

## Biological, Taxonomic and Faunistic Studies on the Shield-Back Katydid of the North American Deserts

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The purpose of this paper is to present what is known concerning the Biology, Taxonomy and Faunistics of the Decticids or Shield-Back Katydid of the North American Deserts. At the same time, an attempt will be made to define and characterize the North American Deserts.

The material presented in these pages to follow, results from the writer's numerous trips and expeditions to the Desert regions during the period 1928 to 1940. What is given on the biology of these rare creatures comes largely from first-hand knowledge, although it is admitted that much is to be ascertained still about the particular life history of each species. Many species of Decticids are so rare that only a single specimen or two is to be found in the museums of North America.

### Desert Studies

The Desert of Lower California is the only one of the North American Deserts that has not been visited by the writer. During the period 1928 to 1930, the writer studied Chihuahuan Desert of the Big Bend Region of Trans-Pecos Texas while stationed at Presidio, Texas. Later during the summers of 1930 and 1931, the writer, as field collector for Mr. Morgan Hebard of the Academy of Natural Sciences of Philadelphia, collected in southwestern Texas, New Mexico, Arizona, California, Nevada and Utah. Five new Decticids were taken on these trips and these were described by Mr. Hebard in the spring of 1934. Again in 1938, the writer, accompanied by his brother, conducted a private trip to Washington, Oregon, California, Nevada and Arizona. In October, 1939, a journey was made through northwestern Arizona, southern Nevada, Death Valley, the Panamints, Funeral and Inyo ranges to the high Sierra Nevadas of California and in November another excursion carried the author far south into the Mexican state of Sonora. The spring and summer of 1940 was spent in the Arizona deserts and in early August, Dr. Forrest Shreve and the writer embarked on an expedition to northeastern Mexico. Large tracts of virgin desert in southern Coahuila, northern Zacatecas, northern San Luis Potosi and southwestern Nuevo Leon were explored and the eastern limits of the Chihuahuan Desert fixed for the first time in this unknown area. The southern boundary of the Chihuahuan or Eastern Desert tract in the heart of Mexico remains unexplored.

### Characteristics of the Desert

The North American Deserts are considered as belonging to the lower Sonoran Faunal Region of the Zoogeographers. They all possess a certain daily temperature range fluctuating between a high diurnal maximum that often reaches 125 degrees Fahrenheit and a lower nocturnal minimum coming just before the dawn. Because the vegetation is sparse and the desert pavement bare the temperature often drops rapidly following sundown, especially during the winter months. Some deserts such as the Sahara and the Gobi are considered geological deserts because they are barren wastes of sand. In contrast the North American deserts possess a definite fauna and flora, peculiar to each type, and are in reality biological deserts. The North American deserts each possess a definite rainfall period varying from five to 10 inches in the various deserts. As the rains are irregular and indefinite, drouths of long and short periods are characteristic. The open stand of vegetation and the exposed and barren desert floor coupled with low humidity and high temperatures produce excessive evaporation. Usually during a normal rainy season sufficient moisture falls on any particular desert to send the vegetation bursting into full bloom in a surprisingly short period of time. For instance Ocotillo (*Fouquieria splendens*) comes forth fully leaved within two days of a good shower breaking a drouth of many months duration. Frost is practically unknown in certain deserts, such as the Sonoran Desert, and the distribution of many plants, such as *Olneya tesota* and *Atriplex hymenolytra* are strictly limited to the frost-free areas of the desert. Water courses are very rare and even large streams coming out of the nearby high mountains are soon licked up by the avid air or disappear beneath the sands to occasionally reappear where rock ledges force the underground water to the surface again.

The plant life is characterized by succulents and microphyllous xerophytes. Succulents include many genera of cacti such as: *Opuntia Mammalaria*, *Ferocactus*, *Echinocereus*, *Peniocereus*, *Coryphantha* and *Asterophyton* and many others. Giant cacti such as the Sahuaro, *Gigantocereus*, Organ Pipe *Lemaireocereus*, and *Pachycereus* add a strong forest-like vista to certain desert types. Microphyllous xerophytes include numerous genera such as: Creosote Bush *Larrea*, Ocotillo *Fouquieria*, Palo Verde *Parkinsonia* and *Cercidium*, Mesquite *Prosopis*, Acacias, Mimosas, Condalias, Lyciums and many others. Plants with long stemmy thorns include *Koeberlinia*, *Canotia* and *Holocantha*. Flowering plants are found growing along the water courses where the arroyos rush by during the storms, in clumps of desert shrubs, and in crevices and the protection of rocks; of these Composites predominate. Xeric ferns such as *Notholaena*, *Cheilanthes*, *Pellaea* and other genera are found growing in the crevices of rocks in the desert mountains. The Resurrection plant, *Selaginella* is a common member of the desert hillside flora.

Out of this vast assemblage of desert plants one in particular more accurately delineates the extent of the deserts of North America by its distribution than any other plant and that is the Creosote bush, *Larrea divaricata*. The periphery of its extensive dispersal is taken to be that of the Sonoran and Chihuahuan Deserts. The Great Basin Desert is delimited by the Sagebrush *Artemisia tridentata*. Another desert plant, Ocotillo, has much the

same range as the Creosote bush. Although the Creosote bush outlines the extent of the desert it is not sufficient to characterize the flora of the North American Deserts for associated with it are many other plants, shrubs and trees characterizing each of the desert types.

### Floristic Composition and Distribution of the North American Desert

North America possesses four main deserts namely, the Sonoran, Chihuahuan, Great Basin and Lower Californian desert. Each possesses a distinctive fauna and flora. The Sonoran and Chihuahuan deserts are divisible into certain subtypes.

#### THE CHIHUAHUAN DESERT

The Chihuahuan Desert is the Eastern Desert tract of southwestern Texas and northeastern Mexico. This desert occupies the Rio Grande Valley from the Pecos River westward sending long arms up the Pecos River to the Carlsbad vicinity in New Mexico; up the Otero Basin to Alamogordo and the Rio Grande valley in New Mexico north as far as Albuquerque. Chihuahuan vegetation also extends into the southeastern corner of Arizona. In Mexico the Chihuahuan desert occupies the eastern half of the State of Chihuahua and northern Durango and Coahuila east to the western edge of the Sierra Madres Oriental. In the Saltillo-Monterrey section the desert breaks through a pass to within fifteen miles of Monterrey at the east base of the Sierra Madres Oriental. In southern Coahuila several high sierras of limestone rock extend from the Sierra de Parras east to Carneros Pass, just south of Saltillo, and more or less isolate the Chihuahuan desert from the higher Creosote valleys to the south of these sierras. This area has been called the Valle de Salado. It is largely unexplored; one of the first expeditions to this region was made by Dr. Forrest Shreve and the writer in August and September of 1940. Present indications tend to show that this region with its interesting fauna and flora may ultimately be considered a subtype of the Chihuahuan Desert. It is here called the Desert of Salado and two new Dectidids will be described from that desert.

Dominant plants of the Chihuahuan Desert are: *Larrea divaricata*, *Agave lechuguilla*, *Flourensia cernua*, *Prosopis chilensis*, *Fouquieria splendens*, *Dasylyrion texanum*, *Koeberlinia spinosa*, *Sericodes greggi*, *Acacia greggi*, *farnesiana*, *paucispinosus*, *vernicaosa*, *Jatropha spathulata*, *Berberis trifoliata*, *Condalia lyciodes*, *Lippia lyciodes*, *Opuntia lindheimeri* and other spp., *Mammalaria* spp., *Echinocereus stramineus*, *conglomeratus*, *Ferocactus ingens*, *F. longihamatus*, *Yucca macrocarpa*, *Y. treculiana*, *Candelaria antisiphiliticus*, *Coldenia greggi*, *C. canescens* and many other typical plants.

The principal plants of the Solado Desert includes such species as: *Larrea divaricata*, *Hectia* sp., *Lycium leiospermum*, *Agave lechuguilla*, *Ephedra antisiphiliticus*, *Mortonia hidalgensis*, *Symphora secundiflora*, *Cassia wislizeni*, *Prosopis* spp., *Dasylyrion longissima*, *Opuntia tunicata*, *Ferocactus pringlei*, *Yucca carnerosana*, and a great variety of other cacti and plants.

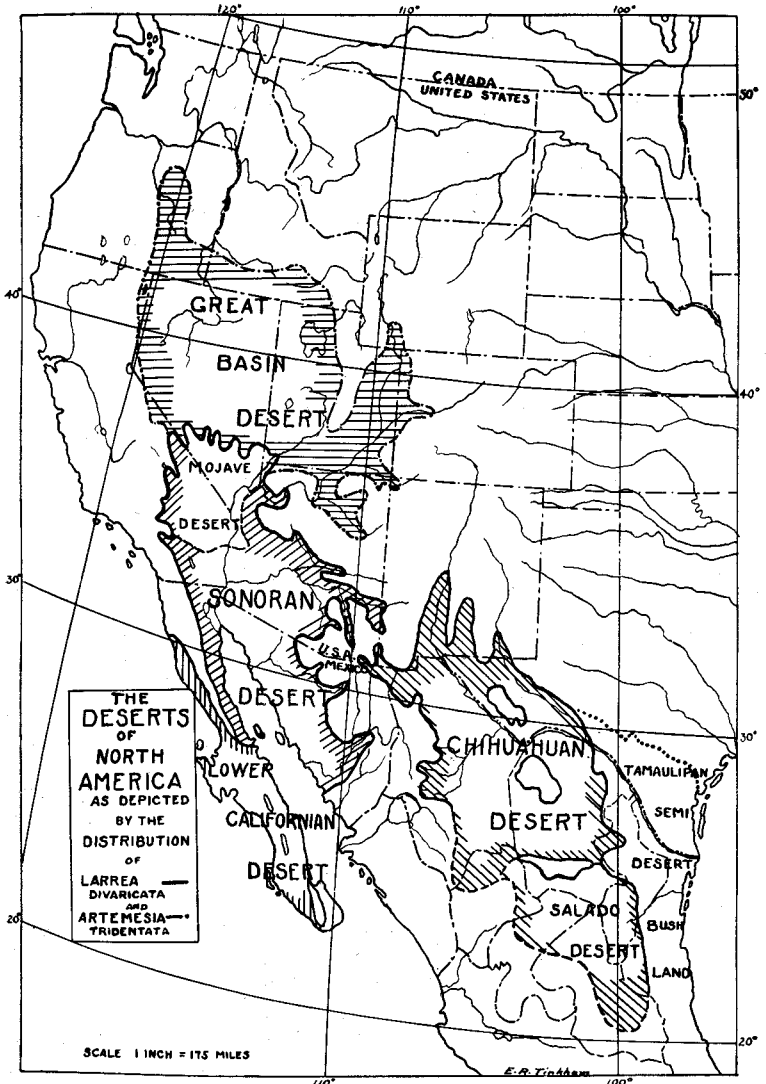


Fig. 1. Map defining the extent of the deserts of North America.

## TAMAULIPAN SEMI-DESERT BUSHLAND

The coastal plains east of the Sierra Madres Oriental and the eastern slopes of this steep range of mountains are dominated by a semi-tropical vegetation that becomes taller and denser as one proceeds south of Laredo. At Salinas Hidalgo the height of this vegetation is less than ten feet, at Monterrey over ten feet in height and at Ciudad Victoria the height of this bushland would average twenty feet. This vegetation is here called the Tamaulipan Semi-Desert Bushland. It extends from the southern edge of the Edwards Plateau, just north of Uvalde, Texas, south to Tampico and from the Pecos River and the Sierra Madres Oriental east to the Gulf of Mexico. In the Laredo region the common plants are: *Acacia berlandieri*, *A. roemeriana*, *A. wrightii*, *Prosopis glandulosa*, *Opuntia lindheimeri*, *Circidium macrum*, *Porlieria angustifolia*, *Leucophyllum misum* and other plant species. As one progresses south other dominants appear. At the Rio Salado *Cordia boussieri* and *Karwinskia humboltiana* appear and soon, if it is late August, the sweet yellow catkins of *Pithecolobium brevifolium* scent the air and stretch like a sea of yellow before one's eyes. Other species such as *Agave americana*, *Yucca australis* with its pendant fruiting masses, *Gochmatia hypoleuca*, *Mimosa pigra* add new interest to the flora. Just north of Ciudad Victoria at the Rio Santa Garcia, the tall organ-pipe-like giant cactus *Myrtilocactus geometrizans* grows in the tall bushland which now averages twenty feet in height. South of Ciudad Victoria this Bushland merges with the tropical forests found at Tamazunchale.

## THE SONORAN DESERT

The Sonoran Desert occupies all of southern Arizona south of the Mogolon Rim following up the Gila River to the eastern edge of Arizona, up the San Pedro to Naco where it meets an influx of Chihuahuan plants such as *Acacia vernicosa*, *Flourensia cernua*, and *Forestiera angustifolia*, and the Santa Cruz and Altar Valleys but does not reach the Mexican boundary. West of the Baboquivari mountains the desert extends south to the Yaqui river where it merges with the Sinaloan Thorn Forest. The northern limits of the Sonoran Desert are the extreme southwestern corner of Utah and southern Nevada where long tongues of Creosote extend up the valley floors between the numerous mountain ranges. Creosote is found in Death Valley and on the slopes of the barren mountains of the neighborhood such as the Funeral, Panamint and Inyo mountain ranges. The outposts of *Larrea* extend to five miles north of Olancho in Owens Valley at the east base of the Sierra Nevadas. The western limits of the Sonoran Desert are the Tehachapi, San Gabriel, San Bernardino, Santa Rosa and the Laguna mountains of California, and the Sierra del Capirote and San Pedro Martia mountains of Baja California. The southern limits are approximately opposite Tiburon Island according to the authority, Dr. Forrest Shreve.

Subdivisions of the Sonoran Desert include the well known Mojave Desert lying north and east of the San Bernardino Mountains north to the limits of *Larrea* and east to the Colorado River and crossing into Arizona north of the Williams River.

The extreme desert of Imperial valley lying south of the San Bernardino and north of the Gulf of California and east of the Santa Rosa, Laguna and Capirote mountains to the Colorado has often been called the Colorado Desert but this subdivision is somewhat debatable.

The dominant plants of the Sonoran Desert include: *Larrea divaricata*, *Prosopis velutina*, *P. juliaeflora*, *Cercidium torreyanum*, *Olneya tesota*, *Acacia constricta*, *Opuntia fulgida*, *O. versicolor*, *O. engelmanni*, *O. arbuscula*, *O. acanthocarpa*, *Dondia menzeii*, *Krameria spinosa*, *Franseria deltoidea* and other plants. On the south slopes of the mountains the Sahuaro-Palo Verde-Encelia Zone is found characterized by such plants as the Sahuaro *Gigantocereus carnegiei*, Palo Verde *Parkinsonia microphylla* and *Cercidium aculeata*, *Encelia farinosa*, *Opuntia bigelovii*, *Jatropha cardiophylla*, *Fouquieria splendens*, *Coursettia glandulosa*, *Acacia dysocarpa*, *Erythrina flabelliformis*, *Lemaireocereus thurberi* the Organ-Pipe Cactus and other interesting plants.

The principal plants of the Colorado Desert include such species as *Larrea divaricata*, *Franseria dumosa*, *Coldenia palmeri*, *Parosela spinosa*, *Cercidium floridum*, *Eriogonum deflexum*, *Petalonyx thurberi*, *Agave deserti*, *Washingtonia filifera* a Palm, *Oenothera deltoidea*, *Eriogonum inflatum*, *Opuntia bigelovii* and many others.,

#### MOJAVE DESERT

The Mojave Desert has an interesting flora, the following being characteristic of that desert: *Yucca brevifolia* the Joshua Tree, *Y. mojavenis*, *Y. baccata*, *Larrea divaricata*, *Franseria dumosa*, *Holocantha emoryi*, *Coleogyne ramossisima*, *Hymenoclea salsola*, *Atriplex confertifolia*, *A. canescens*, *Allerrolfea occidentalis*, *Canotia holocantha*, *Opuntia acanthocarpa*, *O. parishii*, *ursina*, *O. mojavenis*, *Cereus mojavenis*, *C. engelmanni*, and many other interesting plants.

#### THE GREAT BASIN DESERT

North of the Sonoran and Mojave Deserts, the Great Basin Desert of Sagebrush is found covering all of northern Nevada, most of Utah except the high mountains, western Colorado, northeastern Arizona and southeastern Oregon and the northeastern corner of California. The dominant plant of this vast desert is *Artemisia tridentata*, the Desert Sagebrush, popularly known as the "Purple Sage" of the novelists. Unlike the Sonoran and Chihuahuan Deserts, the Sagebrush Desert is far less conspicuous and with a more uniform plant coverage of low height. No Yuccas, Ocotillos or mesquites are to be seen adding variety to the desert landscape as they do farther south. Cacti are few and of small size. Junipers are found at higher elevations in the mountains with sagebrush plants nearby.

Characteristic plants of the Great Basin Desert are: *Artemisia tridentata*, *A. nova*, *A. spinescens*, *Atriplex confertifolia*, *Grayia spinosa*, *Chrysothamnus nauseosus*, *C. graveolans*, *Sarcobatus vermiculatus*, *Tetradymia spinosa*, *Coleogyne ramossisima*, *Kochia vestita*, *Eurotia lanata*, *Cowania stansburiana*, *Hilaria jamesii* and other species.

## LOWER CALIFORNIAN DESERT

The southern half of the Californian Peninsula is occupied by a strange desert that is little known at present. It is one of the few areas that the writer does not know from first-hand experience. Its extreme isolation, aridity and inaccessibility accounts for its obscurity and strangeness. The plants recorded here are taken from Dr. Forrest Shreve's "A Desert by the Sea." The principal plant is the bizarre and remarkable *Citro Idria columnaris* that with their stout tall trunks and twisted spiny limbs resemble a burnt-over pine forest. Other characteristic plants are: terote, *Pachycormus discolor*, *Yucca valida* the Giant Yucca, *Agave goldmaniana*, *Pachycereus pringlei* the Giant Cactus, Ocotillo *Fouquieria peninsularis*, and the creeping devil *Machaerocereus eruca*. Areas along the Pacific coast in this desert despite the lack of rain have high and incessant winds laden with moisture. Not until road conditions are bettered can it be expected that this strange desert will be more frequently studied.

## Zoogeography of the Decticinae

The North American Deserts possess a rich and varied Orthopteran fauna. The Band-winged Grasshoppers of the subfamily Oedipodinae predominate with the Cyrtacanthacrinae and Acridinae close seconds. The Katydids of the family Tettigoniidae are fewer in number and of these the Shield-back Katydids of the subfamily Decticinae are the richest in species, strangest in form and rarest in collections.

Twenty-seven genera of Nearctic Decticinae are to be found in Mexico, United States and Canada, comprising a total of ninety-one species. Of this assemblage several are boreal in habits and distribution, others are campestrian or dwelling on the Great Plains, some monticolous or dwelling in mountains, but the great majority are eremiophilous or inhabitants of the great North American Deserts. To California belongs the honor of having the richest Decticid fauna in North America with some thirteen genera and thirty-nine species known to date. Perhaps no other region of the world possesses a more interesting and varied fauna than this state. The zoocenter of distribution of the Nearctic Decticids appears to be Owens Valley at the east base of the Sierra Nevadas where no less than nine genera and fifteen species have been found.

Of the Neogeic genera, one species *Metrioptera sphnagorum*, closely allied to Siberian species, is found in northern Canada. *Metrioptera* is unquestionably a Gerontogeic genus with some sixty known species on the Eurasian continent. *Atlanticus* is an even more interesting genus with nine North American species known from the Eastern United States between the Mississippi River and the Atlantic seaboard and from Maine to Florida. Ten species are known from eastern China and Siberia, of which seven have been newly described by the writer.\* *Pediodes* is largely a Great Plains genus as is also

\* Zoogeographical Notes on the Genus *Atlanticus* with Keys and Descriptions of Seven new Chinese Species. Notes d'Entomologie Chinoise, Shanghai, fall of 1940. Not yet received.

*Anabrus simplex*, the Mormon Cricket. *Hubbellia* is known only from Florida. *Anabrus*, *Peranabrus*, *Steiroxys*, and *Apote* are northwestern genera largely confined to Washington, Idaho and British Columbia. *Idionotus* and *Climopleura* and *Decticita* are restricted to the western side of the Sierra Nevadas of California. The rare *Acrodictes philopagus* is found feeding on rock lichens at Arctic temperatures at elevations of 12,000 to 13,000 feet above timberline on the slopes of Mt. Whitney, the highest peak in the United States. *Neobarrettia* and "Stipator" are Mexican genera. The remaining genera, 15 in number, to be discussed in the following pages, are found on the North American Deserts.

### Host Plant Relationships

The Shield-back Katydid of the various deserts naturally find their host plants in some of the dominant plants of the desert. It is interesting that such a plant as the Creosote bush despite its sticky pungent leaves should have eighteen species of Orthoptera feeding on it in the Chihuahuan and Sonoran Deserts. Of this number five are grasshoppers, two crickets, three katydids and six are Shield-backs. The Sagebrush also has a large associated fauna of dectidids. Mesquites and Acacias are also favored for the protection they give and even pines have some species.

A summary is here given of the Desert Dectidids according to their host plant. The Creosote bush has the following Chihuahuan dectidids: *Rehnia cerberus*, *Eremopedes scudderi* and *Eremopedes covilleae* while the Sonoran Desert claims *Eremopedes bilineatus*, *Ateloplus splendidus* and *Anoplodusa arizonensis*. Species peculiar to the Sagebrush *Artemisia tridentata* are: *Idiostatus inyo*, *I. inermis*, *I. elegans*, *I. nevadensis*, *I. magnificus*, *I. variegatus*, *I. hendersoni*, *Neduba carinata*, *Aglaothorax segnis* and *Ateloplus hesperus*. In Mesquite are found *Capnobotes fuliginosus*, *Rehnia cerberus*, *R. victoria*, *R. n. sp.* and *Eremopedes n. sp.* *Acacia* is favored with the following species: *Rehnia cerberus*, *R. victoria*, *Eremopedes scudderi*, *E. ephippiatus*, *Ateloplus schwartzi* and *Capnobotes fuliginosus*: Hiding in the sharp-pointed leaves of *Yucca* are found *Aglaothorax armiger*, *A. segnis*, *Neduba castanea*, *Ateloplus minor*, *Eremopedes ephippiatus* and *E. scudderi* and *Pediocetes* sp. Junipers possess such species as *Pediocetes bruneri*, *Capnobotes occidentalis* and *Aglaothorax armiger*. In Pines the following have been taken: *Capnobotes bruneri*, *Neduba carinata*, *N. sierranus*, *Aglaothorax ovatus*, *A. segnis*. Two species have been taken in Oaks namely: *Aglaothorax ovatus* and *Neduba diabolicus*. In *Atriplex confertifolia* have been taken *Zycoptera atripennis*, *Ateloplus luteus* and *Capnobotes fuliginosus*.

### Economic Status

Of all the North American Dectidid genera only *Anabrus* and *Peranabrus* assume an economic role. *Anabrus simplex*, popularly known as the "Mormon Cricket," has a long notorious history since it first devastated the early Mormon colonies in Utah. Since that time few years pass without some outbreak somewhere in its territory of Montana, Utah, Idaho or Wyoming. The years 1938 and 1939 saw heavy infestations in northeastern Wyoming and



Idaho. Another species *Anabrus longipes* occasionally becomes injurious in British Columbia and Washington. The Coulee Cricket *Peranabrus scabricollis* is also a very injurious species especially in the state of Washington. Of the remaining eighty-eight species none is injurious and a large portion of these is to be considered rarities in any collection.

### Collection and Preservation

As practically all the Shield-Back Katydids are nocturnal, the best method of collecting them is to do night collecting by flashlight following the songs of the males. This is a long, tedious but interesting task and brings results. Another method is to sweep desert plants wherever practical, and still another way is to tramp through bushes scaring out the katydid inhabitants. This is especially workable with sagebrush and similar plants and many rare forms are obtained in this fashion.

As the colors of Dectidids are rather delicate and often very beautiful, and their body cavities filled with fluids, every specimen should be gutted and lightly stuffed with cotton if a worth-while collection is desired. Otherwise the specimens will black and many decay before drying. An incision is made at the base of the abdomen, three segments long, and the alimentary tract, seminal vesicles in the males and ovaries in the females, removed with forceps. If the body contains much fluid it should be very lightly swabbed out with absorbent cotton. Then a small roll of cotton is made, the same size as the alimentary tract, and pushed forward into the thorax-end of the creature. The abdomen is fluffed out and the roll of cotton worked back into the abdomen; sometimes it is necessary to add a little cotton for the thorax. In this manner the natural size of the katydid is retained and the beautiful life colors preserved. The sooner this procedure is accomplished after death of the katydid, the better the results.

In the following pages, generic key and specific keys to the various genera will be given. Whatever is known about the Biology, Habits, Song and Host Plants will be given under each species. This material is based almost entirely upon the writer's own study and observation based on many years' work in the field. Two new species and two new subspecies will be described.

#### KEY TO THE GENERA OF NORTH AMERICAN DESERT DECTIDES

- |  |                   |
|--|-------------------|
| 1. Tegmina and wings very long, exceeding the tip of the abdomen .....   | 2                 |
| Tegmina and wings not reaching the apex of the abdomen .....   | 3                 |
| 2. Size large to very large with greyish or greenish tegmina; ovipositor decurved.....   |                   |
| .....  | <i>Capnobotes</i> |
| Size medium, tegmina greenish buff spotted with round ivory white dots; ovipositor decurved .....  | <i>Anoplodusa</i> |
| 3. Tegmina longer than the pronotum .....  | 4                 |
| Tegmina shorter than the pronotum .....  | 6                 |
| 4. Size large, color greenish or grayish .....   | 5                 |
| Size small, mottled green; tegmina right-angled triangular, reddish. Pronotum with caudal margin slightly concave and decidedly reflexed. Caudal femora black at base and red at the apex; caudal tibiae reddish; cerci very large, straight, with large, stout, median uncinatc tooth ..... | <i>Acrodectes</i> |

5. Pronotum subsellate, the posterior margin strongly raised and marked with nacreous. Femora with large or small spine rows. Wings pale green with irregular bands or spots of black and sometimes margined with yellow. Sternites toothed; color foliage green; ovipositor long and decurved ..... *Rehnia*  
 Pronotum flat, color light to dark stone gray mottled with cream; tegmina bister mottled with creamy spots. Femora with only a few small spines. Wings shining jet black. Mesosternum only spined. Ovipositor long and decurved .....  
 ..... *Zycloptera*
6. Pronotum very large and shield like, circular in outline and completely hiding the male tegmina; posterior margin circularly rounded and lateral keels very strong and convex ..... 7  
 Pronotum small, not circular in outline, with the male tegmina exposed; posterior margin usually squarely truncate, rarely slightly rounded; keels if present parallel or subparallel ..... 8
7. Pronotum with disk very large, oval in outline, the constriction one tenth the pronotal length caudad of the anterior margin. Margins and disk of pronotum heavily etched with black. Pseudo-cerci with a minute sub-apical tooth; ovipositor long and recurved ..... *Aglaothorax*  
 Pronotum smaller, the enlarged portion semi-circular in outline, the constriction one-fifth the pronotal length caudad of the anterior margin. Color mainly brown and disk margin not heavily etched with black. Pseudo-cerci without an inner subapical tooth in the large species; ovipositor long and recurved ..... *Neduba*
8. Pronotum with lateral keels ..... 9  
 Pronotum without trace of lateral keels ..... 10
9. Pronotum with parallel lateral margins, disk flat with a depression on the metazona. Ovipositor long and decurved ..... *Plagiostira*  
 Pronotum with lateral keels constricted in the anterior third, median carina faint. Ovipositor long and gently recurved; pronotum flat ..... *Idionotus*
10. Pronotum almost square, of uniform breadth throughout, the lateral lobes shallow and broadly rounding into the disk of the pronotum; posterior margin squarely truncate. Size large to small ..... *Ateoplus*  
 Pronotum more elongate, lateral lobes deeper and more angularly rounding into the disk of the pronotum. Size small to large ..... 11
11. Posterior margin of pronotum convexly rounded; prosternal spines always present. Size medium to large ..... *Pediodes*  
 Posterior margin squarely truncate; prosternum usually unarmed. Size small to medium ..... 12
12. Exposed tegmina less than one-half the length of the pronotum. Metazona of the pronotum smoothly rounded into the lateral lobes and with disk very slightly reflexed ..... *Eremopedes*  
 Exposed tegmina more than one-half the length of the pronotum. Metazona of the pronotum angularly rounded into the lateral lobes and with the disk slightly reflexed and bearing a trace of a median carina ..... *Idiostatus*

## CAPNOBOTES Scudder

1897. *Capnobotes* Scudder. Can. Ent., 29:73-74.  
 1897. *Capnobotes* Scudder. Guide N. Amer. Orth., p. 55.  
 1900. *Capnobotes* Scudder. Cat. Orth. U. S., p. 76.  
 1904. *Capnobotes* Cockerell. The Ent., 37:178-181.  
 1906. *Capnobotes* Kirby. Syn. Cat. Orth., p. 181.  
 1907. *Capnobotes* Caudell. Proc. U. S. Nat. Mus., 32:310-311 (Key).  
 1934. *Capnobotes* Caudell. Pan-Pac. Ent., 10(4):151-152 (Key).

This large and handsome genus is characterized by its large to very large size, fully caudate tegmina and wings and mottled greyish or greenish coloration. The pronotum is rather narrow, subsellate, laterally constricted in the center and with the disk of the metazona flat and gently tilted upwards and backwards. The posterior margin is convexly rounded. The tegmina and wings are long approximately twice the length of the body. Male supra-anal plate is triangular with the apex often elongated; the entire plate cut by a narrow incision. Ovipositor as long or shorter than the caudal femora and gently decurved. Femora of all legs with small teeth. Fore and middle tibiae with long ventral and shorter dorsal teeth; caudal tibiae with short dorsal and strongly appressed ventral teeth. Prosternites with a pair of spined lobes; meso- and metasternites with triangular plates.

*Genotype*.—*Locusta fuliginosa* Thomas.

The species of *Capnobotes* are all nocturnal although rarely they are heard to sing by day. Although herbivorous and feeding on the leaves of their host plants, the species are carnivorous and feed voraciously on insects and their own members when in captivity. *Capnobotes* is largely confined to the Sonoran Desert but ranges into the southern edge of the Great Basin Desert and is known from the northern portions of the Chihuahuan Desert.

#### KEY TO THE SPECIES OF CAPNOBOTES

1. Size very large, mottled gray with black wings and heavy buff antennae; ovipositor strong, gently decurved and distinctly shorter than the caudal femora.....*fuliginosa*  
Size medium, mottled green or gray with hyaline wings and reddish brown antennae; ovipositor gently decurved and as long or longer than the caudal femora ..... 2
2. Color mottled green or gray; tegmina of uniform width throughout its entire length .....*occidentalis*  
Color grayish mottled with brown on the tegmina which are strongly constricted in their apical half .....*bruneri*

#### CAPNOBOTES FULIGINOSUS (Thomas)

1872. *Locusta fuliginosa* Thomas. Ann. Rept. U. S. Geol. Surv. Terr., 5:443, pl. 1, fig. 9.
1875. *Locusta fuliginosa* Thomas. Rept. U. S. Geol. Surv. W. 100 Mer., 5:906.
1884. *Locusta fuliginosa* Riley. Stand. Nat. Hist. 2:191.
1897. *Capnobotes fuliginosus* Scudder. Can. Ent., 29:74.
1900. *Capnobotes fuliginosus* Scudder. Cat. Orth. U. S., p. 76.
1903. *Capnobotes fuliginosus* Caudell. Proc. U. S. Nat. Mus., 26:806.
1904. *Capnobotes fuliginosus* Rehn. Proc. Acad. Nat. Sci. Phila., p. 573.
1904. *Capnobotes fuliginosus* Cockerell. The Ent., 37:180.
1906. *Capnobotes fuliginosus* Kirby. Syn. Cat. Orth., 2:181.
1907. *Capnobotes fuliginosus* Caudell. Proc. U. S. Nat. Mus., 32:311.
1907. *Capnobotes fuliginosus* Rehn. Proc. Acad. Nat. Sci. Phila., p. 64.
1934. *Capnobotes fuliginosus* Caudell. Pan-Pac. Ent.,
1935. *Capnobotes fuliginosus* Hebard. Trans. Amer. Ent. Soc., 61:310.
1938. *Capnobotes fuliginosus* Tinkham. J. N. Y. Ent. Soc., 46:349.

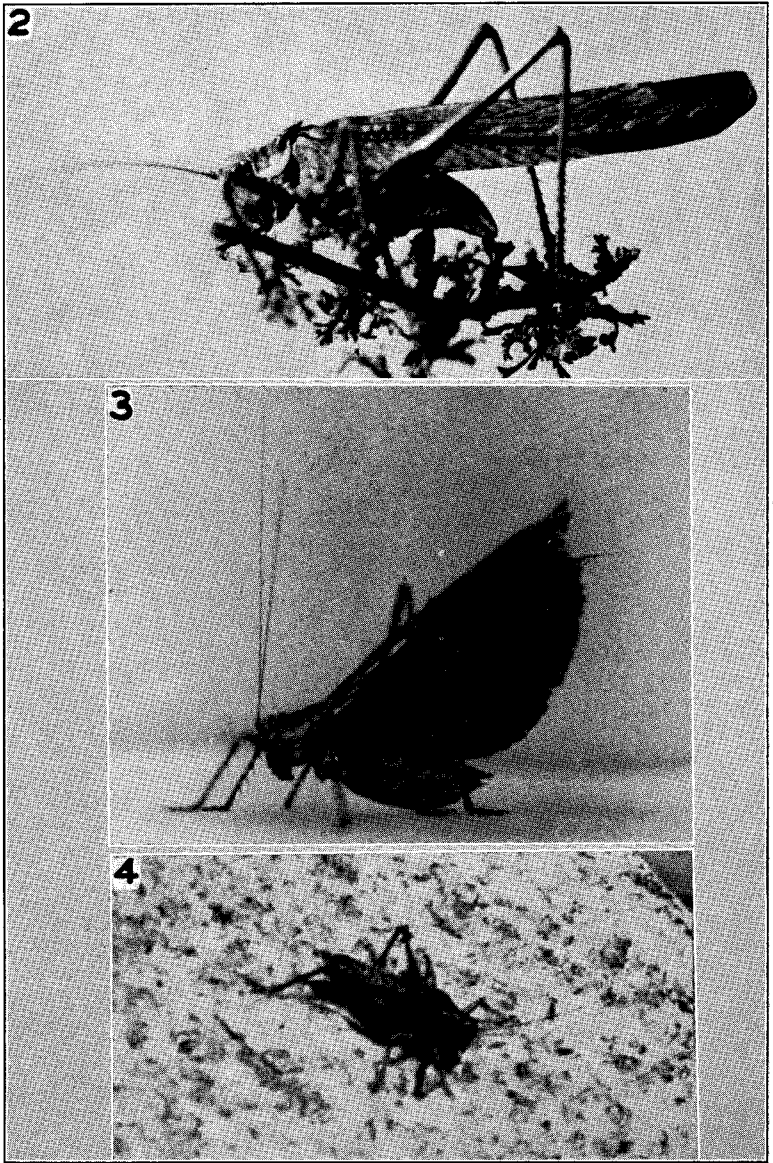


Fig. 2. Male *Capnobotes fuliginosus* perched in the top of a small bush.

Fig. 3. Male *Capnobotes fuliginosus* in fighting attitude with black wings and tegmina raised above its body.

Fig. 4. Male *Acroedectes philopagus* singing on a granite boulder at 12,100 feet on the Whiney Pass, Oct. 22, 1939.

*Description.*—The chief features characterizing this handsome species have been presented in the key. The cercus of this species is long and narrow with two apical internal hooks.

*Biology.*—At present nothing is known about these in particular.

The species matures by mid-June and is found in the adult stage until November but it is not known whether it survives through the winter as does *Neoconocephalus triops* one of the Cone-headed Katydid.

*Habits.*—This handsome species appears to be strictly nocturnal in habits although in the fall with the colder nights appearing, it may sing occasionally in the day time. Usually, however, the singing commences with the crepuscular light of dusk and continues on late into the night. Although phyllophagous to some extent it is believed that *fuliginosus* is predominantly carnivorous as would be attested by the spiny fore legs. When confined this species devours large insects, especially grasshoppers. Such insects are grasped tightly by the fore and middle legs and the strong mandibles with a few swift strokes crush in the head and bases of the legs. Then in a more leisurely fashion the prey is devoured. When irritated or annoyed this species raises its tegmina and black wings over its back and is then ready to fight.

*Song.*—The song is loud and continuous enduring for a long period of time unless broken by the approach of some enemy. It is almost impossible to approach this species without being detected. The note is difficult to interpret into words as it has a fluttering quality about it and can best be indicated as something like “zik-k-k-k-k-k—zik-k-k-k-k-k—zik-k-k-k-k-k” with the “ks” fluttering and undulating in tone. On October 19, 1939, while in the Chaparral Zone near the mouth of Wheeler Canyon in the Hualapai mountains of northwestern Arizona the writer stopped to investigate a song that sounded much like that of some unknown cicada. It was 1 p. m. on a warm fall day. Imagine the writer's surprise to find two males of *fuliginosus* singing to each other in the dense chaparral. One of the males was finally captured.

*Host Plants.*—The host plant varies according to the desert habitat. Large bushes or trees are usually chosen. On the desert at the mouth of Madera Canyon in the Santa Rita range mesquite *Prosopis velutina* is the host plant. At the north end of the Quinlan range which are the continuation of the Baboquivatis the writer took a large series in Palo Verde *Cercidium aculeatum*. At Walkers Lake, Nevada, a male was taken in *Atriplex confertifolia*, and in the Hualapai mountains the host plant was chaparral. On other occasions the host plant has been some species of *Acacia*.

*Records.*—Texas: Paisano, Presidio Co. July 23, 1929, 1 ♂; Mulligan Canyon near El Paso, Sept. 18, 1931, 6 ♂; North end of Davis Mts., 6 miles SW. Toyahvale, Sept. 13, 1940, 1 ♂ (all E. R. Tinkham).

New Mexico: Animas Mts., Sept. 18, 1937, 1 ♀ (L. N. Gooding; U. of Ariz. Cln.).

Arizona: Huachucas reported by Rehn in 1907, Madera Canyon, Santa Ritas, Sept. 1-2, 1938, 6 ♂ (E. R. Tinkham). Cienaga Wash, 30 miles E. Tucson, June 16, 1940, 1 ♂; Quinlan Mts., Sept. 3, 1931, 10 ♂, 2 ♀ (E. R. Tinkham; Hebard Cln.). Hualapai Mts., Oct. 19, 1939, 1 ♂ (E. R. Tinkham). Kofa Mts., May 18, 1937,

1 ♂ (L. N. Gooding). Utah: Beaver Dam mountain pass just west of St. George, July 28, 1930 (E. R. Tinkham; Hebard Cln.). Nevada: Virginia City, July 28-31, 1931, 6 ♂ (E. R. Tinkham; Hebard Cln.). Walkers Lake, Aug. 14, 1938, 1 ♂ (E. R. Tinkham). Calif.: South end Lake Tahoe, Aug. 11, 1930, 1 ♀ (E. R. Tinkham; Hebard Cln.).

*Distribution.*—*Capnobotes fuliginosus* is a member of the lower Sonoran Fauna occupying in distribution the Sonoran Desert and southern portions of the Great Basin Desert. It is also known from the northern part of the Chihuahuan Desert but as yet is unknown from any part of Mexico although certainly occurring there.

#### CAPNOBOTES OCCIDENTALIS (Thomas)

1872. *Locusta occidentalis* Thomas. Ann. Rept. U. S. Geol. Surv. Terr., 5:444.  
 1872. *Capnobotes occidentalis* Glover. Ill N. Am. Ent., Orth., pl. 9, fig. 16.  
 1897. *Capnobotes occidentalis* Scudder. Can. Ent., 29:74.  
 1900. *Capnobotes occidentalis* Scudder. Cat. Orth. U. S., p. 76.  
 1902. *Capnobotes occidentalis* Woodworth. Bull. No. 142, Calif. Exp. Sta., p. 15.  
 1904. *Capnobotes occidentalis* Cockerell. The Ent., 37:179.  
 1906. *Capnobotes occidentalis* Kirby. Syn. Cat. Orth., 2:182.  
 1907. *Capnobotes occidentalis* Caudell. Proc. U. S. Nat. Mus., 32:315.  
 1934. *Capnobotes occidentalis* Caudell. Pan-Pac. Ent., 10(4):152.  
 1935. *Capnobotes occidentalis* Hebard. Trans. Amer. Ent. Soc., 61:310.  
 1935. *Capnobotes occidentalis* Hebard. Proc. Acad. Nat. Sci. Phila., p. 74.

*Description.*—Two phases of this species occur, the green and the grey both of which are mottled with flecks of white especially on the tegmina. The green phase bears the varietal name of *viridis*. This species differs from *C. fuliginosus* by lacking black wings, much smaller size and longer ovipositor in the female. The male cercus is apically armed with a short internal spine with proximally a large subapical internal prong. The supra-anal plate of the male is more equilaterally triangular with a median groove.

*Biology.*—Nothing is known about this species. The species is adult in June.

*Habits.*—These are similar to *C. fuliginosus* but more alert.

*Song.*—A strong zik-zik-zik, continuous but not as fluttering as in *fuliginosus*.

*Host Plants.*—Junipers were the host of this species 6 miles northwest of Mojave. A few miles west of Big Pines on the road to Glacier Lodge the writer found two females of *occidentalis* in a honey locust tree.

*Records.*—Three miles west of Big Pine, Aug. 16, 1938, 2 ♀ (E. R. Tinkham). Six miles northwest Mojave, Aug. 8, 1931, 1 ♀ (E. R. Tinkham; Hebard Cln.). Walker Pass, Aug. 22, 1938, 1 ♀ (E. R. Tinkham). These are California records. Littlefield, Arizona, Aug. 29, 1936, 1 ♂ (E. D. Ball; Univ. of Ariz. Cln.). New Mexico records, Hebard 1935.

*Distribution.*—*Capnobotes occidentalis* is a member of the Lower portions of the Great Basin Desert which would account for its penetration into northwestern New Mexico with Pecos, New Mexico, representing the southeastern limit in the distribution of this species.

## CAPNOBOTES BRUNERI Scudder

1897. *Capnobotes bruneri* Scudder. Can. Ent., 29:74.  
1900. *Capnobotes bruneri* Scudder. Cat. Orth. U. S., p. 76.  
1902. *Capnobotes bruneri* Woodworth. Bull. No. 142, Exp. Sta. Calif. p. 15.  
1904. *Capnobotes bruneri* Cockerell. The Ent., 37:181.  
1906. *Capnobotes bruneri* Kirby. Syn. Cat. Orth., 2:181.  
1907. *Capnobotes bruneri* Caudell. Proc. U. S. Nat. Mus., 32:317.  
1934. *Capnobotes bruneri* Caudell. Pan-Pan. Ent., 10:151, fig. 2.

*Description.*—This species is immediately recognized by abrupt narrowing of the apical half of the tegmina. The coloration is mottled grayish with much rust brown along the central portions of the tegmina. The ovipositor is gently decurved and slightly longer than the posterior femora. *C. bruneri*, based on the length of the ovipositor and the supra-anal plate, would appear to be more closely related to *C. occidentalis* than to the larger *C. fuliginosus*.

*Habits.*—On August 6, 1931, the writer and his brother Herb, were camped in Paradise Valley in the Pine Zone of the Tehachapi mountains immediately south of the town of Tehachapi. The evening meal had just been finished and darkness was fast approaching when some strong "tzwks" sounded from the tops of nearby towering Western Yellow Pines. As the song was new to the writer, it was decided to make the ascent despite the setting and the arduous task facing the would-be hunter. A flashlight and cyanide jar were slipped into a haversack and thrown over his back. The pine was about four feet in diameter and thirty feet up to the first limbs. My brother held a lighted Coleman lantern to aid my ascent. About fifty feet up the katydid, singing in the top of the pine, heard the hunter and stopped singing, whereupon the hunter sat on a limb for a quarter of an hour for the song to recommence. Finally it was resumed and this time the hunter worked upwards through the limbs with as much cat-like stealthiness as possible. Suddenly, when the song seemed to be immediately overhead, it stopped. The writer reached for his flashlight and turned it cautiously and slowly on what he thought was the spot. There in a clump of long pine needles perched the troubador. The hunter raised himself up another foot with slow and cautious precision. The night was pitch dark and there was no trace of the lantern seventy-five feet below. The pine top was gently swaying as the hunter wrapped his legs around the slender trunk for support. Then with the flashlight in his left hand, the hunter made a sudden grab at the Katydid. As he extricated the katydid from the pine needle the creature responded with a vicious bite that caused an "ouch" to resound through the tree-tops, and as the katydid chewed away on finger tissue the flashlight was replaced and the cyanide jar obtained and the lid unscrewed with the fingers of one hand holding it. Finally the katydid was ensconced within the jar and trembling with the strain and excitement, a feeling of great relief came when two hands again gripped the tree. Elated, the hunter worked his way down through a maze of limbs to the ground. The specimen proved to be the first male ever taken of *Capnobotes bruneri* and today rests in the Hebard Collection at the Academy of Natural Sciences of Philadelphia.

*Song*.—The song is a strong continuous "tzwik-tzwik-tzwik" interpolated by a brief pause of several seconds between the "tzwiks."

*Biology*.—Nothing is known about the biology of this wary creature.

*Host Plants*.—The Tehachapi male was taken in *Pinus ponderosa*, the Western Yellow Pine and this is the only host record.

*Records*.—The type locality for the female type was Tepusquet Peak, in Santa Barbara County, California. Caudell, in 1934, records the second known female from Davis, California. The only known male was taken in the Pine Zone in Paradise Valley of the Tehachapi mountains, August 6, 1931, 1 ♂, (E. R. Tinkham; Hebard Cln.).

*Distribution*.—The range as understood at present is represented by the Tehachapi Mts., Tepusquet Peak, and Davis, California. The species appear to be a member of the Upper Sonoran Fauna occurring in the Pine Zone west of the Sierra Nevada range.

#### ANOPLODUSA Caudell

1907. *Anoplodusa* Caudell. Proc. U. S. Nat. Mus., 32:318.

*Anoplodusa* and *Capnobotes* are the only two Nearctic genera of the Decticinae with fully caudate wings. The size is medium about that of *Capnobotes bruneri* or a medium-sized *C. occidentalis*. *Anoplodusa* differs from *Capnobotes* by lacking a pair of spines on the prosternum and the ventral surface of the caudal femora. The ovipositor is slightly shorter than the caudal femora and is gently decurved as in *Capnobotes*. The coloration is greenish or buffish with ivory white markings on the pronotum and the tegmina.

#### ANOPLODUSA ARIZONENSIS (Rehn)

1904. *Drymadusa arizonensis* Rehn. Proc. Acad. Nat. Sci. Phila., p. 573.

1906. *Drymadusa arizonensis* Kirby. Syn. Cat. Orth., 2:180.

1907. *Anoplodusa arizonensis* Caudell. Proc. U. S. Nat. Mus., 32:318, fig. 25.

1919. *Anoplodusa arizonensis* Rehn and Hebard. Proc. Acad. Nat. Sci. Phila., p. 479 (♀ described).

1935. *Anoplodusa arizonensis* Hebard. Trans. Amer. Ent. Soc., 61:310.

1938. *Anoplodusa arizonensis* Tinkham. Journ. N. Y. Ent. Soc., 46:349.

1942. *Anoplodusa arizonensis* Tinkham. Bull. Chicago Acad. Sci., 6(12):221-227, 2 figs.

*Coloration*.—The sexes of this striking and very beautiful creature are closely similar. The tegmina and wings are fully developed, as in *Capnobotes*, and are deep viridian with three rows of large circular spots with tinges of reddish brown on the stridulating field of the male tegmen. The antennae are reddish brown. The head, thorax, and abdomen are pale greenish white with ivory on the labrum, prozona, two small spots on the mesozona and on the posterior half of the metazona. Nacreous spots also mark the mesepisternum, metepimeron and the dorsal basal third of the caudal femora. The metepimeron, humeral angles of the pronotum and the occiput are tinged with reddish brown.



*Adaptive Coloration.*—This handsome dectid as well as a certain katydid *Insara covilleae* and the grasshoppers *Boottettix argentatus* and *B. punctatus* associated only with the Creosote bush have strangely evolved, along parallel lines of development, a closely similar color pattern for protection. In these the foliage green of the body would appear to represent shadows under the leaves and the ivory spots on the tegmina and the nacreous markings on the body, simulating the sun glistening on the sticky leaves of the Creosote bush, serves to break up the body color into light and shadow; thus presenting a picture of perfect camouflage.

*Biology.*—The adults are mature by mid-May and live through the hot summer until late July or early August when the ova are laid. The maximum number of ova appears to be a complement of 21 ova for each ovary or a total of 42 eggs, although two different females had only 22 and 28 ova, respectively. The ova measure 5.5-5.6 x 1.6-1.7 mms. and like most Dectid ova are lustrous pale violet gray. At the anterior pole a row of large pits, the micropylar area, is observed under high magnification. The hexagonal cells are arranged in groups or rosettes with a pit in the center of each cell. It is believed that the eggs hatch in the fall during the rainy season and the developing nymphs, after passing the winter, are mature in early May. However, the nymphs of this rare creature remain to be discovered.

*Habits.*—This rare creature is nocturnal and thamnophilous, dwelling only in the Creosote bush. Its diet is probably strictly herbivorous on the sticky pungent leaves of the Creosote, but in captivity they will feed on grasshoppers. The flight of *Anoplodusa* is swift and low like that of *Schistocerca*.

*Song.* — The song is a soft continuous "tsz-e-e-ek — tsz-e-e-ek — tsz-e-e-ek," with each "tsz-e-e-ek" rather fluttering. It is quite similar to the song of *Capnobotes fuliginosus*, but much softer and if there should be *Capnobotes* singing in any particular area their songs must be silenced before those of *Anoplodusa* can be heard, if they should be present. The singing commences shortly after sundown and continues at least until midnight and perhaps later.

*Host Plant.*—The only known host plant of this unusual creature is the Creosote bush.

*Records.*—The type male was described by Rehn, in 1904, from a single male taken near Florence, Arizona, by Mr. C. R. Beiderman. The female type, described in 1909, came from the foot of the Bird Spring Mountains of extreme southwestern Nevada. Dr. and Mrs. Howard K. Gloyd rediscovered the species in 1941 when the following specimens were taken near Florence: 1 ♂, June 12; 1 ♂, 1 ♀, June 13; 1 ♂, June 15; 1 ♂, July 3; 12 ♂, 1 ♀, July 7-8, 1941, along highway at night. On July 6, the writer captured a pair that had just mated in a creosote bush, at midnight a few miles north of Florence. On July 20, 1941, 9 ♂, 4 ♀ were taken by the author in night collecting in creosote bushes near Florence. Additional records, the first outside of the type locality, in Arizona were made in the spring of 1942 by the writer and are as follows: Maricopa County, 3 to 3.5 miles south of south

end of Sierra Estrellas, 3 ♂, 2 ♀, May 22; Vekol Wash, 1 ♂, May 29; 1 mile east of Vekol Wash on creosote desert, 1 ♂, May 29, 1942 (E. R. Tinkham).

Two additional males are known, one taken by Mr. M. J. Oosthuizen on the Mojave Desert near Mojave, California, June 28, 1932 (Univ. of Minn. Cln.), and the other a pinned male in poor condition collected by Mr. Guy Beevor at Yermo, California, located by the writer and in the Hebard Collection in Philadelphia.

*Distribution.*—*Anoplodusa arizonensis* is a member of the Lower Sonoran Fauna, its range extending from the Mojave desert on the west to Florence, Arizona, on the east. The 1942 records indicate a wider distribution than formerly but apparently localized to the creosote covered mesas of the desert.

#### ACRODECTES Hebard

1920. *Acrodectes* Hebard. Trans. Amer. Ent. Soc., 46:50.

This genus is peculiar in that the tegmina are right-angled triangularly produced by the obliquely truncate inner apical portions of the tegmina. The posterior margin of the pronotum appears to slightly concave due to strong upward reflection of the posterior portion of the disk of the metazona. The cerci are very long, heavy, straight, with bluntly rounded apex and with a long median uncinat hook on the inner margin; the hook itself bearing fine serrate teeth on its inner margin. All femora unspined. Fore tibiae with six stout pairs of large ventral spines and three similar widely-spaced dorsal spines beyond the basal tympanum. Meso-tibiae with six pairs of ventral and two outer and four inner dorsal spines. Caudal femora short, not reaching to the apex of the abdomen and strongly swollen in the basal half. Caudal tibiae with 14-15 external large and small teeth and 13-16 internal teeth on the dorsal surface, and with five pairs of ventral teeth. Greatest breadth below the eyes and greater than the occipital-clypeal depth. Supra-anal plate broad and narrow with the posterior margin straight and bearing a deep median groove.

*Genotype.*—*Acrodectes philopagus* Hebard.

#### ACRODECTES PHILOPAGUS Hebard

1920. *Acrodectes philopagus* Hebard. Trans. Amer. ent. Soc., 46:251, figs.

*Coloration.*—The markings are very unusual in this strange creature. The body color is a beautiful mottled green with fine flecks of black everywhere on the abdomen. The tegmina are reddish brown. The fore and middle legs are greenish and the caudal femora are black at the base and reddish brown in the basal half, as are also the caudal tibiae.

*Habits.*—This boreal creature perches on granite rocks on the Whitney Pass at elevations of 12,000 to 13,000 feet far above the last outposts of pines at 11,000 feet altitude. The young appear in mid-summer when the hot summer sun melts the deep snow off of rocky talus slopes. On August 21,

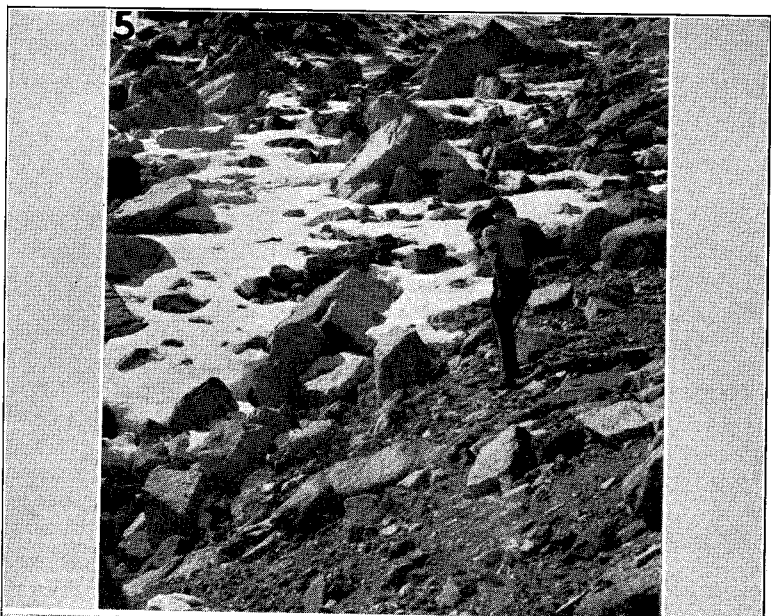


Fig. 5. Habitat of *Acrodectes philopagus* at foot of Whitney Pass, Oct. 22, 1939, showing writer searching for specimens.

Fig. 6. Frozen lake at 12,000 feet at foot of Whitney Pass, Oct. 22, 1939.

1938, the writer and his brother George discovered a small nymph at 12,800 feet on the Whitney pass. It was sitting on top of a small granite boulder on a rocky slide completely surrounded by snow which was still ten feet deep on this day. At that time the writer realized that the adults probably do not appear before late September. Accordingly when an opportunity appeared a year later the writer availed himself of the chance and made an excursion from Tucson, Arizona, to Lone Pine, California, via Death Valley. It was rather late in the fall and snow had already appeared at high elevations in the Sierra Nevadas three weeks earlier. The night was spent at the mouth of Lone Pine Canyon. Breakfast was made the following morning, October 22, 1939, at 5 a.m. and before dawn the writer started off for Whitney Portal in his car. At 6:20 a.m. the writer left Whitney Portal, 7000 feet elevation, on foot. The trail was in the shadow of towering cliffs and the temperature was slightly below freezing. Snow along the trail was frozen solid. Rather lightly clad for the trip the writer was fairly numb with cold long before he made elevations high enough to get into the sun. At 9:30 a.m. the hunter reached 11,500 feet and sunlight. Snow lay everywhere and soon was one foot deep on the level, with bare patches here and there. The writer felt like a fool going up into this world of ice and snow supposedly hoping to find a rare Shield-back Katydid in an arctic world. The air was getting thinner and thinner at this altitude. The hunter left his haversack by a well-marked cliff and proceeded on with camera and net and a bag of sandwiches. At 12,000 feet a small lake was completely frozen over. The base of the Whitney pass was shortly beyond. At 12,100 feet the hunter reached the base which was a south slope and partly bare of snow. The temperature was about 4 degrees Fahrenheit. Leaning up against a rock trying to get his wind the writer thought he heard the familiar "tzick-tzick" of his prize but after an unsuccessful search of the neighboring boulders he thought his subconscious mind had played a trick. Proceeding up the trail, he had gone only a few steps when again the "tzick-tzick" sounded. This time it was real. Looking up the slope the hunter espied his goal on top a small granite boulder some twenty feet above him. What a glorious feeling of triumph and exhilaration surged through him! There on the rock closely pressed against the surface for warmth was a small mottled green katydid with reddish brown tegmina. Its antennae aligned forward were vibrating in the cold breeze. Without disturbing him several photographs were made of this creature in his natural habitat. These photos are shown on the following page.

*Song.*—The song of this rare creature is a moderately strong "tsick-tsick" audible for a distance of twenty to thirty feet. Each "tsick-tsick" is broken by a pause of several minutes probably due to the low temperatures. At warmer temperatures the pause would probably be shortened.

*Food Plants.*—*Acrodictes* is pagiofagous, that is, it feeds on the orange and verona brown lichens growing on the granite rocks of the high Sierra Nevadas. At a distance *Acrodictes* looks like a small patch of brown lichen on a granite boulder and thus this curious creature evades its enemies.

*Records.*—Whitney Pass, 12,800 feet, 1 small ♂ nymph, August 21, 1938 (George Tinkham). Whitney Pass, 12,100 feet, Oct. 22, 1 ♂ 1939 (E. R. Tinkham).

*Distribution.*—*Acrodoctes* is known only from the rocky talus slopes above timberline in the vicinity of Mt. Whitney, the highest peak in the United States.

### REHNTA Caudell

1907. *Rehnia* Caudell. Proc. U. S. Nat. Mus., 32:305.

Size medium to large, color green with nacreous markings on the posterior margin of the pronotum and thoracic pleurites. Posterior margin of the pronotum abruptly elevated to form a flat flanged border thus making the pronotum subsellate when viewed in lateral profile. Tegmina longer than the pronotum but not extending to the apex of the abdomen. Wings plectate or fan-like, when unfolded pale bluish green with irregular bands of black and sometimes chrome-yellow. Legs moderately to strongly spinose. Fore and middle femora with 6-10 pairs of small or large spines; caudal femora with 10-14 pairs of small or large spines. Fore tibiae with 6 pairs of very long teeth and 4 or 5 outer dorsal teeth. Meso-tibiae with 6 pairs of long ventral teeth and 3 to 4 outer and 4 inner shorter dorsal teeth. Caudal tibiae with long rows of paired dorsal spines (immovable) and fewer ventral teeth (in sockets and movable). All the sternites with toothed lobes. Cerci strong and usually uncinatc with an internal proximal prominence or tooth.

*Genotype.*—*Rehnia victoriae* Caudell.

### KEY TO THE SPECIES OF REHNTA

1. Size large; femoral spines of all legs large and conspicuous ..... 2  
 Size medium to small; femoral spines of all legs small and inconspicuous ..... 3
2. Cerci long, simple, falcate, with a long acuminate and gently incurved point and without an internal basal projection or tooth. Color of wing unknown but probably pale bluish green with irregular bands of black ..... *spinosus*  
 Cerci long and uncinatc, the apex sharply incurved and with a stout internal tooth just basad of center. Wings large, plectate, when unfolded pale bluish green with irregular band composed of rectangular patches of blackish brown ..... *cerberus*
3. Size medium, outer margins of wings not distinctly bordered with chrome-yellow ..... 4  
 Size small, wing pale bluish green with irregular central bars of black and with the outer borders chrome-yellow. Cerci bluntly uncinatc with a small internal basal tooth or projection ..... *pulchellus* n. sp.
4. Tegmina greenish with apex uniformly green; wings pale bluish-green with large central patch of shining black. Cerci strongly uncinatc with an internal basal projection ..... *victoriae*  
 Tegmina testaceous with apex infuscated with cellular patches of brownish black; wings atrophied, pale bluish green sparsely marked with small spots of black. Cerci uncinatc with a large internal proximal tooth ..... *sinaloae*

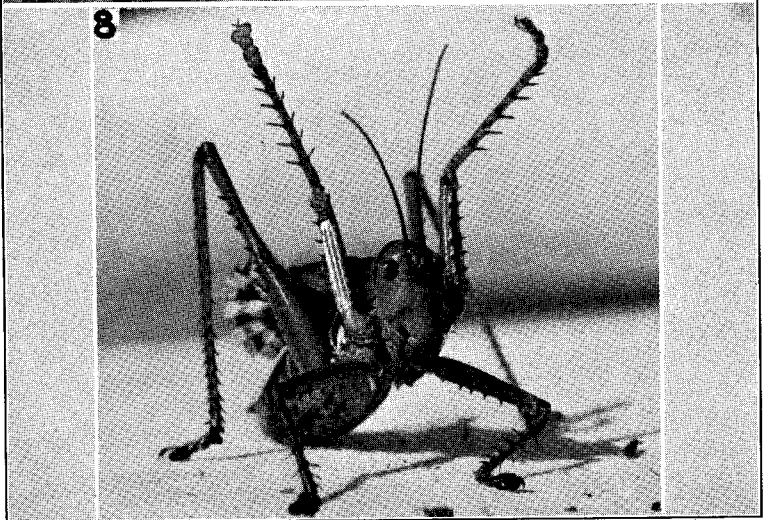
### REHNTA VICTORIAE Caudell

1907. *Rehnia victoriae* Caudell. Proc. U. S. Nat. Mus., 32:306, fig. 14-15.

1931. *Rehnia victoriae* Hebard. Proc. Acad. Nat. Sci. Phila., 83:202 (Kansas).

1932. *Rehnia victoriae* Hebard. Trans. Amer. ent. Soc. 58:337.

*Coloration.*—This handsome creature is uniformly foliage green with the entire raised posterior margin of the pronotum nacreous or pearly white. Wing plectate, when unfolded and fan-like a little less than one-half inch



Figs. 7. Male *Rehnia victoriae* perched in an alert position in Creosote Bush.  
Fig. 8. Male *Rehnia cerberus* portraying aggressive habits and ready to fight.

long, pale bluish green with a large central shining black patch which sometimes has a small spot of pale green invading it. Femoral spines short and green and not black as in *cerberus* and *spinusus*. See Fig. 7.

*Biology*.—The life history has not been worked out or studied but as the adults mature in mid-summer and an occasional nymph is taken at that time it would appear that the nymphs probably appear in the early spring. This species spends its entire life in bushes or trees. The ova are of the same form as grasshopper eggs and thus are markedly different from the flat reniform-shaped ova of the Leaf Katydids. However, the ova lack the cap characteristic of acridid eggs and do not possess the cellular sculpturation of the acridid chorion. The egg is fairly long and lengthily oval, shining, pearly lilac in coloration and with the chorion or egg shell sparsely impunctate with shallow depressions.

*Habits*.—*Rehnia victoriae* is thamnophilous or bush dwelling and nocturnal. When captured or annoyed it is distinctly aggressive, raising its fore-legs in the air, spreading its beautiful wings and ready to fight.

*Food Plants*.—The host plant depends largely upon the type of vegetation in any particular region. As *Rehnia* is partly carnivorous its food does not depend strictly upon the vegetation. In captivity *R. victoriae* takes readily to grasshoppers. The principal host plant is mesquite. In the sand dune region near Monohans and Odessa, Texas, the host plant was *Prosopis glandulosa*. East of Sanderson some fifteen miles it was taken in Blackbrush *Flourensia cernua* and at Eagle Pass in a black-stemmed *Acacia* sp. At Laredo it was in mesquite *Prosopis glandulosa* and in a canyon near Ciudad Victoria, Mexico, the host was *Karwinskia humboltiana*.

*Song*.—The song is baffling to interpret into words. The closest approach seems to be a "zeee-e-e-e-t — zeee-e-e-e-t — zeee-e-e-e-t" repeated in rapid continuous succession. One listening can hear the "t," "z," "e-e-e," and "t" in the short space of slightly more than half a second. At 80 degrees Fahrenheit the writer timed 106 "t-zeee-e-e-e-t's" per minute which is probably the maximum rate as the insect could not possibly produce them with much more celerity. The song is long and sustained often continuing for half an hour or more without a pause unless disturbed. The song can be heard for a distance of 100 feet or more depending upon the sharpness of a person's hearing. Should, however, the would-be captor stalk this Katydid, he seldom gets closer than 10 feet without being heard. Occasionally the males sing in the bright sunlight.

*Records*.—Sand dunes near Monohans and Odessa, Texas, Oct. 2, 1931. TEXAS: 4 ♂; Eagle Pass, Texas, Aug. 14, 1940, 2 ♂; 15 miles E. of Sanderson, Aug. 14, 1940, 1 ♂; Laredo, Aug. 15, 1940, 1 ♂; Sept. 10, 1940, 1 ♂ (E. R. Tinkham). 1 ♀, Camp Barkeley nr. Abilene, July 29, 1942 (E. R. Tinkham). Coahuila: Recorded from Monclova, the female type locality, by Hebard, in 1932. Tamaulipas: Canyon, 3 miles west of Ciudad Victoria, Aug. 31, 1940, 1 ♂; 34 miles South of Linares, Aug. 31, 1940, 1 ♀ (E. R. Tinkham).

*Distribution*.—The type locality is Ciudad Victoria for the male and Monclova, Coahuila for the female. *Rehnia victoriae* is a member of the

Lower Sonoran fauna occupying in Mexico and southern Texas the Tamaulipan Semi-Desert Bushland formation. Its range extends northward up the Pecos Valley to the extreme southwestern corner of Kansas (Hebard 1939), and east to central Texas.

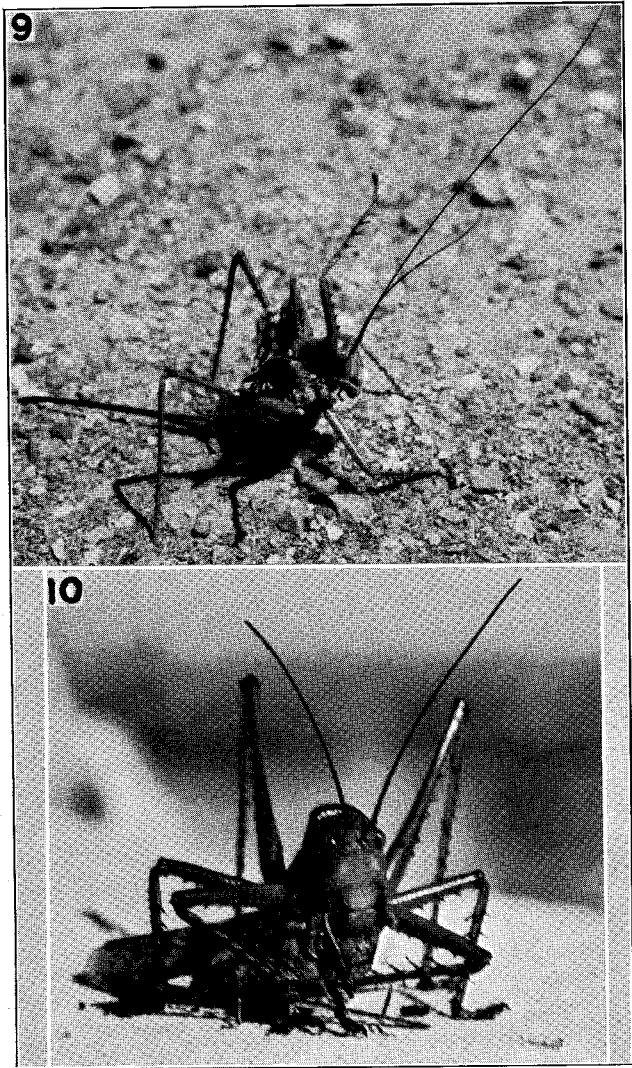


Fig. 9. Female *Rehnia cerberus* in fighting attitude.  
Fig. 10. Male *Rehnia cerberus* feeding on grasshopper.



## REHNSIA SPINOSUS Caudell

1907. *Rehnia spinosus* Caudell. Proc. U. S. Nat. Mus., 32:307, fig. 16.

This large species with long black spines on all the legs is known only from the unique type male described from "Texas." The male cercus is distinctive and separates it from the large *R. cerberus*. Its distribution is not known because there is some question as to the validity of the locality "Texas" based on Bruner's word. The species is probably a Mexican form or it may well be one restricted to the tropical coast of the Gulf of Mexico since all the *Rehnia* occupy different floral formations with no overlapping in their distribution.

## REHNSIA CERBERUS Rehn and Hebard

1920. *Rehnia cerberus* Rehn and Hebard. Trans. Amer. ent. Soc., 46:234, figs.

1932. *Rehnia cerberus* Hebard. Trans. Amer. ent. Soc., 58:337.

*Coloration*.—Deep foliage green with nacreous markings on the posterior margin of the pronotum broken by a spot of brownish at the humeral angles. Pleurites of the thorax with broad stripes of nacreous. Abdominal sternites with a paired row of large round whitish spots in the living specimen, these spots obsolete in the preserved specimen. Wings large, plectate, when unfolded fan-like and three-quarters of an inch in length, pale bluish green with four irregular and sometimes partially fused narrow blackish bands composed of quadrangular spots (see Fig. 11).

*Habits*.—Shortly after my arrival on the desert of southwestern Texas and still a stranger to desert life, I was collecting in the Ruidoso Hot Springs Canyon some fifty miles northwest of Presidio, the evening of October 14, 1928. About sundown I heard the song of a Katydid in a nearby Mesquite and cautiously approached. Later the specimen was identified as *Rehnia cerberus*. At that time I knew nothing concerning the habits of these creatures. Approaching the specimen I planned to catch it in my fingers for it was about five feet off the ground, and I did not have a net. When my hand was slowly approaching and about six inches away *Rehnia* suddenly assumed an interesting and menacing attitude. Its spiny forelegs were held high above its head, mantid-like (see Fig. 8), its antennae held back and its beautiful mottled pale green and black wings spread fan-wise to each side and its mandibles were bared. Suddenly without warning it gave a few rapid "tszicks," jumped to the end of my finger and gave me a vicious nip, then quickly dropped to the ground and crawled under a cactus plant growing in the clump of mesquite. Such aggressiveness took me completely by surprise as it was all over in a few seconds. The mouse had attacked the elephant, a katydid a man a thousand times his size. Undaunted and rather vexed at this sudden turn in events, I crawled in under the mesquite and managed to retrieve my prize, the first male *Rehnia cerberus* I had ever seen. Truly it is well named for Cerberus in Greek mythology was the dog of Hercules that guarded the Gates to Hyades. This aggressive trait is commonly exhibited by this species, in an instant, whenever it is touched or annoyed. In this position it is really

a creature of elegance and pride. The females exhibit this same trait as is shown by Fig. 9.

*Host.*—Although dwelling in mesquite and other bushes and trees, and phyllophagous, this species is probably more inclined to cannibalism. It readily devours weaker members of its own kind and voraciously feeds on grasshoppers (see Fig. 10), and probably other species of insect life that it should find in its home-tree. The species is nocturnal but I have taken specimens sunning themselves in the top of a creosote bush in the early morning hours. The writer has taken this species principally in mesquite (*Prosopis chilensis*), Creosote (*Larrea divaricata*) and rarely in *Karwinskia humboltiana* on the periphery of its range.

*Biology.*—The life history is not known but as the writer has taken nymphs in September it would seem that the eggs hatch in the spring and the adults are mature in July, August or sometimes September. The egg is pearly lilac-grey in color, 6.5 mms. long and 1.5 mms. wide and is slightly larger than that of *R. victoriae*. It is not known whether the adults survive the winter but they are found until November. One female had 54 mature ova.

*Song.*—The song of *cerberus* is closely similar to that of *victoriae* but is a stronger "tszeee-e-e-k — tszeee-e-e-k — tszeee-e-e-k" rapidly repeated and continued indefinitely until disturbed.

*Records.*—Texas: Chinati Mts., 4 miles south of Shafter, Sept. 27, 1931, 8 ♂; Sept. 30, 1928, 1 ♀; Ruidoso Hot Springs, Presidio Co., Oct. 14, 1928, 1 ♂; Haciendita, 9 miles NW. Presidio, Sept. 10, 1928, 1 ♂; Presidio, Sept. 9, 1928, 1 ♀ nymph; 20 miles north of Chisos Mts., July 18, 1930, 1 ♀ nymph (all E. R. Tinkham). Marfa, Texas, 1 ♀ (G. Goddholt). Nuevo Leon: 28 miles NW. Monterrey near Coahuila boundary, Sept. 9, 1940, 1 ♂ (E. R. Tinkham). These are the first Nuevo Leon records. Coahuila: 42 miles NW. Saltillo (en route Torreon), Sept. 3, 1940, 4 ♂, 1 ♀, 1 ♀ nymph; 6 miles north Parras, Sept. 4, 1940, 2 ♂ (E. R. Tinkham). First Coahuila records. Chihuahua: Reported from Jarral, by Hebard, in 1932.

*Distribution.*—*R. cerberus* is a member of the Lower Sonoran faunal region and is restricted to the Chihuahuan Desert tract. On the east is found *R. victoriae* and to the south on the Salado Desert a new species of *Rehnia* is found. The Nuevo Leon record is the southeastern limit point in its distribution and the southeastern corner of the Chihuahuan Desert in this area.

#### REHНИЯ SINALOAE Hebard

1920. *Rehnia sinaloae* Hebard. Trans. Amer. ent. Soc., 46:240.

1932. *Rehnia sinaloae* Hebard. Trans. Amer. ent. Soc., 58:337.

*Coloration.*—Size about that of *R. victoriae*, green in color with only the lateral margins of the pronotum pearly white. Tegmina with the apex more rounded than in the other species of *Rehnia*, reddish brown with the intercellular areas beyond the speculum brown. Wings atrophied and very small, pale greenish brown with small round blackish spots between the veins.

*Biology.*—Nothing is known concerning the life history of this species.

*Song*.—Similar to the other species of the genus.

*Habits*.—This species does not show the aggressive characteristics of *cerberus* and it is probably more phyllophagous than carnivorous, because the femoral spines in this species are very minute.

*Host Plant*.—The two males were taken in a clump of the Sonoran plant *Franseria ambrosioides*, which is probably one of its host plants. Fig. 13 shows two males on *Franseria ambrosioides*.

*Record*.—The types were described from Vendidio, Sinaloa, by Hebard, in 1920. The two males taken 40 miles north of Hermosillo, Sonora, Nov. 1, 1939 by the writer are the first for the state of Sonora.

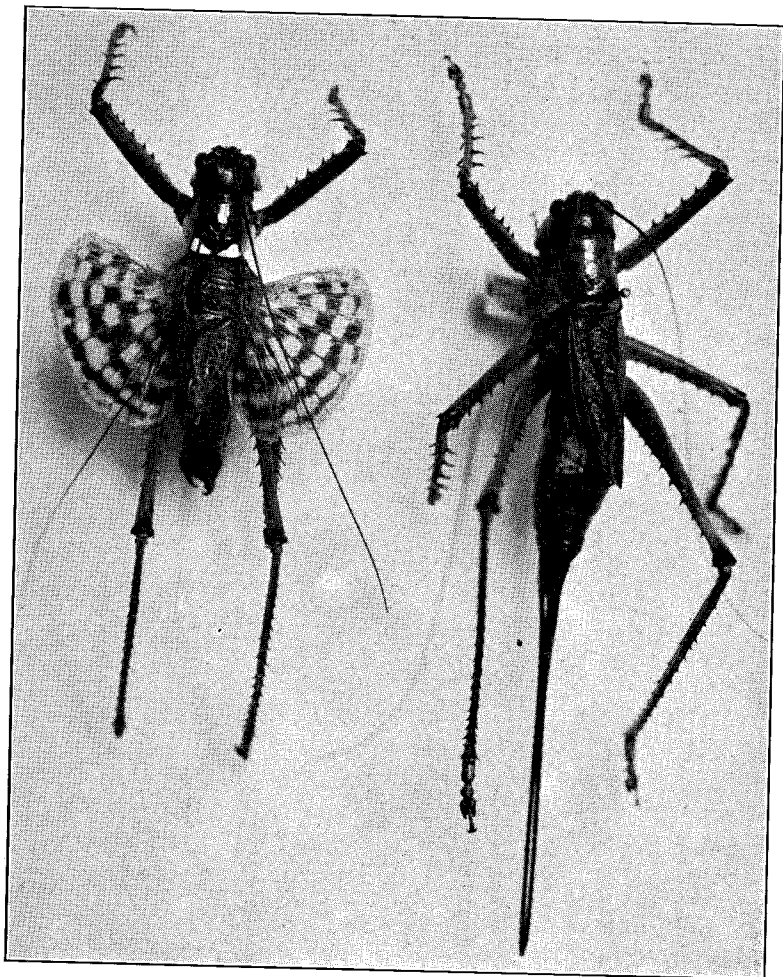


Fig. 11. Male *Rehnia cerberus* with wings expanded (left) and female (right).

*Distribution.*—*R. sindloae* is a member of the Lower Sonoran fauna and is known from Sinaloa north to 40 miles north of Hermosillo. It is probably a member of the Sinaloan Thorn Forests which merge with the flora of the Sonoran Desert in the region of the Yaqui River.

### *Rehnia pulchellus* n. sp.

This is the smallest species of the genus and is most closely allied to *Rehnia victoriae* Caudell. It is readily distinguished from all other species in the genus by having the outer third of the wings beyond the irregular black markings, chrome-yellow (see Fig. 12, no. 6.). In addition the tibiae and tarsi of all legs are tinged with vinaceous differing thus from the green tibiae and tarsi of the other four species.

*Type.*—♂, 4 miles north of Escondida, Sw. Nuevo Leon, elevation approximately 6400 feet, August 26, 1940 (E. R. Tinkham; night collecting). Measurements in millimeters: body length 21.0; pronotum 5.6 x 4.0 wide; tegmina 9.5; wings 8.5; caudal femora 20.0. Type in the Tinkham Collection.

*Description.*—Form typical for the genus; size small. Pronotum with the posterior half of the metazonal disk uptilted and making the pronotum appear subsellate in lateral profile; anterior margin of pronotum with perceptible flanged effect. Tegmina abruptly narrowed beyond the middle with acute apex. Forelegs with fore femora bearing 6 inner and 8-9 outer short ventral spines (immovable); fore tibiae with 6 pairs of long ventral teeth (movable in sockets) and 4 outer dorsal teeth. Middle legs with meso-femora with 6 inner and 8-10 outer short ventral spines; meso-tibiae with 6 pairs of long stout ventral teeth and 3 outer and 5 inner long dorsal teeth. Caudal femora with 9-10 outer and 10-11 inner very short spines on ventral keels; caudal tibiae with 24 outer and 21-23 inner dorsal spines (ventral side in folded leg), and 12-14 outer and 10-11 inner ventral teeth. All the sternites with the typical toothed lobes. Cerci, stout, uncinat, with a median internal prominence.

*Coloration.*—Deep foliage green with the lateral posterior margins of the pronotum nacreous, narrowing to a line on the humeral angles. Wings beautifully marked, pale green with an irregular shining black band formed of coalesced quadrangular black marks beyond which, the outer third of the wing is margined with chrome yellow. Tibiae and tarsi of all legs tinged with vinaceous and crimson lake.

*Allotype.*—♀, same date as the Type. Measurements in millimeters: body length 22.5; pronotum 6.2; tegmina 11.5; caudal femora 24.5; ovipositor 33.0. Type in the Tinkham Collection.

*Description.*—Features and coloration same as the Type but size slightly larger. Ovipositor long, strong and very gently decurved.

*Paratypes.*—2 ♂, same date as the Type; 1 ♂, 7 miles east of Matehuala, San Luis Potosi, August 22, 1940. Range in measurements in millimeters: body length 21.0-24.0; pronotum 5.2-5.8; tegmina 11.5; hind femora 20.0-

22.0. Male paratypes similar to the Type in all respects. 2 ♀, same date as the allotype.—Range in measurements in millimeters: body length 21.0-23.0; pronotum 5.8-6.5; tegmina 12.0-12.5; hind femora 22.5-26.0; ovipositor 31.0-33.0. Female paratypes similar to the allotype.

*Biology*.—These are not known but are probably similar to the other species of *Rehnia*.

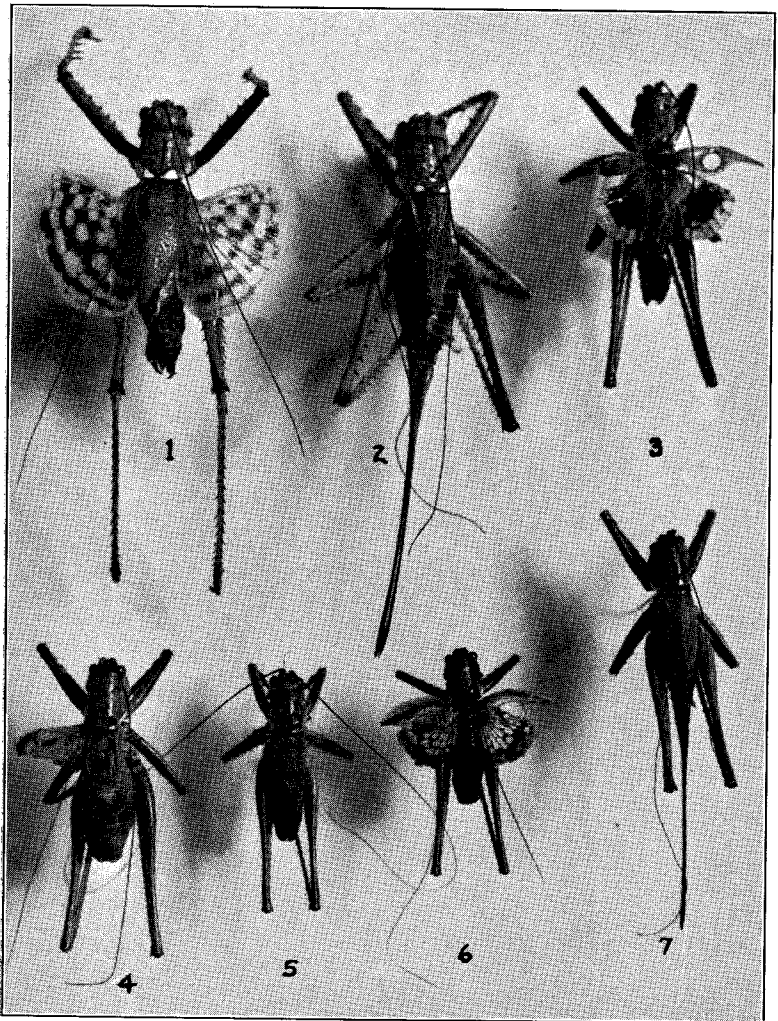


Fig. 12. Showing species of *Rehnia*. 1-2. Male and female *Rehnia cerberus*. 3. Male *Rehnia victoriae*. 4. Male *Rehnia sinaloae*. 5. Male Paratype *Rehnia pulchellus* n. sp. 6. Male Type *Rehnia pulchellus* n. sp. 7. Female Allotype *Rehnia pulchellus* n. sp.

*Habits.*—Like other species of *Rehnia* this species is thamnophilous dwelling in trees and bushes. It is carnivorous as well as phyllophagous and nocturnal. One female contained 18 maturing ova.

*Song.*—The song of this small and interesting species is a moderately strong and continuous "tszik-tszik-tszik" that can be heard for fifty feet or more. The song is quite ventriloquistic and the species is located with great difficulty. The writer was able to locate only one or two specimens in the thorny vegetation during an hour's night collecting by sound and flashlight. This species starts to sing at sunset and the song continues throughout the night until the following sunrise. The writer was fortunate in locating three females and a male on a Cactus plant shortly after dawn. Daylight singing often occurs.

*Host Plants.*—The Matehuala male was found singing during the afternoon in a species of *Lycium*. Some of the Escondida specimens were found hiding on a species of *Opuntia* or Prickly Pear, one male was in *Acacia berlandieri* and a female was taken in *Karwinskia humboltiana*.

*Distribution.*—Known only from Matehuala, San Luis Potosi and Escondida in southwestern Nuevo Leon, this small species inhabits the southern portions of what is recognized as the Salado Desert.

#### ZYCLOPTERA Caudell

1907. *Zycloptera* Caudell. Proc. U. S. Nat. Mus., 32:308.

Size large and rather heavy; head broad and moderately deep. Eyes subcircular and subglobular and very widely spaced. Occiput convex and fastigium low and flat with rounded lateral margins. Pronotum broad and flat with broadly rounded lateral margins and very gently convex posterior margin. Tegmina slightly longer than the pronotum with the inner margin straight and the outer margin subcircularly rounded. Fore and middle femora with a few minute spines; caudal femora with keel spineless. Fore and middle tibiae with 6 pairs of widely spaced short ventral teeth and 3 outer dorsal spines on the fore tibiae and 2 outer and 4 inner dorsal teeth on the meso-tibiae. Caudal tibiae with 10-12 widely spaced short outer teeth and 13 inner teeth on the dorsal surface and 6-7 minute outer and small inner teeth on the ventral side. Ovipositor long, greater than the length of the caudal femora and distinctly decurved. Prosternites with a pair of minute teeth, meso- and meta-sternites with raised and dentate lateral margins.

*Genotype.*—*Zycloptera atripennis* Caudell.

#### ZYCLOPTERA ATRIPENNIS Caudell

1907. *Zycloptera atripennis* Caudell. Proc. U. S. Nat. Mus., 32:309, figs. 1819. (♂ type, Hawthorne, Nevada).

*Coloration.*—Body color pale to darker stone grey with white lateral margins to the pronotum and the posterior half of the lateral lobes. Tegmina bister with cream-colored encrustations sprinkled over their surface. Abdomen

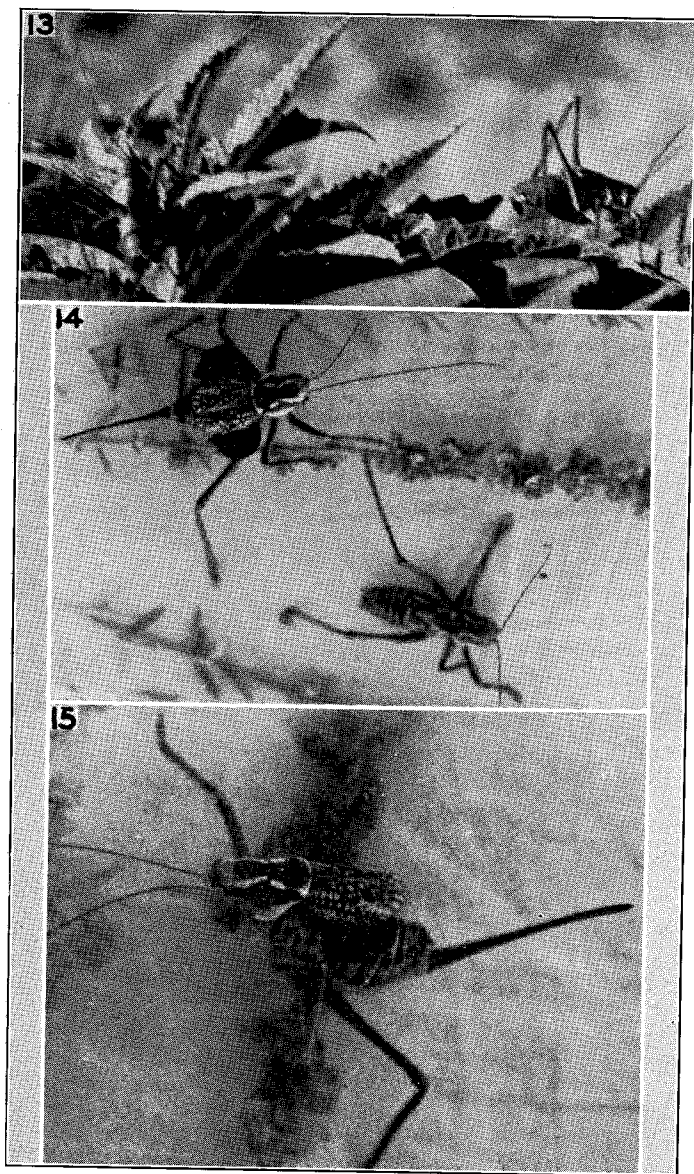


Fig. 13. Showing two males of *Rehnia sinaloae* on host plant *Franseria ambrosioides*.

Fig. 14. Showing male and female of *Zycloptera atripennis*.

Fig. 15. Female *Zycloptera atripennis* in aggressive attitude, with black wings partly exposed.

varying shades of stone gray with dorso-lateral and lateral lines irregularly marked with white. Wings plectate and shining jet black, hence the specific name of *atripennis*. Legs and thoracic and abdominal sternites soft stone gray.

*Biology*.—The life history of this species is not known. The eggs probably hatch in the early spring and the adults mature in middle or late summer.

*Habits*.—*Z. atripennis* is nocturnal and thamnophilous and herbivorous. When gutted for preservation the mesenteron contained the remains of the flowers of *Atriplex confertifolia*. Although exhibiting aggressiveness when annoyed by raising its front legs or the fore and middle legs on one side and spreading its shining jet black wings (see Figs. 14 and 15) there is no evidence to suggest that this species is carnivorous. Seven specimens were kept in a jar for several weeks without losing a specimen due to cannibalism.

*Song*.—At a distance the song of *Z. atripennis* is closely similar to *Capnobotes fuliginosus* but on closer approach the song is softer and somewhat like “zi-i-i-k — zi-i-i-k — zi-i-i-k.” It is long continued.

*Host Plants*.—In its habitat at the south end of Walker's Lake, Nevada, hard clay flats with ridges of sand probably marking different beach levels, were dominated by *Atriplex confertifolia* and *Sarcobatus vermiculatus* and a few other plants one of which was a skeleton weed. The four females and three males were taken in *Atriplex confertifolia*, *Sarcobatus vermiculatus* and the skeleton weed of unknown identity.

*Records*.—South end Walkers Lake, Nevada, August 14, 1938, 4 ♀, 3 ♂ (E. R. and G. E. Tinkham).

*Distribution*.—This very large and rare creature is known only from the type locality, Walkers Lake, Nevada. It is a member of the Great Basin Desert fauna. *Z. atripennis* is probably a relic of Pleistocene days when the Great Basin was a mass of great lakes. It survived to the present day probably because Walkers Lake is the sole remnant of far larger lakes of the Pleistocene Period in this region.

#### AGLAOTHORAX Caudell

1899. *Tropizaspis* Scudder (pt.). Proc. Amer. Acad. Sci., **35**:83-87.

1907. *Aglaothorax* Caudell. Proc. U. S. Nat. Mus., **32**:290.

1920. *Aglaothorax* Rehn and Hebard. Trans. Amer. Ent. Soc., **46**:225.

This remarkable genus is quickly recognized by the enormous size of the pronotum which covers fully half of the body in this Shield-back Katydid. The lateral constrictions come immediately behind the anterior margin of the pronotum, the lateral carinae sharp and diverging strongly posteriorly to round evenly into the strongly convex posterior margin of the pronotum. Tegmina completely hidden by the shield-like pronotum. Fore and middle femora with or without a few small spines. Caudal femora with 7 to 8 small outer and 2 to 3 small inner spines on the lower keels. Fore tibiae with 6 small pairs of ventral teeth and a pair of small apical dorsal teeth. Middle tibiae with 6 small pairs of ventral teeth and one inner basal and one outer apical dorsal teeth. Caudal tibiae armed with long rows of spines on the dorsal surface;



ventral side with 4 or 5 small widely spaced paired teeth. Cerci small, pseudocerci or infracercal plates long, laterally compressed with a black subapical spine on the inner surface. Subgenital plate large; thoracic sternites unarmed. Ovipositor long, recurved, with the apical third of the dorsal valvulae finely serrate.

*Genotype*.—*Tropizaspis ovata* Scudder.

#### KEY TO THE SPECIES OF AGLAOTHORAX

1. Disk of the pronotum large, ovally rounded with the lateral keels gently convex; disk heavily etched with shining black. Body color green with white black and reddish brown markings.....east slope of Sierra Nevada *segnis*  
 Disk of pronotum smaller with the lateral keels parallel or subparallel. Colors duller; size smaller ..... 2
2. Lateral margins of the posterior half of the pronotum parallel. Lateral lobes of prozona without black markings ..... Nevada *armiger*  
 Lateral margins of the posterior half of the pronotum diverging caudally. Colors mainly brown. Lateral lobes of the prozona with brown below keels .....  
 .....mts. of S. Calif. *ovatus*

#### AGLAOTHORAX OVATUS (Scudder)

1899. *Tropizaspis ovata* Scudder. Proc. Amer. Acad. Sci., 35:83.

1900. *Tropizaspis ovata* Scudder. Cat. Orth. U. S., p. 77.

1902. *Tropizaspis ovata* Woodworth. Bull. 142, Calif. Exp. Sta., p. 15.

1906. *Tropizaspis ovata* Kirby. Syn. Cat. Orth., 2:191.

1907. *Aglaothorax ovatus* Caudell. Proc. U. S. Nat. Mus., 32:291, Fig. 2-3.

*Coloration*.—General color castaneous, contrasting sharply with the bright green, black and white coloration of *A. segnis* of the Sierra Nevada. The size is also smaller than that species and the lateral margins of the pronotum divergent posteriorly. In *ovatus* the disk of the pronotum is pale brownish with black etchings only on the posterior margin and with fine streaks of darker brown striating the disk. Lateral lobes of the prozona with brown just ventrad of the lateral keels; this marking is not present in *segnis* or *armiger*. The abdomen is brownish, mottled profusely with darker brown.

*Biology*.—Nothing is known concerning these.

*Habits*.—*A. ovatus* is nocturnal and thamnophilous or arboreal, dwelling in bushes and sometimes tall Western Yellow Pines or in Oak trees. When captured this species plays "possum" and feigns death by drawing its head under its body as far as is possible and drawing all legs together. This species is herbivorous.

*Song*.—The song of *ovatus* is a strong "zip-zip" broken by a pause of several seconds and quite distinct from the "zic-zic-zic" of *segnis*. It can be heard for about one hundred feet. Some males were singing high up in the Western Yellow Pines of the San Gabriel mountains near Big Pines, the night of August 25, 1938. Others were in oaks and two of these were captured.



Fig. 16. Showing camouflage effect of markings of two male *Aglaothorax segnis* (3/5 nat. size) on host plant *Cowania stansburiana*. Sierra Nevadas, California.

Fig. 17. Showing two males of *Aglaothorax armiger* (9/10 nat. size) on pine limb. Charleston Peak, Nevada.

Fig. 18. Female *Plagiostira albonotata* (9/10 nat. size) resting in bush.

*Host Plant.*—Western Yellow Pine (*Pinus ponderosa*) and Oaks, probably *Quercus kelloggii* are hosts of this species. This species is not aggressive and appears to be strictly phyllophagous.

*Records.*—The type locality is Los Angeles County with no particular locality given. It has also been recorded from the San Bernardino mountains. San Gabriel mts., near Big Pines, top of mountain, Aug. 25, 1938, 2 ♂ (E. R. Tinkham).

*Distribution.* — Known at present from the San Bernardino and San Gabriel mountains of southern California.

AGLAOTHORAX SEGNIS Rehan and Hebard

1920. *Aglaothorax segnis* Rehn and Hebard. Trans. Amer. ent. Soc., 46:225.

*Coloration.*—This species is without question one of the most beautiful of the North American Decticinae. The sides of the body are pale green flecked with small white dots and the dorsum of the abdomen possesses a rather broad median band of raw sienna bordered with white. On the second, fourth and fifth abdominal segments this white occupies rather large triangular patches. The purpose of this white is to break up the markings of the body to render the insect inconspicuous and the black etchings on the pronotum acting as shadows also serves this purpose (see Fig. 16 for illustration of this protective camouflage). The very large shield-like pronotum is cream-colored striated with pale brown and streaks of black and heavily etched with black along the margins and the central portions of the pronotum. The antennae are black annulated with white. The fore and middle legs are greenish with a preapical band of reddish brown or blackish on the femora. Caudal femora with the dorsal apical half blackish with a broad central band of cream separating the black areas.

*Biology.*—The life history of this species is not known. The adults are present from August until freeze-up in November but it is not likely that they survive the cold weather. The eggs probably hatch with the warm spring weather and the adults appear in August or late July.

*Habits.*—This beautiful creature is arboreal or thamnophilous living in small pine trees or small shrubs. When captured or touched it feigns death. The adults are strictly nocturnal hiding down in the depths of the dense bushes during the day. The adults are strictly phyllophagous and do not attack one another. No aggressive traits are exhibited by members of this group.

*Song.*—The song of *A. segnis* is a strong “zic — zic — zic — zic” or “zic — zic — zic” the number of “zics” depending upon the individual katydid, some making four, others three; three being the common number. Each series is interrupted by a pause of several seconds during which another individual on the mountain side will probably answer the song. The “zicing” continues from sundown long into the night. Each series of “zics” lasts about a second.

*Host Plants.*—In the Wakers Pass the host was Tree Yuccas *Yucca brevi-*

*folia* and at Carrol Creek west of Lone Pine in 1931, the chief host was *Pinus monophylla*. At the mouth of Lone Pine Creek the Sagebrush *Artemisia tridentata* was the chief host and in Big Pine Canyon *Cowania stansburiana*, Apache Plume, was favored with Sagebrush second in importance.

*Records.*—Big Pine Canyon, 9 miles west Big Pine, Calif., Aug. 16, 1938, 30 ♂, 1 ♀; Oct. 22, 1939, 6 ♂. Lone Pine Canyon, 11 miles west Lone Pine, Calif., Aug. 17, 1938, 5 ♂; Oct. 21, 1939, 2 ♂. Carrol Creek, 9 miles west Lone Pine, Aug. 5, 1931, 14 ♂, 1 ♀ (E. R. Tinkham; Hebard Cln). Walkers Pass, Calif., August 22, 1938, 13 ♂ (all E. R. Tinkham).

*Distribution.*—*A. segnis* occupies a zone roughly 4500 to 5500 feet in elevation at the east base of the Sierra Nevadas. This zone extends from Walker Pass, marking the south extremity of the Sierra Nevadas north to Big Pine Creek, and probably north to Rock Creek but no collecting has been made at this locality. The zone occupied is chiefly *Artemisia tridentata* and west of Lone Pine is at the very base of the Sierra Nevadas. Further north the zone is a few miles east of the base and south at Walker Pass the zone is the *Yucca* zone at the top of the pass.

#### AGLAOTHORAX ARMIGER Rehn and Hebard

1920. *Aglaothorax armiger* Rehn and Hebard. Trans. Amer. ent. Soc., 46:229, figs.

*Coloration.*—Size smaller than *A. segnis*; pronotum smaller and narrower with the lateral keel in the posterior half almost parallel. Pronotal margins etched with black, and black borders the white areas on the dorsum of the abdomen; this black is absent in *A. segnis* and *A. ovatus*. Coloration otherwise similar to the genus.

*Biology.*—Probably the same as the other species but unknown.

*Habits.*—These are similar to the other members of the genus.

*Song.*—The song is a strong “zic — zic — zic” rapidly repeated with a brief pause between each series of “zics.” The song can be heard for almost two hundred feet. This species is very wary and one must make several cautious approaches before the singing katydid can be spotted.

*Host Plants.*—At the mouth of the Canyon leading into Charleston Peak from Las Vegas the writer found this species in the Tree Yuccas, *Yucca brevifolia*; others were singing in *Pinus monophylla* but were impossible to locate because of their ventriloquistic song. Further up the canyon, this species is sometimes rarely taken in the lower branches and on the trunks of *Pinus ponderosa*, and Fir.

*Records.*—Charleston Peak Canyon, elev. 7500 feet, Aug. 15, 1931, 1 ♂ (E. R. Tinkham; in fir; Hebard Cln.). Mouth of Charleston Peak Canyon in Yucca-Pinon-Juniper zone on desert, Oct. 20, 1939, 2 ♂ (E. R. Tinkham).

*Distribution.*—*A. armiger* is known only from Charleston Peak Canyon, the type locality, and is a member of the Yucca-Pinon-Juniper Zone.

## NEDUBA Walker

1869. *Neduba* Walker. Cat. Derm. Salt. Br. Mus., 2:250.  
 1874. *Arythropteris* Hermann. Verh. Zool.-Bot. Ges. Wien, 24:204 (pt.).  
 1893. *Tropizaspis* Brunner. Ann. Mus. Civ. Stor. Nat. Genova, 33 (2d ser., 13):187  
 (invalid as no species included).  
 1894. *Tropizaspis* Scudder. Can. Ent., 26:178-180.  
 1902. *Tropizaspis* Woodworth. Bull. 142, Calif. Exp. Sta. p. 14.  
 1906. *Neduba* Kirby. Syn. Cat. Orth., 2:194.  
 1906. *Tropizaspis* Kirby. Syn. Cat. Orth., 2:194.  
 1907. *Neduba* Caudell. Proc. U. S. Nat. Mus. 32:295.

*Neduba* is closely related to *Aglaothorax* but is smaller in size and with much smaller pronotum; disk of the pronotum smaller and oval in outline. Constriction of the lateral keels slightly more caudad than in *Aglaothorax*. Tegmina completely covered by the pronotum. All femora spineless; fore tibiae with 7 pairs of ventral spines and 1-2 dorsal teeth, though often spineless. Middle tibiae with 8 pairs of ventral teeth and 3 outer and 4 inner dorsal basal teeth. Caudal tibiae with two long rows of dorsal spines, and 2-3 widely scattered minute teeth on the ventral surface. Supra-anal plate usually quadrate and not rounded as in *Aglaothorax*; subgenital plate large. Cerci small; pseudocerci long, laterally compressed and lacking inner subapical tooth in the larger species. Sternites without toothed lobes. Ovipositor long, shorter than the caudal femora, recurved with the apical portions of the dorsal valvulae with finely serrate margin.

*Genotype*.—*Neduba carinata* Walker.

## KEY TO THE SPECIES OF NEDUBA

1. Size very small; pseudocerci with an internal subapical tooth; tegmina uniformly purplish brown ..... *morsei*  
 Size normal and much larger; pseudocerci without internal subapical teeth; tegmina whitish, sometimes with clouded apex ..... 2
2. Maximum breadth of the pronotum more than 7 mms. .... 3  
 Maximum breadth of the pronotum less than 7 mms. .... 4
3. Disk of the pronotum castaneous, body color pale castaneous gray; tegmina whitish with infuscated apex. Outer angles of the quadrate supra-anal plate square.... *convexa*  
 Disk of the pronotum brownish often striated with fine streaks of black; tegmina whitish gray with a black patch at the apex. Outer angles of the supra-anal plate acute angled. .... *carinata*
4. Color uniformly gray; size larger ..... *diabolicus*  
 Color grayish with the sides of the thorax and abdomen with much black; size smaller ..... *sierranus*

## NEDUBA CARINATA Walker

1869. *Neduba carinata* Walker. Cat. Derm. Salt. B. M., 2:251.  
 1874. *Arythropteris steindachneri* Hermann. Verh. Zool.-Bot. Ges. Wien, 24:204, pl. 6, fig. 98-102.  
 1894. *Tropizaspis steindachneri* Scudder. Can. Ent., 26:180-183.  
 1899. *Tropizaspis steindachneri* Scudder. Proc. Amer. Acad. Arts Sci., 35:84, 86.  
 1900. *Tropizaspis steindachneri* Scudder. Cat. Orth. U. S., p. 77.

1902. *Tropizaspis steindachneri* Woodworth. Bull. No. 142, Calif. Exp. Sta., p. 15.  
 1906. *Neduba carinata* Kirby. Syn. Cat. Orth., 2:194.  
 1906. *Tropizaspis steindachneri* Kirby. Syn. Cat. Orth., 2:194.  
 1907. *Neduba carinata* Caudell. Proc. U. S. Nat. Mus., 32:296, fig. 6-7.  
 1922. *Neduba carinata* Buckell. Proc. Ent. Soc. Br. Col. 20:30.  
 1929. *Neduba carinata* Fulton. Pan-Pac. Ent., 5:175-180, 16 figs.

*Coloration.*—Fulton who has written considerably about this species recognized three color phases. In the first phase the pronotum was immaculate, the second was lightly marked and third phase was heavily marked with black on the dark tan-colored pronotum. These color forms are found in any particular habitat and are probably the insect's response to environmental colorations. The general body coloration is brownish or grayish profusely mottled with fine fleckings of black. The tegmina are distinctive, grayish white with the apex possessing a blackish gray patch that serves to distinguish this species.

*Biology.*—What is known concerning the biology of this species has been given by Mr. B. B. Fulton. There are six nymphal instars separable by the length of the pronotum and the development of the male and female genitalia. The nymphs appear in the fall and live through the winter hiding in the leaves, and in mid-summer become adults. The adults feign death when captured or disturbed. The species is nocturnal, thamniphilous on the east side of the Sierra Nevadas and sylvan in the forests of Oregon.

*Habits.*—Mr. Fulton has called this katydid the "Camouflage Cricket" because of the remarkable manner this creature has of hiding or making itself inconspicuous on the forest floor of its home in Oregon. The species is nocturnal, sylvan in Oregon and thamniphilous at the east base of the Sierra Nevadas in Owens Valley. When disturbed or captured this insect feigns death.

*Song.*—The song of *Neduba carinata* cannot be mistaken for that of the genus *Aglaothorax*. Song is a soft "Tst-zee-e-e-e — tst-zee-e-e-e — tst-zee-e-e-e" long continued and heard for a distance of twenty to thirty feet. The "tst" is produced by the drag or return of the tegmina to natural position and the "zee" is the sound stroke. Sometimes the song sounds like "tst-zing-g-g-g" or "t-t-t-tszingggg — t-t-t-tszingggg" the "t-t-t" produced by the teeth of the tegmina as they return to natural position for the next stroke. The latter sound is made at lower temperatures. This species sings at fairly cool temperatures in late October when winter is approaching the Sierra Nevadas.

*Host Plant.*—At Mono Lake the writer took this species in *Pinus monophyllus* in 1930 and in *Artemisia tridentata* in 1938. In Big Canyon *Cowaniana stansburiana*, Apache Plume, was the favored host. A sumac-like plant with small blue berries growing in spikes, is particularly attractive to this species and other Desticids in late August or early September. At Lone Pine Canyon this species was rare but found in *Artemisia*.

*Records.*—Big Pine Canyon, Aug. 16, 1938, 11 ♂; Oct. 22, 1939, 12 ♂. Lone Pine Canyon, Aug. 17, 1938, 6 ♂, Oct. 21, 1939, 1 ♂, Aug. 13, 2 ♂, 1 ♀. Mono Lake, mouth of Tioga Pass, Aug. 11, 1938, 9 ♂, Aug. 1, 1931, 6 ♂, 1 ♀ (E. R. Tinkham; Hebard Cln.). All specimens taken by E. R. Tinkham.

*Distribution*.—Known on the east slopes of the Sierra Nevada Lone Pine Creek to Mono Lake in the Pine Zone above the *Artemisia* zone; at Mono Lake this zone is lower than at Lone Pine. The lower limits of *N. carinata* merge with the upper limits of the *Aglaothorax segnis* zone and in this intergrading zone the two species may be found. The distribution of *N. carinata* probably continues north to the Lake Tahoe region and then swings to the western slopes of the mountains as the species is known from Hood River and Rogue River, Oregon (Fulton) and north to the Okanagan Valley, British Columbia (Buckell).

#### NEDUBA CONVEXA Caudell

1907. *Neduba carinata* var. *convexa* Caudell. Proc. U. S. Nat. Mus., 32:300, fig. 9-10.

1909. *Neduba convexa* Rehn and Hebard. Proc. Acad. Nat. Sci. Phila., p. 475.

*Coloration*.—The body color in this species is castaneous gray and pronotum is castaneous. The size is slightly larger than *N. carinata* and the ovipositor of the female longer.

*Biology*.—The life history is unknown but probably similar to other species of the genus.

*Habits*.—Similar to other species of *Neduba*.

*Song*.—Almost indistinguishable from *Neduba carinata*.

*Host Plant*.—In the Walker Pass near the summit this species was found only in Tree Yuccas *Yucca brevifolia*.

*Records*.—Walker Pass, California, elev. 5,000 feet, Aug. 22, 1938, 5 ♂, 3 ♀ (E. R. and G. E. Tinkham).

*Distribution*.—The Type Locality is Mt. Shasta. Rehn and Hebard (1909) recorded specimens from Mt. Tamaulipas. The species probably ranges south along the western slopes of the Sierras to Walker Pass.

#### NEDUBA SIERRANUS (Rehn and Hebard)

1909. *Aglaothorax sierranus* Rehn and Hebard. Proc. Acad. Nat. Sci. Phila., p. 476, fig. 15-19.

*Coloration*.—Although described as an *Aglaothorax*, this species is a *Neduba* not only on account of its features but on the nature of its song. This is the second smallest species of the genus as is characterized by the black markings on the lateral lobes of the pronotum and on the sides of the abdomen. The pronotum and median area of the dorsum of the abdomen is pale brownish with fine mottling of darker brown.

*Habits*.—This species is arboreal, dwelling in pine trees in the Yosemite region. Other habits are similar to *Neduba*.

*Song*.—The song of *N. sierranus* is soft and low and audible for a short distance only. The song is similar to other species of *Neduba*.

*Host Plant.*—This species was found only in a species of Pine at Carl Inn, Yosemite, California.

*Records.*—Carl Inn, Yosemite Park, Aug. 12, 1938, 2 ♂ (E. R. Tinkham).

*Distribution.*—This species is known only from the Yosemite Park region.

#### NEDUBA DIABOLICUS (Scudder)

1899. *Tropizaspis diabolica* Scudder. Proc. Amer. Acad. Arts Sci., 35:84, 86.

1900. *Tropizaspis diabolica* Scudder. Cat. Orth. U. S. p. 77.

1902. *Tropizaspis diabolica* Woodworth. Bull. No. 142. Calif. Exp. Sta., p. 15.

1906. *Tropizaspis diabolica* Kirby. Syn. Cat. Orth., 2:191.

1907. *Aglaothorax diabolicus* Caudell. Proc. U. S. Nat. Mus., 32:294.

*Coloration.*—This interesting species is distinguished by its uniform color of medium or dark grayish brown. The tegmina are grayish white and immaculate. The fore and middle femora have preapical bands of black.

*Habits.*—Similar to other species of *Neduba* but less sensitive to light at night, some specimens kept on stridulating with the light of a flashlight shining on them.

*Biology.*—Nothing is known concerning the life history of this species.

*Song.*—The song of *N. diabolica* is quite distinct from the other species of the genus. Song of about the same intensity as *Neduba carinata* but continuous with the "zwees" interrupted with a "tck" as the tegmina come back into position. Song is a continuous "zwee-tck — zwee-tck — zwee-tck — zwee-tck — zwee-tck."

*Host Plant.*—Probably oaks as the species was found in amongst the leaves and small bushes at the base of oaks.

*Records.*—Tehachapi mts., Paradise Valley, Aug. 6, 1931, 7 ♂, (E. R. and H. A. Tinkham; Hebard Cln.).

*Distribution.*—The unique female type was described from Mt. Diablo. The species is known from Mt. Diablo south to the Tehachapis.

#### NEDUBA MORSEI Caudell

*Neduba morsei* Caudell. Proc. U. S. Nat. Mus., 32:301, fig. 11.

*Coloration.*—This, the smallest species in the genus, is either uniformly buffish brown or dark grayish; if grayish the specimens are lightly mottled with flecks of black with a small amount of black just ventrad of the lateral keels of the pronotum. The tegmina are purplish brown and the pseudocerci or infra-cercal plates are long and narrow with a minute internal apical tooth.

*Biology.*—Nothing is known concerning these.

*Habits.*—This small species is nocturnal and thamnophilous, feeding on the leaves of the plants which are their home.



*Song*.—Quite distinct and peculiar as it does not resemble any other of the other various species of *Neduba* and *Aglaothorax*. The song is a "Tsip-tsip-tsip-tsip-tsip-tsip-tsip" continuing strong and finishing weaker and lower, then broken by a pause, then shortly the song is repeated.

*Host Plant*.—In the San Gabriel mountains this species was found only in the shining and waxy-leaved shrub called Yerba Santa (*Eriodictyon californicum*).

*Records*.—San Gabriel Mts., Big Pines, Aug. 25, 1938, 8 ♂, 1 ♀ (E. R. and G. E. Tinkham). Olympic Mts., Wash., July 18, 1926, 1 ♂ (R. Flock).

*Distribution*.—The type locality of this species is Mount Wilson, Altadena, California. *N. morsei* is known from the mountains of southern California north along the Pacific Coast west of the high Sierras to the Olympic mountains of Washington.

#### PLAGIOSTIRA Scudder

1876. *Plagiostira* Scudder. Ann. Rept. Chief. Eng., p. 501.

1894. *Plagiostira* Scudder. Can. Ent., 26:179, 182.

1897. *Plagiostira* Scudder. Guide Orth. N. Amer., p. 57.

1906. *Plagiostira* Kirby. Syn. Cat. Orth., 2:195.

1907. *Plagiostira* Caudell. Proc. U. S. Nat. Mus., 32:388.

This species is characterized by its medium size, rather long and slender form and the peculiar form of the pronotum. The pronotal disk is flat with concavities, the pronotal keels strong and parallel and present except on the anterior fifth; the lateral lobes are shallow; the shape of the pronotum squarish or rectangular. Thorax with only the mesosternites armed with a pair of small spines. Fore and middle femora lacking ventral spines; caudal femora with 3 to 4 internal spines on the ventral keel. Fore tibiae with 6 pairs of ventral teeth and 1 to 2 dorsal outer ones. Mesotibiae with 6 pairs of ventral teeth. Caudal tibiae with 12 outer and 14 inner widely spaced dorsal spines and 7 outer and inner ventral teeth. Ovipositor considerably longer than the caudal femora and distinctly decurved.

*Genotype*.—*Plagiostira albonotata* Scudder.

#### PLAGIOSTIRA ALBONOTATA Scudder

1876. *Plagiostira albonotata* Scudder. Ann. Rept. Chief Eng., p. 501.

1876. *Plagiostira albonotata* Scudder. Rept. U. S. Geol. Surv. W. 100th Mer., p. 281.

1900. *Plagiostira albonotata* Scudder and Cockerell. Proc. Davenp. Acad. Nat. Sci. 9:55.

1903. *Plagiostira albonotata* Caudell. Proc. U. S. Nat. Mus., 26:807.

1904. *Plagiostira albonotata* Scudder. Can. Ent., 26:182.

1906. *Plagiostira albonotata* Kirby. Syn. Cat. Orth., 2:195.

1907. *Plagiostira albonotata* Caudell. Proc. U. S. Nat. Mus., 32:389, Fig. 74-76.

1907. *Plagiostira albonotata* var. *Brevipes*, Proc. U. S. Nat. Mus., 32:392.

1929. *Plagiostira albonotata albonotata* Hebard. Proc. Acad. Nat. Sci. Phila., p. 492.

1935. *Plagiostira albonotata* Hebard. Trans. Amer. Ent. Soc., 61:310.

*Synonymy*.—Hebard placed the variety *brevipes* in synonymy, in 1935.

*Coloration.*—Body color grayish green; legs and ovipositor pale green. Head pale green with a white streak just below the eye and the lower margin of the genae; dorsum of head with two narrow chalk white stripes between the eyes. Pronotum grayish green with the lateral keels tinged with lavender and with three pairs of chalk white spots on the dorsum; one pair on the front margin, another pair centrally placed and just within the lateral keels with a small narrowly separated pair of spots just cephalad of this central larger pair.

*Biology.*—This has not been described. The eggs probably hatch in the early spring with the advent of warm weather as nymphs are still present in mid-July. These nymphs are females whereas the males, having one less stadium than the females, are adult at this time. The eggs are pale violet gray 6.2 mms. long and 1.45 mms. in width. The twenty eggs are laid singly. The chorion under high power shows small impressed areas, each with a microscopic pore in the center.

*Habits.*—This species is thamnophilous, dwelling in bushes on eastern section of the Great Basin desert. It is nocturnal and at night work up to the tops of the Rabbit brush bushes where they feed on the leaves, or in the fall on the petals of the yellow flowers which are highly favored for food. This species does not exhibit any aggressive features, nor does it appear to have any cannibalistic traits.

*Song.*—The song of *P. albonotata* is a soft “zee-e — zee-e — zee-e” continuous and audible for a distance of thirty to forty feet.

*Host Plant.*—The chief host plant appears to be Rabbit Brush *Chrysothamnus* spp., the katydid feeding on the leaves but in the fall is especially attracted to the petals of the small yellow flowers. Occasionally specimens are found in the Arrow-weed *Pluchea sericea* and in Sagebrush *Artemisia tridentata*.

*Records.*—The type female was described from New Mexico. Caudell, in 1907, studied specimens from Dolores and Durango, Colorado; Pinedale, Arizona and Albuquerque, New Mexico. The variety *brevipes* was described from Williams, Arizona. The University of Arizona contains specimens ranging from the Kaibab to Shiprock and the Grand Canyon to Springerville. Winslow, Arizona, Sept. 22, 1939, 4 ♂, 2 ♀; Petrified Forest, Arizona, July 15, 1940, 6 ♂, 2 ♀ last instar nymphs (E. R. Tinkham). Ten miles East Flagstaff, Ariz., July 26, 1931, 1 ♀ (E. R. Tinkham; Hebard Cln.).

*Distribution.*—*Plagiostira albonotata* occupies the southeastern corner of the Great Basin Desert. Its range extends from Durango and Dolores, southwestern Colorado, east to Albuquerque, New Mexico, south to Springerville, Pinedale, and Winslow, and west to Williams, the Kaibab Plateau, and Kanab, Utah.

#### PLAGIOSTIRA GILLETTEI Caudell

1907. *Plagiostira gillettei* Caudell. Proc. U. S. Nat. Mus., 32:392, fig. 77.

1929. *Plagiostira gillettei* Hebard. Proc. Acad. Nat. Sci. Phila., 81:403.

*Coloration.*—The coloration in this interesting species is yellow-brown with the sunken area of the pronotum greenish and the posterior margins of

the abdominal segments edged with round black spots. This species is easily distinguished from its relative *P. albonotata* by its larger size and much broader and almost square pronotum.

*Biology*.—The life history of this species has not been described, but is probably similar to that of *P. albonotata*.

*Habits*.—Nocturnal and thamnophilous, living in sagebrush, and strictly phyllophagous.

*Song*.—The song of this species is not known.

*Host Plant*.—These have not been described but are probably similar to those of *P. albonotata*, chiefly Rabbit brush and Sagebrush.

*Records*.—The only published record is the type, a juvenile male, from Grand Junction, Colorado. The writer has a female from Price, Utah, collected by Miss Grace O. Wiley, in 1923, but it is not available for study. The species is also known from Nevada.

*Distribution*.—This species inhabits the eastern section of the Great Basin Desert, occupying an area in eastern Utah and extreme western Colorado, north of the range of *Plagiostira albonotata*.

#### ATELOPLUS Scudder

1894. *Atelopus* Scudder. Can. Ent., **26**:179, 182 (invalid; no spp. desc.).

1897. *Atelopus* Scudder. Guide N. Amer. Orth., p. 57 (invalid).

1900. *Atelopus* Scudder. Cat. Orth. U. S., p. 79, 98.

1906. *Atelopus* Kirby. Syn. Cat. Orth., **2**:195.

1907. *Atelopus* Caudell. Proc. U. S. Nat. Mus., **32**:368.

This genus includes species of large to small size and of rather uniform tan, brown or gray coloration. The pronotum is short, almost square, the posterior margin squarely truncate and the disk of the pronotum broadly rounded into the shallow lateral lobes. Caudal femora short, heavy, and strongly swollen in the basal half. Male tegmina exposed for less than half the length of the pronotum; not exposed in the female. Fore and middle femora unarmed or with a few small ventral spines; caudal femora with one to five small internal spines on the lower keel. Fore tibiae with 6 pairs of ventral spines and 1 to 3 outer dorsal teeth; meso-tibiae with 6 pairs of ventral and usually 2 outer and 4 inner dorsal teeth. Caudal tibiae with two long dorsal spine rows of variable number and a few widely spaced ventral teeth. Ovipositor short, heavy and gently recurved; cerci generally slender with an incurved or subapical prong, acutely pointed.

*Genotype*.—*Atelopus notatus* Scudder.

There are seven known species; the first male of *A. minor* will be described in the following pages.

#### KEY TO THE MALES OF ATELOPLUS

1. Size very large for the genus; pronotal length exceeding 8 mms. ....*splendidus*
- Size medium to small; pronotal length less than 7 mms. .... 2

- |  |                 |
|--|-----------------|
| 2. Size medium to small; cerci almost as broad as long with a short toothed inner prominence .....                       | 3               |
| Size small; much longer and narrower with an apical or subapical toothed prong directed inwards .....                    | 4               |
| 3. Color uniformly brown; outer and apical margins of the cerci acute-angled; size fairly large .....                    | <i>schwarzi</i> |
| Color mottled dark grayish; outer and apical margins of the cerci obtuse-angled; size small .....                        | <i>minor</i>    |
| 4. Cerci with the inner prong subapical in position .....  | <i>coconino</i> |
| Cerci with the inner prong apical in position .....  | 5               |
| 5. Supra-anal plate squarely truncate with a slight median concave notch.....  | <i>notatus</i>  |
| Supra-anal plate with a deep "U"-shaped notch .....  | 6               |
| 6. Size very small, dark gray with pale gray dorso-lateral shadings on the pronotum and abdomen .....                    | <i>hesperus</i> |
| Size small; usually light tan, sometimes tinged with gray, with or without a dorsal median black chain-like marking..... | <i>luteus</i>   |

### ATELOPLUS NOTATUS Scudder

1900. *Ateloplus notatus* Scudder. Cat. Orth. U. S., pp. 79, 98, pl. 2, fig. 3.

1906. *Ateloplus notatus* Kirby. Syn. Cat. Orth., 2:195.

1907. *Ateloplus notatus* Caudell. Proc. U. S. Nat. Mus., 32:369, figs. 54, 55.

*Coloration.*—General coloration uniform reddish brown with a black median stripe on the pronotum and a heavy black chain-like stripe down the dorsum of the abdomen. The genicular areas of the caudal femora are infuscated.

*Biology.*—The particular life history has not been described. Like other species the ova mature in late summer and are laid and hatch the following spring.

*Habits.*—This interesting species is nocturnal and terrestrial.

At night it is found crawling about on the desert floor of its home, but when disturbed exhibits great saltatorial powers and are thus not easily captured.

*Song.*—The song is a soft low "zee-zee-zee-zee-zee" that is inaudible at fifteen feet or more.

*Host Plant.*—These are not known. As the species wanders out over the desert floor it may be partly scavenging for small bits of organic material that it can find.

*Records.*—Six miles east of Jacumba, California, Aug. 24, 1931, 3 ♂, 6 ♀ (E. R. and G. E. Tinkham; Hebard Cln.). The Type locality is San Diego and Caudell recorded an immature male from Indio.

*Distribution.* — The Jacumba specimens were taken where the Pinon-Juniper Zone merged with Creosote and other desert plants. This species is restricted to Southern California and is a member of the Colorado Desert fauna.

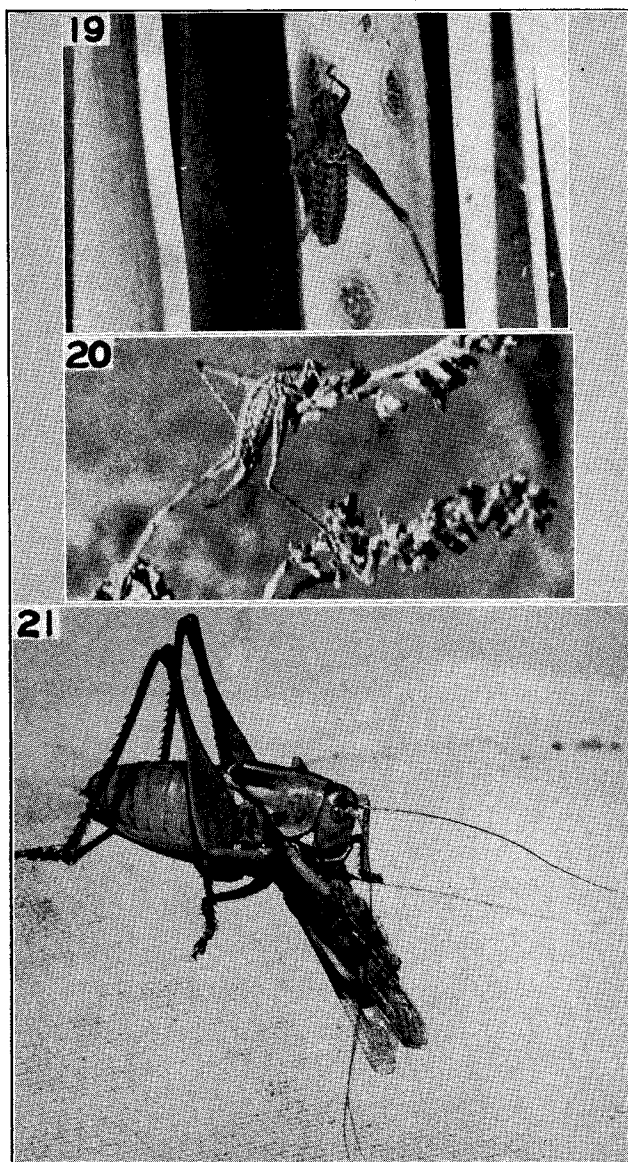


Fig. 19. Allotype male of *Ateloplus minor* (nat. size) on hanging leaves of *Yucca Schottii*.

Fig. 20. Topotype female of *Ateloplus hesperus* (nat. size) on host plant, *Artemisia tridentata*.

Fig. 21. Showing male *Pediodectes americanus* (nat. size) feeding on a grasshopper.

## ATELOPLUS MINOR Caudell

1907. *Ateloplus minor* Caudell. Proc. U. S. Nat. Mus., 32:371, fig. 56.

Caudell described this species from a single female taken at Oracle, Arizona, June 29 (Schwartz).

As the male is undescribed I present below the description of the male type.

This species in size is about that of *A. notatus* but differs by being darker gray and lacking the dorsal median black stripe. It is evidently most closely allied to *A. schwarzi* from which it differs by much smaller size, darker gray coloration and the shape of the cerci; which is quite different from all the species of the genus except *schwarzi* by its breadth. From *schwarzi* the cerci is distinguished by having the outer and apical cercal margins obtuse-angled and not acute angled as in that species.

*Allotype*.—♂, Santa Rita Mountain, near mouth of Madera Canyon, Sept. 2, 1938 (E. R. Tinkham; *Yucca Schottii*). Measurements in millimeters: body length 18.5; pronotum 5.3 x 3.75 in width; exposed tegmina 2.0; caudal femora 13.5 x 3.6 in basal breadth; antennae c. 32.0 mms. Allotype in the Tinkham Collection.

*Description*.—Size moderately small, form typical for the genus. Posterior margin of the pronotum straight and very slightly concave due to the posterior half of the metazona having a perceptible upward tilt. Fore and middle legs stout; caudal femora short, exceeding the apex of the abdomen by one-third its length; the base strongly swollen. Fore femora with the lower keels spineless; meso-femora with one outer apical spine; caudal femora with 5 to 6 outer and 3 to 5 inner short black spines on the lower keels. Fore tibiae with 6 pairs of stout ventral teeth; meso-tibiae with 6 pairs ventral and 1 outer and 4 inner dorsal teeth; caudal tibiae with 27-28 outer and 20-22 inner dorsal spines, those on the basal half alternately small and large, the small spine at the proximal base of the large spine, and 6 outer and 6 inner small widely spaced ventral teeth. Cerci short and broad with the outer and apical cercal margins obtuse-angled and the inner apex toothed.

*Coloration*.—Gray mottled profusely with darker gray on the dorsum of the body. Face and thoracic pleurites pale gray finely mottled with flecks of darker gray. Tegmina dull black with the principal veins testaceous. Fore and middle femora with a dark pre-genicular annulus. Caudal femora mottled gray, darker on the dorsal surface and with the swollen basal half bearing a median black stripe on the outer pagina. Caudal tibiae mottled gray with a dark basal annulus. Fig. 18 shows the male type on the dry pendant leaves of (*Yucca Schottii*).

*Biology*.—These are not known, but observations would lead one to believe that the eggs hatch in the spring and the adults are mature in late July or early August.

*Habits*.—The species is nocturnal and likes to hide in the pendant leaves of Yuccas.

*Song*.—The song is a soft low “zeee — zeee-zeee-zeee” continuous and audible for a distance of ten to fifteen feet. The male type was taken singing at midnight.

*Host Plant*.—The male type was taken in *Yucca Schottii*.

*Records*.—Only the unique male type is known.

*Distribution*.—The female was described from Oracle at the north base of the Santa Catalina mountains and the male type from Madera Canyon in the Santa Ritas, some seventy-five miles to the south of the first locality. *A. minor* inhabits the lower levels of the Sonoran Live Oak Zone in Arizona; this zone merges with the desert vegetation of the Sonoran Desert.

#### ATELOPLUS SCHWARZI Caudell

1907. *Ateloplus schwarzi* Caudell. Proc. U. S. Nat. Mus., 32:372, figs. 57, 58.

1935. *Ateloplus schwarzi* Hebard. Trans. Amer. Ent. Soc., 61:312.

*Coloration*.—In coloration this species most closely resembles *A. notatus* but it is considerably larger and lacks the black median, dorsal chain-like marking characteristic of *A. notatus*.

*Biology*.—These remain to be described.

*Habits*.—*A. schwarzi* is nocturnal, sometimes found on the desert floor, on other occasions found in bushes or perched upon the roof of a pack-rat's den.

*Song*.—The song of *A. schwarzi* is a faint soft trill “zee — zee — zee — zee — zee” that cannot be heard at more than ten feet distance.

*Host Plants*.—One male was taken singing in an *Acacia* bush and others were taken on top of a pack rat's nest. This species probably feeds on organic material rather than on the leaves of microphyllous desert plants.

*Records*.—The Type locality is Tinajas Altas in southwestern Arizona. Caudell (1907) also reports specimens from Phoenix, Hot Springs, Santa Rita mountains. Specimens taken in the Gila Bend Mountains, August 29, and the Maricopa mountains, August 28, 1931, by the writer, are in the Hebard Collection.

*Distribution*.—*A. schwarzi* is a member of the Lower Sonoran fauna restricted to the Sonoran Desert east of the Colorado River. see Bull et al. bc  
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#### ATELOPLUS LUTEUS Caudell

1907. *Ateloplus luteus* Caudell. Proc. U. S. Nat. Mus., 32:373, fig. 59.

*Coloration*.—The prevailing color in this small species is a light tan, although some individuals exhibit a faint gray band on the sides of the body, and rarely an individual with dark gray banding.

*Biology*.—Nothing is known concerning the life history of this small species.

*Habits*.—This species is nocturnal and thamnophilous, hiding in small

desert bushes such as species of *Atriplex*. It is believed that this species is strictly herbivorous in food habits.

*Song*.—Like other species of the genus, the song of *A. luteus* is a faint low "zee-zee-zee-zee" continuous until disturbed and audible for only a few feet.

*Host Plants*.—At Walker Lake, Nevada, this species was found in *Atriplex confertifolia*. Other host plants probably include other species of *Atriplex* of which there are many species.

*Records*.—Walker Lake, near Hawthorne, Nevada, August 14, 1938, 5 ♂, 3 ♀; Walker Pass, California, elev. 4800 feet, Aug. 22, 1938, 5 ♂, 6 ♀ (E. R. and G. E. Tinkham).

The type locality is Mojave, ~~California~~ *Arizona*

*Distribution*.—*A. luteus* is a member of the Mojave Desert and is known from Mojave and Walker Pass, California, east and north to Walker Lake, Nevada.

#### ATELOPLUS HESPERUS Hebard

1934. *Ateloplus hesperus* Hebard. Trans. Amer. ent. Soc. 60:40 (Lone Pine Canyon, California).

*Description*.—This, the smallest species in the genus *Ateloplus* is distinguished by its small size and dark gray coloration. The dorso-lateral areas are pale gray and there is a dorsal median chain-like stripe running from the fastigium of the head to the apex of the abdomen. The female ovipositor is gently recurved and about the length of the caudal femora.

*Biology*.—These are unknown for this rare species.

*Habits*.—This diminutive species is nocturnal and thamnophilous, hiding in dense clumps of sagebrush during the day. It is strictly herbivorous or phyllophagous on the leaves of desert plants.

*Song*.—The song of this small creature is very faint and cannot be heard at distance greater than a few feet. It is a faint buzzing "zee-zee-zee-zee."

*Host Plant*.—This species has been found only in Sagebrush *Artemisia tridentata* as illustrated by Fig. 20.

*Records*.—In addition to the male and female type from Lone Pine Canyon and a female paratype from near Cosa Hot Springs, both in Owens Valley, and in the Hebard Collection, the writer possesses the following specimens: two female topotypes dated Aug. 14, 1938, and 1 female topotype dated Oct. 21, 1939 (E. R. Tinkham). In addition the writer possesses one male and one female taken in Big Pine Canyon, August 16, 1938 (G. E. Tinkham).

*Distribution*.—The range of this small rare species is restricted to Owens Valley at the east base of the Sierra Nevadas. It is a member of the Mojave Desert fauna.

#### ATELOPLUS SPLENDIDUS Hebard

1934. *Ateloplus splendidus* Hebard. Trans. Amer. ent. Soc. 60:43, Pl. 2, fig. 3; Pl. 3, fig. 4 (Barstow, California).



*Coloration.*—This is by far the largest and handsomest species of the genus *Ateloplus*. Its general coloration is gray mottled with darker gray. The lower half of the lateral lobes of the pronotum are conspicuously marked with ochraceous buff. The dorsum of the pronotum and abdomen is pale gray with a median chain-like stripe of dark grey.

*Biology.*—The life history of this rare species is unknown.

*Habits.*—This large species is nocturnal and thamnophilous, dwelling in desert vegetation upon which it feeds. It is not known whether the various species of *Ateloplus* show any cannibalistic traits.

*Song.*—Singing commences in the evening about sundown. The song is distinctive and loud and rapid. The writer timed this species and found it to make 180 distinct "zees" per minute. The song is a long sustained "zee — zee — zee — zee — zee — zee — zee" produced at a very rapid rate and continued for many minutes at a time.

*Host Plant.*—This species was taken on *Larrea tridentata*, the Creosote bush, which is its host.

*Records.*—The original type male specimens were taken on the desert near Barstow, California, August 10, 1931 by the writer and his brother. Nr. Barstow, Aug. 23, 1938, 1 ♂ (E. R. Tinkham).

*Distribution.*—*A. splendidus* is a member of the Lower Sonoran faunal region occupying the Colorado Desert. The female type came from near Coyote Wells in Imperial Valley, California.

#### ATELOPLUS COCONINO Hebard

1935. *Ateloplus coconino* Hebard. Trans. Amer. ent. Soc., 61:140, pl. VII, fig. 1-2.

1935. *Ateloplus coconino* Hebard. Trans. Amer. ent. Soc., 61:311 (listed).

*Coloration.*—In coloration and size this species is closely similar to *A. notatus* but differs in lacking the black dorsal stripe and by the feature of the male cerci which has the internal prong subapical and not apical as in *A. notatus*.

*Biology.*—The biology of this species is not known.

*Habits.*—These are probably similar to *A. notatus*.

*Song.*—The song has not been described but it is probably a low faint "zee-zee-zee-zee" continuous and similar to other small species of *Ateloplus*.

*Food Plants.*—The host plant of this species has not been described. It may dwell in *Yuccas* that are found in the vicinity and north of the type locality.

*Records.*—The type locality is Bill Williams Fork, Arizona and I have been fortunate in examining a topotype male from that locality.

*Distribution.*—*A. coconino* is a member of the Lower Sonoran Faunal region and a member of the Mojave Desert, which finds its eastern limits in this region just east of the Colorado River.

## PEDIODECTES Rehn and Hebard

1897. *Orchesticus* Scudder. Guide. Orth. N. Am., p. 55.  
 1900. *Orchesticus* Scudder. Cat. Orth. U. S., p. 76.  
 1900. *Stipator* Rehn. Trans. Amer. Ent. Soc., 27:90,  
 1904. *Stipator* Rehn. Proc. Acad. Nat. Sci. Phila., p. 543.  
 1906. *Stipator* Kirby. Syn. Cat. Orth., 2:183.  
 1907. *Stipator* Caudell. Proc. U. S. Nat. Mus., 32:339.  
 1920. *Pediodesctes* Rehn and Hebard. Trans. Amer. Ent. Soc., 46:244.

This genus is characterized by species of medium to large size and of rather heavy build. Pronotum rather long, about one and three-quarters times as long as broad. Disk of pronotum flat, the lateral margins smoothly rounding into the deep lateral lobes, the posterior margins of which are concavely sinuate. Tegmina partially exposed in the males and concealed by the pronotum in the females. Prosternum with toothed lobes; meso- and meta-sternites with triangulate lobes. Fore femora with one to two ventral spines; meso-femora unarmed; caudal femora with 6 to 8 small black spines on the lower inner keel. Fore tibiae with 6 pairs of ventral teeth and two outer and 0-1 inner dorsal teeth; meso-tibiae with 6 pairs of ventral teeth and 2 outer and 4 inner dorsal teeth. Caudal tibiae with about 26 outer and 24 inner dorsal spines and 6 pairs of ventral widely spaced teeth. Ovipositor about two-thirds the length of the caudal femora.

*Genotype*.—*Orchesticus americanus* Saussure.

Ten species of *Pediodesctes* are known, five of which, namely: *prattei*, *stevensoni*, *haldemanii*, *daedalus* and *nigromarginata* are species of the Great Plains and do not come within the scope of this treatise. Of the other five species, *P. ateloploides* from Baja California is known only from the type female, and may not belong to this genus.

## KEY TO THE SOUTHWESTERN SPECIES OF PEDIODECTES

- |   |                   |
|---|-------------------|
| 1. Face of uniform coloration .....   | 2                 |
| Face crossed by a band of white bordered with black .....   | 3                 |
| 2. Body coloration green or yellowish green. Metazona of the pronotum verona brown with median and lateral stripes of buffish white .....                               | <i>americanus</i> |
| Body coloration dark mottled brownish black; caudal femora large and bearing an inner dorso-lateral and an outer median stripe of dark brown; size large....            | <i>grandis</i>    |
| 3. Face and genae black and crossed by a white band (one sixteenth inch wide), gently decurved, and running from posterior margin to posterior margin of the head ..... | <i>tinhami</i>    |
| Face only with a white triangular patch edge with black, posterior margin of genae whitish .....  | <i>bruneri</i>    |

## PEDIODECTES AMERICANUS (Saussure)

1859. *Orchesticus americanus* Saussure. Rev. Mag. Zool., 11:201.  
 1869. *Orchesticus americanus* Walker. Cat. Derm. Salt. B. M., 2:248.  
 1894. *Orchesticus americanus* Scudder. Can. Ent., 26:180, 183.

1900. *Orchesticus americanus* Scudder. Cat. Orth. U. S., p. 76.

1900. *Stipator americanus* Rehn. Trans. Amer. Ent. Soc., 26:90.

1906. *Stipator americanus* Kirby. Syn. Cat. Orth., 2:183.

1907. *Stipator americanus* Caudell. Proc. U. S. Nat. Mus., 32:341, figs. 41-42.

1920. *Pediodes americanus* Rehn and Hebard. Trans. Amer. Ent. Soc., 46:245.

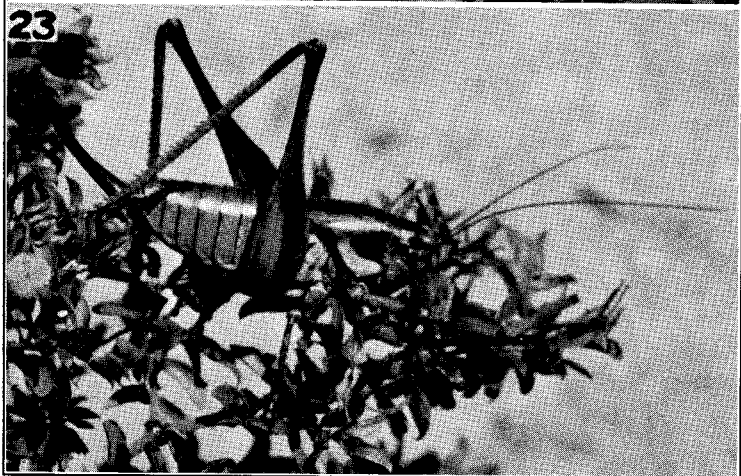


Fig. 22. Male *Pediodes americanus* (nat. size) resting on Creosote bush.

Fig. 23. Showing female *Pediodes grandis* (nat. size) from Ciudad Victoria, Tamaulipas.

*Coloration.*—This species is quickly identified by its uniform yellowish-green coloration with the posterior portion of the disk of the pronotum dark verona brown with median and lateral stripes of buffish white.

*Biology.*—According to Caudell adults appear as early as May in Texas; otherwise there is nothing published on its life history.

*Habits.*—This species is thamnophilous, dwelling in bushes and small trees. It is phyllophagous and nocturnal and when in captivity quickly attacks grasshoppers and other insects offered to it (see Fig. 21). It does not exhibit any aggressiveness for when annoyed this creature tries to escape by jumping.

*Song.*—The song of *P. americanus* is a soft "tsee — tsee — tsee — tsee" that is continuous and can be heard for a distance of thirty to forty feet. When disturbed the species remains quiet for many minutes before resuming its singing.

*Host Plant.*—At Ozona, near the western edge of the Edwards Plateau this species was found in Mesquite (*Prosopis glandulosa*).

*Records.*—Ozona, Texas, Sept. 12, 1940, 4 ♂ (E. R. Tinkham; mesquite).

*Distribution.* — This species is known from the western edge of the Edwards Plateau, east to central Texas and north to northern Texas.

#### PEDIODECTES GRANDIS (Rehn)

1904. *Stipator grandis* Rehn. Proc. Acad. Nat. Sci. Phila., pp. 544-545.

1906. *Stipator grandis* Kirby. Syn. Cat. Orth., 2:183.

1907. *Stipator grandis* Caudell. Proc. U. S. Nat. Mus., 32:347.

1920. *Pediodesctes grandis* Rehn and Hebard. Trans. Amer. Ent. Soc., 46:246.

1932. *Pediodesctes grandis* Hebard. Trans. Amer. Ent. Soc., 58:338.

*Coloration.*—This very large and handsome species is quickly recognized by its size and dark brown coloration with the upper two-thirds of the lateral lobes of the pronotum dark mahogany brown and the lower third pale buffish brown. The caudal femora are very large and strongly swollen in the basal half with the outer pagina heavily marked with blackish brown above the median line (see Fig. 23).

*Biology.*—These are not known at the present time.

*Habits.*—This species is nocturnal and thamnophilous and probably carnivorous as well as phyllophagous.

*Song.*—The song of *P. grandis* is not known.

*Host Plant.*—In the canyon just west of Ciudad Victoria, Tamaulipas, the writer took two females, one in *Karwinskia humboltiana*, the other in *Acacia wrightii*.

*Records.*—Canyon 3 miles west of Ciudad Victoria, Tamaulipas, Mexico, August 31, 1940, 3 ♀ (E. R. Tinkham). The type locality is Alta Mira, Tamaulipas, Mexico. Caudell reported specimens from Carrizo Springs and Eagle Pass and Brownsville,

Texas and Montelovey, Mexico. Hebard, in 1932, reported a female from Rodriguez, Nuevo Leon, Mexico.

*Distribution.*—*Pediodesctes grandis* is a member of the Tamaulipan Semi-Desert Bushland and is known from Ciudad Victoria in Tamaulipas north to Corrizo Springs, Texas, and from the east base of the Sierra Madres Oriental to the Gulf coast.

#### PEDIODECTES BRUNERI (Caudell)

1907. *Stipator bruneri* Caudell. Proc. U. S. Nat. Mus., 32:343.

*Coloration.*—*P. bruneri* is a small species of dark brownish coloration and jet black lining the posterior margin of the lateral lobes of the pronotum which is enlarged to a spot at the humeral angles. The species can be quickly identified by the black face and the triangular patch of white covering the front of the face (see Fig. 24).

*Biology.*—The life history of *bruneri* is unstudied but it is believed that the nymphs appear in the early spring and become adults in August or early September. The female lays 42 ova.

*Habits.*—This species is campestrian, living amongst grasses on the mountain sides. The specimens are quite active during the day and jump into bushes where they hide to escape detection. The species is probably herbivorous but in captivity takes readily to grasshoppers offered to it, hence they are probably carnivorous as well.

*Song.*—The song of *P. bruneri* is not known.

*Food Plants.*—As this species is found chiefly in grasses it may feed on grasses and other vegetation, but it is also likely that being partly carnivorous it catches grasshoppers and other insects which serve as food.

*Records.*—Davis Mts., Prudes Ranch, elev. c. 6000 feet, Oct. 6, 1929, 1 ♂; Davis Mts., south slope of Mt. Livermore, elev. c. 7800 feet in tall grasses, Sept. 29, 1931, 5 ♂, 6 ♀; Twenty miles west of Ozona, Texas, Sept. 13, 1940, 2 ♀ (E. R. Tinkham). The Type Locality is Belfrage, Texas, and Caudell reported a female from Quanan, Texas.

*Distribution.* — In southwestern Texas this species is found in Upper Sonoran Zone of the Pines and Oaks of the higher Mountains and occasionally is taken in the upper limits of the Lower Sonoran zone in semi-desert environment. *P. bruneri* is known from Quanah, in northern Texas south to Belfrage and west through the Edwards Plateau to the Davis Mountains of the Big Bend Region of Trans-Pecos Texas.

#### PEDIODECTES TINKHAMI Hebard

1934. *Pediodesctes tinkhami* Hebard. Trans. Amer. Ent. Soc., 60:35, Pl. 2, fig. 1; Pl. 3, figs. 1, 2.

*Coloration.*—This interesting species is quickly recognized from all other Desert Dectids by the broad arcuate band of bright cream color, crossing

the face just below the eyes and extending from the posterior margin of the head to the opposite posterior margin in a gently decurved band about one-sixteenth of an inch in width. The legs, especially the caudal ones are tinged with green. The general color is cinnamon buff mottled with clay color and microscopic streaks of tawny olive.

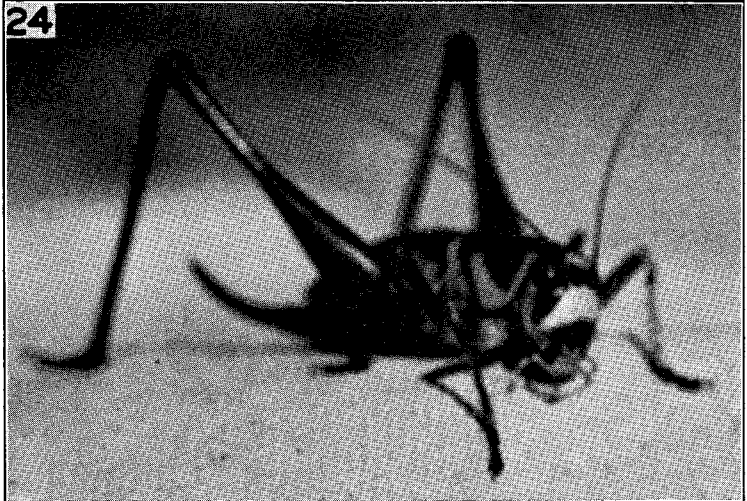


Fig. 24. Showing white-banded face of *Pediodectes bruneri* ( $2 \times$  nat. size).

Fig. 25. Showing male *Eremopedes scudderi* ( $1\frac{1}{4} \times$  nat. size) in host plant *Larrea divaricata*.

*Biology.*—The eggs hatch in the spring and the nymphs become adults in August as I have taken nymphs in July. Aside from this fact little is known about the life history of this strangely marked species.

*Habits.*—Specimens taken at the Wadi Burnum Ranch House at the north base of the Chisos mountains in mid-July, 1930, were taken from a fly-trap which was baited with sour dough. Remains of others, one or two of which were in good condition, were found in pools of water in a small stream at the Wilson Ranch on the north base of Mt. Emory, highest peak of the Chisos range. At first I had supposed that these specimens had met their death when caught by the sudden arroyos sweeping down the dry creek bed, for the first specimen I found had been found in a pool of water in Cibolo Arroyo, just above Shafter in the Chinati Mountains, after a storm, but on discovery of the Wilson Creek specimens I abandoned this idea as there had been no rain for weeks. It appears that these large crickets meet accidental death, probably at night, while seeking water or jumping around in search for food. This species has great saltatorial powers and appears to be terrestrial rather than thamnophilous like most other Decticids.

*Song.*—I have never heard a male of *P. tinkhami* singing.

*Host Plant.*—This species is probably carnivorous, perhaps also a scavenger feeding on bits of organic matter to be found on the desert. The adults become active about sundown.

*Records.*—The type male was captured by the writer on Sept. 29, 1928 on a limestone hillside in the Chinati Mountains some four miles south of Shafter, Presidio County, Texas, vegetated with Ocotillo, *Fouquieria splendens*, Spanish Dagger *Agave lechuguilla*, Huisache *Acacia farnesiana* and other desert plants. The female type came from the Wadi Burnum Ranch, at the north base of the Chisos Mountains of Brewster County, Texas. Paratypes came from the Wadi Burnum Ranch and from the Ord Mountains collected by the field naturalist Mr. O. C. Poling. The writer has a female nymph taken July 3, 1930, at the San Carlos Mines, 10 miles south of San Carlos, Chihuahua, Mexico. This is the first Mexican record.

*Distribution.*—*Pediodesctes tinkhami* is a member of the Lower Sonoran Fauna restricted to the desert mountains, chiefly of limestone, of the Chihuahuan Desert.

#### PEDIODECTES ATELOPLOIDES (Caudell)

1907. *Stipator ateloploides* Caudell. Proc. U. S. Nat. Mus., 32:350.

1932. "*Stipator*" *ateloploides* Hebrad. Trans. Amer. Ent. Soc., 58:338.

1934. *Pediodesctes ateloploides* Hebard. Trans. Amer. Ent. Soc., 60:36.

This interesting and rare species is known only from the unique female type described San José del Cabo, Baja California. It is distinguished by the very narrow vertex and other features resembling the genus *Ateloplus*. The discovery of the male is awaited with interest as it is needed to decide the generic placement of this species. Nothing is known concerning the biology, habits, song or food plants of this rare species.

## EREMOPEDES Cockerell

1894. *Eremopedes* Scudder. Can. Ent., 26:178, 181 (invalid).  
 1897. *Eremopedes* Scudder. Guide Orth. N. Am., p. 56 (invalid).  
 1898. *Eremopedes* Cockerell. Ann. Mag. Nat. Hist. 2(7):323.  
 1900. *Eremopedes* Scudder. Cat. Orth. U. S., pp. 78, 97.  
 1902. *Eremopedes* Scudder. Proc. Davenp. Acad. Nat. Sci., 9:55.  
 1902. *Eremopedes* Caudell. Can. Ent., 33:100.  
 1906. *Eremopedes* Kirby. Syn. Cat. Orth., 2:192.  
 1907. *Eremopedes* Caudell. Proc. U. S. Nat. Mus., 32:330.

Species of this genus are small to medium in size and of a grayish or greenish coloration and often with dorso-lateral pale markings. From *Ateloplus*, *Eremopedes* is distinguished by the more slender build, slightly longer and narrower pronotum with deeper lateral lobes. The cerci in the *scudderi* group including *bilineatus* and *covilleae* are long and slender with a large median internal tooth prong; in *balli* and *ephippiatus* the cerci are broad and short with an inner apical tooth or series of fine teeth and these are closely similar in form to *Ateloplus schwarzi* and *A. minor*; these two genera show closest affiliation through these species. From *Pediodes* on the other hand, *Eremopedes* exhibits much slenderer build, shorter caudal femora, and the prosternum which is usually unarmed or sometimes weakly spined, is strongly spined in *Pediodes*. In *Eremopedes* the tegmina are exposed for about half the length of the pronotum and in *Pediodes* is much less exposed; sexes of both genera in the females have the tegmina covered by the pronotum.

*Eremopedes* is further characterized by the spination of the legs. The fore and middle femora are unarmed; the caudal femora usually unarmed but in some species with about 6 outer and inner small black spines on the lower keels. Fore tibiae with 6 pairs of ventral teeth and 2 outer dorsal teeth; meso-tibiae with 6 pairs of ventral teeth and 2 outer and 4 inner dorsal teeth; caudal tibiae with approximately 26 pairs of dorsal spines on both inner and outer keels and some 6 to 9 outer and inner widely spaced teeth on the ventral side. Ovipositor as long as the caudal femora or distinctly shorter; with a slight recurvature.

*Genotype*.—*Eremopedes scudderi* Cockerell.

## KEY TO THE SPECIES OF EREMOPEDES

1. Cerci long and slender, slightly outcurved in apical half bearing a median or subapical inner toothed prong. Outer pagina of caudal femora not striped with black. Humeral angle of pronotum not shining black ..... 2
- Cerci short and broad with the inner apex toothed. Outer pagina of caudal femora with two basal black stripes. Humeral angles of the pronotum marked with shining black. Color dark brown ..... 5
2. Color green, form slender with a pair of white dorso-lateral stripes. Cerci long and internal tooth basad of center ..... *bilineatus*
- Cerci with the internal tooth median or caudad of center. Form not as slender and without distinct dorso-lateral stripes ..... 3



3. Male ultimate tergite with a deep narrow cleft reaching almost to the base of tergite. Tegmina black with veins white; posterior margin of pronotum buff.....*covilleae*
- Male ultimate tergite with a "U" shaped emargination of varying depth produced by the length of the triangular processes of the tergite. Tegmina reddish brown or blackish brown, never black, with straw-colored veins ..... 4
4. "U"-shaped emargination of ultimate tergite broad and shallow with the triangular lobes short and broad. Size very small. Portions of cercus beyond the internal tooth short .....*shrevei* n.sp.
- "U"-shaped emargination of the ultimate tergite deep with the triangulate processes narrow and long. Size large. Portion of the cercus beyond the internal tooth longer .....*scudderi*
5. Tegmina and veins black with the outer margin of the tegmina edged with buff.  
Size small to large .....*ephippiatus*
- Tegmina black with veins and outer margin buffish. Size small .....*balli*

## EREMOPEDES SCUDDERI Cockerell

1898. *Eremopedes scudderi* Cockerell. Ann. Mag. Nat. Hist., 2(7):323.
1898. *Eremopedes scudderi* var. *viridis* Scudder. ditto, p. 324.
1900. *Eremopedes scudderi* Scudder. Cat. Orth. U. S., p. 78.
1900. *Eremopedes scudderi* var. *viridis* Scudder. ditto, p. 78.
1901. *Eremopedes scudderi* Caudell. Can. Ent., 33:19.
1901. *Eremopedes scudderi* var. *viridis* Caudell. ditto, p. 101.
1902. *Eremopedes scudderi* var. *bicolor* Scudder and Cockerell. Proc. Davenp. Acad. Sci., 9:54.
1906. *Eremopedes scudderi* Kirby. Syn. Cat. Orth., 2:192.
1906. *Eremopedes scudderi* var. *viridis* Kirby. ditto.
1906. *Eremopedes scudderi* var. *bicolor* Kirby. ditto.
1902. *Eremopedes popeana* Scudder and Cockerell. Proc. Davenport. Acad. Sci., 9:54.
1906. *Eremopedes popeana* Kirby. Syn. Cat. Orth., 2:192.
1907. *Eremopedes scudderi* Caudell. Proc. U. S. Nat. Mus., 32:333, fig. 37.
1909. *Ateloplus macroscelus* Rehn and Hebard. Proc. Acad. Nat. Sci. Phila., p. 169, fig. 17 (♀:El Paso, Texas).
1929. *Eremopedes scudderi* Hebard. Proc. Acad. Nat. Sci. Phila., p. 403 (Colo.).
1935. *Eremopedes scudderi* Hebard. Proc. Acad. Nat. Sci. Phila., p. 75 (New Mexico).

*Synonymy*.—Caudell in 1907 placed the varieties *viridis* and *bicolor* and the species *popeana* as synonyms. Hebard, in 1929, placed *Ateloplus macroscelus* in synonymy.

*Coloration*.—Two color phases of this interesting species are found, a green and a gray phase. Great variation is found in both color forms, both having uniform colored specimens and others which are broadly banded with whitish or buff down the dorsum of the body. Still others may show intergrading colors with faint indications or dorso-lateral stripes of pinkish coloration on the abdomen as shown in the specimen in Fig. 25.

*Biology*.—The eggs hatch in the spring and the nymphs become adults in July or August; the males arriving at the adult stage first. The female lays or deposits in the ground her 24 pearly gray eggs in the fall of the year. The ova measure 4.75 mms. long by 1.35 mms. broad.

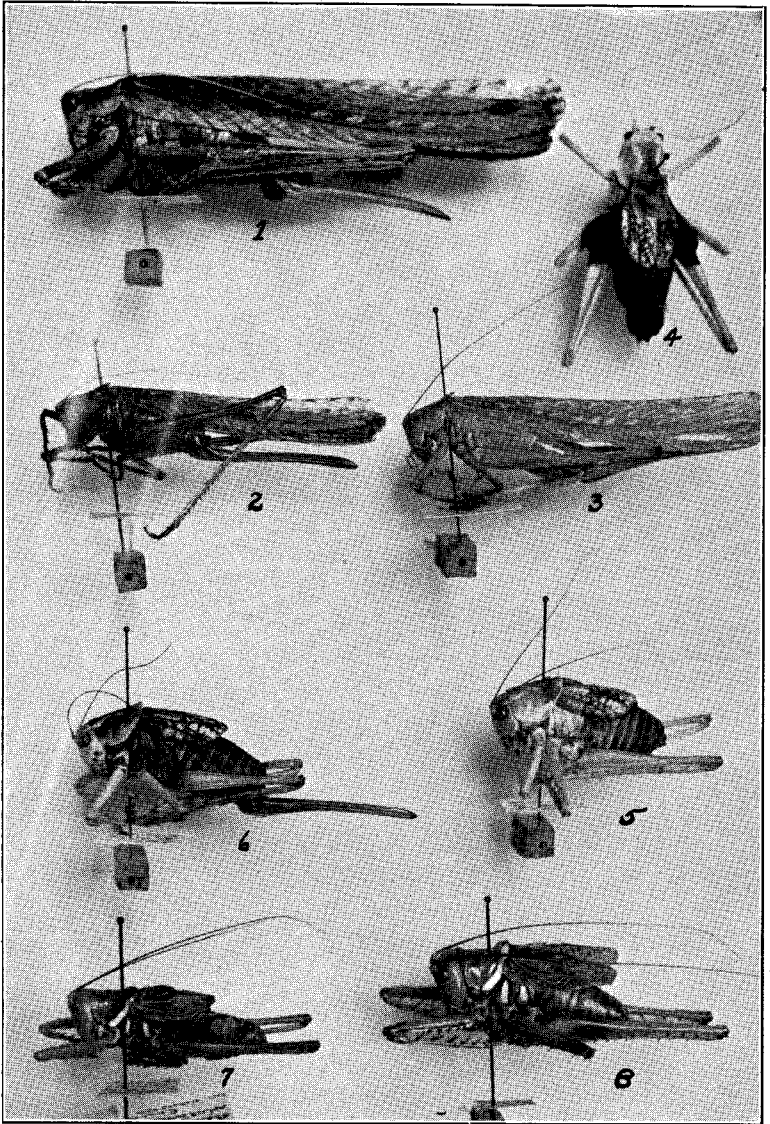


Fig. 26. Showing *Capnobotes*, *Zycloptera*, *Rehnia*: 1. Male *Capnobotes fuliginosus*; 2. Female *Capnobotes occidentalis* gray phase; 3. Female *Capnobotes occidentalis* green phase; 4, 5. Males of *Zycloptera atripennis*; 6. Female of *Zycloptera atripennis*; 7. Male of *Rehnia victoriae*; 8. Male of *Rehnia cerberus*. All figures about two-thirds natural size.

*Habits*.—This species is nocturnal and thamnophilous and phyllophagous. Adults, however, are found sunning themselves in the early morning hours amongst the leaves of their host plant. This species exhibits cannibalistic traits when several are confined together but in nature they are probably only partially cannibalistic, and only on other insects.

*Song*.—The song of *E. scudderi* is a soft low "zeeee-e — zeeee-e — zeee-e — zeee-e — zeee-e — zeee-e" that is continuous for a long period but cannot be heard at distances greater than fifteen feet.

*Host Plants*.—In southern Coahuila the writer found this species chiefly in Creosote *Larrea divaricata*. In the Davis Mts., the host plant is *Acacia constricta*; in northeastern Arizona this species was hiding in clumps of ground Yucca *Yucca elata*. The host varies with the locality. Hebard (1935) reports it from *Sarcobatus vermiculatus* in northern New Mexico.

*Records*.—Texas: Chinati Mts., Presidio Co., July 8, 1929, 1 ♀ in flower stalk of *Dasyllirion texanum*; Sept. 16, 1929, 1 ♂ in clump of *Agave lechuguilla*; Sept. 20, 1931, 1 ♂ singing in *Opuntia arborescens*. Paisano July 22, 1930, 1 ♂ juv. North base Chisos Mts., Brewster Co., July 18, 1930, 1 ♀; Twenty miles north Chisos Mts., July 18, 1930, 1 ♂ in *Larrea*. North end Davis Mts., 6 miles Sw. Toyahvale, Sept. 13, 1940, 2 ♂. Mulligan Canyon near El Paso, Sept. 16, 1931, 3 ♂, 1 ♀. All taken by E. R. Tinkham. New Mexico: Reported from Pojoaque, Rio en Medio and Rancho del Monte by Hebard, in 1935. The type locality is Mesilla Park near Las Cruces. Arizona: Four Miles East of Concho, July 16, 1940, 1 ♂, 2 ♀ juvs., this is the first record for Arizona. Taken by E. R. Tinkham. Coahuila: 42 miles northwest Saltillo, Sept. 3, 1940, 2 ♂, 1 ♀; 6 miles north Parras, Sept. 4, 1940, 1 ♂; Sierra de Parras, 4 miles south of Parras, Sept. 5, 1940, 1 ♀ in *larrea divaricata* (E. R. Tinkham). Chihuahua: Reported from Jaral by Hebard, in 1932.

*Distribution*.—*E. scudderi* is a member of the Lower Sonoran Faunal region and is restricted to the Chihuahuan Desert.

#### EREMOPEDES COVILLEAE Hebard

1934. *Eremopedes covilleae* Hebard. Trans. Amer. Ent. Soc., 60:39, Pl. 2, fig. 2; Pl. 3, Fig. 3.

*Coloration*.—This handsome katydid is quickly recognized by its uniform green coloration with the posterior margin of the pronotum edged with buff; the black tegmina with the veins whitish and by the deeply cleft ultimate tergite of the abdomen.

*Biology*.—This species emerges from the eggs in the early spring and the males mature in mid-July and the females a little later.

*Habits*.—*E. covilleae* appears to be thamnophilous, nocturnal and strictly phyllophagous. Adults sun, however, during the day on their favorite host plant.

*Song*.—The song of this katydid is not known.

*Host Plant*.—As far as is known this species is restricted to the Creosote Bush *Larrea divaricata*.

*Records*.—The only specimens known are the Type specimens taken by the writer on

July 18, 1930, on the Creosote desert, twenty miles north of the Chisos Mountains of Brewster County, Texas, on the Marathon-Boquillas Road.

*Distribution.*—*E. covilleae* is a member of the Lower Sonoran Faunal region restricted to the Chihuahuan Desert.

### EREMOPEDES BILINEATUS (Thomas)

1875. *Steiroxys bilineatus* Thomas. Rept. Expl. and Surv. West of 100th Mer., 5:950 (♀: San Carlos, Arizona).
1894. *Idiostatus bilineatus* Scudder. Can. Ent., 26:181, 183.
1899. *Cacopteris sinuata* Scudder. Proc. Amer. Acad. Arts Sci., 35:88, 90.
1900. *Cacopteris sinuata* Scudder. Cat. Orth. U. S., p. 78.
1900. *Idiostatus bilineatus* Scudder. Cat. Orth. U. S., p. 78.
1902. *Plagiostira albofasciata* Scudder and Cockerell. Proc. Davenp. Acad. Nat. Sci., 9:55, Pl. 3, fig. 2 (♀: Mesilla Jk., N. Mex.).
1905. *Plagiostira gracila* Rehn. Publ. Kans. Acad. Sci., p. 227.
1906. *Idiostatus bilineatus* Kirby. Syn. Cat. Orth., 2:194.
1906. *Idiostatus sinuata* Kirby. Syn. Cat. Orth., 2:193.
1906. *Plagiostira albofasciata* Kirby. Syn. Cat. Orth., 2:195.
1907. *Eremopedes albofasciata* Caudell. Proc. U. S. Nat. Mus., 23:337, fig. 40.
1907. *Idiostatus sinuata* Caudell. Proc. U. S. Nat. Mus., 32:379, figs. 64, 65.
1909. *Eremopedes albofasciata* Rehn and Hebard. Proc. Acad. Nat. Sci. Phila., p. 169.
1909. *Eremopedes gracilis* Rehn and Hebard. Proc. Acad. Nat. Sci. Phila., p. 480.
1935. *Eremopedes bilineatus* Hebard. Trans. Amer. Ent. Soc., 61:311 (synonymy).

*Synonymy.* — Hebard, in 1935, synonymized *Cacopteris sinuata* Sc., *Plagiostira albofasciata* Sc. and Cock., and *P. gracila* Rehn.

*Coloration.*—The general coloration in this rather slender species is foliage green with dorso-lateral stripes of white. Much variation exists in locality-specimens. Specimens from Yuma are very large with a very wide band, this band gradually diminishing in width as one progresses east across Arizona and in New Mexico specimens the dorso-lateral stripe is practically evanescent. As one goes north into the Mojave Desert the size decreases rapidly, specimens from Beatty, Nevada, being less than one-half the size of Yuma specimens.

*Biology.*—The eggs are laid in the fall and hatch in the spring, the adults appearing in July and August during the rainy season.

*Habits.*—This species is thamnophilous, nocturnal and strictly phyllophagous on its host plant.

*Song.*—The song of *E. bilineatus* is a rapid and rather low “tzee — tzee — tzee-tzee-tzee” produced for long periods of time. Specimens from various localities often sound differently sometimes like “sitz-sitz-sitz-sitz” or variations of these notes.

*Host Plant.*—The chief host plant of this species is *Larrea divaricata* with *Baccharis sarrathroides*, Desert Broom second in importance.

*Records.*—In 1931, the writer and his brother, Herb, took large series of this species in the following mountain ranges in Arizona: Gilas; Mohawks; Gila Bend; Maricopas;

Saucedos; Ajos; Quoatoas; Cobabis; Quinlans; Tucsons; Santa Ritas. One male was taken near Cambray, New Mexico. All these specimens are in the Hebard Collection in Philadelphia. The writer has taken additional specimens at many other localities in southeastern Arizona. One dwarf male was taken Oct. 20, 1939, six miles south of Beatty, Nevada, which is the northwestern most limit in the distribution of this species.

*Distribution.*—*E. bilineatus* is a member of the Lower Sonoran Faunal Region having a wide distribution on the Sonoran Desert ranging northwest, where it becomes very small in size, over the Mojave Desert to the northern limits of that Desert as marked by the distribution of *Larrea divaricata*. Its eastern limits are the Rio Grande valley in southern New Mexico.

### *Eremopedes shrevei* n. sp.

*E. shrevei* n. sp. is a member of the *scudderi* group distinguished by its very small size, shallow "U"-shaped median groove of the ultimate tergite of the male and with the processes of this tergite short and broadly triangular and cerci slightly shorter than in *scudderi*. Nearest relationship is shown to *E. scudderi*.

*Type.*—♂, 16 miles north of Doctor Arroyo, southern Nuevo Leon, Mexico, Aug. 25, 1940 (E. R. Tinkham; in mesquite). Measurements in millimeters: body length 14.5; pronotum 5.8 x 4.5 broad exposed tegmina 2.0; caudal femora 15.0 x 3.0 mms. Type in the Tinkham Collection.

*Description.*—Form typical for the genus. Pronotum uniformly broad throughout, decidedly broader than in *scudderi* specimens of very small and of equal size; caudal femora definitely heavier than in *scudderi* specimens of equal size. All femora unarmed; fore tibiae with 6 pairs ventral teeth and 3 dorsal teeth. Meso-tibiae with 6 pairs ventral and 2 outer and 3 to 4 inner dorsal teeth; caudal tibiae with 24-25 pairs of dorsal spines and 7 outer and inner small widely spaced ventral teeth. Male ultimate tergite with a shallow "U"-shaped groove with short and broad paired triangular processes. Cerci shorter than in *scudderi* with the internal tooth slightly caudad of center. Apex of the subgenital plate with a shallow concave excision. All the thoracic sternites unarmed.

*Coloration.*—Color uniformly dark stone gray with the tegmina dark brownish at the base and the outer and exposed half testaceous.

*Biology.*—These are not known at this time.

*Habits.*—This small species is thamnophilous and nocturnal.

*Song.*—The song of this new species is a soft low "zee — zee — zee — zee — zee" continuous and inaudible beyond a few feet.

*Distribution.*—*Eremopedes shrevei* n. sp. is restricted to the Desert of Salado, the southern sub-type of the Chihuahuan Desert.

This species is named in honor of Dr. Forrest Shreve, leader of the Shreve-Tinkham Expedition into northeastern Mexico, in August and September of 1940.

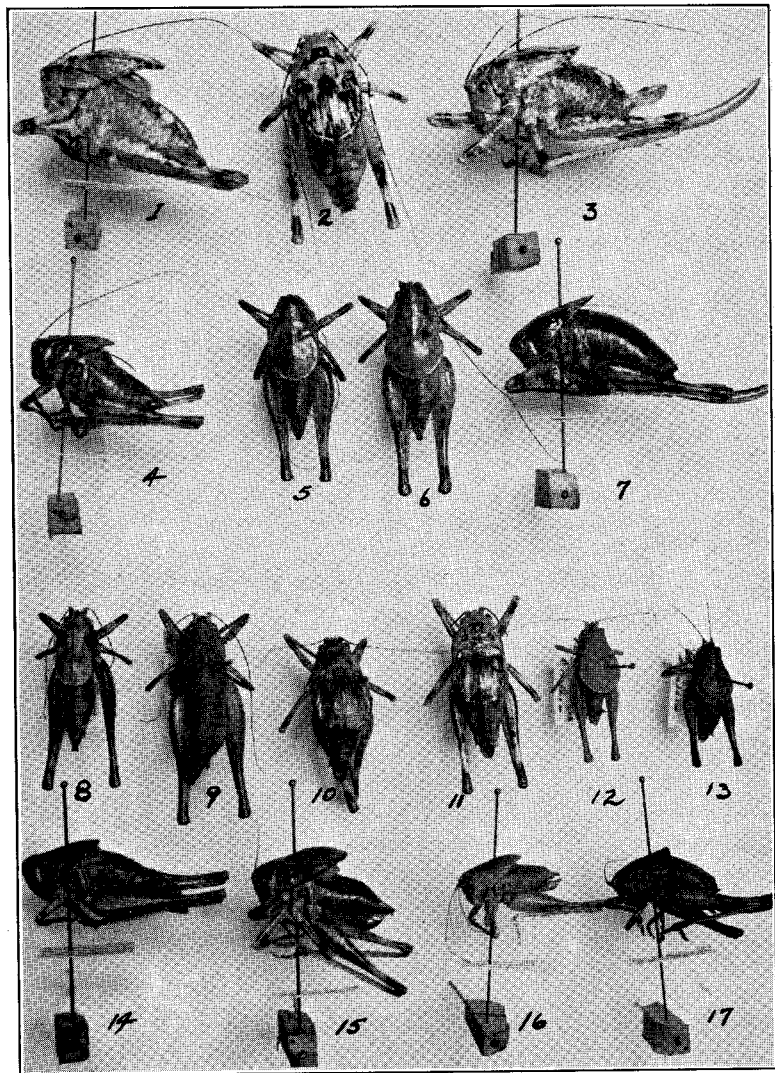


Fig. 27. Showing the following species: 1-2. *Aglaothorax segnis* two males, Sierra Nevadas; 3. *Aglaothorax segnis* female; 4-5. *Neduba carinata* males from Sierra Nevadas; 6. *Neduba convexa* male from Walker Pass; 7. *Neduba carinata* female from Sierra Nevadas; 8. *Neduba sierranus* male from Yosemite; 9. *Neduba diabolica* from Tehachapis; 10. *Aglaothorax ovatus* male, San Gabriel Mts.; 11. *Aglaothorax armiger* male from southern Nevada; 12-13. *Neduba morsei* two color phases, San Gabriels; 14. *Neduba diabolica* male, lateral view; 15. *Aglaothorax ovatus* male lateral view; 16. *Neduba morsei* male lateral view; 17. *Neduba morsei* female, lateral view. All figures about two-thirds natural size.

## EREMOPEDES BALLI Caudell

1901. *Eremopedes balli* Caudell. Can. Ent., 33:100 (part).  
 1903. *Eremopedes balli* Caudell. Proc. U. S. Nat. Mus., 26:807.  
 1906. *Eremopedes balli* Kirby. Syn. Cat. Orth., 2:192.  
 1907. *Eremopedes balli* Caudell. Proc. U. S. Nat. Mus., 32:335, fig. 38.  
 1935. *Eremopedes balli* Hebard. Trans. Amer. Ent. Soc., 61:311.

*Coloration.*—This, one of the smallest species in the genus, is recognized by its dark brown coloration, the pronotum is often yellowish brown, and the two black stripes on the outer pagina or face of the caudal femora. The humeral angles of the pronotum are marked with black and the tegmina are black with the veins buffish, this latter feature and the slightly different form of the cerci separating *balli* from *ephippiatus*.

*Biology.*—The eggs of this mountain dwelling species are laid in the fall and the young, appearing in the spring, mature in July and August. This species is often found dwelling in clumps of brachen fern on the tops of high mountains such as the Santa Catalinas. The species hides in amongst the plants and grasses during the day.

*Habits.* — This small species is campestrian living amongst ferns and grasses and is active by day whenever disturbed. The species is probably strictly vegetarian.

*Song.*—The song is a soft low “zee-zee-zee-zee-zee” continuous and quite typical of *Eremopedes*.

*Records.*—Magdalena Mts., New Mexico, elev. 9600 feet, July 23, 1930, 1 ♂; Santa Catalina Mts., Arizona, elev. 9100 feet, Oct. 22, 1938, 3 ♀, (E. R. Tinkham). Santa Catalinas, elev. 9100 feet, Sept. 5-6, 1931, 5 ♂, 2 ♀; north end Quinlan mts., Sept. 3, 1931, 1 ♂ (E. R. Tinkham; Hebard Cln.). The types came from Williams and Flagstaff, Arizona, but were confused in the original description with *Pediocetes stvensoni* from Ft. Collins, Colorado.

*Distribution.*—*E. balli* is a member of the Pine Zone and is found at high elevations in the mountains of southern Arizona, such as the Quinlan, Baboquivaris, Santa Ritas and Santa Catalinas and in northern Arizona is found on the Mogollon Plateau which extends east into the heart of New Mexico.

W Pine top ↙

*Eremopedes balli pallidus* n. subsp.

Specimens of *E. balli* from the Petrified Forest of Arizona represent a race confined to the Painted Desert which in reality is the southeastern corner of the Great Basin Desert. This species is characterized by its slightly larger size, pale and uniform light brown coloration, and the lack of the two black stripes on the outer surface of the caudal femora.

*Type* — ♂, Petrified Forest, Arizona, July 16, 1940 (Park Naturalist Smith). Measurements in millimeters: body length 20.0; pronotum 7.0 x 4.3; exposed tegmina 2.0; caudal femora 18.0 mms.

*Allotype.*—♀, same data as the type. Measurements in millimeters: body length 20.0; pronotum 6.3 x 4.0; caudal femora 20.4 x 4.0 max. breadth; ovipositor 16.0 mms. One female paratype same data as the allotype. Types in the Tinkham collection.

## EREMOPEDES EPHIPIATUS EPHIPIATUS (Scudder)

1899. *Cacopteris ephippiata* Scudder. Proc. Amer. Acad. Arts Sci., 35:88-91.  
 1900. *Eremopedes unicolor* Scudder. Cat. Orth. U. S., p. 97.  
 1901. *Eremopedes unicolor* Caudell. Can. Ent., 33:99.  
 1903. *Eremopedes unicolor* Caudell. Proc. U. S. Nat. Mus., 26:807.  
 1906. *Cacopteris ephippiata* Kirby. Syn. Cat. Orth., 2:193.  
 1906. *Cacopteris unicolor* Kirby. Syn. Cat. Orth., 2:193.  
 1907. *Eremopedes ephippiatus* Caudell. Proc. U. S. Nat. Mus., 32:332, figs. 35-36.  
 1909. *Eremopedes unicolor* Rehn and Hebard. Proc. Acad. Nat. Sci. Phila., p. 480.  
 1935. *Eremopedes ephippiatus* Hebard. Trans. Amer. Ent. Soc., 61:311.

*Coloration.*—This species is slightly larger than *E. balli* and of a uniform reddish brown. The tegmina are solid black with the posterior margin edged with buffish, contrasting with the tegmina of *E. balli* which are black with the veins buffish. The cerci are broader than in *E. balli* with the outer margin slightly convex and not concave as in *balli*.

*Biology.*—The life history of this species is not known but like other species of the genus the nymph undoubtedly appear in the spring and the adults in mid-summer as specimens taken earlier than mid-July are usually nymphs.

*Habits.*—Like other species of the genus this species is nocturnal and either thamnophilous or sylvan, the writer has taken specimens in the Huachuca Mountains crawling over oak leaves on the forest floor.

*Food Plants.*—This species is probably phyllophagous as well as a scavenger feeding on bits of organic matter that it finds as it wanders about for food.

*Song.*—The song is characteristic of the genus.

*Records.*—Huachuca Mountains, Miller Canyon, Arizona, Sept. 4, 1938, 1 ♂; Oct. 22, 1938, 1 ♀; Carr Canyon, June 14, 1940, 1 ♂, (E. R. Tinkham). The type females was described from "Arizona" and the male type from Sonora, Mexico. Caudell reported specimens Hot Springs, Phoenix, Oracle, Douglas and the Huachuca Mountains.

*Distribution.*—This species appears to be a member of the Sonoran Live Oak Zone of southeastern Arizona.

***Eremopedes ephippiatus sonorensis* n. subsp.**

1932. *Eremopedes ephippiata* Hebard. Trans. Amer. Ent. Soc., 58:338 (Sonora, Mexico).

This subspecies closely resembles *E. ephippiatus ephippiatus* but is quickly recognized by the very large size, being almost twice the size of the nominal race, and of a very dark grayish black coloration. The prosternum is usually spined, five out of six males having bispinose prosternites.

This subspecies inhabits the more torrid areas of the Sonoran Desert characterized by the Ironwood (*Olneya tesota*) and the Resin Plant (*Encelia*



*farinosa*) Zone. This zone is found in southwestern Arizona and in Sonora, Mexico, south to the Yaqui River.

*Type*.—♂, Sonora, Mexico, 40 miles north of Hermosillo, Nov. 1, 1939 (E. R. Tinkham). Measurements in millimeters: body length, 28.0; pronotum 9.0 x 6.0 max. metazonal breadth; exposed tegmina 3.0; hind femora 32.5 mms.

*Paratypes*.—5 ♂, same data as the type. Range in measurements in millimeters: body length 27.0-29.0; pronotum 9.0-9.5 x 5.6-6.0 broad; exposed tegmina 4.0-4.0; hind femora 35.5-36.5 mms. Type and Paratypes in the Tinkham Collection.

The song of this species is a strong "zee-zee-zee-zee" continuous and audible for fifty feet or more.

*Distribution*.—In 1932, Hebard recorded two females from the Copete Mines, thirty miles east of Carbo, Sonora. The University of Arizona Collection contains a series of males and females from the Baboquivari mountains, Arizona. *E. ephippiatus sonorensis* n. subsp. is a member of the Lower Sonoran Faunal Region and in distribution is restricted to the hotter southern portions of the Sonoran desert. It is known from Carbo and the desert forty miles north of Hermosillo, Sonora, north to the Baboquivari Mountains of south-central Arizona.

#### EREMOPEDES SPINOSA Hebard

1923. *Eremopedes spinosa* Hebard. Proc. Cal. Acad. Sci., (4), 12:337, figs. 10-13.

1932. *Eremopedes spinosa* Hebard. Trans. Amer. Ent. Soc., 58:339.

This species was described by Hebard from Mejia Island and Angel de la Guardia Island in the Gulf of California. No additional specimens have been taken and the life history, song, host plants and habits remain unknown.

#### IDIOSTATUS Pictet

1888. *Idiostatus* Pictet. Mem. Soc. Phys. Genev., 30:63.

1894. *Idiostatus* Scudder. Can. Ent., 26:178, 181.

1894. *Cacopteris* Scudder. Can. Ent., 26:178, 181 (invalid).

1897. *Idiostatus* Scudder. Guide N. Amer. Orth., p. 56.

1897. *Cacopteris* Scudder. Guide N. Amer. Orth., p. 56 (invalid).

1899. *Cacopteris* Scudder. Proc. Amer. Acad. Arts Sci., 35:87.

1900. *Idiostatus* Scudder. Cat. Orth. U. S., p. 78.

1900. *Cacopteris* Scudder. Cat. Orth. U. S., p. 78.

1906. *Idiostatus* Kirby. Syn. Cat. Orth., 2:193.

1906. *Idiostatus* Kirby. Syn. Cat. Orth., 2:194.

1907. *Idiostatus* Caudell. Proc. U. S. Nat. Mus., 32:373.

1920. *Idiostatus* Rehn and Hebard. Trans. Amer. Ent. Soc., 46:254.

1934. *Idiostatus* Hebard. Trans. Amer. Ent. Soc., 60:45.

Members of the genus range from small to medium size and are usually grayish or greenish in coloration with a few of the species characterized by the male ultimate tergite being shining black. The tegmina is usually a pale reddish brown color. The fore and middle femora are either unarmed or armed with a few small black spines on the inner keel of the fore femora or outer keel of the meso-femora; caudal femora unarmed or with from 1 to 10 small spines on both outer and inner lower keels. Fore tibiae with 6 pairs of long ventral teeth and 3 outer dorsal ones; meso-tibiae with 6 pairs of long ventral teeth and 2 to 3 outer and 4 inner dorsal teeth; caudal tibiae with two full spine rows on the dorsal keels and from 6 to 10 outer and 4 to 6 inner very small ventral teeth. Ovipositor gently recurved and of various length as long as or shorter than the caudal femora.

*Genotype*.—*Idiostatus californicus* Pictet (= *hermanii* Thomas). Fourteen species of *Idiostatus* are known, five of which have been described in the last decade. Of this number eight species are found east of the Sierra Nevadas and six species west of that lofty range of mountains. The six species restricted to the Californian coastal regions west of the Sierra Nevadas are: *I. rehni* Caudell, *I. hermanii* (Thomas), *I. fuscus* Caudell 1934, *I. wymorei* Caudell 1934, *I. aequalis* Scudder 1899, and *I. inermis* var. *major* Caudell 1934. These six will not be discussed.

#### KEY TO THE MALES OF NEARCTIC SPECIES OF IDIOSTATUS

1. Tegmina with a black mark in the apex; internal apical tooth lengthily directed caudad and incurved. .... 2  
Tegmina concolorous; internal apical tooth not directed lengthily caudad ..... 3
2. Subgenital and supra-anal plates approximate in length, the latter with a broad median "U"-shaped groove ..... *aequalis*  
Subgenital plate projecting caudad of the supra-anal plate; the latter with a "V"-shaped median groove ..... *nevadensis*
3. Apex of male abdomen marked with shining black ..... 4  
Apex of male abdomen not marked with shining black ..... 7
4. Cerci with two long strongly uncinatc teeth, the apical one long and attenuate and pointing downwards and inwards; inner subapical one uncinatc and above the apical one ..... *inermis*  
Cerci with only small internal tooth ..... 5
5. Size very large; internal tooth basal, apex of the cercus pointed ..... *elegans*  
Size large; internal tooth apical, apex of cercus transverse with a slight outer apical prominence ..... *magnificus*
6. Cerci large and very broad with a small median internal dentate prominence.  
Size very large and uniformly green ..... *hermanii*  
Cerci smaller and narrower. Size small to large, color usually grayish, rarely green ..... 7
7. Internal apical tooth very long and slightly incurved, the tooth almost the length of the cercus ..... *hendersoni*  
Internal tooth much shorter than the length of cercus ..... 8
8. Size small, outer margin of cercus convex and bearing a subapical tooth ..... *inyo*  
Size small to large, outer margin of cercus almost straight ..... 9
9. Internal cercal tooth acutely pointed ..... 10  
Internal cercal tooth bluntly rounded ..... *fuscus*

10. Internal tooth subapical and uncinatc, apex of cercus elliptical ..... *wymorei*  
 Internal tooth apical, apex of cercus obliquely truncate ..... 11
11. Inner margin of cercus right-angularly bent at internal tooth ..... *rehni*  
 Inner margin of cercus gently concave to apex of the internal tooth..... *variegatus*

### IDIOSTATUS MAGNIFICUS Hebard

1934. *Idiostatus magnificus* Hebard. Trans. Amer. Ent. Soc., 60:46, Pl. 2, fig. 4; Pl. 3, fig. 6.

This large and beautifully marked species is known from the unique type male taken on Cedar Peak, Warner Mountains, Modoc County, in the northeastern corner of California at an elevation of 8200 feet. The type was taken by Mr. James A. G. Rehn on August 25, 1922. Nothing is known concerning the biology of this species.

### IDIOSTATUS ELEGANS Caudell

1907. *Idiostatus elegans* Caudell. Proc. U. S. Nat. Mus., 32:384, fig. 71, 72.

This large species is recognized by the black on the posterior segments of the abdomen and by the short and rather heavy cercus with an internal basal tooth. The types, a single male and female were described from Nevada. No other information is available for this very large species.

### IDIOSTATUS CALLIMERA Rehn and Hebard

1920. *Idiostatus callimera* Rehn and Hebard. Trans. Amer. Ent. Soc., 46:255.

This interesting species of moderate size is quickly recognized by the proximal and median dark markings of the caudal femora. The species was described from Nevada. The habits and life history of this species are not known.

### IDIOSTATUS INERMIS (Scudder)

1899. *Cacopteris inermis* Scudder. Proc. Amer. Acad. Arts Sci., 35:88, 89.  
 1900. *Cacopteris inermis* Scudder. Cat. Orth. U. S., p. 78.  
 1906. *Cacopteris inermis* Kirby. Syn. Cat. Orth., 2:194.  
 1907. *Idiostatus inermis* Caudell. Proc. U. S. Nat. Mus., 32:386, fig. 73.

*Coloration.*—*I. inermis* is a small species, pale greenish in color with a pale reddish brown tint to the dorsum of the body, which are strikingly marked with black on the last abdominal segment. The tegmina are pale reddish brown and the cerci are very distinctive with apical and subapical long uncinatc hooks.

*Biology.*—The life history of this species is not known but the evidence would indicate that the eggs hatch in the spring and the adults appear in mid-summer.

*Habits.*—This pretty small species is nocturnal and thamnophilous, dwelling in sagebrush and it is without doubt strictly phyllophagous on the leaves of its host plant.

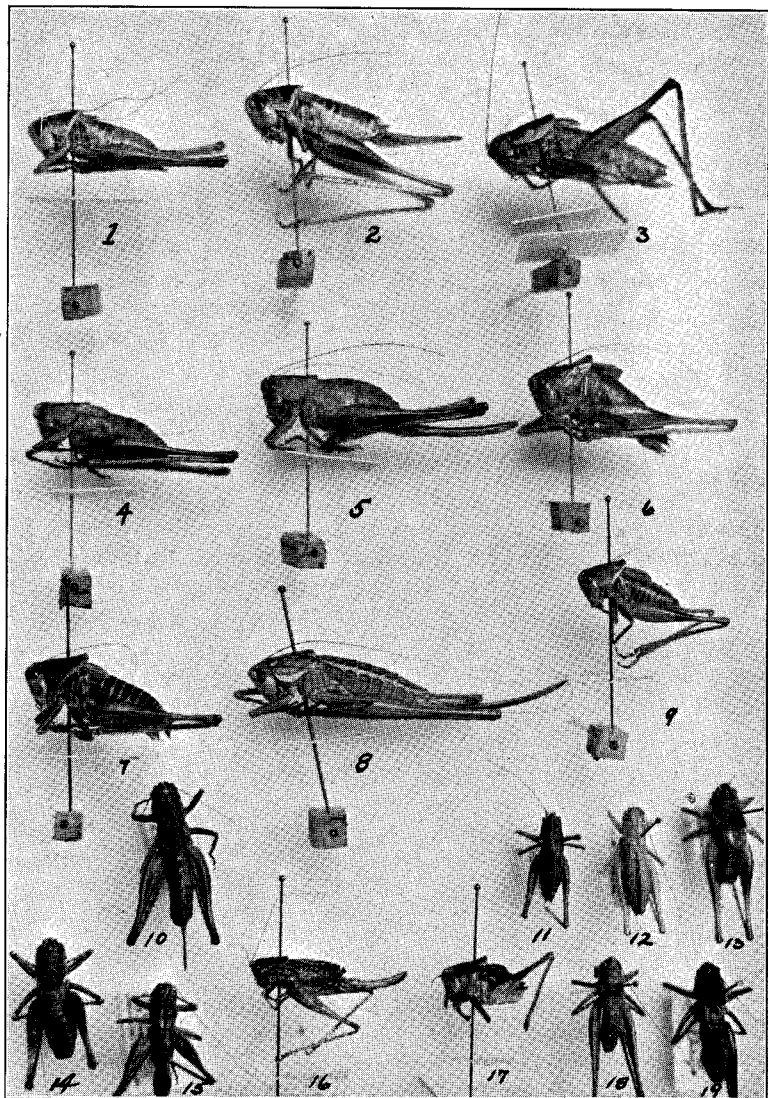


Fig. 28. Showing the following species: 1-2. *Clinopleura melanopleura* male and female; 3. *Atelopus splendidus* male; 4-5. *Idionotus tehachapi* male and female; 6. *Idiostatus hermanni* male from Mt. Shasta; 7. *Idiostatus callimerus* male; 8. *Eremopedes bilineatus* male; 9. *Idiostatus inermis* male from Mono Lake; 10. *Atelopus notatus* female; 11. *Atelopus hesperus* topotype male; 12. *Atelopus luteus* male; 13. *Idiostatus inermis* male from Mono Lake. 14. *Idiostatus inyo* large male from Walker Pass; 15. *Atelopus notatus* male; 16. *Atelopus hesperus* topotype female; 17. *Idiostatus wymorci* tene-al male; 18. *Idiostatus inyo* from Lone Pine Canyon; 19. *Idiostatus aequalis* male. All figures about two-thirds natural size.

*Song*.—The song is a soft low “zea — zea — zea — zea — zea” continuous and audible for only a few feet.

*Food Plants*.—This species was taken in Sagebrush *Artemisia tridentata* at Mono Lake, California.

*Records*.—Mono Lake, California, at mouth of Tioga Pass, Aug. 13, 1938, 2 ♂ (E. R. and G. E. Tinkham). This species was described from Nevada and Caudell records a male from Reno, Nevada.

*Distribution*.—Further material reported by Caudell, in 1934, shows that this species is known from western Nevada, southern Oregon and northern California. The Mono Lake specimens represent the southernmost point in the distribution of this species. *I. inermis* is a member of the Great Basin Desert.

#### IDIOSTATUS VARIEGATA Caudell

1907. *Idiostatus variegata* Caudell. Proc. U. S. Nat. Mus., 32:387.

1939. *Idiostatus variegata* Hebard. Trans. Amer. Ent. Soc., 65:173, Pl. 8, figs. 6, 8.

The type locality of this interesting and most northern member of the genus, is Pocatello, Idaho. The type was a unique female. The life history of this species is not known. The range of this large member of the genus is in southern Idaho on the northern edge of the Great Basin Desert.

#### IDIOSTATUS HENDERSONI Hebard

1939. *Idiostatus hendersoni* Hebard. Trans. Amer. Ent. Soc., 65:173, Pl. 8, figs. 5 and 7.

This, the most recently described species of *Idiostatus*, is of medium large size and rather robust form and can quickly be recognized from all other species of this genus by the very long and needle-like inner cercal tooth which is almost as long as the length of the cercus itself. Like most other species of this genus nothing is given concerning the life history or habits of these rare creatures. The type locality is Leamington, Utah. The species inhabits the Great Salt Lake Valley region of the Great Basin Desert.

#### IDIOSTATUS NEVADENSIS Scudder

1899. *Cacopteris nevadensis* Scudder. Proc. Amer. Acad. Arts Sci. 35:88, 91 (male only).

1900. *Cacopteris nevadensis* Scudder. Cat. Orth. U. S., p. 78.

1906. *Cacopteris nevadensis* Kirby. Syn. Cat. Orth., 2:194.

1907. *Idiostatus nevadensis* Caudell. Proc. U. S. Nat. Mus., 32:378, fig. 63.

1934. *Idiostatus nevadensis* Hebard. Trans. Amer. Ent. Soc., 60:46.

*Coloration*.—This small species is very closely related to *I. aequalis* in size and form of cerci, but the supra-anal plate is much shorter than the subgenital plate and the male ultimate tergite bears a “V”-shaped and not “U”-shaped median groove. The male tegmina has the apex infuscated with blackish.

*Biology*.—The biology of this small species is not known.

*Habits.*—Like other species this form is nocturnal, thamnophilous and phyllophagous.

*Song.*—The song is a soft low continuous “zee-zee-zee-zee.”

*Host Plant.*—The writer has found this species in *Artemisia tridentata* and in snake weed *Gutierrezia*.

*Records.*—Virginia City, Nevada, July 28-31, 1931, 6 ♂, 4 ♀; Two miles south of Gardnerville, Nevada, Aug. 1, 1931, 1 ♂ (E. R. and H. A. Tinkham; Hebard Cln.).

*Distribution.*—*I. nevadensis* is found in west central Nevada and is a member of the Great Basin Desert fauna.

#### IDIOSTATUS INYO Rehn and Hebard

1920. *Idiostatus inyo* Rehn and Hebard. Trans. Amer. Ent. Soc., 46:254.

*Coloration.*—This small species is mottled gray in color with the tegmina uniformly pale reddish brown. The cercus is distinctive and incurved with a subapical internal tooth that separates this species readily from others of the genus.

*Biology.*—From field collecting this species unquestionably hatches in the spring and the adults appear in August as I have taken nymphs at that time.

*Habits.*—This species is nocturnal and thamnophilous and phyllophagous. On one occasion this species did not appear on the tops of its host plant until after midnight. What appeared at first to be a barren evening suddenly after midnight turned out very fruitful and a big catch was made.

*Song.*—The song of *I. inyo* is a very faint and low “zee-zee-zee-zee-zee” continuous, and scarcely discernible at five feet distance.

*Host Plants.*—In Lone Pine Canyon the writer has taken this species on *Eriogonum* sp., and *Artemisia tridentata*. In Big Pine Canyon the females especially were very fond of, along with *Neduba carinata*, the small blue berries growing on a hollow-stemmed, *Rhus*-like plant growing to six or eight feet high. At the west base of the Montgomery Pass, a large series was taken in Russian thistle *Salsola pestifer*, which was young and green.

*Records.*—West base Montgomery Pass near California line, Aug. 15, 1938, 16 ♂, 20 ♀; Big Pine Canyon, Aug. 16, 1938, 3 ♂, 2 ♀; Lone Pine Canyon, Aug. 17, 1938, 8 ♂, 5 ♀; Walker Pass, Aug. 22, 1938, 1 ♂, 1 ♀ (E. R. and G. E. Tinkham).

*Distribution.*—*I. inyo* is known from Walker Pass at the south end of the Sierra Nevadas north in Owens Valley to the west base of Montgomery Pass. It is a member of the Mojave and Great Basin Deserts.

#### Summary and Conclusions

In this paper the floristic characteristics and geographical range of the various deserts are discussed first. This is followed by an account of the zoogeography of the Dectidids and their host plant relationships and economic status and preservation. In the taxonomic and biological section a key to the

thirteen desert genera is presented together with a key to the various species of each genus. Each species is treated in regard to biology, habits, song, host plants and records, as far as information is available and each species is placed in its proper desert allocation. In all twelve genera and fifty-three species are treated, of which two are described as new, namely: *Rehnia pulchellus* and *Eremopedes shrevei*. Two new subspecies are also recognized, namely *Eremopedes balli pallidus* and *Eremopedes ephippiatus sonorensis*.

The following is a list of the species arranged according to the Desert Regions which they inhabit.

## GREAT BASIN DESERT

<i>Idiostatus nevadensis</i>	<i>Idiostatus inyo</i>
<i>Idiostatus callimera</i>	<i>Idiostatus variegatus</i>
<i>Plagiostira albonotata</i>	<i>Idiostatus hendersoni</i>
<i>Plagiostira gilletti</i>	<i>Idiostatus elegans</i>
<i>Eremopedes balli pallidus</i> n. subsp.	<i>Idiostatus inermis</i>
<i>Zycloptera atripennis</i>	<i>Idiostatus magnificus</i>
<i>Ateloplus luteus</i>	<i>Aglaothorax segnis</i>
<i>Ateloplus hesperus</i>	<i>Neduba carinata</i>
<i>Capnobotes fuliginosus</i>	

## SONORAN DESERT

## Mojave Desert

<i>Ateloplus luteus</i>	<i>Eremopedes bilineatus</i>
<i>Aglaothorax armiger</i>	<i>Anoplodusa arizonensis</i>
<i>Idiostatus inyo</i>	<i>Aglaothorax segnis</i>
<i>Capnobotes occidentalis</i>	<i>Ateloplus coconino</i>

## Colorado Desert

<i>Ateloplus notatus</i>	<i>Ateloplus splendidus</i>
<i>Eremopedes bilineatus</i>	

## Sonoran Desert

<i>Rehnia sinaloae</i>	<i>Eremopedes ephippiatus sonorensis</i> n. subsp.
<i>Ateloplus minor</i>	<i>Eremopedes bilineatus</i>
<i>Capnobotes fuliginosus</i>	<i>Ateloplus schwarzi</i>
<i>Anoplodusa arizonensis</i>	

## CHIHUAHUAN DESERT

<i>Rehnia cerberus</i>	<i>Capnobotes fuliginosus</i>
<i>Pediectes tinkhami</i>	<i>Eremopedes scudderi</i>
<i>Pediectes bruneri</i>	<i>Eremopedes covilleae</i>

## Salado Desert

<i>Rehnia pulchellus</i> n. sp.	<i>Eremopedes shrevei</i> n. sp.
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## LOWER CALIFORNIAN DESERT

<i>Eremopedes spinosa</i>	<i>Pediectes ateloploides</i>
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## TAMAULIPAN SEMI-DESERT BUSHLAND

<i>Rehnia spinosa</i>	<i>Rehnia victoriae</i>
<i>Pediectes grandis</i>	

This paper presents one of the first discussions ever attempted to give the floristic characteristics of the various Deserts of North America supplemented by a map depicting the geographical distribution of the Deserts as recognized. It constitutes also the first attempt to treat the entire Shield-Back Katydid or Decticid Fauna of the North American Deserts and adjacent borders supplemented by biological notes accumulated through the years by the writer's own field investigations. Finally the Decticids are arranged according to their Desert distribution.

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