THE GRASSHOPPERS OF OKLAHOMA

(ORTHOPTERA: ACRIDIDAE)

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PREFACE

Because of their wide distribution, abundance, and economic considerations, the Acrididae or short-horned grasshoppers, are a very familiar and important group of insects.

The purpose of this report is to present in one paper descriptions, keys to identification, distribution, and some information on host relationships of the grasshoppers of Oklahoma.

The author wishes to acknowledge the kind interest of Dr. D. E. Howell who introduced the student to the study. The valuable advice and criticisms of Dr. R. R. Walton, the major adviser, and Drs. H. I. Featherly, W. H. Irwin, and the late Professor G. A. Bieberdorf is deeply appreciated. The constant guidance and advice of Dr. W. A. Drew in taxonomic matters is acknowledged.

Several authorities determined and/or verified specimens for the author. Fred Skoog of the Bozeman, Montana, Laboratory of Entomology Research Division of Agricultural Research Service, United States Department of Agriculture and Dr. A. B. Gurney of the United States National Museum, Washington, D. C. aided in the identification of large amounts of material. David Eades and Harold Grant, Jr. of the Philadelphia Academy of Natural Sciences helped with the determination of certain groups. They also were sources of information concerning the distribution of Oklahoma Acrididae. Dr. Herbert S. Wallace, Monroe, Louisiana, determined the species of Hesperotettix Scudder.

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INTRODUCTION

The Acrididae compose one of the most widely distributed groups of insects in the world. They are found in every continent and are especially adapted to a grassland environment. The number of described species is in excess of 10,000.

Man first encountered the grasshoppers, or locusts, as migrating hordes are often called, in the early dawn of civilization. The ravages of these insects, causing widespread famine and suffering, are well-known from ancient and biblical writings. Furthermore, the destructibility of the grasshoppers is not restricted to ancient history. Extensive devastation of crops and grasslands in the United States took place in the 1870's and to a lesser extent in the 1930's. Losses at economic levels occur each year in more restricted areas of the country.

The author has endeavored to list the acridid populations of the State together with their descriptions, important synonomy, distribution within the State and keys to their identification. Information concerning their relative abundance, habitats and economic importance is also included. The distributions of the species listed herein are based upon the results of the author's study plus all previous published records.

A need for a treatise on the grasshoppers of Oklahoma has existed for some time. The applied workers in particular have been desirous of obtaining a single reference which they can use for identification

of the species found within the State. The author hopes that the present work will enable those with limited entomological training and experienced entomologists alike to recognize the species of the State.

REVIEW OF THE LITERATURE

Except for the catalogues of Scudder (1901) and Kirby (1910), the Acrididae of the United States has never been covered in a single work. The literature is scattered throughout many journals and papers; consequently, some of the older works are often collectors items and difficult to obtain for the new student of Acrididae.

Many works of localized areas exist, perhaps the foremost among them being Blatchley's "Orthoptera of Northeastern America" which is invaluable because it is amazingly complete and applies to other areas as well. A number of state lists were prepared by the late Morgan Hebard between 1925 and 1945. In addition, Hebard and J. A. G. Rehn, together and singly, have produced a large number of revisionary works in the field. Other North American orthopterists having contributed major revisionary studies of the Acrididae include: S. H. Scudder (1875, 1892, 1897), A. P. Morse (1894, 1895, 1897, 1898), J. A. McNeill (1897, 1900, 1901), T. H. Hubbell (1932, 1960), A. B. Gurney (1940), and A. R. Brooks (1959), H. S. Wallace (1955) and V. M. Dirsh (1956). James A. G. Rehn and H. J. Grant, Jr. have recently undertaken, group by group, a revision of the North American Orthoptera. To date, they have completed a review of the subfamily Romaleinae.

The Acrididae of Oklahoma were little known prior to 1900. Caudell was the first serious collector of Orthoptera to enter Oklahoma. He collected throughout the east-central and northeastern sections in the 1890's and in 1901. In the report of his findings in 1902,

33 species of Acrididae were listed, including one new species.

Morse visited the central and southeastern sections of the State in 1905 and obtained a fairly good representation of Acrididae in those areas. He published his findings (1907) in "Further Researches in North American Acrididae."

Hubbell and Ortenbruger (1926) based a paper on the results of collections in southwestern, southern and southeastern sections plus all available published records up to that time. Eighty species and subspecies of short-horned grasshoppers were listed for the State. They also described the major physiographic areas of Oklahoma.

Hebard (1938) listed 67 species of Acrididae for Oklahoma in an ecological study. His collections were taken from 56 localities throughout Oklahoma excluding the Panhandle and represented eight different environmental types. Pasture, range or waste land, alfalfa, roadside, corn, cotton, stubble, and weeds along streams were collection habitats. Hebard listed 17 species of grasshoppers sufficiently abundant to indicate they were doing serious damage. Melanoplus differentialis (Thos.) was the most abundant species followed by M. foedus Scudd., M. packardii Scudd., M. angustipennis impiger Scudd., M. bivittatus (Say), and M. mexicanus (Sauss.). It is probable that Hebard would have obtained several more species than he did, had he collected throughout the entire "grasshopper season." His survey began in early June and was concluded about mid-August.

Blair and Hubbell (1938) distinguished 10 biotic districts in Oklahoma with a discussion of their physiographic, climatic and floristic characteristics. They attempted to correlate orthopteran and mammalian populations with the biotic districts. Also, they noted that three

major orthopteran and mammalian faunas were represented in Oklahoma--"an eastern fauna in the eastern deciduous forest districts, a southern Rocky Mountain fauna in the Mesa de Maya district, and a Great Plains grassland fauna in the intervening districts."

The geographic distribution of Acrididae in 26 counties of northern Oklahoma was studied by Bragg (1939). He listed 88 species of Acrididae (his Acridinae) for this northern area including 8 new records for the State. The geographic boundaries within the area studied were given for many of the species. Bragg's work was based upon specimens in the Oklahoma State University Museum, the University of Oklahoma Museum, plus a few collections made by him in Payne, Pawnee and Noble counties. Unfortunately, some of his material including a few new records for the State, could not be located and verified. The writer has ignored Bragg's unverified records in cases where they were the only existing records for the State.

METHODS OF STUDY

The author was fortunate to be employed during the summers of 1956, 1957 and 1958 by the Oklahoma Cooperative Economic Insect Survey as Survey Entomologist. This enabled him to make extensive collections of grasshoppers in all sections of the State.

Collections were taken in all counties of the State during the course of the study. Most of the counties were visited several times. January was the only month during the study in which grasshoppers were not taken.

Collecting was done almost exclusively during daylight hours and largely by use of the standard sweep net. No attempt was made to repeat collections in any given area at designated intervals; instead, a general survey-type plan was initiated. A definite attempt was made to sample the important habitat types of Acrididae such as rangeland, field borders, fence rows, roadsides, meadows, etc. Also, the writer endeavored to make collections in each county during the various seasons of the year.

The distribution of each species was recorded on a county basis rather than that of a distinct ecological unit; however, in some cases, the species range could be delineated by a distinct, vegetative type. Field notes were taken at each collecting site.

An attempt was made to include all previous records for the State. In addition to the writer's records, all material in the Oklahoma State University Museum was critically worked and included. Also, the determined material in the University of Oklahoma Museum was the basis for many records. Many Oklahoma records were obtained in a visit to the

University of Michigan Museum of Zoology this past winter. In addition to State lists and various monographs of certain groups, the "Distributional Maps of Range Grasshoppers in the United States," by Newton and Gurney (1956), and the voluminous works of J. A. G. Rehn and the late Morgan Hebard were sources of many records.

PHYSIOGRAPHIC AND BIOGEOGRAPHIC AREAS OF OKLAHOMA

Oklahoma contains a transitional zone between the deciduous forests of eastern North America and the grasslands of the central and western areas. The extreme eastern part of the State is characterized by the presence of oak, hickory and pine forests. The majority of the middle section is composed of woodlands interspersed with grasslands. As one proceeds westward the trees become more dwarfed and shrubby and grass climax becomes more dominant. Farther west the trees disappear altogether except on hills and along streams, the uplands being entirely covered by grasses.

The precipitation is greatest in the eastern and southeastern sections where it averages above 50 inches per year. It decreases steadily westward to about 25 inches along the general western boundary and to 15 inches in the extreme western portion of the Panhandle. Bruner (1931) observed that precipitation is the most important environmental factor in the latitude of Oklahoma and that the distribution of the various plant formations and associations depends largely upon it.

The average annual rainfall and relative humidity become less as one proceeds westward in Oklahoma. As one would expect, the increasingly higher elevations toward the northwest also mean a gradual decrease in mean temperature.

The physiographic provinces of the State were first studied by Bruner (1931) in his "Vegetation of Oklahoma." He listed 11 distinct areas which he described in detail including the plant associations of each. Blair

and Hubbell (1938) divided the State into 10 biotic districts, their definition of such districts being,"a geographic unit distinguished by the presence of unique ecological associations, or more often by the presence of unique assemblage of widely distributed associations." The meaning of the term "ecological association" as used by them included "all the plants and animals occurring together in a relatively stable environment." Blair and Hubbell's biotic districts corresponded generally with the game type areas of vegetation as outlined by Duck and Fletcher (1943).

A short description and comparison of the above biogeographic areas as designated by Blair and Hubbell, hereinafter referred to as (B. and H.), and Duck and Fletcher, hereinafter referred to as (D. and F.), is given here. For a complete discussion of each, the original works should be consulted.

The Cypress Bottoms Forest Type, the Loblolly Pine Forest Type and a portion of the Oak-Hickory Forest Type (D. and F.) correspond to the Mississippi District (B. and H.). The area involved is the extreme southeastern corner of the State. It is characterized by stands of bald cypress (Taxodium distichum), gums (Liquidambar Styraciflua) and (Nyssa sylvatica) and water oak (Quercus nigra) along the floodplains of the Mountain Fork and Little Rivers. Short-leaf pine (Pinus echinata) and loblolly pine (P. taeda) occur in the uplands, loblolly pine also occurring the the lowlands. This area of Oklahoma has the highest rainfall and humidity.

The Oak-Pine Forest Type (D. and F.) is practically synonymous with the Ouachita Biotic District (B. and H.) and includes the Ouachita Mountains located in southeastern Oklahoma. It is the most mountainous

section of Oklahoma. The common plant assocation of this type is forests of short-leaf pine (Pinus echinata) mixed with oaks and other trees. Common grasses of the area include bluestems (Andropogon spp.) and Indian-grass (Sorghastrum nutans).

The Oak-Hickory Forest Type (D. and F.) corresponds to the Ozark Biotic District (B. and H.) and is situated in the northeastern section of the State. The hills and slopes are covered with an oak-hickory forest, the chief species being the blackjack oak (Quercus marilandica), post oak (Q. stellata), black hickory (Carya buckleyi) and winged elm (Ulmus alata). The ground cover includes huckleberry (Vaccinium vacillans), coral berry (Symphoricarpus orbiculatus) and big bluestem (Andropogon gerardi).

The Postoak-Blackjack Forest Type (D. and F.) includes the Osage Savanna District, Wichita District and a portion of the Mixed-grass Plains District (B. and H.). Of the districts mentioned above the Postoak-Blackjack Forest Type most nearly corresponds to the Osage Savanna District. Blair and Hubbell's zone of demarcation between the Osage Savanna and the Mixed-grass Plains Districts is very general and loosely drawn. The Postoak-Blackjack Forest Type is important for it encompasses the ecotone area between the forests of the east and grass-lands of the west. It is a large area composing a large portion of the central and east-central portions of the State and is characterized by scrubby oaks interspersed with grassland. Chief woody plants of the area are, postoak (Quercus stellata), blackjack oak (Q. marilandica) and black hickory (Carya buckleyi). Little and big bluestems (Andropogon scoparius and A. gerardi) are the most common grasses.

The Bottomland Type (D. and F.) has no counterpart in Blair and

Hubbell's Biotic Districts. It includes the flood plains and stream courses of all drainage in the State. Consequently, the vegetation varies greatly depending upon what section of the State is being considered. In the panhandle and western counties the permanent vegetation is often grasses with scattered growths of cottonwood (Populus deltoides), willows (Salix spp.) and tamarix (Tamarix gallica). In the central area of the State the American elm (Ulmus americana), postoak (Quercus stellata), black walnut (Juglans nigra), chinquapin oak (Q. muhlenbergii), hackberry (Celtis occidentalis), Chickasaw plum (Prunus angustifolia) and others are common. Several species of oaks (Quercus spp.), pecan (Carya illinoiensis), sycamore (Platanus occidentalis), willows (Salix spp.) and winged elm (Ulmus alata) are abundant in the floodplains of the east and southeast.

The Tall Grass Type (D. and F.) includes the Cherokee Prairie District and most of the Mixed-grass Plains District (B. and H.). It covers more area than any other Game Type and includes the best agricultural soils of the State. Big bluestem (Andropogon gerardi), little bluestem (A. scoparius), Indian grass (Sorghastrum nutans), switch grass (Panicum virgatum) and silver-beard grass (A. saccharoides) are abundant. The average annual precipitation in this vegetative type decreases from 40 inches to about 30, east to west.

The Mixed Grass Eroded Plains Type (D. and F.) coincides with the western part of Blair and Hubbell's Mixed-grass Plains District and includes the latters Wichita District. Much of the western one-fourth of the State is included in this area. It is characterized by a mixed-grass composition including buffalo grass (Buchloe dactyloides), blue grama (Bouteloua gracilis), side-oats grama (B. curtipendula) and little bluestem (Andropogon scoparius). Isolated areas in this type, especially

in the southwestern sector, are covered with mesquite (Prosopis juliflora var. glandulosa).

The Short Grass-Highplains Type (D. and F.) and the Short-grass Plains District (B. and H.) are synonymous, composing the panhandle counties and the extreme northwestern corner of the main part of the State. Buffalo grass (Buchloe dactyloides), blue, hairy and side-oats gramas (Bouteloua gracilis, B. hirsuta and B. curtipendula) are dominant grasses. Little bluestem (Andropogon scoparius) is found in more moist areas. The average annual rainfall averages from 17-24 inches. Low relative humidity, a high average wind velocity and rapid changes of temperature also characterize this area.

The Stabilized Dune Type (D. and F.) is coincident with a portion of the sand areas of Blair and Hubbell. This type includes the heavily vegetated sand dunes occurring on the north sides of the Cimarron and North Canadian Rivers in the northwestern area. The dune-like topography includes an overstory of American elm (Ulmus americana), cottonwood (Populus deltoides), hackberry (Celtis sp.), chittamwood (Bumelia lanuginosa), blackjack oak (Quercus marilandica) and postoak (Q. stellata). Little bluestem (Andropogon scoparius), sand dropseed (Sporobolus cryptandrus), sand bluestem (A. halli) and sand lovegrass (Eragrostis trichodes) are dominant grasses.

The Sand Sage-Grassland Type (D. and F.) occupies the same area as the bulk of the sand areas (B. and H.). It is found on the north side of the principal streams in northwestern Oklahoma and is considerably more extensive in area than the Stabilized Dune Type. Sand sage (Artemesia filifolia) forms a very considerable part of the ground cover. Associated with it are hackberry (Celtis sp.), skunkbush (Rhus

trilobata), sand plum (Prunus sp.) and others. The principal grasses are little bluestem (A. scoparius) and sand bluestem (A. halli). Blair and Hubbell consider these sandy areas important as they are highways for the eastward movement of many western species of animals.

The Shinnery Oak-grassland Type has no exact counterpart in Blair and Hubbell's work, being included in their sandy areas. This type is found in parts of the extreme western tier of counties and is not extensive in area. It is characterized by a low growth of several species of oak (Quercus spp.) mixed with tall grasses of which little bluestem (Andropogon scoparius) predominates.

The Pinon-Juniper-Mesa Type (D. and F.) coincides with the Mesa de Maya Biotic District (B. and H.) except that the latter district is restricted to the plateau of Black Mesa; whereas, the former includes the entire distribution of the pinon pine and juniper. The pinon pine (Pinus edulis), juniper (Juniperus monosperma), thick-leaved hackberry (Celtis reticulata), cholla cactus (Opuntia sp.) and scattered stands of western yellow pine (Pinus ponderosa) are the principal woody plants. The grasses are typical of the Shortgrass-High Plains Type. This area is definitely semiarid, average annual rainfall being approximately 18 inches. Extreme changes of temperature are common in this area, especially in the winter.

The author prefers to follow the Game Types of Duck and Fletcher in correlating the distribution of grasshoppers with natural vegetative units, rather than those outlined by Blair and Hubbell. Actually the former title is misleading, their Game Types coinciding very well with natural vegetative types of the State. Blair and Hubbell's work is more general and arbitrary; whereas, Duck and Fletcher's is more complete and;

therefore, more adaptive to the study of an insect group.

FAMILY ACRIDIDAE LATREILLE

Characteristics.

Head variable from short and expanded to distinctly elongate; antennae generally shorter than body, filiform, clubbed or ensiform, the joints distinct; ocelli present; foveolae usually present. Pronotum forming a shield over the three segments of the thorax, never extending over the abdomen. Tegmina and wings either present or absent. Hind femora very much enlarged; hind tarsi three-jointed. Abdomen with auditory organ located on sides of basal segment; ovipositor consisting of four short, horny pieces, located at apex of abdomen.

General Biology.

The family Acrididae includes the true locusts and the common grasshoppers of our meadows, rangelands, and roadsides.

The word locust, as used in most parts of the world, denotes grasshoppers that migrate in swarms. The same species may be a grasshopper during periods of relatively low abundance and a locust during periods of extreme abundance.

Most Acrididae in the United States, especially in the more northern areas pass the winter in the egg stage. A number of species, however, may pass the winter as an adult or a partially grown nymph. The eggs are laid in late summer or autumn and hatch the following spring. Most species deposit their eggs in the soil in characteristic groups or

pods.

The egg-laying habits of most acridids are essentially the same. The female first digs a hole in the soil with her ovipositor then deposits the eggs singularly in a mass of white, gelatinous material, which eventually hardens forming a long bean-shaped mass. The hole above the eggs is then closed with this white, cementing material mixed with dirt, thus forming a protective cap.

The number of eggs per pod varies with the species but generally runs from 20 to about 60 eggs. Location of ovipositing sites often depends upon the type soil and nearness to good food and cover.

Embryonic development within the eggs begins immediately after they are laid in the fall, after which a cessation of development or embryonic diapause takes place, followed by a resumption of growth the next spring, after the temperature raises. The time of hatching is not only dependent upon the maturity of the eggs, but upon various external factors such as temperature, humidity, and light. Within the egg, the larva, by energetic movements, causes the egg shell to rupture. After emerging, the larva, or veriform larva as it is sometimes called, is enclosed in a transparent membrane which surrounds the entire body. In this form it reaches the surface of the soil by worm-like movements after which the skin is shed immediately. The young 'hopper is now a first-instar nymph.

Growth is accompanied by periodic molts, five being the number observed in most Acrididae before adulthood is reached. The young grasshopper, preparatory to molting, climbs up on a plant and assumes a head-downward position. Its skin ruptures on the dorsal mid-line and the new instar nymph struggles out, being aided in its labors by the force of

gravity.

The various instars are generally recognized by certain morphological changes during development which are mainly in the structure of the antennae, of the elytra and wings, and of the end of the abdomen (Uvarov, 1928). In the final molt the wings are transformed into organs of flight. Immediately after molting the elytra and wings are very filmy white and crumpled. Shortly they fill with blood, become distended to their usual size and harden. A very interesting difference may be noted between adult grasshoppers and their nymphs as concerns the relative positions of the elytra and wings. In the nymphal stages the wing rudiments always cover the elytral pads; whereas, in the last molt an inversion takes place so that in the adult the elytra cover the wings.

Sexual maturity in the Acrididae is not acquired immediately upon reaching the adult stage, considerable variation being noted for many of the species. The period of time between the final molt and sexual maturity may vary from a few hours or days among some species and up to several months among others.

Contrary to common belief, both male and female grasshoppers have sound producing organs; however, the organs are generally more developed and specialized in the males. The most common stridulating process is that in which the femora with many small peg-like spines is rubbed against the hardened veins of the tegmina; thus, producing a low buzzing sound. Likewise, other noises may be produced in a similar fashion, i.e. rubbing the inner surface of the femur against the tegmina; however, in these cases the veins of the tegmina are serrated while the femur has no pegs, only a raised ridge. Sounds are produced by the above methods only while the grasshopper is at rest, while in many species,

especially in the sub-family Oedipodinae, crackling or rattling sounds are produced during flight. These are produced by rubbing together the dorsal surface of the wing and the ventral surface of the tegmina. The fan-like closing and opening of the wing in flight also produces noises.

Economic Considerations.

More than 600 species of Acrididae have been reported from North America. All of them are herbivorous and a few are of great economic importance. For example, the Rocky Mountain Locust, Melanoplus spretus (Walsh) was reported to have done approximately 200 million dollars damage during mid-1870's in the Great Plains. The extensive devastation of crops and ranges was so severe that Congress, in 1877 created the United States Entomological Commission to study the grasshopper problem. Luckily, this pest has evidently disappeared, specimens not having been collected since 1902.

The areas of most extensive grasshopper damage are the Great Plains and western United States. The bulk of the depradations occurring in the western one-half of the nation is due to a few species. Parker (1952) estimated that about 90 per cent of the crop damage is caused by the following five species; the lesser migratory grasshopper, the differential grasshopper, the two-striped grasshopper, the redlegged grasshopper, and the clear-winged grasshopper. Of the above; the lesser migratory, differential, two-striped, and red-legged grasshoppers are found in most sections of the United States while the clear-winged grasshopper is restricted to the northern states east of the Continental Divide and all the states west of the Continental Divide.

The lesser migratory grasshopper, Melanoplus bilituratus (Walker) is more wide-spread and destructive than any other locust in America. Crop and range damage due to this species occurs mainly west of the Mississippi River, injury to a lesser extent occurs in most Eastern States. Melanoplus bilituratus is migratory at times and during outbreak years flights of several hundred miles are common. Extensive damage to crops and rangeland often occur during their resting spells. This grasshopper resembles the Rocky Mountain Locust in habits and structures more closely than does any other form. This has led some observers to theorize that perhaps M. bilituratus is the solitary phase of the Rocky Mountain Locust and that with the correct climate and environmental conditions the migratory form might become common again. Gurney and Brooks (1959), on the basis of aedeagal characteristics class M. bilituratus and M. spretus as distinct species.

KEY TO THE SUBFAMILIES OF ACRIDIDAE IN OKLAHOMA

1. Hind tibiae with outer row of dorsal spines extending to apices .....Romaleinae

   Hind tibiae with outer row of dorsal spines ending before apices..2

2. Sternum between front legs with a distinct tubercle or spine .....Cyrtacanthacridinae

   Sternum between front legs without a distinct tubercle or spine...3

3. Face usually slanting, meeting the vertex at an acute angle; median carina of pronotum not raised in a crest (except in Acrolophitus); hind margin of pronotum truncate or obtusely-angled (except in Acrolophitus); hind wings transparent, never brightly colored (except in Acrolophitus); or with dark crossbands.....Acridinae

   Face usually vertical, rounded into vertex; median carina of pronotum often raised in a crest; hind margin of pronotum usually acutely-angled; hind wings usually brightly colored and with dark crossbands.....Oedipodinae

Several genera of the Acridinae and the Oedipodinae possess characteristics intermediate between those of the two subfamilies. To date, a satisfactory division of these two subfamilies does not exist. Roberts (1941) tried to separate them upon differences in phallic structures but was only partially able to do so for the world fauna. Dirsh (1956) reviewed the phallic structures of each family in the Acridoidea and erected several new families and subfamilies as a result. Rehn and Grant (1960)

studied the internal male genitalia and external morphology of many species of both the Acridinae and Oedipodinae. They concluded that:

> while the extreme of development in genera assigned to the subfamilies Oedopdinae and Acridinae, (as understood by most American authors) are sufficient to support the present classification, many genera are annectant. These genera cannot be satisfactorily assigned to either 'subfamily'.

Rehn and Grant recognize only one subfamily, Acridinae, to include those genera previously assigned to Acridinae and Oedipodinae.

SUBFAMILY ROMALEINAE BRUNNER, 1893

Since only one species of this subfamily is found in Oklahoma the generic and specific characteristics are combined. The following, from Froeschner (1954), gives some of the more important subfamily characteristics:

> Vertex flat, triangular, fastigium surpassing eyes; pronotum with median carina distinct throughout, cut by 3 sulci, pronotum with at least prozona tectate; tegmina and wings varying from absent through partially to fully developed and surpassing apex of abdomen.

Genus Brachystola Scudder, 1876

Brachypeplus Charpentier, 1843. (not Brachypeplus Erichson, 1842). Orth. Desc. et Depic., Leipzig, tab. 52.

Brachystola Scudd., 1876. Bull. U. S. Geol. and Geog. Surv. Terr. 2:267.

Genotype: Brachypeplus virescens Charpentier (by monotype and subsequent indication of Rehn, 1904, Proc. Acad. Nat. Sci. Phila. 56:528).

Brachystola magna (Girard)

Brachypeplys magnus Gir., 1853. In Marcy, Explor. Red River, Louisiana (Zoology), pp. 260-261.

Brachystola magna (Gir.). Scudd., 1876, Bull. U. S. Geol. and Geog. Surv. Terr. 2:267.

Brachystola intermedia Bruner, 1906. Biol. Centr. Amer., Orth. 2:194-195.

Characteristics: Very large and robust, reddish-brown grasshoppers with greenish and brown markings. Occiput rounded; vertex of fastigium V-shaped; frontal costa grooved below antennae; antennae long, filiform, joints distinct. Pronotum elongate with three sharp, dark-colored carinae of medium height and continuous except lateral carinae incised by a single transverse sulcus; disk of pronotum rugulose, sides smooth and polished. Wings and tegmina rudimentary, fan-shaped, wings always concealed under the tegmina, tegmina usually pinkish in color with small black dots. Prosternal spine, at the most, only a very low node. Legs all robust, posterior femora especially swollen; external spine of hind tibiae located near the apices.

Comments and distribution: This large lubber locust is widely distributed in midwestern United States. Its range extends from North Dakota southward to Texas and from Wisconsin and Iowa to Montana and Arizona. In Oklahoma, it is largely restricted to the western one-half of the State but has been found as far east as Tulsa County. Brachystola magna (Gir.) is usually found in a grassy-weedy environment on thin, rocky or dry soils. In some years it does local damage to young cotton plants in southwestern Oklahoma.

Rehn and Grant (1959) completed an excellent revision of the subfamily Romaleinae.

County records: Cimarron, Texas, Beaver, Harper, Kay, Osage, Tulsa, Logan, Ellis, Major, Roger Mills, Beckham, Washita, Harmon and Comanche.

SUBFAMILY CYRTACANTHACRIDINAE KIRBY, 1910

Face usually perpendicular, rarely distinctly oblique; disc of vertex shallow, sometimes almost obsolete; lateral foveolae absent or indistinct. Disc of pronotum not wrinkled or tuberculate; hind margin never acutely-angled; median carinae low, rather equal in height throughout; lateral carinae usually obsolete or rounded. Prosternum with a distinct spine or tubercle between the front pair of legs. Fore and hind wings variable in length, the latter usually transparent, never colored.

Members of this subfamily are often found in a great variety of habitats. Some of our most destructive grasshoppers belong to this group, including the well-known genus Melanoplus Stal. For the most part, species of the subfamily are dull colored and inconspicuous. They usually overwinter in the egg stage, there being one or more generations per year in the latitude of Oklahoma. Unlike the subfamily Oedipodinae, members of this group are not capable of producing sounds audible to the human ear.

Key to the Subfamily Cyrtacanthacridinae (Spine-breasted Grasshoppers) in Oklahoma

1. Extremely long and slender forms; slant-faced.....2

   Form normal; not slant-faced.....3

2. Tegmina and wings abbreviated, not reaching apex of abdomen .....Parapomala

   Tegmina and wings long, extending beyond apex of abdomen...Leptysma

3. Body brilliantly and contrastingly marked with black yellow and red-to-orange colors.....Dactylotum

Body not vividly marked as above.....4

4. Lateral lobes of mesosternum longer than wide (Fig.38); large grasshoppers.....Schistocerca

Lateral lobes of mesosternum as wide or wider than length (Fig.37); variable in size.....5

5. Lateral carinae of pronotum pale, heavy, very obvious.....Paratylotropidia

Lateral carinae of pronotum not heavy, nor obvious.....6

6. Cross carinae of pronotum deeply impressed, blackened..Dendrotettix

Cross carinae of pronotum not deeply impressed, or if so, not blackened.....7

7. Specimens with a distinct darker band extending from behind the eye posterio-ventrally, ending on the pleura of the mesonotum (may extend onto the pleura of the metanotum in the paler forms).....Hypochlora

Specimens not with a band extending as above.....8

8. Body covered with long, white hairs.....Campylacantha

Body not covered with long, white hairs.....9

9. Hind femora with subapical pink-to-red rings and/or purple stripes on lateral line of outer, upper faces; bright-green grasshoppers.....Hesperotettix

Hind femora not marked as above; dark-green or brownish grasshoppers.....10

10. Short robust species with green bars on outer faces of hind femora; antennae orange-colored.....Aeoloplides

Not short and robust; green bars not present on hind femora; antennae not orange-colored.....11

11. Head large in proportion to pronotum; posterior margin of pronotum rounded on dorsum.....Phoetaliotes

Head not out of proportion to pronotum; posterior margin of pronotum rectangulate to obtuse on dorsum.....Melanoplus

Genus Paropomala Scudder, 1899

Paropomala Scudd., 1899. Psyche. 8:437.

Genotype: Opomala wyomingensis Thomas, 1871. Rept. U. S. Geol. Surv. Mont., p. 446.

Note: Only one species of the genus is found in Oklahoma; therefore, the description is of that species.

Parapomala wyomingensis (Thos.)

Opomala wyomingensis Thos., 1871. Rept. U. S. Geol. Surv. Mont., p. 446.

Mesops cylindricus Bruner, 1889. Proc. U. S. Nat. Mus. 12:48.

Paropomala calamus Scudd., 1889. Psyche. 8:437.

Paropomala wyomingensis, Scudd., 1889, Loc. cit.

Characteristics: Small, cylindrical brown-to-green grasshoppers with extremely slanted faces. Vertex cone-shaped, elongate, extending a considerable distance in front of the eyes; face quadricarinate, the carinae sharp; eyes oblong; antennae flattened toward bases, sword-

shaped; whitish stripes extend from lower border of eyes to bases of middle legs. Pronotum about length of head, rounded; lateral carinae faint; prosternal spine short, blunt. Tegmina lance-shaped, abbreviated reaching vicinity of the fifth abdominal segment. Abdomen long, cylindrical; apices in the males turned upwards, very pointed.

Comments and distribution: Paropomala wyomingensis (Thos.) is a Great Plains and western species extending into the western part of the State. The Jackson County record represents its southeastern limits in the United States. It prefers coarse grasses such as big and little bluestems and is not often collected, only being reported from about six scattered counties. Adults have been collected throughout the summer and early fall.

County records: Jackson, Harmon, Roger Mills, Alfalfa, Harper, Texas and Cimarron.

Genus Leptysma Stal, 1873

Leptysma Stal, 1873. Recens. Orth. 1:85.

Cylindrotettix Bruner, 1906. Jour. N. Y. Ent. Soc. 14:153.

Genotype: Opsomala marginicollis Serville, 1839. Hist. Orth. p. 591.

Note: This genus is represented in the State by only one species; therefore, the description is of that species.

Leptysma marginicollis (Serville)

Opsomala marginicollis Serv., 1839. Hist. Orth., p. 591.

Opomala marginicollis, Saussure, 1861, Rev. Zool. (2) 13:156.

Leptysma marginicollis, Stal, 1873, Recens. Orth. 1:86.

Characteristics: Extremely long and slender, subcylindrical forms, the tegmina and wings extending beyond apex of abdomen. Head with face oblique; frontal costa shallowly sulcate throughout; antennae shorter than head and pronotum combined, tapered apically; eyes longer than wide; disc of vertex triangular, much produced in front of eyes. Pronotum subcylindrical; front margin subtruncate dorsally, rear margin broadly rounded dorsally; median carina faint; lateral carina absent. Tegmina and wings exceeding the abdomen, the former with acute tips. Hind femora long, slender; spines of hind tibiae tipped with black. General body coloration yellowish-brown tinged with reddish; a yellow stripe extends from lower corner of eyes along lower border of pronotum to coxae of hind legs; head, pronotum and part of tegmina with numerous, small punctate spots.

Comments and distribution: This species is usually found in sedges and grasses around the margins of ponds (Blatchley 1920). It tends to be secretive in habits. This, plus its restricted habitat, perhaps accounts for it having been collected in only a few widely scattered counties.

County records: Pushmataha, Love, Cleveland, Harmon, Alfalfa, Woods and Cimarron.

Genus Dactylotum Charpentier, 1843

Dactylotum Charpentier, 1843. Orth. Descr. et Depict., pl. 52.

Poepedetes Saussure, 1861. Rev. Mag. Zool. 13:158.

Genotype: Dactylotum bicolor Charp., 1843. Orth. Descr. et Depict., pl. 52.

Note: Only one species of this genus is found in the State; therefore, the generic and specific descriptions are combined.

Dactylotum bicolor pictum (Thomas)

Pezotettix picta Thos., 1870. Proc. Acad. Nat. Sci. Phila. 22:78.

Pezotettix flavoannulatum La Munyon, 1877. Proc. Nebr. Assoc. Adv. Sc., March 8.

Dactylotum bicolor pictum, Roberts, 1947, Proc. Acad. Nat. Sci. Phila. 159:220.

Characteristics: Medium-sized grasshoppers brilliantly marked with reddish-orange, black and yellow. Head with frontal costa convex, not constricted, sulcate in vicinity of median ocellus; antennae filiform, nearly as long or longer than head and pronotum combined; vertex rounded into face, narrow between the eyes, triangular-shaped in front of eyes, depression of vertex feeble. Pronotum subcylindrical, punctate throughout; posterior portion of lateral lobes obliquely sloped; dorsum broadly rounded posteriorly; lateral carinae absent; median carinae faint, cut by three sulci. Tegmina abbreviated, small, oblong-ovate, not extending beyond second abdominal segment, not meeting on dorsum.

The placement of the dark purple to black stripes is very aptly described by Thomas (1870) thusly:

> Down the frontal ridge; on the occiput; down each cheek; two interrupted broad stripes running obliquely upward and backward from the anterior margin and angle of the pronotum; four

spots on the base of each dorsal, and two on each ventral segment of the abdomen; posterior femora crossed by three broad bands.

In addition the reddish-orange markings are found on the mid-line of pronotum and abdomen, on the front and sides of head, on sides and lateral borders of pronotum, sides of thorax, on upper portion of hind femora and as bands on fore and middle tibiae.

Comments and distribution: Dactylotum bicolor pictum (Thos.) is without a doubt the most distinctive and contrastingly colored grasshopper of the Great Plains. It is only found in the western one-third and Panhandle of our State. Areas of short, sparse grass interspersed with weeds is its preferred habitat. Adults have been collected from June to October.

County records: Cimarron, Texas, Harper, Woods, Ellis, Major, Blaine, Dewey, Custer, Greer, Harmon, Jackson, Tillman, Cotton, Kiowa and Caddo.

Genus Schistocerca Stal, 1873

Schistocerca Stal, 1873. Recens. Orth. 1:64.

Genotype: Libellula americanus Drury, 1770. Illus. Nat. Hist. 1:128.

Characteristics: Large, elongate, slender-bodied species with lateral lobes of mesosternum longer than broad (Fig. 38). Head with face nearly vertical, quadricarinate, frontal costa partly or wholly sulcate; antennae filiform, considerably longer than combined length of head and pronotum, except in S. d. damnifica (Sauss.); vertex sloping downward, rounded into frontal costa; depression of vertex shallow, median carina

lacking. Pronotum with prozona rounded, metazona flat or nearly so; hind margin broadly rounded or obtusely-angled; median carina low, cut by three transverse sulci; lateral carinae absent. Tegmina fully developed, at least reaching apex of abdomen; hind wings slender, usually reaching or exceeding apex of abdomen. Subgenital plate of male notched.

Key to Males of the Species of Schistocerca in Oklahoma

1. Tegmina subhyaline with dark brown mottlings; light post ocular stripes present.....americana americana

   Not as above.....2

2. Antennae of males not over one-fifth longer than head and pronotum; dorsum of tegmina without pale or colored stripes .....damnifica damnifica

   Not as above.....3

3. Tegmina usually a dark purplish-brown; notch of subgenital plate deep, V-shaped (Fig. 22); hind tibiae often blackish-purple.....obscura

   Tegmina yellowish-brown to rusty-brown to olive-green; notch of subgenital plate an open U- or V-shaped (Fig. 21); hind tibiae usually a lighter hue, often wholly or partly brownish or reddish (never completely dark).....Alutacea Group

Alutacea Group

This grouping of Schistocerca Stal includes the species S. lineata Scudd., S. rubiginosa (Harris) and S. alutacea (Harris). Of these, S. rubiginosa (Harris) has not been reported any closer to Oklahoma than east-central Texas. Schistocerca alutacea (Harris) is known only from one record in LeFlore County, while S. lineata Scudd. occurs in all

areas of the State except the southeast.

Previous to Hubbell's excellent monograph of this group (1960) extreme confusion was prevalent in the separation of the above species. As late as 1954, Froeschner, in his "Orthoptera of Iowa," was in a quandry as to the proper separation of S. lineata Scudd. and S. alutacea (Harris) due to what we now know to be the extreme color variation in the former.

Hubbell's (1960) work pointed out that positive identification of S. lineata Scudd. and S. alutacea (Harris) can best be achieved through a study of the concealed male genitalia, previously considered separation criteria being quite variable.

Key to Alutacea Group

(Based on concealed male genitalia)

Distal portion of phallus when viewed from dorsal aspect (Fig.42); the rami in outline appearing bilobate and transverse, the "waist" very much constricted and the ramal margins strongly expanded to accommodate the broad phallotreme orifice.....alutacea

Distal portion of phallus when viewed from dorsal aspect (Fig.41); the rami in outline appearing hour-glass-shaped instead of distinctly bilobate, the "waist" not so deeply constricted, ramal margins not strongly expanded, phallotreme orifice narrow.....lineata

Note: Those portions of the above keys, other than the separation of alutacea Scudd. and lineata (Harris), were modified from Blatchley (1920); remainder from Hubbell, 1960.

Schistocerca americana americana (Drury)

Libellula americanus Drury, 1770. Illus. Nat. Hist. 1:128.

Gryllus serialis Thunberg, 1824. Mem. Acad. St. Petersb. 9:424.

Cyrtacanthacris interrupta Walker, 1870. Cat. Derm. Salt. Brit. Mus. 3:572.

Acridium piceifrons Walk., 1870. Ibid., p. 578.

Acridium vicarium Walk., 1870. Ibid., p. 580.

Acridium ambigium Thomas, 1872. Rept. Geol. Surv. Mont. p. 477.

Schistocerca americana, Scudder, 1899, Proc. Amer. Acad. Arts Sci. Phila. 34:474.

Schistocerca americana americana, Hebard, 1931, Proc. Acad. Nat. Sci. Phila. 83:169.

Characteristics: Generic characters as above. Large, slender, the female often two inches or more in length; general coloration reddish-brown. Head and lateral lobes of pronotum with light post-ocular stripes extending to principal sulcus; broad yellow stripe extending from vertex backward along midline of head, pronotum and onto tegmina; tegmina subhyaline with large, isolated dark brown blotches; hind tibiae yellowish- to reddish-brown.

Comments and distribution: This species is primarily an eastern form reaching its western limits in Kansas, Oklahoma and Texas. In Oklahoma, it is reported from all sections except the western and panhandle counties. The western-most county record is thought to be the writer's Major County collection. Schistocerca a. americana (Drury) is found in many types of habitats but seems to prefer abandoned fields,

meadows, tall grass along roadsides, etc. When flushed, it flies a considerable distance and often alights in trees or small shrubs. Adults have been reported from May to November.

County records: McCurtain, LeFlore, Choctaw, Latimer, Sequoyah, Cherokee, Muskogee, Wagoner, Craig, Tulsa, Osage, Payne, Pontotoc, Garvin, Jefferson, Cotton, Comanche, Kiowa, Caddo, Major and Alfalfa.

Schistocerca damnifica damnifica (Saussure)

Acridium damnificium Sauss., 1861. Rev. Mag. Zool. (2), 13:164.

Cyrtacanthacris unilineata Walker, 1870. Cat. Derm. Salt. Brit. Mus. 4:169.

Acridium rugosum Provancher, 1876. Prov. Nat. Can. 8:111.

Schistocerca damnifica, Scudder, 1899, Proc. Amer. Acad. Arts Sci. 34:475.

Characteristics: Considerably smaller than S. a. americana (Drury), females two inches or less in length; general coloration uniformally russett-brown. Antennae reddish-brown, shorter than in other species, in the male not over one-fifth longer than combined length of head and pronotum; median carina of pronotum relatively high, it and occiput of head with a narrow reddish-brown or brownish-yellow line; tegmina relatively short, usually reaching only to tips of hind femora in the female, uniform in color without contrasting spots, distinct, dorsal pale stripes not present.

Comments and distribution: The distribution of S. d. damnifica (Sauss) is eastern and southern, Oklahoma being its western limits. It is rare in our collections, only having been reported from three counties in the central section. Blatchely (1920) lists its preferred habitat as being old fields and roadsides.

County records: Payne, Cleveland and Murray.

Schistocerca obscura (Fabricius)

Gryllus obscurus Fabr., 1798. Ent. Syst. Suppl., p. 194.

Acridium olivaceum Serville, 1839. Hist. Nat. Ins. p. 666.

Schistocerca obscura, Scudder, 1899, Proc. Amer. Acad. Arts Sci. 34:441.

Characteristics: Large species, more robust than S. a. americana (Drury); general coloration usually dark purplish-brown. Head and pronotum with conspicuous yellow stripe on median line extending onto tegmina; antennae yellowish, dusky toward tips; hind tibiae usually blackish-purple; hind femora often with short dark cross-bars on upper outer faces; mesopleura usually with short yellow stripes. Subgenital plate with a deep V-shaped notch (Fig.22).

Comments and distribution: Schistocerca obscura (Fabr.) is an eastern and southern form reaching its western limits in Kansas, Oklahoma and Texas. Like S. a. americana (Drury), it is often found in old fields overgrown with trees and shrubs, in abandoned areas, along roadways, etc. Except for a Culberson County, Texas record, the writer's Texas County collection marks the western limit of distribution in the

United States.

County records: Nowata, Osage, Tulsa, Okmulgee, Pawnee, Payne, Noble, Cleveland, Murray, Atoka, Bryan, Love, Cotton, Comanche, Kiowa, Custer and Beaver.

Schistocerca alutacea (Harris)

Acrydium alutaceum Harris, 1841. Rept. Ins. Inj. Veg., p. 139.

Acridium rubiginosum Scudder, 1862. Bost. Jour. Nat. Hist. 7:467.

Acridium scutellare Walker, 1870. Cat. Derm. Salt. Brit. Mus. 3:579.

Acridium strenuum Walk., 1870. Ibid., p. 580.

Cyrtacanthacris concolor Walk., 1870. Ibid., Vol. 4:610.

Acridium proprium Walk., 1870, Ibid., p. 621

Acridium emarginatum Scudd., 1872. Final Rept. Geol. Surv. Nebr. (Hayden) p. 250.

Characteristics: Similar to S. lineata Scudd. in general body form and structure; however, the males of this species average a little more slender than does the former. General body coloration variable as in S. lineata Scudd.; however, a complete, mid-dorsal yellow stripe always extends from vertex to tips of the closed tegmina, which is not always true in the former; tegmina either spotted or not; hind tibiae not as variable in coloration, usually always brownish or yellowish. Subgenital plate similar to that of S. lineata Scudd.

See the above Key to Alutacea Group for a definite separation of

this species and S. lineata Scudd. based upon concealed male genitalia.

Comments and distribution: The range of S. alutacea (Harris) is the United States east of the Great Plains. Only three records are known from west of the Mississippi River, these being one each in Oklahoma, Arkansas and Texas. The only Oklahoma record is from the Oak-Pine Forest Type of the extreme east (LeFlore County). Hubbell (1960) gives this species normal habitat as, "Marshes, bogs, shrubby swamps, thickets of bushes and weeds in wet or moist environments and marginal thickets of mesic forests".

The ranges of S. alutacea (Harris) and S. lineata Scudd. do not overlap in Oklahoma, the latter not as yet having been reported from the Oak-Pine Forest Type.

County records: LeFlore.

Schistocerca lineata Scudder, 1899

Acridium emarginatum Scudd., 1872. Final Rept. U. S. Geol. Surv. Nebr. (Hayden)., p. 250.

Schistocerca lineata Scudd., 1899. Proc. Amer. Acad. Arts Sci. 34:465.

Schistocerca scudderi Bruner, 1906. Proc. U. S. Nat. Mus. 30:676 (New name for lineata Scudd.), see Hubbell, 1960.

Characteristics: Size large, rather robust species. Color characters very variable, background color ranging from yellowish-brown through reddish-brown to olive-green; median dorsal stripe on head, pronotum and tegmina present, or not present, its color usually pale but sometimes deep- or greenish-yellow; tegmina either with or without

spots; hind tibiae very variable in color, yellowish-brown through reddish-brown to partly blackish (never completely blackish). Subgenital plate with a shallow open U- or V-shaped notch (Fig.21).

Often confused with S. obscura (Fabr.) and S. alutacea (Harris), especially the latter. Separated most easily from the former by the shallow, open U- or V-shaped notch in the male subgenital plate as compared to the deep V-shaped notch in S. obscura (Fabr.).

Positive separation from S. alutacea (Harris) can be achieved only by the concealed male genitalic differences as outlined in above Key to Alutacea Group.

Comments and distribution: This species is found in the eastern two-thirds of the United States with the exception of the southeastern states. It has been reported from all areas of our State except the Oak-Hickory and Oak-Pine Types of extreme eastern Oklahoma. Its normal habitat includes open woodlands, meadows and rangelands, but according to Hubbell (1960) always includes areas with trees, shrubs or forbs which constitute its normal food supply.

County records: Cimarron, Texas, Beaver, Harper, Ellis, Woods, Woodward, Alfalfa, Major, Blaine, Custer, Washita, Beckham, Jackson, Tillman, Comanche, Cotton, Jefferson, Garvin, Grady, Cleveland, Logan, Pottawatomie, Kingfisher, Canadian, Payne, Noble, Garfield, Grant, Kay, Pawnee, Tulsa, Wagoner, Okmulgee, Hughes and Bryan.

Genus Paratylotropidia Scudder, 1897

Paratylotropidia Scudd., 1897. Proc. U. S. Nat. Mus. 20:12.

Genotype: Paratylotropidia brunneri Scudd., 1897. Proc. U. S. Nat. Mus. 20:118.

Characteristics: Stout, short-winged species with head narrower than pronotum. Face moderately oblique; frontal costa prominent, sulcate in area of median ocellus; antennae slender, as long or longer than head and pronotum combined; vertex broad, rounded into face; depression of vertex shallow, median carina present. Pronotum with heavy lateral carinae; median carina raised, distinct, cut by one or more transverse sulci; hind margin broadly obtuse-angulate. Tegmina very short, slightly overlapping on mid-line; apices rounded or acute. General coloration reddish-brown above, paler underneath.

Rehn and Rehn (1943) made a detailed treatment of this genus.

Key to the species of Paratylotropidia in Oklahoma

(Adapted from Rehn and Rehn, 1943)

1. Tegmina definitely shorter than dorsum of the pronotum, subovoid, their greatest breadth equal to two-thirds their length; distal extremity of tegmina not acute (Fig.32); cerci of males with apical third more sharply narrowed.....morsei

Tegmina somewhat longer than dorsum of the pronotum, lanceolate, their greatest width little, if any, more than one-half their length; distal extremity of tegmina acute (Fig.31); cerci of males more evenly narrowing apically.....brunneri

Paratylotropidia brunneri Scudder

Paratylotropidia brunneri Scudd., 1897. Proc. U. S. Nat. Mus. 20:118.

Paratylotropidia brunneri, Morse, 1907, Carneg. Inst. Wash., No. 68: 46 (in part).

Paratylotropidia bruneri, Caudell, 1932, Proc. Ent. Soc. Wash. 34:86.

Paratylotropidia bruneri, Blair and Hubbell, 1938, Amer. Midl. Nat. 20:446 (in part).

Characteristics: Base color cinnamon-brown, paler underneath, with a pair of distinct yellowish lines extending from vertex backward along lateral carinae of pronotum and dorso-lateral angles of tegmina. Tegmina abbreviated in Oklahoma forms, shorter than pronotum, apices lanceolate (Fig.31). Caudal femora on dorso-lateral portions usually light colored; caudal tibiae light to dark red. Other characteristics as given under the generic description above.

Comments and distribution: Rehn and Rehn (1943) list this species as a prarie-type occurring for the most part west of the Mississippi River but extending onto the Great Plains. It seems to prefer grassy or weedy areas adjacent to woodland such as occurs in the Postoak-Blackjack Forest Type of the State. This species is rare in our collections.

County records: Bryan, Murray and Pawnee.

Paratylotropidia morsei Rehn and Rehn

Paratylotropidia brunneri Morse, 1907. Carneg. Inst. Wash., No. 68: 46 (in part).

Paratylotropidia brunneri, Blair and Hubbell, 1938, Amer. Midl.

Nat. 20:446 (in part).

Paratylotropidia morsei Rehn and Rehn, 1943. Trans. Amer. Ent. Soc. 64:50.

Characteristics: Possessing those general characteristics as given for P. brunneri Scudd. except tegmina subovoid, shorter than pronotum and apices rounded instead of acute (Fig.32). Also, fastigium narrower, and pale lateral lines on pronotum and tegmina average less contrasting than in P. brunneri Scudd.

Comments and distribution: Paratylotropidia morsei R. and R. was described by Rehn and Rehn in 1943 and reported by them to be limited in distribution to the Ouachita Mountains of west-central Arkansas and southeastern Oklahoma. It is found in the undergrowth of woodlands and in grassy areas in woodland clearings. Adults have been reported from June through August. This species is extremely rare in our collections, being reported only from one locality in Pushmataha County by Rehn and Rehn (1943) and from one locality each in Pushmataha and McCurtain counties by Hubbell and Cantrall in their 1954 collections.

County records: Pushmataha and McCurtain.

Genus Dendrotettix Packard, 1890

Dendrotettix Packard, 1890. Rept. U. S. Ent. Comm. p. 214.

Genotype: Dendrotettix quercus Pack., 1890. Rept. U. S. Ent. Comm., p. 214.

Note: Only one species is found in Oklahoma; therefore, the generic

and specific descriptions are combined.

Dendrotettix quercus Packard

Dendrotettix quercus Pack., 1890. Rept. U. S. Ent. Comm., p. 214.

Dendrotettix longipennis Riley, 1893. Ins. Life 5:255.

Characteristics: Of moderate size and relatively robust with general greenish-yellow color. Head large, broad; eyes small, prominent and widely separated; disc of vertex strongly declivent, widened and concave in front of eyes; antennae slender, about one-half length of body. Prosternal spine stout, acute. Pronotum short, rugose, its apical portion flaring; dark, wide stripes extending posteriorly from high margin of eyes, wider on pronotum than on head; median carina low, black, cut by three transverse sulci; lateral carinae absent. Tegmina dull brownish-yellow, usually short but sometimes fully developed. Inner faces of hind femora blood-red, outer faces reddish-yellow, a bright-yellow ring present at apices. Subgenital plate of male broadly scoop-shaped, cerci about twice as long as wide, furculae minute.

Hosts and distribution: This species is restricted to the Postoak-Blackjack Forest type of the eastern one-half of the State. It is an inhabitant of postoak, Quercus stellata, and other varieties of oak and is usually collected from the trees proper or the immediate area.

County records: LeFlore, Adair, Pushmataha, Osage, Payne, Carter, Okfuskee, Seminole, Cleveland and Love.

Genus Hypochlora Brunner, 1893

Hypochlora Brunn., 1893. Ann. Mus. Genova 33:145.

Genotype: Pezotettix alba, Dodge, 1876. Can. Ent. 8:10.

Note: This genus is monotypic; therefore, the description which follows is of the single species.

Hypochlora alba Dodge

Pezotettix alba, Dodge, 1876. Can. Ent. 8:10.

Characteristics: Small, green to greyish grasshoppers with abbreviated sharp-pointed tegmina. Head not prominent, summit only slightly elevated above level of pronotum, retreating ventrally; frontal costa sulcate throughout, widened above median ocellus; antennae about as long or longer than combined head and pronotum; vertex declivent, depression of vertex scarcely sulcate. Pronotum enlarged posteriorly, especially so in the females, front margin subtruncate, hind margin angulate to rounded; median carina prominent throughout, cut by principal sulcus, sometimes feebly cut by other two sulci. Prosternal spine moderately slender, conical. Tegmina brachypterous, overlapping, apices prolonged into sharp points. General coloration varies from greenish-yellow to greyish, dark bands extend from behind eyes posterio-ventrally, ending on the pleura of the mesonotum or metanotum; median and lateral carinae marked by narrow whitish or yellowish stripes.

This species is very similar to Campylacantha o. olivacea (Scudd.) but may easily be separated by the dark bands which extend posterio-ventrally from the eyes as described above, also Hypochlora alba Dodge is not densely pilose as is the former species.

Comments and distribution: This species is an inhabitant of the Great Plains and reaches its southern limits in southern Oklahoma and northern Texas. Hebard (1931) reports it as "much preferring" heavy sage, Artemesia cana Pursh, to other food plants; thus, accounting for its local and scattered distribution. As one would presume, it has only been reported from the western two-thirds of the State.

County records: Bryan, Stephens, Cleveland, Kay, Comanche and Harmon.

Genus Camplyacantha Scudder, 1897

Camplyacantha Scudd., 1897. Proc. Amer. Acad. Arts, Sci. 32:204.

Genotype: Pezotettix acutipennis Scudd., 1875. Proc. Bost. Soc. Nat. Hist. 17:472.

Characteristics: Body rather compressed and densely pilose, color green or brownish. Head prominent, especially in the males, the occiput arched higher than pronotum; vertex feebly concave. Pronotum with slight median carina; lateral carinae obsolete; front margin subtruncate, rear margin angulate; transverse sulci moderately impressed. Prosternal spine conical, angled backwards. Tegmina usually abbreviated, apices pointed. Cerci shorter than supra-anal plate, basal one-half tapering rapidly, distal portions only gradually so, rounding at apices.

Key to Males of the Subspecies of Campylancantha olivacea (Scudd.) in Oklahoma (from Scudder, 1897)

1. Distal one-half of male cerci less than one-half width at extreme bases.....olivacea olivacea

Distal one-half of male cerci more than one-half width at extreme bases.....*olivacea vivax*

Campylacantha olivacea olivacea (Scudd.)

Pezotettix olivacea Scudd., 1875. Proc. Bost. Soc. Nat. Hist. 17:472.

Campylancantha olivacea, Scudd., 1897, Proc. U. S. Nat. Mus. 20:51.

Campylacantha olivacea olivacea, Hebard, 1925, Proc. Acad. Nat. Sci. Phila. 77:96.

Characteristics: Small robust species, color greenish, tending toward brownish or fuscous. Head with face retreating somewhat; occiput often with darker green median stripe; frontal costa shallowly sulcate, broadest above the ocellus; antennae rather heavy, in both sexes, considerably longer than head and pronotum combined; vertex strongly declivent with disc widened in front of eyes and feebly sulcate. Pronotum with median carina low, cut by principal sulcus, sometimes by other sulci too; prozona approximately one-half times longer than metazona, the former slightly rugulose, the latter definitely so. Tegmina short, overlapping on inner margins. Front and middle femora of the males swollen; hind tibiae with 9-10 spines on outer margins. Apical one-half of male cerci less than one-half width at bases.

Comments and distribution: Weedy areas such as fence-rows, field borders, abandoned fields and roadways is the preferred habitat of this subspecies. It is often locally common on ragweed, *Ambrosia* spp. Most areas of the State are represented in the collections.

County records: Ottawa, Mayes, Wagoner, Latimer, LeFlore, Choctaw, Pushmataha, McCurtain, Bryan, Atoka, Pottawatomie, Payne, Osage, Grady, Comanche, Jefferson, Kiowa, Harmon, Harper, Beaver and Texas.

Campylacantha olivacea vivax (Scudder)

Pezotettix vivax Scudd., 1876. Ann. Rep. Geol. Surv. W. 100th Merid., p. 284.

Campylacantha vivax, Scudd., 1897, Proc. U. S. Nat. Mus. 20:52.

Campylacantha olivacea vivax, Hebard, 1925, Proc. Acad. Nat. Sci. Phila. 77:96.

Characteristics: Similar to C. o. olivacea (Scudd.) but easily separated by differences in the male cerci as outlined in the key.

Comments and distribution: This form is generally found in a weedy habitat. It is rare in Oklahoma collections.

County records: Texas and Washita.

Genus Hesperotettix Scudder, 1876

Hesperotettix Scudd., 1876. Bull. U. S. Geol. Surv. Terr. 2:262.

Genotype: Caloptenus viridis Thomas, 1872. Rept. U. S. Geol. Surv. Mont., p. 450.

Characteristics: Head not prominent with face oblique; frontal costa narrow, sulcate throughout; antennae slightly longer (female), or considerably longer (male) than combined head and pronotum; vertex extremely constricted by angle of eyes with a slight sulcation between,

expanded and declivent anteriorly; depression of vertex usually slight, often longitudional; eyes prominent, long and oval. Pronotum long, rounding, hind margin obtusely - angulate or broadly rounded; lower margins with front one-half ascending; prozona longer than metazona; median carina low, cut only by principal sulcus; lateral carinae obsolete. Prosternal spine long, conical. Tegmina variable in length, either shorter or longer than apex of abdomen. Fore and middle femora of male swollen; hind femora in both sexes usually surpassing abdomen.

Dr. H. S. Wallace is shortly to complete a major revision of Hesperotettix Scudd. The writer wishes to acknowledge his valuable assistance in this study.

Key to the species of Hesperotettix in Oklahoma

(from Wallace, 1961)

1. Prozona and metazona of pronotum on disc and lateral lobes distinctly rugulose; pronotum obviously tectiform; pleura rugolose, tegmina usually not reaching apex of abdomen.....speciosus

   Prozona of pronotum smooth or very sparsely punctate, nowhere rugulose; metazona punctate; disc of pronotum feebly tectiform; pleura nearly smooth or with punctate, not rugulose; tegmina usually not reaching apex of abdomen or beyond.....2

2. Transverse sulci of pronotum marked in black; median stripe of pronotum pale buff or nearly white, bordered narrowly with dark brown to reddish-purple; tegmina with distinct white stripes on dorso-lateral angles, and areas similar in color to rest of tegmina.....viridis viridis

   Transverse sulci of pronotum not distinctly colored; broad reddish-

purple median stripe of pronotum sometimes with a very narrow light stripe in its center; tegmina with anal areas reddish-purple, without distinct white stripes on dorso-lateral angles .....viridis pratensis

Hesperotettix speciosus Scudder

Pezotettix speciosa Scudd., 1871. Final Rept. U. S. Geol. Surv. Nebr., p. 250.

Acridium frontalis Thomas, 1872. Rept. U. S. Geol. Surv. Mont., p. 448.

Hesperotettix speciosus, Scudd., 1897, Proc. U. S. Nat. Mus. 20:66.

Characteristics: Generic characters as described above. Form larger and more robust than other species of the genus. Color, grass green; median carina of pronotum usually reddish-purple; outer dorsal margin of hind femora pinkish-red; antennae pale red; hind tibiae pale green, the spines tipped with black. May be separated from the other species in Oklahoma by its rugulose pronotum and short tegmina.

Comments and distribution: This species is only reported from west of the Mississippi River with exception of a few scattered records from Illinois. Typically, it is an inhabitant of plains country, preferring weedy areas with light, well-drained soil. Some consider this species to be at least partly beneficial because of its habit of feeding largely on noxious weeds such as sunflower (Helianthus) and other Compositae. Collections have been taken from all biotic types of vegetation in the State except the Oak-Pine and the Oak-Hickory Forests

of eastern Oklahoma.

County records: Cimarron, Texas, Beaver, Harper, Woods, Ellis, Dewey, Woodward, Roger Mills, Custer, Beckham, Washita, Greer, Kiowa, Harmon, Jackson, Tillman, Comanche, Cotton, Jefferson, Grady, Caddo, Canadian, Blaine, Kingfisher, Logan, Noble, Kay, Pawnee, Osage, Payne, Tulsa, Mayes, Delaware, Pontotoc, Choctaw, Bryan, Murray, Cleveland, McClain and Oklahoma.

Hesperotettix viridis viridis (Thomas)

Caloptenus viridis Thos., 1872. Rept. U. S. Geol. Surv. Mont., p. 450.

Hesperotettix festivus Scudder, 1898. Proc. U. S. Nat. Mus. 20:57.

Hesperotettix viridis, Uhler, 1877, Bull. U. S. Geol. Surv. Terr. 3:795 (in part).

Hesperotettix viridis viridis, Hebard, 1935, Trans. Amer. Ent. Soc. 61:301.

Characteristics: Generic characters as described above. Pronotum without fine wrinkles, tegmina usually as long or longer than abdomen. Irregular dark blotches or bars on sides of pronotum; antennae with greenish tinge, at least basally; median longitudional stripe on pronotum relatively broad, usually whitish or buff-colored; transverse sulci of pronotum marked with black; tegmina light green with white stripes on dorso-lateral angles; hind femora with pink to reddish-orange bands near apices.

Comments and distribution: Hesperotettix v. viridis (Thos.) is reported from the Great Plains, south to Victoria, Texas, west to the California line and on the eastern slopes of the Rocky Mountains in Colorado, Montana and Wyoming. In Oklahoma it extends as far east as Pittsburg and Tulsa counties and is probably found in every county north and west of a diagonal drawn from Cotton to Cleveland to Rogers counties (Wallace, 1961). It prefers mixed upland prairies and like other species of the genus feeds chiefly on various weedy plants.

County records: Pittsburg, Rogers, Tulsa, Payne, Pontotoc, Love, Jefferson, Cotton, Tillman, Cleveland, Logan, Blaine, Beckham, Kiowa, Greer, Custer and Roger Mills.

Hesperotettix viridis pratensis Scudder

Hesperotettix pratensis Scudd., 1897. Proc. U. S. Nat. Mus. 20:64.

Hesperotettix viridis of many authors, including Bruner, 1885; Claasen, 1911; and Hebard, 1925.

Hesperotettix brevipennis Morse, 1907. Carneg. Inst. of Wash., No. 68:44.

Hesperotettix viridis pratensis, Hebard, 1931, Proc. Acad. Nat. Sci. Phila. 82:392.

Characteristics: Similar to Hesperotettix v. viridis (Thos.) as described above but may be separated by the following; dorsal field of tegmina usually of a purplish or brown-purplish hue; median light stripes on pronotum (when present) narrower, enclosed by wide, purplish, median bands; sides of pronotum with distinct black bars; transverse sulci of

pronotum without black impressions; dorso-lateral angles of tegmina more strongly tinged with purple.

Comments and distribution: Hesperotettix v. pratensis Scudd. is a midwestern form with western limits in Colorado, eastern limits in Kentucky. Wallace (1961) states that it probably will eventually be found in every county of our State. This subspecies is most commonly found in low areas such as in valleys and along streams. It prefers to feed on Solidago spp.

County records: Ottawa, Delaware, Craig, Mayes, Rogers, Tulsa, Payne, Hughes, Pontotoc, Murray, Tillman, Jackson and Greer.

Genus Aeoloplides Caudell, 1915

Aeoloplus Scudder, 1897. Proc. Amer. Acad. Arts and Sci. 32:199 (incorrectly synonymized by Hebard, 1919).

Aeoloplus of authors, not of Scudd., 1897.

Aeoloplides Caud., 1915. Proc. U. S. Nat. Mus. 49:28.

Genotype: Pezotettix chenopodii Bruner, 1894. Ins. Life 7:41.

Considerable confusion was evident in the genus Aeoloplides (Caud.) until Wallace revised it in 1955. This genus is represented by only one species in Oklahoma; therefore, the description is of that species.

Aeoloplides turnbulli bruneri (Caudell)

Aeoloplus regalis Scudd., 1897 (not Caloptenus regalis Dodge, 1876). Proc. U. S. Nat. Mus. 20:69.

Aeolopus turnbulli Bruner, 1885. Bull. Washb. Coll. 1:139.

Aeolopus bruneri Caud., 1907. Proc. Ent. Soc. Wash. 8:134.

Asemoplus bruneri, Kirby, 1910, Brit. Mus. Nat. Hist. 7:507.

Aeoloplus turnbulli plagosus, Hebard, 1925 (of authors, not Scudd., 1876), Proc. Acad. Nat. Sci. Phila. 77:97.

Aeoloplus turnbulli bruneri, Hebard, 1935, Proc. Acad. Nat. Sci. Phila. 87:63.

Aeoloplides turnbulli bruneri, Wallace, 1955, Ann. Ent. Soc. Amer. 48:475.

Characteristics: Robust, specimens with general body coloration olive green but may tend towards brown in some specimens. Head with summit arched, higher than pronotum; frontal costa moderately broad, shallowly sulcate below ocellus; antennae cylindrical, long, orange-colored; disc of vertex shallow. Pronotum stout, increasing in width from front backward; hind margin angulate; prozona tumid, median carina absent or very feeble; metazona flat with low, rounded median carina. Prosternal spine conical, erect. Tegmina in both sexes usually reaching or slightly surpassing apex of abdomen, sometimes abbreviated. Fore and middle femora stout in both sexes with three broad, green bands on outer faces; hind tibiae greenish-blue to blue with pale annuli. Dark green to black median stripe extending from vertex of head to posterior border of pronotum; narrow buff-colored stripe usually present in center of median stripe on pronotum; buffy or red-buffy stripes present on head and pronotum lateral to median dark stripe.

Comments and distribution: This species is restricted to the Great Plains, only being found east of the Rocky Mountains. It extends into the western one-third of Oklahoma not being found east of a line through Alfalfa, Major and Cotton counties. The Cotton County record is its southeastern limit of distribution in the United States. Aeoloplides t. bruneri (Caud.) is commonly known as the thistle grasshopper because of its preference for Russian thistle, Salsola koli tenuifolia. However, when abundant it may do considerable damage to small grains and other crops, especially in the panhandle area. Control measures are often instigated against this species. Adults have been collected from June to October.

County records: Cimarron, Texas, Beaver, Harper, Woods, Alfalfa, Major, Custer, Roger Mills, Beckham, Greer, Harmon, Jackson and Cotton.

Genus Phoetaliotes Scudder, 1897

Phoetaliotes Scudd., 1897. Proc. Amer. Acad. Arts Sci. 32:205.

Genotype: Pezotettix nebrascensis Thomas, 1872. Rept. Geol. Surv. Mont. p. 455.

Note: Phoetaliotes nebrascensis (Thos.) is the only species of the genus in Oklahoma; therefore, the following description is of it.

Phoetaliotes nebrascensis (Thomas)

Pezotettix nebrascensis Thos., 1872. Rept. Geol. Surv. Mont., p. 455.

Pezotettix autumnalis Dodge, 1876. Can. Ent. 8:10.

Caloptenus volucris Dodge, 1877. Can. Ent. 9:112.

Caloptenus sanguinocephalus Lamunyon, 1877. Proc. Nebr. Assoc. Adv. Sci., March 8, 1877.

Melanoplus phoetaliotiformis Scudd., 1899. Proc. Dav. Acad. Nat. Sci. 7:179.

Melanoplus harrisii Morse, 1909. Psyche. 16:12.

Melanoplus flavoannulatus Bruner, 1890. Ins. Life 3:140.

Characteristics: Olive-green to grey species with large heads and slender bodies. Head with face receding; frontal costa concave around median ocellus, much narrowed above ocellus; antennae slender, about three-fourths length of hind femora. Pronotum flaring slightly in front to receive the head; lateral carinae very feeble; median carina distinct throughout; prozona nearly one-half as long again as metazona; front margin of pronotum subtruncate, hind margin obtuse-angled. Prosternal spine erect, conical, blunt. Tegmina usually abbreviated, but when long, surpassing hind femora; apices lanceolate. Hind femora long and slender. Antennae reddish; broad, black band extends from posterior border of eye to principal sulcus of pronotum; hind femora greenish tinged with reddish-brown; abdomen of male with posterior portion of each segment fuscous, female predominantly fuscous.

Comments and distribution: Phoetaliotes nebrascensis (Thos.) reaches its southern limits of distribution in Oklahoma and Texas. Its habitat is grasslands in general. Specimens are rather rare in our collections. The species is probably often overlooked due to its habit

of hiding among the leaves and stems of grasses. Seven counties in widely scattered areas of the State are represented in the collections.

County records: LeFlore, Choctaw, Comanche, Harmon, Alfalfa, Harper and Cimarron.

Genus Melanoplus Stal, 1873

Melanoplus Stal, 1873. Recens. Orth. 1:79.

Aeoloplus Scudder, 1897. Proc. U. S. Nat. Mus. 20:68.

Genotype: Acridium femur-rubrum DeGeer, 1793. Mem. Hist. Ins. 3:498.

Characteristics: Medium-sized, dull-colored species with moderately stout bodies. Head with face nearly vertical; frontal costa usually sulcate below ocellus, of average width; eyes rounded, oval; antennae filiform, slender, never longer than hind femora; vertex declivent anteriorly, rounding into frontal costa; disc of vertex more or less sulcate. Pronotum with front margin truncate or subtruncate, hind margin generally obtuse-angulate; lateral lobes nearly vertical, usually with darkish post-ocular band; metazona flaring somewhat; median carina low; lateral carinae obsolete. Posternal spine conspicuous but variable. Tegmina ranging from small oval to lanceolate pads to fully developed and extending to or beyond apices of hind femora; hind wings showing parallel development with tegmina. Hind femora moderately long and slender. Cerci and furculae of the males exceedingly variable furnishing characteristics widely used in separating the species.

The genus Melanoplus Stal contains more species than does any other genus of the North American Orthoptera. Therefore, as one would expect,

several species may be found in almost any given collecting area in our State. Separation of the species is often more difficult than in other genera of the Acrididae. Characters such as the length of tegmina, color of hind tibiae and shape of male genitalia are often employed in determination of the species. Even in closely related species the male genitalia are often quite distinctive and afford us the best means of species separation. The females of many species are indistinguishable from each other and can only be resolved by associating them with the males collected in a given area. Accordingly, the following key is only to males of the genus.

The author has drawn heavily upon the works of Blatchley (1920), Froeschner (1954) and Brooks (1958), as well as the extensive series of publications by the late Morgan Hebard, in his treatment of this genus.

Key to Males of the Species of Melanoplus in Oklahoma

1. Tegmina short, extending less than four-fifths of way to apex of abdomen.....2

   Tegmina long, extending four-fifths of way to apex of abdomen, or more.....13

2. Hind tibiae red or pink.....3

   Hind tibiae other than red or pink.....10

3. Cerci not constricted, gradually narrowing to apex (Fig. 12).....4

   Cerci constricted somewhere throughout length (Fig. 2).....5

4. Tegmina ovate to elongate - ovate in outline.....scudderi "complex"

   Tegmina lanceolate in outline.....discolor

5. Tegmina narrow, the space between them wider than width of each tegmen.....gracilis

Tegmina broad, overlapping on mid-line, or at best, only narrowly separated.....6

6. Cerci only minutely expanded, if at all, in apical two-thirds .....inconspicuus

Cerci distinctly expanded in apical two-thirds.....7

7. Cerci expanded unevenly, appearing lobe-shaped (Fig. 2).....8

Cerci expanded rather evenly apically (Fig. 16).....9

8. Hind tibiae with partial or complete light rings near bases .....ponderosus

Hind tibiae never with light rings near bases.....oklahomae

9. Cerci with the area of greatest constriction at approximately the basal one-fourth, dorsal margins more strongly incurved than the ventral margins (Fig. 16).....warneri

Cerci with the greatest constriction near the middle, dorsal and ventral margin incurved about the same (Fig. 13).....texanus

10. Proximal portions of cerci bulbous, greatly enlarged; apices extremely narrowed (Fig. 1).....lakinus

Cerci not bulbuous nor greatly enlarged in proximal areas; apices, if narrowed, only gradually so (Fig. 9).....11

11. Apical portions of cerci deeply furrowed on outer faces .....plebejus plebejus

Apical portions of cerci not deeply furrowed on outer faces.....12

12. Cerci widely expanded apically to form trasverse lobes (Fig. 2) .....ponderosus

Cerci not widely expanded apically (Fig. 9).....rusticus

13. Cerci with lateral projections or forked (Fig. 4).....14

Cerci without lateral projections, not forked (Fig. 10).....18

14. Cerci forked, the ventral arms slender and fingerlike (Fig. 4); caudal tibiae reddish.....*keeleri*

Cerci not forked but with projections or nodes on the ventral margins (Fig. 8).....15

15. Pronotum and tegmina with light stripes along the dorso-lateral margins.....*bivittatus*

Pronotum and tegmina without light stripes on the dorso-lateral margins.....16

16. Furculae distinct, parallel, extending over the supra-anal plate at least as far as the width of tenth abdominal segment at point of attachment.....*confusus*

Furculae obsolete or sub-obselete.....17

17. Black chevron-like markings present on outer faces of hind femora .....*differentialis nigricans*

Black chevron-like markings not present on outer faces of hind femora.....*punctulatus arboreus*

18. Cerci with expanded apices (Fig. 11)..... 19

Cerci with apices not expanded, or barely so (Fig. 6).....23

19. Subgenital plate with transverse ridge or fold situated towards apex.....20

Subgenital plate without transverse ridge or fold.....21

20. Rounded extremity of subgenital plate twin rounded, appearing notched.....*angustipennis impiger*

Rounded extremity of subgenital plate not notched.....*bispinosus*

21. Cerci decidedly incurved more on dorsal margins than ventral, (Fig. 11), not concave on apical portions; reported only from the Black Mesa of Cimarron County.....*splendidus*

Cerci incurved about the same on both dorsal and ventral margins, (Fig. 7), concave on apical portions; common species.....22

22. Usually with a dark longitudional stripe on dorsum of head and pronotum.....packardii

Dark central stripe on dorsum of head and pronotum not present, but often with light stripes laterally.....foedus

23. Furculae minute, their length not over twice the width of the 10th abdominal segment at point of attachment.....24

Furculae not minute, length over twice the width of 10th abdominal segment.....26

24. Cerci linear, narrow, acute at apices (Fig. 18).....impudicus

Cerci not linear, inflated somewhere throughout their length, broadly rounded at apices (Fig. 6).....25

25. Sides of head and pronotum with solid black bars extending from eye to posterior margin of pronotum; dorsum of pronotum uniform in coloration; tegmina not distinctly speckled.....glaucipes

Sides of head and pronotum without distinct bars; dorsum of pronotum with contrasting coloration; tegmina distinctly speckled .....occidentalis occidentalis

26. Apex of subgenital plate with median notch (Fig.22) .....bilituratus vulturnis

Apex of subgenital plate not notched (Fig.21).....27

27. Cerci cylindrical, slender, appearing finger-like (Fig. 5) .....flavidus-bowditchi "complex"

Cerci may be elongate but not cylindrical and finger-like (Fig. 10) 28

28. Furculae with apices extremely divergent; cerci concave on lateral

faces, apices rounded.....arizonae

Furculae with apices convergent or if divergent only slightly so; cerci not concave on lateral faces.....29

29. Apices of cerci ending in sharp, fine points (Fig. 15); colorful grasshoppers with variegations of green and red on body and hind femora.....regalis

Apices of cerci tapering, but not ending in sharp, fine points (Fig. 10); brownish, never with green coloration .....femur-rubrum femur-rubrum

Melanoplus scudderi (Uhler) "complex"

Pezotettix scudderi, Uhler, 1864. Proc. Ent. Soc. Phila. 2:555.

Pezotettix unicolor Thomas, 1873. Rept. U. S. Geol. Surv. Terr. 5:151.

Melanoplus scudderi, Scudder, 1879, Proc. U. S. Nat. Mus. 20:213.

Characteristics: Small, short-winged species; general coloration reddish-brown to brown; face, sides of pronotum, thorax, and dorsum of abdomen usually greenish-yellow mottled with fuscous, the male and often the female with dark post-ocular stripes reaching the metazona, hind tibiae red; body covered with short, white hairs; median carina of pronotum distinct throughout, prozona about one-third longer than the densely punctate metazona; tegmina ovate to elongate-ovate; cerci broad at bases, tapering gradually to apices, dorsal surfaces slightly incurved (Fig. 12), outer faces in apical one-half concave; furculae minute, triangular-shaped.

Notes: The exact status of the races of M. scudderi (Uhler) and their distribution in Oklahoma is undetermined at present. Hebard (1931) reported M. scudderi latus Morse as occurring in Oklahoma with eastern representatives tending to grade into M. s. scudderi (Uhler); however, in 1938 he found the latter from Hinton (west-central) which should be in the territory of M. s. latus Morse as delineated by him in 1931. The difficulty in the resolution of these races is understandable in the light of information received from Dr. I. J. Cantrall (1961, personal letter), who informs me that several forms of "scudderi" occur in Oklahoma. He is at present working on a revision of this "complex" including the distribution of the races in Oklahoma which, it is hoped, will clarify the problem.

Comments and distribution: This species is an eastern form extending as far west as the Great Plains. It is most commonly found along the edge of woodlands, in shrubbery and along roadsides. In Oklahoma it reaches the adult stage in August and is present until frost. Specimens have been collected from the eastern two-thirds of our State.

County records: LeFlore, Latimer, Pittsburg, Adair, Bryan, Caddo, Pottawatomie, McClain, Comanche and Kingfisher.

Melanoplus discolor (Scudder)

Pezotettix discolor Scudd., 1879. Proc. Bost. Soc. Nat. Hist. 20:81-82.

Melanoplus discolor Scudd., 1897, Proc. U. S. Nat. Mus. 20:149.

Melanoplus simplex Scudd., 1897. Ibid., p. 150.

Melanoplus inornatus Scudd., 1897. Ibid., p. 254.

Characteristics: Of medium size for the genus; general coloration yellowish- or ashy-brown above, paler below; frontal costa flat or slightly tumid above, sulcate below; post-ocular bars broad, dark, slightly larger behind than in front, extending to the metazona, their upper edges bordering the lateral carinae, median carina equal throughout; tegmina slightly longer than head and pronotum combined, tapering gently, the dorsal fields of same color as disc of pronotum, lateral fields usually darker brown while the median areas are marked by blackish-fuscous; hind femora with two blackish bars above, outer faces with blackish-fuscous, ventral surfaces yellowish; hind tibiae red; cerci broad, semi-circular, rounded, the upper surfaces concave, the lower convex, the apices rounded; furculae small, triangular-shaped, the tips slightly produced.

The above description was modified from Scudder (1897), for male specimens of M. discolor (Scudd.) were unavailable to the author.

Comments and distribution: Newton and Gurney (1956) list this species from Kansas, Texas, Colorado, New Mexico and Arizona, Oklahoma not being included. However, specimens from two Oklahoma counties, (Texas and Woods) are present in the collections of the Philadelphia Academy of Natural Sciences. Bragg (1936), from a survey of northern Oklahoma, lists records from Beaver and Harper counties; however, the latter specimens cannot be found. The author collected one specimen in his survey, it being a female from Beckham County. This species is found in shortgrass areas and is rarely collected.

County records: Texas, Woods and Beckham.

Melanoplus gracilis (Bruner)

Pezotettix gracilis Bruner, 1876. Can. Ent. 8:124.

Melanoplus gracilis, Scudder, 1897, Proc. U. S. Nat. Mus. 20:326.

Characteristics: Slender, rather small species; color grayish-brown above, greenish below; depression of vertex narrowly sulcate; pronotum with shining dark postocular bars extending to metazona, prozona nearly twice the length of metazona, median carina low, distinct throughout, hind margin with medio-dorsal notch; tegmina shorter than pronotum; hind femora and tibiae greenish, knees black; cerci narrow, middle portions less than one-half width at bases, apical one-third slightly expanded and flattened; furculae varying from minute lobes to longer finger-like diverging projections.

Comments and distribution: The range of this species is eastern, extending only as far west as Kansas and Oklahoma. It has only recently been discovered in our State, one record being taken by I. J. Cantrall in 1958 near the banks of the Grand River in Mayes County. According to Froeschner (1954) this species prefers grassy or weedy areas and is usually local in occurrence.

County records: Mayes.

Melanoplus inconspicuus Caudell

Melanoplus inconspicuus Caud., 1902. Trans. Amer. Ent. Soc. 27:87.

Melanoplus latens Morse, 1906. Psyche 13:120.

Characteristics: Medium-sized, short-winged species closely

resembling M. texanus (Scudd.). General characteristics as listed for M. texanus Scudd. but easily separated by differences in male genitalia. Cerci straight, constricted in basal one-third, expanded narrowly in apical two-thirds, more so on dorsal surfaces than ventral, narrowing in apical one-third, apices roundly-acute; furculae minute, almost obsolete.

Comments and distribution: Melanoplus inconspicuus Caud. has been reported from southeastern Kansas, western Arkansas, eastern Oklahoma and eastern Texas. Oklahoma records are widely scattered over the eastern one-half of the State; however, only small numbers have been collected. It has been taken in open-grasslands in the Postoak-Blackjack Forest Type.

County records: LeFlore, Bryan, Pontotoc, Logan, Payne, Osage and Craig counties.

Melanoplus ponderosus (Scudder)

Caloptenus ponderosus Scudd., 1875. Proc. Bost. Soc. Nat. Hist. 17:473.

Caloptenus robustus Scudd., 1875. Loc. cit.

Melanoplus ponderosus, Scudd., 1879. Cent. Orth., p. 84.

Characteristics: Size, above medium for the genus, robust; color grayish-brown to olive-brown above, with fuscous markings, yellowish below; frontal costa wide, sulcate only in vicinity of median ocellus, antennae yellowish, infuscated toward tips; pronotum with fuscous spots, post-ocular stripes either broken or distinct, reaching to metazona, median carina feeble on prozonta; tegmina either short or long, fuscous

spots pronounced in median areas; hind femora with two, average to pronounced, wide, dark bands on outer, upper and upper-inner faces, lower faces yellow to orange; hind tibiae yellow or reddish-yellow with basal portions dark followed by pale annuli, often with fuscous premedian rings; cerci large, short, greatly expanded in apical one-half to form obliquely transverse, rounded lobes, expanded upward more than below (Fig. 2); furculae wanting.

Comments and distribution: According to Hebard (1934), eastern Oklahoma, all of Arkansas and most of Louisiana, are areas of intergradation between the races of M. p. ponderosus (Scudd.) and M. p. viola (Thos.). The latter is more eastern in distribution, being found in the southern and mid-western states, extending as far east as Kentucky and Tennessee, while the former is reported from Oklahoma and Texas. Material from eastern Oklahoma examined at the University of Michigan by the writer showed the intermediate form between M. p. ponderosus (Scudd.) and M. p. viola (Thos.) to be in great preponderance. All material from the western two-thirds of the State was typical M. p. ponderosus (Scudd.), it being reported from a few eastern counties as well. Typical M. p. viola (Thos.) has not been reported from Oklahoma; a record from Pawnee County (Bragg,1939) has disappeared, undoubtedly a wrong determination. Hebard (1938), however, did report one atypic male of the latter from Sherwood, in the extreme southeast.

Typical M. p. ponderosus (Thos.), as noted above, occurs throughout all areas of the State; however, it is more abundant in the western part. It is most often collected in or adjacent to woodlands and grassy areas. Adults have been collected from June to December. Melanoplus p. viola

(Scudd.) prefers undergrowth of woodlands or forests.

County records: (M. p. ponderosus (Thos.))--Texas, Harper, Major, Blaine, Custer, Roger Mills, Beckham, Harmon, Jackson, Caddo, Comanche, Tillman, Kiowa, Cotton, Grady, Jefferson, McClain, Cleveland, Payne, Pittsburg, Latimer, McCurtain, Bryan and Wagoner.

County records: (Intergrade between M. p. ponderosus (Thos.) and M. p. viola (Thos.))--McCurtain, Pushmataha, LeFlore, Latimer, Pittsburg, Hughes, Sequoyah, Adair, Wagoner, Tulsa, Rogers, Mayes and Osage.

County records: (Atypical M. p. viola (Thos.))--McCurtain.

Melanoplus oklahomae Hebard

Melanoplus oklahomae Hebard, 1937. Trans. Amer. Ent. Soc. 63:171.

Characteristics: Short-winged grasshoppers of medium size, closely related to M. texanus (Scudd.) and other members of the Texanus Group. Color and general description as given for M. texanus (Scudd.); however, cerci and internal male genitalia quite different than the latter; cerci broad, very strongly expanded in apical two-thirds, appearing lobe-shaped, incurved more on dorsal than ventral surfaces (Fig. 17), external faces irregularly depressed; furculae minute, similar to M. texana (Scudd).

Comments and distribution: This species was listed by Hebard (1937) as occurring only in McCurtain and Pushmataha counties. Since that time it has also been reported from LeFlore and Adair counties by University of Michigan Museum expeditions. It is an inhabitant of open grasslands and has not been reported outside of our State.

County records: McCurtain, Pushmataha, LeFlore and Adair.

Melanoplus warneri Little

Melanoplus texanus Little, 1926. Ent. News 37:319 (not of Scudder, 1879).

Melanoplus warneri Little, 1929. Proc. Ent. Soc. Wash. 31:114.

Characteristics: Medium-sized, the females being distinctly robust; color light brown, often reddish-brown on head and pronotum; antennae deep reddish-brown, as long as head and pronotum combined; pronotum with metazona about three-fourths length of prozona, median carina distinct throughout, post-ocular bars distinct, shining black; epimera of meso- and metathorax black; tegmina short, not as long as head and pronotum combined, overlapping, ovate with roundly-pointed apices; hind femora reddish on lower surfaces, hind tibiae red; supra-anal plate sulcate medially, cerci broad throughout, spatulate, dorsal margin slightly more incurved than ventral (Fig. 16); furculae very short, broader than long.

Comments and distribution: The range of M. warneri Little includes eastern Texas extending barely into southeastern Oklahoma. It has been reported only from Bryan County in our State. Habitat of this species seems to be open grasslands in post-oak areas. According to Knutson (1940), adults have been collected in Texas throughout the spring and early summer.

County records: Bryan.

Melanoplus texanus (Scudder)

Pezotettix texanus Scudd., 1879. Proc. Bost. Soc. Nat. Hist, 20:80.

Melanoplus texanus, Scudd., 1897, Proc. U. S. Nat. Mus. 20:324.

Characteristics: Medium-sized grasshoppers; color dull-brown above, pale brown below, with conspicuous broad, black post-ocular bars on sides of head and pronotum, extending to metazona; frontal costa prominent, not sulcate except in the vicinity of the ocellus, vertex steeply declivent, depression of vertex very shallow, antennae pale red, infuscated apically; pronotum truncate, or nearly so, at front margin, hind margin broadly angulate, median carina distinct, equal throughout, prozona one-third longer than metazona; tegmina short, about as long as head and pronotum combined, overlapping on mid-line, apices roundly pointed; cerci curved inward, broadly constricted in the middle, apices roundly truncate (Fig. 13); furculae minute in length, broad, their apices far apart.

Comments and distribution: The range of this species extends from east-central Texas through Oklahoma to southeastern Kansas. Like other members of the Texanus Group, it is most often found in heavy grassy areas of open woodlands. It is rare in our collections.

County records: Comanche and Caddo counties.

Melanoplus lakinus (Scudder)

Pezotettix lakinus Scudd., 1897. Proc. U. S. Nat. Mus. 20:124.

Melanoplus marculentis Scudd., 1897. Loc. cit.

Melanoplus sonorae Scudd., 1897. Loc. cit.

Melanoplus lakinus Scudd., 1897, Ibid., p. 141.

Characteristics: Size, medium for the genus; color brownish,

becoming yellowish below; antennae dark, of average length for the genus; head and pronotum with a broad, fuscous median band (occasionally partially or wholly obsolete), sides of prozona with broad, fuscous or blackish bars, often broken and usually not extending to front margin, median carina distinct, lateral carinae well-marked; tegmina abbreviate (rarely long-winged), overlapping, lanceolate, finely pointed; hind femora with two broad, dark oblique bars on outer faces, ventral surfaces light-orange; hind tibiae blue; cerci broad at bases, very much swollen, carinate posteriorly on outer faces, ending in finger-like projections which extend inward and upward (Fig. 1); furculae wide at bases, small, set far apart, finely pointed.

Comments and distribution: This is a western form not being reported from east of the Mississippi River. In Oklahoma, it occurs in several counties in the western one-third. Grassland with a mixture of weedy plants, rather than true prairie, is its preferred habitat.

County records: Tillman, Comanche, Kiowa, Greer, Harmon, Custer, Beckham, Roger Mills, Alfalfa, Dewey, Woodward, Harper, Beaver, Texas and Cimarron.

Melanoplus plebejus plebejus (Stal)

Pezotettix plebejus Stal, 1878. Bib. K. Sv. Vet.-Akad. Handl. 5, No. 9:12.

Pezotettix pupaeformis Scudder, 1879. Proc. Bost. Soc. Nat. Hist. 20:83.

Melanoplus plebejus, Scudd., 1897, Proc. U. S. Nat. Mus. 20:326.

Melanoplus plebejus plebejus, Roberts, 1947, Not. Nat. of Acad. Nat. Sci. Phila., p. 1.

Characteristics: Small or medium in size; general coloration light brown, abdomen and underparts brownish-yellow, antennae yellowish at bases, darkened near apices; head and pronotum with dark post-ocular bars extending to metazona which, in the females, are cut by oblique yellow streaks extending from the cheeks nearly to the lateral carinae of pronotum, prozona faintly punctate, metazona deeply punctate, prozona one-half as long again as metazona; tegmina abbreviated, about as long as pronotum, obovate in outline, apices acute-angled; hind femora yellowish, infusiated; hind tibiae blue with pale subapical bands; cerci in basal portions tapering rapidly, about one-half as broad in middle as at bases, broadening somewhat beyond middle, appearing sub-spatulate, dorsal surfaces strongly incurved, tips broadly rounded (Fig. 14), deeply furrowed on outer faces, furculae sub-obsolete.

Comments and distribution: This form is limited in its range having been reported only from Oklahoma and Texas. It is restricted to the southern counties of our State. Morse (1907) reported it as "living in dense grasses and other herbage in moist prairie meadows."

County records: Latimer, Choctaw, Bryan, Marshall, Comanche and Caddo.

Melanoplus rusticus (Stal)

Pezotettix rusticus Stal, 1878. Bih. K. Sv. Vet-Akad, Handb. 5, No. 9:13.

Melanoplus rusticus, Scudder, 1897, Proc. U. S. Nat. Mus. 20:240.

Characteristics: See under M. r. rusticus (Stal) below.

Key to Subspecies of M. rusticus (Stal) in Oklahoma

1. Male furculae approximately one-third length of supra-anal plate .....rusticus obovatipennis

Male furculae considerably less than one-third length of supra-anal plate.....rusticus rusticus

Melanoplus rusticus obovatipennis Blatchley

Pezotettix obovatipennis Blatch., 1894. Can. Ent. 26:241.

Melanoplus obovatipennis, Scudder, 1897, Proc. U. S. Nat. Mus. 20:264.

Melanoplus rusticus obovatipennis, Hebard, 1935, Trans. Amer. Ent. Soc. 60:359.

Characteristics: Males small for the genus, females considerably larger and more robust; color grayish-brown to reddish-brown above, yellowish brown below; pronotum then downward onto metapleurae, usually bordered below by whitish bands; tegmina abbreviated, about two-thirds length of pronotum, obovate to ovate in outline, not meeting at mid-line; hind femora with two indistinct dark bars on outer and upper faces, lower faces orange; hind tibiae olive-green with white annuli near bases; cerci slender, tapering to near the middle, then expanded somewhat, middle one-third approximately one-half width at bases, apices sub-truncate (Fig. 9); furculae about one-third length of supra-anal plate, tapering and finely pointed.

Comments and distribution: Intergradation between Melanoplus r. rusticus (Stal) and M. r. obovatipennis Blatch, occurs in western Arkansas and southeastern Oklahoma. Most of the material collected in our State is intermediate between these two subspecies (personal communication from Dr. I. J. Cantrall, 1961). This, plus the fact that only small numbers of specimens have been collected from Oklahoma, makes it difficult to resolve the subspecies adequately. The writer did not collect either form in his survey.

Melanoplus r. obovatipennis Blatch, occurs from Ohio and Iowa, south to Tennessee and west to eastern Oklahoma and Texas. Blatchley describes its optimum habitat as, "high, dry, open woods." The only record for Oklahoma is Pittsburg County by Morse (1907). In addition, Hubbell and Cantrall have collected integrade forms as disucssed above from McCurtain and LeFlore counties.

County records: Pittsburg.

County records: (Intermediate between M. r. obovatipennis Blatch. and M. r. rusticus (Stal))--McCurtain and LeFlore.

Melanoplus rusticus rusticus (Stal)

Pezotettix rusticus Stal, 1878. Bih. K. Sv. Vet. Akad. Handb. 5, No. 9:13.

Melanoplus rusticus, Scudder, 1897, Proc. U. S. Nat. Mus. 20:240.

Melanoplus rusticus rusticus, Hebard, 1935, Trans. Amer. Ent. Soc. 60:359.

Characteristics: Similar to M. r. rusticus (Stal) except furculae

shorter, hind femora not as distinctly banded, hind tibiae tending more toward bluish than olive-green and apices of cerci more rounded.

Comments and distribution: This subspecies extends only into the southeastern corner of the State. It prefers the same general type habitat as M. r. rusticus (Stal), i.e. dry woodlands or immediate vicinity thereto.

County records: McCurtain and LeFlore.

Melanoplus keeleri (Thomas)

Caloptenus keeleri Thos., 1874. Bull. U. S. Geol. Surv. Terr. 1, No. 2:69.

Caloptenus deletor Scudder, 1875. Proc. Bost. Soc. Nat. Hist. 17:475.

Melanoplus tenebrosus Scudd., 1879. Ibid., Vol. 21:63.

Characteristics: Medium-sized forms; color grayish-brown to reddish-brown above, yellowish below; head and pronotum usually covered with heavy fuscous, post-ocular bars dark and wide in the males, often subobsolete in the females, hind margin of pronotum obtuse-angled, median carina distinct on metazona, feeble on prozona; tegmina reaching apices of hind femora in the males, usually slightly shorter in the females, brownish-fuscous in color, usually with a row of fuscous spots in median areas; hind femora usually with longitudional black bars on outer faces, two oblique dark bars on upper and upper-inner faces; hind tibiae dark red with dark rings near knees; cerci small, forked, the dorsal arms broad and rounded at apices, the ventral arms small, thumb-like and pointed, but angle of fork very variable in size and length (Fig. 4); furculae reduced to slight tubercules; subgenital plate broad.

Comments and distribution: Two subspecies of M. keeleri (Thos.) have been reported in Oklahoma. Melanoplus k. keeleri (Thos.) is the more southern and southeastern race, ranging as far west as Oklahoma and Texas, while M. k. luridus (Dodge) occurs along the northern boundary of the United States, ranging southward into Arkansas and Oklahoma. Intergradation between these two forms occurs in the latter two states (Hebard, 1925). Dr. I. J. Cantrall (personal communication, 1960) is of the opinion that most Oklahoma material is intermediate between the two subspecies. Rehn and Hebard (1916) separated the above two species; they stated:

> This southern race (keeleri subspecies) is distinguished from luridus subspecies by its greater size, more attenuate form and smoother structure, by the subgenital plate of the male being longer in proportion to its width and by the ventral valves of the ovipositor of the female having the distal portions much longer and less curved, in fact nearly straight.

Blatchley (1920) also separated these subspecies, largely by use of the length-versus-breadth of the subgenital plate and the angle of the upper fork of the male cerci. The writer was unable to separate the few specimens of Oklahoma material available to him into specific subspecies.

Determined specimens of both forms have been reported from eastern Oklahoma and M. k. keeleri(Thos.) has been reported from two counties in the southwestern section.

County records: (M. k. keeleri (Thos.))--LeFlore, Latimer, Pittsburg, Hughes, Bryan, Wagoner, Rogers, Osage, Kiowa and Comanche.

County records: (M. k. luridus (Dodge))--Delaware, Cherokee and Pittsburg.

County records: (Intergrades between the above M. k. keeleri (Thos.)

and M. k. luridus (Dodge))--McCurtain.

Melanoplus bivittatus (Say)

Gryllus bivittatus Say, 1825. Jour. Acad. Nat. Sci. Phila. 4:308.

Caloptenus femoratus Burmeister, 1838. Handb. Ent. 2, Pt. 1, p. 638.

Acridium milberti Serville, 1839. Ins. Orth. p. 648.

Acrydium flavovittatum Harris, 1841. Ins. Inj. Veg., p. 140.

Pezotettix edax Saussure, 1861. Rev. Mag. Zool. (2), 13:160.

Heteracris rejecta Walker, 1870. Cat. Derm. Salt. Brit. Mus. 4:675.

Heteracris vittipes Walk., 1870. Loc. cit.

Melanoplus bivittatus, Scudder, 1874, Hitchcock's Rept. Geol. N. Hamp. 1:376.

Characteristics: Size large, females considerably larger than the males; color brown to greenish-brown above, much lighter below, narrow yellow stripes extending from upper portion of eyes posteriorly along dorso-lateral margins of pronotum nearly to apices of tegmina, these stripes usually bordered below on pronotum by black markings; median carina of pronotum more distinct on metazona than prozona; tegmina extending to or beyond apices of hind femora, usually with a few dark markings in median areas; hind femora with longitudional dark stripes on upper one-half of outer faces, inner faces with the longitudional bars on upper portions; hind tibiae variable in color, cerci broad, incurved, with small, trinagular, posterio-ventral lobes, apical portions

of upper lobes gently rounded; furculae minute, triangle-shaped.

Comments and distribution: Melanoplus bivittatus (Say) is one of our most common and widespread grasshoppers, occurring throughout all areas of the United States, except the extreme southeastern part. It prefers heavy vegetation such as occurs in bottomlands, field borders, roadsides and edges of woodlands; however, it is very adaptive to other habitats and is often numerous in grasslands and in cultivated areas. This species is often quite injurious to crops and ranks among the most destructive grasshoppers in the United States.

In Oklahoma, this form reaches maturity in June and persists until late in the fall, having been collected well into November. It undoubtedly occurs in all 77 counties of the State but, as yet, is unreported from seven counties in the southern and eastern sections.

County records: Unreported from Haskell, McCurtain, Pushmataha, Choctaw, Atoka, Johnston and Stephens.

Melanoplus confusus Scudder, 1897

Caloptenus minor Scudd., 1875. Proc. Bost. Soc. Nat. Hist. 17:478 (not of Walker, 1870).

Melanoplus confusus Scudd., 1897, Proc. U. S. Nat. Mus. 20:339.

Melanoplus minor, of authors

Melanoplus mutatus Caudell, 1915. Proc. U. S. Nat. Mus. 49:30.

Characteristics: Medium-sized forms; yellowish-brown to reddish-brown above, yellowish below; head with depression of vertex distinctly

sulcate and linear in the males, shallowly sulcate and shorter in the females, post-ocular bars dark, distinct, sometimes broken in the females, extending to metazona of pronotum, widening posteriorly on prozona, bordered below by brownish-yellow coloration; pronotum with median carina heaviest on metazona, primary sulcus more distinct than anterior sulci; tegmina extending to apices of hind femora or beyond; hind femora orange-red below, bars on outer faces indistinct; hind tibiae greenish-blue, occassionally reddish; cerci stout, ending in broadly-rounded dorsal arms and triangular-shaped ventral projections, dorsal margins deeply concave, apical portions of outer faces hollowed; furculae short, widely separated, cylindrical.

Comments and distribution: This species ranges from Coast to Coast in the northern states and extends as far south as Oklahoma and New Mexico in the Great Plains. All major areas of Oklahoma are represented in our collections. It has a wide range of habitats, being found in open woodland clearings, grasslands, weedy pastures and upland waste areas.

County records: Cimarron, Texas, Woods, Alfalfa, Roger Mills, Beckham, Custer, Harmon, Jackson, Cotton, Love, Comanche, Cleveland, Logan, Payne, Noble, Seminole, Pontotoc, Murray, Pittsburg, McCurtain, Mayes, Rogers, Osage, Tulsa, Washington, Craig and Ottawa.

Melanoplus differentialis nigricans Cockrell

Caloptenus differentialis Uhler, 1863 (not a published record).

Melanoplus differentialis Uhler, var. nigricans Cock., 1917. Ent. Rec. 29:247.

Melanoplus differentialis nigricans, Roberts, 1942, Trans. Amer. Ent. Soc. 68:154.

Characteristics: Size large; color ranging from yellowish-brown through brownish to live-brown above, bright to dull yellow below; post-ocular bars missing on head, present on sides of pronotum as broken black patches or sometimes only as blackened sulci; primary sulcus of pronotum bent forward on dorsum near the mid-line, deeper than anterior sulci, hind margin of pronotum broadly rounded; tegmina as long or longer than hind femora, witout maculations; hind femora yellowish, with narrow, black, chevron-like markings on outer faces, upper-inner faces with three oblique, dark bars; hind tibiae yellow with narrow black rings near bases; cerci broad, boot-shaped, the upper forks as long as bases and strongly up-curved, the lower forks only rounded, projecting lobes (Fig. 8); furculae obsolete or present only as thickenings on the tenth abdominal segments.

Comments and distribution: Roberts (1942) lists two subspecies of M. differentialis (Thos.) from the United States, M. d. differentialis (Thos.) and M. d. nigricans Cock., the latter being the western species. At the present time these two subspecies can be separated only on the basis of differences in internal male genitalia. Only M. d. nigricans Cock. is present in our State, M. d. differentialis (Thos.) not being found any closer than eastern Arkansas.

This is one of the most common and destructive grasshoppers. It has adapted itself better to agricultural enroachment of its range than any other acridid. Its range of habitats is very general, occurring in cultivated crops as well as waste areas, roadsides, field borders and

grasslands. It probably does more damage to cultivated crops than any other species of grasshopper in the State.

Adults are found from July to November. It has been reported statewide, except four counties in the southeastern area where it undoubtedly occurs.

County records: All counties except Atoka, Pushmataha, Latimer and Haskell.

Melanoplus punctulatus arboreus Scudder

Melanoplus arboreus Scudd., 1897. Proc. U. S. Nat. Mus. 20:372.

Melanoplus punctulatus arboreus, Rehn and Hebard, 1916, Proc. Acad. Nat. Sci. Phila. 87:247.

Characteristics: Size medium; color gray to grayish-brown above, yellowish-brown to reddish-brown below; head prominent, occiput considerably elevated above pronotum, antennae slender, longer than hind femora in the males, eyes large, prominent, head and pronotum mottled with fuscous; post-ocular bars usually broken and indistinct, median carina more distinct on metazona, sulci well-impressed in the males, often marked with black, metazona distinctly punctate; tegmina surpassing apices of hind femora, sprinkled with numberous fuscous blotches; outer and upper faces of hind femora with fuscous bars, lower portions of inner faces and ventral faces coral-red; hind tibiae either grey, red, or a mixture of both; cerci large, expanded in apical one-half to almost twice width of basal portion, appearing roughly boot-shaped, a small denticulation present on ventro-posterior angle; furculae minute, triangular-shaped.

Comments and distribution: This forest-loving species is found in the southeastern states westward to southwestern Oklahoma and eastern Kansas. Hubbell's 1926 record from Comanche County is the western limit of distribution. It lives on trees or in their immeidate vicinity, both deciduous and coniferous. The eggs are often deposited in old stumps or logs. Oklahoma records are few, M. punctulatus arboreus Scudd. only being reported from four scattered locations.

County records: McCurtain, Choctaw, Payne and Comanche.

Melanoplus angustipennis impiger Scudder

Melanoplus impiger Scudd., 1897. Proc. Amer. Philos. Soc. 36:26.

Melanoplus angustipennis impiger, Hebard, 1938, Okla. Agr. Exp. Sta. Tech. Bull. 5:25.

Characteristics: Of medium size for the genus, body about 23 to 30 mm. in length; color grayish- through reddish-brown; head and pronotum with scattered fuscous spots, post-ocular stripes wide, extending to metazona, usually distinct but sometimes broken or vague, widening posteriorly; median carina distinct on metazoma, obsolete on prozona, cross carinae all distinctly impressed; tegmina surpassing the hind femora, usually with distinct fuscous spots in median area; hind femora distinctly to obscurely banded with fuscous on outer-upper faces, inner-upper faces with faint to distinct cross bars; hind tibiae red or varying shades of blue, usually paler toward bases; cerci small, spatulate, incurved on both dorsal and ventral margins, apical one-third almost as broad as bases, broadly rounded at apices, concave on outer faces; furculae long, over one-third length of supra-anal plate, tapering to

fine points, less divergent than in M. a. angustipennis (Dodge).

Comments and distribution: Melanoplus a. impiger Scudd. is difficult to separate from the more western and northern form, M. a. angustipennis (Dodge). Hebard (1938), in his Ecological Survey of the Orthoptera of Oklahoma states:

> All of the series now available for study give convincing proof that the insect described as impiger represents nothing but the southeastern optimum of angustipennis, very different in general appearance but differing only sufficiently to warrant recognition of a weakly defined race. It reaches its optimum development in southern South Carolina and is supplanted in western Oklahoma by typical angustipennis. All of the present material is typical of angustipennis impiger.

One notes that Hebard above lists typical M. a. angustipennis (Dodge) as replacing M. a. impiger Scudd. in western Oklahoma; however, he does not cite any records of such, and I am unable to find any records or specimens of the former subspecies elsewhere. The University of Michigan Museum of Zoology has a large series of Oklahoma specimens determined as intergrades between these two subspecies. It is the writer's belief that these intergrades are closer to M. a. impiger Scudd., but tending toward the more western from, M. a. angustipennis (Dodge). Many of the Oklahoma specimens studied are similar in size and coloration to typical M. a. impiger Scudd; however, the length of furculae was intermediate between that of the latter and M. a. angustipennis (Dodge). Perhaps more intensive collecting and study in Oklahoma and surrounding states will resolve this problem.

Melanoplus a. impiger Scudd. is generally eastern in distribution, reaching its western limits in Kansas, Oklahoma, and Texas. It and intergrade forms, tending toward M. a. angustipennis (Dodge), are found in all areas of our State. Grasslands, especially those with light or sandy soils, are usually preferred. It is often quite common.

County records: Cimarron, Texas, Beaver, Harper, Woods, Ellis, Woodward, Roger Mills, Beckham, Custer, Dewey, Alfalfa, Blaine, Caddo, Comanche, Cotton, Tillman, Jackson, Kiowa, Greer, Harmon, Jefferson, Grady, Logan, Kay, Payne, Osage, Cleveland, McClain, Murray, Love, Marshall, Bryan, Pontotoc, Seminole, Hughes, Okfuskee, Okmulgee, Tulsa, Wagoner, Sequoyah, Atoka, Choctaw and McCurtain.

Melanoplus bispinosus Scudder

Melanoplus bispinosus, Scudd., 1897. Proc. U. S. Nat. Mus. 20:292.

Melanoplus terminalis Scudd., 1897. Ibid., p. 293.

Characteristics: Medium-sized species; yellowish-brown to reddish-brown in color; head with frontal costa sulcate below ocellus, antennae darkened toward apices, depression of vertex sulcate in the males, barely so in the females, post-ocular bars black; pronotum with front margin truncate, hind margin obtuse-angled, median carina distinct on metazona, inconspicious on prozona, lateral lobes with black bars, generally broken and wider posteriorly; tegmina long, surpassing abdomen and hind femora, marked with small fuscous blotches in discoidal areas; hind femora marked with two oblique, blackish or brownish, bars on upper one-half of outer faces; hind tibiae greenish-blue with pale annuli near bases; cerci slender, length about five times their narrowest width, incurved throughout on dorsal margins, apical one-half moderately enlarged giving it a spatulate appearance, concave on outer faces toward the apices; furculae long, tapering to fine points, apical portions lying outside of median sulcus.

Comments and distribution: The range of M. bispinosus Scudd. is

rather limited, being reported from Kansas to Texas, and including extreme western Arkansas. It is very widespread in Oklahoma, being found in the majority of counties. The habitat of this species is general grassy area.

County records: McCurtain, LeFlore, Haskell, Sequoyah, Choctaw, Pushmataha, Bryan, Atoka, Coal, Latimer, Pittsburg, Muskogee, Adair, Okmulgee, Wagoner, Rogers, Tulsa, Osage, Pawnee, Payne, Seminole, Murray, Pontotoc, Pottawatomie, Carter, Johnston, Love, Jefferson, Garvin, Grady, Stephens, Cotton, Comanche, Caddo, Canadian, Blaine, Custer, Roger Mills, Beckham, Harmon, Jackson, Tillman, Dewey, Woodward, Logan, Payne, Major, Alfalfa, Woods, Harper and Texas.

Melanoplus splendidus Hebard

Melanoplus splendidus Hebard, 1920. Trans. Amer. Ent. Soc. 46:364.

Characteristics: Medium-large forms, somewhat robust; color brownish; head with frontal costa sulcate, depression of vertex shallowly impressed, rounding at anterior margin; head and pronotum heavily overlaid with dark brown, suffused spots, post-ocular bars distinct on head, widened and broken by light patches on pronotum, median carina strong on prozona, transverse sulci distinct, well-impressed, hind margin of pronotum obtuse-angled; tegmina fully developed, extending beyond apices of hind femora, brownish with dark flecks, especially along median line of costal fields; hind wings hyaline, usually tinged with green; hind femora with two dark blotches on outer faces, ventral borders blood red; hind tibiae brown in proximal portions, shading to ox-blood-red in apical one-half; cerci broad at bases, narrowed strongly in proximal two-fifths, width in

midsections about three-fifths that at bases, distal portions moderately expanded, dorsal margins strongly concave, ventral margins not so (Fig. 11); furculae broad, extending only slightly beyond tenth abdominal segment.

Comments and distribution: This species is listed by Ball et al. (1942) as being reported only from Arizona and east-central New Mexico; however, Hubbell collected one male from the Black Mesa area of our State in 1926. It is extremely rare throughout its range, and so far, has been reported almost exclusively from juniper trees. Ball et al. describes it as "probably nocturnal".

County records: Cimarron.

Melanoplus packardii Scudder

Melanoplus packardii Scudd., 1878. Proc. Bost. Soc. Nat. Hist. 19:288.

Characteristics: Size medium to large; color yellowish-brown to reddish-brown above, dull yellow below; usually with a wide median reddish-brown or fuscous stripe extending from vertex to end of pronotum, widening on pronotum, occasionally partly or completely absent from the latter, post-ocular stripes present on sides of head and pronotum, often broken or obscure; median carina distinctly present on metazona, obsolete or sub-obsolete on prozona; tegmina surpassing apices of hind femora; hind femora dull yellow, the upper parts of outer faces with dark longitudional stripes, upper faces, with two dark bars, inner- and lower faces yellowish; hind tibiae usually blue but varying sometimes to red; cerci rather small, constricted near the middle, expanded in posterior one-half, apices roundly truncate, concave on apical one-half of outer faces; furculae short, flattened, tapering and widely

divergent.

Comments and distribution: This species is often confused with M. foedus fluviatilis Bruner in some sections of its range, the external male genitalia, as well as general appearance, being similar. Under these circumstances it is necessary to examine the valves of the aedeagus for positive separation (see Froeschner, 1954). All Oklahoma specimens of the above two species, examined by the writer, appear to be separable on the basis of the color characteristics as outlined in the Key to Species of Melanoplus.

Melanoplus packardii Scudd. does not occur east of the Mississippi River. It is common and widespread in all the western states, being most numerous in the prairie or plains environment. From an economic standpoint, it is important, for it often does considerable damage to rangelands and, when abundant, frequently makes heavy inroads upon grain crops, legumes, cotton and vegetables.

In Oklahoma, this species occurs in all vegetative types except the forested areas of the southeast and east. Adults have been reported from July to October.

County records: Cimarron, Texas, Beaver, Harper, Woods, Woodward, Ellis, Roger Mills, Beckham, Harmon, Greer, Jackson, Kiowa, Washita, Custer, Dewey, Major, Alfalfa, Grant, Blaine, Caddo, Canadian, Grady, Comanche, Cotton, Tillman, Jefferson, Love, Murray, McClain, Cleveland, Oklahoma, Kingfisher, Logan, Lincoln, Payne, Noble, Kay, Pawnee, Osage, Creek, Tulsa, Rogers, Craig, Okmulgee, Muskogee, Pittsburg, Bryan, Johnston, Marshall, Pottawatomie, Seminole and Pontotoc.

Key to Subspecies of *Melanoplus foedus* in Oklahoma

1. Hind tibiae rich pink.....*foedus foedus*

   Hind tibiae not rich pink.....2

2. Ventral surfaces of hind femora rich orange; pronotal disc usually uniform in coloration; post-ocular bars heavier and more distinct .....*foedus fluviatilis*

   Ventral surfaces of hind femora yellow, or yellow tinged with orange; pronotal disc uniform or not in coloration; post-ocular bars usually broken, sometimes obsolete.....*foedus iselyi*

Melanoplus foedus foedus Scudder

Melanoplus foedus Scudd., 1879. Proc. Bost. Soc. Nat. Hist. 20:69.

Melanoplus foedus foedus, Hebard, 1931, Proc. Acad. Nat. Sci. Phila. 83:187.

Description: Size medium to large; color grayish-brown or yellowish-brown above, dull yellow below; post-ocular bars moderately distinct to obscure, sulci well-impressed, median carina obsolete on prozona, slight on metazona, metazona punctate, dorsum of pronotum often pale laterally; tegmina extending beyond apices of hind femora, usually with small feeble fuscous spots in median areas; hind femora with irregular dusky markings on outer surfaces, yellow or yellowish-brown below; hind tibiae rich pink; cerci comparatively small, tapering in proximal one-half, apical one-half spatulate, hollowed on outer faces, corners rounded into truncate extermities (Fig. 7); furculae strongly divergent, slender, tapering to fine points.

Comments and distribution: This subspecies occurs from Minnesota to Texas and throughout many of the western states. Oklahoma records show it to be restricted to approximately the western one-half of the State. Light or sandy soil with weeds and grasses is the preferred habitat of this form. It often feeds on cultivated crops.

County records: Payne, Blaine, Dewey, Custer, Grady, Roger Mills, Beckham and Greer.

Melanoplus foedus fluviatilis Bruner

Melanoplus fluviatilis Brun., 1897. Ann. Rept. Nebr. St. Bd. Agr. 1896, p. 136.

Melanoplus foedus fluviatilis, Hebard, 1931, Proc. Acad. Nat. Sci. Phila. 83:187.

Characteristics: Similar to M. f. foedus Scudd, except smaller in size, more slender in form, coloration of pronotal disc more uniform, post-ocular bars more distinct and ventral surfaces of hind femora rich orange. Also, the caudal tibiae ranges from blue-green to buffy, usually the former, never rich pink as in M. f. foedus Scudd.

Comments and distribution: The range of this subspecies extends from Minnesota to Montana and south to Oklahoma. In our State it has been reported from all areas except the Panhandle, extreme northern and southeastern portions. Sandy areas with weedy vegetation is its preferred habitat. Like M. f. foedus Scudd., it often attacks cultivated crops in local areas.

County records: Sequoyah, Okmulgee, Okfuskee, Seminole, Hughes, Pontotoc, Pottawatomie, Love, Jefferson, Comanche, Grady, Payne, Logan, Blaine and Beckham.

Melanoplus foedus iselyi Hebard

Melanoplus foedus iselyi Hebard, 1936. Trans. Amer. Ent. Soc. 62:182.

Characteristics: Close to *M. f. fluviatilis* Bruner but separated by the following, (Hebard, 1936): "Averages large in size and more robust form, the buffy or yellow caudal tibiae and the post-ocular bar which is rarely solid, usually decidedly broken and sometimes obsolete." In addition, the ventral surfaces of hind femora are yellow, or yellow tinged with orange, instead of rich orange as in *M. f. fluviatilis* Bruner. Variation in coloration is common in *M. f. iselyi* Hebard, specimens ranging from light yellow to brown.

Comments and distribution: Hebard (1938) lists Oklahoma specimens of this subspecies as often atypic, "variation toward *M. f. fluviatilis* Bruner being considerably more frequent and stronger than toward *M. f. foedus* Scudd." *Melanoplus f. iselyi* Hebard appears to grade into the former subspecies in our State. It is a mixed-feeder being found throughout all areas of Oklahoma.

County records: Mayes, Pittsburg, Tulsa, Osage, Payne, Okfuskee, Hughes, Pontotoc, Bryan, Choctaw, Love, Jefferson, Pottawatomie, Logan, Cleveland, Grady, Caddo, Blaine, Cotton, Tillman, Kiowa, Jackson, Greer, Beckham, Roger Mills and Custer.

Melanoplus impudicus Scudder

Melanoplus impudicus Scudd., 1897. Proc. U. S. Nat. Mus. 20:204.

Characteristics: Size small to medium, slender; color grayish- to reddish-brown above, yellowish below, head and pronotum with numerous small fuscous spots; pronotum with post-ocular stripes of medium width on prozona, fading on metazona, median carina distinct on metazona, feeble on prozona, hind margin obtuse-angled (nearly right-angled in the males); tegmina reaching or extending beyond apices of hind femora, the median areas with considerable fuscous; hind femora with two dark, oblique bars of moderate width on upper-outer faces, lower faces orange-red; hind tibiae reddish; cerci narrow, tapering rapidly near bases, middle one-third about one-half width at bases, terminal one-third only slightly enlarged, the apices rounded-angluate (Fig. 18); furculae minute, parallel, lying upon bases of the ridges of supra-anal plate.

Comments and distribution: Melanoplus impudicus Scudd. occurs chiefly in the southeastern and eastern states extending westward almost to the border of the Great Plains in Kansas and Oklahoma. The Pawnee County, Oklahoma, record represents the western limit for the United States while Choctaw County is the southwestern limit. This species is rare in Oklahoma collections, being reported only from three counties in the eastern part. Its habitat was described by Morse (1907) as, "grasses of dry open woodlands and sometimes also fields of sandy or stony soil.

County records: Choctaw, LeFlore and Pawnee.

Melanoplus glaucipes (Scudder)

Caloptenus glaucipes Scudd., 1875. Proc. Bost. Soc. Nat. Hist, 17:476.

Melanoplus glaucipes, Scudd., 1879, Can. Ent. 12:75.

Characteristics: Small to medium-sized for the genus; yellow-brown to brown in color; head and pronotum sometimes with blackish flecks, also, distinct, broad, black bands extend from behind the eyes across the entire upper-lateral portions of the pronotum, widening on metazona, median carina of pronotum most distinct on metazona, all transverse sulci distinct and cutting median carina; tegmina fully developed but usually not as long as hind femora with two blackish, oblique bars on upper-outer faces; hind tibiae greenish-blue; cerci very broad, length scarcely twice the width at bases, dorsal surfaces concave, ventral surfaces convex throughout, apices bluntly rounded, outer faces with depressions in apical portions; furculae minute, triangle-shaped.

Comments and distribution: Melanoplus glaucipes (Scudd.) is southwestern in distribution, being reported from Kansas to Texas and extending into New Mexico and Colorado. Its range in Oklahoma includes counties in the western two-thirds. The preferred type of habitat seems to be rangelands with either grama or bluestem grasses. It is often found in sandy areas. Adults have been reported from June to October.

County records: Cimarron, Texas, Harper, Woods, Woodward, Major, Roger Mills, Custer, Blaine, Caddo, Comanche, Jefferson, Cotton, Jackson, Harmon, Beckham, Murray, Pontotoc, McClain, Logan and Payne.

Melanoplus occidentalis occidentalis (Thomas)

Caloptenus occidentalis Thos., 1872. Ann. Rept. U. S. Geol. Surv. Terr. 5:453.

Melanoplus variolosus Scudder, 1879. Proc. Bost. Soc. Nat. Hist. 20:67.

Melanoplus flabellifer Scudd., 1879. Ibid., p. 68.

Melanoplus occidentalis, Scudd., 1897, Proc. U. S. Nat. Mus. 20:145.

Melanoplus cuneatus Scudd., 1897. Ibid., p. 147.

Melanoplus occidentalis occidentalis, Hebard, 1925, Proc. Acad. Nat. Sci. Phila. 77:109.

Characteristics: Small to medium in size; general coloration gray to brownish with fuscous markings; head with frontal costa unusually prominent for the genus, dorsum of head with a median, blackish, broken stripe widening posteriorly, extending to hind margin; pronotum with post-ocular bars dark, indistinct, broken, median carina distinct on metazona, feeble between transverse sulci, hind margins of pronotum broadly rounded; tegmina extending to or beyond apex of abdomen, with narrow, yellowish stripes in median areas and large fuscous spots scattered throughout, giving it a spotted appearance; hind femora reddish on ventral and inner faces, indistinctly banded on outer faces; hind tibiae blue; cerci large, ear-shaped, broadly-rounded at apices, lateral lobes turned upward; furculae minute, triangle-shaped.

Comments and distribution: Melanoplus o. occidentalis (Thos.) occurs only west of the Mississippi River and is found in all the Great

Plains and Intermountain States except Nevada. In Oklahoma, it has been seldom collected and does not occur east of the Panhandle and western tier of counties. The Greer County record is the southeastern limits of distribution in the United States. Brooks (1958) reports this species as a general feeder.

County records: Cimarron, Texas, Harper, Roger Mills, Harmon and Greer.

Melanoplus bilituratus vulturnis Gurney and Brooks

Melanoplus bilituratus vulturnis G. and B., 1959. Proc. U. S. Nat. Mus. 110:25.

Characteristics: Size small to medium for the genus; coloration grayish-brown to reddish-brown above, yellowish below; pronotum mottled with fuscous above, front margin truncate, hind margin broadly angulate, post-ocular bars entire or broken, extending to metazona, median carina distinct on metazona, indistinct or obsolete on prozona; tegmina extending beyond apices of hind femora, distinct fuscous spots present in median areas; hind femora with three dark bars on dorsal surfaces, sometimes continued indistinctly on outer faces, yellow ventrally, except a pinkish stripe occurring lateral to keel, knee crescents black; hind tibiae variable in color from yellowish-brown through shades of blue and green or bright pinkish-red; cerci broad, short, dorsal margins slightly convex, ventral margins expanded to beyond mid-length then tapered rapidly, apices broadly rounded (Fig. 6); furculae diverging, slender, tapering, about one-third length of supra-anal plate; subgenital plate with apex elevated, somewhat thickened and twin rounded (Fig.20).

Gurney and Brooks (1959), in their original description of M. bilituratus vulturnis, describe the hind tibiae as, "pale, greenish gray mesally and yellowish brown externally, spines and apical half of spurs blackish brown." A considerable amount of the author's material, verified as the above subspecies by Gurney in 1959, have bright pinkish-red hind tibiae; others range through his, "greenish gray mesally and yellowish brown externally", through varying shades of blue and green.

Comments and distribution: The Mexicanus Group of grasshoppers to which this subspecies belongs was in chaotic order for many years, Gurney and Brooks (1959) resolved this group, including the lesser migratory grasshopper, M. bilituratus (Walker), its subspecies, as well as the infamous Rocky Mountain Locust, M. spretus (Walsh).

The material that we now know from Oklahoma as M. b. vulturnis G. and B. has been most often referred to in the literature as M. atlantis Riley, M. mexicanus (Saussure) and M. bilituratus (Walk). As the situation now stands, M. mexicanus (Sauss.) is restricted to southwestern Texas and Mexico; M. b. vulturnis G. and B., the southern form, and M. b. bilituratus (Walk.), the northern form of the lesser migratory grasshopper, occurring in the southern and northern parts of the United States, respectively. Also, a southwestern subspecies, M. b. defectus Scudd. occurs from southwestern Texas to California and southern Utah and Nevada.

According to the above mentioned paper by Gurney and Brooks, M. b. vulturnis G. and B. is the only subspecies found in Oklahoma with the exception of a few specimens from the Panhandle which "are of uncertain subspecific position." In addition, the writer collected two specimens from southwestern Oklahoma which Gurney (personal

correspondence, 1959), states as "of uncertain subspecific position and evidently intermediate between M. b. vulturnis G. and B. and M. b. bilituratus (Walk.)".

The lesser migratory grasshopper (all subspecies included) is the most destructive locust in the United States. It occurs throughout all sections and is equally destructive to rangeland and crops. The northern form, M. b. bilituratus (Walk.) is often migratory, extensive flights having taken place as late as the 1930's and 1940's. For an excellent listing and discussion of the important works dealing with the economics of this locust, the reader is referred to Gurney and Brooks (1959).

Melanoplus b. vulturnis G. and B. has been reported from all but four counties in the State, those being in the southeast. There are two generations per year in Oklahoma. Adults have been collected from June to November.

County records: Recorded from all counties in the State except Haskell, Coal, Johnston and Marshall.

Melanoplus flavidus - bowditchi "complex"

Melanoplus flavidus Scudd. and M. bowditchi bowditchi Scudd. have been reported from Oklahoma. They are extremely difficult to separate. Hebard (1925) stated:

> In the male genitalia nothing can be found to separate flavidus from bowditchi or the races of these species. Due to this and their variability, they present one of the most difficult problems in the North American Melanopli.

Brooks (1958), working in Canada, separated M. flavidus flavidus Scudd. from M. b. canus Hebard on the basis of external characters as well as differences in the internal male genitalia. The writer has attempted

to distinguish the Oklahoma forms chiefly on the basis of differences in the dorsal valves of the male phallus.

Key to flavidus - bowditchi "complex" in Oklahoma

1. Dorsal aedeagal valves recurved posteriorly (Fig. 43).....flavidus
   Dorsal aedeagal valves not recurved posteriorly (Fig. 42)
   .....bowditchi bowditchi

Melanoplus flavidus Scudder

Melanoplus flavidus Scudd., 1897. Proc. Bost. Soc. Nat. Hist. 20:74.

Melanoplus cenchri McNeill, 1891. Psyche 6:74.

Melanoplus incisus Scudd., 1899. Proc. Dav. Acad. Nat. Sci. 7:163.

Melanoplus elongatus Scudd., 1897. Proc. U. S. Nat. Mus. 20:160.

Melanoplus flavidus flavidus, Hebard, 1925, Proc. Acad. Nat. Sci. Phila. 77:118.

Melanoplus flavidus, Hebard, 1938, Okla. Agr. Exp. Sta. Tech. Bull. 5:26.

Characteristics: Size medium or slightly above for the genus; color olive-brown to reddish-brown above, mottled with fuscous above, yellowish below; face usually sprinkled with fuscous; post-ocular bars variable, faint to distinct, extending to metazona, often covering much of lateral lobes as well as extending along sides of dorsum, median carina distinct on metazona, faint on prozona; tegmina extending to or beyond apices of hind femora, usually with light, narrow faint stripes in median

areas, these sometimes with feeble fuscous spots; hind femora dull yellow, upper one-half of outer faces with fuscous, dorsal faces and upper parts of inner faces usually with two fuscous bars; hind tibiae blue; cerci broad at bases, tapering rapidly, then produced into long finger-like processes, bluntly terminated (Fig. 5); furculae broad, flat, touching in proximal one-half, then tapered on inner surfaces to rounded points or knobs, lateral surfaces nearly straight; dorsal aedeagal valves recurved posteriorly (Fig.43).

Comments and distribution: This species occurs from Michigan west to Montana and south to Arizona and Texas. In Oklahoma it has been reported from the western one-half. It is a mixed-feeder and prefers sandy or blow-out areas.

County records: Texas, Beaver, Harper, Woodward, Alfalfa, Payne, Blaine, Dewey, Ellis, Roger Mills, Custer, Beckham, Greer, Harmon, Jackson, Tillman, Comanche, Jefferson, Stephens, Caddo, Kingfisher.

Melanoplus bowditchi bowditchi Scudder

Melanoplus bowditchi Scudd., 1879. Proc. Bost. Soc. Nat. Hist. 20:72.

Melanoplus bowditchi bowditchi, Hebard, 1925, Proc. Acad. Nat. Sci. Phila. 77:120.

Characteristics: Similar to M. flavidus Scudd., but often separable by a more bluish-gray tinge, light stripes usually being present laterally to mid-dorsal stripe on head and pronotum, tegmina more spotted with fuscous in median areas and apices of furculae not thickened as much as in M. flavidus Scudd. In addition, the dorsal aedeagal valves are not

recurved posteriorly in M. b. bowditchi Scudd. (Fig. 42).

Comments and distribution: Melanoplus bowditchi Scudd. extends from the Great Plains westward to Montana and south to Arizona, New Mexico and Oklahoma. The southern and southwestern race, M. b. bowditchi Scudd., extends into the western part of Oklahoma. The writer's Canadian County record represents the southeastern limit of the latter race's distribution in the United States. It has been collected from July to October and prefers short-grass ranges.

County records: Cimarron, Texas, Beaver, Harper, Roger Mills, Custer, Beckham, Greer, Jackson, Tillman and Canadian.

Melanoplus arizonae Scudder

Melanoplus arizonae Scudd., 1879. Proc. Bost. Soc. Nat. Hist. 20:64.

Melanoplus palmeri Scudd., 1897. Proc. U. S. Nat. Mus. 20:230.

Melanoplus scitus Scudd., 1902. Proc. Dav. Acad. Sci. 9:44.

Melanoplus sanguineus Bruner, 1904, Colorado Agr. Coll. Agr. Exp. Sta. Bull. 94 (Tech. Ser.), p. 63.

Characteristics: Of medium size; grayish to brownish in color with fuscous markings, lighter ventrally; depression of vertex sulcate with distinct walls, subspatulate in appearance, post-ocular bars narrow on head, widening and broken on prozona, extending to metazona; pronotum with median carina distinct on metazona, ill-defined on prozona, primary sulcus very distinct, deep, transverse sulci, on prozona, not cutting median carina, metazona distinctly punctate; tegmina long, extending

considerably beyond abdomen and hind femora, with considerable fuscous markings, especially in discoidal fields; hind femora with two dark fuscous bars on upper-outer faces, inner faces deep orange-red; hind tibiae blue with greenish tinges; cerci moderately broad, tapering in basal one-third, middle one-third with sides nearly parallel, apical portions well-rounded and notched on posterio-ventral borders; furculae about one-third length of supra-anal plate, tapering, finger-like, apices diverging.

Comments and distribution: The distribution of this species is southwestern United States, extending from western Kansas and Oklahoma to Arizona and southwestern Utah. The Jefferson County, Oklahoma record represents the eastern and southeastern limits of distribution in the United States. Melanoplus arizonae Scudd. is an inhabitant of short-grass areas and may be found in the adult stage from May to October.

County records: Texas, Harper, Roger Mills, Custer, Beckham, Greer, Caddo, Kiowa, Harmon, Tillman and Jefferson.

Melanoplus regalis (Dodge)

Caloptenus regalis Dodge, 1876. Can. Ent. 8:11.

Melanoplus regalis, Bruner, 1893, Publ. Nebr. Acad. Sci. 3:28.

Aeoloplus crassus Scudder, 1902. Proc. Dav. Acad. Sci. 9:42.

Melanoplus picturatus Brun., 1905. Biol. Centr. Amer., Orth. 2:318.

Characteristics: Of medium size; with green markings on head, pronotum and hind femora; antennae light brown, disc of vertex sulcate, of equal width throughout; head and pronotum usually with a wide, green,

median band extending from depression of vertex across head to hind margin of pronotum, widening on posterior portions of head and pronotum, sides of pronotum with green and brown coloration, median carina darkened, more distinct on metazona, transverse sulci deeply impressed, blackened, hind margin obtuse-angled; tegmina and wings fully developed, slightly longer than abdomen, tegmina brownish with a row of dark spots interspersed with light patches laterally; hind femora with two broad, oblique, dark bars on external faces, red on internal faces; hind tibiae bluish, pale basally; cerci tapering in basal one-half, slender, cylindrical and tapering to a fine point in apical one-half (Fig. 15); furculae slender, finger-like, their apices diverging.

Comments and distribution: The range of M. regalis (Dodge) extends from Nebraska to Texas and west to Arizona. In Oklahoma, it is most common in the grama and bluestem areas of the western one-half; however, Hebard (1938) reported it from the Oak-pine Forest Type of McCurtain County which is not the normal habitat of the species. The latter record represents the southeastern limital record for M. regalis (Dodge) in the United States.

County records: Cimarron, Texas, Beaver, Harper, Woodward, Ellis, Roger Mills, Dewey, Blaine, Washita, Caddo, Beckham, Harmon, Kiowa, Comanche, Payne, Logan, Oklahoma, Pottawatomie and McCurtain.

Melanoplus femur-rubrum femur-rubrum (De Geer)

Acrydium femur-rubrum De Geer, 1773. Mem. Hist. Nat. Ins. 3:498.

Gryllus (Locusta) erythropus Gmelin, 1788. Linn. Syst. Nat. 1, Pt. 4:2086.

Comments and distribution: This species is very common and widespread, occurring throughout all of the United States except the Southeast where is is replaced by M. femur-rubrum propinguus Scudd. Like the other destructive Melanopli, it is found in a wide range of habitats including grassland, roadsides, open woodlands, cultivated fields and field borders. Cereals, forage crops, fruits and vegetables are often attacked by this pest. It ranks fourth among the destructive grasshoppers of our State behind M. bilituratus vulturnis Gurney and Brooks, M. differentialis nigricans Cock., and M. bivittatus (Say).

Melanoplus f. - r. femur-rubrum (De Geer) undoubtedly is present in all counties of the State; however, it has not been reported from several counties at present. Adults are present from June to November.

County records: All counties in the State except Dewey, Major, Alfalfa, Grant, Washita, Greer, Caddo, Canadian, Kingfisher, Oklahoma, Stephens, Jefferson, Johnston, Atoka, Latimer, Sequoyah, Cherokee and Adair.

SUBFAMILY ACRIDINAE LATREILLE, 1825

Face usually slanting, meeting the vertex at an acute angle; vertex horizontal or slightly ascending; lateral foveolae absent or present, if present, usually invisible from above; antennae variable in length and shape. Pronotum with prozona not shorter than metazona; hind margin truncate or obtusely-angled (acute in Acrolophitus); lateral carinae usually distinct; median carina low (except in Acrolophitus); tegmina and wings either long or short (some species have both long- and short-winged forms); hind wings clear, never brightly-colored or with distinct cross-bands (except in Acrolophitus). Stridulatory pegs are found on inner surfaces of hind femora.

Members of this subfamily are quite variable in size, shape and coloration. However, those with extremely slanted faces tend to be rather slender in form. Most species in this group are found in rather moist areas such as tall-grass meadows, lowlands, and along streams. These are of little economic importance. A few members of the subfamily, occurring for the most part in the western counties of the State, are capable of doing heavy damage to grasslands.

As discussed earlier, some of the Acridinae are difficult to separate from the Oedipodinae. Generally speaking, the former have more slender bodies than the Oediopdinae, also, they do not have the capability for leaping or sustained flight, as do the Oedipodinae. In Acridinae, the males produce a rasping sound by rubbing the inner-surfaces of the hind femora against the edges of the tegmina. In

Oklahoma, the members of this group overwinter in the egg stage.

Key to the Subfamily Acridinae (Slant-faced Grasshoppers) in Oklahoma

1. Face strongly receding, forming a sharp angle at point of meeting with the vertex; lateral foveolae invisible from above (Fig. 24) 2

   Face usually vertical, rounded at point of meeting with the vertex; lateral foveolae visible from above (Fig. 23).....14

2. Antennae strongly flattened and widened near bases, sword-shaped.12

   Antennae rounded or somewhat flattened near bases, distinctly not sword-shaped.....3

3. Median carina on posterior portion of pronotum raised into a high, arcuate crest; body and legs pubescent.....Acrophilitus

   Median carina on posterior portion of pronotum not raised into a high, arcuate crest; body and legs not pubescent.....4

4. Antennae flattened at apices, appearing clubbed.....Eritettix

   Antennae not flattened at apices, not appearing clubbed.....5

5. Hind tibiae with 16-24 fixed spines on outer margins.....Syrbula

   Hind tibiae with 9-15 fixed spines on outer margins.....6

6. Lateral carinae of pronotum definitely appearing constricted from dorsal view.....7

   Lateral carinae not constricted, at point of nearest convergence, about four-fifths width at posterior border.....9

7. Lateral carinae very strongly constricted near the middle, there less than one-half width at posterior border; females robust; face nearly vertical in the female.....Phlibostroma

   Lateral carinae strongly constricted near the middle, there more than one-half, or more, width at posterior border; females

slender; face slanting in the female.....8

8. Lateral carinae indistinct, may only be marked with color lines; brown stripe extending from posterior border of eye onto the thorax.....Cordillacris

Lateral carine distinct; no brown stripe extending from posterior border of eye.....Orphulella

9. Hind tibiae blue.....Amphitornus

Hind tibiae not blue.....10

10. Hind tibiae reddish.....Chloealtis

Hind tibiae not reddish.....11

11. Tegmina not more than three-fourths length of the abdomen .....Dichromorpha

Tegmina longer than abdomen.....Amblytropidia

12. Median carina of vertex wanting or, at best, only a faint line .....Mermiria

Median carina of vertex distinct.....13

13. Outer margin of hind tibiae with 10-12 fixed spines.....Opeia

Outer margin of hind tibiae with 14-17 fixed spines....Pseudopomala

14. Hind tibiae blue.....15

Hind tibiae not blue.....16

15. Tegmina extending only to posterior one-third of hind femora; hind femora marked with two or three, distinct, black bars which are continuous on inner faces; yellowish-brown species.Drepanopterna

Tegmina extending to end of hind femora or beyond, hind femora sometimes with darker markings on outer faces but not distinct; brownish species.....Aulocara

16. Median carina of pronotum obsolete throughout most of its length,

at best, only a faint line.....Heliaula

Median carina of pronotum distinct throughout.....17

17. Lateral foveolae obsolete or very weakly defined; males often partly or entirely shiny black.....Boopedon

Lateral foveolae distinctly defined; males never shiny black.....18

18. Prozona longer than metazona; hind tibiae red.....Ageneotettix

Prozona shorter than metazona; hind tibiae buff-to-pink...Psoloessa

Genus Acrolophitus Thomas, 1871

Acrolophitus Thomas, 1871. Rept. U. S. Geol. Surv. Wyo. p. 273.

Genotype: Gryllus hirtipes Say, 1825. Amer. Ent. 2, pl. 34.

Note: Only one species is found in Oklahoma; therefore, the generic description is included in the species description.

Acrolophitus hirtipes hirtipes (Say)

Gryllus hirtipes Say, 1825. Amer. Ent. 2, pl. 34.

Acrolophitus uniformis Bruner, 1904. Biol. Centr. Amer., Orth. 2:47.

Acrolophitus hirtipes hirtipes, Hebard, 1938, Okla. Agr. Exp. Sta. Tech. Bull. 5:14.

Characteristics: Large greenish grasshoppers with cone-shaped heads. Vertex of head pyramid-shaped, coming to extreme point, directed upward; antennae reddish, heavy, of moderate length, basal joints very large. Pronotum with very high arcuate crest on metazona extending over base of elytra; posterior margin acute; three transverse sulci present, the posterior bent forward around base of the crest. Tegmina long,

narrow, most usually with darker-green spots on a lighter-green background, interspersed with yellow. Hind femora usually mottled green. Body and legs pubescent.

Comments and distribution: Acrolophitus h. hirtipes (Say) is often taken in weedy and grassy upland areas, along roadways and adjacent to shrubbery. This species has been reported only from scattered central and western counties and three panhandle counties. According to Newton and Gurney's distributional map (1956), the Latimer County record of this species (L. G. Duck, 1938) marks the eastern-most limits in the United States.

A western race, A. h. variegatus Bruner, is reported from Harmon and Cimarron counties in Oklahoma State University Museum records; however, the specimens are missing. Acrolophitus h. variegatus Brun. is otherwise restricted to Texas and other western states.

County records: Cimarron, Texas, Beaver, Harper, Woods, Alfalfa, Major, Dewey, Roger Mills, Harmon, Jackson, Comanche, Jefferson, McClain, Cleveland, Oklahoma, Payne, Pawnee, Okfuskee and Latimer.

Genus Eritettix Bruner, 1890

Eritettix Bruner, 1890. Proc. U. S. Nat. Mus. 12:56.

Genotype: Eritettix variabilis Brun., 1890. Proc. U. S. Nat. Mus. 12:56.

Characteristics: Face slanted; lateral foveolae shallow; frontal costal widened below, constricted near median ocellus; antennae short, flattened toward apices, appearing club-shaped. Pronotum with lateral

carinae nearly parallel to somewhat constricted, raised, stong; median carina low, cut by one sulcus. Tegmina and wings extending to apex of abdomen or beyond.

Key to the Subspecies of Eritettix simplex Scudd. in Oklahoma

1. Lateral carinae of pronotum minutely constricted near middle; antennae definitely thickened near apices, distinctly club-shaped.....simplex simplex

   Lateral carinae of pronotum distinctly constricted near the middle; antennae barely thickened at apices, appearing only slightly club-shaped.....simplex tricarinatus

Differentiation between the above two races in Oklahoma specimens is sometimes difficult as the features separating them are not well marked (see Hebard, 1931). Eritettix s. simplex (Scudd.) is found most extensively in the states to the east and north of Oklahoma, while E. s. tricarinatus (Thos.) is a western form. Intergradation of the two races occurs in the State, especially in western Oklahoma.

Eritettix simplex simplex (Scudd.)

Gomphocerus simplex Scudd., 1869. Proc. Amer. Ent. Soc. 2:305.

Gomphocerus virgatus Scudd., 1875. Proc. Bost. Sci. Nat. Hist. 17:511.

Gomphocerus carinatus Scudd., 1875. Loc. cit.

Eritettix simplex, McNeill, 1897, Proc. Dav. Acad. Sci. 6:219.

Eritettix simplex var. dorsalis, Blatchley, 1920. Orthop. N. E. Amer., p. 212.

Characteristics: Background color brown but may be replaced in some females by green on head, pronotum and portions of the tegmina and hind femora. Antennae thickened, flattened and darker near apices. Head and pronotum generally with brown or black bands bounded externally by the lateral carinae and a broad, pale band delimited externally by a pair of supplementary carinae, one on each side of median one; lateral carinae of pronotum subparallel, only minutely constricted near the middle, if at all. Tibial spines black on tips.

Comments and distribution: Intensive collecting will probably show this race to be present in many counties; however, as yet it has only been reported from a few scattered counties in the southern panhandle and western sections.

It is often found in upland areas of short grasses. Both races of Eritettix simplex Scudd. hibernate as partially grown nymphs, the adults being present until late fall.

County records: Cimarron, Roger Mills, Comanche and Cleveland.

Eritettix simplex tricarinatus (Thos.)

Stenobothrus tricarinatus Thos., 1873. Rept. U. S. Geol. Surv. Terr. 5:84.

Eritettix navicula Scudd., 1876. Ann. Rept. U. S. Geog. Surv. W. 100th Merid., App. JJ, p. 506.

Eritettix simplex tricarinatus, Hebard, 1936, N. Dak. Exp. Sta. Bull. 284:29.

Characteristics: Same as those given above for Eritettix s. simplex (Scudd.) even to coloration except, in E. s. tricarinatus (Thos.), the lateral carinae are distinctly constricted near the middle and the antennae are only slightly club-shaped near the apices.

Comments and distribution: This species, like Eritettix s. simplex Scudd., is found in upland short grasses. Its Oklahoma distribution is more extensive than the latter, having been reported from several counties in the western one-half and in the three panhandle counties.

County records: Cimarron, Texas, Beaver, Beckham, Comanche, Logan, Payne and Cleveland.

Genus Syrbula Stal, 1873

Syrbula Stal, 1873. Recens. Orth. 1:102.

Genotype: Syrbula leucocerca Stal, 1873. Recens. Orth. 1:102 = (Stenobothrus admirabilis, Uhler, 1864), according to Kirby, 1910.

Characteristics: Size of sexes unequal, males being much smaller and more slender; color variable, females usually largely green. Head with length approximately that of pronotum; face distinctly slanted, quadricarinate; frontal costa wide, narrowed at apex, deeply sulcate in the male, shallow in the female; depression of vertex extending well ahead of eyes, subtriangular, median carina distinct, bounding walls well defined; antennae filiform in the female, slightly club-shaped in the male. Pronotum tricarinate; lateral carinae more or less sinuate; median and lateral carinae cut by principal sulcus behind middle; lateral lobes almost vertical. Tegmina extending to or beyond apex of abdomen.

Hind femora very long, slender, surpassing apices of tegmina.

Key to the Species of Syrbula in Oklahoma

1. Lateral carinae of pronotum gently curved inward; basal portion of antennae may be flattened somewhat but not distinctly so .....admirabilis

   Lateral carinae of pronotum strongly curved inward; basal portion of antennae distinctly flattened and widened.....fuscovittata

Syrbula admirabilis (Uhler)

Stenobothrus admirabilis Uhler, 1864. Proc. Ent. Soc. Phila. 2:553.

Syrbula leucocerca Stal, 1873. Recens. Orth. 1:102.

Syrbula pacifica Bruner, 1904. Biol. Centr. Amer., Orth. 2:44.

Characteristics: Males much smaller and more slender than females, color brownish with yellowish markings. Antennae light basally, apical portion enlarged with one side dark, other pale. Lower one-fourth of lateral lobe of pronotum yellowish. Hind femora with two or three dark, oblique bars on outer faces, knees black. Females with head, thorax and tegmina largely green, colored with fuscous or black; dorsal and costal fields of tegmina, each with a bright green stripe, the latter notched above by the serrations of a fuscous stripe. Hind femora with outer faces green, upper lateral carinae pale; hind tibiae pale.

Comments and distribution: This grasshopper occurs throughout the State but is considerably more common in the eastern part since it prefers heavy grass cover. Habitat of this species in western counties is

usually restricted to roadsides, fencerows, along streams, etc. Adults are found June through October.

County records: McCurtain, Choctaw, LeFlore, Muskogee, Wagoner, Mayes, Delaware, Ottawa, Nowata, Rogers, Tulsa, Creek, Osage, Pawnee, Payne, Kay, Kingfisher, Canadian, Oklahoma, Grady, McClain, Cleveland, Pontotoc, Coal, Love, Jefferson, Comanche, Caddo, Tillman, Kiowa, Harmon, Beckham, Custer, Alfalfa, Harper, Beaver and Texas.

Syrbula fuscovittata Thomas

Syrbula fuscovittata Thos., 1875. Rept. U. S. Geol. Surv. W. 100th Merid., Vol. 5:870.

Syrbula acuticornis Bruner, 1889. Proc. U. S. Nat. Mus. 12:55.

Syrbula modesta Brun., 1904. Biol. Centr. Amer., Orth. 2:46.

Characteristics: Possessing those characteristics given above for S. admirabilis (Uhler) except lateral carinae of pronotum strongly curved inward instead of gently so, and basal portion of antennae more flattened. In addition, the stripe on costal margin of tegmina in S. fuscovittata Thos. is bright yellowish-white instead of pale as in the former species.

Comments and distribution: Syrbula fuscovittata Thos. is a southwestern species reaching its eastern limit of distribution in Oklahoma. It prefers a tall grass habitat. State records for this species are rather rare, it only having been collected from three widely scattered counties.

County records: Osage, Jefferson and Cimarron.

Genus Phlibostroma Scudder, 1875

Phlibostroma Scudd., 1875. Bost. Soc. Nat. Hist. 17:516.

Genotype: Stenobothrus quadrimaculatus Thomas, 1871. Prelim. Rept. U. S. Geol. Surv. Wyo. and Terr. 2:280.

Note: Only one species of the genus occurs in the State; therefore, the description is of that species.

Phlibostroma quadrimaculatum (Thos.)

Stenobothrus quadrimaculatus Thos., 1871. Prelim. Rept. U. S. Geol. Surv. Wyo. and Terr. 2:280.

Phlibostroma pictum Scudd., 1875. Proc. Bost. Soc. Nat. Hist. 15:517.

Phlibostroma parvum Scudd., 1876. Ann. Rept. U. S. Geog. Surv. W. 100th Merid., App. JJ, p. 290.

Stenobothrus laetus Uhler, 1877. Bull. U. S. Geol. Surv. Terr. 3:792.

Phlibostroma quadrimaculata, McNeill, 1897, Proc. Dav. Acad. Sci. 6:248.

Characteristics: Yellowish-brown to green grasshoppers with four or five dark, irregular blotches on the median areas of tegmina. Head elevated; face slightly slanted; frontal costa narrowed above level of the antennae; lateral foveolae large, shallow, not visible from above; antennae slender, longer than head and pronotum combined; disc of vertex shallow, with faint median carina; dark post-ocular stripe present. Pronotum strongly constricted medially; lateral carinae weak, constricted;

median carina strong, cut by principal sulcus behind middle, hind margin very broadly rounded; dorsal surface of pronotum usually with light stripes following, and medial to, the lateral carinae. Tegmina variable in length, longer or shorter than abdomen, with blotches as described above. Hind femora partly banded on outer faces; hind tibiae orange to yellowish.

Comments and distribution: This species is almost entirely restricted to the Shortgrass Highplains and the Mixedgrass Eroded Plains Types of vegetation. Damage to rangelands by this species is fairly extensive in some years.

County records: Cimarron, Texas, Beaver, Harper, Woods, Alfalfa, Major, Woodward, Ellis, Roger Mills, Dewey, Custer, Beckham, Washita, Greer, Harmon, Jackson, Tillman, Kiowa, Comanche, Jefferson, Caddo, Blaine, Logan and Payne.

Genus Cordillacris Rehn, 1901

Alpha Brunner, 1893, (preoccupied by Alpha Saussure, 1853 and 1875). Ann. Mus. Genova 33:121.

Cordillacris Rehn, 1901. Can. Ent. 33:271.

Genotype: Stenobothrus occipitalis Thomas, 1873. Rept. U. S. Geol. Surv. Terr. 5:81.

Characteristics: Head and pronotum with dark brown post-ocular stripe laterally; face receding, quadricarinate; frontal costa sulcate, diverging ventrally; antennae flattened near bases, usually considerably longer than head and pronotum combined; lateral foveolae large, shallow, not visible from above. Pronotum with lateral carinae absent, their

position indicated by constricted color lines; median carina distinct on metazona, feeble on prozona; hind margin widely rounded. Tegmina extending to apex of abdomen or beyond, opaque with brown markings. Hind femora light with longitudional fuscous bars on outer faces.

Key to the Species of Cordillacris in Oklahoma

1. Tegmina with several brown scallops or crenulate markings in central areas; hind tibiae pink to red; small species..crenulata crenulata

   Tegmina with brown elongate spots (not crenulate) in central areas; hind tibiae usually buff-colored; larger species .....occipitalis occipitalis

Cordillacris occipitalis occipitalis (Thos.) 1873

Stenobothrus occipitalis Thos., 1873. Rept. U. S. Geol. Surv. Terr. 5:81.

Cordillacris occipitalis, Bruner, 1904, Biol. Centr. Amer., Orth. 2:71.

Cordillacris occipitalis occipitalis, Hebard, 1925, Proc. Acad. Nat. Sci. Phila. 87:55.

Characteristics: Yellow lines on pronotum not as constricted as in C. c. crenulata Brun.; tegmina with brown, elongate spots in central areas; hind tibiae usually buff-colored; larger than its cogener.

Comments and distribution: Like C. c. crenulata Brun., this species is also western in distribution and finds its southeastern limits in Oklahoma. Areas of thin or gravelly soil with a sparse growth of short

grasses and weeds is its preferred habitat; however, of the two species, C. c. crenulata Brun. is usually found in areas of thinner soils and sparser vegetation. Oklahoma records have been reported only from two counties in the Panhandle and three extreme-western counties.

County records: Cimarron, Texas, Harper, Beckham and Harmon.

Cordillacris crenulata crenulata (Bruner)

Ochilidea crenulata Bruner, 1890. Proc. U. S. Nat. Mus. 12:51.

Alpha crenulata McNeill, 1897. Proc. Dav. Acad. Nat. Sci. 6:247.

Cordillacris crenulata, Caudell, 1903, Proc. U. S. Nat. Mus. 26:782.

Cordillacris crenulata crenulata, 1936, Hebard, N. Dak. Exp. Sta. Bull. 248:30.

Characteristics: Head with medio-dorsal, dark brown bar extending from vertex to hind margin; yellow lines on pronotum considerably more constricted than in C. o. occipitalis (Thos.); tegmina with several brown scallops or crenulate markings in central areas; hind tibiae pink to red; smaller species than C. o. occipitalis (Thos.).

Comments and distribution: Cordillacris c. crenulata Brun. is a western species, extending into Cimarron and Texas counties of the Panhandle. It prefers thin soil and scanty cover, and in Oklahoma is restricted to the Shortgrass Highplains and the Black Mesa Types of vegetation. The Texas County record (Hubbell, 1926) constitutes the southeastern limit of distribution for the species in the United States.

County records: Cimarron and Texas.

Genus Orphulella Giglio-Tos, 1894

Orphulella Giglio-Tos, 1894. Boll. Mus. Zool. Comp. Anat. Torino 9:8.

Genotype: Acrydium punctatum DeGeer, 1773. Mem. Hist. Ins. 3:503.

Characteristics: Small to medium-sized, slender grasshoppers with short antennae and variable in color. Head horizontal, distinctly receding; lateral foveolae small, narrow, shallow, not visible from above; antennae short, filiform, usually darker toward apices; frontal costa high, weakly sulcate near ocellus; disc of vertex without median carina. Pronotum with median carina distinct, cut behind middle by principal sulcus; lateral carinae strong, divergent on both prozona and metazona; posterior margin obtusely-angled; ventral margin distinctly angulate near middle, strongly ascending in front portion. Tegmina narrow, extending to or beyond apex of abdomen; hind wings clear. Hind femora surpassing tip of abdomen; hind tibiae with 10-12 spines on outer margins.

Key to the Species of Orphulella in Oklahoma

1. Tegmina usually extending beyond apices of hind femora; outline of vertex rectangular to acute; depression of vertex more developed and removed from front margin (Fig. 26)..pelidna pelidna

   Tegmina rarely extending to apices of hind femora; outline of vertex more rounded; depression of vertex slightly developed and nearer to front margin (Fig. 25).....speciosa

Orphulella speciosa (Scudder)

Stenobothrus speciosus Scudd., 1862. Bost. Jour. Nat. Hist. 7:458.

Stenobothrus aequalis Scudd., 1862. Ibid., p. 459.

Stenobothrus bilineatus Scudd., 1862. Ibid., p. 460.

Stenobothrus gracilis Scudd., 1872. Final Rept. U. S. Geol. Surv. Nebr., p. 250.

Orphula decora McNeill, 1897. Proc. Dav. Acad. Nat. Sci. 6:239.

Orphulella obliquata Scudd., 1899. Can. Ent. 31:181.

Orphulella picturata Scudd., 1899. Ibid., p. 182.

Orphulella speciosa, Bruner, 1904, Biol. Centr. Amer., Orth. 2:79.

Characteristics: Color very variable, sometimes brown with dark markings on head and pronotum, or brown with green on head, pronotum and tegmina, or almost entirely green. Head with lateral foveolae closed below; outline of vertex more rounded than in O. pelidna pelidna (Burm.), depression of vertex slightly developed and nearer to front margin than in the above species (Fig. 25). Pronotum with lateral carinae heavy, not broken in area of constriction. Tegmina rarely extending to apices of hind femora, usually with a row of dark spots occurring medially. Usually shorter and smaller specimens than O. p. pelidna (Burm.).

Comments and distribution: Orphulella speciosa Scudd. is a very common and widespread species throughout the State. It is a grass feeder and prefers dry, upland areas of short grass, often being the most abundant grasshopper along freshly-mowed roadsides. Adults have been collected from early June through September.

County records: McCurtain, LeFlore, Pushmataha, Choctaw, Bryan, Latimer, Pittsburg, Hughes, Okfuskee, Okmulgee, Cherokee, Tulsa, Rogers, Washington, Craig, Nowata, Osage, Pawnee, Payne, Noble, Kay, Logan, Cleveland, McClain, Pottawatomie, Murray, Love, Grady, Canadian, Blaine, Caddo, Comanche, Cotton, Kiowa, Harmon, Custer, Roger Mills, Woods, Alfalfa, Harper, Beaver, Texas and Cimarron.

Orphulella pelidna pelidna (Burmeister)

Gomphocerus pelidnus Burmeister, 1838. Handb. Ent. 2:650.

Stenobothrus maculipennis Scudd., 1862. Bost. Jour. Nat. Hist. 7:458.

Stenobothrus propinquans Scudd., 1862. Ibid., p. 461.

Orphulella pratorum Scudd. 1899. Can. Ent. 31:186.

Orphulella pelidna, Scudd., 1899, Ibid., p. 187.

Orphulella pelidna pelidna, Gurney, 1940, Entom. Amer. 20, No. 3:117.

Characteristics: Brown to greenish species with dark markings. Very similar to O. speciosa (Scudd.) but usually, although not always, separable from it by the characteristics given in the key, plus the following: Head with lateral foveolae open below; pronotum with lateral carinae usually broken in area of constriction; dark bars behind eyes more distinct; usually larger forms than in O. speciosa (Scudd.).

Gurney (1940), in a revision of Orphulella, points out that O. p. pelidna (Burm.) and O. speciosa Scudd. are not always separable by

external characters, it being necessary to resort to a study of the base of the lateral basivalvular sclerite of the ovipositor.

Comments and distribution: Orphulella p. pelidna (Burm.) is distributed throughout all sections of the State; however, it is not nearly as abundant in a given locality as is O. speciosa (Scudd.). Unlike the latter it prefers tall grasses and usually, although not always, is found living in a more moist habitat than does O. speciosa (Scudd.).

County records: McCurtain, LeFlore, Atoka, Sequoyah, Hughes, Okmulgee, Tulsa, Rogers, Ottawa, Osage, Pawnee, Payne, Oklahoma, Woods, Cleveland, Comanche, Jackson, Custer, Harper, Beaver, Texas and Cimarron.

Genus Amphitornus McNeill, 1897

Amphitornus McNeill, 1897. Proc. Dav. Acad. Sci. 6:223.

Genotype: Stenobothrus bicolor Thomas, 1872. Rept. U. S. Geol. Surv. Mont. p. 465 = (S. coloradus (Thos.) 1873).

Note: The description below is that of the species A. coloradus coloradus McNeill, since it is the only representative of the genus in Oklahoma.

Amphitornus coloradus coloradus McNeill

Stenobothrus bicolor Thos. 1872, Rept. U. S. Geol. Surv. Mont., p. 465 (homonym of S. bicolor (Charpentier) 1825).

Stenobothrus coloradus Thos., 1873. Syn. Acrid. N. Amer., P. 82.

Stenobothrus coloradus var. unicolor, Thos., 1873. Syn. Acrid. N.

Amer., p. 82.

Akentetus unicolor McNeill, 1897. Proc. Dav. Acad. Sci. 6:225.

Akentetus carinatus Scudder, 1899. Proc. Amer. Acad. Sci. 35:45.

Amphitornus coloradus coloradus, Hebard, 1937, Trans. Amer. Ent. Soc. 63:357.

Characteristics: Brown and yellow species, usually with two dark, broad lines extending along dorso-lateral portion of head, pronotum and sometimes to apex of tegmina. Head horizontal, face slanting; foveolae very shallow; disc of vertex slightly concave with short, feeble, median carina; antennae slender, flattened near bases. Pronotum with dorso-lateral margins rounded; cut by three sulci; front margin truncate, hind margin broadly rounding; lateral carinae absent except sometimes feebly indicated on metazona; median carina low, cut slightly behind middle by principal sulcus. Tegmina fully developed, usually surpassing apex of abdomen; rear wings clear. Hind femora partially barred on outer and inner faces; hind tibiae blue, 12-13 spines on outer margins.

Comments and distribution: Amphitornus c. coloradus McNeill is a grass feeder and inhabits dry upland areas of short grass. It is largely restricted to the western one-third of the State. In some years it has been abundant enough in western Oklahoma rangelands to cause considerable damage.

County records: Cimarron, Texas, Harper, Woodward, Major, Dewey, Roger Mills, Blaine, Custer, Beckham, Harmon, Jackson, Tillman, Comanche, Cotton, Murray and Cherokee.

Genue Chloealtis Harris, 1841

Chloealtis Harris, 1841. Rept. Ins. Mass. Inj. Veg. p. 148.

Genotype: Locusta (Chloealtis) conspersa Harris, 1841. Rept. Ins. Mass. Inj. Veg. p. 149.

Note: Only one species occurs in the State; therefore, the generic and specific descriptions are combined.

Chloealtis conspersa (Harris)

Locusta (Chloealtis) conspersa Harris, 1841. Rept. Ins. Mass. Inj. Veg. p. 149.

Locusta (Chloealtis) abortiva Harris, 1841. Loc. cit.

Stenobothrus melanopleurus Scudder, 1862. Bost. Jour. Nat. Hist. 7:456.

Chloealtis conspersa, Morse, 1896. Psyche 7:419.

Characteristics: Small to medium-sized grasshoppers, grey to brown in color. Face slanting; frontal costa flat or feebly sulcate below level of antennae; lateral foveolae wanting; disc of vertex triangular, shallow, median carina present; antennae in the males about twice the length of head and pronotum, flattened near bases. Pronotum in the males with lateral lobes shiny black and hind margin truncate, slightly rounded in the females; three carinae equally distinct, the lateral carinae slightly constricted; prozona longer than metazona. Tegmina of males macrocopterous, fuscous spots not present; females very seldom

macrocopterous, numerous small fuscous spots present; hind wings clear in both sexes. Hind femora with faint bars on outer faces, ventral parts of femora and hind tibiae reddish.

Comments and distribution: We only have one record of this species from Oklahoma, that being from Adair County in 1938. This represents the southeastern limits of the species range in the United State. Chloealtis conspersa (Harris) is most often found in heavy cover such as in or adjacent to woodlands and thicket areas. The female possess an ovipositor capable of excavating holes in wood and according to Blatchley (1920) often deposits her eggs in old logs or stumps.

County records: Adair.

Genus Dichromorpha Morse, 1896

Dichromorpha Morse, 1896. Psyche 7:326.

Genotype: Chloealtis viridis Scudder, 1862. Bost. Jour. Nat. Hist. 7:455.

Note: Only one species of Dichromorpha Morse is present in Oklahoma; therefore, the description is of that species.

Dichromorpha viridis (Scudder)

Chloealtis viridis Scudd., 1862. Bost. Jour. Nat. Hist. 7:455.

Chloealtis punctulata, Scudd., 1862. Loc. cit.

Opomala brevipennis Thomas, 1865. Trans. Ill. State. Agr. Soc. 5:451.

Truxalis angusticornis Stal, 1873. Recens, Orth. 1:105.

Chloealtis brunnea Scudd., 1875. Proc. Bost. Soc. Nat. Hist. 17:510.

Characteristics: Medium sized grasshoppers, the male much smaller than the female. Dimorphic in color, the males brown, usually with dorsal portions of head, pronotum and tegmina green; females either almost entirely green or speckled-brown. Face slanting, foveolae wanting; frontal costa sulcate, narrowed above bases of antennae; vertex wide, bluntly pointed; antennae about as long as head and pronotum combined, somewhat flattened. Pronotum with lateral lobes perpendicular, longer than deep, front and hind margins converging downward; median and lateral carinae distinct, parallel, all cut by principal sulcus; disc of pronotum flat. In most females a dark line extends from behind the eye along the upper border of each lateral lobe of pronotum. Tegmina ovate-lanceolate; one-half to three-fourths length of abdomen, rarely fully developed. All specimens examined had 10 spines on outer margin of hind tibiae.

Comments and distribution: Dichromorpha viridis (Scudd.) has been collected in coarse, dense grasses and weedy areas. It seems to prefer a rather humid environment which probably accounts for it being reported only from scattered locations in the eastern two-thirds of the State. Adults have been collected from June through September.

County records: McCurtain, LeFlore, Adair, Mayes, Tulsa, Pawnee, Oklahoma, Cleveland, Murray, Johnston, Comanche and Canadian.

Genus Amblytropidia Stal, 1873

Amblytropidia Stal, 1873, Recens. Orth. 1:107.

Genotype: Amblytropidia ferruginosa Stal, 1873. Recens. Orth. 1:107.

Note: Amblytropidia Stal is represented by only one species in Oklahoma and the description which follows is of that species.

Amblytropidia occidentalis Saussure

Stenobothrus occidentalis Sauss., 1861. Rev. Zool. (2), 13:317.

Stenobothrus subconspersus Walker, 1870. Cat. Derm. Salt. Brit. Mus. 4:755.

Amblytropidia subhyalina Scudder, 1875. Proc. Bost. Soc. Nat. Hist. 17:511.

Chloealtis canadensis Provancher, 1876. Nat. Can. 8:135.

Characteristics: General body coloration greyish to reddish-brown. Head short; face slanting; foveolae not visible from above; antennae not flattened, filiform, shorter than head and thorax; disc of vertex convex, sides not raised. Pronotum with sides parallel, higher than length; hind margin sharply angulate, front margin straight; median carina distinct, cut near the middle; lateral carinae strong, parallel. Tegmina longer than abdomen, tips rounded; hind wings transparent. Hind femora stout; outer faces convex; ventral faces red; hind tibiae with 13-15 spines on outer margin.

Comments and distribution: This species is fairly rare in Oklahoma collections and has been reported only from five eastern counties. It prefers thick cover such as bunch grasses and when disturbed tends to be secretive in habit; thus, probably accounting for it not being taken more

often by collectors. The writer has collected it as late as October 18.

County records: Bryan, Pushmataha, Pittsburg, LeFlore and Creek.

Genus Mermiria Stal, 1873

Mermiria Stal, 1873. Recens. Orth. 1:102.

Papagoa Bruner, 1904. Biol. Centr. Amer. Orth. 2:42.

Genotype: Mermiria belfragii Stal, 1873. Recens, Orth. 1:102 = (Opomala neomexicana Thomas, 1870).

Characteristics: Long, slender, brown and green species with sword-shaped antennae. Head slightly ascending, subequal to length of pronotum; face strongly slanted; lateral foveolae shallow, not visible from above; frontal costa parallel, sulcate; antennae strongly flattened, sword-shaped, equalling or exceeding head and pronotum in length; vertex with disc triangular or semi-elliptical, its sides distinctly raised; median carina faint or wanting; apex acute or rounded. Pronotum long, hind margin truncate, broadly rounded or angulate; lateral carinae either present or absent; metazona shorter than prozona, lower margin of lateral lobes sinuate. Tegmina and wings reaching to apex of abdomen or beyond. Hind femora and tibiae long and slender.

Key to the Species of Mermiria in Oklahoma

(Adapted from Rehn, 1919)

1. Lateral carinae of pronotum present (weak in M. texana Bruner)...2
   Lateral carinae of pronotum not present.....4
2. Form more robust; lateral carinae of pronotum weak, decidedly

diverging posteriorly; tegmina color pattern bold, subcostal pale line strongly marked; dorsal surface of hind femora with broken bars.....texana

Form more slender; lateral carinae of pronotum strong, diverging only slightly, if at all, posteriorly; tegmina color pattern not bold; dorsal surface of hind femora without barred effect.....3

3. Vertex from dorsal view semi-elliptical, bluntly rounded at the apex (Fig. 29).....neomexicana

Vertex triangular, converging sides straight, apex very narrowly rounded (Fig. 30).....picta

4. Males with subcostal pale stripes on basal one-half of tegmina; vertex without median carina; general coloration more buffy; size typically larger.....maculipennis

Males without subcostal pale stripes on basal one-half of tegmina; vertex with or without median carina; general coloration more greenish, size typically smaller.....bivittata

Mermiria texana Bruner

Mermiria texana Brun., 1890 Proc. U. S. Nat. Mus. 12:53.

Mermiria texana mutation viridis, Cockerell, 1902, Proc. Dav. Acad. Sci. 9:24.

Papagoa arizonensis Brun., 1904. Biol. Centr. Amer., Orth. 2:38.

Characteristics: The most easily separated species of the genus due to its distinct, bold color pattern. Head and pronotum with dark brown, longitudional stripes laterally extending to apices of tegmina; medio-dorsal dark brown stripe and light yellow dorso-lateral stripes

present, all extending onto tegmina. In addition, tegmina with light yellow stripes present in subcostal area of basal one-half and in distal one-half of median field. Lateral and supplementary lateral carinae present on pronotum. Hind femora with dark incomplete bars on dorsal surfaces.

Comments and distribution: Mermeria texana Brun., is a southwestern species reported by Rehn (1919) to be found in Texas, Arizona, New Mexico, and Colorado. It has been collected in Oklahoma by Hubbell (Cimarron County--1926, Osage County--1937) and by the writer in the former county, 1958. The Cimarron county collections were taken by both parties,only among bunch grass and short grass, on the rocky slopes and top of Black Mesa.

County records: Cimarron and Osage.

Mermiria neomexicana (Thomas)

Opomala neo-mexicana Thos., 1870. Proc. Acad. Nat. Sci. Phila., p. 77.

Mermiria belfragii Stal, 1873. Recens. Orth. 1:102

Mermiria neomexicana, Scudder, 1876, Bull. Geol. Surv. Terr. 2:262.

Characteristics: Slender forms; head, pronotum and costal margin of tegmina sometimes greenish, the dorsal field of tegmina often tinged with reddish; post-ocular dark stripe as in M. maculipennis Brun. Vertex from dorsal view appearing semi-elliptical, bluntly rounded at apex. Pronotum with lateral carinae distinct, prozona almost twice the length of metazona. Tegmina without pale stripes on subcostal portion of basal

one-half.

Comments and distribution: This is a northern and western species reaching its southeastern distributional limits in eastern Oklahoma. It prefers dry upland areas of coarse grass, and is not nearly as abundant as M. maculipennis Brun. and M. bivittata (Serv.). Scattered collections have been taken from all regions except the southeastern section.

County records: Cimarron, Beaver, Harper, Alfalfa, Blaine, Roger Mills, Custer, Harmon, Kiowa, Comanche, McClain, Logan, Rogers and Cherokee.

Mermiria picta Walker

Opomala picta Walker, 1870. Cat. Derm. Salt. Brit. Mus., pt. 3:516.

Mermiria alacris Scudder, 1877. Proc. Bost. Soc. Nat. Hist. 19:30.

Mermiria rostrata McNeill, 1897. Proc. Dav. Acad. Nat. Sci. 6:207.

Mermiria vigilans Scudd., 1899. Proc. Amer. Acad. Arts Sci. 35:43.

Mermiria picta, Uvarov, 1925, Trans. Ent. Soc. Lond., pts. 34:268.

Characteristics: Color largely green, stripes on sides of head and pronotum reddish-brown; dorsum of head and pronotum with median reddish-brown stripe; tegmina green, sometimes with narrow reddish stripes extending longitudinally in the median areas; antennae and tibiae reddish-brown; hind femora dull green tinged with fuscous brown. Vertex of head distinctly triangular, apex very narrowly rounded; subgenital plate of male vary strongly produced.

Comments and distribution: This species inhabits tall grass in

both wooded and open upland areas. It is eastern in distribution and reaches its western-most limits in Oklahoma (Kiowa County, Morse, 1907). Rehn (1919) in his monograph of the genus did not list the Kiowa County record, but did include the remainder of Morse's records. Mermiria picta (F. Walk.) is uncommon in Oklahoma collections being reported from only five scattered counties in the southern and north-central areas of the State.

County records: Latimer, Jefferson, Pottawatomie, Payne and Kiowa.

Mermiria maculipennis Bruner

Mermiria maculipennis Brun., 1890. Proc. U. S. Nat. Mus. 12:54.

Mermiria bivittata Townsend, 1893. Insect Life 6:31. (not Opsomala bivittata Serville, 1839).

Mermiria texana Caudell, 1903. Proc. U. S. Nat. Mus. 26:780.

Characteristics: Light brown and yellowish specimens, pale greenish-yellow underneath, a wide purplish-brown stripe extending from behind the eyes to hind margin of pronotum. Antennae and hind tibiae reddish; vertex without median carina; hind margin of pronotum rounded or slightly angled; males with subcostal pale stripes on basal one-half of tegmina.

Comments and distribtion: Mermiria maculipennis Brun. is by far the most abundant and widespread species of the genus in Oklahoma, being reported from all sections of the State. On the basis of relative morphological characteristics such as size, robustness, length and

constriction of pronotum, etc., Rehn (1919) separated the species into two races, M. m. maculipennis Brun. and M. maculipennis macclungi Rehn, the former being the southern part of the maculipennis population and the latter the more northern. All of Oklahoma seems to be encompassed in the zone of intergradation between these races.

Rehn further classified populations in areas of intergradation (Central Texas through Oklahoma to Central Kansas) as atypical M. m. macclungi, intermediates between M. m. macclungi and M. m. maculipennis, and atypical M. m. maculipennis. Most of the Oklahoma specimens collected and/or examined by the writer fall into the intermediate group. Specimens of true M. m. maculipennis have been reported only from scattered areas throughout the State while M. m. macclungi has not been reported as yet. As would be expected, atypical M. m. maculipennis occurs especially in collections from the southern areas. Contrary to the findings of Bragg (1936, unpublished thesis), much of the northern Oklahoma material is nearer M. m. macclungi than M. m. maculipennis.

Since Oklahoma apparently is in a transitory area, it is extremely difficult to resolve the races of M. m. maculipennis therein. Additional collecting and study is needed.

Mermeria maculipennis Brun. is often abundant in areas of short and mid-grasses and may be of economic importance especially during periods of drought. Adults have been collected from June to November.

County records: (Mermeria m. maculipennis Brun.) - Beckham, Greer, Jackson, Tillman, Kiowa, Custer, Blaine, Kingfisher, Logan, Payne, Creek, Pottawatomie, McClain, Grady, Garvin, Jefferson, Murray, Bryan, Choctaw, Pontotoc, Hughes and Seminole.

County records: (Atypical M. m. maculipennis Brun.) - Texas, Harmon, Jackson, Cotton, Bryan, Tulsa and LeFlore.

County records: (Intermediates between M. m. maculipennis Brun. and M. m. macclungi Rehn) - Cimarron, Beaver, Harper, Woods, Alfalfa, Beckham, Harmon, Jackson, Comanche, Cotton, McClain, Cleveland, Oklahoma, Logan, Kay, Osage, Tulsa, Bryan, Choctaw, LeFlore, McCurtain.

Mermiria bivittata (Serville)

Opsomala bivittata Serv., 1839. Hist. Nat. Ins. Orth., p. 589.

Mermiria bivittata Scudder, 1877, Proc. Amer. Acad. Arts Sci. 35:42.

Characteristics: Similar to M. maculipennis Brun. Except both sexes more greenish, the males definitely so, vertex with or without median carina, size typically smaller, and males without subcostal pale stripes on basal one-half of tegmina.

Comments and distribution: This species is very closely related to M. m. maculipennis Brun. and is often confused with it. Rehn (1919) stated that:

> . . . the two are very hard to separate, particularly in the female sex. The most conspicuous feature of the species is found only in the male sex and is purely a color character, i.e., the absence of a pale subcostal stripe on the tegmina.

Unlike M. maculipennis Brun., this species prefers dense, tall grass and, therefore, is not found in the northwestern and panhandle counties. It is most common throughout the eastern one-half of the State.

County records: McCurtain, LeFlore, Latimer, Pittsburg, Hughes,

Choctaw, Bryan, Okfuskee, Rogers, Ottawa, Pawnee, Payne, Alfalfa, Logan, Cleveland, McClain, Caddo, Comanche, Tillman, Kiowa and Harmon.

Genus Opeia McNeill, 1897

Opeia McNeill, 1897. Proc. Dav. Acad. Sci. 6:214.

Genotype: Oxycoryphus obscura Thomas, 1872, Rept. U. S. Geol. Surv. Mont., p. 466.

Note: The genus Opeia McNeill is represented by a single species in Oklahoma; therefore, the description is of that species.

Opeia obscura obscura (Thomas)

Oxycoryphus obscurus Thos., 1872. Rept. U. S. Geol. Surv. Mont. p. 466.

Opeia obscura, McNeill, 1897, Proc. Dav. Acad. Sci. 6:214.

Opeia testacea Scudder, 1899. Proc. Amer. Acad. Sci. 35:46.

Opeia pallida Bruner, 1904. Biol. Centr. Amer., Orthop. 2:60.

Characteristics: Brownish-yellow to green in color; females considerably larger and showing more color dimorphism than males. Face strongly slanting; disc of vertex possessing median carina; antennae flattened and widened at bases, distinctly sword-shaped. Pronotum narrow, hind margin slightly rounded; median carina cut by one sulcus behind the middle; lateral carinae strong, approximately parallel throughout. Tegmina brown to green, usually with a line of dark spots or markings in central areas; hind wings clear. Hind femora pale with

dark, longituditional stripe on outer-upper faces; hind tibiae pale blue to brownish, 10-12 fixed spines on outer margins.

Comments and distribution: This species has been reported from several counties in the western two-thirds of the State. It is most prevalent from mid-summer to late fall and seems to be restricted chiefly to areas of mid- and short grasses. Its distribution in the United States is entirely west of the Mississippi River.

County records: Harper, Alfalfa, Washita, Kiowa, Harmon, Comanche, Cotton, Carter, Love, McClain, Cleveland, Caddo, Canadian, Kingfisher, Noble and Osage.

Genus Pseudopomala Morse, 1896

Pseudopomala Morse, Psyche 7:325.

Genotype: Opomala brachyptera Scudder, 1862. Bost. Jour. Nat. Hist. 7:454.

Note: This genus is represented by only one species in Oklahoma which serves as basis for the description.

Pseudopomala brachyptera Scudder

Opomala brachyptera Scudd., 1862. Bost. Jour. Nat. Hist. 7:454.

Opomala aptera Scudd., 1869. Trans. Amer. Ent. Soc. 2:305.

Pseudopomala brachyptera, Morse, 1896, Psyche, 7:343.

Pseudopomala brachyptera form reversa, Morse, 1911, in Walden,

Bull. Geol. Nat. Hist. Surv. Conn., No. 16, p. 73 (Nomen nudum).

Characteristics: Very slender, strongly-compressed, brown grasshoppers, with yellowish underparts. Face extremely receding; antennae strongly flattened, sword-shaped; median carina of vertex elevated in discal area. Pronotum with hind margin truncate, median and lateral carinae distinct throughout, metazona two-thirds as long as prozona. Tegmina in most specimens with tips sharply rounded and abbreviated, one-third to three-fourths length of hind femora. Outer margin of hind tibiae with 14-17 fixed spines.

Comments and distribution: This species was collected by Hubbell in 1926 from several counties in the western one-half, otherwise unreported from the State. Hubbell's records show this species to be most often encountered in bunch grasses (Andropogon spp.) It is seldom collected.

County records: Roger Mills, Harmon, Comanche, Alfalfa and McClain.

Genus Drepanopterna Rehn, 1927

Drepanopterna Rehn, 1927, Trans. Amer. Ent. Soc. 53:226.

Genotype: Aulocara femoratum Scudder, 1899, Proc. Amer. Acad. Arts. Sci. 25:55.

Note: Only one species is found in Oklahoma; therefore, the description is of that species.

Drepanopterna femoratum (Scudd.)

Aulocara femoratum Scudd., 1899. Proc. Amer. Acad. Arts, Sci. 25:55.

Drepanopterna femoratum, Rehn, 1927, Trans. Amer. Ent. Soc. 53:227.

Characteristics: Brownish-yellow species with distinct, black bars on outer and inner faces of hind femora. Females conspiciously larger than males. Head large, swollen; face receding but lateral foveolae visible from above; frontal costa constricted above level of antennae, shallowly sulcate; lateral foveolae shallow, triangular; antennae slender, considerably longer than combined length of head and pronotum; disc of vertex deep, triangular, median carina not present. Pronotum usually with white cross-marks on dorsum; large, conspicuous dark blotches present on sides of prozona; lateral carinae weak or absent, except some times fairly distinct behind principal sulcus; median carina raised, cut by principal sulcus. Tegmina not reaching apex of abdomen, a few small dark flecks present; hind wings clear. Hind femora pale with contrasting black bands on inner and outer faces; hind tibiae blue.

Comments and distribution: This species is restricted to the Short-grass Highplains Type of the Panhandle. It feeds on range grasses and in some western states it is one of the more destructive range grass-hoppers. Adults have been collected from June to October. The writer's Beaver County record is near the southeastern limits of this species' known range in the United States.

County records: Cimarron, Texas and Beaver.

Genus Aulocara Scudder, 1876

Aulocara Scudd., 1876. Bull. U. S. Geol. Surv. Terr. 2:266.

Oedocara Scudd., 1876. Ann. Rept. Geog. Surv. W. 100th Merid, App.

JJ, p. 289.

Genotype: Aulocara caeruleipes Scudd, 1876. Bull. U. S. Surv. Terr. 2.266 (synonymic with Stauronotus elliotti Thomas, 1870).

Note: The following description is that of A. elliotti (Thos.), since it is the only species of the genus found in the State.

Aulocara elliotti (Thos.)

Stauronotus elliotti Thos., 1870. Proc. Acad. Nat. Sci. Phila. p. 82.

Aulocara caeruleipes Scudd., 1876. Bull. U. S. Surv. Terr. 2:266.

Aulocara decens Scudd., 1876. Loc. cit.

Oedocara strangulatum Scudd., 1876. Ann. Rept. Geog. Surv. W. 100th Merid., App. JJ, p. 289.

Aulocara parallelum Scudd., 1899. Proc. Amer. Acad. Arts Sci. 35:57.

Characteristics: Large-headed, brown, range grasshoppers with blue hind tibiae; females larger than the males. Head swollen; frontal costa slightly sulcate, narrowed above level of antennae; lateral foveolae large, distinct, visible from above; antennae slender, long, slightly flattened basally, darkened in apical portions; depression of vertex deep, triangular, median carina not present. Pronotum with lateral carinae weak or absent; light crossmarks usually present on dorsal surface; light, broken blotches present on sides of prozona; median carina weak on prozona, cut by principal sulcus. Tegmina extending beyond apex of abdomen, usually with a light, thin longitudional stripe on mid-line,

numerous fuscous spots present; hind wings clear. Bands on outer faces of hind femora not distinct as in Drepanopterna femoratum (Scudd.), ventral and inner faces usually blue; hind tibiae blue, occasionally yellowish.

Comments and distribution: Aulocara elliotti (Thos,) is often confused with Drepanopterna femoratum (Scudd.). The blotches on the sides of the prozona in the latter species are darker and more distinct, general body coloration is lighter, and continuous bars are present on inner and outer faces of hind femora. The tegmina in D. femoratum (Scudd.) extend beyond the apex of the abdomen; whereas, in A. elliotti (Thos.), they do not.

This species is found in the western two-thirds of the State. It is one of the most common and widespread grasshoppers of western Oklahoma rangelands. During periods of abundance it may do extensive damage to range grasses, especially buffalo grass and the gramas.

County records: Cimarron, Texas, Beaver, Harper, Woods, Woodward, Alfalfa, Major, Dewey, Blaine, Custer, Roger Mills, Beckham, Greer, Harmon, Kiowa, Jackson, Tillman, Comanche, Jefferson, Stephens, Grady, Caddo, McClain, Logan and Kay.

Genus Heliaula Caudell, 1915

Heliaula Caudell, 1915. Proc. U. S. Nat. Mus. 49:27.

Genotype: Aulocara rufum Scudder, 1899. Proc. Amer. Acad. Arts. Sci. 35:55

Note: Only one species of this genus, Heliaula rufa (Scudd.), is

Genus Boopedon Thomas, 1870

Boopedon Thos., 1870. Proc. Acad. Nat. Sci. Phila., p. 83.

Genotype: Gryllus nubilum Say, 1825. Jour. Acad. Nat. Sci. Phila. 4:308.

Characteristics: Head bulging, wider than thorax, rounded in front; frontal costa wide, not sulcate, lateral margins nearly parallel; antennae filiform, long; lateral foveolae shallow, visible from above; vertex rounded, sloping, broad; disc of vertex very shallow, faint median carina present. Pronotum with sides parallel; front margin subtruncate; hind margin angulate, except broadly rounded in B. auriventris McNeill; median carina distinct, low, cut behind middle by principal sulcus; lateral carina obsolete to distinct. Tegmina abbreviated or reaching end of abdomen. Hind femora surpassing apex of abdomen. Females usually dimorphic in color, considerably larger than males.

Key to the Species of Boopedon in Oklahoma

1. Posterior sulcus of pronotum, especially in the male, situated much behind the middle; tegmina of males abbreviated, not over one-half length of abdomen.....auriventris

   Posterior sulcus of pronotum of both sexes situated not far behind the middle; tegmina of males long, extending nearly to apex of abdomen or beyond.....2

2. General coloration of males uniformally black; hind femora of males black, except light subapical bands may be present. Females with outer faces of hind femora not barred.....nubilum

General coloration of males dark brown to black with light markings; hind femora of both sexes with distinct dark crossbars upon pale backgrounds.....gracile

Boopedon auriventris McNeill

Boopedon auriventris McNeill, 1899. Can. Ent. 31:54.

Boopedon savannarum Bruner, 1904. Biol. Centr. Amer., Orth. 2:97.

Characteristics: Females not showing extreme color dimorphism as in other two species of Boopedon. Both sexes brown to grayish-brown; lateral lobes of pronotum with yellowish-white bands along anterior borders and wider yellow-white bands occurring sub-marginally parallel to posterior borders; lateral carinae of pronotum obsolete; median carina cut by principal sulcus more posteriorly on pronotum than in other species. Tegmina of both sexes abbreviated, sharply rounded, but not lanceolate. Hind femora more slender than in other species; hind tibiae multicolored in both sexes as in B. gracile Rehn.

Comments and distribution: This species is rather limited in its distribution being restricted to forested areas in the eastern boundary of the Great Plains. The only exception to the above is the record of Hubbell, 1926, taken from the Black Mesa of the Panhandle. This collection was at least 200 miles west of the species' range otherwise. Boopedon auriventris McNeill is most often found in grassy clearings in the Postoak-Blackjack Type. It is the least common species of Boopedon in the State and is not often collected.

County records: Delaware, Rogers, Osage Pawnee, Payne, Hughes,

Pittsburg, Haskell, Pushmataha, Bryan, McClain, Comanche and Cimarron.

Boopedon nubilum (Say)

Gryllus nubilum Say, 1825. Jour. Acad. Nat. Sci. Phila. 4:308.

Boopedon nigrum Thomas, 1870. Proc. Acad. Nat. Sci. Phila., p. 83.

Boopedon flavofasciatum Thomas, 1870. Ibid., p. 84.

Boopedon fuscum Bruner, 1904. Biol. Centr. Amer., Orth. 2:96.

Characteristics: Both sexes with lateral carinae of pronotum not distinct; primary sulcus of pronotum situated not far behind the middle. Males shining black; tegmina reaching apex of abdomen or beyond; hind femora black, except light subapical bands may be present, hind tibiae red to reddish-black. Females green and brown in color; tegmina abbreviated, lanceolate; outer faces of hind femora not barred.

Comments and distribution: Arizona and the Great Plains States is the range of this species. It prefers thick grassy areas and is found in all regions of Oklahoma except the timbered areas of the east. The males are conspicuous, and active fliers, while the females are more or less secretive and, therefore, not often taken in collections. Adults have been reported from July through October.

County records: Cimarron, Texas, Beaver, Harper, Woods, Woodward, Rogers Mills, Beckham, Washita, Greer, Harmon, Jackson, Tillman, Comanche, Cotton, Murray and Seminole.

Boopedon gracile Rehn

Boopedon gracile Rehn, 1904. Proc. Acad. Nat. Sci. Phila. 56:519.

Boopedon nubilum var. *maculatum* Caudell, 1915. Proc. U. S. Nat. Mus. 49:29.

Characteristics: Both sexes with lateral carinae of pronotum distinct, at least on prozona; light yellowish-white bands extend from hind border of eye along lateral carinae; posterior sulcus of pronotum situated not far behind the middle as in *B. nubilum* (Say); hind femora with dark bars on both outer and inner faces; hind tibiae with pale subbasal rings followed by premedian dark rings, remainder reddish. Males blackish-brown to dark brown with light brown to buffy markings; tegmina extending to or beyond apex of abdomen. Females green and brown, or green with buffy markings; tegmina abbreviated and lanceolate.

Comments and distribution: *Boopedon gracile* Rehn is restricted to the southern Great Plains. It is usually found in dense grass such as occurs in bluestem prairies. In Oklahoma, it is restricted to the Tallgrass Prairie, Postoak-Blackjack Forest and Mixedgrass Eroded Plains Types. This species is not as often collected as *B. nubilum* (Say).

County records: Dewey, Major, Harmon, Jackson, Comanche, Cotton, Love, Murray, Grady, McClain, Cleveland, Pottawatomie, Seminole, Oklahoma, Kingfisher, Logan, Payne, Pawnee, Rogers and Craig.

Genus *Ageneotettix* McNeill, 1897

Ageneotettix McNeill, 1897. Psyche 8:71.

Eremnus McNeill, 1897 (preoccupied by Eremnus Schench). Proc. Dav. Acad. Sci. 6:267.

Genotype: Chrypochraon deorum Scudder, 1876. Bull. U. S. Geol. Surv. Terr. 2:262.

Note: Only one species of Ageneotettix McNeill is found in Oklahoma and the description which follows is based on that species.

Ageneotettix deorum deorum (Scudder)

Chrysochraon deorum Scudd., 1876. Bull. U. S. Geol. Surv. Terr. 2:262.

Aulocara scudderi Bruner, 1889. Proc. U. S. Nat. Mus. 12:63.

Phlibostroma parva McNeill, 1891. Psyche 6:64.

Ageneotettix deorum, Brun., 1905, Biol. Centr. Amer., Orth. 2:109.

Ageneotettix occidentalis Brun., 1905. Loc. cit.

Ageneotettix australis Brun., 1905. Biol. Centr. Amer., Orth. 2:110.

Ageneotettix arenosus Hancock, 1906. Ent. News. 17:253.

Ageneotettix deorum deorum, Hebard, 1935, Trans. Am. Ent. Soc. 61:283.

Characteristics: Short, mottled-brown species with reddish hind femora. Face somewhat receding; lateral foveolae conspicuous, rectangular, visible from above; frontal costa divergent downward, sulcate on botton portion; depression of vertex deep, no median carina present, bounding walls meeting at almost right angle in front; antennae longer than combined length of head and pronotum. Pronotum constricted; lateral

carinae absent on prozona, somewhat evident on metazona; median carina distinct throughout, cut by one sulcus; front margin truncate on dorsum, hind margin broadly rounded or angulate; lower-ventral margins of lateral lobes with front portions strongly ascending; light, hour-glass-shaped figure usually present on dorsum extending onto head; some specimens show pale medio-dorsal stripe extending from vertex of head to tip of tegmina. Tegmina brown or brownish-grey with small fuscous spots, opaque, variable in length, extending to, beyond, or shorter than apex of abdomen. Hind femora stout with indistinct crossbars on outer faces; hind tibiae red or orange-colored with pale basal annuli.

Comments and distribution: This is one of the most widespread and common grasshoppers of the Great Plains. In Oklahoma, it is most abundant in the shortgrass areas of the western and panhandle counties where it has done considerable damage in some years. All of the State is included in its range except the Oak-Hickory Forest and the Oak-Pine Forest Types of eastern and southeastern Oklahoma. Adults have been collected from June to November.

The western race, Ageneotettix, d. curtipennis Bruner occurs only in Arizona and Colorado.

County records: Cimarron, Texas, Beaver, Harper, Woods, Alfalfa, Major, Woodward, Ellis, Dewey, Blaine, Custer, Roger Mills, Beckham, Harmon, Greer, Jackson, Kiowa, Tillman, Caddo, Grady, Jefferson, Love, Garvin, McClain, Cleveland, Logan, Payne, Noble, Kay, Pawnee, Osage, Washington, Rogers, Ottawa, Tulsa, Wagoner, Okmulgee, Muskogee, Sequoyah, Seminole, Pontotoc, Bryan and Choctaw.

section immediately dorsal of the median ocellus with lateral margins subparallel; form of medium build.....,texana

Psoloessa texana Scudder

Psoloessa texana Scudd., 1875. Proc. Bost. Soc. Nat. Hist. 17:512.

Psoloessa ferruginea Scudd., 1875. Ibid., p. 513.

Psoloessa maculipennis Scudd., 1875, Loc. cit.

Psoloessa buddiana Bruner, 1890. Proc. U. S. Nat. Mus. 12:61.

Stirapleura pusilla Scudd., 1899. Proc. Amer. Acad. Arts Sci. 30:52.

Stirapleura mescalero Rehn, 1903. Proc. Acad. Nat. Sci. Phila. 55:719.

Psoloessa texana Hebard, 1925 (not Scudd. 1875). Proc. Acad. Nat. Sci. Phila. 77:66.

Characteristics: Head mottled with yellowish and blackish, lateral facial carinae united dorsally and vertrally with the frontal costa by cross carinae; lunate depressions present lateral to the median ocellus. Sides of pronotum mostly dull yellowish, each with a black, irregular, longitudinal band below the middle. Abdomen reddish above, duller on sides and ventrally.

Comments and distribution: Psoloessa texana Scudd. occurs in Oklahoma chiefly as intermediates between the races P. t. texana Scudd. and P. t. pawnee Rehn. In his monograph of the Genus Psoloessa, Rehn (1942) lists Oklahoma forms as either being intermediate between P. t.

texana and P. t. pawnee, or atypical P. t. pawnee. No true P. t. texana has been reported from the State. The reader is referred to the above paper of Rehn for a discussion of the characters involved in separating these races. Specimens of Psoloessa texana Scudd. in the OSU Museum, University of Michigan Museum of Zoology, plus an Ellis County record collection by me, all show intermediate characters between these two races. Psoloessa texana Scudd. is usually found in areas of short grass and has been reported from scattered locations throughout the State except the eastern one-third. It is not common in our collections.

County records: (Psoloessa texana, all subspecies)--Cimarron, Texas, Woodward, Beckham, Comanche, Logan, Cleveland and Hughes.

Psoloessa delicatula delicatula (Scudder)

Scyllina delicatula Scudd., 1876. Bull. U. S. Geol. Surv. Terr. 2:263.

Psoloessa coloradensis Thomas, 1876. Proc. Dav. Acad. Nat. Sci. 1:252.

Dociostaurus ornatus Scudd., 1876, Ann. Rept. Chief Eng. U. S. Army, 1876, Append. JJ, p. 507.

Stirapleura decussata Scudd., 1876. Ibid., p. 510.

Psoloessa? eurotiae Bruner, 1890. Proc. U. S. Nat. Mus. 12:62.

Stirapleura tenuicarina Scudd., 1899. Proc. Amer. Acad. of Arts and Sci. 35:53.

Characteristics: Similar to P. texana Scudd., except larger forms; lower one-half of sides of pronotum not contrastingly marked, frontal costa more sulcate, depression of vertex in female markedly transverse (Fig. 27), and frontal costa broader.

Comments and distribution: Psoloessa d. delicatula (Scudd.) is an inhabitant of short, sparse grasslands. Rehn (1942) gives its distribution as the Great Plains, southern Rocky Mountains, plateau sections of the Southwest, and the great Basin area. The eastern boundary of the distribution in Oklahoma is Cimarron and Texas counties in the Panhandle. The author did not collect this species in the study.

County records: Cimarron and Texas.

SUBFAMILY OEDIPODINAE WALKER, 1870

Face usually nearly vertical and rounded at its junction with the vertex; antennae filiform, never strongly modified; vertex generally flat to depressed, lateral foveolae present and clearly visible from above. Pronotum generally rugose and tuberculate with median carina often raised and crest-like, cut by one or more sulci, except in Arphia; hind margin of pronotum generally produced posteriorly forming an acute angle at or between the wing bases; lateral carinae usually weak or absent. Tegmina and wings fully developed; wings usually brightly colored and with black crossbands.

Many species of the Oedipodinae have vivid wing coloration; therefore, being very conspicious in flight. At rest, with the tegmina closed, they often possess a definite concealing coloration, the dull brown or grayish color of the wing covers blending well with the background. Oedipodids live, for the most part, on bare clay or rocky slopes, sandy areas, along roadsides and railways, and other areas of sparse vegetation.

Most of this subfamily produce loud crackling or popping sounds during flight. These noises may be due to the bases of the tegmina and wings rubbing together during flight, or in some cases, from a slackening and sudden tightening of the membrane between the stiff veins of the hind wing (Isely, 1937). True stridulation, produced by rubbing the hind femora against the rough edge of the tegmina while the insect is at rest, is also common among this subfamily.

The Oedipodinae are among our larger grasshoppers and, in general,

are active fliers and jumpers. Often they are very shy and alert and one must use considerable dexterity in approaching and capturing them.

Key to the Subfamily Oedipodinae (Banded - Winged Grasshoppers In Oklahoma)

1. Median carina of pronotum either cut by only one transverse sulcus or appearing entire.....2

   Median carina of pronotum cut by two transverse sulci, the anterior notch sometimes indistinct and the weaker of the two.....10

2. Hind wings hyaline, each possessing a submarginal band or cloud...3

   Hind wings colored, each usually with a dark submarginal band.....4

3. Tegmina with three dark crossbands; median carina of pronotum distinctly cut by principal sulcus; lateral carinae present on prozona of pronotum.....Encoptolophus

   Tegmina without distinct crossbands; median carina of pronotum cut by principal sulcus; lateral carinae not present on prozona of pronotum.....Chortophaga

4. Discs of hind wings black with pale yellow borders.....Dissosteira

   Discs of hind wings not black, dark submarginal bands present.....5

5. Vertex with or without a weak median depression which is divided by a comparatively broad, non-carinate, median area into two shallow dorso-lateral depressions.....Hippiscus

   Vertex with a distinct median impression which may or may not contain a narrow median carina, but which never completely separates the vertex into two parts.....6

6. Vertex behind the disc rugose or reticulate with raised lines, median carina present but broken within the disc.....7

   Vertex behind the disc smooth, without a median carina or only faintly

carinate.....8

7. Median carina of pronotum well-defined, not arcuate; large dark spots on tegmina; heavy-bodied species.....Pardalophora

Median carina compressed, generally high and arcuate; tegmina dark but no spots present; not heavy-bodied.....Arphia

8. Median carina of pronotum only a raised line; basal two-thirds of inside of posterior femora dark blue.....Hadrotettix

Median carina of pronotum well developed; basal two-thirds of inside of posterior femora not dark blue.....9

9. Median carina of pronotum very high, arched, posterior margin toothed, transverse sulcus not present.....Tripidolophus

Median carina prominent, weakly arched, margin not toothed, distinct transverse sulcus present.....Spharagemon

10. Median carina of pronotum cut by one deep sulcus and one shallow sulcus.....11

Median carina cut by two deep sulci.....15

11. Median carina of pronotum weakly developed, only a raised line...12

Median carina well-developed, definitely crestlike.....13

12. Pronotum rugose; wing discs yellowish-green or blue.....Leprus

Pronotum smooth; wind discs yellow.....Hadrotettix

13. Vertex behind the disc rough and wrinkled.....14

Vertex behind the disc comparatively smooth.....Spharagemon

14. Anterior sulcus of pronotal carina very weak and indistinct; pronotum roughened, but not extremely so.....Pardalophora

Anterior sulcus of pronotal carina distinct; pronotum extremely roughened.....Xanthippus

15. Posterior sulcus of pronotal carina much in advance of the middle, the part behind it being about twice the length of the part in

front.....16

Posterior sulcus of pronotal carina much nearer the middle, the part behind considerably less than twice the length of the part in front.....17

16. Marginal outlines of hind wings lobed, some anal veins thickened, crossbands usually incomplete or absent (Fig.34).....Circotettix

Marginal outlines of hind wings not lobed but rather even, anal veins not thickened, crossbands usually broad and complete (Fig.33).....Trimerotropis

17. Antennae much flattened, recessed on dorsal surfaces.....Psinidia

Antennae sometimes slightly flattened but not recessed on dorsal surfaces.....18

18. Posterior angles of lateral lobes of pronotum broadly rounded (Fig.36).....19

Posterior angles of lateral lobes of pronotum never broadly rounded (Fig.35).....20

19. Lateral ridges or elevations present on posterior region of pronotum (metazona) adjacent to the median carina.....Derotmema

Posterior region of pronotum smooth or with scattered granulations.....Mestobregma

20. Median carina of pronotum very low on mesozona and metazona..Rehnita

Median carina of pronotum raised on mesozona and metazona.....21

21. Hind wings clear (may be light yellow basally), each with light crossbands; inner surface of hind femora black and yellow .....Trachyrhachys

Hind wings red or yellow, each with a dark crossband; inner surface of hind femora blue.....Metator

Genus Encoptolophus Scudder, 1875

Encoptolophus Scudd., 1875. Proc. Bost. Soc. Hist. 17:478.

Genotype: Oedipoda sordida Burmeister, 1838. Handb. Ent. 2:643.

Characteristics: Head with disc of vertex roughly traingular, recessed; median carina present on basal one-half; lateral foveolae distinct, triangular. Hind margin of pronotum forming right angle; median carina distinct, cut slightly ahead of the middle by a single, distinct, transverse sulcus; lateral carina present on prozona and metazona, sometimes not distinct on prozona. Tegmina short, possessing two dark bands on a lighter background; hind wings hyaline with smoky clouds near outer edges, no crossbands present. Hind femora more or less banded on outer faces.

Key to species of Encoptolophus in Oklahoma

1. Crest of median carina on prozona a straight line, (higher and more distinct than in E. subgracilis texensis Brun.)..sordidus costalis

   Crest of median carina on prozona a wavy line (sometimes broken) .....subgracilis texensis

Encoptolophus sordidus costalis (Scudder)

Encoptolophus costalis Scudd., 1862. Bost. Journ. Nat. Hist. 7:473.

Encoptolophus parvus Scudd., 1875. Proc. Bost. Soc. Nat. Hist. 17:478.

Encoptolophus coloradensis Bruner, 1904. Bull. Agr. Exp. Sta. Colo. 99:58.

Encoptolophus montanus Brun., 1905. Biol. Centr. Amer. Orth. 2:140.

Encoptolophus sordidus costalis, Hebard, 1934. Ent, News 45:104.

Characteristics: Rather robust light brown to yellowish-brown grasshoppers with dark mottlings. Antennae brown at bases, apical portions darker. Pronotum usually with a pale X-shaped mark on the disc; crest of median carina a straight line on prozona. Tegmina with two dark distinct crossbands; hind wings hyaline in discal areas, usually with yellowish tinges, dark clouds present apically. Hind femora with outer faces indistinctly banded with brown to black markings; hind tibiae glaucous to blue with sub-basal pale rings.

Comments and distribution: This grasshopper prefers upland pastures, open woodlands and weedy areas such as along roadways and fence rows. In this respect its habits differ from E. subgracilis texensis Brun. which prefers a prairie environment with scanty vegetation. Encoptolophus s. costalis (Scudd.) is most numerous in the western and northern sections of the State.

County records: Bryan, Jefferson, Harmon, Kiowa, Beckham, Payne, Grant, Kay, Noble, Osage, Alfalfa, Woods, Woodward, Ellis, Harper, Beaver, Texas and Cimarron.

Encoptolophus subgracilis texensis Bruner

Encoptolophus texensis Brun., 1905. Biol. Centr. Amer., Orth. 2:142.

Encoptolophus subgracilis Caudell, 1903. Proc. Ent. Soc. Wash. 5:163.

Encoptolophus subgracilis texensis, Hebard, 1938, Okla. Agr. Exp. Sta. Tech. Bull. 5:16.

Characteristics: Very closely resembling E. sordidus costalis (Scudd.) and difficult to differentiate from it. The X-shaped mark on the pronotal disc is not as often found nor as distinct in E. subgracilis texensis Brun. as in E. sordidus costalis (Scudd.), also the tegminal crossbands are more distinct in the latter. As stated in the above key to the species of Encoptolophus, the crest of the median carina of pronotum is a straight line on the prozona of E. sordidus costalis (Scudd.); whereas, in E. subgracilis texensis Brun. the crest is a wavy or broken line.

Comments and distribution: This species is restricted largely to the southwestern United States. In Oklahoma, it is found in prairie areas of the western one-half.

County records: Payne, Grant, Jefferson, Tillman, Comanche, Kiowa, Greer, Harmon, Jackson, Harper and Beaver.

Genus Chortophaga Saussure, 1884

Chortophaga Sauss., 1884. Prodr. Oedip. 28:43.

Tragocephala Harris, 1841 (not of Dupont). Rept. Ins. Mass., p. 146.

Genotype: Acrydium viridifasciatum De Geer, 1773. Mem. Hist. Nat. Ins. 3:498.

Note: This genus is represented only by one species in Oklahoma; therefore, the generic and specific characteristics are combined.

Chortophaga viridifasciata (De Geer)

Acrydium viridifasciatum DeGeer 1773. Mem. Hist. Nat. Ins. 3:498.

Gryllus virginianus Fabricius. 1775. Syst. Ent. p. 291.

Gryllus (Locusta) chrysomelas Gmelin, 1788. Syst. Nat. 1 (4):2086.

Acridium marginatum Olivier, 1791. Encycl. Meth. 6:229.

Acridium hemipterum Beauvois, 1817. Ins. Afr. and Amer., p. 145.

Locusta (Tragocephala) radiata Harris, 1841. Rept. Ins. Mass., p. 148.

Locusta (Tragocephala) infuscata Harris, 1841. Ibid. p. 147.

Tomonotus zimmermanii Saussure, 1861. Rev. Zool. (2) 13:320.

Chortophaga viridifasciata, Sauss., 1884, Prodr. Oedip. 28:72.

Characteristics: Small to medium-sized specimens with rather slender bodies. Face appearing slanted; frontal costa sulcate below ocellus, narrowed slightly above level of antennae; antennae somewhat flattened. Pronotum with hind margin acutely margined; median carina high with sharp crest, faintly cut by one sulcus; lateral carinae not present on prozona. Tegmina distinctly longer than abdomen; hind wings hyaline, faint yellow in discal areas, possessing fuscous submarginal bands or clouds. Hind tibiae always with pale sub-basal rings.

Comments and distribution: This species shows definite dimorphic color characteristics. Specimens may range from green with brown tegminal markings to entirely brown in color. A higher percentage of the females tend to be green than males. Chortophaga viridifasciata (De Geer) overwinters in the nymphal stage; consequently, it is one of the first grasshoppers to appear in the spring. The writer has taken adult specimens in late March and early April. Two generations per year are found in

Oklahoma. It is common throughout the State and prefers meadows and other grassy area.

County records: McCurtain, LeFlore, Choctaw, Bryan, Atoka, Pittsburg, Latimer, Sequoyah, Muskogee, Adair, Wagoner, Mayes, Rogers, Ottawa, Tulsa, Osage, Kay, Pawnee, Payne, Logan, Oklahoma, Pottawatomie, McClain, Seminole, Hughes, Pontotoc, Garvin, Murray, Love, Jefferson, Grady, Canadian, Caddo, Comanche, Kiowa, Tillman, Harmon, Dewey, Ellis, Woodward, Woods, Alfalfa, Harper and Texas.

Genus Dissosteira Scudder, 1876

Oedipoda Latreille, 1825, and others (in part). Fam. Nat. Regne Anim.

Dissosteira Scudder, 1876. Ann. Rept. of Geog. Surv. W. 100th Merid. App. JJ, p. 511.

Genotype: Gryllus (Locusta) carolinus Linnaeus, 1758. Syst. Nat. 10th ed., p. 433.

Characteristics: Grasshoppers with elongate, slender and compressed bodies. Wings much exceeding abdomen. Vertex elevated with the disc impressed and divided longitudinally by a low, median carina; broad between eyes. Pronotum with high, sharp, median carina; incised anterior to the middle with a deep, oblique sulcus. Tegmina and wings broad, long; wings not banded, large, black, with a narrow yellowish border along outer edges.

This genus contains the longest-winged grasshoppers in Oklahoma.

Key to the species of Dissosteira in Oklahoma

1. Tegmina usually plain, sometimes slightly fasciate with spots. Pronotal crest of moderate height.....carolina

   Tegmina always fasciate with darker colored spots; marked contrast between dark areas and background. Pronotal crest higher than above.....longipennis

Dissosteira carolina (Linnaeus)

Gryllus (Locusta) carolinus Linn., 1758. Syst. Nat., 10th ed., p. 433.

Acrydium carolinum De Geer, 1773, Mem. Hist. Ins. Orthop. 3:491.

Gryllus carolinus, Fabricius, 1775, Syst. Ent., p. 291.

Locusta carolina Harris, 1883, Hitchcock Rept. Geol. Mass., p. 583.

Oedipoda carolina, Burmeister, 1838, Handb. Entom., p. 643.

Dissosteira carolina, Scudder, 1876, Rept. U. S. Geol. Surv. W. 100th Merid. App. JJ, p. 511.

Characteristics: Median carina of pronotum on prozona of moderate height. Tegmina either plain or sprinkled with small, dark dots; wings dark with a greenish-yellow marginal area about one-half the width of tegmina; marginal areas much widened at apices.

Comments and distribution: This is perhaps the most widely-known grasshopper in the United States due largely to its striking appearance and its habit, uncommon among most grasshoppers, of frequenting roadways and other habitats of man. The adults prefer roadways, margins of

cultivated lands, open meadows and other bare areas. Somes (1914) refers to the Carolina locust as "an insect primarily of dusty places and may be found wherever bare earth, sand or clay is exposed." It occurs throughout all of Oklahoma. When numerous, it may damage growing crops such as corn, sorghums, cotton, potatoes, etc.

County records: Cimarron, Texas, Beaver, Harper, Woods, Woodward, Dewey, Custer, Roger Mills, Beckham, Kiowa, Jackson, Comanche, Jefferson, Love, Murray, Pontotoc, Cleveland, Pottawatomie, Canadian, Blaine, Logan, Payne, Kay, Osage, Tulsa, Ottawa, Cherokee, Adair, Okmulgee, Muskogee, Sequoyah, Hughes, Pittsburg, LeFlore and McCurtain.

Dissosteira longipennis (Thomas)

Oedipoda longipennis Thos., 1872. Hayden's Rept. U. S. Geol. Surv. Terr., Vol. 5:463.

Dissosteira longipennis, Scudder, 1876, Rept. U. S. Geol. Surv. W. 100th. Merid., Append. JJ, p. 511.

Oedipoda nebraskensis Bruner, 1876. Canad. Ent. 8:123.

Characteristics: The head and pronotum, especially dorsal portions, pale reddish. Median carina of pronotum high and subcristate on prozona. Tegmina covered with dark spots some of which may be in the shape of bands. Wings black with narrow yellowish outer margins as in D. carolina (Linn.).

Comments and distribution: This species is most abundant in the Shortgrass Highplains Type of the Panhandle and Northwest. It is generally found in bare areas, especially where poor soil is present. Unlike D.

carolina (Linn.), it prefers open areas away from roads and habitations.

County records: Cimarron, Texas, Beaver, Harper, Woods, Woodward, Major, Alfalfa, Ellis, Roger Mills, Beckham, Dewey, Custer, Washita, Harmon, Greer, Jackson, Kiowa, Tillman, Comanche, Jefferson, Love, Caddo, Canadian, Oklahoma, Blaine, Kingfisher, Garfield, Grant, Kay, Payne, Pawnee, Osage, Okfuskee, Okmulgee, McIntosh, Pittsburg, Haskell, LeFlore, Sequoyah and Cherokee.

Genus Hippiscus Saussure, 1861

Hippiscus Sauss., 1861. Rev. Mag. Zool. 24:398.

Genotype: Oedipoda (Hippiscus) ocelota Sauss., 1861. Rev. Mag. Zool. 24:398.

Note: The genus is represented by one species and the description below is of that species.

Hippiscus rugosus Scudder[1]

Oedipoda rugosa Scudd., 1862. Bost. Jour. Nat. Hist. 7:469.

Hippiscus rugosus, Scudd., 1874, Rep. Geol. N. Hamp. p. 377.

Hippiscus compactus Scudd., 1892. Psyche 6:268, 288.

Hippiscus variegatus Scudd., 1892. Ibid., p. 301.

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[1]Hebard (1945, Trans. Amer. Ent. Soc. 71:86) used H. ocelote Sauss. in his list of Orthoptera in the vicinity of Hot Springs, Virginia. He might have considered H. rugosus (Scudd.) as a synonym of H. ocelote Sauss. but made no comments about the matter; therefore, I am including Oklahoma material as H. rugosus (Scudd.).

Hippiscus suturalis Scudd., 1892. Loc. cit.

Hippiscus citrinus Scudd., 1901. Can. Ent. 33:88.

Hippiscus immaculatus Morse, 1906. Psyche 13:119.

The Group Hippisci of the Oedipodinae includes the Oklahoma genera Hippiscus, Xanthippus, Leprus, and Pardalophora. All were described by Saussure, either in 1861 or 1884, the three former being described as distinct genera and Pardalophora as a subgenus of Hippiscus. Scudder, in 1892, discarded Pardalophora altogether and recognized only the genera Hippiscus and Leprus. Bruner (1905) followed Scudder somewhat, but placed Hippiscus, Xanthippus, and Pardalophora under the single genus Hippiscus. Kirby (1910) and Rehn and Hebard (1916, and other dates) recognized the genera Hippiscus, Xanthippus, and Leprus of Saussure and elevated his subgenus Pardalophora to generic rank. Blatchley (1920), not in agreement with Kirby, and Rehn and Hebard, discarded Pardalophora, as Scudder had done; thus, placing the species of Pardalophora under the genus Hippiscus. The subgenus Pardalophora of Saussure was based primarily on the absence of cross carinae of the vertex. Blatchley believed this to be a minor character, the transverse carina being present, as well as absent, in the same species. At the present time, most workers follow the generic categorization of Kirby, and Rehn and Hebard; however, all will agree that the Group Hippisci is badly in need of revision.

Characteristics: Head and thorax generally dark brown, occiput rounded giving a convex appearance. Two light-yellowish bands run from eyes backwards and inwards, meeting a little in advance of mid-pronotum where they diverge, striking the hind edge of the pronotum at the outer angles (may be indistinct in females). Disc of vertex almost flat, not

well-defined, divided by a flat median carina into two shallow lateral depressions which are further divided by an oblique cross carina, resulting in the disc being divided into four subequal parts, the front pair more distinct. Pronotum with median carina low, cut near middle by principal sulcus; metazona fairly flat, its surface with numerous low, oblong-to-elongate, glistening tubercules. Discs of hind wings either reddish or yellow. Hind tibiae yellow with pale rings near the bases.

Comments and distribution: Hippiscus rugosus Scudd. is most abundant in upland meadows, open woodlands and other grassy areas of the eastern one-half; however, it is found in all areas of the State. H. rugosus Sauss. is one of the latest grasshoppers to diappear in the fall. Adults are often found in late October and November.

County records: LeFlore, Sequoyah, Cherokee, Adair, Ottawa, Rogers, Wagoner, Okmulgee, Pittsburg, Hughes, Latimer, Pushmataha, Choctaw, Bryan, Marshall, Pottawatomie, Creek, Payne, Pawnee, Noble, Kay, Grant, Alfalfa, Blaine, Canadian, Oklahoma, Cleveland, McClain, Jefferson, Comanche, Tillman, Kiowa, Harmon, Caddo, Custer, Woods, Harper and Texas.

Genus Pardalophora Saussure, 1884

Pardalophora Sauss., 1884. Prodr. Oedip. 28:83.

Hippiscus Scudder, 1892 (in part). Psyche 6:265, 266.

Genotype: Oedipoda phoenicoptera Burmeister, 1838. Burm. Handb. Ent. 2:643.

Many workers following Saussure placed Pardalophora in the genus Hippiscus, including Scudder, Bruner, Blatchley, and Somes. Kirby resurrected the name Pardalophora in 1910. It is in use by most workers today.

Characteristics: Large, heavy-bodied forms, ash-brown to gray in color with large, dark spots on tegmina. Head with frontal costa not sulcate toward vertex (except in P. saussurei Scudder), constricted above antennal bases, lateral foveolae of vertex small, triangular; disc of vertex definitely impressed with narrow, median carina which never completely separates the disc into two separate compartments; vertex behind the disc, rugose or reticulate with raised lines. Pronotum rugose, but not as strongly as in Xanthippus Sauss.; median carina of medium height, cut by one transverse sulcus, except a few specimens may have, in addition, a faint, anterior sulcus.

Key to the Species of Pardalophora in Oklahoma

(Modified from Bruner, 1905 and Blatchley, 1920)

1. Anterior portion of disc of vertex not prolonged, narrowing rapidly, front as broad or broader than one-half the width at middle; hind margin of pronotum usually rectangulate.....2

   Anterior portion of disc of vertex prolonged, narrowing gradually, front less than one-half the width at middle; hind margin of pronotum usually more acutely-angled than above.....3

2. Inner faces of hind femora dark blue; tubercules on disc of metazona rounded or oblong, not forming ridges parallel to hind margin .....phoenicoptera

Inner faces of hind femora reddish to yellow; tubercules on disc of metazona more or less united to form oblique ridges parallel to hind margin.....haldemanii

3. Metazona with two pairs of distinct lateral rugae parallel to hind margin.....saussurei

Metazona without lateral rugae.....apiculata

Pardalophora phoenicoptera (Burmeister)

Oedipoda phoenicoptera Burm., 1838. Handb. Ent. 2:643.

Oedipoda discoidea Serville, 1839. Hist. Nat. Orthop., p. 724.

Hippiscus teranus, Stal., 1873, Recens, Orthop., P. 121.

Hippiscus ploenicopterus Saussure, 1884, Prodr. Oedip. 28:87.

Hippiscus texanus Scudder, 1892. Psyche 6:267, 286.

Pardalophora phoenicoptera, Kirby, 1910, Synon. Cat. Orthop., Vol. 3:206.

Characteristics: General color ash or reddish brown, often infiltrated with green on pronotum, head and hind femora. Frontal costa narrowed at upper extremity; disc of vertex not prolonged in front but narrowing rapidly. Pronotum cut by only one sulcus; hind margin usually rectangulate; tubercules on disk round or oblong, never forming definite ridges. Inner faces of hind femora deep blue with light bars near the apices.

Comments and distribution: This species is most commonly taken in the eastern one-half of the State. It prefers grasslands and open meadows

in woodlands. The Comanche County record marks this species western limits in the United States.

County records: McCurtain, LeFlore, Pushmataha, Adair, Delaware, Ottawa, Mayes, Payne, Carter and Comanche.

Pardalophora haldemanii (Scudder)

Oedipoda haldemanii Scudd., 1872. U. S. Geol. Surv. Nebr., Final Rept., p. 251.

Hippiscus haldemanii, Scudd., 1876, Bull. U. S. Geol. Surv. Terr., p. 264.

Hippiscus nanus Saussure, 1884. Prodr. Oedip. 28:86, 87.

Hippiscus tigrinus Scudd., 1892. Psyche 6:334.

Pardalophora haldemanii, Kirby, 1910, Synon. Cat. Orthop., Vol. 3:206.

Characteristics: General color greyish-brown with form and size resembling P. phoenicoptera (Burm.). Frontal costa narrowed at upper extremity; disc of vertex narrowed rapidly anteriorly, in most specimens. Pronotum either cut by one or two sulci; hind margin more or less rectangulate; tubercules on disk of metazona united to form oblique ridges parallel to hind margin. Inner faces of hind femora generally yellow, but may vary to reddish.

Comments and distribution: This species is found throughout the entire State and prefers bare areas and regions with low, scattered grasses. It has variable characteristics and is often hard to separate

from other species of Pardalophora and the genus Xanthippus Sauss. Hebard (1938) noted that the majority of specimens examined by him showed a variation toward P. sausseri (Scudd.).

County records: Cimarron, Texas, Beaver, Harper, Woods, Alfalfa, Roger Mills, Custer, Harmon, Kiowa, Comanche, Caddo, Canadian, Logan, Payne, Pawnee, Osage, Tulsa, Rogers, Craig, Ottawa, Cherokee, Latimer, Pittsburg, Pontotoc, Bryan and McClain.

Pardalophora saussurei (Scudder)

Hippiscus saussurei Scudd., 1892. Psyche 6, pp. 268,302.

Pardalophora saussurei, Kirby, 1910, Synon. Cat. Orthop., Vol. 3:206.

Characteristics: Color and size resembling P. haldemanii (Scudd.). Frontal costa sulcate toward the vertex, narrowed above the level of the antennae; disc of vertex prolonged anteriorly, narrowing gradually. Pronotum either cut by one or two sulci; hind margin more acute than in P. haldemanii (Scudd.) and P. phoenicoptera (Burm.); metazona with two pairs of lateral rugae running parallel to hind margin. Inner faces of hind femora blue with yellow to red crossbands toward the apices.

Comments and distribution: This species is restricted to Kansas, Oklahoma, Texas and New Mexico. Its known Oklahoma distribution includes all the State except the Panhandle and the extreme southeastern and northeastern portions.

County records: Harper, Woods, Alfalfa, Major, Dewey, Roger Mills,

Custer, Beckham, Greer, Kiowa, Harmon, Jackson, Comanche, Jefferson, Caddo, Canadian, Oklahoma, Cleveland, Payne, Logan, Osage, Tulsa, Rogers, Hughes, Latimer, Choctaw, Bryan and Love.

Pardalophora apiculata Harris

Pardalophora tuberculata, Beauvois, 1805. Ins. Afr. Amer., p. 145 (not of Fabricius, 1775).

Locusta apiculata Harris, 1835. (In Hitchcock) Rept. Geol. Mass., 2nd ed., p. 576.

Oedipoda obliterata Burmeister, 1838. Burm. Handb. Ent. 2:643.

Locusta corallina Harris, 1862. Rept. Ins. Inj. Veg. 3rd ed., p. 176.

Pardalophora apiculata, Morse, 1920, Proc. Bost. Soc. Nat. Hist. 35:462.

Characteristics: General color ash brown, darker above than below. Frontal costa narrowed above level of antennae; anterior portion of disc of vertex prolonged, narrowing gradually. Antennae yellowish at bases. Disc of pronotum almost flat, very little wrinkled and bearing a few small, rounded, black tubercules. Wings coral-red near bases. Hind femora with basal one-half of inner faces dark-blue to black, apical one-half yellow with median, black bars. Hind tibiae dull yellow with an orange tinge.

Comments and distribution: The only Oklahoma records in the literature are; Hebard (1938) cited one specimen collected from McCurtain County and Caudell (1902) reported the species from Cherokee Nation,

Indian Territory.

County records: McCurtain.

Genus *Arphia* Stal, 1873

Tomonotus Saussure, 1861 (in part). Rev. Mag. Zool. 13:319.

Arphia Stal, 1873. Recens. Orthop. 1:113.

Genotype: *Gryllus sulphureus* Fabricius, 1871. Spec. Ins. 1:369.

Characteristics: Medium to large grasshoppers with moderately compressed bodies, dark in coloration. Disc of vertex with median carina often divided by a curved, transverse impression behind the middle; frontal costa narrowed at top, widened and sulcate below; foveolae large and shallow. Pronotum acutely produced, posteriorly; median carina compressed, generally high and arcuate, appearing entire. Tegmina dark, no distinct spots present, leathery in texture, densely reticulate with larger cells on apical third; hind wings brightly colored, red to yellow on the discs. Hind femora stout with basal halves dilated.

Key to the Species of *Arphia* in Oklahoma

1. Frontal costa with sides not sharply narrowed above level of antennae, there more than one-half as wide as below the ocelli.....2
   Frontal costa narrowed above level of antennae to less than one-half its width below the ocelli.....3
2. Median carina of pronotum strongly elevated; distinctly arched in profile view, not cut by transverse sulcus; subcostal spurs in hind wings extending approximately one-third way to base of

wings.....xanthoptera

Median carina weakly elevated almost straight in profile view, cut near the middle by transverse sulcus; subcostal spurs extending over half-way to base of wings.....p. pseudonietana

3. Disc of vertex with length greater than width, vertex meeting frontal costa at a faint obtuse angle.....4

Disc of vertex with length no greater than width, vertex meeting frontal costa at a distinct angle,.....sulphurea

4. Subcostal spurs in hind wings removed from costal margins about twice their width.....simplex

Subcostal spurs in hind wings in close proximity to costal margins .....conspersa

Arphia xanthoptera (Burmeister)

Oedipoda xanthoptera Burm., 1838. Handb. Ent. 2:643.

Oedipoda carinatus Scudder, 1869. Trans. Amer. Ent. Soc. 2:36.

Tomonotus xanthopterus Thomas, 1873, Rept. U. S. Geol. Surv. Terr. 5:105.

Arphia xanthoptera Scudder, 1874, Hitchcock's Rept. Geol. N. H., p. 377.

Arphia crepusculum Saussure, 1884. Prodr. Oedip. 28:67.

Characteristics: Light to dark-brown medium-sized grasshoppers, frontal costa at junction with vertex more than one-half its width immediately below ocelli. Median carina of pronotum very high, cristate, entire, distinctly arched, hind margin acute. Tegmina often

mottled with slight fuscous markings; discs of hind wings bright yellow or orange red; subcostal spurs in hind wings extend approximately one-third distance to base of wings. Apical portions of hind femora dark; hind tibiae black with distinct light rings near bases.

Comments and distribution: This species is found in dry, untilled land such as old fields and weedy pastures, borders of woodlands and roadsides. Adults are present from July to November. The range of Arphia xanthoptera (Burm.) includes all game type areas of the State. The Cimarron County record marks its western-most limit of distribution in the United States.

County records: LeFlore, Sequoyah, Latimer, Wagoner, Mayes, Delaware, Tulsa, Okmulgee, Creek, Osage, Pawnee, Payne, Okfuskee, Hughes, Pottawatomie, Cleveland, McClain, Comanche, Beckham, Ellis, Harper, Alfalfa and Cimarron.

Arphia pseudonietana pseudonietana (Thomas)

Tomonotus pseudonietanus Thos., 1870. Proc. Acad. Nat. Sci. Phila., p. 82.

Oedipoda tenebrosa Scudder, 1871. Rept. U. S. Geol. Surv. Nebr. P. 251.

Arphia sanguinaria Stal, 1873. Recens. Orthop. 1:119.

Arphia ovaticeps Saussure, 1884. Prodr. Oedip. 28:127.

Tomonotus theresiae Brunner, 1895. Berl. Ent. Zeits. 40:277.

Arphia calida Bruner, 1905. Biol. Cent. Amer., Orth. 2:127.

Arphia pseudonietana, Somes, 1914, Univ. of Minn. Agr. Exp. Sta. Bull. 141, Tech., p. 36.

Characteristics: General color pattern extremely variable, the males sometimes nearly black, females often grayish-brown mottled with darker spots and blotches. Frontal costa slightly converging in upper third. Median carina of pronotum elevated but not cristate, slightly arched, cut by a single slight notch in front of middle. Discal areas of hind wings bright orange-red; subcostal spurs extend more than one-half way to base of wings.

Comments and distribution: Arphia p. pseudonietana (Thos.) prefers dry, open areas with light soil and is often taken in weedy habitats. Adults are found from July through early fall. At present, this species has been reported only from the panhandle and southeastern sectors. More intensive collecting will probably show it to be present in other areas of the State. The writer's Bryan County record is undoubtedly near the southeastern limits of the distribution of the species.

County records: Cimarron, Texas and Bryan.

Arphia sulphurea (Fabricius)

Gryllus sulphureus Fabricius, 1781. Spec. Ins. 1:369.

Acridium sulphureum, Olivier, 1791, Encycl. Meth. 6:227.

Locusta sulphurea, Harris, 1833, Hitchcock's Rept. Geol. Mass., p. 583.

Oedipoda sulphurea, Burmeister, 1838, Handb. Ent. 2:643.

Acridium (Oedipoda) sulphureum, Haan, 1842, Bijdr. Kenn. Orthop., p. 143.

Tomonotus sulphureus, Thomas, 1873, Rept. U. S. Geol. Surv. Terr. 5:105.

Arphia sulphurea, Stal, 1873, Recens. Orthop. 1:119.

Characteristics: General coloration varies from dark brown to light brown, abdomen yellow to light red. Frontal costa sharply narrowed above level of antennae; vertex meeting frontal costa at a distinct acute angle; disc of vertex no longer than wide, front half ascending. Pronotum with median carina low, entire and slightly arched. Tegmina often covered with small, indistinct fuscous spots; hind wings with basal two-thirds bright sulphur-yellow; subcostal spurs extending almost to bases of wings along the costal margin. Hind femora with pale ring near knees; hind tibiae blackish or blue-black with pale sub-basal rings.

Comments and distribution: This species generally prefers dry upland pastures, open woodlands, along roadsides and bare rocky areas. Arphia sulphurea (Fab.) passes the winter in the nymphal stage and reaches aturity around the first of May. Its gregarious and active habits, plus the fact that it is a noisy stridulator while in flight, makes it one of the best known of our spring and summer Acrididae. It has been reported from many of the eastern, central and mid-western counties of Oklahoma.

County records: McCurtain, LeFlore, Sequoyah, Pittsburg, Atoka, Pushmataha, Bryan, Johnston, Carter, Murray, Okmulgee, Tulsa, Adair, Delaware, Ottawa, Mayes, Craig, Rogers, Washington, Payne, Oklahoma,

Cleveland, Comanche, Custer, Dewey and Alfalfa.

Arphia simplex Scudder

Arphia simplex Scudd., 1875. Proc. Bost. Soc. Nat. Hist. 17:514.

Arphia luteola Scudd., 1875. Ibid., p. 515.

Arphia decepta Bruner, 1905. Biol. Centr. Amer., Orthop. 2:132.

Characteristics: Of a general brownish fuscous color, the males with abdomen light yellow. Lower one-half of face ashy color; frontal costa narrowed above level of antennae to less than one-half its width below ocelli; vertex meeting frontal costa at an obtuse angle; disc of vertex no longer than broad; lateral foveolae broad, large. Pronotum with median carina low, only very slightly arched. Tegmina with fuscous spots; rear wings yellow-through-orange in discal areas, partly pellucid beyond the arcuate bands; subcostal spurs tapering, removed from costal margins about twice their width, extending over one-half way to wing bases. Hind tibiae with pale annuli near bases.

Comments and distribution: This species is commonly found in dry, open grasslands with light soil and along roadways. It is the most common species of Arphia in the State and has been reported from early spring until late summer. All sections of Oklahoma, except the Panhandle, are included in its range.

County records: Harper, Woods, Woodward, Alfalfa, Major, Dewey, Custer, Beckham, Kiowa, Jackson, Harmon, Caddo, Comanche, Cotton, Murray, Jefferson, McClain, Cleveland, Oklahoma, Payne, Pawnee, Osage, Washington, Tulsa, Rogers, Mayes, Craig, Ottawa, Pittsburg, Atoka, LeFlore, Choctaw

and Bryan.

Arphia conspersa Scudder

Arphia conspersa Scudd., 1875. Proc. Bost. Soc. Nat. Hist. 17:514.

Arphia frigida Scudd., 1875. Dawson's Rept. Geol. 49th Parallel, p. 344.

Arphia teporata Scudd., 1876. Ann. Rept. Chief Eng. p. 505.

Arphia arcta Scudd., 1876. Bull. U. S. Geol. Surv. Terr. 2:263.

Arphia infernalis Saussure, 1884. Prodr. Oedip. 28:70.

Characteristics: Brown to reddish-brown above, yellowish below. Frontal costa narrowed sharply above level of antennae; vertex and frontal costa meeting at obtuse angle; disc of vertex deep, no longer than wide, lateral walls well-defined; median carina of vertex distinct. Pronotum with median carina low, notched near the middle. Tegmina sprinkled with small, fuscous spots; discs of hind wings range from yellow to reddish; crossbands narrow, apical one-third pellucid; subcostal spurs situated close to costal margins, extending nearly to bases of wings. Hind tibiae pale yellow with brownish apices and on basal one-third.

Comments and distribution: Arphia conspersa Scudd. is generally found among sparse grasses in areas of light, well-drained soil. Brooks (1958) reports it as a mixed-feeder. It is rather rare in our collections and is reported from only a few counties in the central, western and panhandle portions of the State. The distribution of this species in the United States is west of the Mississippi River.

County records: Cimarron, Texas, Alfalfa, Comanche, Harmon, Cleveland

and Payne.

Genus Hadrotettix Scudder

Hadrotettix Scudd., 1876. Ann. Rept. U. S. Chief Eng., App. JJ: 291.

Genotype: Gryllus trifasciatus Say, 1825. Amer. Ent. 2, pl. 34.

Note: Only one species of this genus is found in Oklahoma; therefore, the description is based on the species.

Hadrotettix trifasciatus (Say)

Gryllus trifasciatus Say, 1825. Amer. Ent. pl. 34.

Oedipoda pruninosa Thomas, 1870. Proc. Acad. Nat. Sci. Phila., p. 80.

Oedipoda trifasciata, Glover, 1872, Illust. N. Amer. Ent., Orthop., pl. 9, Fig. 6.

Oedipoda hoffmanii Thos., 1873. Rept. U. S. Geol. Surv. Terr. 5:127.

Hadrotettix trifasciatus, Scudder, 1876, Ann. Rept. U. S. Chief, Eng., App. JJ:291.

Characteristics: Color grey to brown, sometimes reddish-brown. Vertex of head declivent; eyes prominent; antennae considerably longer than hind femora. Pronotum flattened with a very low median carina; two transverse sulci cutting carina well in advance of middle; metazona very finely reticulate; lateral carinae absent; hind margin of pronotum acute. Tegmina surpassing length of abdomen with three prominent, black bands present. Hind wings with discal areas greenish-yellow; crossbands

broad, black without subcostal spurs. Outer faces of hind femora with oblique, post-median black bars, inner faces bluish-black with broad, pale, subapical crossbars; hind tibiae pinkish-orange to yellow.

Comments and distribution: Hadrotettix trifasciatus (Say) is most commonly found in areas of gravelly soil and bare hillsides. There is a definite correlation between its coloration and the color of the soils upon which it resides. Reddish-brown specimens often are found in the "red-bed plains" area of the central area. It is found throughout the State but is most abundant in the western one-half. Adults are found from June through September.

County records: Cimarron, Texas, Beaver, Harper, Woods, Alfalfa, Woodward, Major, Blaine, Custer, Roger Mills, Beckham, Harmon, Jackson, Kiowa, Tillman, Cotton, Comanche, Jefferson, Caddo, Canadian, Cleveland, Logan, Payne, Osage, Creek, Tulsa, Rogers, Craig, Wagoner, LeFlore, Pushmataha, Choctaw, Pittsburg, Bryan, Johnston, Hughes and Murray.

Genus Tropidolophus Thomas

Tropidolophus Thos., 1873. Rept. U. S. Geol. Surv. Terr. 5:138.

Cyrtolopha Stal, 1873. Recens. Orthop. 1:118.

Genotype: Gryllus formosus Say, 1825. Amer. Ent. 2, pl. 34.

Note: The genus Tropidolophus is represented by only one species; hence, the specific description will also serve as the generic description.

Tropidolophus formosus (Say)

Gryllus formosus Say, 1825. Amer. Ent. 2, pl. 34.

Tropidolophus formosus Thos., 1873, Rept. U. S. Geol. Surv. Terr. 5:138.

Characteristics: Body of medium size, very slender with pale green color and yellowish antennae. Head short; width about equal to length; occiput rounded; disc of vertex deflexed with margins elevated and continuous with the sides of the deeply sulcate frontal costa; antennae robust, longer than combined length of head and pronotum. Pronotum compressed, dorsal surface elevated into a very high, thin, arcuate crest which is dentate on posterior portion and extends over the base of the tegmina; transverse sulci or lateral carinae not present. Tegmina longer than abdomen, pale green in color with several brown spots; wings with bright orange discs and imperfect black bands. Legs long, slender; posterior tibiae with distinct spines on ventral surfaces.

Comments and distribution: This species is perhaps the most distinctive and colorful of the Oklahoma Acrididae, as well as one of the rarest. Its habitat is very restricted and it is generally found in low-growing vegetation on rocky slopes. It seems to prefer undisturbed areas. Tropidolophus formosus (Say) is reported from only three counties in the State. The writer's Greer County record represents the easternmost limits of distribution in the United States.

County records: Cimarron, Beckham and Greer.

Genus Spharagemon Scudder, 1875

Gryllus Say, 1825 (in part). Jour. Acad. Nat. Sci. Phila. 4:307.

Spharagemon Scudd., 1875. Proc. Boston Soc. Nat. Hist. 17:467.

Dissosteira (Spharagemon), Saussure, 1884. Prodr. Oedip. 28:135.

Genotype: Gryllus aequalis Say, 1825. Jour. Acad. Nat. Sci. Phila. 4:307.

Characteristics: Rather slender, medium-sized grasshoppers with dark flecks or bars on tegmina, yellow wing-discs and reddish tibiae. Head more or less swollen; vertex with a distinct median impression, carina faint; vertex behind disc comparatively smooth; foveolae large, triangular; frontal costa sulcate. Pronotum flattened on the metazona median carina generally high and crest-like, cut in front of the middle by a deep notch. Tegmina traversed with bands or groupings of dark flecks; hind wings yellow on discs, crossed by dark, broad bands, the portion apical of the bands being hyaline. Hind tibiae red or pinkish.

Key to the Species of Spharagemon in Oklahoma

1. Proximal portion of hind tibiae without colored annuli.....2
   Proximal portion of hind tibiae with colored or dark annuli.....3
2. Median carina of pronotum distinct but not raised into a strong crest; tegmina clearly banded.....equale
   Median carina of pronotum raised into a strong crest; tegmina with dark flecks but not clearly banded.....collare
3. Proximal, pale portion of hind tibiae broad and partly clouded by dark bands.....bolli bolli
   Proximal, pale portion of hind tibiae short, not clouded by dark bands.....superbum

Spharagemon equale (Say)

Gryllus equalis Say, 1825. Jour. Acad. Nat. Sci. Phila. 4:307.

Locusta aequalis, Harris, 1852, Cat. Ins. Mass., p. 56.

Oedipoda aequalis, Uhler, 1862, in Harris, Ins. Injr. to Veg. 3rd. ed., p. 178.

Trimerotropis aequalis, Scudder, 1874, in Hitchcock, Rep. Geol. N. Hamp., p. 377.

Spharagemon aequale, Scudd., 1875, Proc. Bost. Soc. Nat. Hist. 17:468.

Dissosteria (Spharagemon) aequalis, Saussure, 1884, Prodr. Oedip. 28:139.

Dissosteira texensis Sauss., 1884. Ibid., p. 140.

Dissosteira texensis Morse, 1895. Psyche. 7:293.

Many authors have listed the name Gryllus equalis (Say) as G. aequalis (Say) due to an incorrect supposition of Harris (1835, Catalog of Insects of Massachusetts, p. 56). He reports thusly, "Mr. Say, to whom I sent a specimen of this handsome locust, informed me that it was his Gryllus equalis, probably intended for Gryllus aequalis." Say's original description lists the species as Gryllus equalis. Hebard (1937) pointed out that S. equale (Say) was often improperly emended to S. aequale (Say), but did not elaborate further.

Characteristics: Median carina of pronotum not with a high crest, sinuate on prozona, principal sulcus conspicuous but not oblique. Tegmina

with definite dark bands. Inner surface of hind femora yellow to orange; hind tibiae without colored annuli.

Comments and distribution: Spharagemon equale (Say) prefers sandy open areas, roadsides and short sparse grasslands. It is a western species and occurs throughout all areas of the State except the southeast.

County records: Cimarron, Texas, Harper, Ellis, Roger Mills, Custer, Beckham, Greer, Harmon, Jackson, Kiowa, Comanche, Tillman, Cotton, Jefferson, McClain, Cleveland, Canadian, Blaine, Kingfisher, Major, Logan, Payne, Kay, Okfuskee, Rogers, Mayes, Wagoner, Delaware and Muskogee.

Spharagemon collare (Scudder)

Oedipoda collaris Scudd., 1872. Rept. U. S. Geol. Surv. Nebr., pp. 250, 251.

Oedipoda wyomingiana Thomas, 1872. Rept. U. S. Geol. Surv. Mont., p. 462.

Oedipoda belfragii Stal, 1873. Recens. Orthop. p. 129.

Spharagemon collare, Scudd., 1875, Proc. Bost. Soc. Nat. Hist. 17:470.

Spharagemon cristatum Scudd., 1875. Loc. cit.

Oedipoda utahensis Thos., 1875. Rept. U. S. Geol. Surv. W. of 100th Merid. Vol. 5:883.

Dissosteira collaris, Saussure, 1884, Prodr. Oedip. 28:139

Dissosteira utahensis, Sauss., 1888, Ibid., Vol. 30:167.

Spharagemon wyomingianum, 1891, Bruner, Publ. Neb. Acad. Sci. 3:25.

Spharagemon aequale scudderi Morse, 1894. Proc. Bost. Soc. Nat. Hist. 26:225.

Spharagemon collare angustipenne Morse, 1895. Psyche 7:298.

Spharagemon collare pallidum Morse, 1895. Psyche 7:299.

Characteristics: More grayish-brown than related species with small dark patches over most of body. Median carina of pronotum with a very high crest, incision of principal sulcus deep and oblique. Tegmina with dark flecks but not banded. Inner surface of hind femora pale; hind tibiae red, without colored annuli.

Comments and distribution: The species is a mixed-feeder and prefers open, sandy grasslands. It has been reported from most sections of the State but is most abundant in the western one-third. The stabilized Dune-Type of grassland seems to be its preferred habitat.

County records: Cimarron, Texas, Beaver, Harper, Woods, Woodward, Alfalfa, Major, Dewey, Blaine, Custer, Roger Mills, Beckham, Greer, Harmon, Kiowa, Jackson, Tillman, Comanche, Stephens, Jefferson, Caddo, Canadian, Grady, McClain, Cleveland, Logan, Payne, Osage, Tulsa, Hughes, Okfuskee, Pontotoc, Bryan, Choctaw and McCurtain.

Spharagemon bolli bolli Scudder

Spharagemon bolli Scudd., 1875. Proc. Bost. Soc. Nat. Hist. 17:469.

Spharagemon balteatum Scudd., 1875. Proc. Bost. Soc. Nat. Hist. 17:469.

Dissosteira bolli Saussure, 1884, Prodr. Oedip. 28:140.

Spharagemon bolli bolli, Hebard, 1937, Trans. Amer. Ent. Soc. 63:365.

Characteristics: Median carina of pronotum moderately high (higher in male than in female), incision of principal sulcus conspicuous but not sloped. Tegmina sprinkled throughout with minute blackish dots, only partial crossbands present. Crossband of hind wings broader than in S. collare (Scudd.) and S. equale (Say). Inner surfaces of hind femora pale, black basally each with an apical black band. Proximal pale portions of hind tibiae broad, each partly clouded by the dark band.

Comments and distribution: This species frequents bare and open areas such as along paths and in old fields. It is common in upland, woodland pastures in the western counties and not recorded from the northwestern and panhandle areas; whereas, the other species of Spharagemon are most abundant in the western one-half of the State.

County records: McCurtain, LeFlore, Bryan, Atoka, Pittsburg, Hughes, Okmulgee, Wagoner, Adair, Delaware, Ottawa, Mayes, Rogers, Tulsa, Osage, Pawnee, Payne, Lincoln, Pottawatomie, Cleveland, Murray, Comanche and Kiowa.

Spharagemon superbum Hebard

Spharagemon superbum Hebard, 1937. Trans. Amer. Ent. Soc. 63:366.

Characteristics: This species is very near S. collare (Scudd.) and differs from it largely in color characteristics. Hind tibiae, each with a colored annulus which is not suffused into the narrow pale portion which precedes it. Hebard (1937) points out some distinguishing features between it and S. collare (Scudd.), thusly:

> Organs of flight fully developed but more produced than is usual with S. collare (Scudd.). Tegmina proportionately slightly narrower with veinlets more numerous and regular ....caudal tibiae and tarsi clear translucent scarlet, a short post-proximal whitish buff annulus present with short proximal area preceded with brown externally.

Comments and distribution: Hebard collected one male in LeFlore County (SE) June, 1937, which is the only record for the State.

County records: LeFlore.

Genus Xanthippus Saussure, 1884

Xanthippus Sauss., 1884. Prodr. Oedip. 28:26.

Hippiscus Scudder, 1892 (in part). Psyche 6: 269, 318.

Genotype: Oedipoda corallipes Haldemann, 1852. Stansb. Expl. Utah, p. 371.

Note: Considerable confusion exists in the taxonomy of Xanthippus Sauss. and other genera of the Hippisci. The reader is referred to the notes under the Genus Hippiscus Sauss. for a discussion of the problem.

Characteristics: Medium to large, heavy-bodied grasshoppers most

closely related to the genera Hippiscus Sauss. and Pardalophora Sauss. Frontal costa constricted above level of the antennae, sulcate or not sulcate toward vertex; disc of vertex not ended abruptly in front but somewhat tapered, more depressed and conspicuous than in Hippiscus Sauss., no cross carina present. Metazona of pronotum long in proportion to length of prozona as compared to other Hippisci, median carina distinct, although largely obliterated between the two sulci, anterior sulcus distinct but not deeply impressed. Pronotum extremely rugose, more so than any other Oedipodinae; however, rugosities not forming raised lines as in most of the Pardalophora (Sauss.). Hind tibiae coral red, at least on inner surfaces.

Key to the Species of Xanthippus in Oklahoma

Depression of vertex shallow, broad, margins not well defined; tegmina with sharp, distinct markings, mostly transverse .....corallipes pantherinus

Depression of vertex deep, narrow, margins sharply defined; tegminal markings not distinct, mostly tending toward the longitudional.....montanus

Recent workers are not in accord on the classification of species of Xanthippus Sauss. At present most of the U. S. forms are considered as geographic races of X. corallipes Haldeman. An exception is X. montanus (Thos.) which I have listed as a separate species due to its distinct depression of vertex and longitudional tegminal markings. Recent workers of southwestern Acrididae considering X. montanus (Thos.) as a distinct species include Hebard (1928, 1929) and Ball et al. (1942), while Brooks (1958), working with Canadian forms, considers the latter as

a race of X. corallipes Hald. A thorough revision of the genus is needed to adequately define and limit the various species and subspecies.

Xanthippus corallipes pantherinus (Scudder)

Hippiscus pantherinus Scudd., 1892. Psyche 6:285.

Hippiscus corallipes, Rehn, 1907, Proc. Acad. Nat. Sci. Phila. 59:36.

Xanthippus corallipes pantherinus, Hebard, 1929, Proc. Acad. Nat. Sci. Phila. 81:337.

Characteristics: Depression of vertex broad, shallow, margins often not well-defined. Pronotum sulcate or not toward vertex. Tegmina with fuscous markings, more rounded, darker and distinct than in X. montanus (Thos.). Hind femora with broad, oblique stripes on outer faces, internal faces bluish-black with apical bands of coral red.

A number of specimens of Xanthippus from Cimarron County in the Museum of Zoology, University of Michigan, have been determined by T. H. Hubbell as intermediate between X. corallipes pantherinus (Hald.) and X. corallipes latefasciatus Scudd., the latter species being the Northern and Rocky Mountain race. Intergradation undoubtedly occurs in Cimarron County. The author, after checking the above University of Michigan series, is in accord with the findings of Hubbell.

Comments and distribution: This subspecies is a range grasshopper found throughout the State except in the extreme eastern and southeastern counties. Adults are found from April to September. Both X. corallipes pantherinus (Scudd.) and X. montanus (Thos.) may overwinter in the nymphal stage.

County records: Cimarron, Texas, Harper, Woods, Alfalfa, Major, Roger Mills, Beckham, Harmon, Jackson, Kiowa, Comanche, Carter, Murray, Pontotoc, Cleveland, Oklahoma, Logan, Payne, Osage, Tulsa and Rogers.

Xanthippus montanus (Thomas)

Oedipoda montana Thomas, 1872. U. S. Geol. Surv. Mont., p. 462.

Hippiscus (Xanthippus) montanus, Bruner, 1885, Can. Ent. 17:12.

Xanthippus corallipes montanus, Brooks, 1958, Can. Ent. 40: Supp. 9, p. 49.

Characteristics: Depression of vertex deep, narrow, margins sharply defined. Pronotum distinctly sulcate toward vertex. Tegmina with markings not distinct, more longitudinal than rounded, becoming paler toward apices. Bars on outer faces of hind femora indistinct, inner faces predominantly coral-red.

Comments and distribution: This species is reported from Oklahoma (Cimarron County only) by Newton and Gurney (1956). I did not collect the species in this study. Hebard (1925) reports X. montanus (Thos.) as being largely restricted to sandy areas.

County records: Cimarron.

Genus Circotettix Scudder, 1876

Circotettix Scud., 1876. Bull. U. S. Geol. Surv. Terr. 2:264.

Genotype: Oedipoda undulata Thomas, 1871. Ann. Rept. U. S. Geol. Surv. Terr. 5:460.

Note: This genus is represented by one species in our State; therefore, the generic and specific descriptions are combined.

Circotettix rabula nigrafasciatus Beamer

Circotettix nigrafasciatus Beamer, 1917. Bull. Univ. Kans., Biol. Ser. 18, p. 123.

Circotettix rabula nigrafasciatus, Rehn, 1921, Trans. Amer. Ent. Soc. 47:181.

Characteristics: (modified from Beamer, 1917). Head slightly raised above level of pronotum; antennae long, threadlike, alternating joints light and dark. Pronotum constricted anteriorly; median carina moderately developed, cut by two sulci. Tegmina long, grey to reddish-brown with darker brown fascia. Wings medium in length, very broad; external margin undulated and lobed; radiate veins swollen medially (Fig. 34); discs yellow bordered by solid black, slightly arctuate bands; apical portions hyaline. Inside of hind femora marked with two black spots, the basal one being larger.

Separated from the other races of Circotettix rabula by its larger size, paler coloration, generally narrow tegminal apices, more elongate wings, radiate veins of the wings less swollen, and generally more complete and solid dark wing bars.

Comments and distribution: Newton and Gurney (1956) list Circotettix rabula Rehn and Hebard as present from Major County--this being the only Oklahoma occurrence. This record is undoubtedly of the geographic race Circotettix rabula nigrafasciatus Beamer (see Rehn, 1921), as it is the typical Great Plains form and has been reported by Beamer from Barber

County Kansas, a distance of less than 60 miles.

This species likes a sand-hill type of habitat. Its distribution extends from south-central South Dakota to extreme south-central Kansas (Rehn). The Major County Oklahoma record represents the southeastern-most record for this geographic race.

County records: Major.

Genus Leprus Saussure, 1861

Leprus Sauss., 1861. Rev. Mag. Zool. (2), 13:398.

Genotype: Oedipoda (Leprus) elephas Sauss., 1861. Rev. Mag. Zool. (2), 13:398.

Characteristics: Robust grasshoppers, medium to large in size. Head smooth; antennae slender, filiform; eyes large, prominent; vertex broad with sunken disc; face vertical, straight or slightly concave. Pronotum very rugose, unusually flat; median carina very weak (more so than in any of the other Hippisci), cut by two sulci. Tegmina with dark bands; discs of hind wings blue or yellow, black bands present.

Key to the Species of Leprus in Oklahoma

1. Discs of hind wings blue.....cyaneus
   Discs of hind wings light yellow (may have a faint greenish tinge sometimes).....wheeleri

Leprus cyaneus Cockerell

Leprus wheeleri Townsend, 1892 (not Thomas, 1875). Ins. Life 6:31.

Leprus cyaneus Cock., 1902. Ent. News 13:305.

Characteristics: Lateral lobe of pronotum wider ventrally than dorsally due to the rounded extension of the ventro-caudal margins. Tegmina dusky with almost obsolete dark bars; transverse median light bars white or nearly so; sutural stripes very light; apical portion of tegmina beyond transverse light bars more feebly marked than in L. wheeleri (Thos.); discs of wings always blue. Tibiae blue except proximal light bands present.

Comments and distribution: The only record of this species for Oklahoma is that of Hubbell (1937) from Black Mesa, Cimarron County. Ball et al. (Arizona, 1942) reports this species as found on rocky hillsides, ridges and to some extent in bare areas in the grassland. Leprus cyaneus Cock. overwinters either in the nymph or egg stage.

County records: Cimarron.

Leprus wheeleri (Thomas)

Oedipoda wheeleri Thos., 1875. Rept. U. S. Geol. Surv. W. 100th Merid. 5: p. 879.

Leprus wheeleri, Saussure, 1888, Add. Prodr. Oedip. 30:169.

Characteristics: Lateral lobe of pronotum not wider ventrally than dorsally. Tegmina with distinct, dark bars contrasting with lighter background which is reddish-gray; hind wings with discs light yellow, sometimes tinged with very light green. Posterior femora broad with upper and lower carina very prominent, dark blue on inner faces with light crossbars; hind tibiae glacuous but may be replaced by buffy on

the outer sides.

Comments and distribution: Confusion seems to exist concerning the wing color of L. wheeleri (Thos.). In the original description, Thomas reports the disc as being yellow. Later workers reported yellow, greenish-yellow and blue wing colors. All Oklahoma specimens that I examined possess light yellow wing discs sometimes tinged with green. Leprus elephas Sauss., which we now know to be Mexican in distribution, was reported from Comanche County by Hubbell and Ortenburger (1927). I have examined the single specimen of the above, and it is Leprus wheeleri (Thos.).

Leprus wheeleri (Thos.) is a southwestern form and extends into the panhandle and southwestern counties of our State. It prefers a habitat of rocky or bare soil sparsely covered with grass.

County records: Cimarron, Texas, Comanche and Caddo.

Genus Trimerotropis Stal, 1873

Trimerotropis Stal, 1873. Recens. Orthop. 1:118.

Agonozoa McNeill, 1901. Proc. U. S. Nat. Mus. 23:398.

Pseudotrimerotropis Rehn, 1901. Trans. Amer. Ent. Soc. 27:334.

Genotype: Locusta maritima Harris, 1841. Rept. Ins. Mass., p. 143.

Characteristics: Medium to large grasshoppers with elongate, slender bodies and tegmina always exceeding the abdomen. Disc of vertex impressed, often longer than wide, median carina faint or absent; fontal costa continuous with vertex, narrowed at junction, strongly sulcate and widened on lower two-thirds. Antennae small, filiform, longer than head and

pronotum combined. Pronotum wider than head, flat and smooth on the metazona except for small granulations; median carina very low, cut by two deep sulci, the posterior occuring much in advance of the middle, lateral carinae very faint or non-existent. Tegmina much exceeding abdomen, coloration arranged in three distinct areas or bands; wings sometimes near-hyaline in basal area but most often yellow, yellow-green or blue; broad fuscous bands present (Fig. 33); apices hyaline. Posterior tibiae with 8 to 10 spines on the outer side.

Key to the Species of Trimerotropis in Oklahoma

1. Posterioro-ventral corner of lateral lobe of pronotum a rounded point.....agrestis

   Posterioro-ventral corner of lateral lobe of pronotum rounded but not pointed.....2

2. Antennae large; subcostal spurs on hind wings non-existent or reaching not over one-fourth way to base of wings; very large grasshoppers.....magnifica

   Antennae threadlike; subcostal spurs reach more than one-fourth way to base of wings (Fig. 33); mostly medium-sized grasshoppers...3

3. Apices of hind wings clear or hyaline.....3

   Apices of hind wings smoky.....cincta

4. Posterior tibiae red or orange.....5

   Posterior tibiae yellow, yellowish-green or brown.....7

5. Inner faces of hind femora yellowish.....citrina

   Inner faces of hind femora reddish.....6

6. Wing bands approximately the width of wing discs.....laticincta

   Wing bands one-half, or less, width of wing discs.....pistrinaria

7. Metazona less than one and three-fourths times as long as prozona .....saxatilis

   Metazona nearly twice as long as prozona.....8

8. Wing bands very broad; tegminal bands broken, relatively inconspicuous; wing discs pale (only slightly tinged yellow) .....pallidipennis salina

   Wing bands narrower; tegminal bands not broken, conspicuous; wing discs yellow.....pallidipennis pallidipennis

Trimerotropis agrestis McNeill

Trimerotropis agrestis McNeill, 1900. Psych 9:32, 1901, Proc. U. S. Nat. Mus. 23:433.

Characteristics: Light-colored specimens, speckled with black. Median carina of pronotum prominent in front of principal sulcus; posterior-ventral corner of lateral lobe rounded and pointed. Tegmina sandy-colored with small dark maculations; hind wings with discs yellow, cross-bands broad, subcostal spurs extending about one-half way to base of wings. Inner faces of hind femora reddish with central dark bars, or with basal one-third entirely dark and apical third with narrow black bands; hind tibiae reddish.

Comments and distribution: Hebard (1931) and Brooks (1958) ascribe this insect to sandy areas. It is seldom collected and has been found only in the Panhandle.

County records: Cimarron.

Trimerotropis magnifica Rehn

Trimerotropis magnifica Rehn, 1907. Proc. Acad. Nat. Sci. Phila. 57:43-44.

Characteristics: This robust grasshopper is the largest species of Trimerotropis found in Oklahoma. Antennae heavy, lengthy; disc of vertex shallow, median carina very feeble. Pronotum with median carina faint on prozona, distinct but very low on metazona. Tegmina with two distinct, darkish bands, third band scattered; hind wings with dark brown bands about one-fourth as broad as length of wings, wing discs pale yellow. Internal face of the hind femora black with light apical bands; hind tibiae bright orange-red.

Comments and distribution: Ball et al. (1942) describe this species as rare in Arizona and report it being found on bare soil in tall-grass areas of the desert grassland. He lists adults as occurring from August to November in that State. We have only one record for Oklahoma, that being Cimarron County, collected in 1937.

County records: Cimarron.

Trimerotropis cincta (Thomas)

Oedipoda cincta Thos., 1870. Proc. Acad. Nat. Sci. Phila. p. 80.

Oedipoda occidentalis Bruner, 1889. Proc. U. S. Nat. Mus. 12:77.

Trimerotropis teplata McNeill, 1901. Proc. U. S. Nat. Mus. 23:417.

Trimerotropis cincta, McNeill, 1901 (in part), Ibid., p. 414.

Characteristics: Dark brown grasshoppers with black bands on head, pronotum and tegmina. Face with two black bars, one below antennal bases and one above. Rear wings with pale-yellow discs, indistinct bands, long spurs; apices smoky-colored. Hind tibia usually bluish.

Comments and distribution: This species is restricted to the western one-half of the United States. Ball et al. (1942) describe the habitat of T. cincta (Thos.) as "rocky soil with sparse vegetation, usually near trees." It is not often collected.

County records: Payne and Muskogee.

Trimerotropis citrina Scudder

Trimerotropis citrina Scudd., 1876. Bull. Geol. and Geog. Surv. Terr. 2:265.

Trimerotropis rubipes Rehn, 1904. Proc. Acad. Nat. Sci. Phila. 56:568.

Characteristics: Grey to light brown species with tegminal bands scattered. Median carina of vertex absent or very faint; foveolae small, indistinct. Pronotum with median carina low on prozona and metazona; disc flat, finely granulate; hind margin obtuse-angled, tip rounded. Hind wings pale-yellow in discs; crossbands dark, broad, about one-fourth length of wings; spurs extend less than one-half way to wing bases. Inner faces of hind femora yellow, three fuscous bands present; hind tibiae pink, pale at bases.

Comments and distribution: T. citrina Scudd. is one of the most common species of Trimerotropis. It especially prefers sandy, bare areas along roadways, old fields and streams. It occurs throughout all sections

of the State but is perhaps most common in the Stabilized Dune and Sand-sage Grassland Types of western Oklahoma.

County records: McCurtain, LeFlore, Sequoyah, Pittsburg, Muskogee, Wagoner, Tulsa, Washington, Osage, Kay, Pawnee, Oklahoma, Cleveland, Pottawatomie, Okfuskee, Hughes, Pontotoc, Marshall, McClain, Grady, Caddo, Canadian, Kingfisher, Comanche, Cotton, Kiowa, Jackson, Harmon, Alfalfa, Woods, Harper, Texas and Cimarron.

Trimerotropis laticincta Saussure

Trimerotropis laticincta Sauss., 1884. Prodr. Oedip. 28:169.

Trimerotropis latifasciatus Beamer, 1917 (not Scudder, 1880.)
Bull. Univ. Kans. Biol. Ser. 18:121.

Characteristics: Head with vertex slightly sulcate; median carina of vertex present or not. Pronotum with median carina moderately well developed on prozona and mesozona, faint on metazona; transverse sulci distinctly cutting median as well as lateral carinae; disc of metazona with numerous rugae tending to parallel median carina, also several small, elongate, black tubercules present. Apical bands of tegmina broken; rear wings elongate, dark crossbands about one-third as wide as length of wings (Fig. 33), continuing almost to anal angles; subcostal spurs about one-eighth inch in length or less. Hind tibiae reddish with black-tipped spines.

Newton and Gurney (1956) list T. latifasciata Scudd. as being reported from several of the western counties. The writer hasn't seen these specimens but has studied T. latifasciata Scudd. from other south-western states and was unable to differentiate between the latter and

and T. laticincta Sauss. The keys of McNeill (1900) and Tinkham (1947) seem to be of little value. There are series of specimens in the O.S.U. Museum and the Museum of Zoology, University of Michigan, identified by both Morgan Hebard and T. H. Hubbell as T. latifasciata laticinata Sauss. It may well be that much of the Oklahoma material is intermediate between the two species. As yet I am unable to find a published work on the racial status of T. latifasciata laticincta Sauss., so I am regarding Oklahoma material as T. laticincta Sauss.

Comments and distribution: This species has been reported from the western two-thirds of the State. It is a western species and does not occur east of Oklahoma. Like other species of Trimerotropis Stal, it prefers areas of sparse vegetation.

County records: Cimarron, Beaver, Harper, Ellis, Major, Beckham, Harmon, Jackson, Kiowa, Comanche, Cotton, Payne, Pawnee and Osage.

Trimerotropis pistrinaria Saussure

Trimerotropis pistrinaria Sauss., 1884. Prodr. Oedip. 28:173.

Trimerotropis bruneri McNeill, 1900. Psyche 9:31 (key only);
McNeill, 1901, Proc. U. S. Nat. Mus. 23:430.

Characteristics: Grey to reddish-brown with well-formed bands on tegmina. Median carina of pronotum line-like throughout. Tegmina grey to reddish-brown; two anterior bands complete, apical band scattered. Hind wings pale yellow on discs; crossbands black, broad; subcostal spurs reach less than half way to bases. Outer surface of hind femora with prominent bands on apical third; inner surfaces reddish-yellow with

black bands on apical third which is continuous with bands on outer faces; hind tibiae red, yellowish on outer surfaces and toward bases.

Comments and distribution: This species is reported only from the far western and panhandle counties with the exception of several records from McClain County. The writer is not acquainted with the habitat of this species in our State. Ball (1942) reports it as, "a rather rare species found on the most barren, eroded areas in rolling country in the upper Sonoran Zone."

County records: Cimarron, Texas, Beaver, Harper, Woods, Beckham, Harmon, Jackson and McClain.

Trimerotropis saxatilis McNeill

Trimerotropis saxatilis McNeill, 1901. Proc. U. S. Nat. Mus. 23:440.

Characteristics: As specimens of T. saxatilis McNeill were not available to the author, the following description is the original of McNeill, 1901:

> Very similar to T. vinculata, (T. pallidipennis pallidipennis) and possibly not distinct from that species, but differing in the following particulars.
> Scutellum broader; pronotum with the metazona not more than one and three-quarter times as long as the prozona, with the process rectangular. Tegmina, as well as the whole body and limbs, excepting the lower surface of the head and abdomen, extremely variable in color, the ground color being white, bluish green, or brown, generally very strongly varied with fuscous, but sometimes nearly plain by the suffusion of the ground color with fuscous. Wings shorter relatively as well as positively, being considerably less than twice as long as broad; fuscous band broader, being from one-fourth to one-fifth the length of the wing, extending along the posterior border much beyond the middle; apex hyaline, with many or few fuscous spots. Posterior femora with the lower sulcus black, crossed by two white bands on the apical half, the median with the color of the femora; the prevailing color greenish, with a lighter generally conspicuous, subapical annulus.

Comments and distribution: Trimerotropis saxatilis McNeill is reported from scattered locations throughout the State except the Panhandle. It prefers areas of rocky or bare soil.

County records: Ellis, Comanche, Cleveland, Pawnee, Osage, Hughes, Pittsburg, Johnston and Sequoyah.

Trimerotropis pallidipennis salina McNeill

Trimerotropis salina McNeill, 1900. Psyche 9:33.

Trimerotropis palledipennis salina, Hebard, 1928, Proc. Acad. Nat. Sci. Phila. 80:253.

Characteristics: A greyish-brown species with very broad, black crossbands on hind wings. Head with disc of vertex sulcate; median carina line-like. Pronotum with prozona more than one-half as long as metazona; median carina prominent on first two lobes, faint behind. Tegminal bands obscurely marked, scattered spots present on apical third; hind wings with discs pale to very light-yellow; crossbands dark, median in location and broad, about one-third length of wings; subcostal spurs extend less than one-half way to wing bases. Hind femora pale-brown on outer faces, not banded; inner surfaces black on about basal one-half; hind tibiae yellow to buff with brownish influences.

Comments and distribution: Collection records show this species to have been collected in several north-central and southwestern counties. It is known to be fairly well restricted to alkaline and "salt flats" in prairie areas. Trimerotropis p. salina McNeill bears close resemblence to T. p. pallidipennis (Burm.), but may be best differentiated

by the following (Hebard, 1931):

> There is less color contrast than in typical pallidipennis, the tegmina are more tesselate with bands more broken, the wings have the disc paler (cream color with the faintest tinges of yellow), and the bands are very broad and solid, while the external faces of the caudal femora are immaculate brownish buff.

County records: Woods, Alfalfa, Comanche, Harmon and Pawnee.

Trimerotropis pallidipennis pallidipennis (Burmeister)

Oedipoda pallidipennis Burm., 1839. Handb. Ent. 2:464.

Trimerotropis pallidipennis, Saussure, 1884, Prodr. Oedip. 28:171.

Trimerotropis vinculata Scudder, 1876. Proc. Bost. Soc. Nat. Hist. 18: pt. 3, 270.

Characteristics: Grey to brownish with yellow tibiae. Head with disc of vertex well-impressed with steep sides; antennae dark brown, obscurely annulate. Median carina of pronotum distinct only on two anterior lobes; hind margin of pronotum forming right angle. Tegmina with first and second tegminal bars distinct, third scattered; apical third of tegmina pellucid, spots faint. Hind wings pale yellow in discal areas; narrow black, sickle-shaped crossbands present and extending about three-fourths of the way across anal areas; subcostal spurs extend about one-third of distance to bases of wings. Hind femora with two or three obscure bands on outer faces; hind tibiae yellowish, spines black-tipped.

Comments and distribution: A common grasshopper and perhaps the most important member of the genus from an economic standpoint. They often damage cotton, corn, sorghums, legumes, and vegetables, generally

restricting their injury to margins of the field. This species has been reported from all sections of Oklahoma from May through September. It prefers areas of rather sparse vegetation such as occurs in sandy or rocky habitats, along roadways and borders of cultivated fields.

County records: Cimarron, Beaver, Harper, Roger Mills, Harmon, Greer, Kiowa, Jackson, Comanche, Cotton, Carter, Garvin, Cleveland, Kingfisher, Pawnee, Creek, Okfuskee, Okmulgee, Latimer and LeFlore.

Genus Psinidia Stal, 1873

Psinidia Stal, 1873. Recens. Orthop. 1:77.

Genotype: Oedipoda fenestralis Serville, 1839. Hist. Orthop., p. 726.

Note: Only one species is found in the State; therefore, the generic and specific descriptions are combined.

Psinidia fenestralis fenestralis (Serville)

Oedipoda fenestralis Serv., 1839. Hist. Orthop., p. 726.

Psinidia fenestralis, Stal, 1873, Recens. Orthop. 1:133.

Psinidia fenestralis fenestralis, Rehn, 1919, Trans. Amer. Ent. Soc. 45:247.

Characteristics: Small, grey to brown grasshoppers closely related to Mestobregma Scudd., but differing from it by the much flattened antennae which are recessed on the dorsal surface. Head prominent, elevated; disc of vertex recessed, triangular, connecting with the sulcate frontal costa. Pronotum strongly constricted, posterior margin rectangulate;

median carina elevated, sharp, cut by two sulci. Tegmina without definite bands, sprinkled with small, darker markings; hind wings with discal areas red to yellow, dark, wide wing bands, and apical portions largely hyaline. Posterior femora with dark bars on outer faces, inner faces dark with two light stripes; posterior tibiae light with dark, wide bands.

Note: The above description was rewritten from Beamer (1917), since Oklahoma specimens were unavailable to the writer.

Comments and distribution: The writer was able to locate only one specimen of this form, that being a female from Alfalfa County, now in the Philadelphia Academy of Natural Sciences' collection. Bragg (1939) reported P. f. fenestralis (Serv.) from several counties in northern Oklahoma; however, his specimens could not be located. Beamer (1917) found this species largely restricted to sandy areas.

County records: Alfalfa.

Genus Derotmema Scudder

Derotmema Scudd., 1876. Ann. Rept. U. S. Geog. Surv. W. 100th Merid., App. JJ:293.

Tmetodera Saussure, 1884. Prodr. Oedip. 28:154.

Genotype: Derotmema cupidineum Scudd., 1876. Ann. Rept. Geog. Surv. W. 100th Merid., App. JJ, p. 293.

Note: This genus is represented by one species in Oklahoma; thus, the description is based on the species.

Derotmema haydenii haydenii (Thomas)

Oedipoda haydenii Thos., 1872. Rept. U. S. Geol. Surv. Terr. 5:460.

Derotmema cupidineum Scudder, 1876. Ann. Rept. U. S. Geog. Surv. W. 100th Merid. App. JJ:513.

Derotmema brunnerianum Saussure, 1884. Prodr. Oedip., 28:155.

Derotmema haydenii var. flavum, Scudd., 1902, Dav. Acad. Sci. 9:32.

Derotmema haydenii haydenii, Rehn, 1919, Trans. Amer. Ent. Soc 45:230.

Characteristics: Small, brownish to brownish-grey grasshoppers with small dark flecks over the body and pronotum. Eyes prominent, bulging; antennae very long, as long or longer than hind femora, filiform; depression of vertex, deep with very prominent lateral and median ridges, extending to the front and continuous with the frontal costa; frontal costa sulcate throughout, very narrow above the ocelli. Pronotum very rough, large longitudinal ridges present on dorsal surface; median carina distinct, usually with blackish summit, bilobate on prozona, twice cut with deep and conspicuous transverse sulci; posterior angle of lateral lobes broadly rounded. Tegmina and wings much surpassing the abdomen, at rest showing extreme tapered form; discs of hind wings yellow to red with broad dark bands crossing beyond; spurs long, extending more than half way from bands to bases of wings. Front and middle tarsi annulate with light and dark bands.

Discussion: D. haydenii haydenii (Thos.) is the easternmost form of four subspecies and extends from Alberta and Saskatchewan, Canada to Oklahoma. Hebard (1931) considered Morton County, Kansas, the southern

limits of distribution of this form; however, Hubbell in 1926 collected it in Cimarron and Beaver counties of the Oklahoma Panhandle. The Beaver County record is the southeastern limit of distribution. The writer has collected D. haydenii haydenii (Thos.) in Cimarron County.

Comments and distribution: The above species is found in dry bare areas of the Shortgrass Highplains Type. It feeds on both forbs and grasses and overwinters in the egg stage.

County records: Cimarron and Beaver.

Genus Mestobregma Scudder, 1876

Trachyrhachys Scudd., 1876 (in part). Ann. Rept. Geog. Surv. W. 100th Merid., App. JJ, p. 291.

Mestobregma Scudd., 1876. Bull. U. S. Geog. Surv. Terr. 2:264.

Genotype: Oedipoda plattei Thomas 1873. Hayden's Rept. U. S. Geol. Surv. Terr. 5:1-258.

Note: This genus is represented in Oklahoma by one species which serves as a basis for the description.

Mestobregma plattei plattei (Thomas)

Oedipoda plattei Thos., 1873. Rept. U. S. Geol. Surv. Terr. 5:123.

Mestobregma plattei, Scudder, 1876, Bull. U. S. Geog. Surv. Terr. 2:264.

Trachyrhachis plattei, Bruner, 1905, Biol. Centr. Amer., Orthop. 2:175.

Mestobregma plattei plattei, Rehn, 1919, Trans. Amer. Ent. Soc. 45:238.

Characteristics: Head large, with an oblique brownish-black stripe embracing the lower portion of eye; front of occiput elevated, vertex broad, much deflected with disc opening in front, connecting with the sulcus of the frontal costa; frontal costa sulcate throughout; eyes oblong, prominent. Sides of pronotum with oblique, brownish-black stripes near middle; lateral lobes with posterior angles broadly rounded; median carina moderately high and deeply cut twice, more prominent on anterior lobe than posterior lobe; middle lobe very short; posterior sulcus about the middle of pronotum; metazona smooth or with scattered granulations (no lateral ridges or elevations present on metazona adjacent to median carina as in Derotmema Scudder). Fore wings, each with a broad dark band on costal margin; hind wings with either yellow or pink discs and black bands. Posterior femora, each with inner face blackish and a pale ring near apex.

Discussion: Separated easily from the race M. plattei corrugata (Scudd.) as the latter is darker brown, the ridges of pronotum and vertex are more prominent and posterior angles of lateral lobes of pronotum are slightly produced. Oklahoma is populated only by M. plattei plattei (Thos.) while M. plattei corrugata (Scudd.) is found to the west of our State.

Comments and distribution: This species was reported from Payne County by Hubbell and Ortenburger (1927), otherwise restricted to the western and panhandle counties. The Payne County record is the south-eastern limit of the race in the United States. Mestobregma p. plattei (Thos.) appears as an adult in late summer and early fall. It prefers dry areas with sparse vegetation such as hillsides and outcrops.

County records: Cimarron, Harper, Roger Mills, Beckham, Major and Payne.

Genus Rehnita Hebard, 1935

Rehnita Hebard, 1935. Proc. Acad. Nat. Sci. Phila. 87:56.

Genotype: Mestobregma gracilipes Caudell, 1905. Proc. U. S. Nat. Mus. 28:471, 472.

Note: This genus, erected by Hebard from species formerly included under the genera Psinidia Stal and Mestobregma Scudd. The genus Rehnita Heb., is represented in Oklahoma by one species which serves as a basis for the description.

Rehnita capito (Stal)

Psinidia capito Stal, 1873 Recens. Orthop. i, p. 133.

Trachyrhachis capito, Saussure, 1884, Prodr. Oedip. 28:163.

Mestobregma capito, Scudder, 1900, Proc. Dav. Acad. Nat. Sci. 9:39.

Conozoa melleola Scud., 1902. Ibid., p. 34.

Rehnita capito, Hebard, 1935, Proc. Acad. Nat. Sci. Phila. 87:57.

Characteristics: Head elongate vertically with eyes prominent and elevated well above the prontum; antennae very small, longer than head and pronotum together. Pronotum with median carina deeply cut by two sulci, low on mesozona and metazona, not cristate on the former; posterior angle of lateral lobes of pronotum moderately produced, acute or sharply rounded. Tegmina banded, hind wings with yellow discs, broad, dark bands

and hyaline tips. This genus bears most resemblance to Trachyrhachys Scudd., but may be easily separated by the much lower mesozonal and metazonal carina of Rehnita capito (Stal).

Hosts and distribution: This species has been rarely collected in Oklahoma. Hubbell in 1926 and 1937 took it in Cimarron and Texas counties in the Panhandle, and in the southwest (Comanche County). The author collected Rehnita capito Stal in Cimarron County in the summer of 1958.

County records: Cimarron, Texas and Comanche.

Genus Trachyrhachys Scudder, 1876

Trachyrhachys Scudd. 1876. Ann. Rept. Geog. Surv. W. 100th Merid. App. JJ, p. 291.

Psinidia (Trachyrhachis) Saussure, 1884. Prodr. Oedip. 28:162.

Genotype: Trachyrhachys coronata Scudd., 1876. Ann. Rept. Geog. Surv. W. 100th Merid., App. JJ, p. 292.

Characteristics: Head large, prominent, broadening slightly below; disc of vertex quadrate, deeply depressed, bounded by sharply elevated carinae which connect with the deeply sulcate frontal costa; lateral foveolae triangular, deep. Pronotum with median carina moderately high, deeply cut by two sulci, the posterior occuring near middle; posterior angle of lateral lobes slightly produced and angulate. Tegmina banded; hind wing clear or yellow basally, crossbands may or may not be present. Hind femora broad, both upper and lower carinae distinctly crested, inner surfaces black and yellow.

This species is similar to the genus Metator McNeill, but has tegmina

banded, hind wings clearer and hind portion of pronotum tuberculate.

Key to the Species of Trachyrhachys in Oklahoma

1. Hind wings transparent without distinct bands or markings (discs may be pale yellow, however).....kiowa kiowa

Hind wings colored, wing bands or markings present..kiowa fuscifrons

Trachyrhachys kiowa kiowa (Thomas)

Oedipoda kiowa Thos., 1872. Prelim. Rept. U. S. Geol. Surv. Mont. and Terr., Rept. 5:461.

Mestobregma kiowa, Thos., 1876, Proc. Dav. Acad. Sci., p. 256.

Psinidia kiowa, Saussure, 1884, Prodr. Oedip. 28:161, 164.

Mestobregma pulchella Bruner, 1890. Proc. U. S. Nat. Mus. 12:64.

Trachyrhachis kiowa, Brun., 1906, Biol. Centr. Amer., Orthop. 2:174.

Trepidulus kiowa, Kirby, 1910, Syn. Cat. Orthop. 3:249.

Mestobregma kiowa kiowa, Beamer, 1917, Bull. U. Kans., Vol. 18, pt. 2:112.

Mestobregma kiowa kiowa, Hebard, 1925, Proc. Acad. Nat. Sci. Phila. 77:84.

Trachyrhachis kiowa kiowa, Heb., 1929, Ibid., Vol. 81:348.

Trachyrhachys kiowa kiowa, Brooks, 1958, Can. Ent. 90, Supp. 9:44.

Characteristics: Similar in appearance to the other race of kiowa

(Thos.) found in Oklahoma except somewhat lighter in color and with transparent hind wings; no distinct markings or bands present on hind wings except the discal areas may sometimes be pale yellow.

A few specimens collected from central and western Oklahoma showed integradation between T. kiowa kiowa (Thos.) and T. kiowa fuscifrons (Stal). In these individuals the wing discs were pale yellow and traces of wing bands were present.

Comments and distribution: This is the most western in distribution of the two subspecies of T. kiowa, extending to Arizona and Utah. In Oklahoma, T. kiowa kiowa (Thos.) is most commonly found in the western counties, its preferred habitat being short grass areas.

County records: Logan, Payne, Woods, Harper, Jackson, Beaver, Texas and Cimarron.

Trachyrhachys kiowa fuscifrons (Stal)

Psinidia fuscifrons Stal, 1873, Recens. Orthop. 1:134.

Psinidia (Trachyrhachis) fuscifrons var. texana Saussure, 1884. Prodr. Oedip. 28:163.

Trachyrhachis fuscifrons, Sauss., 1888, Add. Prodr. Oedip., p. 58.

Mestobregma fuscifrons, Scudder, 1900, Proc. Dav. Acad. Nat. Sci. 9:39.

Mestobregma thomasi Caud., 1904 (New name for Mestobregma cinctum of Bruner, Scudder and others, but not of Thomas, 1870). Proc. Ent. Soc. Wash. 6:125.

Trachyrhachis obliterata Bruner, 1906. Biol. Centr. Amer., Orthop. 2:175.

Mestobregma kiowa thomasi, Beamer, 1917, Bull. U. Kans., Vol. 18, pt. 2:112.

Mestobregma kiowa obliterata, Beamer, 1917, Bull. U. Kans., Vol. 18, pt. 2:112.

Trachyrhachis kiowa thomasi, Hebard, 1931, Proc. Acad. Nat. Sci. Phila. 83:161.

Trachyrhachis kiowa fuscifrons, Hebard, 1937, Ent. News 48:274.

Characteristics: Closely resembling T. kiowa kiowa (Thos.), except wings bands are present in T. kiowa fuscifrons (Stal), also the latter has bright yellow, wing discs instead of transparent discs.

A third race, T. kiowa thomasi Caudell, was orgnially reported from eastern Oklahoma. Hebard (1931) suggested that the latter was synonymous with T. kiowa fuscifrons (Stal).

Comments and distribution: This is a southwestern form, reaching its western limits in Oklahoma and Texas. It is found throughout the State but largely replaced in the Panhandle by T. kiowa kiowa (Thos). As does the latter, it prefers short grasses and areas of sparse vegetation.

County records: McCurtain, LeFlore, Latimer, Pittsburg, Hughes, Okmulgee, Nowata, Logan, Pottawatomie, Johnston, Bryan, Stephens, Kiowa, Jackson, Greer, Harmon and Custer.

Genus Metator McNeill, 1901

Metator McNeill, 1901, Proc. U. S. Nat. Mus. 23:394, 398.

Genotype: Psinidia pardalina Saussure, 1884. Prodr. Oedip. 28:162.

Note: This genus is represented by only one species in Oklahoma. The generic and specific characters are combined.

Metator pardalinus (Saussure)

Psinidia pardalina Sauss., 1884. Prodr. Oedip. 28:162.

Psinidia pardalina var. maculosa, Sauss., 1884, Prodr. Oedip. 28:162.

Metator pardlina, McNeill, 1901, Proc. U. S. Nat. Mus. 23:398.

Metator pardalinus, Rehn and Hebard, 1906, Proc. Acad. Nat. Sci. Phila. 58:381.

Characteristics: Head large; disc of vertex quadrate with very high lateral and frontal carinae; antennae longer than femora. Pronotum with posterior border rectangulate; posterior angle of lateral lobes angulate; median carina of moderate height, twice deeply cut by sulci, slightly higher on front than on hind lobe. Tegmina covered with black blotches somwehat resembling the genus Hippiscus Sauss., no distinct bands, dorsal and posterior portions divided by a yellow line; discs of hind wings red or yellow with dark crossbands. Posterior femora and tibiae blue on inner surfaces.

The above genus is very close to Trachyrhachys Scudd., but may be separated from the latter by a higher median carina, smoother surface of head and pronotum, tegmina without definite bands and antennae longer

than femora.

Comments and distribution: This species was reported by Newton and Gurney (1956) from the panhandle counties of Cimarron and Texas. It occurs in the short-grass prairie of the high plains from May to September.

County records: Cimarron and Texas.

SUMMARY

A field survey of the grasshopper populations of Oklahoma was made during 1956, 1957 and 1958. All counties of the State were surveyed.

A total of four subfamilies, 50 genera, and over 120 species and subspecies were reported from Oklahoma.

Keys to the subfamilies, genera and species are given. Descriptions and illustrations to aid in their determination are also included. Distributional data, based upon previous county records, plus the author's collections are given for each species.

Information concerning their relative abundance, habitat preferences, and economic considerations is also included.

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ILLUSTRATIONS

PLATE I

Left cercus of male, lateral view

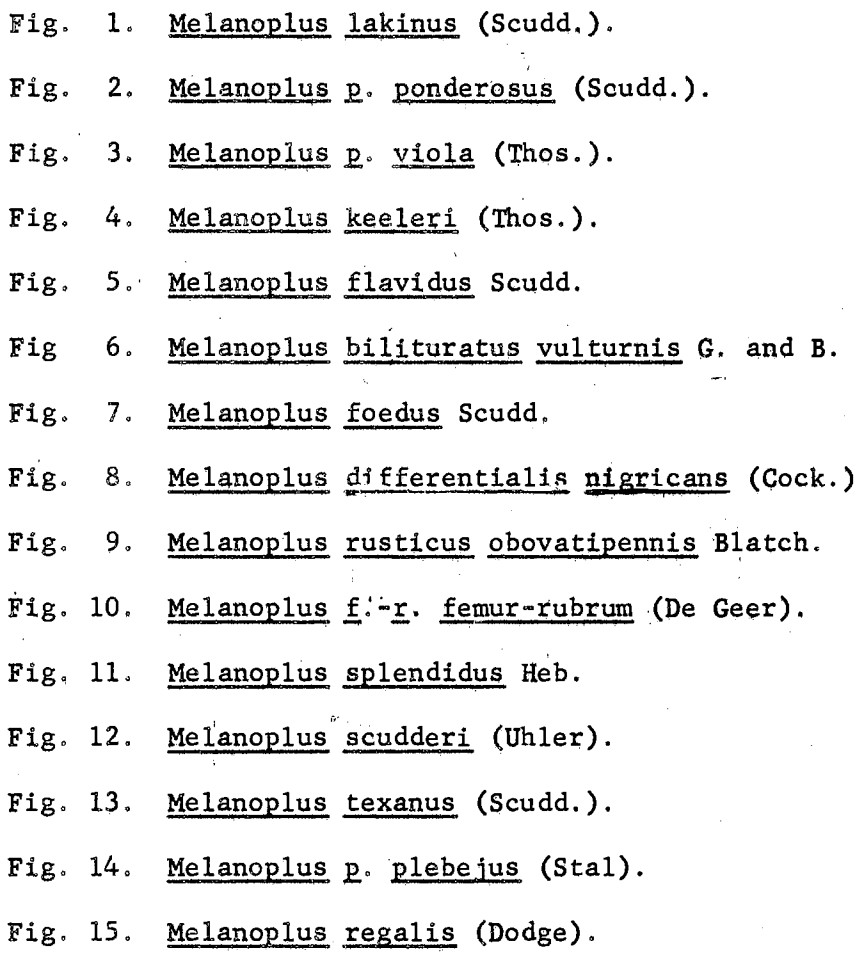


Fig. 1. *Melanoplus lakinus* (Scudd.).

Fig. 2. *Melanoplus p. ponderosus* (Scudd.).

Fig. 3. *Melanoplus p. viola* (Thos.).

Fig. 4. *Melanoplus keeleri* (Thos.).

Fig. 5. *Melanoplus flavidus* Scudd.

Fig 6. *Melanoplus bilituratus vulturnis* G. and B.

Fig. 7. *Melanoplus foedus* Scudd.

Fig. 8. *Melanoplus differentialis nigricans* (Cock.)

Fig. 9. *Melanoplus rusticus obovatipennis* Blatch.

Fig. 10. *Melanoplus f.-r. femur-rubrum* (De Geer).

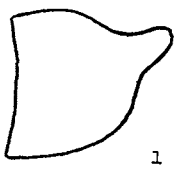
Fig. 11. *Melanoplus splendidus* Heb.

Fig. 12. *Melanoplus scudderi* (Uhler).

Fig. 13. *Melanoplus texanus* (Scudd.).

Fig. 14. *Melanoplus p. plebejus* (Stal).

Fig. 15. *Melanoplus regalis* (Dodge).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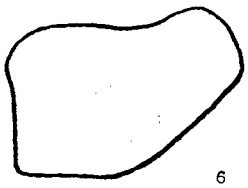
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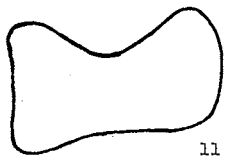
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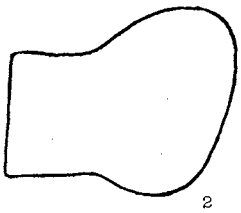
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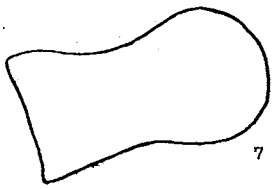
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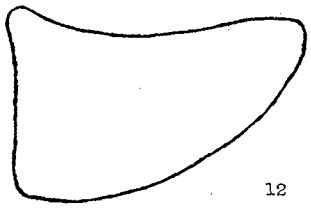
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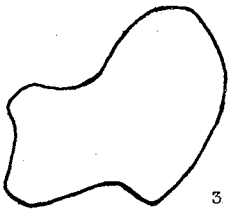
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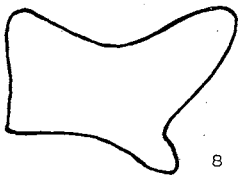
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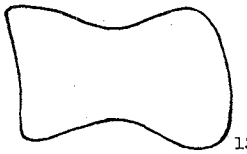
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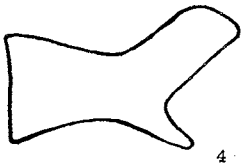
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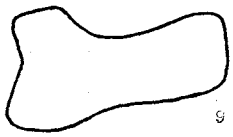
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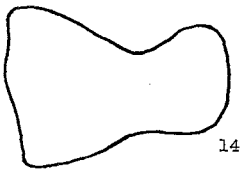
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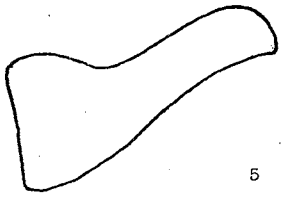
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PLATE II

Fig. 16. Melanoplus warneri Little, left cercus of male, lateral view.

Fig. 17. Melanoplus oklahomae Heb., left cercus of male, lateral view.

Fig. 18. Melanoplus impudicus Scudd., left cercus of male, lateral view.

Fig. 19. Melanoplus b. bowditchi Scudd., apex of subgenital plate.

Fig. 20. Melanoplus bilituratus vulturnis G. and B., apex of subgenital plate.

Fig. 21. Schistocerca lineata Scudd., apex of subgenital plate.

Fig. 22. Schistocerca obscura (Fabr.), apex of subgenital plate.

Fig. 23. Ageneotettix d. deorum (Scudd.), dorsal view of head.

Lf.----------Lateral foveola

Fig. 24. Head of a grasshopper, dorsal view.

Fr. cs.----------Frontal costa
Md. cr.----------Median carina of vertex
Ds. vt.----------Disc (or depression) of vertex

Fig. 25. Orphulella speciosa (Scudd.), dorsal view of head, showing depression of vertex.

Fig. 26. Orphulella p. pelidna (Burm.), dorsal view of head, showing depression of vertex.

Fig. 27. Psoloessa d. delicatula (Scudd.), dorsal view of head of female, showing fastigium. (Redrawn from Rehn, 1942).

Fig. 28. Psoloessa texana Scudd., dorsal view of head of female, showing fastigium. (Redrawn from Rehn, 1942).

Fig. 29. Mermiria neomexicana (Thos.), outline of vertex, dorsal view.

Fig. 30. Mermiria picta (Walk.)., outline of vertex, dorsal view.

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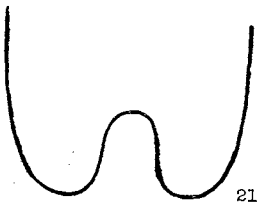

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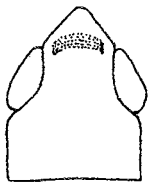

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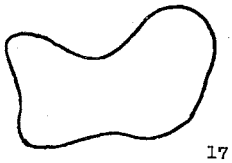

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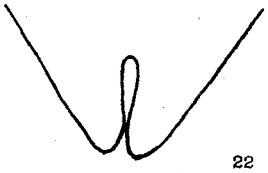

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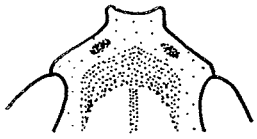

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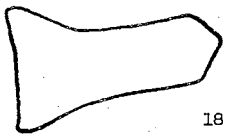

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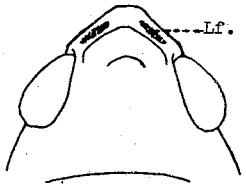

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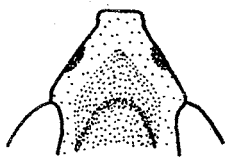

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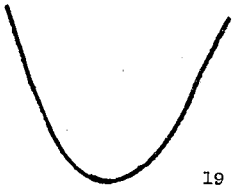

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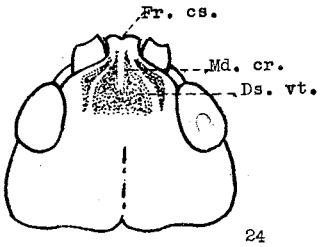

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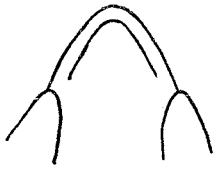

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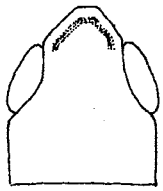

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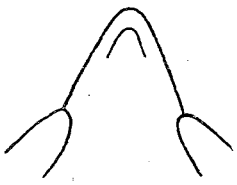

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PLATE III

Fig. 31. *Paratylotropidia brunneri* Scudd., outline of tegmina.

Fig. 32. *Paratylotropidia morsei* R. and R., outline of tegmina.

Fig. 33. *Trimerotropic laticincta* Sauss., hind wing.

Fig. 34. *Circotettix rabula nigrafasciatus* Beamer, hind wing, showing swollen veins.

Fig. 35. *Trachyrhachys k. kiowa* (Thos.), lateral view of pronotum.

Proz.----------Prozona
Mtz.----------Metazona
Pr. sl.----------Primary sulcus
Sc. sl.----------Secondary sulcus
Lt. lb.----------Lateral lobe

Fig. 36. *Mestobregma p. plattei* (Thos.), lateral view of pronotum.

Fig. 37. *Paratylotropidia brunneri* Scudd., mesosternum.

Lt. lb.----------Lateral lobe

Fig. 38. *Schistocerca* spp., mesosternum.

Fig. 39. *Melanoplus bilituratus vulturnis* G. and B., end of male abdomen.

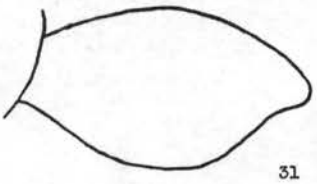
Fur.----------Furcula
Sp. pl.----------Supranal plate
Cer.----------Cercus
Sb. pl.----------Subgenital plate
10th Ab. sg.----------10th abdominal segment

Figs. 40 and 41. *Schistocerca alutacea* (Harris), and *Schistocerca lineata* Scudd, respectively: Oblique views of distal portions of phalli, with ectophallic membranes retracted and ventral lobes depressed. (Redrawn from Hubbell, 1960).

Z.----------Zygoma, between rami of cingulum
Pht.----------Phallotreme orifice
Vl.----------Ventral lobe

Figs. 42 and 43. *Melanoplus b. bowditchi* Scudd., and *Melanoplus flavidus* Scudd., respectively: Internal male genitalia, showing dorsal valves of aedeagus. (Fig. 43 redrawn from Brooks, 1958).

Ds. vl----------Dorsal valve
Mn. st.----------Main stem of penis



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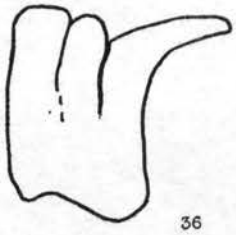

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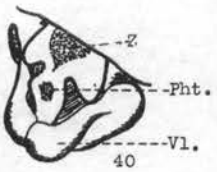

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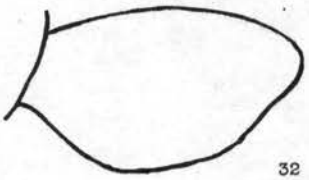

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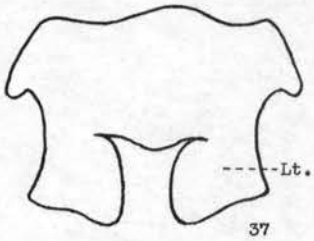

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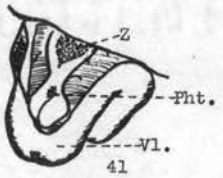

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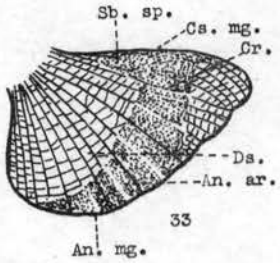

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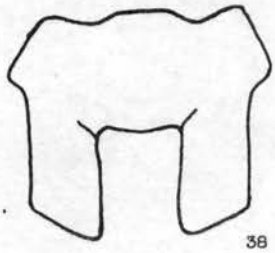

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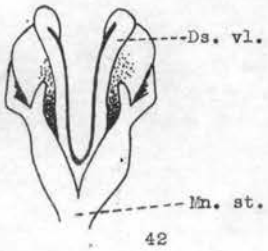

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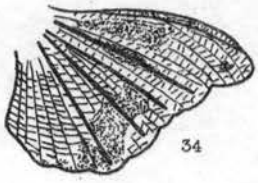

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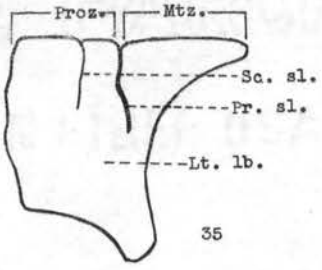

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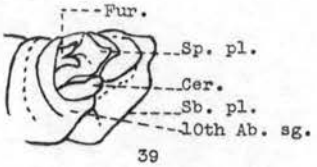

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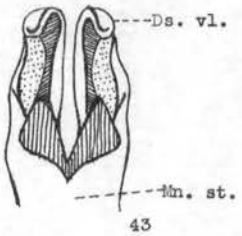

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VITA

STANLEY COPPOCK, JR.

Candidate for the Degree of

Doctor of Philosophy

Thesis: THE GRASSHOPPERS OF OKLAHOMA (ORTHOPTERA: ACRIDIDAE)

Major Field: Entomology

Biographical:

Personal Data: Born at Cleo Springs, Oklahoma, February 1, 1926, the son of Stanley and Bertha M. Coppock, Sr.

Education: Attended grade school at Hog Ranch, District 214, Major County, Oklahoma; graduated from Cleo Springs, Oklahoma High School; received the Bachelor of Science degree from Phillips University, Enid, Oklahoma, in 1947; received the Master of Science degree from the University of Oklahoma, with a major in Zoology, in 1951; completed the requirements for the Doctor of Philosophy degree in May, 1962.

Experiences: Medical laboratory technician, United States Army, 1950-1952; research fellowship (Hercules Powder Company) in entomology at Iowa State University, 1953; ranching and farming 1953-1954; Oklahoma Survey Entomologist, 1955-1958; graduate student at Oklahoma State University, 1958-1961.