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The Grasshoppers of Kansas: Part I.

The Melanopli of Kansas.

A thesis submitted to the Department of Entomology and to the Graduate Faculty of the
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for the degree of master of arts.

By P. W. ^{Walter}CLAASSEN,
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The Melanopli of Kansas.

INTRODUCTION.

This paper is the result of several years' study of the group of grasshoppers known as the Melanopli, belonging to the subfamily Acridiinae. This group contains a large number of species of grasshoppers and includes nearly all of those of economic importance. The group is represented in Kansas by the following genera: *Hypochlora*, *Campylacantha*, *Hesperotettix*, *Æoloplus*, *Melanoplus*, and *Phætalotes*. Thirty-nine species are recorded here and are distributed under the six genera, as follows:

Hypochlora	1
Campylacantha	3
Hesperotettix	3
Æoloplus	2
Melanoplus	29
Phætalotes	1 (two var.)

The taxonomic side of the paper is based largely upon material collected during the summers of 1910, 1911 and 1912 by the Kansas University entomological expedition while collecting material for the museum in central and western Kansas. A lot of material was also collected during the summers of 1913 and 1914 while the writer, with five other members of the Department of Entomology of the University, was engaged in organizing the various counties for campaigns against the native destructive grasshoppers in Kansas.

The economic and biologic phases of the paper are based upon observations made at the time when economic work was carried on in the western part of the state.

Contribution from Entomological Laboratory, No. 221.

Grasshoppers of Kansas.

SYSTEMATIC TREATISE OF THE MELANOPLI WITH REFERENCE TO VARIATIONS FROM SCUDDER'S DESCRIPTIONS.

The aim of this paper has been to prepare a treatise on the Melanopli of Kansas which would treat the taxonomic, economic and biologic phases concerning this important group of grasshoppers. The greater number of species studied have come from central and western Kansas, and subsequent collecting in the eastern part of the state will undoubtedly reveal a number of species belonging to this group, not treated in this paper.

The keys to the genera and species have been modeled after Scudder's keys; the description of the group and the genera have been copied from Scudder directly. In the discussion of the species the variations of the Kansas species from Scudder's description have been given. In recording the measurements, the largest and smallest specimens were taken and their measurements recorded, respectively.

The author wishes to thank Prof. S. J. Hunter, under whose direction this work was undertaken. He also wishes to express his appreciation to Prof. H. B. Hungerford and to Miss Ruby Hosford for many helpful suggestions and corrections of the paper; to Mr. F. B. Millikan, of Garden City, with the Bureau of Entomology, for the use of laboratory and material in carrying on experiments in the field and for his many helpful suggestions; to Prof. G. A. Dean, of Manhattan, for the loan of a number of specimens; and to Mr. J. A. G. Rehn, of the Philadelphia Academy of Natural Sciences, and Prof. Lawrence Brunner, of the University of Nebraska, for verifying some of the more difficult species and for some very helpful suggestions.

MELANOPLI.

The Melanopli are acridians in which the antennæ are longer than the fore femora, which have no foveolæ on the vertex, the fastigium more or less deflexed, passing insensibly into the frontal costa, the prosternum mucronate, no sharp and distinct lateral carinæ (or they are rarely present), an arolium on all the tarsi, the hind tibia with smooth margins, provided with nine to fourteen (by rare exceptions eight) spines regularly disposed in the outer series, which lacks an apical representative, and the second hind tarsal joint only half as long as the first.

Stating their characters more in detail, the Melanopli may be described as acridians, generally of small or medium size, never very large, in which the head is not greatly exserted and the face is moderately oblique or subvertical; the antennæ are linear, longer than the fore femora; the eyes are of moderate size, not very strongly prominent,

never twice as long as the infraocular portion of the genæ, the interspace between them very rarely broad, generally narrow; the fastigium is more or less declivent, never greatly produced in the axis of the body, apically entire and with no transverse ruga, passing insensibly and with obtuse arcuation into the frontal costa; the latter is hardly rounded as seen from the side, percurrent or subpercurrent, generally sulcate, the sulcation ordinarily confined to the lower portion; without foveolæ, the tempora small, obliquely declivent, confused with the front; the superior ocelli more distant than the antennal scrobes; the lateral carinæ of the face nearly equidistant from the lateral margins of the frontal costa, but slightly divergent inferiorly. The dorsum of the pronotum is nearly plane and without a crest, generally with no distinct lateral carinæ, but at most with rounded shoulders or feeble rugæ to represent them, but often passing insensibly in the lateral lobes; the principal sulcus is continuous; the prozona is generally smooth or obsoletely punctate, never tuberculate, its sulci generally feebly impressed, often mesially interrupted or subinterrupted, the posterior sulcus often distinctly divergent laterally from the principal sulcus; the metazona is generally shorter than the prozona and lies in the same or nearly in the same plane with it, almost always densely punctate; the lateral lobes are truncate or subtruncate posteriorly, with no humeral sinus or only a feeble one, the posterior lower angle distinctly obtuse. The prosternum is armed with a spine, which is usually rather prominent and conical, sometimes truncate, never sinuate, generally vertical on the posterior face, nearly or quite as high as the anterior coxæ, the posterior portion of the prosternum not or but slightly tumescent; the mesosternal lobes are quadrate or transverse, separated more or less widely, the apical inner angle rectangular or obtusangulate, generally rounded (often obtusely), the inner margins generally rounded, often posteriorly divergent; the metasternal lobes are contiguous or not very distant, excepting sometimes in the female, and then rarely as distant or even nearly as distant as the metasternal lobes. The tegmina are frequently abbreviate or even wanting; when fully developed they taper gently almost throughout and are rather remotely reticulate at least in their apical half, the cells of the postradial area wholly or partially biseriate in arrangement on either side of an intercalary vein; the wings are almost always clear and uniform, never definitely pictured, the veins never scalariform, the areolæ quadrate or longer than broad. All the tarsi are furnished with an arolium, the front legs are less distantly separated than the hind pair, the fore tarsi are of moderate length, first joint short or rather short; the hind femora are distinctly incrassate basally, generally surpass the abdomen, the upper face generally smooth, the dorsal carina entire, unarmed, not profoundly excised before the geniculation; the hind tibiæ have smooth lateral margins, the spine of the outer and inner series are equal or subequal in length, those of the outer series typically nine or more in number, rarely exceeding fourteen, placed at subequal distances apart and lacking an apical spine next the calcaria; the hind tibiæ have the first joint not compressed, equal to or slightly longer than the third, the second much shorter, generally a half shorter, than the first, as seen from above. The second dorsal segment of the abdomen

is neither granulate nor dentate at the anterior angles, the extremity of the abdomen of the male generally more or less clavate and removed, the supra-anal plate not tuberculate, with a basal medial sulcus, a furcula usually present, the cerci very variable, rarely longer than the supra-anal plate, straight or gently curved, never abruptly recurved basally, generally compressed at least in part, often ———, but with no indirected median spine.—I. c. SCUDDER.

KEY TO THE GENERA OF MELANOPLI.

- A¹. Lateral margin of subgenital plate of male, as seen laterally, straight throughout, or very slightly convex, never at all abruptly ampliate at the base; tegmina always abbreviate.
- b¹. Head not prominent, the summit very slightly arched longitudinally; prosternal spine erect; furcula of male composed of projecting cylindrical fingers; surface of body feebly pilose. *Hypochlora*.
- b². Head prominent, the summit strongly arched longitudinally; prosternal spine more or less retrorse; furcula of male reduced to slight, scarcely projecting lobes; surface of body rather densely pilose. *Campylacantha*.
- A². Lateral margin of subgenital plate of male suddenly ampliate to a considerable degree at the base, or if not to a considerable degree, then the entire margin rather strongly convex or sinuate.
- b¹. Subgenital plate of male furnished with a distinct subapical tubercle (*i. e.*, one in which the apical margin does not pass through and form part of the summit of the tubercle, but where it is distinctly separate from that summit), but not otherwise tumescent.
- c¹. Body relatively slender and compressed, not much enlarged at the metathorax, particularly in the male; disk of pronotum tectiform, the prozona not distinguished from the metazona either by its plane or by any lack of the median carina, which latter is generally marked in color; pronotum fully half as long as broad; hind femora long and slender; apical tubercle of male abdomen prominent; furcula present as distinctly projecting lobes; terminal segment of female abdomen not abbreviate, the ovipositor fully exerted *Hesperotettix*.
- c². Body relatively short and stout, considerably enlarged at the metathorax, even in the male, disk of pronotum gently convex transversely, the prozona slightly and independently tumid with no median carina, thus distinguishing it from the metazona; hind femora relatively short and stout; apical tubercle of male abdomen not very prominent; furcula scarcely or not apparent; terminal segments of female abdomen abbreviate, the ovipositor only partially exerted *Ecolopus*.
- b². Subgenital plate of male with no distinct subapical tubercle, but often apically prolonged or tumescent.
- c¹. Head not large in proportion to pronotum, not prominent, but little longer above than prozona except when the latter is transverse, the intercalary veins of the discoidal area rather numerous. Cerci of male very variable. *Melanoplus*.
- c². Head large in proportion to pronotum, and prominent, nearly half again as long above as the prozona. Intercalary veins few and indefinitely marked; cerci of male styliform; subgenital plate of male very narrow. *Photulites*.

Hypochlora.

Body slender, compressed, very thinly pilose. Head not prominent, the summit gently arched, the fastigium descending with moderate rapidity, the face retreating considerably; interspace between the eyes broad, the fastigium scarcely sulcate, the frontal costa rather narrow, not nearly so broad as the space between the eyes, sulcate, percurrent, and subequal; eyes moderate in size, not very prominent, similar in the two sexes, about

half again as broad as long, and distinctly longer than the anterior infraocular portion of the genæ; antennæ moderately stout, somewhat longer (male) or a little shorter (female) than the head and pronotum together. Pronotum subequal, even in the female, very feebly and gradually enlarging in passing backward, with a distinct percurrent median carina, the disk very broadly subtectate, passing by a rounded angle hardly forming a lateral carina into the vertical lateral lobes, the front subtruncate, the hind angle very obtusely angulate, the very coarsely, feebly, and sparsely punctate prozona half again as long as the finely and suddenly punctate metazona, its posterior margin faintly angularly emarginate, the transverse sulci feeble, one dividing into two equal halves and straight, the other a third the way behind it to the metazona and sinuate. Prosternal spine erect, moderately slender, conical; interspace between mesosternal lobes more than twice as long (male) or nearly half as long again (female) as its middle breadth, the shape being strongly clepsydral from the convexity of the inner margin of the lobes, the metasternal lobes subattinent, especially in the male. Tegmina abbreviate, acuminate, attinent or overlapping, about as long as the pronotum. Fore and middle femora slightly tumid in the male; hind femora slender, somewhat compressed, the lower genicular lobe not free from markings, the hind tibia with nine to ten spines in the outer series. Abdomen of male not clavate nor turned upward apically, the lateral margins of the subgenital plate straight from the very base, acutangulate at tip, with a slight, blunt, apical tubercle; cerci very slender and simple; furcula consisting of a pair of slight cylindrical slender fingers, subparallel or more or less crossing one another, perhaps parallel in life.—
l. c. SCUDDER.

Hypochlora alba Dodge.

Whitish to yellowish green, rather small, the head with a pallid stripe from the upper margin of the eye backward, extending in the paler forms across the entire pronotum and downward on the pleura of the metanotum. An olive-green postocular band extends backward over the entire pronotum; the antennæ of the darker forms are ferruginous except at the extreme base, where they are somewhat paler. The median and lateral carina are marked by narrow yellowish stripes, becoming white in the paler forms; tegmina pale grass green to testaceous; the sulcus, which divides the median ridge of the supra-anal plate, fails to reach the tip in some cases.

MEASUREMENTS IN MILLIMETERS.

Length of body:

Male 17.0-18.5

Female 20.0-24.0

Tegmina:

Male 4.5- 7.0

Female 6.0- 6.5

Antennæ:

Male 7.0- 8.0

Female 6.0- 7.5

Hind femora:

Male 11.0

Female 13.0

LOCALITIES. Finney, Rooks, Sedgwick, Russell, Clark, Lane, Stevens and Douglas counties.

This species is rather common in the state, and is usually found among the Chenopodiaceæ.

Campylacantha Scudder.

Body somewhat compressed, rather densely pilose. Head rather prominent, especially in the male, the genæ being rather tumid and the summit strongly arched and distinctly elevated above the level of the pronotum, the fastigium descending rapidly, but the face moderately retreating; interspace between the eyes rather broad (male) or broad (female), the fastigium feebly if at all sulcate, the frontal costa distinctly broadest between the antennæ, where it is nearly as wide as (male) or still much narrower (female) than the interspace between the eyes, percurrent, sulcate at least below the ocellus; eyes not very prominent nor very large, longer in proportion to breadth in female than in the male, and yet in the female hardly, in the male distinctly, longer than the anterior infraocular portion of the genæ; antennæ rather coarse, more than half as long as the body of the male, distinctly longer than the head and pronotum together in the female. Pronotum subequal (male) or distinctly and very gradually broadening posteriorly (female) with a rather slight median carina, sometimes interrupted between the sulci, the disk very broadly subtectate, passing by a rounded angle, without forming lateral carina, into the vertical (female) lateral lobes, the front margin subtruncate, in no way flaring, the hind margin obtusely angulate, the impunctate or very feebly rugulose prozona nearly or quite half again as long as the punctate or distinctly rugulose metazona, its transverse sulci moderately distinct, that in the middle straight, and followed a third of the way to the metazona by a similar but arcuate sulcus. Prosternal spine blunt conico-cylindrical, more or less retrorse; interspace between mesosternal lobes nearly twice as long (male) or half as long again (female) as broad, the inner margins of the lobes nearly straight; metasternal lobes attingent (male) or subattingent (female). Tegmina abbreviated, generally, but not always, a little longer than the pronotum, rounded or subacuminate at tip, their inner margins overlapping or separated. Fore and middle femora distinctly gibbous in the male; hind femora variable, as also the coloring of the inferior genicular lobe; hind tibia with nine to ten, generally nine, spines in the outer series. Abdomen of male very feebly clavate, very feebly upturned, the lateral margins of the subgenital plate not ampliate at the base, the apex bluntly angulate at tip, with a distinct but not very large tubercle, extending beyond the inner side of the apical margin; furcula consisting of a pair of slightly rounded, feebly projecting lobes.

This genus is closely allied to *Hypochlora*, but is composed of generally stouter forms, in which the antennæ are longer, the pronotum is usually rugulose rather than punctate, and the males of which have more tumid anterior femora, besides the differences pointed out in the table of genera.—l. c. SCUDDER.

KEY TO THE SPECIES OF *Campylacantha*.

- A¹. Distal half of anal cerci of male less than half as broad as the extreme base.
 b¹. General color griseous, sometimes a slight greenish tinge, hind tibia livid, finely flecked with griseous.....*acutipennis*.
 b². General color olivaceous; hind tibia yellowish green.....*olivacea*.
 A². Distal half of anal cerci of male more than half as broad as the extreme base.....*vivax*.

Campylacantha acutipennis Scudder.

Our specimens agree remarkably well with Scudder's description, and vary only slightly, as follows: Antennæ pale yellowish testaceous, sometimes becoming infuscated at the extreme tip; median carina distinct, the lateral carina more distinct on the metazona than on the prozona.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	20.0
Female	24.0-27.0
Tegmina:	
Male	7.0
Female	8.0-10.0
Antennæ:	
Male	10.0
Female	9.5
Hind femora:	
Male	11.5
Female	15.0-16.0

LOCALITIES. Douglas, Lane, McPherson, Labette, Shawnee and Barber counties. Found along roadsides and in the grasses.

Campylacantha olivacea Scudder.

General color varies from rather bright to dark olivaceous green. The antennæ are greenish at the base, sometimes mottled with brown; beyond the base they are orange to ferruginous, infuscated at the tip. The darker forms have very little of the lemon-yellow marking on the pronotum; pronotum dusky. Legs yellowish green to dark olivaceous, rarely tinged with orange; cerci slender, feebly incurved, the apical half about half as broad as the basal half.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	18.0-20.0
Female	23.0-30.0
Tegmina:	
Male	5.0- 8.0
Female	8.0- 9.0
Antennæ:	
Male	10.5 (approx.)
Female	10.0 (approx.)
Hind femora:	
Male	12.5-13.0
Female	16.0

LOCALITIES. Lane, Clark, Douglas, Sedgwick and Rooks counties. The habitat of this species is very much the same as that of *acutipennis*.

Campylacantha vivax Seudder.

Size medium; general color yellowish green with brownish markings. Head with a narrow longitudinal brown stripe on top bordered broadly on each side with dark olivaceous. Frontal costa subequal, sulcate at and below ocellus, fastigium very shallowly sulcate; antennæ dark ferruginous, infuscated in apical two-thirds. Pronotum nearly as wide as head, feebly enlarging posteriorly, dorsum rather convex; prozona about a third longer than metazona. Median carina more distinct on metazona than on prozona cut by the principal sulcus, the lateral carina with a short yellowish-brown stripe; prozona sparsely punctate; metazona profusely punctate, becoming rugulose, anterior margin truncate, posterior margin obtusely angulate. Prosternal spine rather stout, bluntly pointed, appressed. Tegmina sublanceolate, about as long as the pronotum; wings rudimentary. Hind femora greenish yellow, bifasciate above with olivaceous and with a whitish stripe on outer lower margin. Hind tibia blue, the spines blue with black tips, ten in number in the outer series; orolium large. Supra-anal plate of male triangular, as wide as long apically, acuteangulate, with median sulcus extending nearly one-half the length of the supra-anal plate. Furcula consisting of a pair of minute lobes; cerci nearly straight, failing to reach the tip of supra-anal plate by one-half their length, distal half more than half as broad as basal half, tip produced below.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	19.5
Female	24.5
Tegmina:	
Male	5.5
Female	6.25
Hind femora:	
Male	11.5
Female	14.0
Antennæ:	
Male	8.5

LOCALITY. One male, two females; Morton county, Kansas, August 5, 1911, F. X. Williams.

Now first reported from Kansas.

Hesperotettix Scudder.

Body almost parallel-sided, very little enlarged at the metathorax, more or less but not generally compressed, more so in the male than in the female. Head not very prominent; vertex usually very narrow between the eyes, with a slight depression or sulcation between; fastigium broadening in front of it, declivent, with a median depression or longitudinal sulcation, sometimes distinct, sometimes obscure, the sides rounded; front straight, somewhat oblique, the frontal costa equal, only slightly contracted at the extreme summit, generally as broad as if not broader than the interval between the eyes, sulcate throughout; antennæ slightly (female) or considerably (male) longer than the head and pronotum together; eyes slightly prominent, a little more so in the male than

in the female, rather long oval, much longer than the infraocular portion of the genæ. Pronotum long and slender, the dorsum fully half again as long as broad; the prozona little longer, sometimes half again as long as the metazona, with less distinction in surface and sculpture between them than common, alike broadly tectiform, the median carina slight but alike or nearly alike in both, the descending lateral lobes separated by no angle or ruga; posterior margin very obtusely angulate, the angle rounded, the border delicately margined. Prosternal spine rather long, bluntly conical; mesostethia and metastethia together much longer than broad; interspace between mesosternal lobes generally twice as long as broad in the male, almost equally narrow or subquadrate in the female, the metasternal lobes subattinent in both sexes. Tegmina and wings always present, generally fully developed or abbreviate, but sometimes lobate. Fore and middle femora of male tumid; hind femora long and slender, somewhat compressed, generally surpassing the abdomen, the superior carina slight, unarmed; hind tibia feebly amplicate apically, with spines of similar length on the two sides; first joint of hind tarsi scarcely longer than the third, the second small, with a large inferior apical lobe; arolium rather large, nearly twice as long as broad. Subgenital plate of male furnished with a prominent, subapical, more or less conical tubercle, the lateral margins of the plate suddenly ampliate at the base; furcula always distinctly present as a pair of projecting lobes; last abdominal segment of female not abbreviate, the ovipositor normally exerted.

This genus is closely related to *Hypochlora* and *Campylacantha*, but is separated from them by the basal ampliation of the margins of the subgenital plate of the male. The genus is still more closely allied to *Æoloplus*, from which it is separable by the form of the pronotum and the slenderness of the body.—l. c. SCUDDER.

KEY TO SPECIES OF *Hesperotettix*.

- A¹. Metazona of pronotum distinctly punctate on dorsum but not rugulose; prozona smooth.
- b¹. Dorsum of pronotum nearly plane; transverse sulci of pronotum distinctly marked in black.....*viridis*.
- b². Dorsum of pronotum tectiform; the transverse sulci not marked in black or in strong contrasting colors.....*pratensis*.
- A². Prozona and metazona, both on dorsum and lateral lobes equally and distinctly rugulose*speciosus*.

Hesperotettix viridis Thos.

The infraocular bar and the infra-antennal band vary from olivaceous to black, the infra-antennal band being absent in some of the specimens, while in others it forms a wide band reaching from the eye down to the clypeal suture. Longitudinal stripe of vertex olivaceous to black; sides of head behind the eyes streaked longitudinally with darker colors, sometimes becoming a broad olivaceous to black postocular band. Mediodorsal stripe white to ochraceous, or sometimes the stripe is ochraceous on the prozona and white or greenish white on the metazona. Lateral lobes of prozona variegated by an irregular assortment of brief longitudinal dark green, rarely black, bars. The greenish tinge on the

antennæ sometimes extends to the middle on the antennæ, becoming yellowish in the middle and testaceous from the middle toward the end. In most cases the cerci of the male taper all the way to the tip. This species looks very much like *H. festivus*, but the transverse markings are more strongly contrasted, the pregenicular annulation is more distinct; the tegmina are a little wider, not tapering as much.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	16.0-21.0
Female	18.0-28.0
Tegmina:	
Male	11.0-16.0
Female	16.0-22.0
Antennæ:	
Male	8.0- 9.0
Female	8.0-10.0
Hind femora:	
Male	8.5-12.5
Female	14.0-16.0

LOCALITIES. Stanton, Grant, Sherman, Trego, Seward, Russell, Stevens, Wichita, Norton, Greeley, Rooks, Decatur, Meade, Rawlins, Cheyenne, Wallace, Stanton, Rush, Graham, Douglas, Gray, Pawnee, Crawford and Montgomery counties.

Hesperotettix speciosus Scudder.

Grass green to a darker brownish green; head often flecked with fuscous or dark olivaceous; antennæ pale pink to ferruginous, becoming testaceous at the tip in some of the specimens; the first two basal joints grass green or olivaceous, often as long or longer than the head and pronotum together. Most of the specimens have the median carina of the pronotum pink rosette, in some specimens it is more pallid; tegmina vary from pale green and yellowish green to yellowish brown in the darker forms, the longitudinal veins yellow to yellowish green. Hind tibia light green, becoming yellowish green toward the tip; furcula consist of small lobes little longer than broad, sometimes triangular. Subapical tubercle often transverse.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	23.0-24.5
Female	27.0-36.0
Tegmina:	
Male	11.5-13.0
Female	14.0-20.0
Antennæ:	
Male	10.0-10.5
Female	8.5-11.0
Hind femora:	
Male	13.0-15.0
Female	14.5-19.5

LOCALITIES. This species is very common, and has been collected in all parts of the state where collections have been made.

Hesperotettix pratensis Scudder.

Head yellowish-green, flecked with fuscous in front, lower portion of face more or less purplish to dark green; a blackish or fuscous stripe on vertex of head usually extending back over the entire pronotum, a lighter-colored median stripe is sometimes present. Pronotum of both male and female increasing slightly from the front backward. All specimens have a pallid line along the position of the lateral carina of the prozona, extending in some cases across the head and following the upper hinder margin of the eye to the vertex, in a few specimens the pallid line also extends backward across the metazona. The white dashes on the lateral aspect of the pronotum usually fade out entirely upon drying. Tegmina rarely as short as the length of the abdomen, in length from 2 to 4 mm.; the anal vein is usually marked by a distinct pinkish stripe, varying more or less in width. Male cerci straight to feebly downcurved.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	20.0-22.0
Female	18.0-31.0
Tegmina:	
Male	16.0-18.0
Female	14.0-22.5
Antennæ:	
Male	8.5
Female	7.0- 9.0
Hind femora:	
Male	11.5-12.0
Female	13.5-16.5

LOCALITIES. Ford, Sedgwick, Gray, Douglas, Seward, Sherman, Logan, Stevens and Norton counties.

This species is much more rare than *H. speciosus*.

Æoloplus Scudder.

Body relatively short and stout, considerably enlarged at the metathorax, even in the male. Head normal, the eyes moderately distant, not very prominent except sometimes in the male, the summit well arched, the fastigium slightly sulcate between the eyes, the frontal costa moderately broad, subequal, plane or nearly plane; antennæ moderately stout, cylindrical, equal, slightly longer (male) or slightly shorter (female) than the head and pronotum together. Pronotum stout, regularly increasing in size from in front backward, the disk gently convex transversely, the prozona slightly and independently tumid, with no or an exceedingly feeble median carina, distinguishing it from the flat carinulate metazona; posterior margin of pronotum very obtusely angulate, the angle more or less rounded; prozona about half again as long as the metazona, generally slightly broader than long or quadrate. Prosternal spine conical, erect; interval between mesosternal lobes of male about twice as long as broad, often clepsydral from the convexity of the inner margins of the lobes; of female varying from the same to quadrate; the metasternal lobes attingent or subattingent in the male, a little distant in the female. Fore and middle femora considerably tumid in the male, the

hind femora relatively short and stout, occasionally furnished inferiorly in the male with a basal tooth protecting the calcaria when the tibia are closed upon the femora. Tegmina generally completely developed, but often somewhat abbreviate, rarely lobate. Subgenital plate of male with the lateral margins very strongly ampliate and arched at the base, and furnished with a distinct but not very prominent subapical tubercle, the apical margin of the plate forming its inner base; furcula scarcely or not apparent; cerci tapering, apically very slender, simple; terminal segments of female abdomen more or less considerably abbreviated, the ovipositor only partially exerted.

This genus is closely related to *Hesperotettix*, and these two genera are the only ones in the section of *Melanopli* with ampliate base to the lateral margins of the subgenital plate, in which the abdomen terminates in a tubercle distinct from the margin itself, though it is a rather common feature in the alternate sections.—I. C. SCUDDER.

KEY TO THE SPECIES OF *Æoloplus*.

- A¹. Tegmina at rest extending slightly to considerably beyond the tip of the abdomen, especially in the male. Supra-anal plate of male subtriangular with broadly angulate sides, cerci more than twice as broad at base than at tip.....*regalis*.
 A². Tegmina at rest shorter, as long as or slightly longer than the tip of the abdomen. Supra-anal plate of male triangular, sides nearly straight; cerci at the base scarcely more than twice as broad as at tip.....*turnbulli*.

Æoloplus regalis.

"The variation among the specimens before us is very slight, being limited to shades of coloration, and the markings of the hind femora. They conform with Scudder's description. The range of coloration is noticeable, the green varying from light to dark green. The ground color varies from testaceous to greenish yellow. Of the femur Scudder says 'testaceous yellow with two broad angulate and sagittate bands darkest above'; our specimens present these features and in addition a basal spot which sometimes takes the form of a third oblique stripe. In some these angular bands fuse so as to cover almost the entire surface of the femur. The pallid base of the hind tibia mentioned by Scudder takes in our specimens the form of a clearly definite annulus."—HUNTER AND SUTTON.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	18.0-24.0
Female	22.0-28.0
Tegmina:	
Male	14.0-20.0
Female	17.0-19.5
Antennæ:	
Male	8.0-11.0
Female	9.0-10.0
Hind femora:	
Male	11.0-14.0
Female	15.0-16.5

Found everywhere over the state, and is one of the first to mature in spring. There probably are two generations a year.

* Reported from Kansas by Bruner.

Melanoplus Stal.

Body moderately stout, rarely slender, generally feebly compressed, more or less but generally feebly pilose. Head moderately, rarely not at all, prominent, generally but little if any longer than the prozona, unless the latter (as rarely) is distinctly transverse; face almost vertical or a little oblique, its angle with the fastigium rarely less than 75 degrees; vertex gently tumid; eyes rounded oval, never more, generally less, than half as long again as broad, the anterior margin subtruncate or feebly convex, separated above rather narrowly, at most but little farther apart than the width of the equal or subequal frontal costa; fastigium more or less, sometimes very, declivent, passing insensibly into the frontal costa, always more or less sulcate or with elevated lateral margins generally more deeply sulcate in the male than in the female; frontal costa moderately prominent, generally sulcate below, usually more or less punctate; antennæ slender, of variable length, but never very short, never longer than the hind femora, and rarely if ever more than twice as long as the pronotum, even when this is subtruncate posteriorly. Pronotum generally subcompressed, rarely or never twice as long as the average breadth, generally only half again as long as the average breadth even in the male, the metazona generally more or less flaring, its disk plane and ——— densely punctate, while that of the prozona is more or less, generally slightly, convex, is rarely at all flaring in front or only in the very slightest degree, at most faintly punctate and generally distinctly longer than the metazona; front margin generally truncate or subtruncate, hind margin obtuse-angulate to a greater or less degree, rarely subtruncate; median carina always distinct on the metazona, generally much less so on the prozona, often subobsolete between the sulci and never wholly wanting; lateral carina typically obsolete, but often indicated by a distinctly abrupt though rounded shoulder, rarely becoming carinate; lateral lobes vertical or subvertical, especially below, often feebly tumid above on the prozona, and generally marked by a piceous postocular band, crossing either the prozona alone or the whole pronotum, not infrequently broken or maculate. Prosternal spine variable, but always prominent; meso- and metastethia together distinctly longer than broad in both sexes, interspace between mesosternal lobes generally longer or much longer than broad, never in the least broader than long, even when the sides of the interspace are very divergent posteriorly (male) or generally quadrate but more variable than in the other sex, sometimes as narrow as there but more frequently subtransverse, occasionally in brachypterous forms distinctly transverse, as a general rule wider in the other sex (female), in both always distinctly, generally much, narrower than the lobes themselves, metasternal lobes generally attinent or subattinent, rarely only approximate (male), or generally approximate or subapproximate, the interspace between them generally narrower than the frontal costa (female); metasternum rapidly narrowing posteriorly, so that the portion behind the lobes is not, or is hardly more than, half the greatest width of the metasternum, but is more than twice as broad as long. Tegmina always present, but either abbreviate and then lateral, attinent or overlapping, sometimes shorter and sometimes longer than, but gen-

erally nearly the length of the pronotum, and usually more or less acuminate apically; or they are fully developed and then usually about attain or a little surpass the tips of the hind femora, tapering more or less but very gradually and apically well rounded, at a distance from the apex equal to the breadth of the tegmina distinctly narrower than the metazona, the intercalaries and cross-veins of the discoidal area relatively numerous at least in the apical fourth and usually throughout, the venation in general sharp and clearly defined, the humeral vein straight and only apically arcuate, nearly always terminating either on the apical margin or only a short distance before it, running for some distance almost exactly parallel to the costal margin or merging insensibly into it, the area intercalata always, even in macropterous forms of dimorphic species, extending somewhat, generally considerably, beyond the middle of the tegmina. Hind femora moderately long and slender, the inferior genicular lobe with at least a darker basal spot or transverse band, the hind tibia with a variable number of spines (generally nine to fourteen) in the outer series, by rare exception eight only. Abdomen more or less compressed, the sides of the first segment with a distinct tympanum, the extremity of the male more or less, sometimes strongly, clavate, usually considerably recurved, the subgenital plate of variable form, but always with the lateral margins ampliate at the base and with no distinct apical tubercle, though not infrequently apically produced or subtuberculate and frequently tumescent; cerci exceedingly variable in form, often enlarging apically, always lamellate excepting (the *lakinus* series) where they are basally globose, never styliform, rarely in the least substyliform, generally incurved and of about the length of the supra-anal plate; furcula usually developed and to a very variable extent, and with variable form; pullium rarely exerted; ovipositor of female generally fully exerted.—

l. c. SCUDDER.

KEY TO THE MELANOPLI.

- A¹. Tegmina conspicuously shorter than the abdomen, often no longer than pronotum; furcula generally feebly developed, generally no longer than the last dorsal segment from which it arises.
 - b¹. Cerci of male expanding from the base outward and bullate, abruptly tapering and bent inward at the tip; subgenital plate of male abruptly elevated apically.
 - c¹. Interval between mesosternal lobes of male distinctly twice as long as broad; of female fully as broad as long. *marentensis*.
 - c². Interval between mesosternal lobes of male distinctly less than twice as long as broad; of female barely broader or not broader than long. *lakinus*.
 - b². Cerci of male tapering in the basal half, usually from the very base, sometimes throughout, usually laminate; subgenital plate of male of variable elevation apically.
 - c¹. Cerci of male beyond the middle either equal or tapering, sometimes simply styliform throughout, the tip usually more or less pointed, metasternal lobes of male attinent or subattinent.
 - d¹. Cerci of male very broad and short, not more than twice as long as the middle breadth, and broadly rounded at apex. *discolor*.
 - d². Cerci of male more elongate, at least twice, generally much more than twice, as long as middle breadth, ordinarily more or less acuminate at apex. *scudderii*.
 - c². Cerci of male more or less expanded apically so as to be broader at some point beyond the middle than at the middle; spatulate or subspatulate.

- d¹. Subgenital plate of male short and broad, its apical breadth equal to or surpassing the length of its lateral margin.....**texanus*.
- d². Subgenital plate of male distinctly narrower than long, often narrowing apically.....†*gracilis*.
- A². Tegmina nearly or quite as long as, or longer than the abdomen; furecula generally well developed, generally at least a quarter as long as the supra-anal plate, but sometimes obsolete.
- b¹. Cerci of male expanding from the base toward the middle, as a whole broad and short, flabellate, not expanded apically.
- e¹. Cerci of male twice as broad in broadest as in narrowest portion.
- d¹. Subgenital plate of male with a distinct though minute independent apical tubercle*occidentalis*.
- d². Subgenital plate of male with no trace of an apical tubercle.....*flabellifer*.
- e². Cerci of male with no striking inequality in breadth.....*flabellifer*.
- b². Cerci of male tapering from the very base toward the middle, rarely equal in basal portion; generally long and slender and rarely as little as twice as long as broad.
- e¹. Cerci of male beyond the middle either equal or tapering, the tip usually slender or acuminate, never bifurcate.
- d¹. Furecula of male developed as large flattened lobes, about half as long as the supra-anal plate and exceptionally broad, but apically narrowed by the considerable excision of the inner side; subgenital plate not elevated apically above the lateral margins.
- e¹. Forks of the male furecula more or less obliquely or transversely truncate at tip, and given an oppositely hooked appearance by the rounded excision of the inner margin; hind femora generally distinctly banded.
- f¹. Lateral lobes of prozona with a broad and usually distinct piecous band above; tegmina generally distinctly flecked along the middle line.....*bowditchi*.
- f². Lateral lobes of prozona with a narrow or no distinct band above; tegmina very obscurely flecked, if at all, along the middle line*flavidus*.
- e². Forks of the male furecula rounded symmetrically at the tip, the inner margin scarcely more excised than the outer, so that the forks are straight and not oppositely hooked; band of hind femora scarcely perceptible.....*elongatus*.
- d². Furecula of male variously developed, rarely at all unusually broad and flattened, and then either not apically emarginate on the inner side or the subgenital plate is considerably elevated apically, or both.
- e¹. Subgenital plate of male almost or quite as broad as the marginal length, its apical margin generally notched; cerci broad and nearly equally broad throughout (except sometimes narrowed by the oblique excision on the lower side of the apical half), the basal half scarcely tapering, the whole rarely more than twice and never thrice as long as the middle breadth (except in a few cases, and then the apical margin of the subgenital plate is mesially notched), very broadly rounded at the apex.
- f¹. Apical margin of subgenital plate of male not mesially notched; mesosternum of male variable.
- g¹. Apical margin of subgenital plate of male but slightly elevated above the lateral margin and moderately prolonged posteriorly; mesosternum of male in front of lobes flat*glaucepes*.

* Reported from Labette county, Kansas, by Scudder. Proceedings of Natl. Museum, Vol. 20.

† Reported from Sedgwick county, Kansas, by Isely. Kansas Academy of Science, Vol. XIX, 1903 and 1904.

- g². Apical margin of subgenital plate of male conspicuously elevated above the lateral margin and prolonged posteriorly; mesosternum of male in front of lobes with a central swelling, forming a blunt tubercle. *scitus*.
- f². Apical margin of subgenital plate of male mesially notched; mesosternum of male in front of lobes with a central swelling a blunt tubercle.
- g¹. Tegmina extending beyond hind femora, if at all, by not more than the length of the pronotum; prozona of male quadrate or very feebly transverse; cerci of male generally almost or quite twice as long as broad. *atlantis*.
- g². Tegmina extending beyond hind femora by the length of the pronotum or nearly as much, often by the length of the head and pronotum combined; prozona of male generally strongly transverse; cerci of male not more than half as long again as broad. *spretus*.
- e². Subgenital plate of male entire, narrower than long, apically conspicuously narrower than at base; cerci distinctly narrowing on basal half, the upper angle of the apex prolonged and often subacuminate.
- f¹. Pronotum marked above with light carinal streaks on dark background; tegmina dark olivaceous green. *plumbeus*.
- f². Pronotum uniform in coloring above; tegmina dark fuscous. *femur-rubrum*.
- e². Cerci of male more or less expanded apically, so as to be broader at some point beyond the middle than at the middle, spatulate or subspatulate or apically bifurcate.
- d¹. Cerci of male spatulate or subspatulate, at most moderately broad, apically entire and no broader than at base; furcula always developed as distinct denticulations, generally as long or very long ones.
- e¹. Furcula of male long and prominent, the projecting portion much longer than the last dorsal segment from which it springs, generally more than a third as long as the supra-anal plate.
- f¹. Subgenital plate of male not very broad at apex, distinctly narrower than long, not notched; furcula about half as long as supra-anal plate. *bispinosus*.
- f². Subgenital plate of male very broad apically, nearly or quite as long as broad, apically generally notched, though feebly; furcula rarely more than a third the length of subgenital plate.
- g¹. Hind tibia red. *coccineipes*.
- g². Hind tibia glaucous.
- h¹. Furcula of male not more than a third as long as supra-anal plate; tegmina lightly or not at all maculate. *angustipennis*.
- h². Furcula of male more than a third as long as supra-anal plate; tegmina usually heavily maculate. *impiger*.
- e². Furcula of male slight, the projecting portion not longer or scarcely longer than the last dorsal segment from which it springs.
- f¹. Interval between mesosternal lobes of male nearly or quite twice as long as broad.
- g¹. Median carina of pronotum obsolete or almost obsolete on the prozona, distinct but low on the metazona; extremity of male cerci nearly plain exteriorly or merely depressed within the margin; fork of furcula conspicuously divergent.

* Now apparently extinct.

- h¹. Prozona ordinarily with a broad median dark stripe, made more conspicuous by the much lighter colors on either side, or else light brownish testaceous; antennæ of male little more than three-fourths as long as hind femora; hind tibia blue or red *packardii*.
- h². Prozona with uniform dingy coloring on disk; antennæ of male almost as long as hind femora; hind tibia red..... *fordus*.
- g². Median carina of pronotum tolerably distinct on the prozona, at least anteriorly, distinct and moderately high on the metazona; extremity of male cerci deeply sulcate exteriorly or else tumid; forks of furcula parallel or only slightly divergent *conspersus*.
- f². Interval between the mesosternal lobes of male subquadrate. *compactus*.
- d². Cerci of male apically bifurcate, or with an inferior submedian process or abrupt angulation, or else expanded so as to be distinctly, generally much, broader apically than at extreme base; furcula wanting or minute.
- e¹. Size small or medium; supra-anal plate of male pretty regularly triangular, with straight or feebly convex lateral margins; furcula usually distinctly developed; prosternal spine usually short.
- f¹. Furcula of male consisting of slender spines, longer than the last dorsal segment; base of lateral margins of subgenital plate incurved *minor*.
- f². Furcula of male consisting of brief triangular lobes; base of lateral margins of subgenital plate incurved. *avidus*.
- e². Size large; supra-anal plate of male of variable shape; furcula either absent or very minutely developed; prosternal spine usually long.
- f¹. Furcula of male entirely absent or present only as a minute point or bead; hind tibia usually yellow. *differentialis*.
- f². Furcula of male distinctly present, though always very small, angulate, the angle rarely produced; hind tibia never entirely yellow *bicittatus*.

Melanoplus marculentus Brunner.

Of this genus we have no representative in the collection now, but it has been reported from Kansas by Hunter and Sutton, in *Psyche*, July, 1900. The following notes are taken from their report: "This specimen of *marculentus* manifests a trait liable to appear in short-winged varieties. It agrees with Scudder's description, with the exception of the darker coloring of the upper portion of the head and pronotum and the greater length of the subgenital plate, but instead of the normal abbreviated wing the insect has well-developed tegmina and wings. The tegmina extend clearly beyond the end of the abdomen and are remarkably broad for one of this genus. Width of tegmina, 6 mm.; length, 11 mm. (tips were frayed); basal half testaceous, two or three testaceous spots on the discoidal area. Wings hyaline, veins and cross veins fuscous in distal portion, glaucous basally."

LOCALITY. Russell county.

Melanoplus lakinius Scudd.

Antennæ a little more (male) or a little less (female) than two-thirds the length of the hind femora. Frontal costa variably sulcate. Median carina more distinct on metazona than on prozona. Prozona of female

longer than metazona. Lateral carina more or less distinctly marked, forming rather square shoulders. Furcula with the pointed projections subparallel, widely separated and extending outside of the ridge of the median sulcus of the supra-anal plate.

The general color is brownish griseous tinged with olivaceous, and yellowish beneath. Antennæ apically infuscated. The bands on the head and pronotum vary from piceous black to dark olivaceous. Hind femora trifasciate above with dark olivaceous.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	17.0-23.0
Female	23.0-32.0
Tegmina:	
Male	4.5-16.5
Female	6.0-20.0
Antennæ:	
Male	7.5- 9.0
Female	8.5-10.0
Hind femora:	
Male	9.5-13.5
Female	12.5-17.5

This species is very common in Kansas and is one of the first to mature in spring. Fully developed specimens have been found the first of June. There are, very probably, two generations a year. Although very common and at times quite numerous, we have never observed them in large enough numbers to be of any great economic importance. They are found along the roadsides and pastures as well as in cultivated fields. The length of the tegmina varies from very short to ones that extend the entire length of the abdomen, or even beyond it. We have observed the females oviposit from the middle of June till late in September, and even in October.

Found in all counties where collecting has been done.

Melanoplus discolor Scudd.

The general color is brownish fuscous above and yellowish brown below. Antennæ ferruginous, somewhat infuscated at the tip. A very broad piceous belt, which widens posteriorly, extends from behind the eyes across the prozona. Tegmina are darker on the lateral field than on the dorsal.

Vertex of head considerably elevated above the pronotum of the male, but not elevated at all in the female. Frontal costa subequal, flat above ocellus, slightly sulcate at and below ocellus. Median carina distinct, cut only by the principal sulcus. Prosternal spine cylindrical, blunt and retrorse. Supra-anal plate of male triangular, with median sulcus extending half the length of the plate. Furcula very small approximate lobes, the lobes shorter than the last dorsal segment from which it springs. Hind femora trifasciate above with blackish, the basal fasciation taking the form of a dark spot. Hind tibia bright red with black-tipped spines eleven to twelve in number in the outer series.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	16.0-18.5
Female	22.0
Tegmina:	
Male	6.0- 9.0
Female	10.0
Antennæ:	
Male	7.0- 8.5
Female	8.0
Hind femora:	
Male	9.0-11.5
Female	12.5

LOCALITIES. Clark, Osborne and Grant counties. Now first reported from Kansas.

Melanoplus scudderi Uhler.

The postocular band varies from obscure fuscous to piceous black. Frontal costa subequal, about as wide as the interspace between the eyes. Eyes somewhat longer than the infraocular portion of the genæ, but not much longer. Infuscation of apical portion of antennæ slight. Tegmina in the male not much longer than prozona, of female about as long as pronotum. The hind femora of all specimens have a distinct olivaceous tinge on the outer face, and most of them on the lower, bifasciate above. Hind tibia with 11 to 13 spines in the outer series. Cerci of male less than twice as long as the basal breadth, and not more than one-half again as long, very slightly sulcate in the apical half. Subgenital plate of male slightly raised apically.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	18.0
Female	22.5
Tegmina:	
Male	3.25
Female	6.5
Antennæ:	
Male	8.5
Female	9.0
Hind femora:	
Male	10.5
Female	14.0

LOCALITIES. Douglas, Sedgwick and Riley counties.

Melanoplus occidentalis Thomas.

Interspace between the eyes of male as wide or a little wider than the first antennal joint. Median carina more distinct on the metazona than on the prozona, but distinctly present between the sulci. Tegmina extending beyond the tip of the abdomen in all specimens by 1.5 mm. or more. The blackish-brown median stripe passing from between the eyes backward extends in most specimens back over the entire prozona. A piceous postocular band continues backward, more or less broken, over the prozona, expanding posteriorly. Hind femora trifasciate above with fuscous. Hind tibia with ten black-tipped spines in the outer series.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	18.0-22.0
Female	28.0
Tegmina:	
Male	16.0-17.5
Female	20.5
Antennæ:	
Male	8.5- 9.5
Female	10.0
Hind femora:	
Male	12.0-12.5
Female	15.0

LOCALITIES. Hamilton, Morton, Greeley, Stanton, Gove, Rawlins. Grant and Stevens counties.

Melanoplus regalis Dodge.

This handsome species is singularly like *Æoloplus regalis* in appearance, nearly equaling it in size, closely resembling it in color and general form, but at once distinguishing from it by the nontuberculate subgenital plate of the male, the dull-pointed valves of the ovipositor of the female, and the cherry-red coloring of the lower sulcus and inner face of the hind femora.—l. c. A. P. MORSE.

Fastigium shallowly sulcate; frontal costa subequal, depressed at the ocellus. Median carina more distinct on the metazona than on the prozona; tegmina brownish flecked with dark brown. A black postocular band extends to the thorax and across the prozona as a more or less distinct brownish stripe. Hind femora reddish brown on the outer face, inner and lower side bright red, bifasciate above with olivaceous; hind tibia blue, spines blue with black tips nine to ten in number in the outer series. Antennæ testaceous.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	21.0-26.5
Female	27.5-31.0
Tegmina:	
Male	15.0-17.5
Female	19.0-20.5
Antennæ:	
Male	8.5- 9.0 (approx.)
Female	10.0
Hind femora:	
Male	11.0-13.0
Female	14.0-14.5

LOCALITIES. Morton, Grant and Stevens counties.

Melanoplus bowditchi Scudder.

The general color is griseous or grayish brown. Disk of pronotum is marked in longitudinal stripes with a darker stripe in the middle and two lighter stripes on the side near the position of the lateral carina. The head and sides of pronotum are more or less mottled with olivaceous and ferruginous. The species looks quite a little like *M. pictus*. The tibia are very hairy. Top of hind femora transversely marked with fuscous.

approaching trifasciation. Interspace between the eyes of male a little wider than the first antennal joint. Frontal costa subequal, reaching the clypeus, biserially punctate above the ocellus. Tegmina of male extending beyond the tips of the hind femora in several cases by 3 mm. Furcula much larger than the cerci, attinent in the basal half and then separating at an angle of about 35 to 40 degrees.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	22.0-26.0
Tegmina:	
Male	18.0-21.0
Antennæ:	
Male	10.0-12.0
Hind femora:	
Male	11.5-14.0

LOCALITIES. Greeley, Meade and Seward counties.

Melanoplus flavidus Scudder.

General color brownish fuscous with a slight greenish tinge, especially along the tegmina. Antennæ yellowish with slight testaceous at the tip. A dark-brown, almost black, band extends backward from behind the eyes across the pronotum, widening posteriorly; the color of this stripe is not uniform, but mottled more or less with light brown. The tegmina have the general color of the insect, except that the distal half has a more or less distinct bluish tinge, being almost entirely free from any maculation. Prozona of male slightly longer than metazona. Front margin of pronotum truncate with a slight emargination, hind margin obtuseangulate, the angle well rounded.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	24.0-28.0
Tegmina:	
Male	17.0-24.0
Antennæ:	
Male	10.5-13.0
Hind femora:	
Male	11.5-15.0

LOCALITIES. Stanton, Seward, Meade, Stevens, Morton and Graham counties.

Melanoplus elongatus Scudder.

This species is very closely related to *M. flavidus* and *M. bowditchi*, but is generally somewhat larger, more slender and more lively colored. It is about the same size as *M. packardii*. Median carina distinct on metazona but indistinct on the prozona; sulci of pronotum not cutting the median carina. Front margin of pronotum truncate with a slight emargination. The tegmina are long and slender, feebly or not at all flecked. In the other details the specimens agree very closely with Scudder's description.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	25.0-31.0
Female	27.0-33.0
Tegmina:	
Male	21.0-28.0
Female	22.0-30.0
Antennæ:	
Male	11.0-15.0 (approx.)
Female	9.5
Hind femora:	
Male	13.5-16.5
Female	15.0-18.0

LOCALITIES. Trego, Morton, Hamilton and Finney counties. This species has never been found to appear in large enough numbers to be of any economic importance.

Melanoplus glaucipes Scudder.

General color fuscous to fusco-testaceous. A black piceous band extends back from the eyes over the entire pronotum, widening posteriorly and extending downward in two lines over the pleura of the meso- and metathorax. In one male the tegmina are as long as the abdomen, in the other specimens the tegmina are quite a little shorter than the abdomen. The subgenital plate of male is slightly elevated apically, the apex rather square than uniformly rounded.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	22.0-24.0
Female	27.0-28.0
Tegmina:	
Male	13.5-15.0
Female	15.5-16.0
Antennæ:	
Male	9.5 (approx.)
Female	10.0
Hind femora:	
Male	11.5-12.5
Female	13.0-14.0

LOCALITIES. Rooks, Russell and Finney counties.

Melanoplus scitus Scudder.

General color luteotestaceous to brownish fuscous, marked with fuscous. Head plumbeo-fuscous in the darker forms and yellow to fuscous in the lighter forms. Vertex with a dark mesial band expanding posteriorly. A piceous band extending from behind the eyes across the side of the pronotum. Vertex of head raised distinctly above the level of the pronotum. Sulcus of fastigium not very shallow; frontal costa failing to reach the clypeus. Antennæ ferrugino-testaceous to ferruginous, about three-fourths as long as the hind femora. Front margin of pronotum transverse, slightly emarginate; median carina on metazona distinct, on prozona subobsolete, sides of metazona shouldered. Disk of prozona feebly punctate, of metazona densely punctate. Tegmina surpassing the hind femora by from 2 to 3.5 mm. Furcula reaching a

little beyond one-third the length of the supra-anal plate, the apical half of the furcula densely punctate; cerci subequal, little more than twice as long as broad, slightly sulcate and emarginate below. Supra-anal plate of male finely punctate all over.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	22.0-26.0
Tegmina:	
Male	18.5-22.0
Antennæ:	
Male	9.0-10.0
Hind femora:	
Male	13.0-14.0

LOCALITIES. Greeley, Wichita, Stevens, Scott, Morton, Stanton, Clark, Rawlins, Riley and Hamilton counties. Now first reported from Kansas.

Melanoplus atlanis Riley.

"Genæ and sides of pronotum varying from yellowish testaceous to dark griseo-fuscous. Markings of vertex of pronotum variable, vertex generally showing a dark mottled stripe widening posteriorly and a lighter linear area between this and the eye. Sometimes the vertex is marked with irregular diffusion of fuscous. Dorsum of pronotum dark griseo-fuscous, sometimes uniform and noticeably darker along the median line, or rarely lighter in this position."

This species is very closely related to *M. spretus* Uhl., the famous Rocky Mountain locust. It is sometimes spoken of as the lesser migratory locust and is known to fly for considerable distances. In size and color it is also very closely related to *M. femur-rubrum*, the common red-legged 'hopper, but may be readily distinguished by the notch in the apical portion of the subgenital plate and the blunt tubercle or swelling on the mesosternum in front of the lobes. This species becomes so numerous at times as to be of real economic importance. The habits of this species and the method of control are very similar to some of the other species and will be discussed later.

M. atlanis may be found all over the state, and is found in all kinds of vegetation, cultivated as well as uncultivated fields. The writer has noticed females of this species oviposit as late as November 15.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	20.0-26.0
Female	22.0-28.0
Tegmina:	
Male	18.0-24.0
Female	18.0-25.0
Antennæ:	
Male	9.5-11.0
Female	9.0-10.0
Hind femora:	
Male	12.0-15.0
Female	12.0-15.0

Melanoplus spretus Uhler.

In general appearance this species is very much like *M. atlantis*. This is the famous and dreaded Rocky Mountain locust which invaded Kansas in the early days and caused the complete destruction of all growing vegetation. It is the true migratory grasshopper, and has been known to fly great distances. Although once very much dreaded, it has now apparently become extinct. During the grasshopper campaign in the western part of the state in 1913 no specimens of this species were noticed. Its place seems to have been taken by *M. atlantis*, which occurs all over the state but seldom becomes very numerous; even in the summer of 1913, although there were a good many specimens of this species present, they were not as numerous as *M. differentialis* and *M. bivittatus*.

Many people believe that our native large yellow grasshoppers, *M. differentialis* and *M. bivittatus*, are migratory and fly great distances. This erroneous belief is based partly upon the reports given out by the old settlers of their experiences with the grasshoppers in the seventies, but chiefly upon newspaper reports. Whenever there is a small outbreak of 'hoppers the newspaper reporters go back to their old files and find an exciting article about the Rocky Mountain locust, and by adding a few more of their own ideas they are able to present to the public quite an "interesting" article. The article is usually accompanied by some misleading illustration, and the people are led to believe that the grasshoppers on their premises have come from a far-away place, and if killed or poisoned will be followed by another horde the next day.

Melanoplus plumbeus Dodge.

"Of medium size, very dark fusco-olivaceous, with bright luteous or flaveous markings." Prozona of male sometimes a little longer than the metazona; prosternal spine retrorse or appressed in both male and female. Interspace between mesosternal lobes of female subquadrate. Fore and middle femora of male more or less tumid; hind femora trifasciate above with blackish olivaceous. Apical portion of male cerci fully half as wide as at the base.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	20.0-24.5
Female	24.0-26.0
Tegmina:	
Male	18.0-19.0
Female	21.0
Antennæ:	
Male	9.0 (approx.)
Female	7.5 (approx.)
Hind femora:	
Male	12.0-12.5
Female	13.5-14.0

LOCALITIES. Logan, Cheyenne, Wallace, Rawlins, Morton, Grant, Thomas and Decatur counties.

Melanoplus femur-rubrum DeGeer.

This species is commonly known as the red-legged grasshopper or locust, and is common everywhere. The general ground color is brownish-fuscous, often with a yellowish or olivaceous tinge. The head and pronotum are mottled with fuscous and olivaceous; a piceous postocular band extends beyond the prozona and widens posteriorly. Front margin of prozona slightly emarginate; the transverse sulci of prozona not cutting the median carina. Tegmina surpassing the hind femora by various lengths. (A specimen from Colorado in our collection has tegmina not much over half the length of the abdomen; the specimen is only about half as large as the ordinary specimens found here.) None of these specimens with abbreviate tegmina have been found in Kansas so far. The tegmina are more or less maculate; upper face of hind femora trifasciate; hind tibia red or pale blue, though more often red.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	22.0-26.0
Female	23.0-27.0
Tegmina:	
Male	19.0-22.0
Female	19.5-22.5
Antennæ:	
Male	9.5-11.0
Female	8.5- 9.5
Hind femora:	
Male	12.0-13.5
Female	14.0-15.5

LOCALITIES. Found everywhere over the entire state.

As stated under *M. atlantis*, this species compares pretty well in size and color with *atlantis*, and the two may easily be interchanged unless a close examination is made, as they both are very common and at times become numerous enough to be of real economic importance. Writers on Orthoptera have reported this species as inhabiting mostly lowlands, but our collections from the extreme western part of the state shows that this species was just as numerous on the plains as any of the other species. In the summer of 1913 *femur-rubrum* was quite numerous in western Kansas and did considerable damage, especially to the alfalfa fields.

Melanoplus bispinosus Scudder.

Cinereo-fuscous, very slightly ferruginous. Tegmina surpassing the hind femora by from 2 to 3 mm.; hind tibia dull green to brighter green, spines ten to twelve in number in the outer series. Extremity of male abdomen slightly clavate, very little upturned; the furcula diverge slightly. In the other characters the specimens at hand correspond very well with those given by Scudder.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	23.5-26.5
Tegmina:	
Male	19.0-22.0

Antennæ:	
Male	10.0-12.0 (approx.)
Hind femora:	
Male	12.5-14.5

LOCALITIES. Haskell, Pratt and Osborne counties.

Melanoplus coccineipes Scudder.

Of dark fuscous color, head and thorax with a ferrugino-testaceous tinge; frontal costa widening anteriorly, sulcate at and below the ocellus; antennæ ferrugino-testaceous. Interspace between mesosternal lobes of male not more than three times as long as wide; tegmina surpassing the tips of the hind femora by 3.25 mm. Furcula of male about two-fifths the length of the supra-anal plate.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	23.0
Tegmina:	
Male	20.5
Antennæ:	
Male	11.0 (approx.)
Hind femora:	
Male	14.0

LOCALITY. One male specimen, Gray county.

Melanoplus angustipennis Scudder.

The general ground color varies but little in the specimens at hand. The head is quite prominent, postocular piceous band present in most of the specimens; vertex distinctly elevated above the pronotum. Interspace between the eyes of male about twice as wide as the first antennal joint; frontal costa widening anteriorly, just failing to reach the clypeus. A subluteous streak borders the postocular piceous band very distinctly in some specimens, but is subobsolete in others. Tegmina surpassing the hind femora about 2 mm. Hind tibia glaucous or red, spines apically black, ten to eleven in number in the outer series. Furcula of male a little more than a third as long as the supra-anal plate.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	22.0-25.0
Tegmina:	
Male	17.0-20.5
Antennæ:	
Male	10.0-11.5
Hind femora:	
Male	12.0-14.0

LOCALITIES. Stevens, Rooks, Graham and Sedgwick counties.

Melanoplus impiger Scudder.

Head quite prominent. Frontal costa subequal, just failing to reach the clypeus; antennæ fulvous to ferruginous, infuscated at the tip. Disk of pronotum forming with the lateral lobes a much sharper shoulder on the metazona than on the prozona; front margin of prozona truncate;

transverse sulci on disk of prozona deep and percurrent. Tegmina brownish fuscous with very little maculation along the median line; the markings on the hind femora vary from dark fuscous to dark olivaceous. The general color is brownish testaceous with a ferruginous tinge.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	22.0-27.5
Tegmina:	
Male	18.0-22.0
Antennæ:	
Male	10.5-12.0
Hind femora:	
Male	12.0-16.0

LOCALITIES. Sedgwick, Ford, Stevens and Seward counties.

Melanoplus packardii Scudder.

This species varies considerably in the general ground colors, varying from real light yellow to dark brownish fuscous. Medio-dorsal stripe varies both in intensity of color and in breadth; in color from testaceous to blackish, in width from a rather narrow stripe to one-half the width of the prozona. In the blue-legged forms the stripe often is darker and more clearly defined than in those with red hind tibia, and shows a stronger tendency to taper to a point on the metazona. Frontal costa slightly sulcate at and below the ocellus; antennæ yellowish brown, infuscated at the tip; tegmina extending beyond the hind femora 2 to 5 mm. Hind femora bifasciate to trifasciate above; hind tibia blue or red with black-tipped spines ten to twelve in number in the outer series.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	28.0-30.0
Female	26.0-36.0
Tegmina:	
Male	20.0-25.0
Female	22.0-28.5
Antennæ:	
Male	11.5-16.0
Female	9.5-11.0
Hind femora:	
Male	13.0-17.5
Female	15.0-18.5

LOCALITIES. This species is very common in the state, and may be found among practically all the cultivated fields and crops as well as pastures and meadows.

Melanoplus fædus Scudder.

The general color is "dirty cinereous above and dingy clay-yellow below." Quite similar in size and structure to *M. packardii*, but with red hind tibia. Frontal costa enlarging slightly anteriorly, failing to reach the clypeus. Tegmina extending beyond the abdomen of the male by at least 2 or 3 mm. Extremity of male abdomen somewhat recurved, clavate. Hind tibia dull red with a blackish basal annulus; spines black, ten to thirteen in number in the outer series.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	24.5-30.0
Tegmina:	
Male	21.5-23.0
Antennæ:	
Male	13.0-14.0
Hind femora:	
Male	14.5-15.0

LOCALITIES. Norton and Rooks counties.

In regard to this species Scudder says: "The species indeed differs but slightly from *M. packardii*, and may prove to be merely a varietal form of it, dependent upon station, which in this species is in the dank vegetation of river bottoms, where *M. packardii* occurs but rarely." Our specimens in the collection were all taken on the uplands and dry plains.

Melanoplus conspersus Scudder.

A stout, compact, medium-sized species. The disk of pronotum is dark brown; tegmina heavily maculate, reaching to the tip of the hind femora. The general description agrees with the specimens at hand. Specimens of this species from Colorado are much larger than the specimen from Kansas.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	18.0
Tegmina:	
Male	16.0
Antennæ:	
Male	9.0 (approx.)
Hind femora:	
Male	11.0

LOCALITY. One male from Sherman county.

Melanoplus compactus Brun. & Scudd.

This species resembles very closely *M. conspersus*. The general color is brownish fuscous with a ferruginous tinge, especially on the top of the head and disk of pronotum; sulci of pronotum deep and very distinct; median carina cut by the principal sulcus. Tegmina heavily maculate; hind tibia pale blue, more or less valgate with a basal annulus, spines black.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Female	25.0-26.5
Tegmina:	
Female	18.5-20.5
Antennæ:	
Female	9.0-10.0
Hind femora:	
Female	14.0-14.5

LOCALITY. Four females from Clark county.

Melanoplus minor Scudder.

Vertex of head slightly elevated above the pronotum; the interspace between the eyes of female about twice as long as the first antennal joint. Fastigium of male distinctly but not steeply declivent; frontal costa subequal, feebly sulcate, just failing to reach the clypeus. Median carina of pronotum more prominent on metazona than on prozona; prozona of male a little longer than broad, of female subquadrate. Hind femora trifasciate above, the lower face dull to bright orange. Hind tibia glaucous with yellowish at the extremities, spines black tipped, usually eleven in number in the outer series. Extremity of male abdomen slightly clavate. The description of the genitalia agrees with Scudder's description.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	20.0-21.0
Female	26.0-27.5
Tegmina:	
Male	16.0-16.5
Female	15.0-19.0
Antennæ:	
Male	8.0- 9.0
Female	9.5 (approx.)
Hind femora:	
Male	12.0-12.5
Female	13.0-15.0

LOCALITIES. Gove, Russell and Clark counties.

Melanoplus luridus Dodge.

"Rather small in size, brownish fuscous, more or less ferruginous." Interspace between the eyes slightly wider than the first antennal joint. Eyes quite prominent, about as long as the infraocular portion of the genæ; prosternal spine somewhat retrorse. Interspace between the mesosternal lobes of male about twice as long as broad. Hind femora bifasciate above with olivaceo-fuscous to blackish-fuscous; below luteous, flecked with fuscous and sometimes tinged with orange; hind tibia carmine red. Upper fork of cerci one-half to three-fifths as wide as the basal piece of the cercus, subequal, apically somewhat expanded, the upper angle considerably more rounded than the lower.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	21.00-24.50
Female	27.00-28.00
Tegmina:	
Male	16.50-17.50
Female	21.00-22.00
Antennæ:	
Male	8.75- 9.50
Female	9.50 (approx.)
Hind femora:	
Male	12.50-14.00
Female	14.50-15.50

LOCALITIES. Rooks, Sedgwick and Riley counties.

Melanoplus differentialis Uhler.

This is one of the largest and most common of the species of the *Melanopli*. It is a heavy, rather clumsy insect, and together with *M. bivittatus* is usually referred to by the average person as "the big yellow grasshopper." "The frontal costa is generally equal, but rather frequently slightly expanded at the ocellus. Angle of hind margin of metazona somewhat more obtuse in the male than in the female; the transverse sulci of the pronotum are deeply marked with fuscous on the lateral lobes, and especially at the middle sulcus. In the insects of this species in which the ground color is light or yellowish testaceous there is a strong tendency to marbling of the face and pronotum with darker testaceous, which is frequently localized in three quarters: first, as two diverging stripes upon the vertex; second, as irregular clouds upon the face; third, as spots principally upon the disk of the pronotum, whose outlines follow but do not coincide with those of the blackish fuscous of the sulci." The tegmina extend considerably beyond the tips of the hind femora in many of the female specimens.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	27.0-40.0
Female	29.0-45.0
Tegmina:	
Male	23.0-35.0
Female	23.0-38.0
Antennæ:	
Male	14.0-20.0
Female	11.0-17.0
Hind femora:	
Male	15.0-20.0
Female	16.0-23.0

LOCALITIES. This species is found everywhere in the state, and often occurs in large numbers and causes considerable damage.

Melanoplus bivittatus Say.

The description of this species in Scudder agrees very well with our specimens. Although there occurs quite a little variation in the length of the tegmina, especially in the female, we have never noticed any dimorphism in this line. In size this species agrees well with *M. differentialis*.

MEASUREMENTS IN MILLIMETERS.

Length of body:	
Male	22.0-36.0
Female	32.0-46.0
Tegmina:	
Male	18.0-27.5
Female	21.5-33.0
Antennæ:	
Male	13.0-18.0
Female	12.5-17.0
Hind femora:	
Male	13.5-18.5
Female	17.0-24.0

LOCALITIES. This species has been taken in all parts of the state, and at times occurs in great numbers, thus causing considerable damage to all kinds of vegetation, and even trees. *M. bivittatus* does not restrict itself to cultivated fields only, but may be found in prairies, meadows and along the roadside; in fact, most anywhere where vegetation occurs. They will defoliate such trees as apple, peach, osage orange, mulberry and many other fruit and shade trees.

Phætalotes Scudder.

Body elongate, rather slender, a little compressed, very feebly pilose, including faintly the tegmina and legs. Head large, full, prominent, relatively elongate, nearly half again as long as the prozona, the space behind the eyes fully half as long as the breadth of the eyes, the genæ a little tumescent, the head apart from the eyes slightly broader than the pronotum; vertex prominent and well arched both longitudinally and transversely; face a little oblique; eyes rounded broad oval, moderately prominent, subtruncate anteriorly, moderately distant, somewhat farther apart than the greatest width of the frontal costa; fastigium very faintly sulcate, almost plane; frontal costa prominent, markedly narrower above than below the ocellus; antennæ slender, moderately long, but shorter than the hind femora, though fully twice as long as the pronotum. Pronotum of moderate length, faintly subsellate but otherwise equal, feebly flaring in front to receive the head; disk rounded subtectate, with broadly rounded, very indistinct lateral carina, and a sharp, equal and percurrent median carina; prozona longitudinal, nearly half as long again as the metazona, with indistinct transverse sulci; front margin subtruncate, hind margin extremely obtuseangulate. Prosternal spine rather large, erect, conical, blunt, mesostethia and metastethia together much more than twice as long as broad; interspace between mesosternal lobes much (male) or little (female) longer than broad, the metasternal lobes attinent (male) or approximate (female); portion of metasternum behind the lobes about twice as broad as long and about half as broad as the greatest breadth of the metasternum. Tegmina either abbreviate, broad lanceolate, acuminate, attinent, slightly longer than the pronotum, or fully developed, surpassing the hind femora, rather broad and equal, well rounded at tip, hardly tapering in the distal half, at a distance from the apex equal to the breadth of the tegmina as broad as the metazona; the intercalaries and crossveins of the discoidal area everywhere few, the venation in general loose, irregular and ill defined, the humeral vein broadly sinuous, terminating on the costal margin at least as far before the apex as the breadth of the tegmina, nowhere running closely parallel to the costal margin nor gradually merging into it; the area intercalata not reaching the middle of the tegmina. Hind femora long and slender, the genicular lobes pallid with a transverse basal fuscous stripe; the hind tibia glaucous, sometimes yellowish, with eleven to thirteen spines in the outer series. Abdomen compressed, mesially carinate, apically clavate and recurved in the male, the subgenital plate narrow and long, with lateral margins ampliate at the base, the apical margin mesially pinched

but not elevated, the apical face with no subapical tubercle; furcula delicately developed; cerci compressed styliform, rather small; ovipositor of female normally exerted.

This genus is very closely related to *Melanoplus*, from which it is to be distinguished by its large, tumid head and subsellate equal pronotum, as well as by its substyliform cerci. The neururation of the tegmina, when the latter are developed, also differs to a certain degree, pointed out in the description.—L. C. SCUDDER.

Phactaliotes nebrascensis Thos.

Varieties *nebrascensis* and *volucris*.

Head flaveo-testaceous to rather ferruginous, especially on the top. The interspace between the eyes of the female is hardly three times as wide as the first antennal joint, in some cases not more than twice as wide. The fastigium is distinctly though not deeply sulcate in most of the specimens; frontal costa nearly reaching the clypeus, about half again as broad below the ocellus than above in the male, and twice as broad in the female, narrowest just between the antennæ. Antennæ ferrugino-testaceous, somewhat infuscated at the tip. Disk of pronotum varies from testaceous to bright ferruginous; median carina sharp, subequal, more distinct on the metazona than on the prozona in some specimens; prozona distinctly longitudinal in the male but subquadrate in the female. Prosternal spine rather retrorse.

MEASUREMENTS IN MILLIMETERS.

Length of body:	<i>nebrascensis</i> .	<i>volucris</i> .
Male	18.0-22.5	22.0-25.0
Female	22.0-31.0	26.0-30.0
Tegmina:		
Male	5.0- 7.0	17.0-20.0
Female	5.5- 8.0	16.0-21.0
Antennæ:		
Male	8.0-12.0	8.5-10.0
Female	8.0-10.5	8.0- 9.5
Hind femora:		
Male	11.0-13.0	11.0-12.0
Female	12.5-16.0	13.0-16.0

LOCALITIES. Sedgwick, Seward, Rooks, Lane, Clark, Osborne, Cheyenne, Graham, Ford, Smith, Scott, Wichita, Stevens, Sherman, Grant, Norton and Wallace counties.

Of this species both varieties are quite common and have been found in practically all parts of the state. The short-winged variety, *P. nebrascensis*, is more common than the long-winged variety, *nebrascensis volucris*. Neither one of these varieties has ever been found in large enough numbers to be of any economic importance.

FREAK SPECIMENS IN SPECIES OF MELANOPLI.

In going over a lot of duplicate material, one always finds variations, in one form or other, in specimens of the same species. Usually these variations are slight and not so noticeable in superficial observations; however, once in a while there occur variations or freak specimens which are very readily noticeable, and interesting to study.

Two such freak specimens were found in the collection here in the museum while the writer was working with the *Melanopli*. The first of these specimens, *Melanoplus fædus*, was found to have two distinct median ocelli, both perfect, each about normal in size. The other two ocelli were present as usual, thus giving the grasshopper four perfect ocelli.

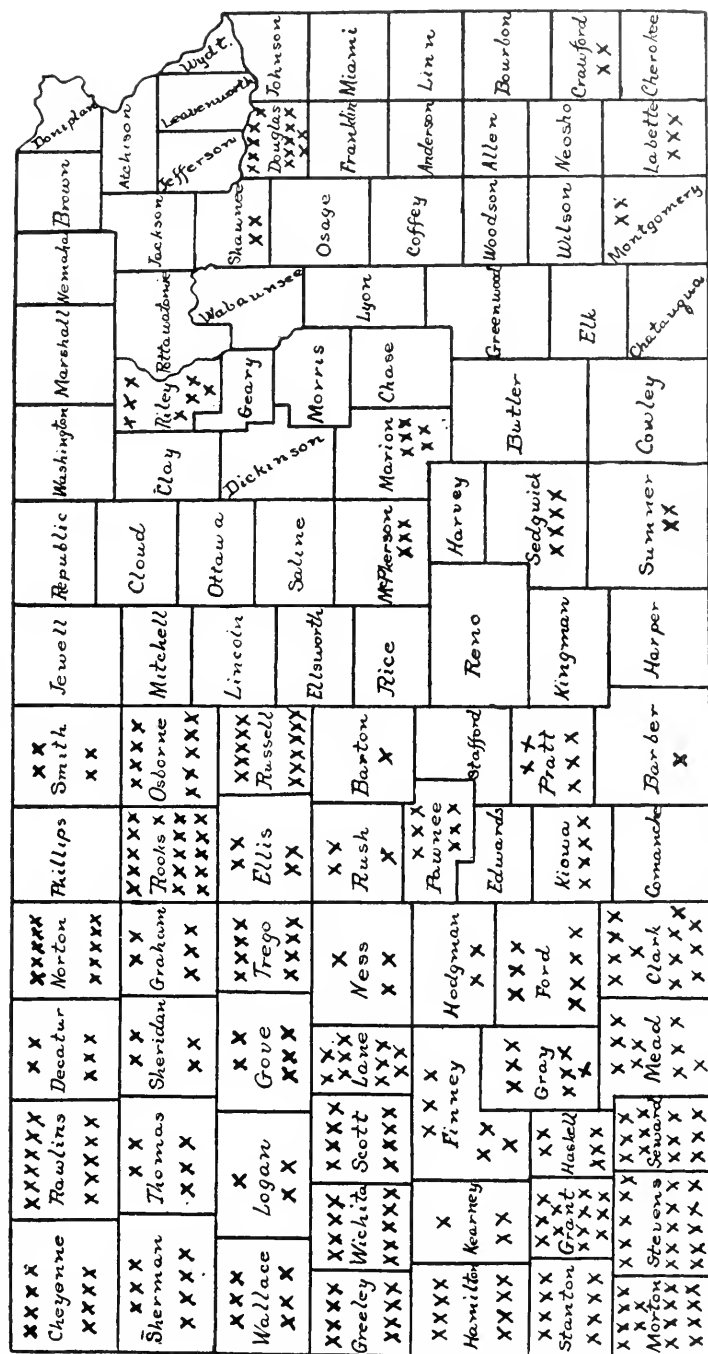
B. M. Blackman found a specimen of *femur-rubrum* with two median ocelli, and a description and photographs of the same are given in *Psyche*, vol. 19, pp. 92-97.

Plate 2, Fig. 4, shows the head and position of the median ocelli of *M. fædus*.

The second specimen, *M. bispinosus*, shows a great variation in the cerci. The right cercus tapers uniformly from the base toward the tip, is subacuminate, and in no way exteriorly sulcate; while the left cercus tapers from the base toward the middle and then enlarges in the apical half so as to be much wider apically than in the middle; sulcate exteriorly, so as to be distinctly spatulate.

Plate 2, Figs. 2 and 3, shows the right and left lateral views of the genitalia of the specimen, which shows the differences in the shape of the cerci.

PLATE I.



Map of Kansas, showing localities where collections have been made. The number of *x*'s indicates the approximate number of species taken in the county.

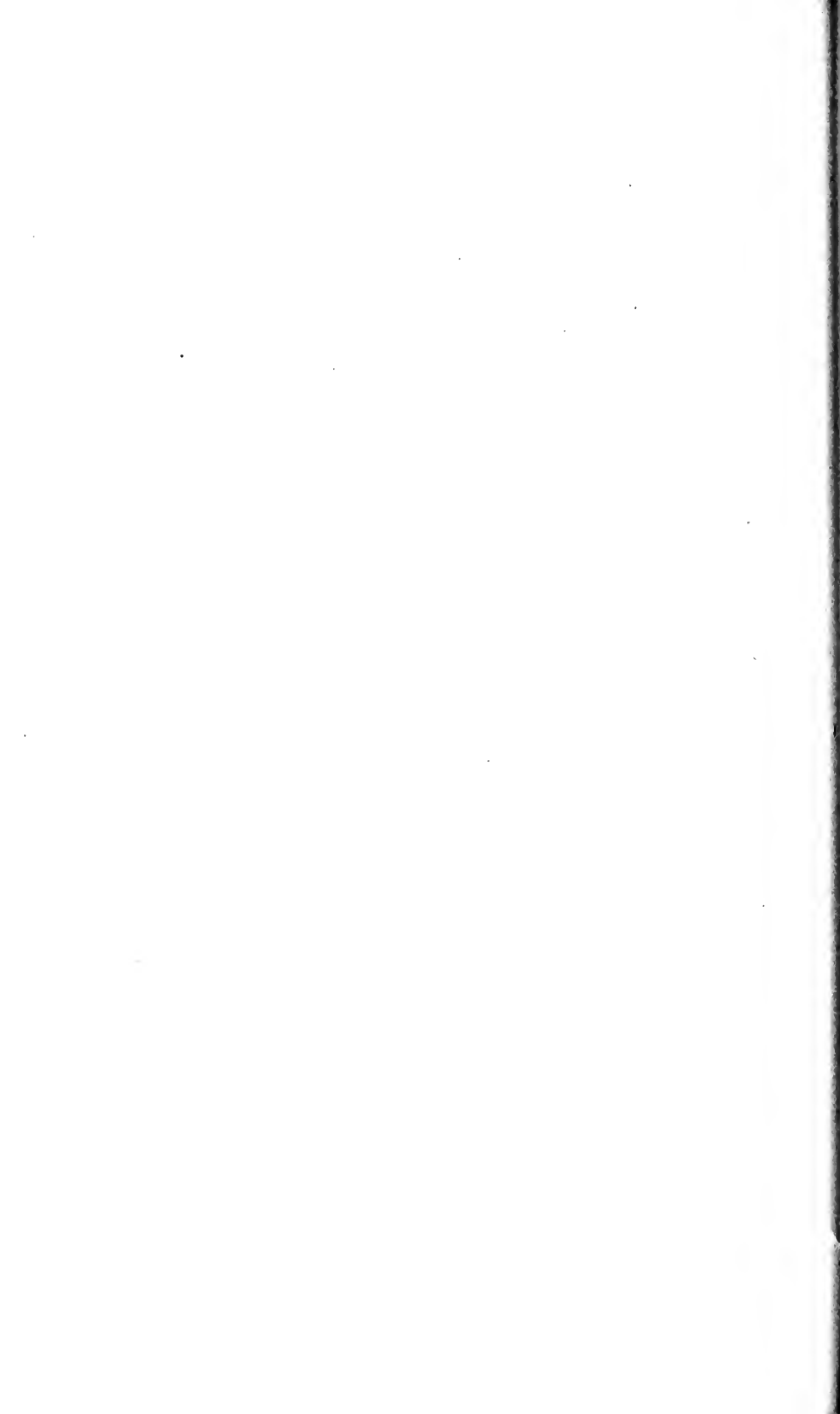
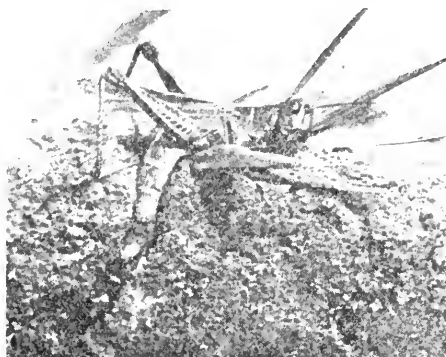
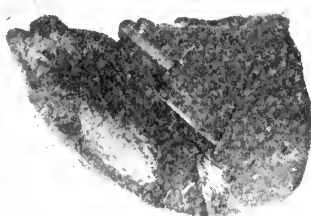


PLATE II.

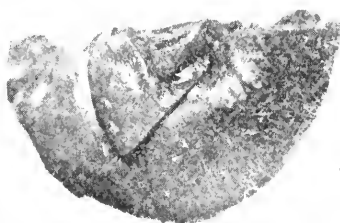
Melanpoli of Kansas.



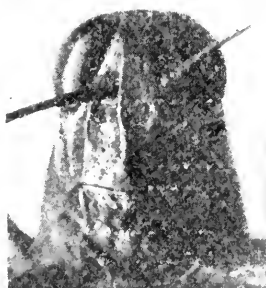
1



2



3



4

FIG. 1. *M. differentialis* ovipositing.

FIG. 2. Right cercus of *M. bispinosus*.

FIG. 3. Left cercus of *M. bispinosus*.

FIG. 4. *Melanoplus fodus*, showing two median ocelli.

THE BIOLOGIC AND ECONOMIC PHASES OF THE MELANOPLI.

NATURAL ENEMIES OF THE GRASSHOPPER.

The grasshoppers have many natural enemies which tend to hold them in check, and without these enemies the farmer would experience much greater losses from the ravages of the grasshoppers, and artificial control measures would have to be employed much oftener. During a season favorable to the development of the grasshopper they occur in such numbers that their natural enemies are unable to hold them in check, and the 'hoppers become a serious pest. The relation existing between the parasite and its host offers a very interesting problem for study. An increase of the host tends toward a greater increase of the parasite. Sometimes this enemy or parasite, although beneficial in destroying one pest, becomes a pest itself by attacking, at some stage of its life history, some crops; as, for instance, the blister beetle, which in the larval stage is predaceous upon the eggs of the grasshopper, in the adult stage does much damage to such crops as potatoes and sugar beets.

FLIES.

Several species of parasitic flies often destroy grasshoppers in great numbers. The most important of these, according to Webster, are *Sarcophaga helioides*, *S. hunteri*, *S. sarraceniæ*, and *S. kellyi*. Bee flies and tachinid flies also are active in destroying grasshoppers. Some of these flies deposit small maggots upon the bodies of the grasshoppers. The maggots eat their way into the body of the 'hopper, where they feed upon the live insect until they become full-grown larvæ; they then leave the grasshopper—which by this time has either been killed or is dying—and go into the ground, where they pupate and transform into adult flies. Mr. E. O. G. Kelly, of the United States Bureau of Entomology, has recently discovered one of the above-named parasitic flies in Kansas which attacks grasshoppers in great numbers.

The following notes taken from Mr. Kelly's paper shows how effective the work of these parasites is under favorable conditions: "Quite a serious outbreak of grasshoppers occurred in the vicinity of Wellston, Okla., early in June, 1913, the prevalent species being *M. differentialis*, *M. bivittatus* and *M. atlantis*, with a few scattering individuals of other species, both imagoes and nymphs doing much damage to corn and alfalfa, and literally swarming in grass lands. The grounds were strewn with nymphs and adults of the three species mentioned, which had died from parasitism by sarcophagids, their bodies being alive with maggots, while the fields were also literally swarming with these flies engaged in striking adults and nymphs of each instar, except the first; but deposition took place only while grasshoppers were flying, or in the case of nymphs, hopping. The winged grasshoppers appeared to know that the parasites were after them, as when they took wing they made many twists and turns in attempting to get away from the flies. Several adults of *Sarcophaga kellyi* were reared from the Wellston material, while later investigations indicated that the grasshoppers had been ma-

terially reduced and practically controlled, so that late in September few eggs were to be found."

MITES.

The red grasshopper mite, *Trombidium locustarium*, has probably received too much credit for destroying grasshoppers. According to my observation in the field, this mite settles mostly on the tegmina and wings of the grasshopper; seldom on the body of the insect. I have found as many as fifty to eighty mites on a single specimen, with no noticeable effect except that they seem to cause the grasshopper considerable discomfort, and in attempting to rid himself of these mites the grasshopper tears his wings and tegmina into shreds by scratching them with his hind tibia. The mite very likely weakens the host to some extent, whether enough to kill it seems rather doubtful.

BEETLES.

Beetles and the larvæ of beetles are known to be predaceous upon the grasshoppers or their eggs. Of these the blister beetles are probably the most important. Although the blister beetles, in the adult stage, become serious pests to such crops as potatoes and sugar beets, in the larval stage many of them are beneficial in destroying grasshopper eggs. The eggs of the blister beetles are laid in the ground. The newly hatched larvæ are very active, and at once begin to search for food, which in several species consists of grasshopper eggs. Whenever one of these egg pods is found the larvæ "remain in camp" until the supply is exhausted. In digging up grasshopper egg pods I have found as many as eight larvæ of the blister beetle directly under the egg pod. Thus, while one pest is suppressed, the other is increased, and in the beet fields the blister beetles are not much to be preferred to the grasshoppers, and can be controlled only by spraying the plants with an arsenical poison.

FUNGUS DISEASES.

There are several fungus diseases which attack grasshoppers, and at times kill thousands of them. Most important of these are *Empusa grilli* and *Sporotrichum globuliferum*, the latter being the same as the one that attacks chinch bugs. These fungus diseases, however, attack the grasshopper only during damp, warm weather, and are therefore of little value during a hot, dry season.

BIRDS.

More than a hundred species of birds are known to feed upon grasshoppers to a greater or less extent. Of these, according to Webster, the following are the most important: quail, prairie chicken, sparrow hawk, Swanson hawk, loggerhead shrike, all cuckoos, all blackbirds, the cowbird, the catbird, the meadow lark, and the red-headed woodpecker.

DOMESTIC FOWLS.

Chickens will eat a large number of grasshoppers and thrive upon them. Turkeys are very fond of grasshoppers, and a drove of turkeys will keep a large field free from 'hoppers.

OTHER ANIMALS.

Snakes, lizards, toads, skunks and pigs have been observed to catch grasshoppers and feed upon them.

ARTIFICIAL MEANS OF CONTROL.

In applying preventive measures the destroying of the eggs seems to be the only one that proves to be practical. Many of the egg pods may be destroyed by exposing them to the weather and birds, by disking, harrowing, or in some way cultivating the soil to a depth of two to three inches. All waste lands, roadsides and other places that may be reached should be cultivated during the winter or early spring. Alfalfa fields have been found to profit by such cultivation. Not only are the grasshopper eggs destroyed or exposed, but the yield of alfalfa is often increased to quite an extent.

After the grasshoppers have hatched from the eggs one must resort to other methods. Of these measures of control the most practical and important ones will be discussed briefly.

THE HOPPERDOZER.

The use of the hopperdozer, although practical and effective, is limited. It can be used only in such fields as alfalfa and other low crops. In the beet fields it does not prove very satisfactory, and in the corn fields it can not be used after the corn has reached a height of twenty inches or more. Neither can it be used in grain after the grain has headed out. In alfalfa fields, however, I have observed very effective work with the hopperdozer.

Especially good results may be obtained if, at the time when the crop is cut, strips of alfalfa six to fifteen feet wide are left standing at intervals of fifty to seventy-five yards. The hoppers congregate on these strips, and with several trips back and forth with the hopperdozer most of the 'hoppers are caught. This method of leaving strips is also very effective and economical in poisoning. The strips may be cut down in a day or two after the poisoning or after using the hopperdozer.

POISONED BAITS.

A number of poisoned baits have been recommended and tried, but the one that we found to be the most satisfactory is known as the poison bran mash. This bait is made as follows:

I.—2½ lbs. Paris green or white arsenic.
50 lbs. bran.

Mix these dry.

II.—6 lemons, chopped up fine, rind and all.
4 quarts syrup.
5 gallons water.

Mix these three together thoroughly.

Mix I and II, then add sufficient water to make a wet mash.

Early in the morning, between five and seven o'clock, this poisoned bran should be scattered broadcast in the infested areas. It is of great importance to get the poison out early, as the 'hoppers eat it better when first beginning to feed.

The morning was found to be the best time to apply the mixture. It does not dry as fast then, and the grasshoppers are more eager for food, and are, therefore, more easily attracted to it. It should be scattered broadcast, using three to five pounds of the mixture to the acre.

Effect of Poison Bran Mash on Birds, Chickens, Turkeys, Stock, Bees, etc. When the poison bran mash is scattered thinly and evenly as directed, the danger of poisoning fowls and stock is practically eliminated. In our experience we have never found any dead birds or dead chickens as a result of feeding on the bran mash. Although the birds undoubtedly do feed on the bran to some extent, they do not receive enough poison to hurt them. Should the bran mash, however, be made too wet, so it will clog and scatter in bunches where birds can eat it by mouthfuls, they may take enough scattered poison to kill them.

In a good many instances where we scattered poisoned bran in the lawns, gardens and orchards, the chickens, large and small, had free access to the scattered bran as well as to the poisoned grasshoppers, but in no instance did we find any chickens dead or sick as a result of the poison. Little chicks were seen picking up flakes of the poisoned bran here and there without any apparent effect.

As far as the stock is concerned, there is no danger of poisoning from the bran scattered in the fields. Care should be taken, however, that the stock does not have access to the mixture. Not enough of the poison will adhere to the vegetation to endanger it either for pasture use or as a hay crop.

Effect of Poison Bran Mash on Bees. During the experiments with the poison the question arose whether or not the bees, on account of the lemons and syrup used, might not be attracted to the poison and eat enough to kill them. Mr. G. H. Vansell, of the department of entomology here, conducted a good many experiments to determine whether the bees were attracted to the poison bran mash. He found that the bees would not voluntarily go to the poison bait and eat it, and that the danger of poisoning bees is very slight. The following I have taken from his field notes: The bees died after eating the mash. This was proven by actual experiment. The mash was placed upon the running-board of the hive, where the bees were bound to notice it. They did not seem to scent the bait at all, but after running against it they would stop and lap at it quite greedily, then start off, but return presently and lap at it again, as if they hated to leave. However, even in this conspicuous place, there were but few bees that were observed to eat the poison, probably fifteen during the course of an hour. Where the mash was placed a few feet away from the hive I did not notice a single bee bother the bait. Again, some bees were caught in a bell jar, and this was placed over some of the poison. After a while the bees came down and ate of the sweet mixture.

I also placed poison in a sweet-clover patch, which was in bloom. A good many bees were present, but I did not observe a single bee touching the mash. The bait was also placed among fallen rotten peaches and in open places with the same negative results.

Then, lastly, I took the poison and scattered it in bunches among thirty-eight stands of bees. After this was done I helped rob the bees. Even under these disturbances, which ordinarily makes them very anxious to rob, I observed but a single bee eating of the mash. All

these attempts at feeding the bees were repeated in the morning, at noon and in the evening, with the same results. From these experiments, therefore, it seems that there is no danger to the bees from using the poisoned bran mash for grasshoppers.

OVIPOSITION.

The egg-laying habits of the grasshoppers are essentially the same. A rather hard place is chosen by the female grasshopper, and with the ovipositor (the four horn-like points) she drills a hole into the ground to a depth of from one and one-half to two inches, the abdomen often being stretched to at least twice its natural length. As soon as the hole is drilled a small amount of white, frothy substance is placed at the bottom, and then the eggs are laid. The number of eggs laid in one hole varies from 30 to 80, but may at times reach as high a number as 120. The most common places chosen for oviposition are the roadsides, alfalfa fields, bare irrigating ditches, and pasture lands where they occur near cultivated fields, and other compact places. In the summer and fall of 1913, during the extreme hot and dry weather, the females seemed to prefer a shady place, and deposited their eggs among the vegetation.

More egg pods were found in the ground on the north side of a sweet-clover plant (*Melonotus alba*) than any other place. Buffalo-grass pastures were very common places for oviposition. Special attention was given to the position of the abdomen relative to the head of the insect. During oviposition the female is very quiet and easily caught and held in the position assumed. In order to get a photograph, I took a bottle containing about an ounce of commercial prussic acid (HCN), to which had been added a few small crystals of potassium cyanide (KCn), and while holding the insect in position I placed a few drops of the liquid on the body of the insect, which in every case died in less than a minute without changing the position of the body or withdrawing the abdomen from the hole. The earth was then carefully removed from one side until the hole and abdomen were exposed. In this position the photograph was taken as shown in Plate 2, Fig. 1.

The relative position of the abdomen to the head was noted in about twenty-one *M. differentialis*, ten or twelve *M. bivittatus*, one *Dessosterris* sp. (December 2, 1913), and about thirty *M. atlantis* (October, 1914). In every case the abdomen had a decided backward tilt, and not with a recurved position as has been shown in all texts and papers, except those of Milliken¹ and J. S. Hunter.² The grasshoppers *M. differentialis* and *M. bivittatus* were not observed ovipositing in large numbers till the latter part of September and the first of October.

1. In the *Journal of Economic Entomology*, vol. 5, No. 2, p. 232, 1913, Milliken records the correct mode of oviposition of *M. bivittatus*, *D. carolina*, and *S. shoshone*.

2. In California Bul. 170, 1905, J. S. Hunter reports the correct oviposition of *M. differentialis*.

SUMMARY.

TAXONOMIC.

The Melanopli of Kansas number thirty-nine species, which are included in six genera. The following table shows the distribution of the species among the genera:

Genus.	Species.
1. <i>Hypochlora</i>	1
2. <i>Campylacantha</i>	3
3. <i>Hesperotettix</i>	3
4. <i>Æoloplus</i>	2
5. <i>Melanoplus</i>	29
6. <i>Pharalioptes</i>	1
Total	39

The greater number of specimens have been collected in the central and western part of the state between the years 1909 and 1914. *Campylacantha virar*, *Melanoplus seitus* and *Melanoplus discolor* are now reported from Kansas for the first time.

The females, particularly of the genus *Melanoplus*, are very difficult to classify, and unless they are found with the males can not always be placed with the right species. The greatest variations in individuals of the same species are the color variations. These variations depend upon the time when the insect was taken (they are much lighter shortly after the last molt than later on), the method of preservation, etc.

All species of *Melanopli* found in Kansas are native to the state. The Rocky Mountain locust, *M. spretus*, the only migratory representative, has not been found in Kansas for twenty years or more. It is now apparently extinct here.

BIOLOGIC.

The olfactory sense is very keenly developed in the grasshopper. Experiments in the field showed that the insects detected the poisoned bait as far as fifty feet away.

The method of oviposition of the female is very much the same in all the species. A rather firm place is chosen, and from 30 to 100 eggs are deposited. In every case where the females were dug up during the act of oviposition the abdomen was found to have a decided backward tilt and was not curved under the body of the insect.

ECONOMIC.

The Melanopli include most of the economically important grasshoppers. *M. differentialis*, *M. bivittatus*, *M. atlanis*, *M. femur-rubrum* and *A. regalis* do more damage than all other species put together. The most important enemies of the grasshoppers are several species of flies, beetles, birds, chickens, turkeys, and fungus and bacterial diseases.

To prevent the increase of grasshoppers the eggs should be destroyed in winter or early spring by disking the fields. For control measures the hopperdozer does very efficient work where it can be used readily. The poison bran mash has been found to be the most satisfactory way of controlling the grasshoppers, and when applied as directed the danger of killing fowls and other animals is eliminated.

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October, 1917

Grasshoppers of Kansas: Part II.

The *Ædipodinæ* of Kansas.

Submitted to the Department of Entomology and to the Graduate Faculty of the University of Kansas in partial fulfillment of the requirements for the degree of Master of Arts.
May 15, 1917.

BY RAYMOND BEAMER.

(51)

The *Ædipodinae* of Kansas.

INTRODUCTION.

This paper is proposed as No. 2 of a series covering the Orthoptera of Kansas; "The *Melanopli* of Kansas," by P. W. Claassen, to be taken as No. 1.

It is the object of the present paper to so treat this group of Kansas 'hoppers that even the casual observer may be able to recognize the various species and the relation they bear to one another. Wherever possible, the original descriptions have been given, along with any notes on variation of Kansas forms, habitat records, etc., which have seemed necessary. The original descriptions are given in single-space form, while the notes and comments by the author are given double spacing.

Keys for separating the genera and species are those of former writers, modified to suit the Kansas forms. It has been the intention to so illustrate these keys by means of photographs and drawings that they will present the minimum amount of difficulty. It is exceedingly difficult, however, to formulate an artificial key by which these species may be easily separated, as, in some cases at least, they seem to merge from one species directly into another, a series of specimens showing all degrees of variation.

It would seem that Kansas is so located that the Eastern and Western fauna meet here and tend to merge into each other. We are thus confronted with some very interesting taxonomic problems.

The *Ædipodinae* present a much more difficult problem than the *Melanopli*, as the male genitalia are of practically no value whatever taxonomically, and there does not seem to be a set of nonvariable characters to be found. The number of sulci that intersect the carinæ of the pronotum has been used quite extensively in separating both genera and species. This character, at least in Kansas forms, is quite unreliable, as all variations from one to two distinct intersections may be found both in groups which normally have one and also in those which normally have two intersections. The shape, depth and size of the scutellum of the vertex is also used, and is found to be equally varying. In fact, all characters used in separating the forms are extremely variable and unreliable. It is the opinion of the author, therefore, that there are quite a few more names than there are good species. It seems very probable, however, that no very definite results can be obtained in the matter without prolonged breeding and rearing experiments.

The taxonomic literature in this group is both meager and badly scattered. A few of the genera are fairly well treated, but in these the authors have omitted the original descriptions and have made very few if any drawings to help interpret their meaning.

The material in the museum of the University of Kansas has served for the basis of the paper. It has been accumulating through quite a number of years, and at the present time the numbers run well into the thousands of specimens. The entomological division of the Biological Survey has paid special attention to this group during the past two summers, about five hundred specimens having been collected in the genus *Hippiscus* alone. The greater bulk of the material comes from western Kansas, for the reason that the systematic survey of the state, started some years ago, has covered that part of the state quite thoroughly, while the eastern half is as yet not worked. The dry, hot, barren prairies of western Kansas, however, are very rich in this group of grasshoppers and have furnished us with a relatively large number of species.

In conclusion the writer wishes to thank Prof. S. J. Hunter, under whose direction the work was done, for his many suggestions and criticisms. He is also indebted to Prof. Lawrence Bruner, of the University of Nebraska, Mr. Morgan Hebard and J. A. G. Rehn, of the Philadelphia Academy of Science, and Dr. L. O. Howard and A. N. Caudell, of the Bureau of Entomology, for determinations and verifications of some of the more difficult species, and to Miss Ellen Edmonson for making the drawings. Valuable assistance was also given by the members of the Biological Survey party during the summers of 1915 and 1916.

KEY TO SUBFAMILIES OF ACRIDIDÆ.

	Fig.	Page.
1. Claws without ærolium; pronotum extended over the abdomen	1	54
1. Claws furnished with an ærolium; pronotum extending at most over the extreme base of the abdomen.....	2	54

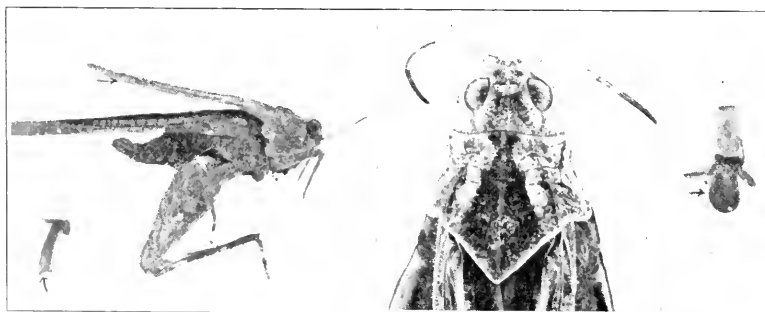


FIG. 1.—TETTIGINÆ.

(2)

FIG. 2.

(2)

	Fig.	Page.
2. Prosternum without marked prominence.....(3)	3	55
2. Prosternum armed anteriorly with a distinct conical spine	4	55
	ACRIDINÆ.	



FIG. 3.—(3)

FIG. 4.—ACRIDINÆ.

	Fig.	Page.
3. Face more or less oblique, usually meeting the vertex at an acute angle.....	5	55
3. Face nearly or quite vertical, rounded at the meeting with the vertex.....	6	55 56
	TRYXALINÆ.	
	ÆDIPODINÆ.	

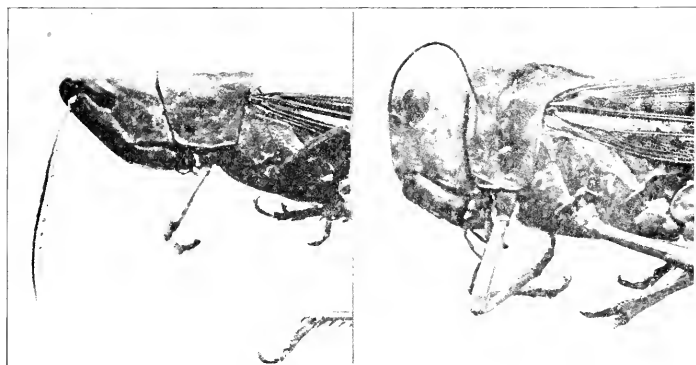


FIG. 5.—TRYXALINÆ.

FIG. 6.—ÆDIPODINÆ.

ÆDIPODINÆ.

	Fig.	Page.
1. Outer margin of hind tibiæ with no apical spine next the spurs	7	56 57
1. Outer margin of hind tibiæ with an apical spine next the spurs	8	56

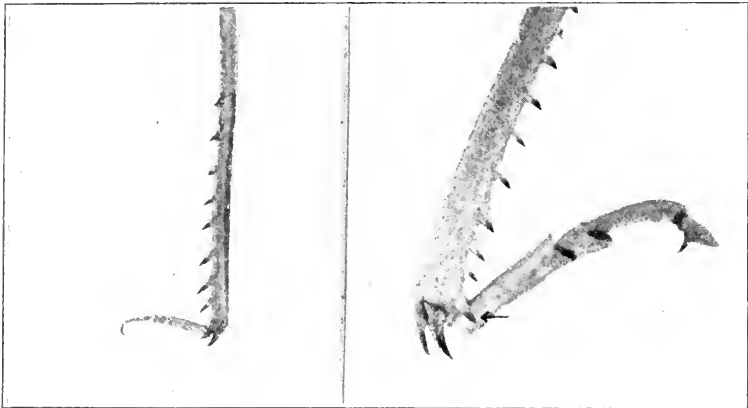


FIG. 7.—ÆDIPODINI.

FIG. 8.—EREMOBIINI.

EREMOBIINI.

	Fig.	Page.
1. Of this tribe we have but the one genus and species. <i>Brachystola magna</i> .	9	84

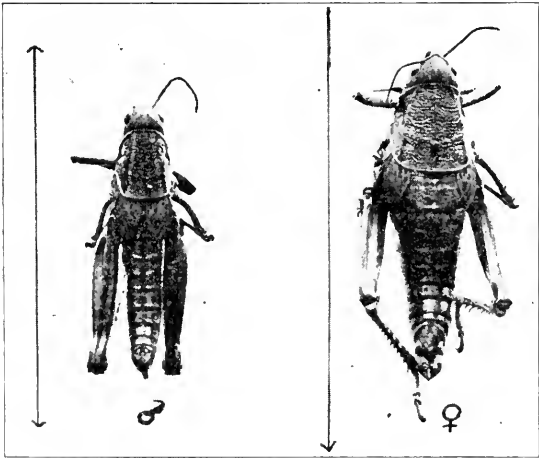


FIG. 9.—*Brachystola magna*.

CEDIPODINI.

1. Interspace between the metasternal foramina linear, or distinctly longer than broad in the male, narrower than the interspace between the mesosternal lobes in the female.... (2)

Fig. Page.

10

-57

1. Interspace between the metasternal foramina rather broad, in the male quadrate, in the female transverse..... (4)

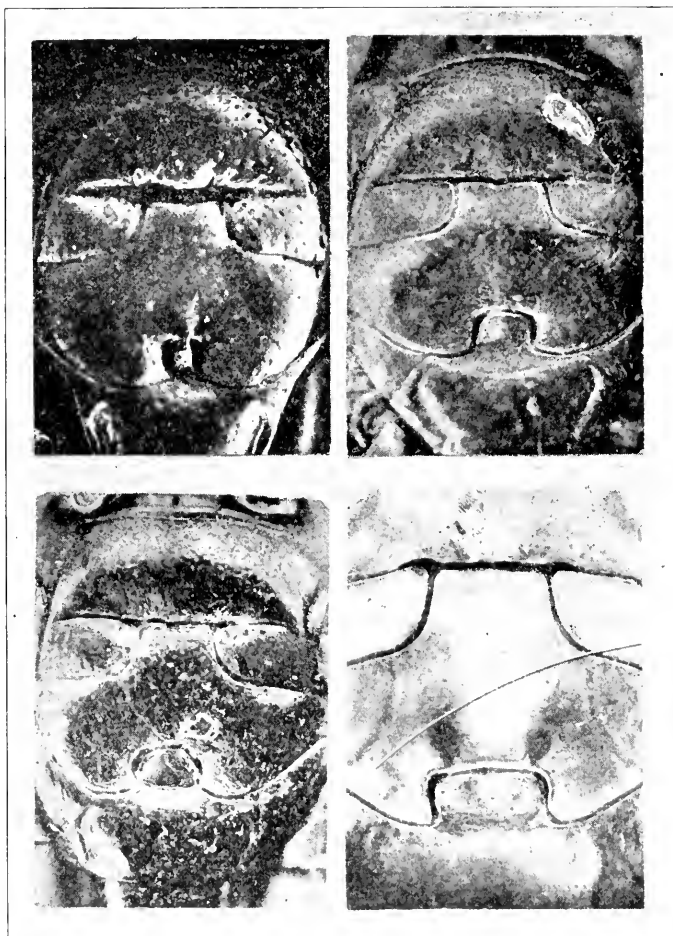
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-57

(2)—Male.

FIG. 10.

(2)—Female.



(4)—Male.

FIG. 11.

(4)—Female.

2. Intercalary vein nearer the median than the ulnar vein; wings brightly colored.....	<i>Arphia.</i>	Fig. 12	Page. 58 67
2. The intercalary vein midway between or nearer the ulnar than the median vein, wings not brightly colored... (3)		Fig. 13	Page. 58 59

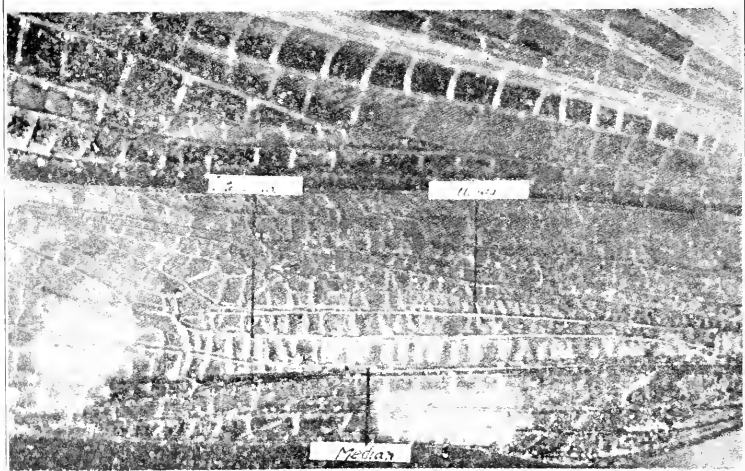
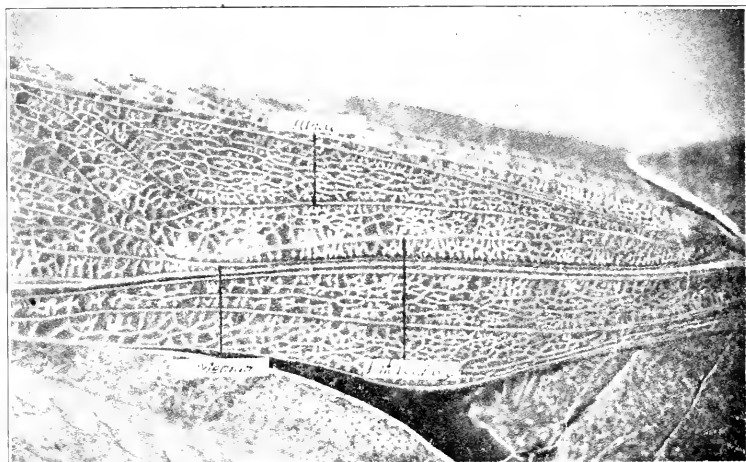
FIG. 12.—*Arphia.*

FIG. 13.—(3)

	Fig.	Page.
3. Intercalary vein of tegmina midway between the median and ulnar veins..... <i>Chortophaga</i> .	14	59
3. Intercalary vein of tegmina nearer the ulnar than the median vein	15	59
		<i>Encoptolophus</i> .

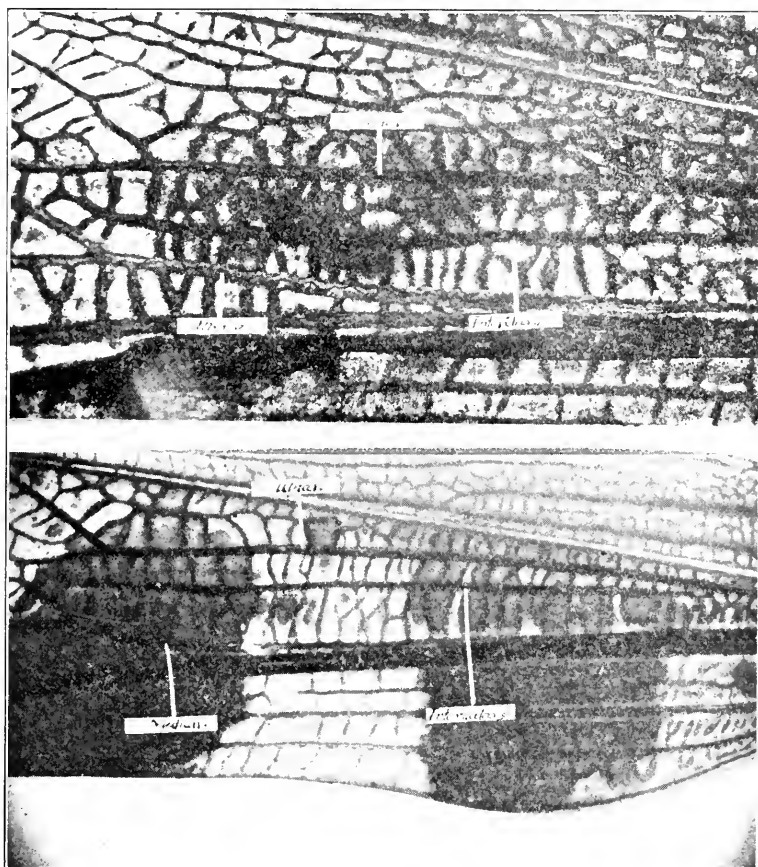
FIG. 14.—*Chortophaga*.FIG. 15.—*Encoptolophus*.

	Fig.	Page.
4. Lateral canthi of the metazona traversing the principal sulcus, not intersected by that sulcus..... <i>Hippiscus</i> .	16	60
4. Lateral canthi of the metazona typically intersected by the principal sulcus.....(5)	17	60

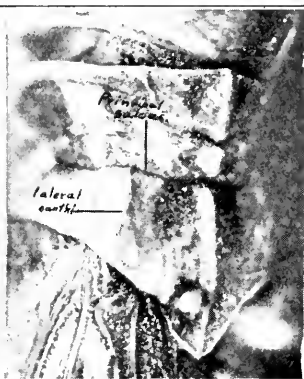
FIG. 16.—*Hippiscus*.

FIG. 17.—(5)

	Fig.	Page.
5. Pronotal carina entire, intersected by one sulcus, or sometimes with two in the case of <i>Spharagemon æquale</i> ... (6)	18	60
5. Pronotal carina twice intersected by the transverse sulci, the intersections of about equal depth except in <i>Trimerotropis magnifica</i> , when sometimes there appears to be but one intersection (7)	19	60

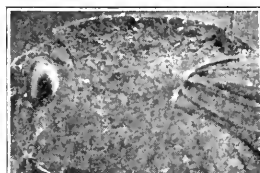
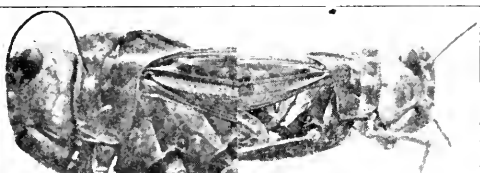


FIG. 18.—(6)



(6)

FIG. 19.—(7)

	Fig.	Page.
6. Wings not banded..... <i>Dissosteira</i> .	20	61 75
6. Wings with a fuscous arcuate band..... <i>Spharagemon</i> .	21	61 73

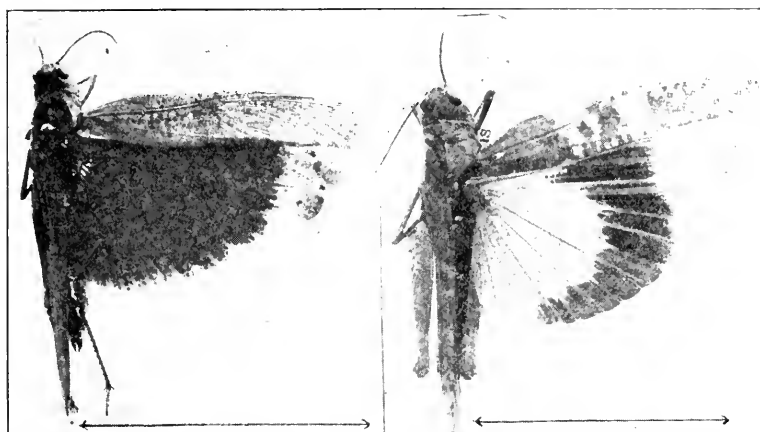
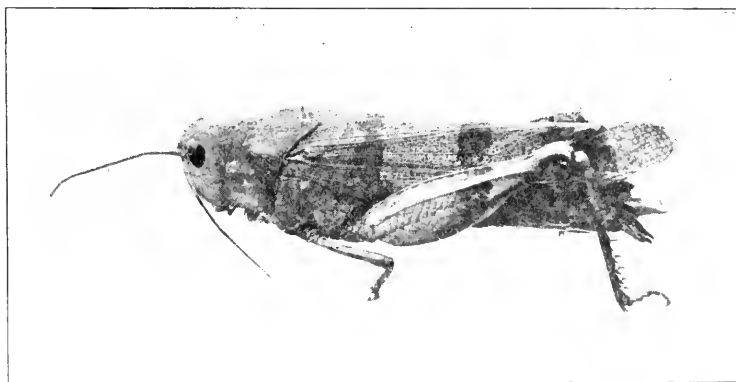
FIG. 20.—*Dissosteira*.FIG. 21.—*Spharagemon*.

	Fig.	Page.
7. Basal two-thirds of inside of posterior femora solidly dark blue	22	61 77
7. Basal two-thirds of inside of posterior femora not dark blue	(8)	61 62

FIG. 22.—*Hadrotettix*.

8. Antennæ widened basally.....	<i>Psinidia</i> .	Fig. 23	Page. 62 175
8. Antennæ filiform	(9)	Fig. 24	62 155

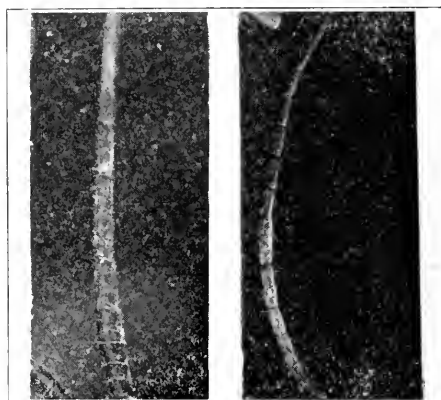
FIG. 23.—*Psinidia*.

FIG. 24.—(9)

Fig. Page.

9. Intercalary vein about the middle of the median area distally or if much in advance of the middle distally with one row of cells on either side.....(10)

25 63

9. Intercalary vein much in advance of the middle of the median area, which is occupied almost entirely by a reticulation of irregular cells.....(12)

26 63

FIG. 25.—(10)

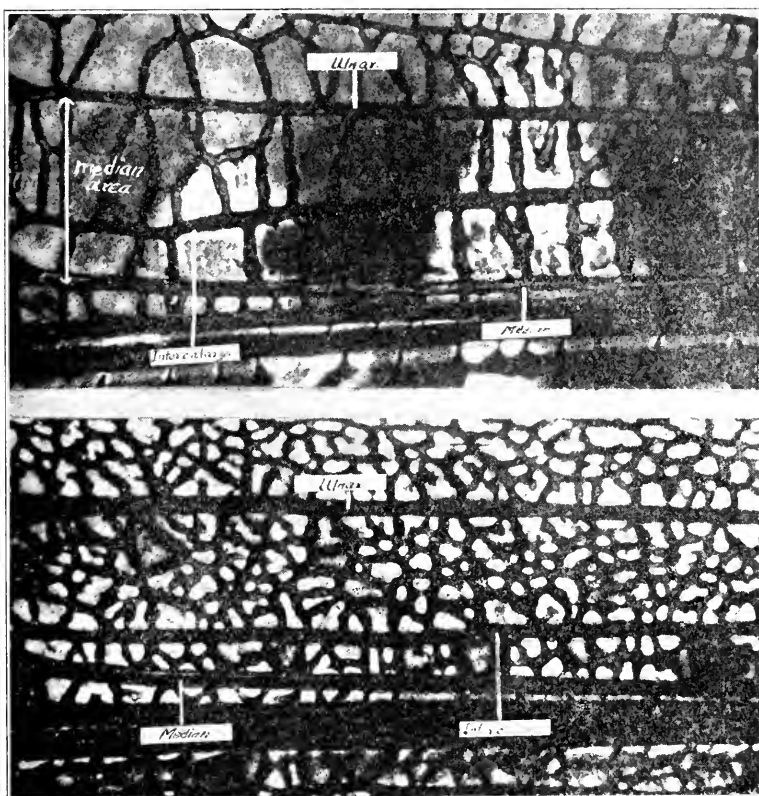


FIG. 26.—(12)

	Fig.	Page.
10. Posterior angle of the lateral lobes of the pronotum never broadly rounded.....(11)	27	64 65
10. Posterior angle of the lateral lobes of the pronotum broadly rounded <i>Derotmema</i> .	28	64 78

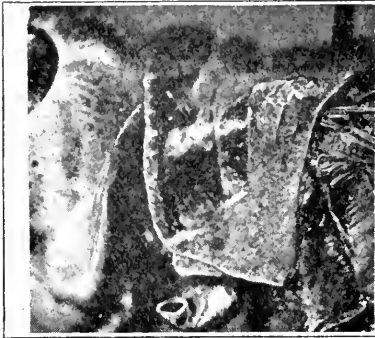


FIG. 27.—(11)



FIG. 28.—*Derotmema*.

Fig. Page.

11. Intercalary vein considerably or much in advance of the middle of the median area distally, with a single row of cells on either side *Metator*.

29

65

11. Intercalary vein but little in advance of the middle distally, bordered by several rows, at least posteriorly, of irregular cells *Mestobregma*.

30

65

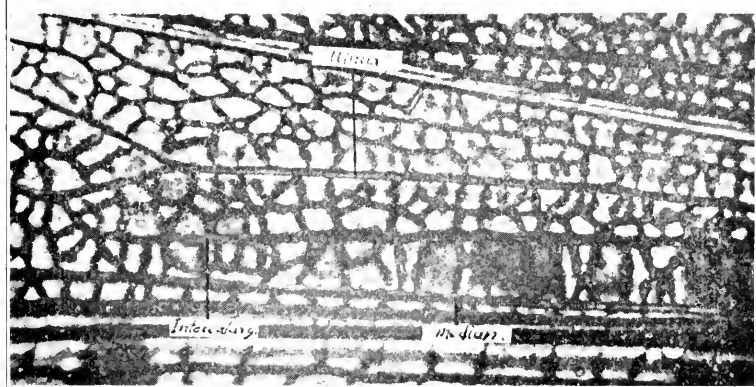
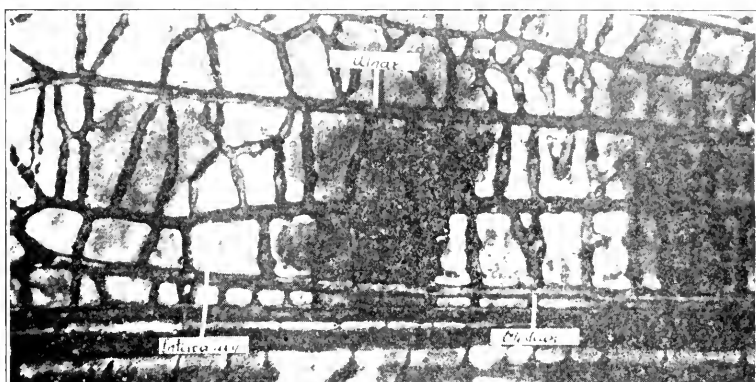
FIG. 29.—*Metator*.FIG. 30.—*Mestobregma*.

	Fig.	Page.
12. Radiate veins of the anal field of the wing not swollen, so they are not much larger medianly than near the base.		
<i>Trimerotropis.</i>	31	66
12. Radiate veins swollen so that they are much stronger medianly than near the base.....		
<i>Circotettix.</i>	32	66

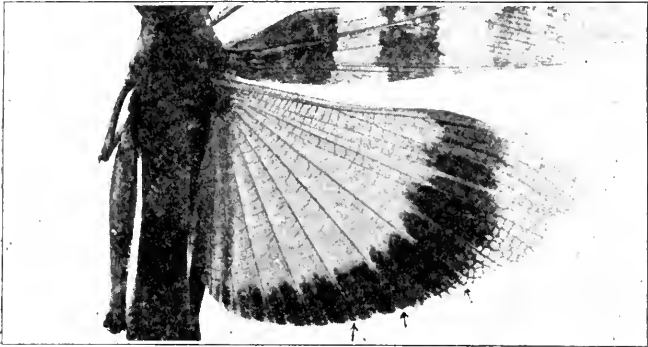


FIG. 31.—*Trimerotropis.*

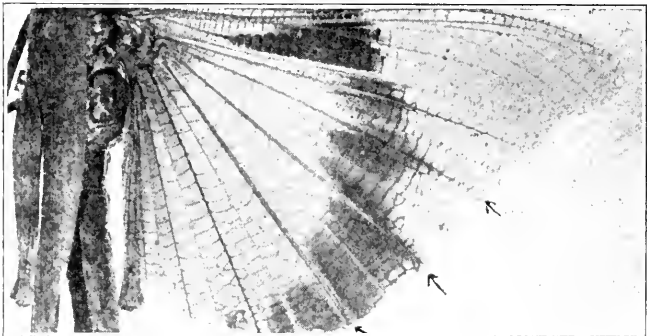


FIG. 32.—*Circotettix.*

Arphia Stal.

	Fig.	Page.
1. Lateral foveolæ of vertex large, lower edge often indefinite	<i>simplex</i> .	33 -67
1. Lateral foveolæ of vertex smaller and distinct.....	(2)	34 -67

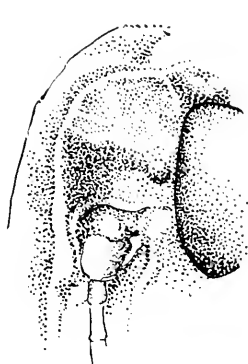
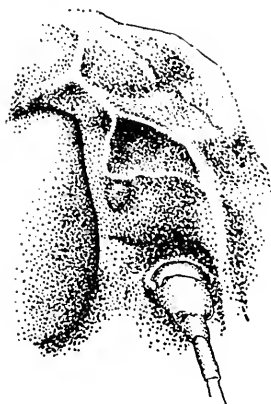
*A. simplex*.

FIG. 33.

(2)

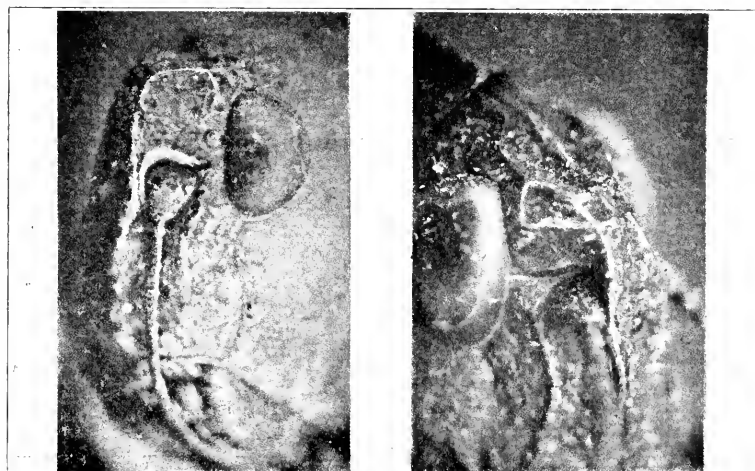
*A. simplex*.

FIG. 34.

(2)

	Fig.	Page.
2. Frontal costa with subparallel sides, more than half as wide above as below the ocellus.....(3)	35	68
2. Frontal costa narrowed above, less than one-half as wide above the ocellus as below..... <i>arcta</i> .	36	68 64

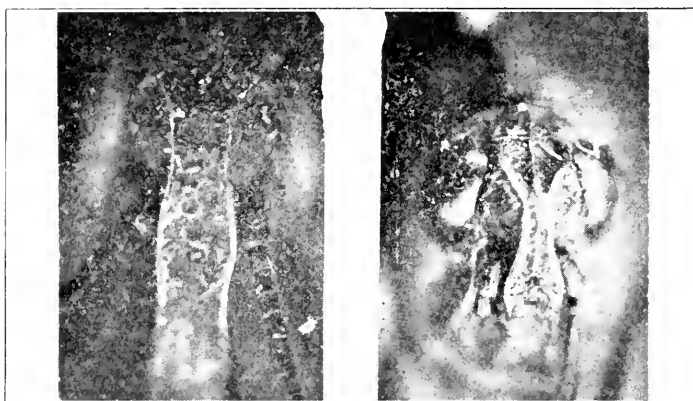


FIG. 35.—(3)

FIG. 36.—*A. arcta*.

	Fig.	Page.
3. Pronotal carina extremely high and arched.... <i>carinata</i> .	37	68 47
3. Pronotal carina of less than medium height, not arched. <i>pseudonietana</i> .	38	68 94

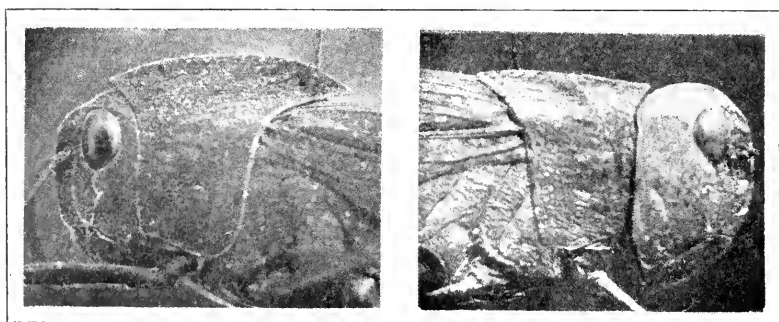
FIG. 37.—*A. carinata*.FIG. 38.—*A. pseudonietana*.

	Fig.	Page.
2. Intercalary vein usually straight, located very slightly nearer the ulnar than the median vein..... <i>texensis</i> .	42	70
2. Intercalary vein usually curved, very much closer to the median than the ulnar vein..... <i>costalis</i> .	43	70

FIG. 42.—*E. texensis*.

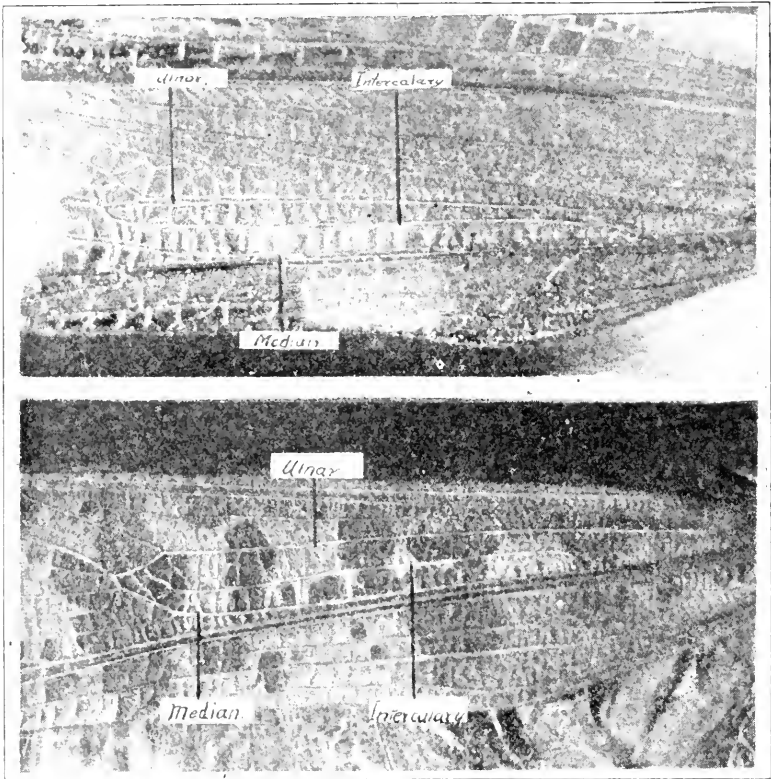


FIG. 43.—*E. costalis*.

Hippiscus Sauss.

1. Sides of frontal costa parallel throughout.....	<i>rugosus</i> .	44, 46	71	+
1. Sides of frontal costa considerably narrowed at upper extremity	(2)	45	71	✓

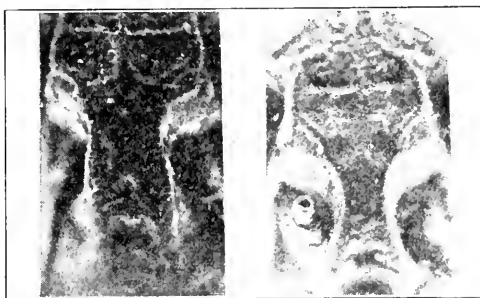
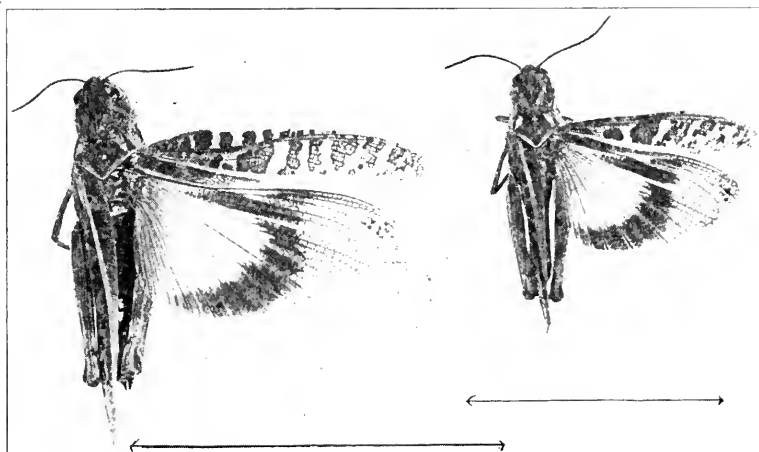
FIG. 44.—*H. rugosus*.

FIG. 45.—(2)

FIG. 46.—*H. rugosus*.

2. Scutellum of vertex of form A: metazone short in proportion to the length of the prozone..... (3) ~~47,49~~ ⁷⁴ ~~72,73~~
2. Scutellum of the vertex of form B: metazone long in proportion to the length of prozone..... (5) ~~48,50~~ ⁷⁴ ~~72,73~~



FIG. 47.—(3)
Form A.

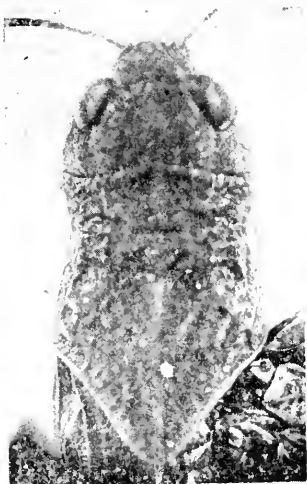


FIG. 48.—(5)
Form B.

FIG. 49.



FIG. 50.



(3)



(5)

	Fig.	Page.
3. Inside of hind femora bright vermillion to lemon yellow. <i>haldemanii</i> .	..	73
3. Inside of hind femora not so colored..... (4)	..	73
4. Inside of hind femora dark blue with two lighter bands. <i>phænicopterus</i> .	51	74
4. Inside of hind femora straw yellow with three black spots <i>tuberculatus</i> .	52	74

FIG. 51.

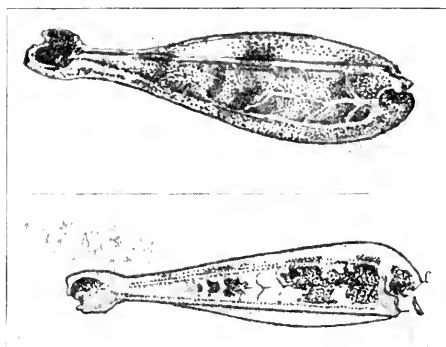
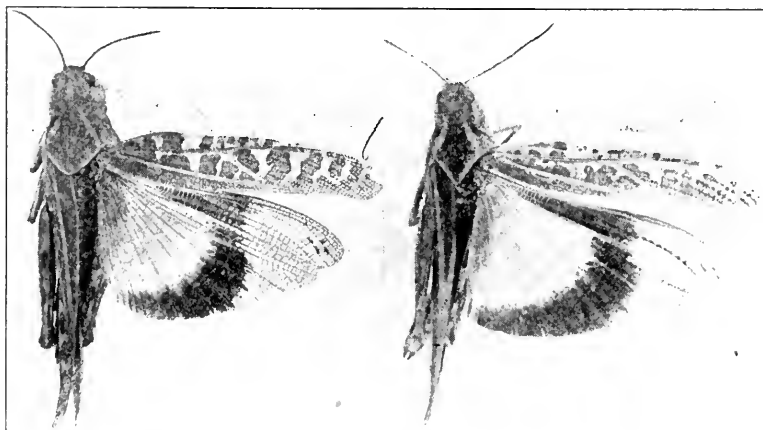


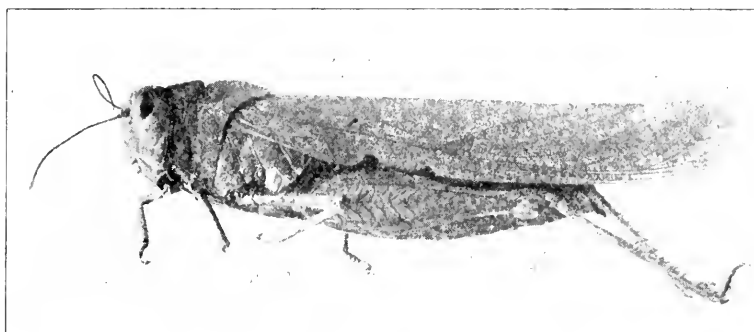
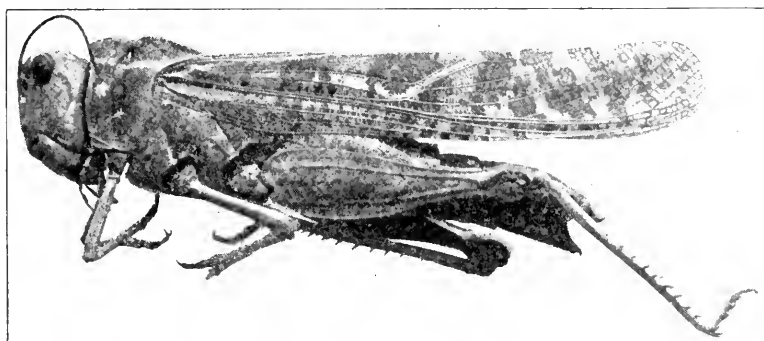
FIG. 52.

	Fig.	Page.
5. Tegmina with sharp, well-defined maculations, mostly transverse <i>corallipes</i> .	53	74
5. Tegminal markings not sharp, mostly tending toward the longitudinal <i>montanus</i> .	54	74

FIG. 53.—*H. corallipes*.FIG. 54.—*H. montanus*.

Dissosteira.

	Fig.	Page.
1. Tegmina usually plain, sometimes slightly fasciate with spots	<i>carolina</i> .	55 75
1. Tegmina always fasciate with darker colored spots; the contrast between the light and dark areas very marked.	<i>longipennis</i> .	56 75

FIG. 55.—*D. carolina*.FIG. 56.—*D. longipennis*.

Spharagemon.

	Fig.	Page.
1. Posterior tibiæ with black basal annulus..... <i>bolli.</i>	57	76 104
1. Posterior tibiæ without such annulus..... (2)	58	76

FIG. 57.—*S. bolli.*

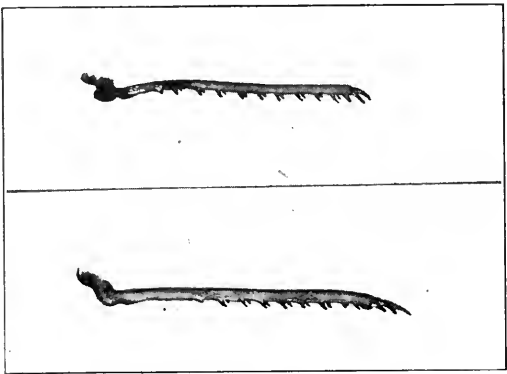


FIG. 58.—(2)

	Fig.	Page.
2. Pronotal carina well marked but not high..... <i>æquale.</i>	59	76 105
2. Pronotal carinæ very high (3)	60	76 77

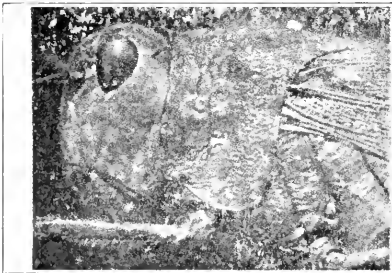


FIG. 59.—*S. æquale.*



FIG. 60.—(3)

	Fig.	Page.
3. Carina of pronotum about equal in height to the width of one-half of the disk of the metazona..... <i>cristatum</i> .	61	77 1 2
3. Carina of pronotum only one- to two-thirds as high as the width of one-half of disk of metazone..... <i>collare</i> .	62	77 1 2

FIG. 61.—*S. cristatum*.FIG. 62.—*S. collare*.*Hadrotettix*.

	Fig.	Page.
1. We have but the one species of this genus. <i>trifasciatus</i> .	63	77 1 2

FIG. 63.—*H. trifasciatus*.

Psinidia.

1. We have but the one species.....*fenestralis*.

Fig. Page.
64 ~~78~~

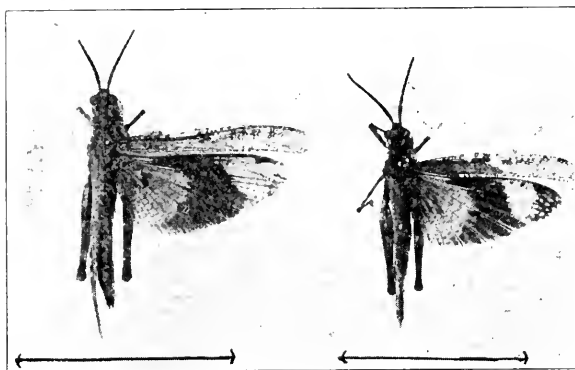


FIG. 64.—*P. fenestralis*.

Derotmema.

1. We have but the one species in Kansas.....*haydenii*.

Fig. Page.
65 ~~78~~

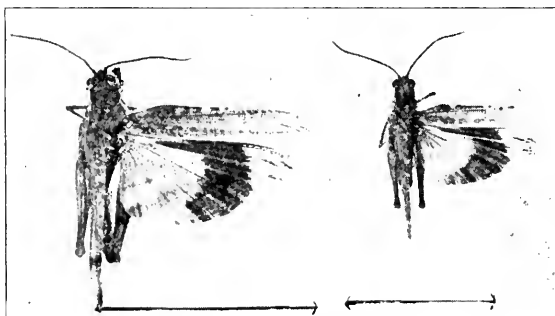
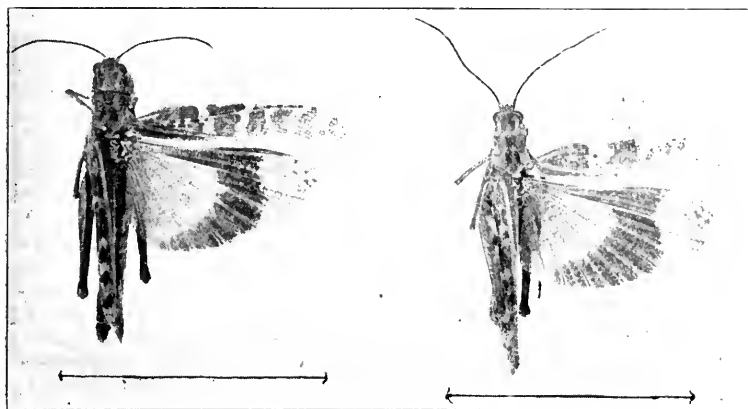


FIG. 65.—*D. haydenii*.

Metator.

- | | Fig. | Page. |
|---|------|-------|
| 1. We have but the one species of this genus... <i>pardalinus</i> . | 66 | 79 |

FIG. 66.—*M. pardalinus*.*Mestobregma.*

- | | Fig. | Page. |
|--|----------------|-------|
| 1. Wings hyaline | <i>kiowa</i> . | 67 79 |
| 1. Wings always marked, at least the disk yellow, and a trace of the spur of the black arcuate band..... | (2) | 68 79 |

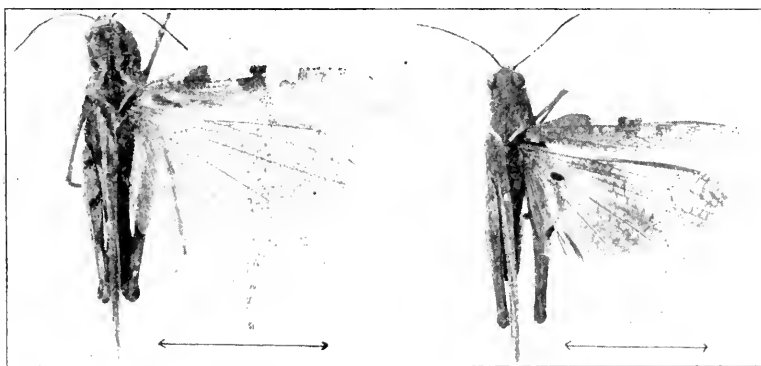
FIG. 67.—*M. kiowa*.

FIG. 68.—(2)

	Fig.	Page.
2. Disk of the wing yellow with but a trace of the spur left of the black arcuate band..... <i>kiowa</i> var. <i>obliterata</i> .	69	80
2. Wing with a distinct black arcuate band..... (3)	70	80

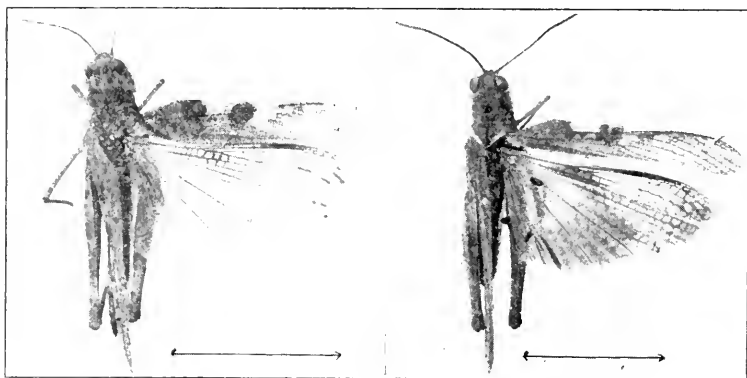
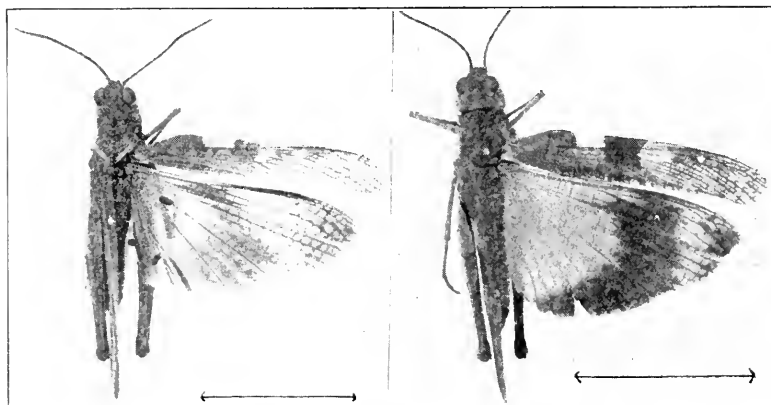
FIG. 69.—*M. kiowa* var. *obliterata*.

FIG. 70.—(3)

	Fig.	Page.
3. Arcuate band of wing receding anteriorly toward the base of the wing..... <i>kiowa</i> var. <i>thomasi</i> .	71	80
3. Black arcuate band of wing not receding anteriorly toward the base of the wing..... <i>plattei</i> .	71	80

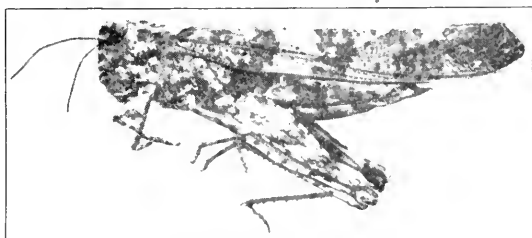
FIG. 71.—*M. k.* var. *thomasi*.FIG. 72.—*M. plattei*.

Trimerotropis.

1. Hind tibiæ orange red.....(2)
 1. Hind tibiæ pale lemon yellow.....*vinculata*.

Fig. Page.

.. 81

73 ~~81~~ 114FIG. 73.—*T. vinculata*.

2. Antennæ small, threadlike; a spur on the black band of the wing.....(3)
 2. Antennæ large, not threadlike; spur on the dark band of the wing wanting.....*magnifica*.

Fig. Page.

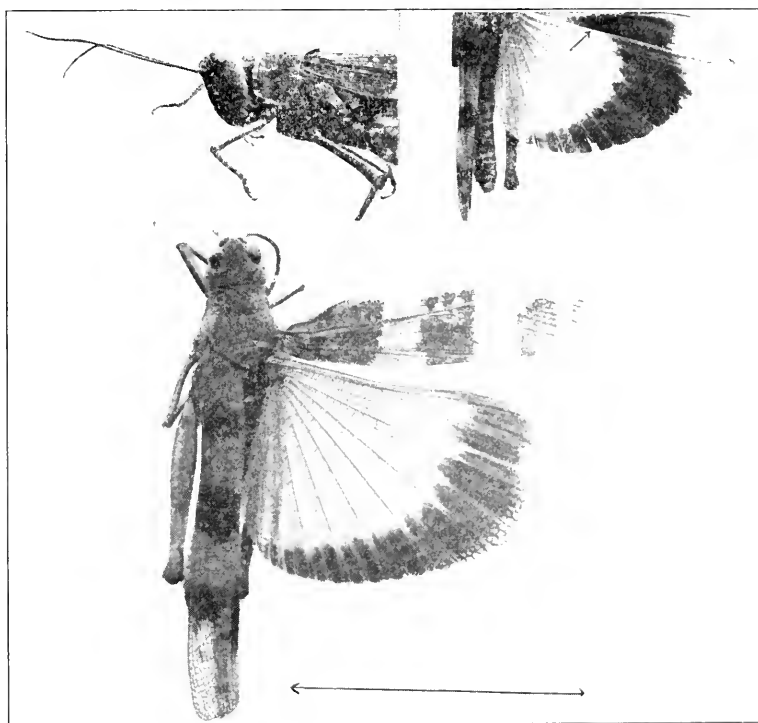
74 81

75 ~~81~~ 115

(3)

FIG. 74.

(2)

FIG. 75.—*T. magnifica*.

3. Lateral lobes of the pronotum with a tooth on the posterior part of the lower border..... <i>agrestis</i> .	Fig. 76	Page. 82
3. Lateral lobes of the pronotum without such a tooth on the posterior part of the lower border.....(4)	Fig. 77	Page. 82

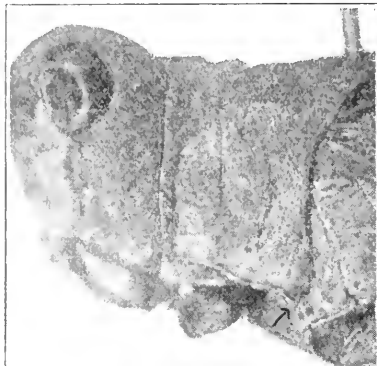
FIG. 76.—*T. agrestis*.

FIG. 77.—(4)

4. Black fascia of tegmina distinct.....(5)	Fig. 78	Page. 82
4. Black fascia at most indistinct..... <i>citrina</i> .	Fig. 79	Page. 83

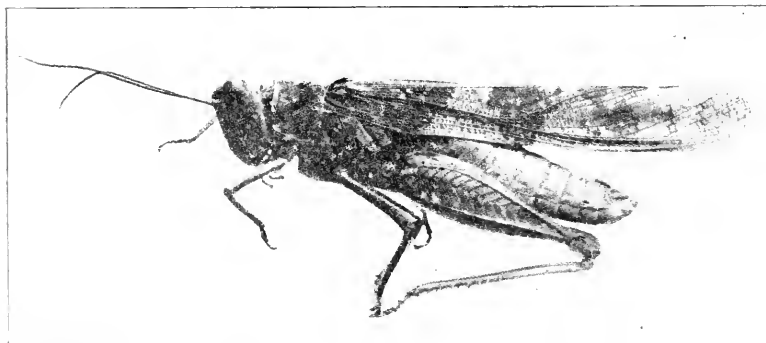


FIG. 78.—(5)

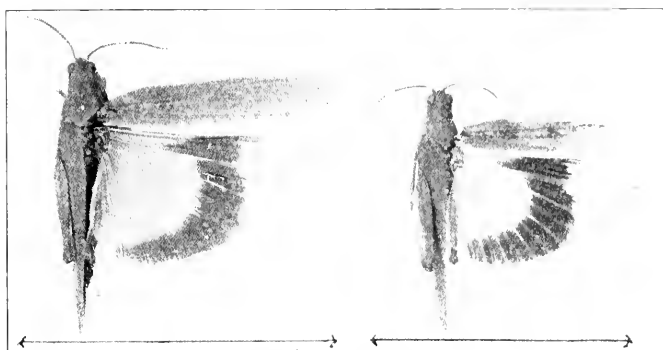
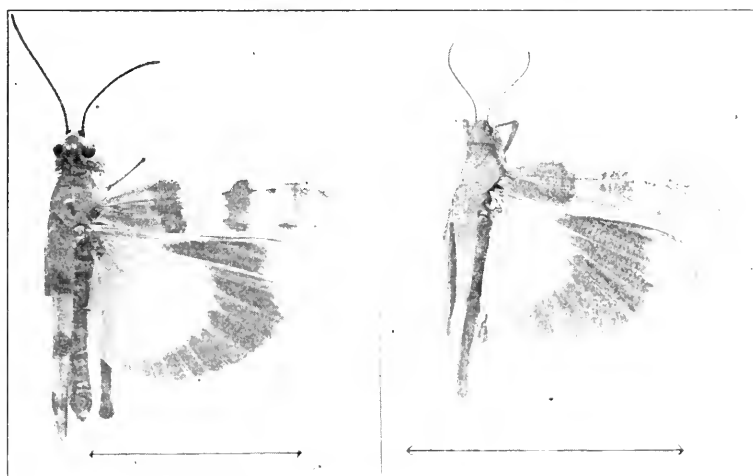
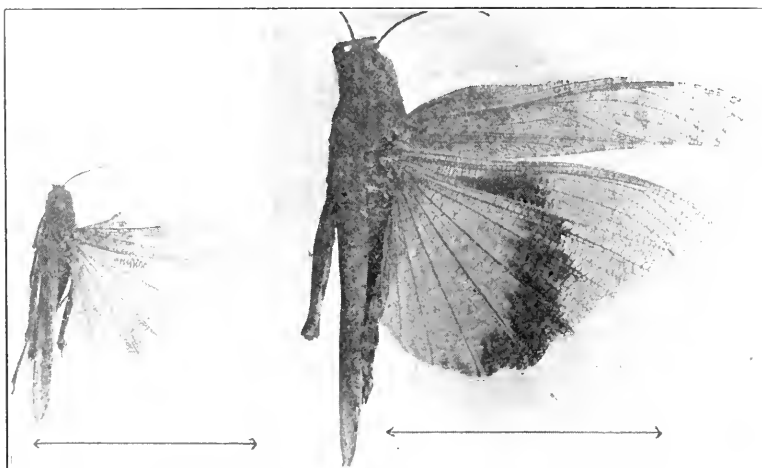
FIG. 79.—*T. citrina*.

	Fig.	Page.
5. Fascia of tegmina solid bands.....	<i>bruneri</i> .	80 83-120
5. Fascia of tegmina made up of small dots, not solid bands	<i>latifasciata</i> .	81 82-121

FIG. 80.—*T. bruneri*.FIG. 81.—*T. latifasciata*.

Circotettix.

	Fig.	Page.
1. Fuscous arcuate band of the wing almost wanting. <i>undulatus</i> .	82	122 84
1. Fuscous arcuate band of the wing distinct, broad and black throughout <i>nigrafasciatus</i> n. sp.	83	123 84

FIG. 82.—*C. undulatus*.FIG. 83.—*C. nigrafasciatus* n. sp.*Brachystola* Sc.

Body very robust. Occiput broad, convex, relatively smooth; fastigium of the vertex rather V-shaped; frontal costa broad, short, slightly sulcate, converging above the antennæ. Pronotum elongate, with three carinæ, rugulose on the dorsum, laterally quite smooth; carinæ equidistant, slightly elevated and continuous. Wings and tegmina rudimentary. Legs very robust.

Brachystola magna Girard.

Morey's Expl. Red. Riv. of La., 260, pl. 15, figs. 1-4.

Insects of large size, gibbous, eyes widely separated, occiput rounded. Vertex of the fastigium V-shaped, convex. Frontal costa sulcate below the antennæ, its carinæ converging to meet the vertex of the fastigium. Antennæ long, filiform, of medium size, joints distinct. Pronotum long, tricarinate; carinæ sharp, of medium height and continuous; dorsum rugulose, sides quite smooth. Tegmina and wings very short, fan-shaped, tegmina with a number of black spots. Legs all robust, posterior femora particularly heavy. Posterior tibiæ with an extra spine on the outside.

General color greenish-yellow spotted with black and brown, usually two yellowish median stripes dorsally, those of the thorax not meeting those of the abdomen.

This large, awkward 'hopper is quite common in a great many locations in Kansas.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	65.0-47.0	10.0-7.0	27.0-22.0
Male	56.0-42.0	11.0-7.0	32.0-24.0

(For general photographs of male and female see page 56, fig. 9.)

Arphia Stal.

Kansas forms of medium size; body more or less compressed, varying from light grayish to dull fuscous in color; scutellum of the vertex as in type *A. hippiscus*; carina of the pronotum usually well developed, not cut by the sulci, sometimes faintly sinuate; disk of the pronotum finely granulate to regulose; tegmina ample, coriaceous, densely and irregularly reticulate; base of wings bright red or yellow with a dark arcuate band, spur either long or short, wide or narrow; apically the wing is hyaline or infuscated; inside of hind femora dark with lighter stripes.

All of the Kansas forms look very much alike in general appearance and with the aid of the key will not be especially difficult to separate.

Arphia simplex Sc.

Proc. of the Soc. Nat. Hist., vol. 17, 514; 1875.

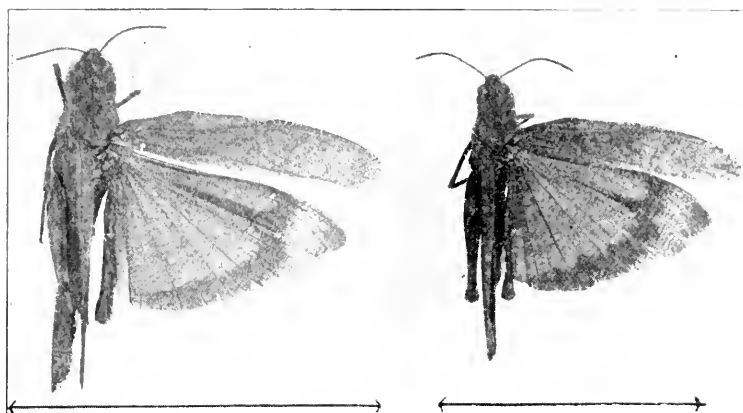
Brownish fuscous. The general color is very uniform, but the lower half of the head, and especially the face, passes to ashen; lateral foveolæ of the head scarcely distinguishable from the parts below, the lower limits being very obscurely marked. The edges of the lateral lobes of the pronotum are sometimes dotted irregularly with yellowish; pronotum somewhat scabrous; pronotal crest not high nor arched uniformly; tegmina flecked with fuscous dots pretty uniformly distributed over the whole, excepting in being a little crowded in the basal half of the middle area; wings at base red, with a slight orange tinge, bounded by a moderately broad, nearly equal, arcuate, dark fuscous band, padding from the middle of the outer half of the costal border nearly at right angles to the same, until it reaches the outer border, when it curves inward, following the border more than half the way to the anal angle; it sends inward, fully half way to the base of the wing, a broad generally tapering shoot just below the costal margin; beyond the arcuate band the wing is fuligno-pellucid, and at the tip fuliginous, all the veins dusky; hind femora vary indistinctly transversely trifasciate with an indistinct pale annulus just before the tip, the hind tibiæ obscure glaucoplumbeous, with a pale annulus near the base.

Length of body, male 24.5 mm., female 32 mm.; of antennæ, male 9 mm., female 9.5 mm.; of tegmina, male 26 mm., female 31 mm.; of hind femora, male 16 mm., female 18.5 mm. Two males taken June the third and sixth, one female taken April 26, in Dallas, Texas, by J. Boll.

This is the commonest *Arphia* in our state, appearing early in the spring and lasting throughout the summer. The very peculiar, broad lateral foveolæ of the vertex separate it very effectively from other species.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	39.0-29.0	35.5-27.0	20.5-16.5
Male	31.5-25.0	29.0-23.5	17.0-13.5

FIG. 84.—*Arphia simplex* Sc.*Arphia arcta* Sc.

Bull. U. S. G. Survey Terr., 2, 263; 1876.

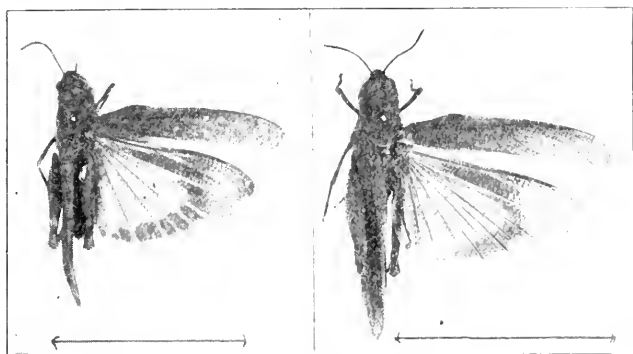
Head grayish brown above, yellowish elsewhere; the median carina of vertex broken at the posterior limit of the fastigium by the feebly impressed arcuate transverse furrow which marks the same, extending through the frontal costa nearly to the ocellus, expanding and forming a loop at the extremity; lateral foveolæ strongly and deeply impressed, narrowing anteriorly. Pronotum grayish brown, the upper surface unusually flat for an *Arphia*, rugulose, the median carina but little elevated, not laterally pinched at middle, regularly but slightly diminishing in height posteriorly. Tegmina profusely sprinkled with small grayish-fuscous spots, less abundant apically where the area is pellucid. Wings yellowish at the base, pellucid to an unusual extent at tip (nearly one-third of the ante-anal field is included in the pellucid area), making the transverse dusky bar narrower than in any species of *Arphia* known to me; the radial shoot toward the base, however, is unusually broad and long, equaling at its origin the entire breadth of that part of the wing and scarcely stopping short of the base. Hind femora brownish yellow externally, with two broad, a little oblique, dusky transverse bands; hind tibiæ pale yellow, with a broad fuscous cloud at tip and just before the middle.

Length: Male 21 mm., tegmina 22.5 mm., antennæ 8.5 mm., hind femur 11.5 mm.

Described from one male taken at Denver, Colo.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	23.0-28.0	27.5-24.5	15.0-14.0
Male	22.0-16.5	23.0-21.5	13.0-10.0

FIG. 85.—*Arphia arcta* Sc.*Arphia carinata* Sc.

Ædipoda carinata. Trans. Amer. Ento. Soc., vol. 2, p. 306.

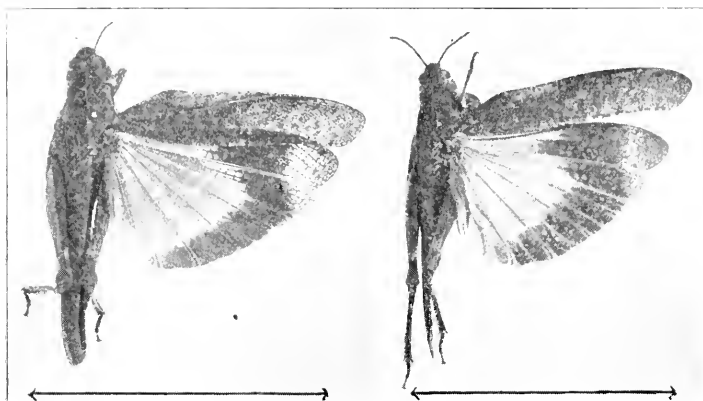
Head blackish, profusely streaked and spotted with dull bluish white; frontal carinæ and upper border of clypeus edged with whitish; palpi blackish, the joints tipped with luteous. Pronotum dull dark brownish fuscous, with a short pale streak behind the lower edge of the eye; hinder edge of the pronotum forming less than a right angle; median carina very prominent, whole, sharp, rounded. Basal third of tegmina dark brownish fuscous; beyond ash gray, profusely and rather regularly sprinkled with small brownish spots; basal half of wings pale dull orange, bordered by a broad blackish fuscous band, occupying the rest of the wing, excepting the apex, and encroaching on the orange near the costal margin, as in *Æ. xanthoptera*; apex semipellucid, a little fuliginous, darker at the very tip. Hind femora dull dirty hoary without, black with three transverse white bands within near the base.

Length of body, 30 mm.; of tegmina, 30 mm.; of hind tibiæ, 14.5 mm. One male; no locality. I have specimens in my own collection from Iowa.

This is a very dark brown species with a strikingly high-arched carina. It is not present in the state in extremely large numbers.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	35.0	31.0	18.0
Male	29.0	30.0	19.0

FIG. 86.—*Arphia carinata* Sc.*Arphia pseudonietanus* Th.

Proc. Acad. Nat. Sci. Phil., 82; 1870.

Male. Size and appearance much like *T. nietanus* Sauss., from which it differs only as follows: The facial costa is slightly broader and less excavated below the ocellus; the occiput and pronotum less rugose; the antennæ nearer cylindrical. The color is darker, the sides being deep black throughout to the tops of the elytra; the posterior part of the occiput and dorsum of the pronotum an ashy gray; the front lobe and lateral margins of the pronotum dotted with black; the upper edge of the posterior femur has two yellow spots, one next the base the larger. Beneath shining black. Wings as in *nietanus*; base rosaceous, posterior border broadly margined with black, and a fascia of the same running along the anterior margin nearly to the base.

Dimensions: Male, length, 1 in.; to tip of elytra, 1.25 in.; femur, .67 in.; tibia, .53 in.

Habitat: Found near Canon City, Colo., in a mountain canyon.

I have not seen the female. It may possibly be a variety of *T. nietanus*, but its variations from that species, added to the fact that it was found at but one point, justify me in describing it as new.

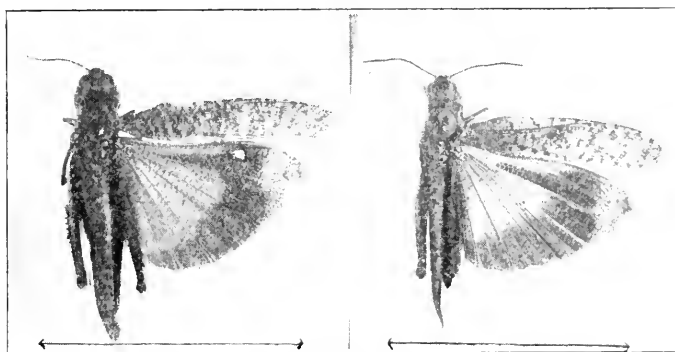
This species is decidedly the most variable of the Kansas forms. A great many of the specimens have very striking white pronotums. The species is found strictly in the western part of the state.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	37.0-31.0	30.0-27.0	17.5-15.5
Male	30.0-22.0	30.0-22.0	16.5-11.5

CHEYENNE	RAWLINS	DECATUR	MORTON	PHILL	SMITH	JEWELL	REPUBLIC	WASH	MARSH	NEMO	BROWN	DODGE
SHERMAN	THOMAS	SHERIDAN	GRAHAM	ROOKS	OSBORN	MITCHELL	CLOUD	CLAY	WAGON	POTTER	JACKSON	ATCHAFALYA
WALLACE	LOGAN	GOVE	TREGG	ELLIS	RUSSELL	LINCOLN	OTTAWA	DICKINSON	GEARY	WABASH	SHAWNEE	JEFFERSON
GREAT	WICHITA	SCOTT	LAND	NESS	RUSH	BARTON	ELLIS	SALINE	MORRIS	OSAGE	DOUGLASS	JOHN
HAM	KEARNEY	FINNEY	HODGE	PAWNEE	STAFFORD	RICE	M'PHERSON	MARION	CHASE	LYON	COFFEY	ANDERSON
STANLEY	GRANT	HASKIN	GRAY	FORD	KIOWA	PRATT	KING	SEDGE	BUTLER	GREEN	WOOD	ALLEN
MORT	STEVENS	SEWELL	MEAD	CLARK	COMAN	BARBER	HARDY	SUMNER	GOV.	CHAUTAUQUE	MONTGOMERY	LABETTE
												CHESTER

Distribution.

FIG. 87.—*Arphia pseudonietanus* Th.*Chortophaga* Sauss.*Prodromus ædipodiorum*, 72; 1884.

Body compressed, smooth, slightly punctate, delicately rugulose, greenish, subglabrous, sparsely pubescent, feet remotely hairy. Antennæ stout, slightly flattened. Pronotum posteriorly acute-angled. Elytra narrow, costal half green, sutural part (in dried specimens) griseous; that part of the proximal half anterior (anterior to ulnar vein) with perpendicular transverse veins; posterior portion (posterior to ulnar vein) irregularly reticulate. Axillary veins of wings subparallel, anteriorly crassate, posteriorly delicate; anterior axillary area divided by spurious vein longitudinally. Posterior femora quite slender. Posterior tibiæ sky blue. Ærolia between the claws of tarsi lobiform.

Insects dwelling in boreal America and Antilles.

Chortophaga viridifasciata D. G.

Lugger. Orthoptera of Minnesota, 234; l. c.

This common locust is exceedingly variable, and a number of varieties occur, which shade into each other. Two well-marked varieties are found, the green form (*virginiana* Fab.), and the brown form (*infuscata* Harris). This dichromatism is largely, but not entirely, characteristic of sex, most of the females being green, of the males brown.

The green variety is the typical one; wing covers with a broad, green stripe on the outer margin, extending from the base beyond the middle, and including two small dusky spots on the edge, the remainder dusky, but semitransparent at the end; wings transparent, very pale greenish-yellow next to the body, with a large dusky cloud near the middle of the hind margin, and a black line on the front margin. Antennæ, fore and middle legs reddish; hind femora green, with two black spots in the furrow beneath. This form is the larger one.

The dusky-brown variety has the wing covers faintly spotted with brown; wings transparent, pale greenish-yellow next to the body, with a large dusky cloud near the middle of the hind margin, and a black line on the front margin; hind femora pale, with two large black spots on the inside; hind tibiæ brown, with darker spines, and a broad whitish ring below the knees. The hind tibiæ differ much in color in different specimens, being variously tinted with brown, blue, pink, or purple, without regard to sex. Many intergrades occur, in which the head and pronotum are of a reddish velvety brown.

This species is one of our most common ædipods. It is quite generally distributed in grass land throughout the state, appearing among the first in the spring and lasting throughout the summer.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	31.0-27.0	25.0-22.0	17.0-13.5
Male	23.0-19.5	20.0-15.0	13.0-11.0

(See fig. 39, page 69.)

Encoptolophus Sc.

Bost. Soc. Nat. Hist., vol. 17; 1874-'75.

Allied to *Tragocephala* Harr. Head but little tumid above; front vertical above, roundly declivant below the costa, nearly equal, but broadening and fading on approaching the labrum, a little constricted above the antennæ; vertex moderately broad, the eyes being separated by their own width, the summit of the head minutely and bluntly carinate as far forward as the middle of the fastigium; the latter somewhat declivant, tapering anteriorly, distinctly though not very deeply hollowed; lateral fastigia triangular, slightly transverse, scarcely sulcate; eyes moderately large, shaped as in *Tragocephala*. Antennæ as long as (female) or much longer than (male) the combined head and pronotum, the joints flattened, on the apical half punctate. Disk of pronotum nearly flat, the median carina abrupt but not greatly elevated, cut into two equal halves by a distinct though slight notch; lateral carinæ distinct but broken, very slightly arcuate; posterior margin of the pronotum forming a rather sharply marked right angle; tegmina rather broad and short, but little surpassing the tip of the abdomen, the basal half of the costal margin sinuate, the apex broadly rounded, scarcely obliquely docked; wings short and broad, pellucid or nearly pellucid, with a postmedian costal stigma and more or less duskiness near the outer border, the principal veins of the front area broader than long. Type. *Ædipoda sordida* Burm.

The flatter disk of the pronotum with its slight but abrupt median carina and almost equally distinct lateral carinae distinguish this at once from *Tragocephala*, with which Doctor Stal unites it. As he has pointed out, the intercalary vein of the tegmina approaches the ulnar vein, instead of lying midway between it and the radial vein, as in *Tragocephala*.

Encoptolophus sordidus Burm.

Size large for the genus; face blunt; frontal costa scarcely sulcate, lateral carinae of same parallel below the antennae, convergent above; lateral foveolae trigonal, shallow; fastigium of vertex large, heart-shaped, with a median carina from the center caudad; antennae slender, of medium length; pronotum not much wider caudad than cephalad; carina sharp, higher and wider on the prozona than on the metazona, cut by one sulcus; tegmina a little longer than the body; fasciate with fuscous, scarcely hyaline apically; wings with disk whitish hyaline, no arcuate black band, apical half more or less infuscated, the anal and axillary veins black; inside of hind femora black with two light bands and a basal light spot; tibiae blackish blue with an apical light band.

General color very dark, quite strongly maculate. This species is quite common in Douglas county late in the fall. Just why it should not occur or have been taken in more localities in the state is rather difficult to answer. Possibly it is because the collecting parties return before this species reaches the adult form. A female of this species was taken mating with *Dissosteira carolina*.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	31.0	24.5	16.5
Male	25.0	20.0	14.0

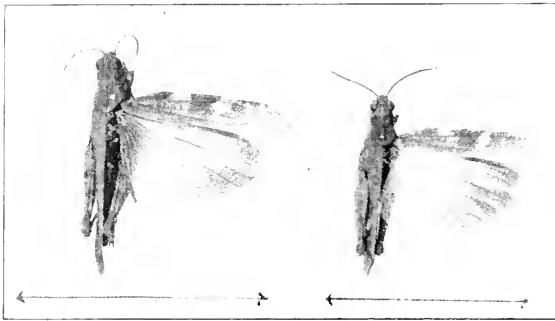
(See fig. 40, page 69.)

Encoptolophus texensis Bruner.

In size a little larger than *costalis*. Color brownish fuscous with maculations, but more indistinct than in *costalis* Sc. Head slightly elevated above the level of the pronotum. Antennae filiform, of medium length. Frontal costa sulcate in region of the ocellus and below, sides parallel below antennae, convergent above. Lateral foveolae trigonal, not very distinct. Fastigium of the vertex of medium size, slightly sulcate, longer than broad in the male, about equal in the female. Pronotum very little constricted cephalad; median carina well marked and sharp but not high, cut by one sulcus. Tegmina long and narrow, maculate, apical fourth semihyaline; ulnar and median veins of moderate separation, intercalary vein slightly nearer the ulnar than the median vein, usually almost straight, the space between them filled either with one row of cells or a reticulate mass, usually with more than one row of cells. Wings with basal disk hyaline with a yellowish brownish tinge, no arcuate band, apically infuscated, less so than in *sordidus*, axillary vein shining black, the anal lighter. Posterior femora robust, stout, black on the inside with two apical light bands and a small light blotch basally at the upper side, tibiae bluish with a lighter annulus basally.

MEASUREMENTS IN MILLIMETERS.

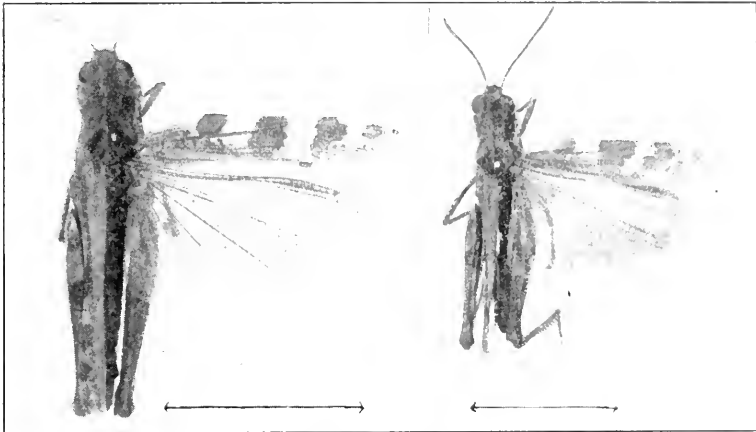
	Body.	Tegmina.	Post. femora.
Female	29.0-23.0	25.0-21.0	14.0-13.0
Male	21.5-19.0	20.5-18.0	12.8-10.0

FIG. 88.—*E. texensis* Br.*Encoptolophus costalis* Sc.

Head blunt and of the same relative size to the size of the body as in *sordidus*. General size about as in *texensis*. Color varying from light gray with fuscous maculations through green to brown, the maculations very distinct and clear-cut in every case. Antennæ rather short and clubbed—that is, thicker on the proximal third—lighter in color at the base. Vertex of the fastigium rather small, trigonal, sulcate; median carina well defined caudad. Frontal costa sulcate at the ocellus, sides parallel below the antennæ, slightly convergent above, meeting the scutellum of the vertex at such an angle as to almost confuse this insect with the *Tryxalinæ*. Pronotum about as in the other two species; median carina thin, sharp, and higher than in *texensis*; lateral carinæ on prozona come nearer meeting those of the metazona than is the case in *texensis*. Tegmina of medium width and length, always with two well-defined bands, and usually a third; the median and ulnar veins widely separated, the intercalary vein much nearer the ulnar than the median vein and usually curved, the space between them almost always filled by one row of long cells. Wings almost entirely hyaline, slightly infuscated apically; the axillary vein black, the anal white. Posterior femora of medium size, black or bluish-black on the inside, not as dark as in *texensis* and *sordidus*, with two apical light stripes and a basal one located on the upper side; tibiæ blue with a lighter basal annulus.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	30.0-25.0	22.0-18.0	16.0-14.0
Male	22.0-17.0	18.5-13.5	14.0-10.0

FIG. 89.—*E. costalis* Sc.*Hippiscus* Sauss.

Prodromus (*Edipodiorum*, pp. 82.

Species robust; at least moderately heavy, smooth. Antennæ of the male robust, scarcely attenuate at the point. Posterior part of head and between the eyes carinulate. Pronotum in the middle of the prozona coarctate, laterally constricted; lateral canthi angulated within near this place; typical sulcus vanishing in the lateral lobes. Elytra attenuated at the tips, maculate, fascia in anal veins pale. Wings at apex broadly transparent, or cloudy dark veined, on the apical margin dirty; black fascia divides lobes four and five freely on the posterior external margin, humeral bands widely distributed, costal margin at this place narrowly colored, dark fascia interrupted in anal veins. Posterior femora on the inside reddish-yellow striped. Posterior tibiæ blood red, in dried form for the most part reddish-yellow. Color of the body ochraceous or griseous, black and white marble-like, dorsum sometimes palely divided crosswise, or with two oblique pallid fascia. Dusky insects inhabiting North America.

The classification of the genus *Hippiscus* at the present time is in a hopeless condition. In a letter Dr. Morgan Hebard, of the Philadelphia Academy of Science, writes: "True *Hippiscus* appears to include but *rugosus* and *ocelote*. After these come, however, an array of questionable species which at the present day is positively staggering. . . . I feel sure it is beyond the power of any one to arrange a collection of these insects properly with the literature in its present condition." It is not expected, therefore, that the present arrangement will be entirely satisfactory, but it is believed that it will not make the condition any more confusing, and it is hoped that it may at least eliminate some of

the existing attempts to distinguish where no differences are present and may bring to light some variations in specimens of the same species which have hitherto not been recorded, due perhaps to the locality of collection and to the limited number of specimens at hand when the descriptions were made.

The present conclusions were reached after the study of about one thousand specimens, collected for the most part by the author in western Kansas during the summers of 1915 and 1916. Undoubtedly the central location from which these specimens were taken give them a variation which, while exceedingly confusing for the systematist with the present literature, may lead us to the true relations of many forms now supposed to be different, and may show the instability of many characters formerly supposed to be distinguishing. For instance, many writers have based their classification largely on the number of sulci intersecting the carina of the pronotum, whereas in the specimens at hand all variations can be found, from one to two distinct sulci in specimens which appear identical in every other detail, and it would be impossible to differentiate them into any number of groups on that character because of so complete a series.

The determinations of some of the specimens are questionable as yet. It is hoped, however, that these may be definitely cleared up when the breeding experiments, which have been commenced, are completed.

Hippiscus rugosus Sc.

E. rugosa Sc. Boston Journal of Natural History, vol. 7, No. 3; 1862.

This species is closely allied to *E. discoidea*. The head and thorax are dark brown; two yellowish bands run from behind the eye backwards and inwards, nearly or quite meeting one another a little in advance of the middle of the pronotum, where they converge and strike the hinder edge of the pronotum at the outer angles; there are two yellowish spots, one below the other, on the sides of the pronotum; the wing covers are marked much as in *E. discoidea*, but the dark blotches are larger and fully as abundant, generally occupying the larger portion of the wings, so that it might better be described as very dark brown with light blotches; the tip of the wing cover is pellucid, nearly free of spots; the wings are as in *E. discoidea*, with the basal color pale yellowish instead of red, and the apical portion less dusky than there.

Length of body, male 1.1 in., female 1.4 in.; expanse of wings, male 1.9 in., female 3 in.; depth of wings, male .5 in., female .7 in. Four specimens.

This is one of the commonest species of *Hippiscus* in Kansas. It appears in adult form a little later than some of the others, but may be found until after quite heavy frosts. It is very easily separated from all the other species by the very peculiar frontal costa and vertex of the fastigium.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	42.0-33.5	39.0-29.5	26.0-19.5
Male	43.0-19.0	31.5-20.5	20.5-17.0

(See fig. 46, page 71.)

Hippiscus haldemanii Sc.

Edipoda haldemanii. Final Rep. of U. S. G. S. of Neb., by F. V. Hayden. Washington; 1872.

This species is closely allied to *E. corallipes* Hald., but differs from it in the greater rugosity of the pronotum and in the greater separation and distinctness of the markings on the tegmina. The wings are pale yellow at base, hyaline with black veins at tip and across the middle, have a rather narrow fuliginous band, curving regularly around to the inner angle, broken at the division of the central and inner areas of the wing, and above this projected strongly and broadly inward, almost to the very base of the wing; at the costal border the band becomes almost piceous.

Length from vertex to tip of tegmina, male, 1.25 in.; female, 1.8 in. One male and four females. Nebraska City and the banks of the Platte.

Generally of large size and exceedingly variable characters. Vertex of fastigium usually of type A, but varying in large series toward type B. Carina of pronotum cut by one or two sulci, the carina very rarely obliterated between them. Disk of wings red or yellow. Macula-

FIG. 90.—*H. haldemanii* Sc. Post. femora red.

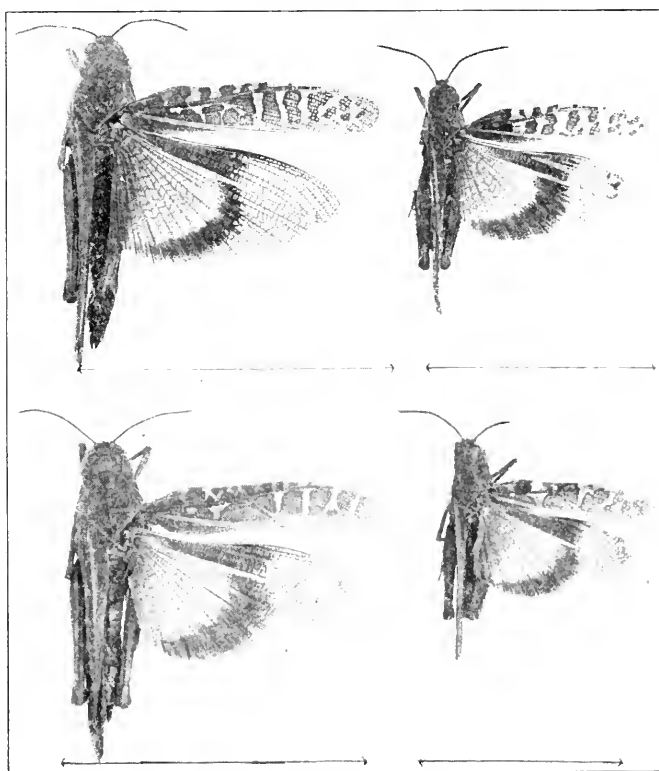


FIG. 91.—*H. haldemanii* Sc. Post. femora yellow.

tions of tegmina all shapes and sizes. Inside of posterior femora and tibiae from pale lemon yellow to bright vermilion, sometimes greenish, blackish or reddish brown.

This is the commonest species of *Hippiscus* in the state, as well as one of the most variable.

Habitat: Old, rocky, cactus-covered pastures and hillsides are preferred. Seldom found in tall grass or weeds.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	51.0-40.0	44.5-35.0	25.0-20.0
Male	39.5-22.0	31.0-24.5	19.0-14.5

Hippiscus phœnicopterus Burm.

Vertex of fastigium of type A variable, about as in *haldemanii*. Frontal costa narrowed at the upper extremity; pronotal carina cut but once, fairly sharp; pronotum between *haldemanii* and *tuberculatus* in roughness; head slightly turned down; general color from a blackish fuscous to a brownish olive, a good many specimens infiltrated with green on pronotum, head and posterior femora. Tegminal markings varying from deep black maculations in most males to almost no markings in some females; wings with base red, beyond which is a black arcuate band, spur reaches one-half way to the base, the outside of the black band rather diffusing into the hyaline apical portion; basal three-fourths of posterior femora dark blue with two lighter bands, apical fourth forming a yellow annulus; general size large.

This species is rather limited in its distribution within the state, the only places in which it has been found being Cowley and Chautauqua counties. It is a lover of low ground, preferably covered by tall grass, weeds, shrubs, and even trees. The dividing line between the habitat of this species and *haldemanii* is quite marked. The former was often

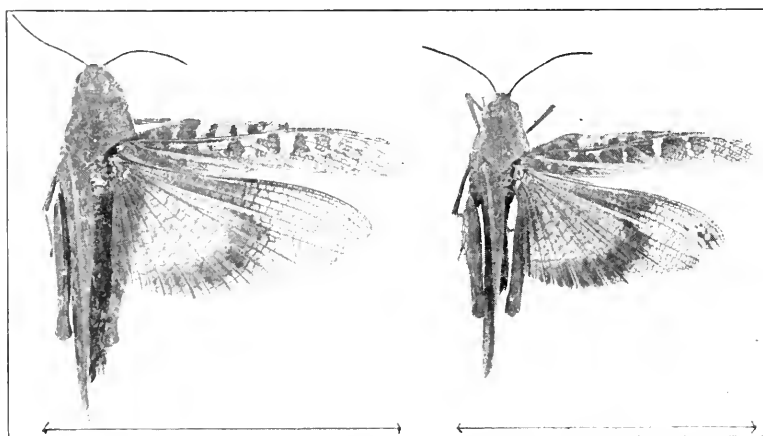


FIG. 92.—*H. phœnicopterus* Burm.

found occupying the brushy ravines and slopes of a hill, with the latter holding undisputed sway on the flat, barren top.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	50.0-46.0	44.5-39.0	25.5-22.5
Male	34.0-29.0	33.5-30.5	18.5-18.0

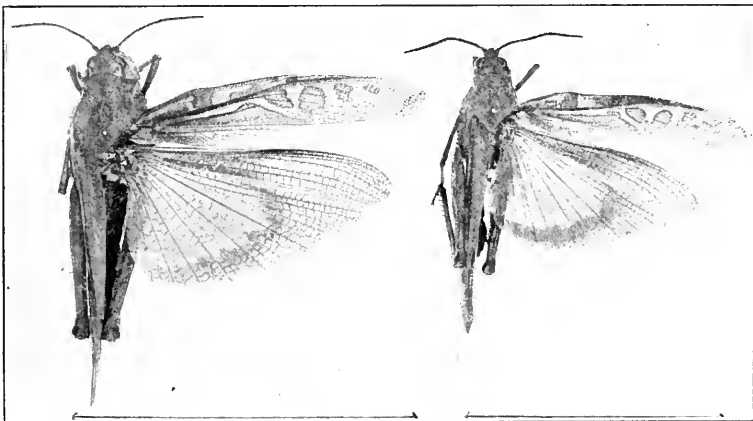
Hippiscus tuberculatus P. d. B.

General size large; vertex of fastigium of type A not converging so sharply anteriorly as in *phænicopterus*; carina of pronotum cut by one sulci, sharp but not high; pronotum the smoothest of the Kansas forms; head smaller in comparison to pronotum than in *phænicopterus*; color varying from dark fuscous to very light brown, with even lighter markings; tegmina very unevenly maculate; disk of wings red, bordered by black arcuate band whose spur reaches to base of wings, apical portion of wings hyaline, veins black; inside of posterior femora yellow with three black spots, the two basal ones connected.

This striking hopper is readily distinguished from *phænicopterus* by the inside of the hind femora, spur of the wing, and general appearance of the head and pronotum.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	45.0-44.0	44.0-39.0	24.0-22.0
Male	32.0-31.0	31.5-27.0	18.0-17.0

FIG. 93.—*H. tuberculatus* P. d. B.*Hippiscus corallipes* Hald.

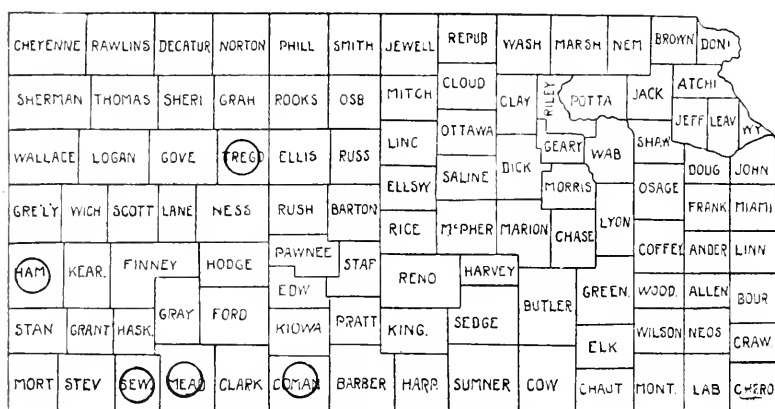
Edipoda corallipes. Exploration and Survey of the Valley of the Great Salt Lake of Utah. Philadelphia, 1852; by Howard Stansbury. Appendix C. Insects, by Prof. S. S. Haldeman, p. 371, pl. 10, fig. 2.

Yellowish gray, conspicuously varied with brown, mostly in blotches, and upon the elytra and exterior side of the posterior femora. Vertex and pronotum scabrous and dark brown, the latter margined with

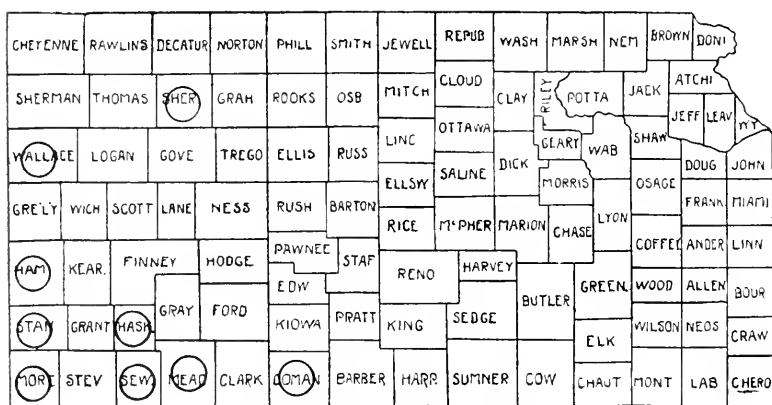
flavous, its surface nearly flat, and the medial line but little raised. Angle of the elytra marked with a yellow line; a narrow line upon the internal margin. Wings bright yellow, margined with black. Inside of the posterior femora, tibiae and tarsi bright vermilion, a paler tint extending to the outside of the tarsi and lower half of the tibiae. Length twenty (two and a half inches), pronotum five, posterior femora ten, and tibiae nine, lines.

This fine large grasshopper is probably the species which has been destructive to vegetation in the valley of the Great Salt Lake. It is nearly as large as the destructive *Edipoda migratoria* (with which it is congeneric). The last-named species is known under the English name of "migratory locust."

There can be no doubt but that this species contains both a red- and blue-legged variety, the extremes of which have been named different species in the past. A large series of these 'hoppers show all degrees of variation from one extreme to the other.



Distribution of blue-legged variety.



Distribution of red-legged variety.

The blue-legged variety is the larger, with a shallower vertex of the fastigium, while the red-legged variety varies from forms identical with the first to quite a smaller species with a very rough pronotum and deep-walled scutellum of the vertex.

This species is separated from *H. montanus* by the kind and shape of maculation on the tegmina, and also by the shallowness and broadness of the scutellum of the vertex, and from type A 'hoppers by having

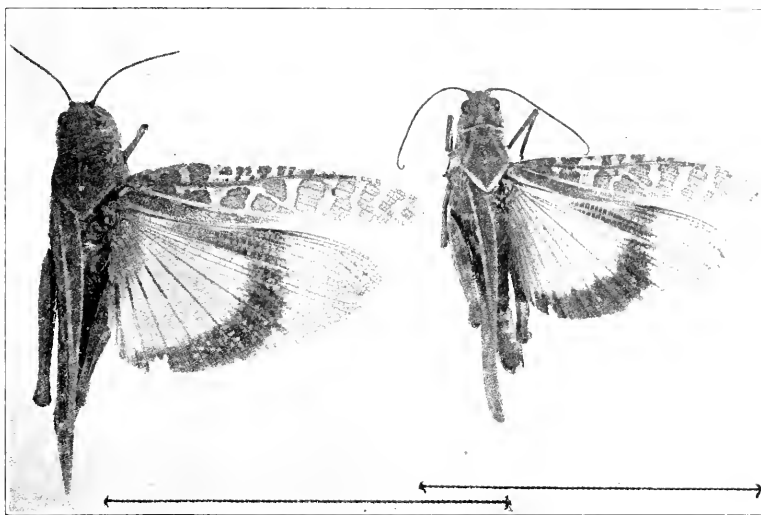


FIG. 94.—*H. corallipes* Hald. Blue-legged variety.

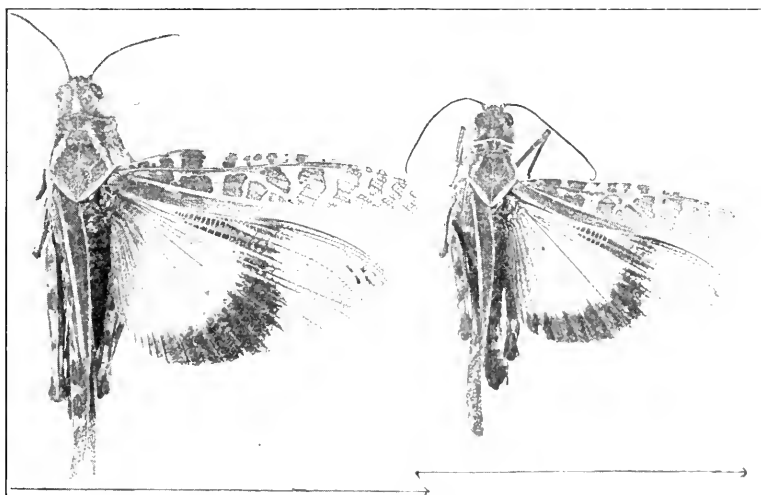


FIG. 95.—*H. corallipes* Hald. Red-legged variety.

a type B scutellum of the vertex (fig. 48), and by the metazona being longer in proportion to the pronotum than in the type A group (fig. 50).

(For type A, see figs. 47 and 49, pages 72, 73.)

MEASUREMENTS IN MILLIMETERS.

Blue-legged variety.

	Body.	Tegmina.	Post. femora.
Female	53.0-42.5	45.0-41.0	25.5-21.5
Male	42.0-35.5	38.0-34.0	22.0-19.5

MEASUREMENTS IN MILLIMETERS.

Red-legged variety.

	Body.	Tegmina.	Post. femora.
Female	51.5-40.0	44.5-36.0	25.0-20.0
Male	40.0-33.0	36.0-29.5	20.0-15.0

Hippiscus montanus. Th.

Æ. montana Th. Ann. Rep. U. S. G. S., vol. 5, 462; 1871 (1872).

Female. In form and size much like *Æ. corallipes*, but a very distinct species. Vertex broad; central foveolæ subcylindrical, transverse, its interior surface more or less interrupted by small tubercles; the two lateral foveolæ distinct; tip depressed, sometimes forming two small

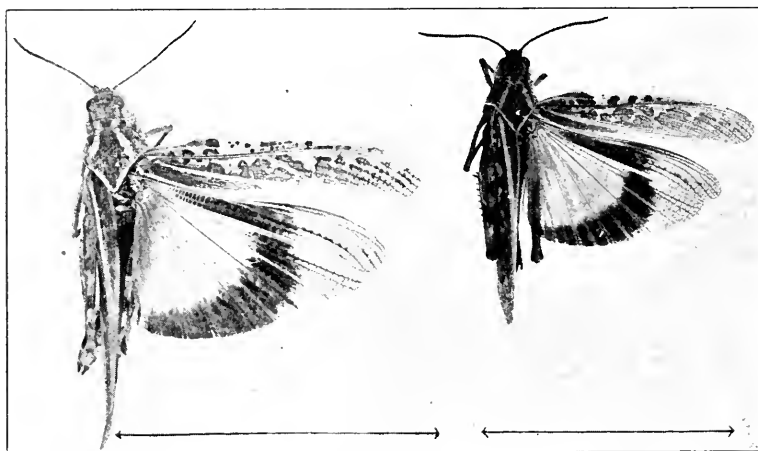


FIG. 96.—*H. montanus* Th.

foveolæ, but these are irregular, sometimes running into one and sometimes wanting. Frontal costa vertical, broad, expanding at the ocellus and at the base, more or less sulcate. Pronotum rugose, tuberculate, but not so broad as in either of the two species just named.

Color (dried after immersion in alcohol), reddish brown. Elytra brownish at the base, paler and semipellucid toward the apex, with dim, brown, cellular spots scattered somewhat equally over it, growing paler and dimmer toward the apex; in some specimens these spots are quite distinct, somewhat fuscous and partially run together. The wings are pale red at the base (but when living they are of a bright red); a narrow, somewhat broken, cellular, dark band crosses beyond the middle, curving round the posterior margin, decreasing rapidly; it does not

quite reach the anal angle; a broad ray of the same color runs up the front margin to the base. Posterior femora dull yellow, with no distinct bands.

Dimensions: Length, 1.4 to 1.6 in.; elytra, 1.25 to 1.3 in.; posterior femora, .7 to .75 in.; posterior tibiae, .62 in.

Found in the upper part of Snake river plain, near the mountains, and in southern Montana. I do not know where I first met with this species as we moved northward, because for some time I supposed it was the same as that before noticed under the name of *Æ. paradoxa* Thomas, and therefore did not examine it closely; so it is possible that I did meet with it on the north (Atlantic) slope of Market lake, and from there to Virginia City in Montana.

This species is found only in the extreme western part of the state. The peculiar maculations on the tegmina and the very deep, narrow scutellum of the vertex separate it from *H. corallipes*.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	44.5	41.0	21.0
Male	34.5-31.0	30.5-30.0	17.0-15.5

Dissosteira Sc.

Size from medium to large; head prominent; disk of vertex somewhat ovate, the front truncate; lateral carinae low; foveolae small, triangular; frontal costa sulcate, a little narrowed above and below the ocellus; carina of pronotum high, cut by one sulci, posteriorly arched; tegmina broad and quite long; intercalary vein about midway between the median and ulnar veins; wings not banded, large, black, with a narrow yellowish border along the outer edge as far as the apex, which is fuscous; posterior femora small for the size of the species. This genus is represented by but two species in Kansas.

Dissosteira carolina Linn.

Color from light reddish brown to very dark fuscous, quite variable, often being a reproduction of the color of the soil upon which the insect is found; tegmina either plain or thickly sprinkled with small dark dots;

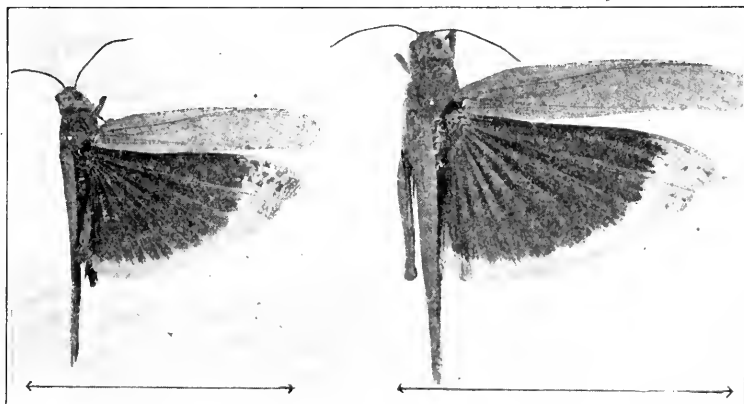


FIG. 97.—*Dissosteira carolina* Linn.

wings mostly black with the outer border pale greenish-yellow, the apex smoky with several darker spots; inside of hind femora light with three dark bands. This species resembles *D. longipennis* quite closely, but may be separated from it by the almost plain tegmina and lower carina of the pronotum.

The species is to be found from early spring to late in the fall along dusty roads, paths, fields, on sand bars, in fact on any bare or sparsely covered locations. It has been reported as doing quite a little damage to crops. It occurs everywhere throughout the state.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	45.0-34.0	47.0-37.0	22.0-17.0
Male	36.0-33.0	39.0-33.5	17.5-14.0

Dissosteira longipennis Th.

E. longipennis. U. S. Geol. Sur. of Terr., vol. 5, pp. 463; 1872.

Elytra and wings longer than the body; the elytra spotted; the wings black or dark fuliginous at the base.

Male. The vertex not very broad; central foveola elongate elliptical, with a slight median raised line, and open in front; frontal costa rather narrow, slightly expanded at the ocellus, sulcate, not expanding below. Median carina of the pronotum prominent, subcristate, as in *E. carolina*, cut near the middle by the posterior transverse incision, each part arcuate; anterior margin somewhat angled, and extending slightly on the occiput; the posterior extremity acutely and rather sharply angled; the disk of the posterior lobe smooth and apparently without punctures. The elytra narrow, remarkably straight, the margins parallel; longer than the entire body. Wings about the same length, and broad. The posterior femora not channeled beneath. The cerci rather long, subcylindrical, and terrete. Antennæ passing the thorax.

Color (dried after long immersion in alcohol) reddish yellow. The head and pronotum, especially the dorsal portions, pale reddish, the apical portion pellucid; marked throughout with dark-brown spots somewhat in the form of bands. The wings for a very small space around the immediate base are transparent yellow; a triangular space at the apex extending inward about one-third of the way to the base pellucid, sprinkled at the immediate apex with fuscous dots; the posterior margin has a narrow pellucid rim; the rest is of a dark fuliginous color, which, when the wing is fully spread, appears like a very broad band across the basal two-thirds, with its outer border parallel to the body. The posterior femora have two oblique brownish bands on the external face; within are two black bands; apex pale at base; apical portion dusky.

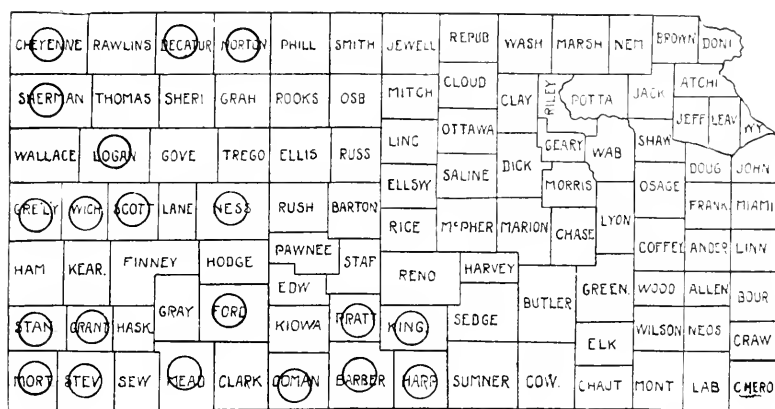
Dimensions: Length, 1.14 in.; elytra, 1.25 in.; posterior femora, .64 in.; posterior tibiae, .55 in.

Found among the collections submitted to me from the Agricultural Department, marked Kansas, which, from the other specimens, I suppose to be correct. The species is somewhat remarkable, and quite different from any other one belonging to the United States which I have seen. The dark wing would appear to bring it near to *carolina* and *carlingiana*, but while it approaches the former in its slender form it is nevertheless very distinct. I have never met with it at any point in the West, nor have I seen it in any other western collection. On this account, added to that of its semitropical look (this word conveys my idea better than a long sentence), I am inclined to believe it is a southern species, and may be found in the Indian Territory or Texas.

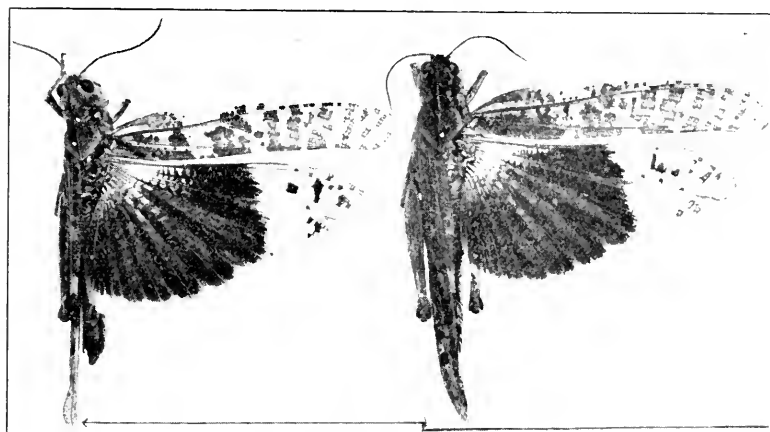
This large long-winged grasshopper is quite plentiful in parts of western Kansas. When sitting upon the ground it resembles very much the mottled appearance of *Hippiscus*.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	48.5-39.0	47.0-39.0	22.5-18.5
Male	40.0-32.0	43.0-34.6	19.0-15.4



Distribution.

FIG. 98.—*Dissosteira longipennis* Th.

Spharagemon Sc.

Boston Soc. Nat. Hist., vol. 17; 1874-'75.

Body compressed. Head rather tumid above, the vertex as declivant as the back of the head, broad, tapering rapidly, scarcely sulcate, the eyes separated by more than double the width of the basal antennal joint. Front vertical, scarcely convex on a side view, the costa moderately broad, nearly equal, slightly contracted above the antennæ, more or less sulcate throughout, excepting at the extreme upper end; its lateral ridges continuous with those of the vertex, the lateral foveolæ rather small, scarcely sulcate but more or less distinct, triangular, close to the eyes. Eyes rather small, transversely short obovate. Antennæ about as long as the hind femora in both sexes, little flattened, especially near the base, some of the apical joints very short. Disk of pronotum moderately flat, the median carina cristate or subcristate, strongly compressed almost from its very base, divided obscurely, but to the very base, by the principal transverse furrow into two parts, the front portion a little the longer, the edge of the ridge straight or nearly straight on the front lobe, and arched more abruptly in front than behind on the hind lobe; lateral carina nearly obsolete, excepting behind; the front lobes equal, its front margin very slightly angulated; hind lobe expanding posteriorly, its hind margin generally more acute than a right angle. Tegmina extending beyond the tip of the abdomen, nearly equal, slightly sinuous, obliquely excised apically, transversed by three bands of more or less distinctly agglomerated dark flecks. Wings subtriangular, yellowish at the base, crossed beyond the middle by a continuous broad dark belt. Hind femora rather stout and short, scarcely, if at all, surpassing the tip of the abdomen.

Type. *Gryllus æqualis* Say.

Spharagemon bolli Sc.

Proc. Bos. Soc. Nat. Hist., vol. 17, 469; 1875.

Brownish fuscous, the face with a grayish cinereous (male) or yellowish cinereous (female) tinge, distinctly punctate, the pits dusky or blackish; antennæ brownish yellow on the basal half, infuscated beyond, the whole more or less annulate with dusky yellow and blackish in the male. Tegmina flecked throughout with minute blackish spots, and transversely trifasciate with rather broad blackish clouds, much more distinct in the male than in the female. Wings light greenish, yellow at the base, with a broad median arcuate band, blackish or almost piceous in color, sending a broad, short shoot toward the base, near the upper border. Beyond, the wing is at first hyaline, with broadly blackish fuliginous veins, while the extreme tip is black as the median band. Hind femora dull brownish, quadrifasciate transversely with dark brown, more distinctly in the male than in the female, the basal two-fifths of the hind tibiæ blackish, with a broad whitish annulus, beyond coral red. Crest of pronotum very high, that of the posterior lobe independently arched, much more elevated in front than behind.

Length of the body, male 28.5 mm., female 36.5 mm.; of antennæ, male 16 mm., female 18 mm.; of tegmina, male 32 mm., female 34 mm.; of hind femora, male 18 mm., female 20.5 mm. Described from four males, four females. The males taken September 10, the females July 18 and August 18, 21, 23, at Dallas, Tex., by J. Boll.

This species has been confounded with *S. æquale*, from which it may be readily distinguished by the hind tibiæ; the tip of the wings is generally darker, and the median band does not approach the anal angle so closely; the tegmina are more distinctly trifasciate, the front half of the median crest of the pronotum is less pinched posteriorly, and the hinder half less arched.

I have specimens also from Vermont, Massachusetts, Maryland and Iowa. They are smaller than those from Texas.

This species is not found very extensively in the state. It has been taken only in the extreme southeastern part.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	35.0-32.0	33.5-29.0	19.0-17.0
Male	30.0-25.0	30.5-26.5	17.0-16.0

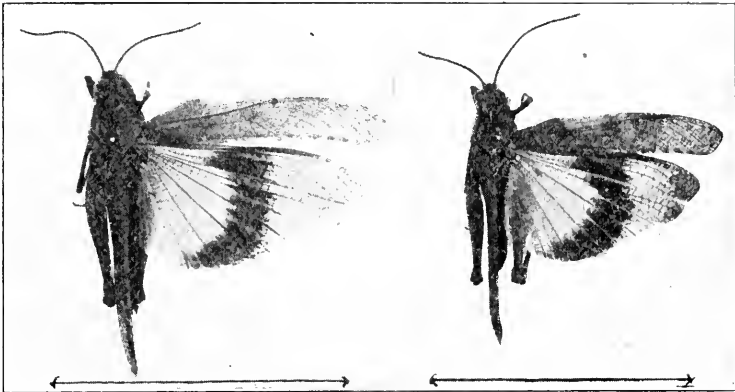


FIG. 99.—*Spharagemon bolli* Sc.

Spharagemon æquale Say.

Gryllus æquale. Acad. Nat. Sci. Phil., vol. 4, 1825, p. 307.

Hemelytra spotted with brown; wings pale yellowish at the base, with a black band and dusky tip.

Inhabits the United States.

Head varied with brown and light gray; thorax varied with brown and dull rufous, with a carinate line; hemelytra dark cinereous, with numerous unequal small dark brown spots; wings sulphurous at base, then a black band arcuated behind so as nearly to reach the inner angle; tip dark cinereous, darker at the angle or with small fuscous spots on that part; feet pale cinereous, spotted with fuscous; hind thighs within with four black bands; posterior tibiæ sanguineous.

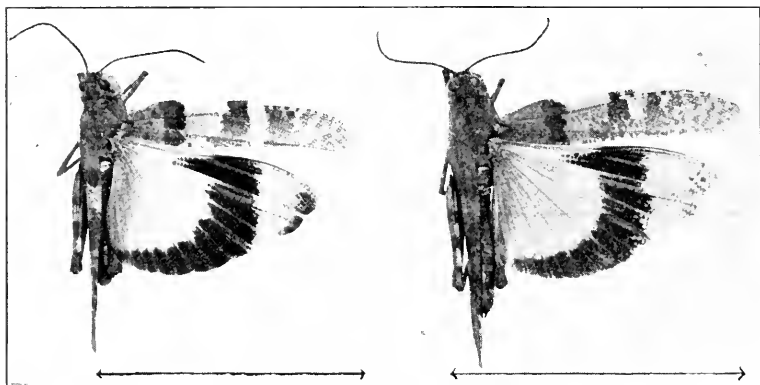
Length to the tip of hemelytra, one inch and two-fifths.

Not an uncommon species. The thorax is not gradually raised into a carina, but the line is abrupt and of little elevation.

This widely spread species is quite commonly confused with specimens of *Trimerotropis*, and even *Hadrotettix*. It is quite easily distinguished from both by the carina of the pronotum. The carina is quite often sinuate and sometimes cut twice but is larger and sharper than in any species of *Trimerotropis*.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	42.0-34.0	39.0-28.5	20.5-15.5
Male	32.0-26.5	34.0-25.0	18.0-14.0

FIG. 100.—*Spharagemon aequale* Say.*Spharagemon cristatum* Sc.

Proc. Bos. Soc. Nat. Hist., vol. 17, 469; 1875.

Dark yellowish brown, profusely mottled and flecked with grayish cinereous, the dark color generally predominating, and sometimes becoming black on the summit of the head, the sides of the pronotal crest, and in a couple of short longitudinal stripes along the anterior half of the lateral lobes of the pronotum; the hinder edge of the pronotum is usually alternately pale and dark; antennæ dusky, yellowish brown at the base, and annulate with yellowish brown for some distance beyond it; tegmina mottled with dark cinereous and blackish-brown, the latter most conspicuous in an agglomeration of these spots just before the middle, half way between that and the base, and at an equal distance beyond the middle band; the apical fourth of the wing is obscurely subhyaline, occasionally with a slight concentration of dark spots at the tip; the lighter colors predominate along the costal margin on either side of the median dark patch. Wings light greenish-yellow at the base, sometimes tinged to the least possible degree with saffron (more noticeable in the closed wing), with a moderately broad, blackish fuscous, arcuate mesial band, at the costal border (but omitting the costal edge), extending abruptly a short way toward the base of the wing; beyond this band the wing is hyaline with blackish fuscous nervures, some of the cells near the tip partially or wholly fuliginous fuscous, forming a more or less marked infuscation. Hind tibiæ coral red, the extreme base black, followed by a more or less distinct pale annulation. Crest of pronotum exceedingly high, arched pretty regularly, the hinder extremity of the anterior lobe sometimes overlapping the front of the posterior lobe; the posterior border of the pronotum very acutely angled.

Length of the body, male 26.5 mm., female 36.5 mm.; of antennæ, male 13.5 mm., female 14.6 mm.; of tegmina, male 30.25 mm., female 36 mm.; of hind femora, male 16 mm., female 20 mm.

Described from eleven males, seven females, taken in Dallas, June 3, 23, August 21, 23, by J. Boll; and one specimen in Waco, as late as October 16, by G. W. Belfrage.

This is by far the most common species of the genus in the state. The species is exceedingly variable both in size and coloring.

Habitat. Sandy, hot flats sparsely covered with grass and weeds.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Females	37.0-26.0	34.0-27.0	19.5-16.5
Males	29.0-22.5	28.0-23.0	16.5-13.0

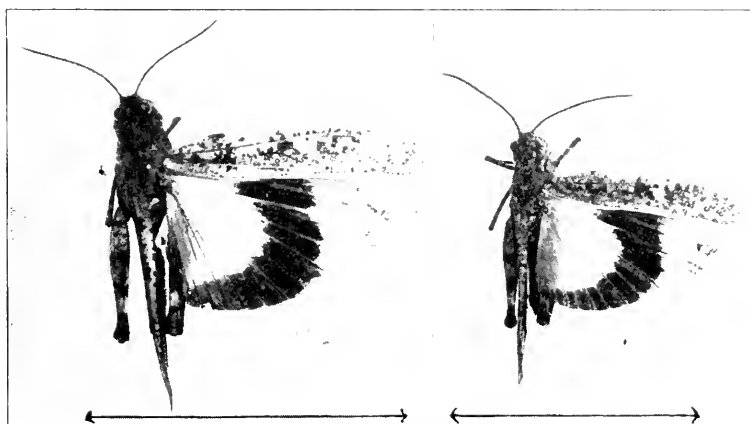


FIG. 101.—*Spharagemon cristatum* Sc.

Spharagemon collare Sc.

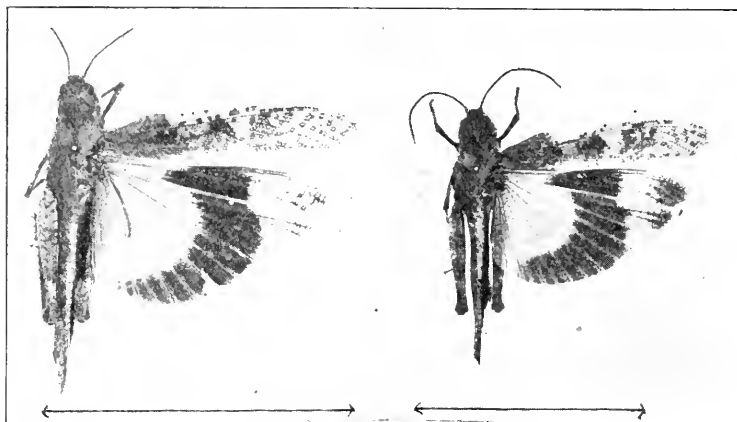
Ædipoda collaris. Rep. U. S. Geol. Sur. Neb., 250; 1871.

Dark reddish brown; lower half of the head, base of hind femora, and a broad band along the posterior edge of the pronotum, pale clay yellow; hind tibiæ reddish; tegmina mottled somewhat uniformly with fuscous blotches, which forms three distinct bands, the outer of which is sometimes lost in the nearly equal mottling of the tip; wings pale yellow at the base, somewhat infuscated at tip with a broad median blackish band, occupying the middle third of the wing at the costal border, crossing the wing at right angles with uniform breadth (excepting a spur thrown out toward the base, as in *E. xanthoptera*), and then with decreasing width, following the curve of the wing to the inner angle; pronotum with a prominent median ridge throughout its extent.

This species is very similar to *cristatum*, and can only be separated from it by the character of the pronotum. It is not at all widespread over the state, and is not numerous where found.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	38.0-31.0	37.0-29.0	20.0-17.0
Male	31.0-25.0	31.0-25.5	16.0-14.0

FIG. 102.—*Spharagemon collare* Sc.*Hadrotettix* Sc.

Similar in structure and coloration to *Trimerotropis*; size large, thick through the metazona; antennæ long and heavy; neck constricted; scutellum of the vertex not sulcate; pronotal carinæ scarcely visible; tegmina relatively short compared to the length of the body, trifasciate with solid bands, thickened, densely coriaceous beyond the edge of the basal band, quadrate cells not much within the basal branch of the radial sector; fuscous arcuate band of wing beyond the middle and lacking a spur; inside of posterior femora deep indigo blue with an apical light band.

Hadrotettix trifasciatus Say.

Robust, resembling very much some of the species of *Trimerotropis*. Color varies from gray through light reddish brown to quite dark brown. Antennæ long, heavy, lighter in color at the base. Frontal costa very slightly sulcate, slightly converging from the base upward. Scutellum of the vertex not sulcate at all. Pronotum large, relatively smooth, slightly punctate; principal sulcus quite deeply impressed; pronotal carinæ scarcely visible. Tegmina short in comparison to the length of the body; trifasciate with almost solid bands; densely coriaceous for three-fourths of the length; thickened, quadrate cells not much within the basal branch of the radial sector. Base of wings hyaline, faintly tinged with blue; fuscous arcuate band beyond the middle and without a spur; tip hyaline, slightly infuscated. Posterior femora stout, exterior with a deep fuscous band, interior deep indigo blue with a light band apically. Tibiæ and tarsi pink to bright red.

Quite equally distributed throughout the state in rocky, dry places.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	39.0-25.0	36.0-26.0	21.0-15.0
Male	33.0-25.0	32.0-27.0	18.5-15.4

(See fig. 63, page 77.)

Psinidia Stal.

This genus is very closely related to *Mestobregma* and *Scirtetica* and is quite often found in the same locality with them; however, it is easily distinguished from them by the constricted pronotum and the very peculiar shape of the antennæ. The antennæ are unlike those of any other species of the subfamily in the depressed, prismatic form of the joints, appearing almost ensiform next the base. The general coloration is quite varied, presenting all shades from pale dust color to bright reddish brown, or even black.

Psinidia fenestralis Stal.

General size small; head prominent; eyes small, protruding; fastigium trigonal, deeply sulcate; antennæ of medium length, tapering toward the tip, flattened; frontal costa sulcate, converging from the base upward; pronotum strongly constricted, posteriorly rectangulate; pronotal carinæ sharp, intersected by two sulci; lateral lobes parallel, the lower posterior corner with a tooth; general color varying from pale dust color to bright reddish brown; tegmina brownish, usually slightly maculate; wings with base red or yellow; posterior femora fasciate with fuscous on the outside, on the inside black with two light stripes; posterior tibiæ purplish.

This species has not yet been found very extensively in Kansas. It usually chooses low sandy locations and is accompanied by species of *Arphia*, *Trimerotropis* and *Mestobregma*.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	27.5-24.0	26.5-24.5	14.5-13.0
Male	21.0-20.0	20.5-19.0	11.5-10.5

(See fig. 64, page 78.)

Derotomema Sc.

General size very small; head and thorax somewhat wrinkled; scutellum of the vertex with high bounding walls; cranium between the eyes with transverse carinæ; antennæ filiform; pronotal carinæ anteriorly elevated, centrally bilobate, posteriorly low and intersected usually by two sulcii; neck constricted; eyes very prominent. Wings usually with basal coloring and fuscous arcuate band. Color quite variable, from dirty gray to fuscous, often with spots.

This genus is represented in Kansas by but one species.

Derotmema haydenii Thomas.

E. haydenii Thomas. Rep. U. S. G. S. Terr., vol. 5, 460; 1871 (1872).

Head and thorax somewhat wrinkled. Vertex rather narrow; central foveola somewhat elongate; margins prominent and sharp; open in front and continuous with the sulcus of the frontal costa; median carina distinct; frontal costa sulcate throughout its length, very narrow above the ocellus; eyes prominent, subglobose. Antennæ rather longer than usual. Pronotum tricarinate; median carina distinct but not prominent; lateral carinæ distinct only on the posterior lobe; third transverse incision very distinct, nearly straight, cuts the median carina about the middle; the anterior lobes are covered with irregular raised lines, the posterior lobe with elongate tubercles; apex blunt, terminating in a right angle. Elytra and wings passing the abdomen, narrow. Posterior femora slender.

Color (dried after immersion in alcohol). Dull clay colored, dotted with brown or fuscous. A transverse fuscous stripe in front between the eyes. A smaller fuscous spot about the middle of each side of the pronotum. Upper and lower margins of the elytra marked with small fuscous spots; the middle field nearly clear, a few minute paler dots only being visible. Wings, of the alcoholic specimens, a dull yellow at the base, but when living this portion is red; beyond which a tolerably broad fuscous band crosses, narrowed in front and behind, curving round the posterior margin but not reaching the anal angle; a submarginal ray extends up the front nearly to the base; apex pellucid, with the nerves partly ochereous and partly dusky. Anterior and middle tarsi with two black annulations. Antennæ with alternate rings of yellow and fuscous. Color of the living insects, as appears from the short field note made in regard to it, is as follows: Wings red at the base; antennæ with alternate rings of brown and red; general color ash gray, marked with fuscous dots and spots.

Dimensions: Female—length, 1 in.; elytra, .87 in.; posterior femora, .54 in.; posterior tibiæ, .45 in. Male—length, .62 to .7 in.; elytra, .7 in.

Found in Colorado and Wyoming. My attention was first called to this species a short distance above Fort Fetterman, on the North Platte, but I afterward found it among my collections made in Colorado.

This species is apparently restricted to the western part of our state, which would naturally be expected from the distribution as given by Thomas.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	26.0-22.0	24.5-21.0	13.0-10.5
Male	18.0-14.0	19.0-15.5	10.0- 9.0

(See fig. 65, page 78.)

Metator McN.

Closely allied to *Mestobregma* Sc.; in fact, the genus was founded on *Mestobregma pardalina* Sauss. Head large; face horizontal; vertex tumid, broad between the eyes; fastigium quadrate, depressed, with very high and abrupt lateral and frontal carinæ; lateral foveolæ small; eyes small; moderately prominent; antennæ long filiform; pronotum posteriorly as broad as the head, somewhat constricted in the middle, posterior border rectangular; median carina of pronotum moderately conspicuous, slightly higher on the front than on the hind lobe, twice deeply cleft; tegmina and wings surpassing abdomen; in tegminal markings resembling the

genus *Hippiscus* quite closely; intercalary vein considerably in advance of the median area distally, with a single row of cells on either side; posterior femora unusually slender.

Metator pardalinus Sauss.

Ps. pardalina. Prodr. Œdip., 162; 1884.

Robust, smooth. Antennæ longer than the femora. Pronotum above sparsely granulate, lateral lobes posteriorly acute, obliquely subtruncate. Elytra fusco-multimaculate, pardaline, one-half of basal maculations broadly rounded, intercalary area anteriorly transversely veined; intercalary vein apically inclined toward the median. Basal disk of the wings purplish, at least rosaceous, apically fusco-punctate; ulnar area barely wider than the discoidal area. Posterior femora dark sky blue on the inside, fasciate with reddish yellow apically.

Length, female 34 mm., male 26 mm.; elytra, female 31 mm., male 26 mm.

Colorado.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	40.0-27.0	35.0-24.0	21.0-14.0
Male	29.0-24.5	27.0-23.5	17.0-13.5

(See fig. 66, page 79.)

Mestobregma Sc.

Bull. U. S. Geol. Sur. Terr. 2, 264; 1876.

Somewhat allied to *Psinidia* Stal. Head large; face horizontal; vertex tumid but not so elevated as in *Psinidia*, broad between the eyes, the fastigium quadrate, depressed, with very high and abrupt lateral and frontal carinæ, which form the continuation on the sides of the equal, completely sulcate frontal costa; lateral foveolæ small, depressed, widely semicircular, the ocelli situated beneath their outer extremity; eyes small, moderately prominent, but little longer and not so broad as the space between them; antennæ of the female about as long as the hind femora. Pronotum posteriorly as broad as the head, somewhat constricted in the middle, the hind lobe scarcely longer than the front, the posterior border rectangular; median carina moderately conspicuous, slightly higher on the front than on the hind lobe, twice deeply cleft, the transverse sulcations extending into the lateral lobes; lateral carinæ of posterior lobe with a few oblique regæ and small tubercles. Tegmina and wings surpassing the abdomen, the axillary vein of the former free; hind femora as long as the abdomen.

Mestobregma kiowa Th.

Ann. Rep. U. S. Geol. Sur. Terr., vol. 5, 461; 1871 (1872). (*E. kiowa*).

Of small size; head as in *E. longipes* Charp. of Europe; occiput ascending, the front part standing above the disk of the pronotum; vertex broad, transverse; central foveolæ very distinct, quadrilateral, opening in front by a short channel, which connects it with the sulcus of the frontal costa; lateral foveolæ distinct; frontal costa rather narrow, distinctly sulcate throughout its length; eyes very prominent, slightly oblong. Pronotum more than usually contracted, a little in advance of the middle, tricarinate; median carina distinct, but not very prominent, twice notched, posterior notch about the middle, the middle portion shortest; lateral carinæ distinct on the posterior lobe, indistinct on the

others; apical angle slightly obtuse, but not blunt; disk somewhat rugose. Elytra and wings rather narrow, passing the abdomen.

Color (dried after long immersion in alcohol) dull clay yellow, with fuscous dots and spots; occiput with two indistinct fuscous stripes; disk of the posterior lobe of the pronotum dusky brown in the center, margins yellow; there are, also, generally two dusky spots on each side of the pronotum, near the front margin. The elytra have three fuscous bands across them, the one nearest the apex generally more or less obliterated by the transparency of this part; the apex pellucid; wings pellucid; nerves of the anterior portion dusky, the rest ochereous. Posterior femora with three indistinct brownish bands exteriorly, the inside black next the base, and a smaller spot of the same color near the apex, rest yellow; tibiae dull yellow (probably blue when living), slightly dusky at the base and apex.

Dimensions: Female—length, .87 in.; elytra equal the body; posterior femora, .53 in.; posterior tibiae, .47 in.

I have found this species only in Colorado, east of the mountains.

A very common species in the western part of the state but gradually becomes less numerous as we go east, while the color variants of this species, *M. kiowa obliterata* and *M. kiowa thomasi* appear and gradually grow more numerous.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	27.0-21.0	24.0-19.0	15.0-11.0
Male	17.5-14.0	18.0-15.5	12.5- 9.5

This species is easily separated from the two color variants by the fact that the wing is entirely free from coloration.

(See fig. 67, page 79.)

Mestobregma kiowa var. *obliterata* Bruner.

Very similar to *M. kiowa*, but differing from that species in that the basal disk of the wing is yellow, while in that species it is hyaline. There is also a faint trace of the spur of the black arcuate band. The band itself has entirely disappeared. This fact is the separating character between this variant and the other color variant, *M. kiowa thomasi*.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	26.0-23.0	24.0-21.0	14.0-13.0
Male	18.0-16.0	20.0-16.0	12.0-11.0

(See fig. 69, page 80.)

Mestobregma kiowa var. *Thomasi* Caud.

This species is in every way identical with *kiowa*, with the exception of the coloration of the wing. The base of the wing is yellow; arcuate band black with a spur, whole band receding basally in the region of the spur; apically the wing is hyaline, slightly infuscated.

This species is easily separated from *plattei* Th. by the shape of the arcuate band, general size, and coloration of the whole insect. The wing coloration also separates it from *M. kiowa* and *M. kiowa obliterata*.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	25.0-22.5	26.5-21.0	15.0-12.5
Male	19.0-14.5	21.0-17.0	13.0-11.0

(See fig. 71, page 80.)

Mestobregma plattei Th.

E. plattei. Syn. Acrid. North America, U. S. Geol. Sur., p. 123.

Somewhat like *E. encerrata*, but invariably larger.

Head large; front of the occiput elevated; vertex broad, much deflected; median foveolæ subquadrate, transverse in female, opening in front, connecting with the sulcus of the frontal costa; frontal costa of moderate width, sulcate throughout, expanding slightly at the ocellus. Eyes slightly oblong, subglobose, prominent. Antennæ slender, passing the pronotum. Median carina distinct, not prominent on the posterior lobe, slightly prominent on the anterior lobes, notched twice; middle part very short; posterior incision about the middle of the pronotum; front margin slightly angled, apical angle slightly obtuse, pointed. Elytra and wings about as long as the body.

Color (dried after immersion in alcohol). Clay color, varied with brown and fuscous. Lower portion of the face, the cheeks, and lower margin of the sides of the pronotum pale yellowish; two or three rows of brown dots on the occiput; a broad stripe along the middle of the pronotum brown. The male generally has two oblique brownish stripes on the sides of the head and pronotum, the upper one embracing the lower portion of the eye. Elytra with the upper half and apical third sprinkled with small fuscous spots; lower half with two broad fuscous bands, behind each a pale yellow immaculate space, appearing as oblong, fuscous spots, alternating with pale spots. Wings pale transparent yellow at the base (color when living unknown); a moderately broad band crosses just beyond the middle, curving abruptly upon the posterior margin to the anal angle; tip more or less clouded, rest pellucid; nervules pale yellow (tip of male fuscous). Posterior femora with two or three dim, oblique bands outside; inside blackish next the base; a pale ring near the apex.

Dimensions: Female—length, 1 in.; elytra, same; hind femora, .55 in.; hind tibiæ, .5 in. Male—length, .75 in.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	30.0-28.0	28.0-25.0	15.0-10.0
Male	25.0-21.0	25.0-22.0	15.5-13.0

(See fig. 72, page 80.)

Trimerotropis.

As the original description of *Trimerotropis* is inaccessible to me, I will give McNeill's (U. S. Nat. Mus., vol. 23, 394).

"*Trimerotropis* may be briefly defined as follows: Head of moderate size, slightly exceeding the prozone in width, but always exceeded by the metazone, which is considerably expanded. Antennæ filiform, of variable length. Eyes rarely equal to the genal groove. Frontal costa contracted below the ocellus and at the vertex. Sulcate always below and sometimes above the ocellus. Scutellum of the vertex never much shorter and generally longer than broad, usually plainly sulcate, with or without a median carina. Central foveolæ generally distinctly separated from the frontal costa and the scutellum of the vertex. Lateral foveolæ distinct and triangular. Pronotum with the disk only moderately wrinkled on the prozone and quite smooth on the metazone, except for granulations. Median carina cristate or rarely only a raised line on the prozone, less elevated on the metazone, especially posteriorly; cut by the principal much in advance of the middle, half to more than twice as long as the prozone, and by the first sulcus behind the middle of the prozone. Shoulders well marked, but lateral carinae usually absent except occasionally on the front of metazone and prozone.

Process of the metazone acute, right or obtuse angled, with the side sinuate, arcuate or straight. Lateral lobes with the posterior border straight or slightly sinuate and nearly vertical, lower border sinuate anteriorly and arcuate posteriorly, with the posterior angle well rounded, or, less commonly, with a dentation extending downward.

"Tegmina plain; isabelline or maculate; in the last case the spots are annular or solid and pretty evenly scattered over the whole surface, or much more frequently arranged in three well-marked groups, one each at the end of the first and second quarters and one on the distal third. The first two are generally much better defined than the last and may become solid bands, as in *Hadrotettix*. The intercalary vein is curved forward distally, where it is always much closer to *M* than to *Cu*. Area *M* is filled with a reticulation of irregular cells. *Rs* has from two to five branches, separated by spurious veins, which are bordered on either side by quadrilateral cells, which become irregular and smaller toward near the middle of the tegmina. *M* 1 and 2 and *M* 3 and 4 are present without branches. *Cu* 1 has one or two anterior accessory branches. Wings sometimes hyaline, but usually colored yellow, green or blue at the base, hyaline at apex, with a fuscous band between, varying in width from one-eighth to two-thirds the length of the wing. This fuscous band may include more or less completely the whole outer part of the wing, and it always has a submarginal spur which extends inward toward the base, and it is generally continued around the posterior margin to or toward the posterior angle. . . . The posterior femora are moderately developed, with the outer face plain or banded and the inner face and lower sulcus black, with one or two light bands on the apical half; or by the fading of these black markings are modified and may be wanting, especially in the lower sulcus. Posterior tibiæ with eight to ten spines on the outer side."

The spur on the wing may be very small, as will be seen in *Trimerotropis magnifica* Rehn.

Trimerotropis vinculata Sc.

Proc. Bost. Soc. Nat. Hist., vol. 18, pt. 3, 270; 1876.

Ash gray, blotched with dark fuscous; foveolæ of the head distinct, the costa being prominent throughout; tip of fastigium with a rather deep circular or posteriorly angulated pit having abrupt sides, reaching the margin of the lateral foveolæ; antennæ dark brown, very obscurely annulate with darker and lighter colors. Median carina of pronotum distinct only on front lobe, and cut behind the middle by the transverse sulcus, the hinder portion of the anterior lobe somewhat corrugated; hind border of pronotum forming a right angle. Tegmina as long as the hind legs, the basal third testaceous, with a fuscous cloud on its apical third, and fuscous dots sprinkled over the rest; middle third ashen, with a fuscous cloud traversing the entire breadth of the wing in the middle, broadest centrally; apical third pellucid, sprinkled with small fuscous spots, fainter than the previous ones, closely clustered basally, distant and fainter apically. Wings very faint lemon yellow at base, pellucid with black nervules at apex and near the middle a broad band of blackish fuliginous; it commences on the middle of the costal margin, half as broad as the tegmina, suddenly broadens by a narrow interior shoot to double or more than double its former width, and then passes nearly at right angles to the costal border, but directed a little obliquely outward, slightly broadening as it goes, to the outer margin, when it turns toward the anal angle, narrowing and fading until it has traversed nearly or quite three-quarters of the anal area; its margins are ill-defined and slightly irregular, but its general form is a sickle-like curve, which greatly resembles that of most species of *Sphragemon*.

Hind femora ash gray, with two or three faint, ill-defined, slightly oblique fuscous bands. Hind tibiae yellow, the spines black tipped.

Length (of an average specimen), male 19 mm., female 28 mm.; of antennae, male 8 mm., female 9.75 mm.; of tegmina, male 24 mm., female 30 mm.; of hind femora, male 11 mm., female 13.5 mm.

Six males and nine females. Gaudalupe Islands, off Lower California (E. Palmer); San Diego, Cal. (H. Edwards, No. 9); Mexico (Coll. Schaum).

This is our only species with lemon-yellow tibiae; therefore there will be no trouble in separating it from the other *Trimerotropis*. The coloring of the species is quite fantastic, often being a complete reproduction of the variegated color of the lichen-colored rocks upon which it lives. It is needless to say that the protective coloration is most striking.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	34.0-27.0	32.0-25.8	15.8-12.7
Male	21.0-30.0	19.2-27.8	9.3-13.5

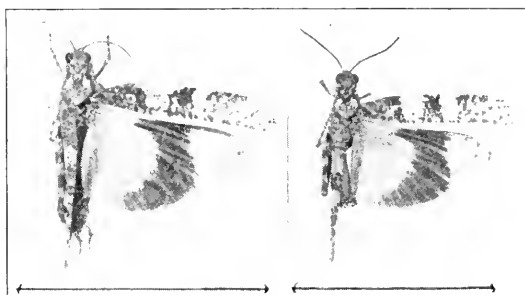


FIG. 103.—*T. vinctata* Sc.

Trimerotropis magnifica Rehn.

Proc. Acad. Nat. Scie. Phil., Feb. 1907, pp. 43-44.

Type: Male; Carr Canyon, Huachuca mountains, Cochise county, Arizona; August, 1905 (Henry Skinner).

This very large and striking new species is allied to *T. tolteca* and *pistrinaria* Saussure, but differs from both in the very much greater size, and from *tolteca* in the presence of a hyaline distal section on the wings, as well as from *pistrinaria* in the practical absence of the usual ulnar spur on the wing.

Size very large (for the genus); form moderately robust. Head with the occiput rounded and slightly elevated above the level of the disk of the pronotum, interspace between the eyes as broad as the greatest width of the disk of the fastigium; fastigium considerably declivent, the slope of the same being a regular continuation of the arch of the occiput, lateral carinae of the fastigium parallel caudad, regularly approaching one another cephalad, median carina faintly indicated caudad; lateral foveolae undefined, no ventral bounding ridge in the usual position; frontal costa considerably constricted dorsad, broader and subequal for a distance dorsad and ventrad of the ocellus, on the ventral portion of the face the costal carinae expand in an undulating fashion, sulcation distinct but not very deep, in fact shallow in the constricted dorsal portion; eyes not prominent, somewhat shorter than the infraocular sulcus; antennae

heavy, in length exceeding that of the head and pronotum combined by that of the head alone. Pronotum with the disk but very slightly tectate, prozona contained about one and three-fourths in the metazona; cephalic margin very slightly arcuate, caudal margin rectangulate with the margins slightly undulate; median carina very faintly indicated on the prozona, distinct but very fine on the metazone; lateral angles faintly tuberculate on the prozone, rounded shoulders on the metazona; lateral lobes of the pronotum with the depth slightly exceeding cephalad trend, ventral margin irregularly rounded. Interspace between the metasternal lobes slightly transverse. Tegmina four and a half times the length of the pronotum, exceeding the apices of the caudal femora and the abdomen by the pronotal length, the greatest width contained about four and a half times in the length; costal margin with the distal third regularly arcuate, apex obliquely truncate; intercalary vein closer to the median than to the ulnar vein throughout its length. Wings ample, rather broad, the greatest width contained about one and three-fourths times in the length; apex obliquely truncate, axillary field with the margin distinct arcuate. Abdomen with the subgenital plate rather broad; cerci simple, straight, substyliform, blunt. Cephalic and median limbs rather slender; caudal femora robust, not strongly but regularly inflated, the ventral carina distinctly elevated, length about two and one-half times that of the pronotum; caudal tibiae with nine spines on the lateral margins.

General color pale ochraceous-buff, overlaid with bistre. Head pale ventrad and on the face, dark dorsad, genæ lightly mottled; eyes burnt umber; antennæ, except for the paler two proximal joints, clove brown. Pronotum nearly uniform bistre. Tegmina with solid median and proximal dark transverse bars, the latter confluent with the base of the tegmen and both extending solidly across the same; a premedian bar is present, but not as regular as the others, the pale interspace between the three bands being sharply defined and distinctly but not greatly narrower than the average of the dark bars; apical fourth changing from subhyaline to hyaline, with about a half dozen subquadrate blotches of the darker color. Wings with the band clove brown in color, crossing the wing immediately distad of the middle, extending in a complete arc from the costal to very near to the internal margin, regularly narrowing in width from the axillary field caudad, the width on the axillary field being about two-sevenths the length of the tegmin, spurs hardly indicated; disk pale sulphur yellow; apical area hyaline except for several blotches of dark color, no suffusion, however, being present. Abdomen dull Naples yellow. Caudal femora of the lighter general color inclined to vinaceous pink on the ventral portion of the lateral face, dorsal and bounding carinæ of the paginæ sparsely beaded, face of the paginæ suffused with the dark color, broad pregenicular annulus of the pale color laterad; genicular regions mingled drab and bistre, internal and ventral face of the femora blackish except for the pregenicular annulus and a proximal portion, both of which are Chinese orange; caudal tibiae orange vermilion, the genicular section and tips of the spines black; caudal tarsi buffy ventrad, washed with orange vermilion dorsad.

Measurements: Length of body, 38.5 mm.; length of antennæ, 19 mm.; length of pronotum, 9 mm.; length of tegmen, 39.5 mm.; length of caudal femora, 21.5 mm.

The type is the only specimen of this handsome species seen by the author.

A male and female of this species were sent to Mr. Rehn, of the Academy of Natural Science of Philadelphia, for comparison with the type. The following is taken from his letter: "I have compared the specimens with the type of *magnifica*, with the following results: Your male is distinctly smaller, with the frontal costa more deeply sulcate and

more regularly attenuate dorsad, while the pronotum is proportionately shorter. I have not spread your specimens, so I can not compare the wing pattern. The male is close to *magnifica*, but I do not care to call them identical, yet at this writing I would not venture to describe the Kansas insect as distinct."

There are three species—*T. tolteca* Sauss., *pistrinaria* Sauss., and *magnifica* Rehn—to which our specimens might be related, and without a doubt they are a great deal closer to the latter than the two former. The very few differences Mr. Rehn mentions would hardly be too large a variation in the same species, and the wing markings are identical with his drawings.

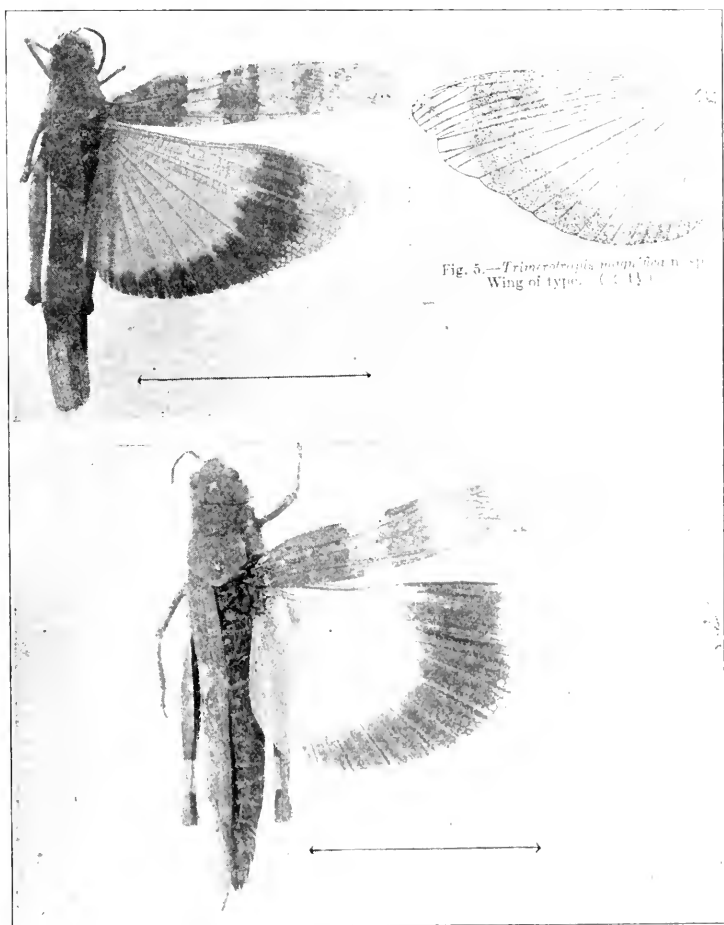
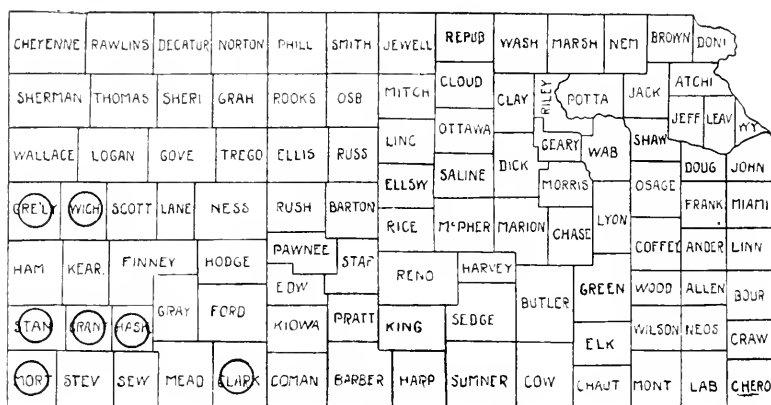


FIG. 104.—*T. magnifica*. Upper left, male; upper right (fig. 5), taken from Rehn's drawing accompanying the original description; below, female.

The females, of which we have two, do not differ materially from the males. The tegminal bars are perhaps not quite so solid, a little more loosely put together, and aside from this they agree in all the essential details with the males.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Females	42.5-39.2	38.0-24.0	20.5-18.5
Males	35.0-29.	36.0-20.0	19.5-15.2



Distribution.

Trimerotropis agrestis McN.

Proc. U. S. Nat. Mus., vol. 23, p. 433.

Pale reddish brown, with the face and sides of the head whitish, plain, with a few scattered spots on the tegmina, not showing any trace of the usual arrangement into three bands.

Front plainly sulcate above as well as below the ocellus; scutellum strongly sulcate, with the merest trace of a median carina, broad, almost equaling the long diameter of the eye in the female; eyes plainly (male) or much (female) shorter than genal groove. Pronotum with the median carina more than usually distinct on the metazona, slightly cristate and plainly bilobate on the prozone; median carinae barely visible on the front part of both metazona and prozone; metazona nearly twice as long as the prozone, with the disk finely granulate and the process decidedly obtuse-angulate; lateral lobes with a large tooth, which causes the posterior lower angle to appear to be drawn downward. Tegmina entirely plain except for a few scattered spots, without a trace of the usual bands. Wings moderately broad, with a distinct and wide fuscous band, which is equal in width to about one-fifth the length of the wing, continued upon the posterior border much more than half way to the anal angle. Spur very short, extending less than one-fourth of the way to the base. Posterior femora with the whole inner face reddish, but more or less suffused with fuliginous, so that the three black bands are not easily distinguished; outer face plain, with a narrow light subapical band. Posterior tibiae red with the usual light subbasal cloud.

Length of body, male 22 mm., female, 27 mm.; length of tegmina, male 23 mm., female 28 mm.; length of posterior femora, male 11 mm., female 13.5 mm.

One male and one female. Sidney, Neb. Bruner collection.

This species is unique among the red-legged *Trimerotropis* for its plain tegmina.

It seems quite doubtful if this species is distinct from *citrina*. The tooth on the lateral lobes of the pronotum by which they are separated vary from small, scarcely noticeable projections to quite long points, while the lobes in *citrina* vary from not a sign of a point to quite a pronounced angle.

MEASUREMENTS IN MILLIMETERS.

	Bod. .	Tegmina.	Post. femora.
Female	33.9-29.5	38.0-21.0	16.8-14.6
Male	31.8-22.7	30.4-23.5	15.2-13.0

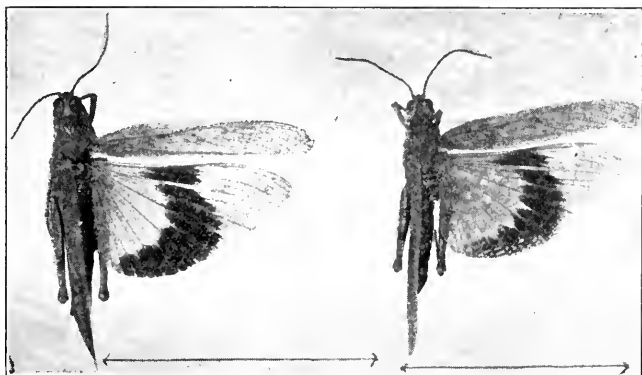


FIG. 105.—*T. agrestis* McN.

Trimerotropis citrina Sc.

Bul. U. S. Geol. Sur. Terr., 2, 265; 1876.

Ash gray, blotched with dark fuscous; foveolæ of the head moderately distinct, a slight, lozenge-shaped, flat depression at the tip of the fastigium; antennæ yellowish-brown; obscurely annulated with fuscous. Median carina of the pronotum distinct only on the front lobe, and on its anterior part somewhat elevated, deeply cleft by the transverse sulcations, and sometimes below the general level of the surface at the hindmost sulcation; front lobe corrugate, hind lobe nearly flat, granulose, with a few small, scattered tubercles, the posterior margin rectangular. Tegmina and wings extending far beyond the abdomen, the former as in *T. vinulata* Scudd., but much more uniform, the transverse ashen bands being more infuscated and very rarely so distinct as in that species; wings rather pale lemon yellow at base, pellucid, with black nervules at apex, and near the middle furnished with a broad, blackish, or very dark fuliginous band, shaped as in *T. vinulata* Scudd., but a little broader; beyond it, half way to the apex of the wing, the space between the anterior two veins is more or less distinctly castaneous. Hind femora as in *T. vinulata* Scudd., hind tibiæ rather pale coral red, becoming very pale at the base, the spines black tipped.

Length (of average specimens), male 23 mm., female 28.5 mm.; of antennæ, male 12 mm., female 10.5 mm.; of tegmina, male 27.5 mm., female 31.5 mm.; of hind femora, male 12.5 mm., female 15 mm.

A single male was taken at Denver, Colo., July 10. I have also specimens from the Red River of the North (Kennicott) to Texas (Belfrage, Boll). Boll's specimens were taken in Dallas county, June 6. Belfrage found the species "common in sandy places" in October and November, and a few also in June and July in the same state. The species seem to vary somewhat, northern specimens differing from the southern in having a paler band on the wings, the tegmina more distinctly fasciate, and the disk of the pronotum more depressed at the posterior sulcation. It is closely allied to *T. vinculata* Scudder, but the color at the base of the wings is deeper, the black band is broader, the tegmina are rarely so distinctly fasciate, and the hind tibiae are red instead of yellow.

Common in dry, hot, sandy places, especially on sand bars in dry stream beds in western Kansas. This hopper is a lover of barren places, and quite extended efforts to drive him elsewhere resulted in failure. In Harper county, Kansas, in the summer of 1916, the author noted especially the dividing line between the habitat of this species and the genus *Spharagemon*. On absolutely barren, sandy places *citrina* was quite common, while *Spharagemon* was to be found in the grass and weeds immediately surrounding these places. The thing that seemed remarkable to me was that I could drive the species of *Spharagemon* out on the barren places, but *citrina*, while they would fly over the grassy places, would invariably come back to bare ground to alight.

This species is close to *T. agrestis* McN. The following characters will usually separate them: No tooth on the lateral lobe of the pronotum; general color darker; maculations on the tegmina more distinct, however not as distinct as in *T. latifasciata*; disk of wings usually a brighter lemon yellow, bands broader and darker.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	31.8-29.1	34.4-30.2	15.5-14.5
Male	27.3-24.8	30.5-25.2	13.6-11.1

(See fig. 79, page 83.)

Trimerotropis bruneri McN.

Proc. Nat. Mus., vol. 23, 423. (*Hadrotettix gracilis* Bruner M. S.)

Reddish brown, not strongly punctate with fuscous but very conspicuously banded on the tegmina and posterior femora; head, and less commonly the lateral lobes of the pronotum in front of the principal sulcus, pallid; pronotum with a longitudinal whitish stripe on the upper part of the lateral lobes, extending from the middle sulcus to the front margin; below this, near the middle of the lobes, a second but smaller quadrate spot of a similar color. Scutellum of the vertex somewhat (male) or not (female) longer than wide (if the very slightly impressed median foveolæ are included as a part of the scutellum, the proportion of length to breadth will be considerably increased); median carina present and more or less distinct; eyes decidedly shorter than the genal grooves, even in the male. Pronotum with the median carina very low, not bilobate on the prozone; anterior margin decidedly angulate; metazone about twice as long as the prozone, its disk evenly and very finely granulate; process of the metazone decidedly acute-angled, with the margins straight and the tip a little rounded. Tegmina, more especially in the male, narrowed considerably and regularly from the basal band to the apex; basal and median bands very distinct and solid, with the base rouged without fuscous punctations and the apex with the usual scattered punctations,

usually rather faint and more distinct on either margin than in the middle. Wings broad, one and three-quarters times as long as broad, with the apex not attenuate; fuscous band moderately broad, at least a sixth as wide as the length of the wing and very distinct, continued along the posterior margin more than half way to the anal angle; spur short, extending toward the base about one-third of the distance. Posterior femora unusually heavy, with the inside yellow, more or less suffused with red, and crossed by three black bands, the basal sometimes much reduced; outer side crossed transversely by one distinct subapical band, a continuation of the one on the inner surface; lower sulcus red, crossed by the same subapical band. Posterior tibiae bright red, with an indefinite subbasal yellow cloud on the outer face only.

Length of body, male 21 to 26 mm., female 23 mm.; length of tegmina, 21.5 to 25 mm., female 22 mm.; length of posterior femora, male 11 to 13 mm., female 13 mm.

Two males, Hot Springs, S. Dak.; one male and one female, Chadron, Neb.; one male and one female, Hot Springs, S. Dak. Stanford University collection.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	34.0-27.0	35.0-28.0	18.5-16.0
Male	29.5-26.7	33.0-23.0	14.3-13.9

(See fig. 80, page 83.)

Trimerotropis latifasciatus Sc.

App. 2 Rep. U. S. Ent. Comm., 1880, p. 26.

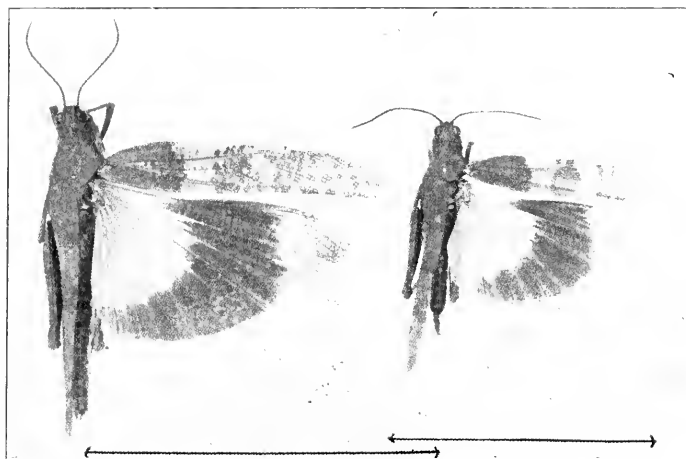
Brownish cinereous, the vertex darker than the rest of the head, all the sculpturing of the head sharply defined; antennae yellowish brown, deepening apically. Posterior half of anterior lobe of pronotum rather strongly corrugated, the median transverse sulcus very deeply impressed; surface of anterior lobe otherwise smooth, posterior lobe delicately but distinctly rugulose; median carina rather prominent and heavy on anterior lobe, slight but sharply defined and posteriorly obsolescent on posterior lobe. Tegmina marked with two obscure, narrow transverse belts of dark fuscous flecks, one in the middle and one beyond the basal fourth; a similar but faint third band appears before the base of the apical fourth, and beyond it a few obscure quadrate fuscous flecks in the diaphanous part of the tegmina, caused by the infumation of single cells and the nigrescence of their bordering veins. Wings very pale yellowish or milky, with a diaphanous tip, on which the veins are black and the cross-veins yellowish or partly yellowish and black, and with an unusually broad, very dark, almost piceous middle band, occupying about one-third the length of the wing on the middle of the costal margin, and curving around to the inner angle; its outer border straight or even slightly concave until just before it reaches the outer margin, which it avoids by bending in a short distance; the inner border of the band is strongly and pretty regularly arcuate, scarcely tending toward the base above. Hind femora with faint traces of a pair of dusky transverse bands on the outer face; hind tibiae pale reddish, with black-tipped spines.

Length of body, 29 mm.; of antennae, 11.5 mm.; of pronotum, 6 mm.; of tegmina, 32 mm.; of hind tibiae, 12 mm.

This species seems to be limited to the western portion of the state.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	39.0-32.0	35.0-29.0	18.6-15.2
Male	32.0-25.0	28.5-24.0	15.5-12.0

FIG. 106.—*T. latifasciatus* Sc.*Circotettix* Scudder.

Bull. U. S. Geol. Sur. Terr., 2, 265; 1876.

Somewhat closely allied to *Cythippus* Fieb., but differing considerably from it in general aspect, head closely resembling that of *Trimerotropis* Stal.; eyes rather smaller, somewhat prominent, separated above by a space about equal to their width; antennæ but little longer than the head and prothorax combined. Pronotum with the front lobe slightly narrower than the head, severed behind the middle; the hind lobe, which is about twice as long as the front lobe, broadening rapidly and greatly, slightly gibbous; the median carina distinct on the anterior portion of the front lobe, obsolete on the posterior portion, and inconspicuous on the hind lobe; front margin scarcely angulate; hind margin rectangulate; lateral carinæ distinct in posterior lobe, but not prominent; surface slightly rugulose. Tegmina and wings much longer than the body, the former with the intercalary vein approximating the radial at its tip, the axillary vein free; wings peculiar, being falcate with more or less undulate margin; the falcation arises from the prolongation of the preanal area and the fullness of the middle of the anal area; the principal veins of the latter are supported on either side by spurious veins, running very close beside and parallel to them, to which the transverse veins are attached, while the spurious veins are themselves united to the principal nervures by other cross-veins, forming a more or less regular network on either side of the principal veins; with this exception, the neurulation of the wing is unusually regular and scalariform, the veins of the apex resembling somewhat their disposition in *Ctyphippus*.

The type of this genus is *Ædipoda undulata* Thomas. (*Ædipoda sparsa* Thomas also belongs here, and I have a third undescribed species of the genus from Nevada, sent me by Mr. H. Edwards.

Circotettix undulatus Th.

(*E. undulatus*. U. S. Geol. Sur. Terr., 460; 1871.

Middle foveolæ of the vertex somewhat elongate, elliptical, with a median carina through it, and generally a depression at the front at the top of the frontal costa; lateral foveolæ very shallow, small, triangular; the frontal costa expanding just above the ocellus and at the

base, sulcate in the middle portion. Pronotum contracted on the anterior lobes, posterior lobe flat on the disk, rapidly expanding and punctured; median carina a dim line, slightly raised on the front lobe; apex right-angled. Elytra and wings passing the abdomen about one-third their length. Wings papilioform, very broad, the anterior margin regularly and beautifully undulated or waved; anterior submarginal space almost as broad as the elytra; nervules prominent, regularly and remarkably parallel.

Color (dried after short immersion in alcohol). Ash brown. Head and thorax sometimes mottled with darker brown or fuscous. Elytra marked with dusky spots, presenting a basal group, an irregular middle band, those on the apical portion sporadic. Wings transparent, tinged with yellow at the base, the outer half transparent or slightly fuliginous; the inner margin of this portion generally forms an irregular somewhat dusky stripe, parallel with the body when the wing is fully expanded, not bending inward at the hind margin; sometimes the dusky portion is indicated only by dark nervules and nerves, those of the inner half always being yellowish white. Posterior femora have two black spots inside; the inferior channel black, or chiefly occupied by two black spots; posterior tibiae are probably bluish when the insect is living.

Dimensions: Female—length, 1.05 in.; elytra, 1.12 in.; posterior femora, .54 in.; posterior tibiae, .47 in. Male nearly as large as the female, with similar proportions.

I found this species in Colorado and Wyoming east of the mountains. I also find it among the collection made by Mr. Dodge in Colorado; but as it is not among his collections made in Nebraska or Kansas, and does not appear to have been in the collection made by Professor Hayden in Nebraska, it probably belongs nearer the mountains.

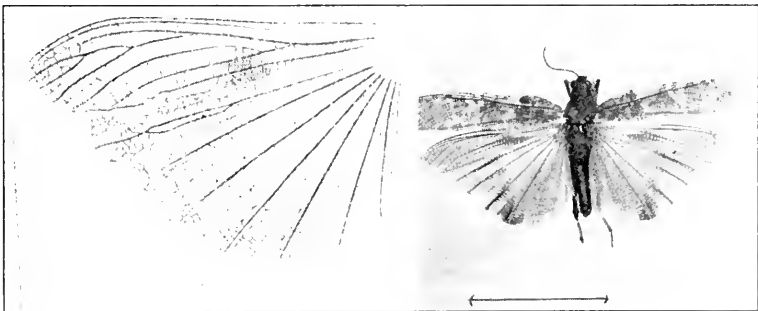
Wing of *C. lobatus* S.

FIG. 107.

C. undulatus.

We have this species represented by two male specimens, marked from Kansas, collected by Snow. They agree in every respect with other specimens from Colorado, so it must be the species reaches slightly into western Kansas, but occur in so few numbers as to be seldom found by collectors.

The almost entire absence of a black arcuate band on the wing serves to distinguish this species from *C. nigrafasciatus*.

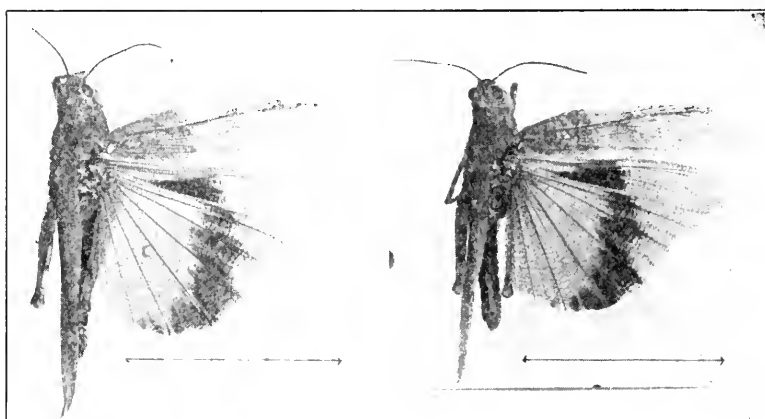
Circotettix nigrafasciatus n. sp.

Size very large for the genus; form rather long and slender. Head somewhat raised above the level of the pronotum, dorsally rather smooth; scutellum of the vertex ranging from slightly sulcate with scarcely a trace of a median carina to sulcate with a definite carina, in shape quite

variable, in some longer than wide, in others about equal; the lateral carinæ gently arcuately converging caudad, sharply converging in straight lines cephalad; lateral foveolæ in general shape trigonal, quite variable in shape, size and distinctness in both sexes, frontal costa sulcate at and immediately below the ocellus, its lateral carinæ slightly diverging at the base and immediately above the ocellus, converging rapidly above the antennæ to meet the scutellum of the vertex in a rather deep, almost bilobed median foveolæ. Antennæ long and threadlike, alternating joints light and dark. Pronotum constricted anteriorly; disk of metazona flat, punctate; carinæ fairly well developed, cut by two sulcii, higher and wider on the prozona than on the metazona; posterior margin acute to right angled. Tegmina long, of medium width, varying from plain to somewhat fasciate. Wings of medium length and very

CHEYENNE	RAWLINS	DECATUR	NORTON	PHILL	SMITH	JEWELL	REPUBLIC	WASH	MARSH	NEMO	BROWN	DONI
SHERMAN	THOMAS	SHEPHERD	FRANKLIN	ROCK	OSBORN	MITCHELL	CLOUD	CLAY	RILEY	POTTER	JACKSON	ATCHAFALY
WALLACE	LOGAN	GOVE	FRED	ELLIS	RUSS	LINCOLN	OTTAWA	DICK	GEARY	WABASH	SHAWNEE	JEFFERSON
GREELY	WICHITA	SCOTT	LANE	NESS	RUSH	BARTON	ELLSWORTH	SALINE	MORRIS	OSAGE	DOUGLASS	JOHN
HAM	KEARNEY	FINNEY	HOOGE	PAWNEE	STAFFORD	RENO	HARVEY	BUTLER	GREEN	WOOD	ALLEN	BOURBON
STANLEY	GRANT	HASKINSON	GRAY	FORD	KIOWA	PRATT	KING	SEDGE	ELK	WILSON	NEOSHO	CRAWFORD
MORTIMER	STEVENS	SEWELL	MEAD	CLARK	COMANCHE	BARBER	HARRIS	SUMNER	COWLEY	CHAUTAUQUE	MONTGOMERY	LABETTE
												CHEROKEE

Distribution.



Male.

Female.

FIG. 103.—*Circotettix nigrifasciatus* n. sp.

broad; external margin undulated, lobed; radiate veins swollen in the middle. Hind femora of medium size; not large in comparison to the size of the insect.

The general color varies from a dirty gray through yellowish gray, reddish brown to dull brown. Head often almost white. Pronotum usually grayish brown. Tegmina plain gray, gray with brownish fascia, or reddish brown with darker brown fascia; the fascia are made up of small spots, the basal band the heavier. Wings with the disk sulphur yellow, bordered by a solid black, slightly arcuate band; spur well marked, reaching at least half way to the base; apical portion hyaline. Outside of hind femora grayish white to brownish; inside the same marked with two black spots, the basal one the larger.

This species is very closely related to *C. undulatus* Th. and *C. lobatus* Sauss., from which it may be easily separated by its much larger size and the solid black band of the wing. It is far more distinct from the above-mentioned species than they are from each other.

MEASUREMENTS IN MILLIMETERS.

	Body.	Tegmina.	Post. femora.
Female	40.0-37.0	38.0-35.5	17.0-16.5
Male	38.0-34.0	35.0-33.0	16.5-15.0

This species was described from twenty-nine males and sixteen females.

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