection in Orthoptera. Trans. Amer. Ent. Soc., 87:67–230.

GRANT, H. J. and D. C. RENTZ

1967. A biosystematic review of the family Tanaoceridae, including a compartive study of the proventriculus Pan-Pac. Ent., 43:65–74, 9 figs.

GREATHEAD, D. J.

1963. A review of the insect enemies of Acridoidea. Trans. Roy. Ent. Soc. Lond., 114:437–517.

GURNEY, ASHLEY B.

1940. A revision of the grasshoppers of the genus *Orphulella* Giglio-Tos., from America north of Mexico. Ent. Amer., 20:85–157.

1960. Grasshoppers of the Immunis group of *Melanoplus*, and notes on the grouping of other far western brachypterous species of this genus. Proc. Ent. Soc. Wash., 62:145–166.

1962. On the name of the migratory grasshopper of the United States and Canada *Melanoplus sanguinipes*. Proc. Biol. Soc., Wash., 75:189–192.

GURNEY, ASHLEY B. and A. R. BROOKS

1959. Grasshoppers of the Mexicanus group, genus *Melanoplus*. Proc. U. S. Nat. Mus., No. 3416, 110: 1–93.

GURNEY, ASHLEY B. and GEORGE M. BUXTON

1963. New California grasshoppers of the genera *Melanoplus* and *Hypsalonia*. Bull. Brooklyn Ent. Soc., 58: 62–71.

1965. New California grasshoppers of the genus *Melanoplus*. Calif. Dept. Agric. Occ. Papers, No. 7:1–7.

GURNEY, ASHLEY B. and DAVID C. EADES

1961. A new genus of wingless grasshoppers from California related to *Bradynotes*. Trans. Amer. Ent. Soc., 87: 281–306.

GURNEY, ASHLEY B. and DAVID C. RENTZ

1964. A new spine-throated grasshopper from the White Mountains of California. Proc. Calif. Acad. Sci., 31:503–513.

GURNEY, ASHLEY B., J. P. KRAMER and G. C. STEYSKAL

1964. Some techniques in the preparation, study and storage in microvials of insect genitalia. Ann. Ent. Soc. Amer., 57:240–242.

GURNEY, ASHLEY B. and H. F. STROHECKER

1959. Some California oedipodine grasshoppers, particularly three species given the specific name *occidentalis* by Lawrence Bruner. Bull. Brooklyn Ent. Soc., 54:77–82.

GURNEY, ASHLEY B., H. F. STROHECKER and J. R. HELFER

1964. A synopsis of the North American acridine grasshoppers of the genus-group *Chrysochraontes*. Trans. Amer. Ent. Soc., 89:119–137.

HARPER, ROBERT W.

1952. Grasshoppers of economic importance in California. Calif. Dept. Agric. Bull., 41:153–175.

HASTINGS, E. and J. H. PEPPER

1964. Population studies on the big-headed grasshopper, *Aulocara elliotti*. Ann. Ent. Soc. Amer., 57:216–220.

HEBARD, M.

1927. Fixation of the single types of species of Orthoptera described by Cyrus Thomas. Proc. Acad. Nat. Sci. Phila., 79:1–11.

1928. The Orthoptera of Montana. Proc. Acad. Nat. Sci. Phila., 80:211–305.

1935. Studies in the Orthoptera of Arizona. Pt. 2. A list of the Dermaptera and Orthoptera with new records and corrections of the literature subsequent to 1909. Trans. Amer. Ent. Soc., 61:269–316.

1937. Studies in Orthoptera which occur in North America north of the Mexican boundary. VII. Notes and a new species of *Timema*, and a new race of *Diapheromera velii* (Phasmidae). VIII. On a new species and a new race of the Acridinae. IX. On *Arphia conspersa*, notes and a new species of *Spharagemon*, a new genus and its races of the Group Heliasti and a new generic name for the Group Anconiae. Trans. Amer. Ent. Soc., 63:347–379. pl. 21–23.

1945. The species of *Hesperotettix* in Utah. Ent. News, 56:175–178.

HELFER, J. R.

1963. How to know the grasshoppers, cockroaches and their allies. W. C. Brown, Dubuque. 353pp.

HEWITT, G. B. and W. F. BARR

1967. The banded-wing grasshoppers of Idaho. Univ. Ida. Res. Bull., 72:1–64. 29 figs.

HUBBELL, T. H.

1932. Revision of Puer group of North American genus *Melanoplus*. Univ. Mich. Mus. Zool. Misc. Publ., 23:1–64.

HURD, P. D. and C. D. MICHENER

1955. The megachiline bees of California. Bull. Calif. Ins. Surv., 3:1–248.

ISELY, F. B.

1938a. Survival value of acridian protective coloration. Ecology, 19:370–389.

1938b. Relations of Texas Acrididae to plants and soils. Ecol. Monog., 8:551–604.

1944. Correlation between mandibular morphology and food specificity in grasshoppers. Ann. Ent. Soc. Amer., 37:47–67.

KELLY, GERALD D. and WOODROW W. MIDDLEKAUFF

1961. Biological studies of *Dissosteira spurcata* Saussure with distributional notes on related California species. Hilgardia, 30:395–424.

LA RIVERS, IRA

1948. A synopsis of Nevada Orthoptera. Amer. Midl. Nat., 39:652–720.

LINSLEY, E. GORTON

1936. Studies in the Genus *Aulicus* (Coleoptera:Cleridae). Univ. Calif. Publ. Ent., 6:249–262.

1958. Geographical origins and phylogenetic affinities of the cerambycid beetle fauna of western North America. *In* Carl L. Hubbs Zoogeography. Washington, D. C. pp. 299–320.

MIDDLEKAUFF, WOODROW W.

1958. Biology and ecology of several species of California rangeland grasshoppers. Pan-Pac. Ent., 34:1–11.

1959. Some biological observations on *Sarcophaga falciformis*, a parasite of grasshoppers. Ann. Ent. Soc. Amer., 52:724–728.

1964. Effects of photoperiod upon oogensis of *Melanoplus devastator* Scudder. Jour. Kans. Ent. Soc., 37:163–168.

MORSE, A. P.
1899. The distribution of New England locusts. Psyche, 8:315–323.

MORSE, A. P. and M. HEBARD
1915. Fixation of single type (lectotypic) specimens of species of North American Orthoptera. Proc. Acad. Nat. Sci. Phila., 67:96–106.

PARKER, J. R.
1930. Some effects of temperature and moisture upon *Melanoplus mexicanus* Saussure and *Camnula pellucida* Scudder (Orthoptera). Univ. Mont. Agric. Exp. Sta. Bull. 223:1–132.
1957. Grasshoppers, a new look at an ancient enemy. U. S. Dept. Agric. Farm Bull., 2064:1–40, illus.

PFADT, R. E.
1949. Food plants, distribution and abundance of the big-headed grasshopper, *Aulocara elliotti* (Thomas). Jour. Kans. Ent. Soc., 22:69–74.

PICKFORD, R. and R. W. RIEGERT
1964. The fungous disease caused by *Entomophthora grylli* Fres., and its effects on grasshopper populations in Saskatchewan in 1963. Canad. Ent., 96:1158–1166.

REHN, JAMES A. G.
1921. Descriptions of new and critical notes upon previously known forms of North American Oedipodinae. Second paper. Trans. Amer. Ent. Soc., 47:179–197.
1923. North American Acrididae. A study of the Ligurotettigi. Trans. Amer. Ent. Soc., 49:43–92.
1958. The origin and affinities of the Dermaptera and Orthoptera of western North America. Amer. Assoc. Adv. Sci., Pub. No. 51:253–298.
1964*a*. A systematic and geographic analysis of the genus *Bradynotes*. Trans. Amer. Ent. Soc., 90:131–203.
1964*b*. Contributions to our knowledge of the North American Melanoplini. Notul. Nat., Philad., 368:1–16.

REHN, JAMES A. G. and DAVID C. EADES
1961. The tribe Leptysmini as found in North America. Proc. Acad. Nat. Sci. Philad., 113:81–134.

REHN, J. A. G. and H. J. GRANT, JR.
1959. Critical remarks on a recent contribution to the taxonomy of the Acridoidea (Orthoptera) by V. M. Dirsh. Ent. News, 70:245–249.
1960*a*. A new concept involving the subfamily Acridinae (Orthoptera: Acridoidea). Trans. Amer. Ent. Soc., 86:183–185.
1960*b*. An additional tribe of the Romaleinae. Notul. Nat., Philad., 327:1–4.
1961. A monograph of the Orthoptera of North America (North of Mexico). Acad. Nat. Sci., Philad., Monog. No. 12, 1:1–255, 8 pls.

REHN, J. A. G. and M. HEBARD
1909. An orthopterological reconnaissance of the southwestern United States. Part III. California and Nevada. Proc. Acad. Nat. Sci. Phila., pp. 409–485.
1912. Fixation of single type (lectotypic) specimens of species of North American Orthoptera. Proc. Acad. Nat. Sci. Philad., 64:60–128.

REHN, JAMES A. G. and ROBERT L. RANDELL
1962. *Boonacris*, a new generic component of the North American Melanoplini. Trans. Amer. Ent. Soc., 88:105–182.

RENTZ, DAVID C.
1962*a*. A technique useful for the dry preservation of soft-bodied Orthoptera. Wasm. Jour. Biol. 20:159–160.
1962*b*. *Melanoplus alpinus* Scudder in California. Pan-Pac. Ent., 38:167–168.
1965. Females of *Melanoplus borealis palaceus* Fulton with frayed wings. Pan-Pac. Ent., 41:70.
1966. A review of the genus *Esselenia* Hebard with the description of a new subspecies. Calif. Acad. Sci., Occ. Papers, 54:1–10.

ROBERTS, H. R.
1941. A comparative study of subfamilies of the Acrididae (Orthoptera) primarily on the basis of their phallic structure. Proc. Acad. Nat. Sci. Philad., 93:201–246.

SCHICK, ROBERT X.
1965. The crab spiders of California. Bull. Amer. Mus. Nat. Hist., 129, Art. 1:1–180.

SCUDDER, S. H.
1901. Alphabetical index to North American Orthoptera. Boston Soc. Nat. Hist., Occ. Papers 6:1–436.

SHOTWELL, ROBERT L.
1941. Life histories and habits of some grasshoppers of economic importance on the Great Plains. U. S. Dept. Agric. Tech. Bull., 774:1–47.

SLIFER, E. H.
1938. The formation and structure of a special water absorbing area in the membranes covering the grasshopper egg. Quart. Jour. Microscopical Sci., 80:437–457.
1946. The effects of xylol and other solvents in diapause in the grasshopper egg, together with a possible explanation for the action of these agents. Jour. Expt. Zool. 102:333–356.
1958. Diapause in the eggs of *Melanoplus differentialis* (Orthoptera, Acrididae). Jour. Exp. Zool., 138:259–282.

STEBBINS, G. L. and J. MAJOR
1965. Endemism and speciation in the California Flora. Ecol. Monog., 35:1–35.

STROHECKER, H. F.
1963. New Acrididae from western North America. Pan-Pac. Ent., 39:157–174.

STROHECKER, H. F. and GEORGE M. BUXTON
1963. A new oedipodine grasshopper from California. Pan-Pac. Ent., 39: 260–263.

THOMPSON, R. M. and GEORGE M. BUXTON
1964. An index of the Acridoidea (Orthoptera) of California, with selected references. Bureau Ent. Calif. Dept. Agric. Occ. Papers, 5:1–62.

TINKHAM, ERNEST R.
1947. New species, records and faunistic notes concerning Orthoptera in Arizona. Amer. Midl. Nat., 38:127–149.
1966. Grasshoppers and locusts. Cambridge Univ. Press. Vol. I, 481 pp., 245 figs.

UVAROV, B.
1966. Grasshoppers and locusts. Cambridge Univ. Press. Vol. 1, 481 pp., 245 figs.

VAN DYKE, E. C.
1919. The distribution of insects in western North America. Ann. Ent. Soc. Amer., 12:1–12.

VICKERY, V. R.

1964. The validity of the name *curtipennis* (Harris) for North American *Chorthippus* (Orthoptera: Acridoidea). Canad. Ent., 96:1537–1548, 26 figs., 1 table.

WALLACE, H. S.

1955. Revision of the genus *Aeoloplides*. Ann Ent. Soc. Amer., 48:453–480.

WHITE, M. J. D.

1948. A cytological survery of wild populations of *Trimerotropis and Circotettix*. I. the chromosomes of twelve species. Genetics, 34:537–563.

1951. A cytological survey of wild populations of *Trimerotropis* and *Circotettix*. II. Racial differentiation in *T. sparsa*. Genetics, 30:31–53.

WILSON, C. C.

1936. Notes on the warrior grasshopper, *Camnula pellucida* (Scudder). Jour. Econ. Ent., 29:413–416.

1947. Control of the devastating grasshopper in California. Bull. Calif. State Dept. Agric., 36:97–102.

WILSON, C. C. and H. H. KEIFER

1941. A study of the marginate grasshopper, with notes on associated species. Calif. Dept. Agric. Bull., 30: 291–311.

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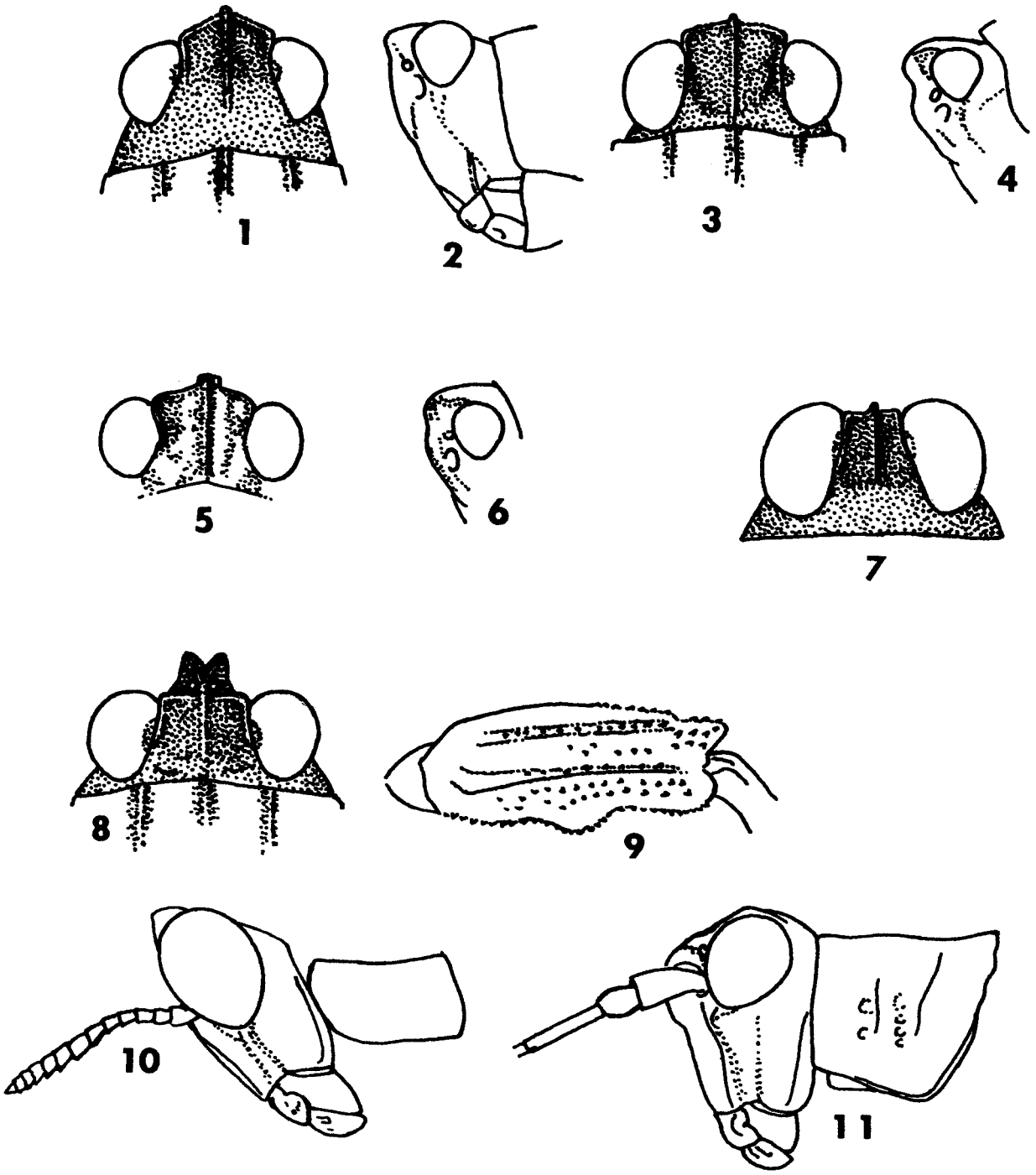
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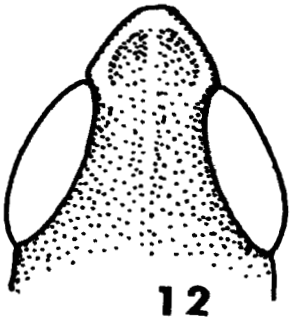
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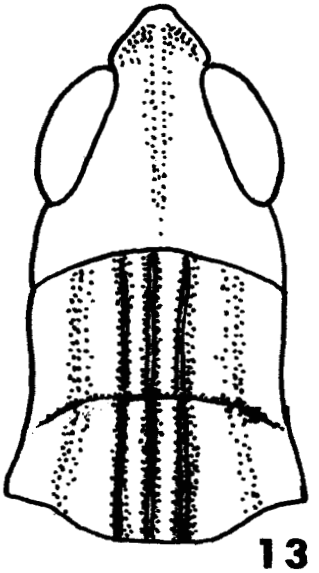
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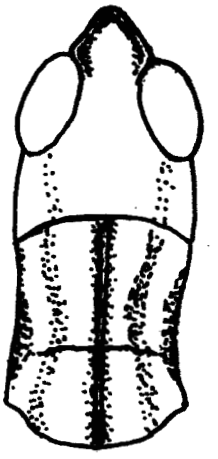
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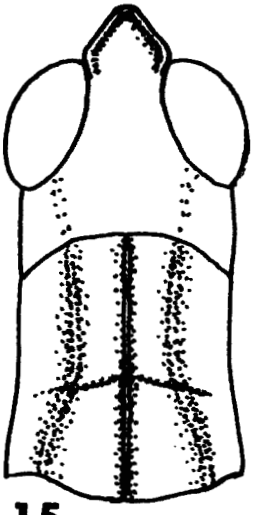
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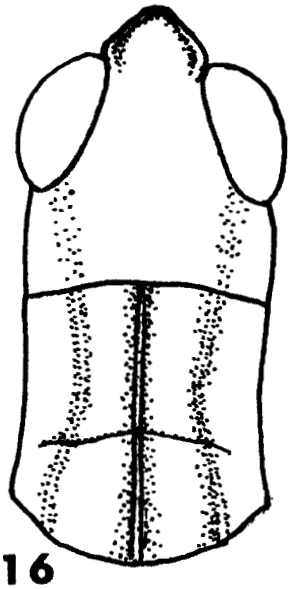
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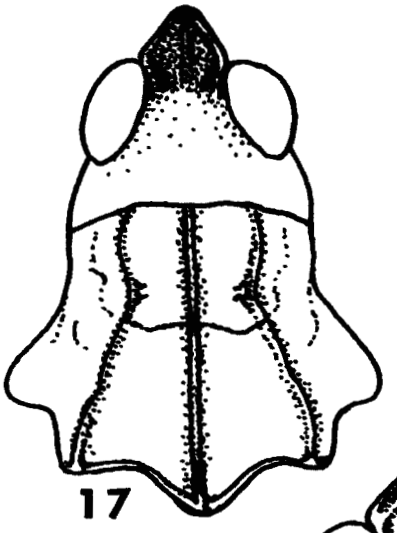
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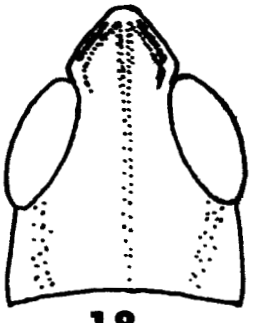
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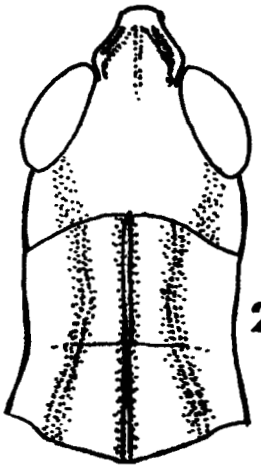
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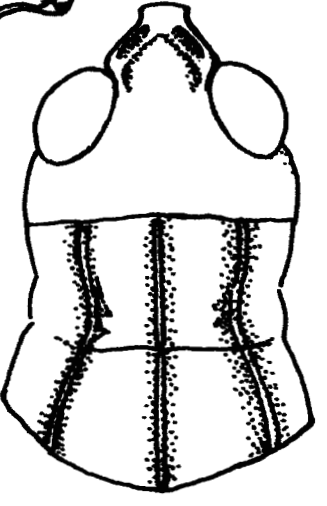
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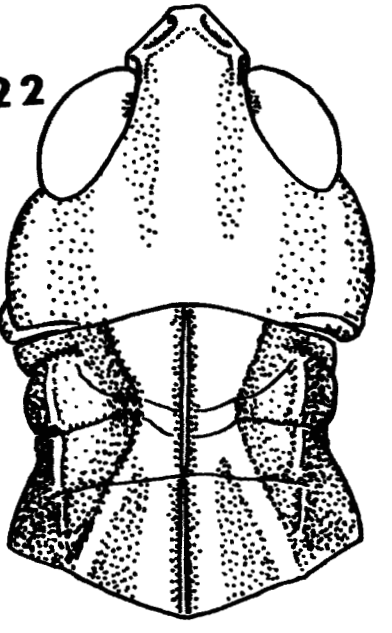
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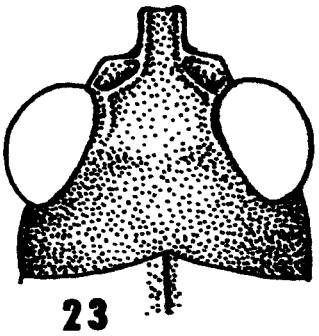
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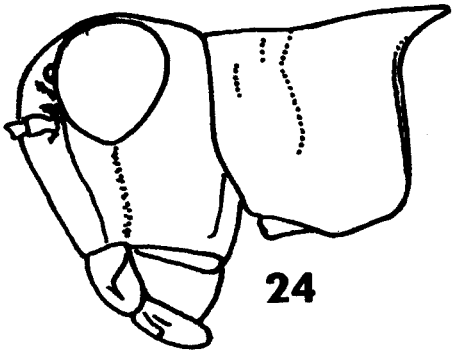
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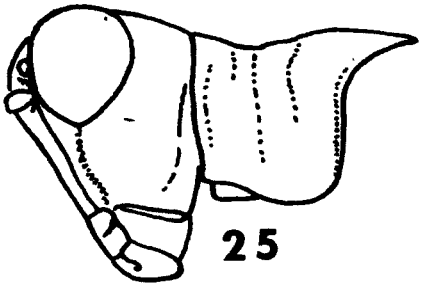
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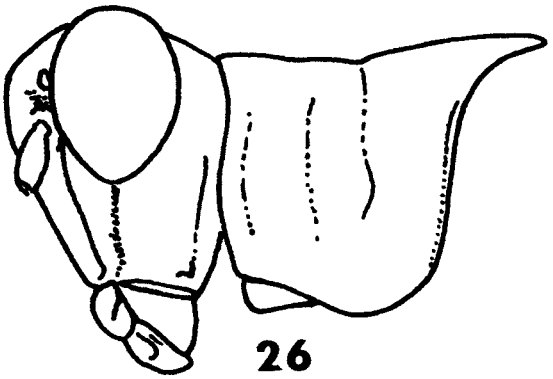
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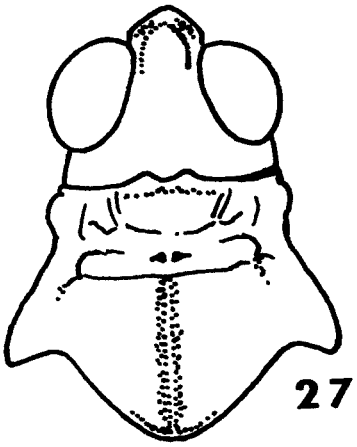
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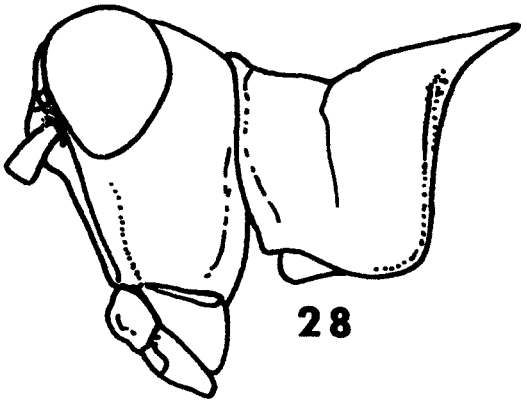
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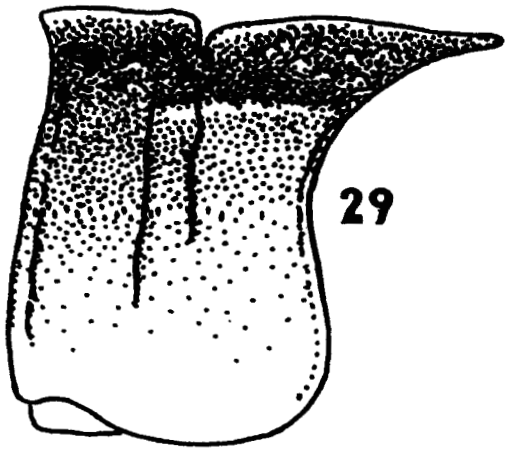
Fig. 33. *Microtes occidentalis* (Bruner), dorsum of head, male.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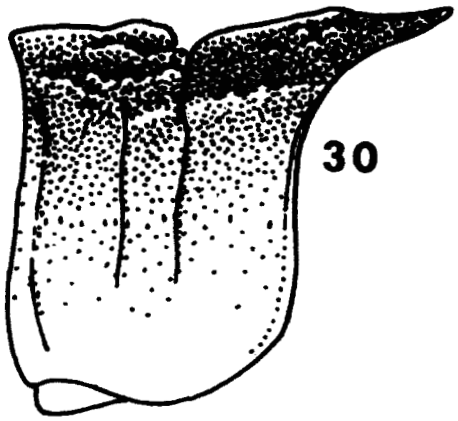
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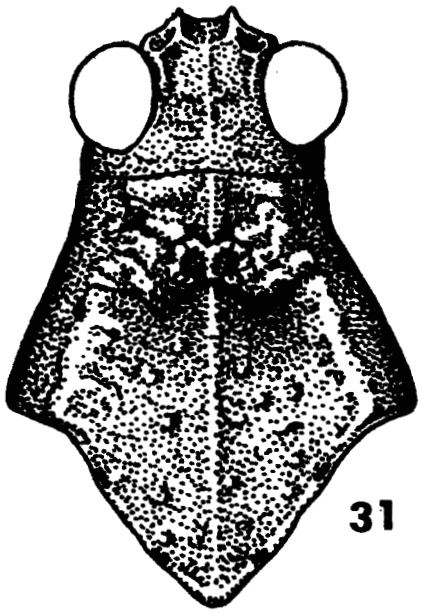
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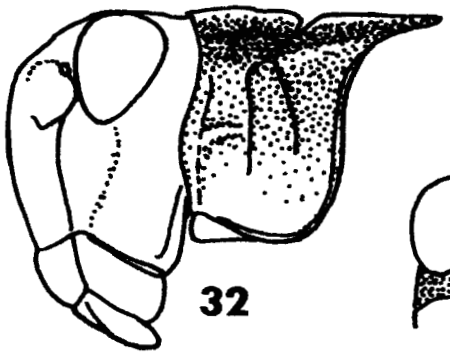
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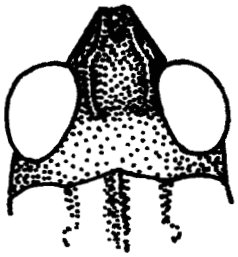
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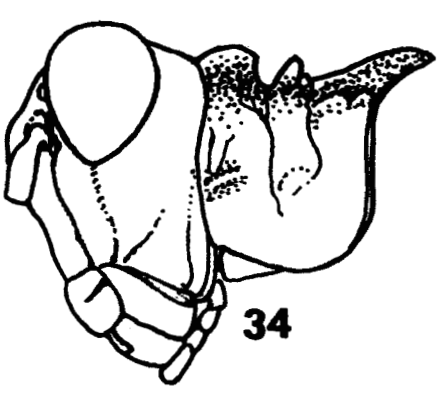
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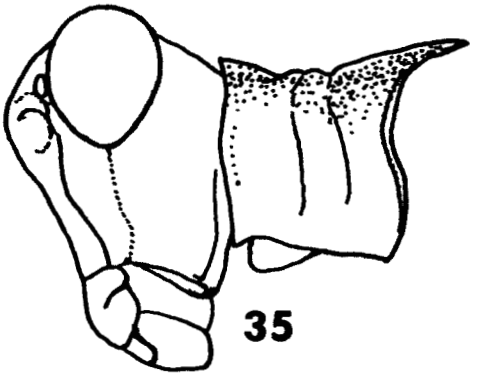
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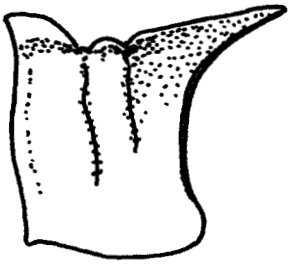
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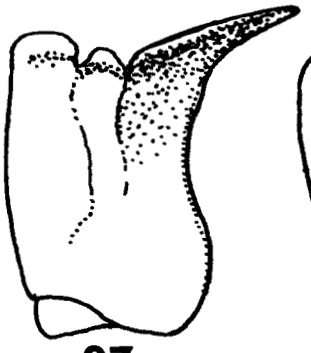
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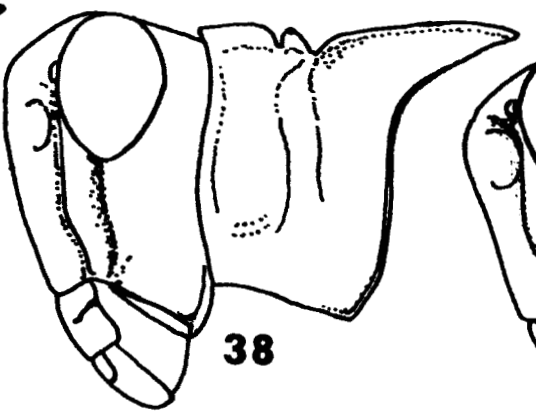
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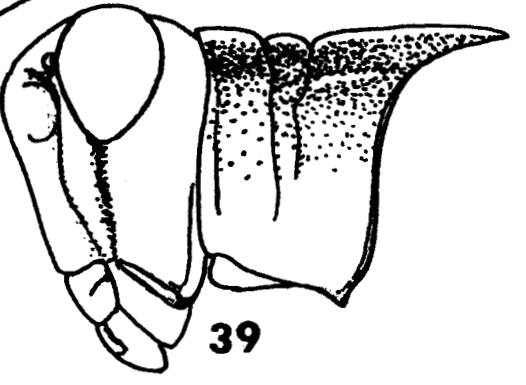
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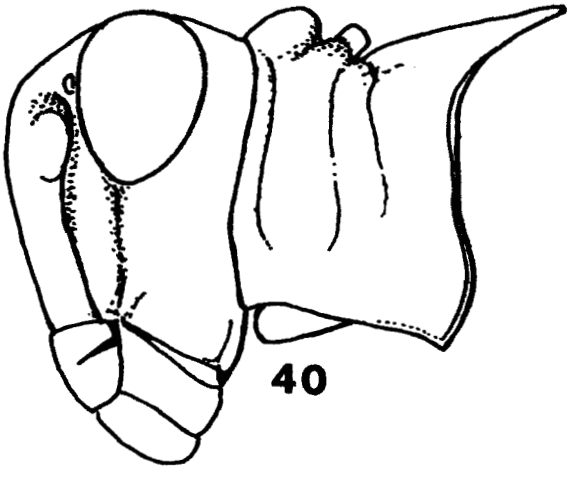
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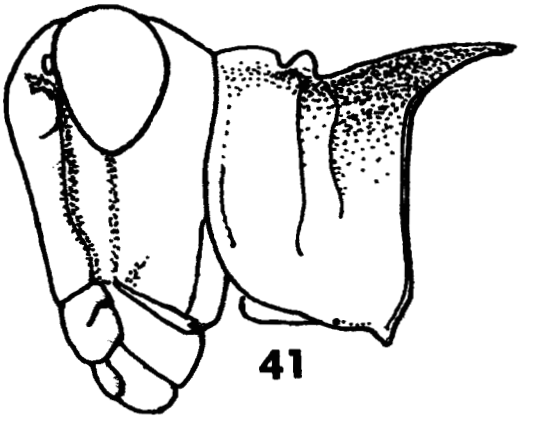
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Fig. 42. *Trimerotropis bilobata* Rehn and Hebard, left side of head and pronotum, male.
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Fig. 44. *Trimerotropis albescens* McNeill, left side of head and pronotum, male.
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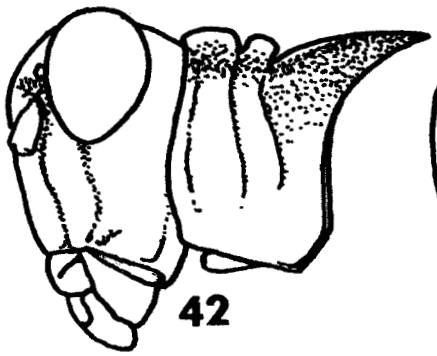
Fig. 47. *Trimerotropis bifasciata* Bruner, left side of head and pronotum, male.
Fig. 48. *Trimerotropis inconspicua* Bruner, left side of head and pronotum, male.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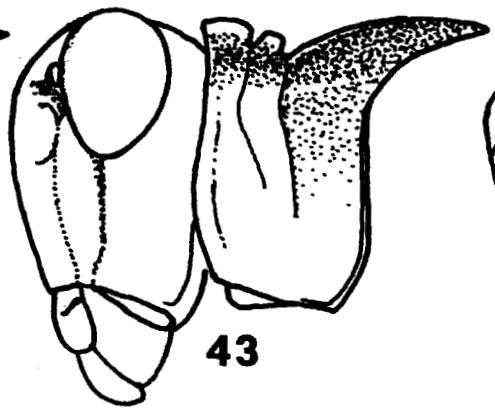
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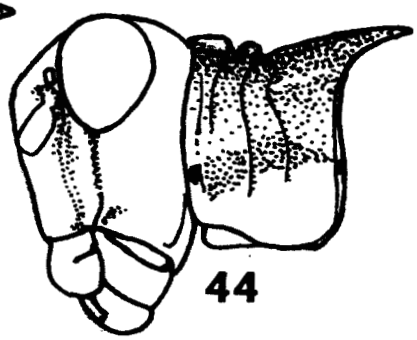
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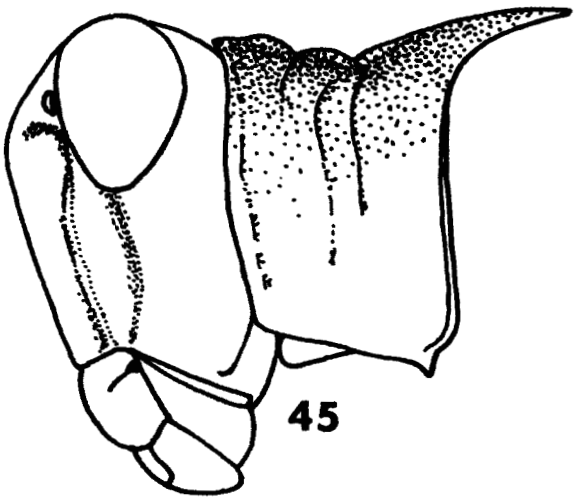
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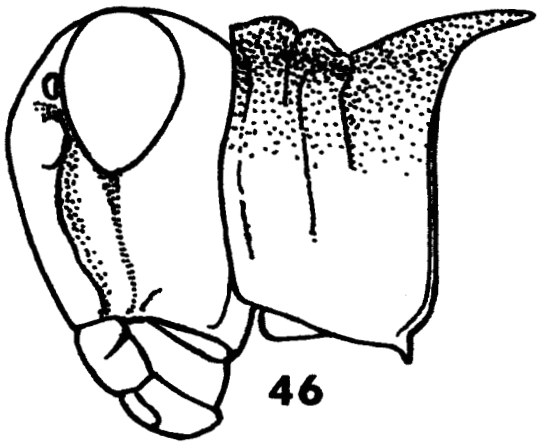
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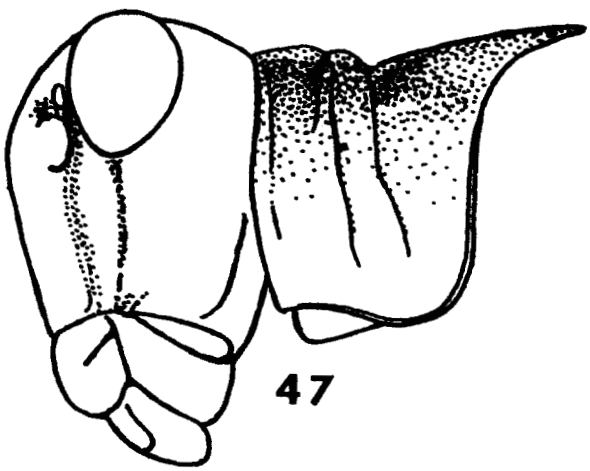
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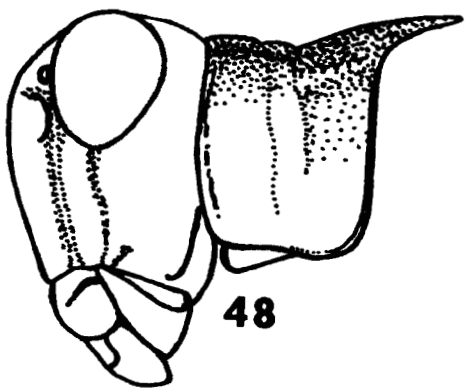
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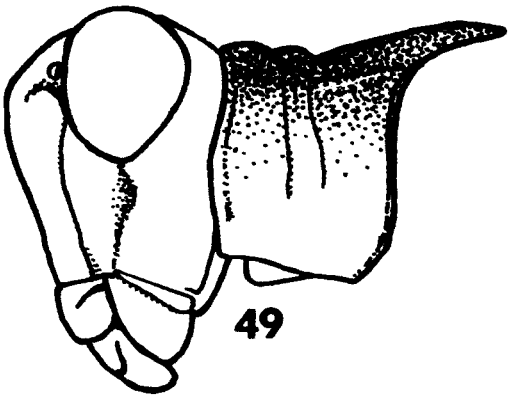
Fig. 49. *Trimerotropis thalassica* Bruner, left side of head and pronotum, male.
Fig. 50. *Trimerotropis occidentalis* (Bruner), left side of head and pronotum, male.
Fig. 51. *Trimerotropis arenacea* Rehn, left side of head and pronotum, male.
Fig. 52. *Trimerotropis pogonata* Strohecker, left side of head and pronotum, male.
Fig. 53. *Trimerotropis helferi* Strohecker, left side of head and pronotum, male.
Fig. 54. *Trimerotropis p. pallidipennis* (Burmeister), left side of head and pronotum, male.
Fig. 55. *Trimerotropis fontana* (Thomas), left side of head and pronotum, male.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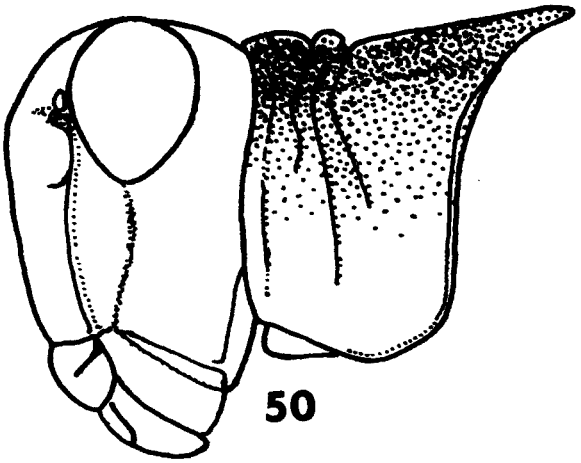
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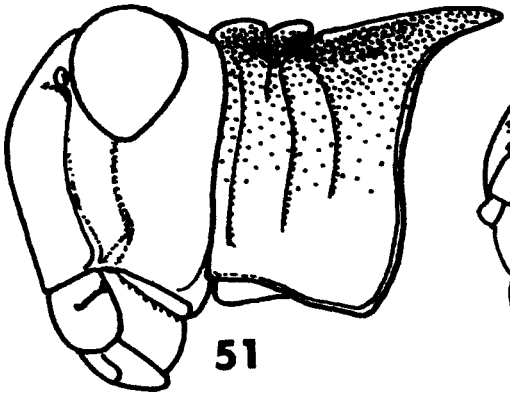
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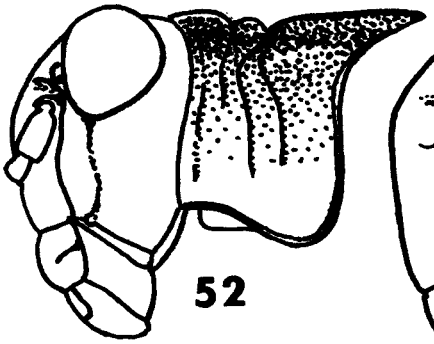
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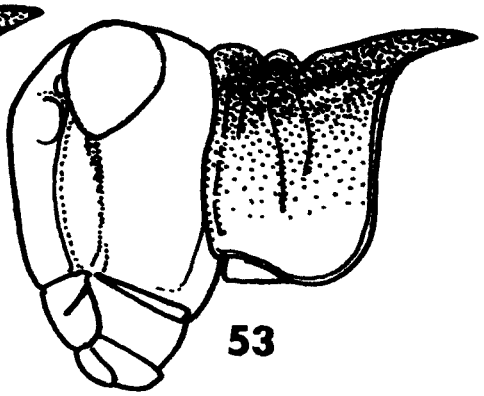
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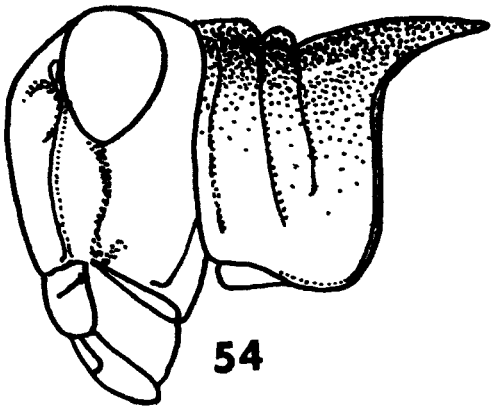
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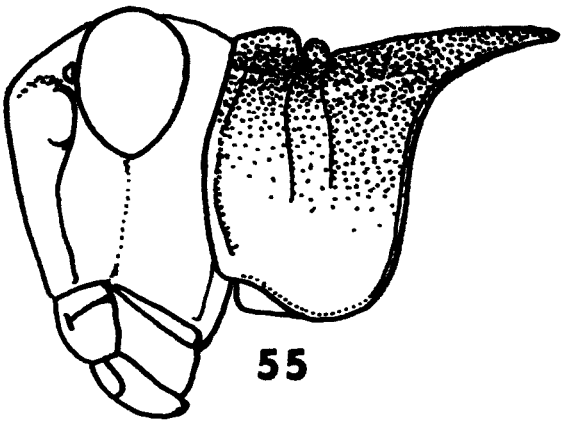
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Fig. 56. *Trimerotropis koebelei* (Bruner), left side of head and pronotum, male.
Fig. 57. *Trimerotropis suffusa* Scudder, left side of head and pronotum, male.
Fig. 58. *Trimerotropis pseudofasciata* Scudder, left side of head and pronotum, male.
Fig. 59. *Trimerotropis cyaneipennis* Bruner, left side of head and pronotum, male.
Fig. 60. *Trimerotropis sparsa* (Thomas), left side of head and pronotum, male.
Fig. 61. *Circotettix shastanus* Bruner, left tegmen of male, (ic) intercalary vein.

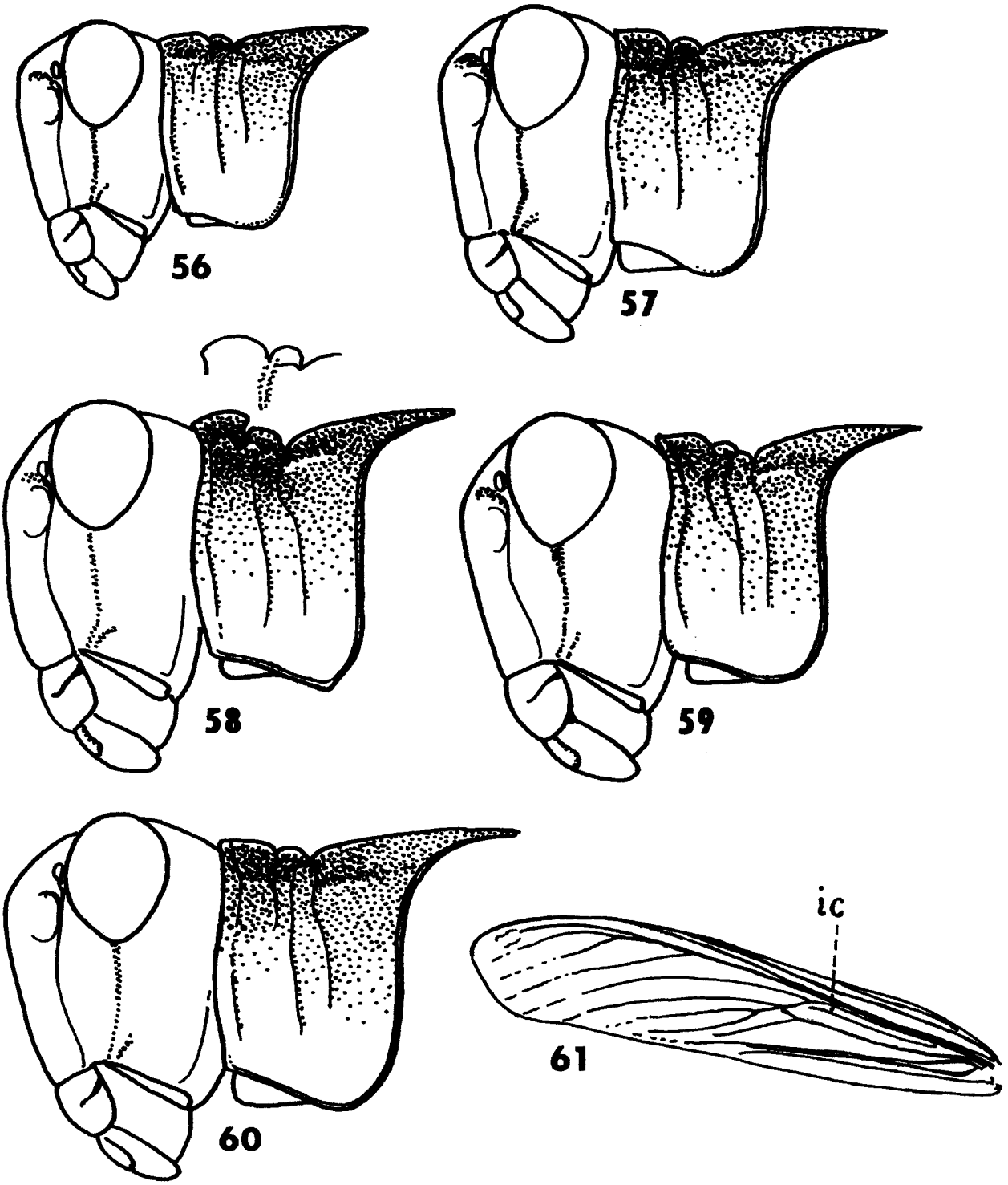
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Fig. 62. *Aeoloplides fuscipes* (Scudder), apex of male abdomen.
Fig. 63. *Aeoloplides fuscipes* (Scudder), aedeagus, left side.
Fig. 64. *Aeoloplides fratercula* (Hebard) left cercus, male.
Fig. 65. *Aeoloplides fratercula* (Hebard), aedeagus,left side.
Fig. 66. *Agnostokasia sublima* Gurney and Rentz, left cercus, male.
Fig. 67 *Oedaleonotus enigma* (Scudder), left cercus, male.
Fig. 68. *Oedaleonotus pinctus* (Scudder), left cercus, male.
Fig. 69. *Oedaleonotus borckii* (Stal), left cercus, male.
Fig. 70. *Oedaleonotus pacificus* (Scudder), left cercus, male.
Fig. 71. *Oedaleonotus enigma* (Scudder), aedeagus, caudal view.
Fig. 72. *Oedaleonotus borckii* (Stal), aedeagus, caudal view.
Fig. 73. *Oedaleonotus pacificus* (Scudder), aedeagus, caudal view.
Fig. 74. *Oedaleonotus pacificus* (Scudder), aedeagus, right side.
Fig. 75. *Oedaleonotus* sp., aedeagus, caudal view.
Fig. 76. *Oedaleonotus* sp., aedeagus, right side.

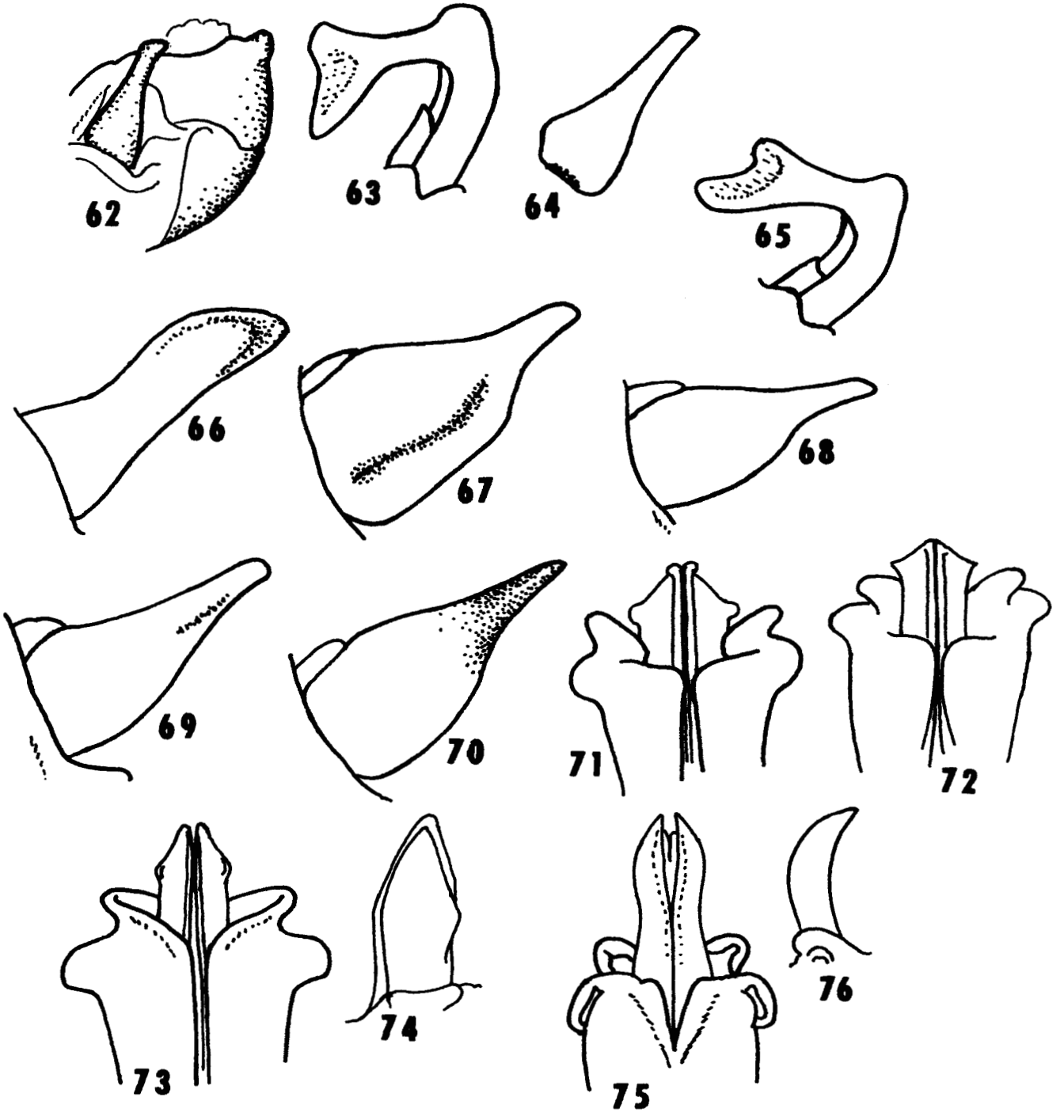
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Fig. 77. *Melanoplus femur-rubrum* (DeGeer), left cercus, male.
Fig. 78. *Melanoplus S. sanguinipes* (Fabricius), left cercus, male.
Fig. 79. *Melanoplus s. sanguinipes* (Fabricius), aedeagus, left side.
Fig. 80. *Melanoplus devastator* Scudder, left cercus, male.
Fig. 81. *Melanoplus devastator* Scudder, aedeagus, left side.
Fig. 82. *Melanoplus borealis palaceus* Fulton, left cercus, male.
Fig. 83. *Melanoplus borealis palaceus* Fulton, aedeagus, left side.
Fig. 84. *Melanoplus packardii* Scudder, left cercus, male.
Fig. 85. *Melanoplus yarrowii* (Thomas), left cercus,male.
Fig. 86. *Melanoplus bivittatus* (Say), left cercus, male.
Fig. 87. *Melanoplus differentialis nigricans* Cockerell, left cercus, male.
Fig. 88. *Melanoplus alpinus* Scudder, left cercus, male.
Fig. 89. *Melanoplus herbaceus* Bruner, left cercus, male.
Fig. 90. *Melanoplus herbaceus* Bruner, epiproct and furcula, male.
Fig. 91. *Melanoplus cinereus* Scudder, left cercus, male.
Fig. 92. *Melanoplus complanatipes* Scudder, left cercus, male.

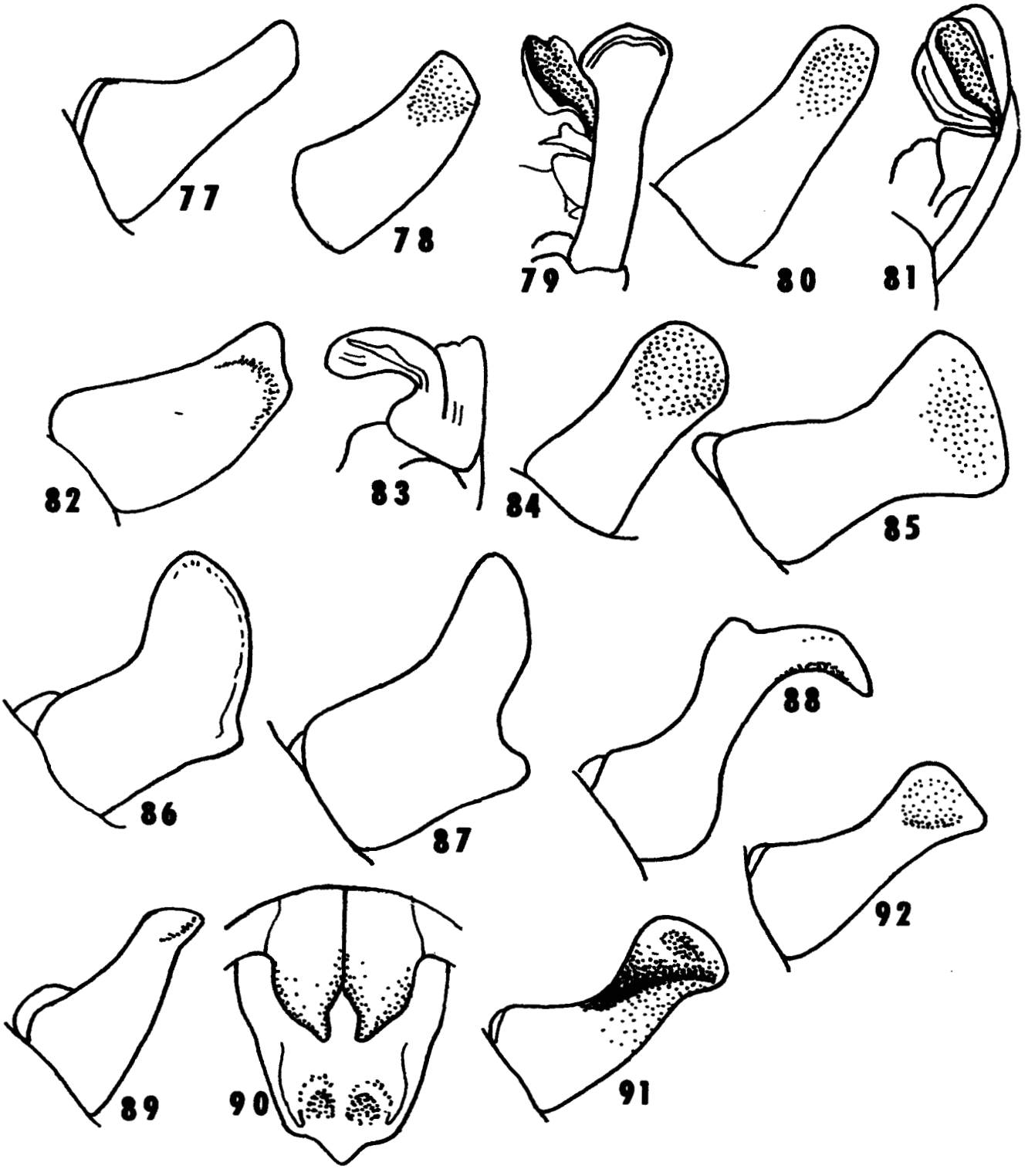
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Fig. 93. *Melanoplus rugglesi* Gurney, left cercus, male.
Fig. 94. *Melanoplus marginatus* (Scudder), left cercus, male.
Fig. 95. *Melanoplus huporeus* Hebard, left cercus of paratype male.
Fig. 96. *Melanoplus huporeus* Hebard, left cercus of Hopland male.
Fig. 97.* *Melanoplus huporeus* Hebard, aedeagus, caudal view.
Fig. 98. *Melanoplus fricki* Strohecker, left cercus, male.
Fig. 99.* *Melanoplus fricki* Strohecker, aedeagus, caudal view.
Fig. 100. *Melanoplus hesperus* Hebard, aedeagus, caudal view, ammonia-inflated in situ.
Fig. 101. *Melanoplus sonomaensis* Caudell, left cercus, male, from pencil drawing by A. B. Gurney.
Fig. 102. *Melanoplus sonomaensis* Caudell, aedeagus, caudal view, from pencil drawing by A. B. Gurney.
Fig. 103. *Melanoplus muricolor* Strohecker, left cercus, male.
Fig. 104.* *Melanoplus muricolor* Strohecker, aedeagus, caudal view.
Fig. 105. *Melanoplus ligneolus* Scudder, left cercus, male.
Fig. 106.* *Melanoplus ligneolus* Scudder, aedeagus, caudal view.
Fig. 107. *Melanoplus nanus* Scudder, left cercus, male.
Fig. 108.* *Melanoplus nanus* Scudder, aedeagus, caudal view.
Fig. 109. *Melanoplus fultoni* Hebard, left cercus, male.
Fig. 110. *Melanoplus fultoni* Hebard, aedeagus, caudal view (KOH).

*Right, the aedeagus as it appears when dried; left, as a KOH-glycerol preparation.

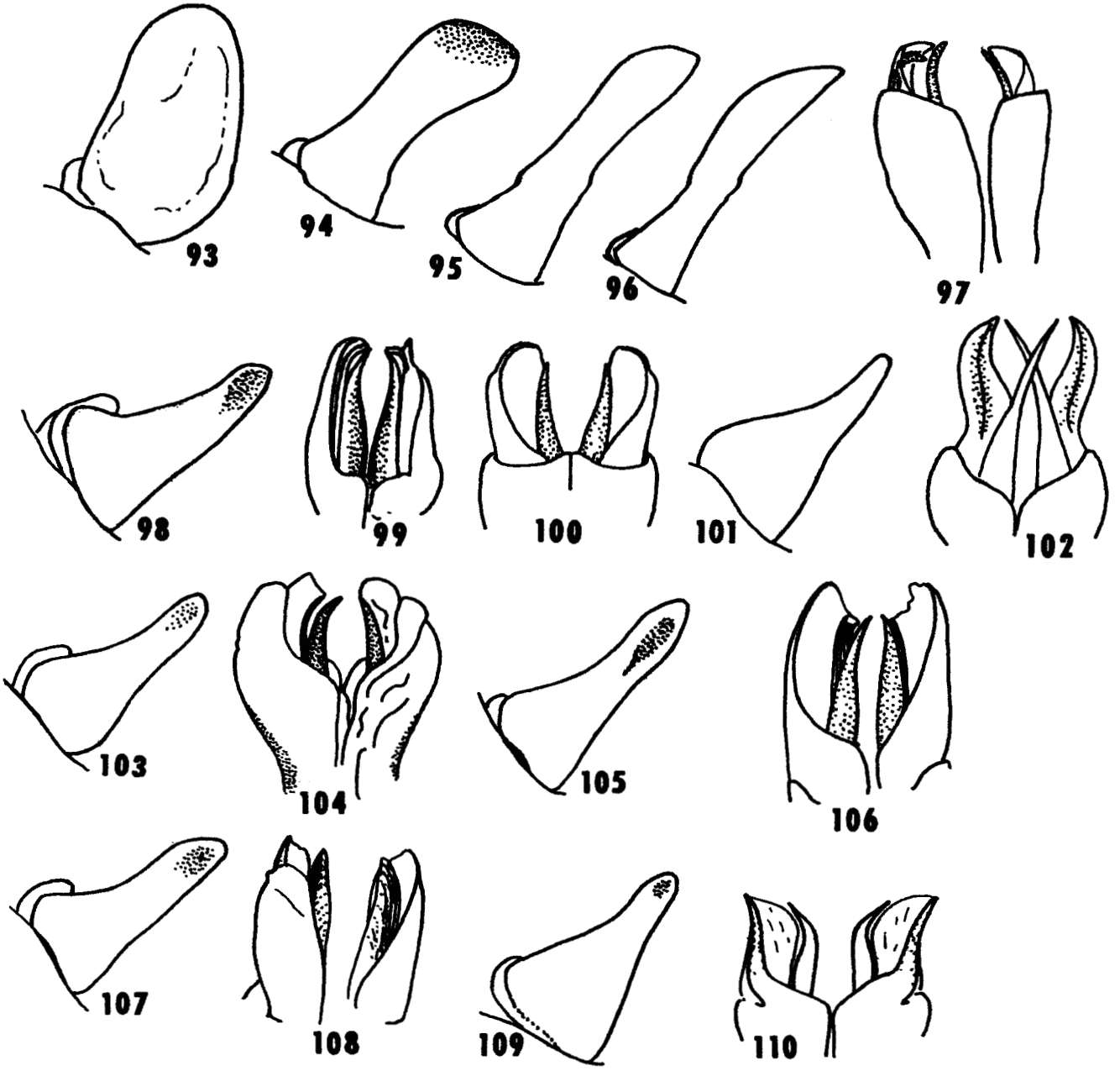
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Fig. 111. *Melanoplus gracilipes* Scudder, left cercus, male.
Fig. 112. *Melanoplus microtatus* Hebard, left cercus, male.
Fig. 113. *Melanoplus microtatus* Hebard, aedeagus, caudal view, ammonia-inflated in situ.
Fig. 114. *Melanoplus aspasmus* Hebard, left cercus, male.
Fig. 115. *Melanoplus fultoni* Hebard, left cercus, paratype male.
Fig. 116. *Melanoplus fultoni* Hebard, aedeagus of paratype male, caudal view, ammonia-inflated in situ.
Fig. 117. *Melanoplus rileyanus* Scudder, left cercus, male.
Fig. 118.* *Melanoplus rileyanus* Scudder, aedeagus, caudal view.
Fig. 119. *Melanoplus olamentke* Hebard, left cercus, male.
Fig. 120.* *Melanoplus olamentke* Hebard, aedeagus, caudal view.
Fig. 121. *Melanoplus keiferi* Gurney & Buxton, left cercus, male.
Fig. 122. *Melanoplus chimariki* Gurney & Buxton, left cercus, male.
Fig. 123. *Melanoplus platycercus* Hebard, left cercus, male.
Fig. 124. *Melanoplus ablutus* Scudder, left cercus, male.
Fig. 125. *Melanoplus caroli* Gurney & Helfer, left cercus, male.
Fig. 126. *Melanoplus caroli* Gurney & Helfer, aedeagus, caudal view (KOH).

*Right, the aedeagus when dried; left, after KOH-glycerol treatment.

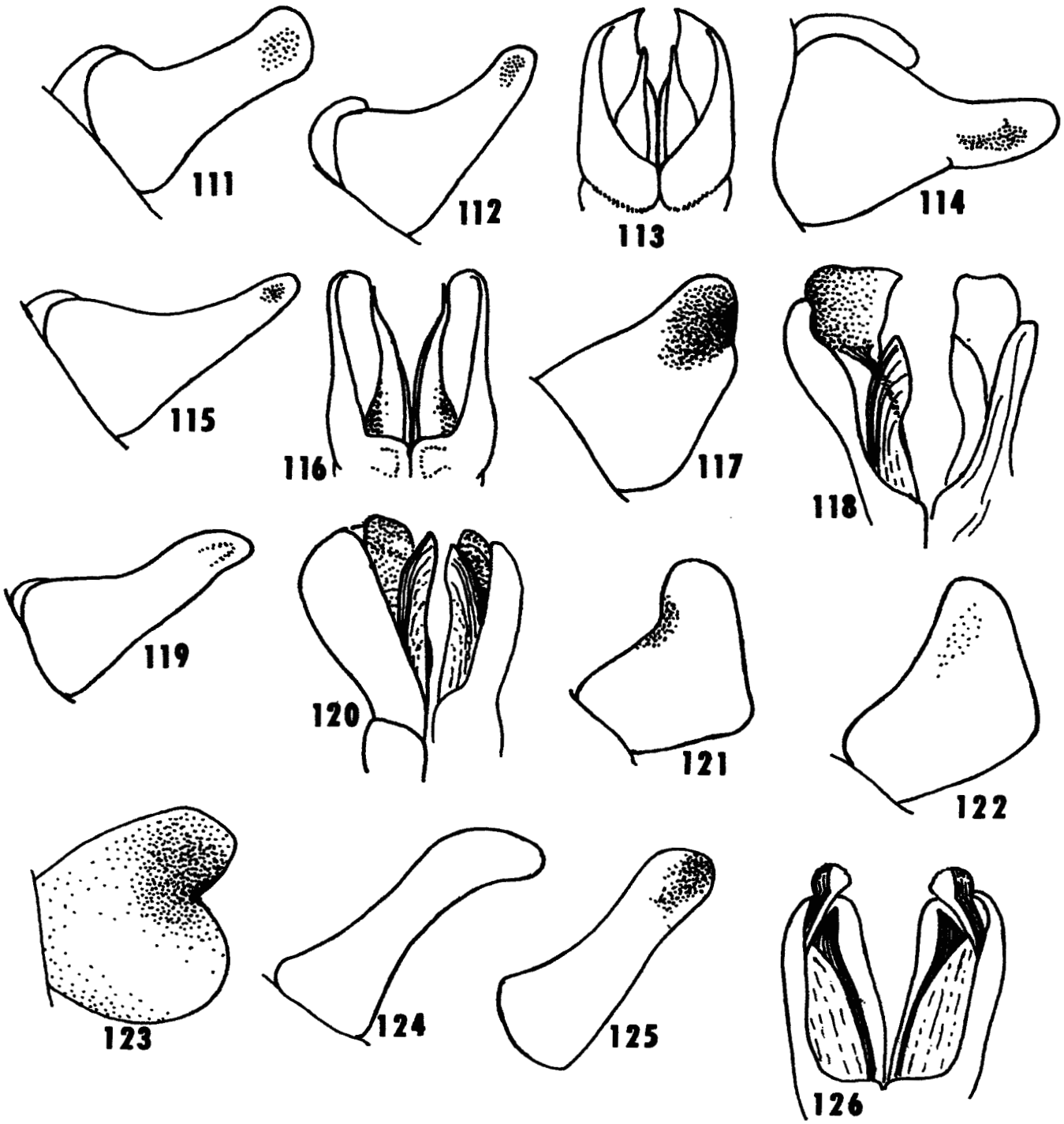
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Fig. 127. *Melanoplus wilsoni* Gurney, left cercus, male. (Redrawn from Gurney.)
Fig. 128.* *Melanoplus wilsoni* Gurney, aedeagus, caudal view. (Redrawn from Gurney.)
Fig. 129. *Melanoplus wintunus* Strohecker and Helfer, left cercus, male.
Fig. 130.* *Melanoplus wintunus* Strohecker and Helfer, aedeagus, caudal view.
Fig. 131. *Melanoplus hupah* Strohecker and Helfer, left cercus, male.
Fig. 132.* *Melanoplus hupah* Strohecker and Helfer, aedeagus, caudal view, left side partly dissected.
Fig. 133. *Melanoplus eremitus* Strohecker, left cercus, male.
Fig. 134.* *Melanoplus eremitus* Strohecker, aedeagus, caudal view.
Fig. 135. *Melanoplus bernardinae* Hebard, left cercus, male.
Fig. 136.* *Melanoplus bernardinae* Hebard, aedeagus, caudal view.
Fig. 137. *Melanoplus lepidus* Scudder, left cercus of male.
Fig. 138.* *Melanoplus lepidus* Scudder, aedeagus, caudal view.

*KOH-glycerol preparations.

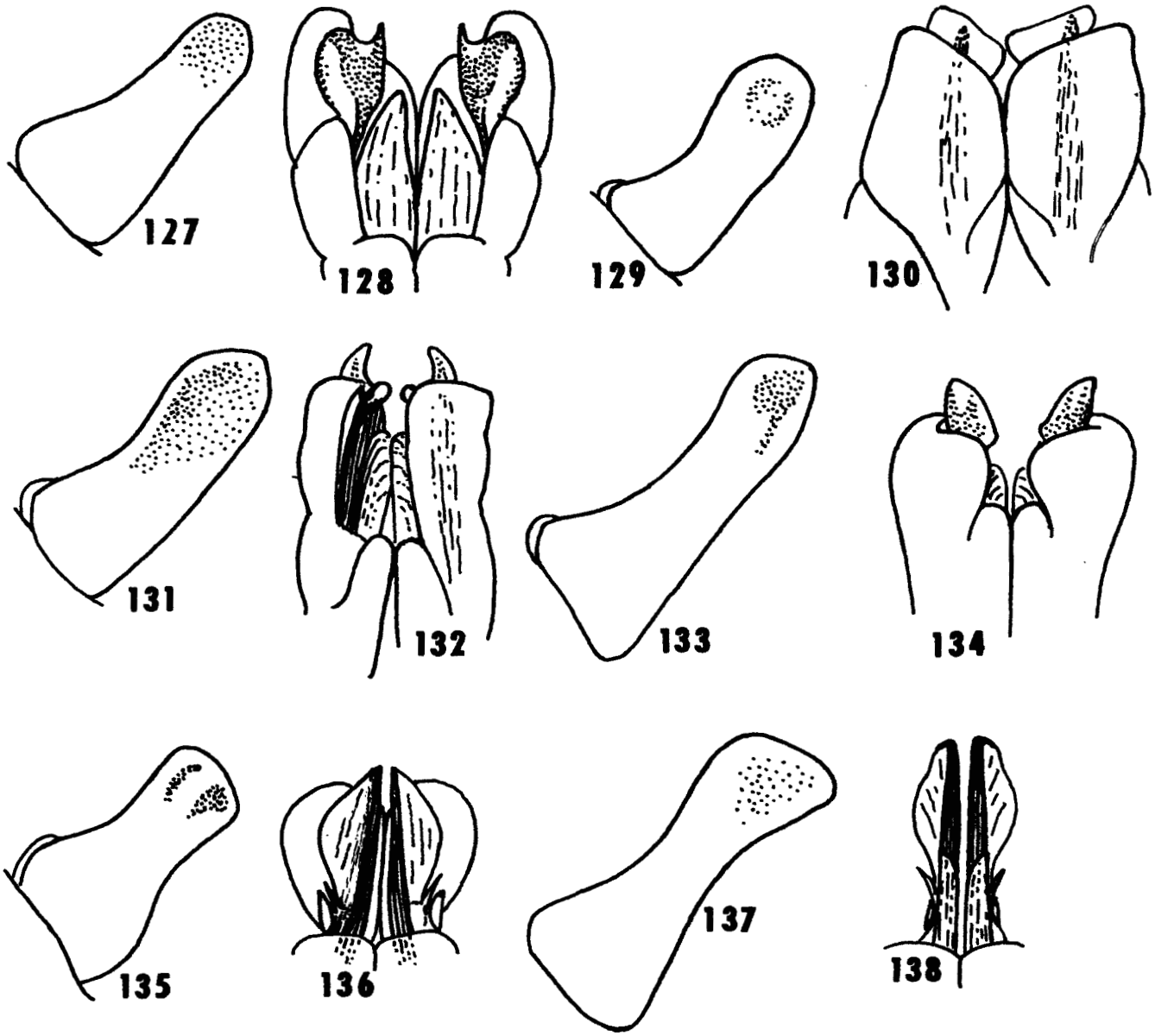
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Fig. 139. *Melanoplus buxtoni* Strohecker, left cercus, male.
Fig. 140. *Melanoplus buxtoni* Strohecker, aedeagus, caudal view in situ.
Fig. 141. *Melanoplus elaphrus* Strohecker, left cercus, male.
Fig. 142.* *Melanoplus elaphrus* Strohecker, aedeagus, caudal view.
Fig. 143. *Melanoplus elater* Strohecker, left cercus, male.
Fig. 144.* *Melanoplus elater* Strohecker, aedeagus, caudal view.
Fig. 145. *Melanoplus a. ascensus* Scudder, left cercus, male.
Fig. 146.* *Melanoplus a. ascensus* Scudder, aedeagus, caudal view.
Fig. 147. *Melanoplus siskiyou* Strohecker, left cercus, male.
Fig. 148.* *Melanoplus siskiyou* Strohecker, aedeagus, caudal view.
Fig. 149. *Melanoplus* sp. (Del Norte Co.), left cercus, male.
Fig. 150.* *Melanoplus* sp. (Del Norte Co.), aedeagus, caudal view.

*KOH-glycerol preparations.

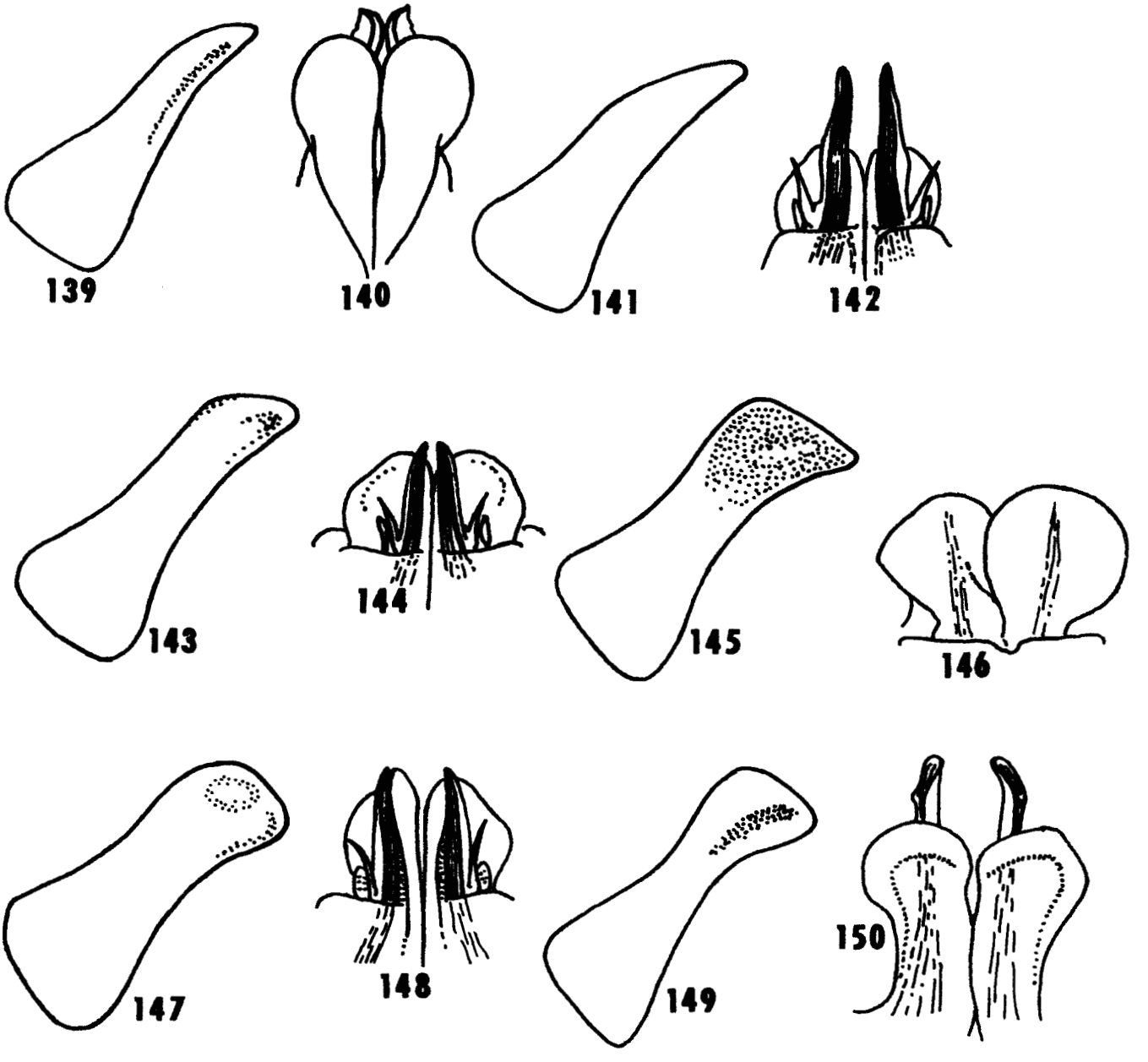
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Fig. 151 *Melanoplus* sp. of Aridus Group (Clark Co., Nev.), left cercus, male.
Fig. 152. *Asemoplus sierranus* Hebard, left cercus, male.
Fig. 153. *Hebardacris albida* (Hebard), left cercus, male. (Redrawn from Hebard.)
Fig. 154. *Hebardacris excelsa* (Rehn), left cercus, male. (Redrawn from Hebard.)
Fig. 155. *Hebardacris sp.* (White Mts., Mono Co.), left cercus, male.
Fig. 156. *Bradynotes obesa opima* Scudder, left cercus, male.
Fig. 157. *Bradynotes obesa deplanata* Hebard (Chemult, Ore.), left cercus, male.

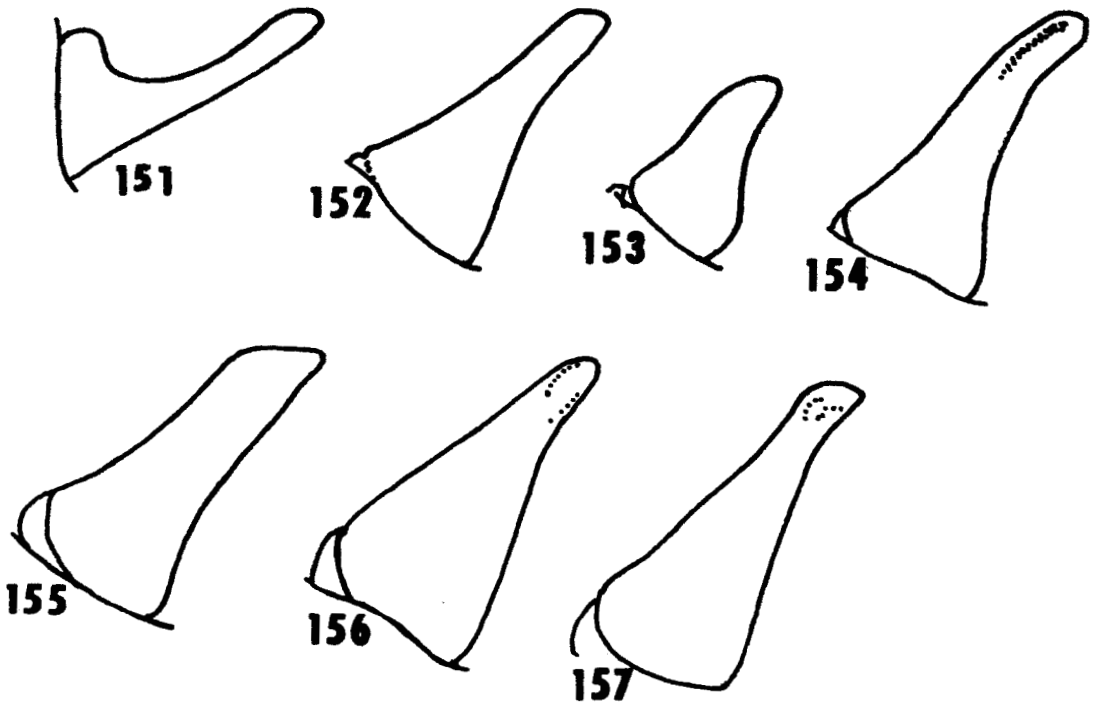
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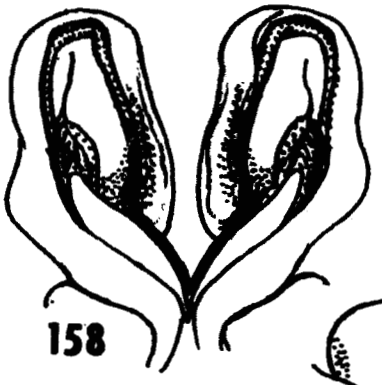
Fig. 158.* *Melanoplus complanatipes* Scudder, aedeagus, caudal view.
Fig. 159. *Melanoplus complanatipes* Scudder, left cercus, male (Mono Co.)
Fig. 160. *Melanoplus complanatipes* Scudder, epiphallic lophi, caudal view.
Fig. 161.* *Melanoplus cinereus* Scudder, aedeagus, caudal view.
Fig. 162. *Melanoplus cinereus* Scudder, epiphallic lophi, caudal view.
Fig. 163.* *Melanoplus microtatus* Hebard, aedeagus, caudal view.
Fig. 164. *Melanoplus harperi* Gurney & Buxton, left cercus, male.
Fig. 165.* *Melanoplus* sp., aedeagus, caudal view.
Fig. 166. *Melanoplus* sp., left cercus, male.
Fig. 167. *Oedaleonotus pacificus* (Sc.), male topotype, epiproct and cerci, dorsal view.
Fig. 168. *Oedaleonotus orientis* Hebard, male, (Modoc Co.), epiproct and cerci, dorsal view.

*KOH-glycerol preparations.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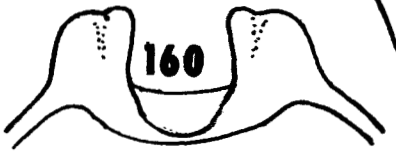
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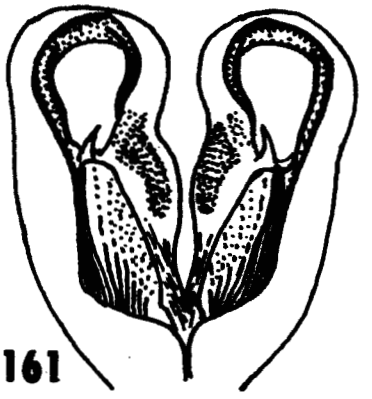
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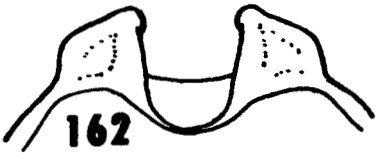
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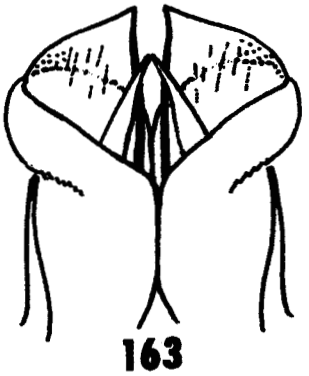
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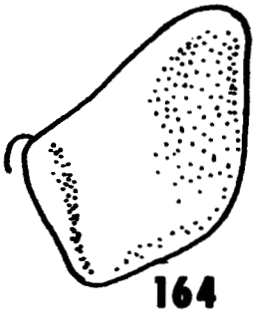
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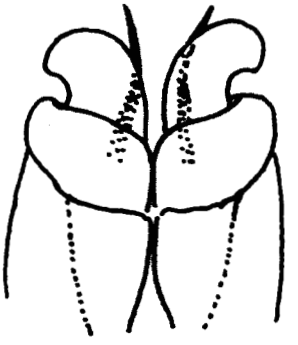
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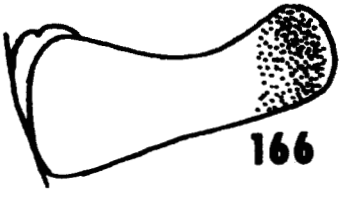
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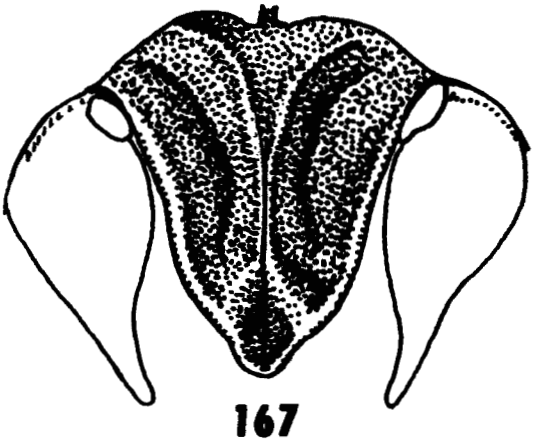
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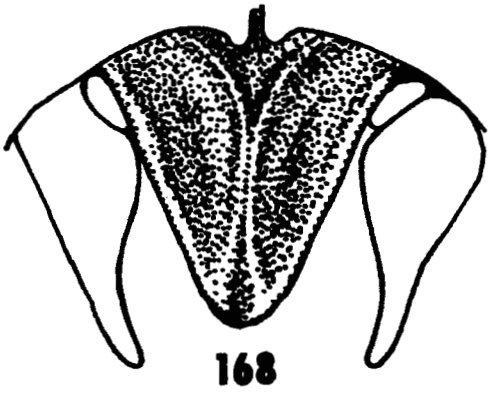
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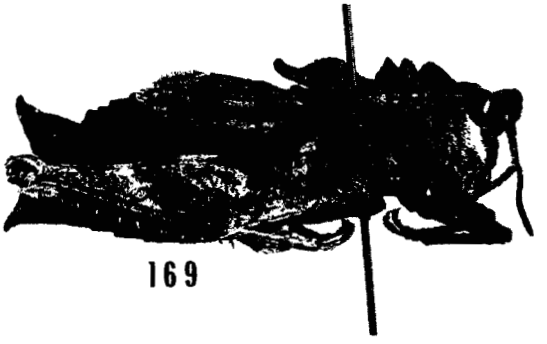
Fig. 169. *Dracotettix monstrosus* Bruner.
Fig. 170. *Tytthotyle maculata* (Bruner).
Fig. 171. *Circotettix shastanus* Bruner.
Fig. 172. *Circotettix splendidus* Rehn and Hebard.
Fig. 173. *Aerochoreutes maculatus* (Scudder).
Fig. 174. *Bootettix punctatus* (Scudder).
Fig. 175. *Leptysma hebardi* Rehn and Eades.



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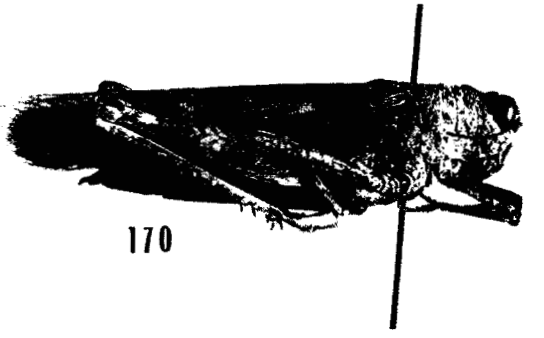

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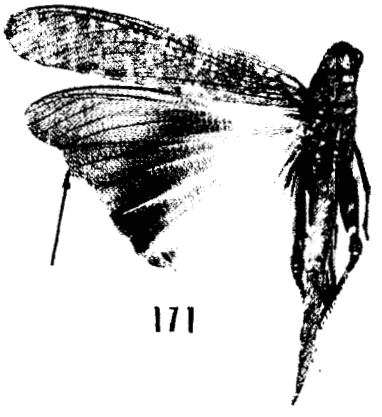

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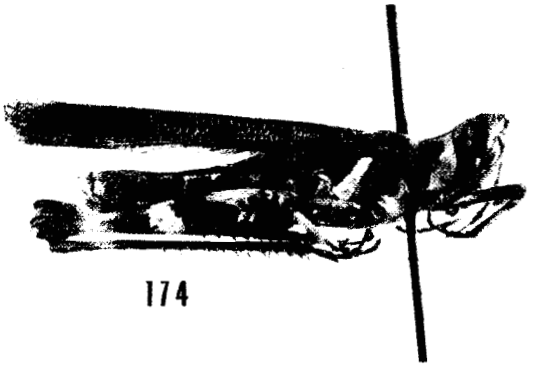

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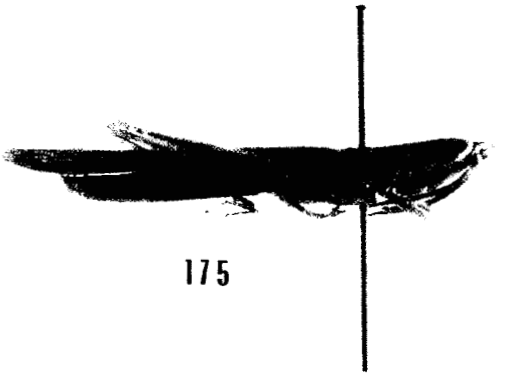

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