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U. S. DEPARTMENT OF AGRICULTURE.
DIVISION OF ENTOMOLOGY.
BULLETIN No. 28.

THE
MORE DESTRUCTIVE LOCUSTS
OF
AMERICA NORTH OF MEXICO.

BY
LAWRENCE BRUNER.

(PUBLISHED BY THE AUTHORITY OF THE SECRETARY OF AGRICULTURE.)

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1893.

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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
DIVISION OF ENTOMOLOGY,
Washington, D. C., October 15, 1892.

SIR: I have the honor to submit for publication Bulletin No. 28 of this Division. It comprises an account of the destructive locusts of the United States, and of those species which are liable to become destructive, and may be looked upon as supplementary to Bulletins 25 and 27 of this Division. It has been prepared by Mr. Lawrence Bruner, the agent of the Division at Lincoln, Nebr., who has been associated with me in the study of the family to which these insects belong, and since the completion of the work of the Entomological Commission has made a special study of the true locusts of North America, materially aiding in the investigations of the injuries caused by them of late years.

Respectfully yours,

C. V. RILEY,
Entomologist.

Hon. J. M. RUSK,
Secretary of Agriculture.



LETTER OF SUBMITTAL.

LINCOLN, NEBR., *October 20, 1892.*

SIR: Since there has been an apparent increase in the number of certain of the destructive locusts in many parts of the country during the past two or three years, it has been deemed advisable to prepare a brief account of all of the species that have been connected with these depredations. The following pages on the Destructive Locusts of America North of Mexico are therefore submitted for approval and for publication, if thought worthy. As will be seen, this paper covers all of the forms that have been the cause of injury in the past, as well as those that are liable to do injury in the future.

The manuscript which forms this paper was originally prepared as a part of another report,* but at your suggestion has been somewhat rearranged so as to make a separate bulletin, if thought desirable. The excuse for offering this paper at the present time is that, although all of the insects herein mentioned have been previously described, the literature in which the descriptions originally appeared is so scattered and difficult of access that the general reader would have trouble in referring to it. Besides, many of these works are now out of print. Then, too, a paper treating of the entire group of these destructive insects of the region included is in demand by both the working entomologists and the general reader. The short sketches relative to the food habits and distribution of each of the species treated have been compiled from previous writings and field notes gathered by the various agents of the United States Entomological Commission and the Division of Entomology, and are supposed to be approximately correct, at least as nearly so as could be made at present, while the life histories are chiefly from your own notes and observations.

Through your kindness and interest in the undertaking a number of the forms are herewith figured for the first time. Other courtesies are also gratefully acknowledged.

LAWRENCE BRUNER,
Special Field Agent.

Prof. C. V. RILEY,
U. S. Entomologist,
Washington, D. C.

* Reports on the Damage by Destructive Locusts during the season of 1891. (Bull. No. 27, of U. S. Department of Agriculture, Division of Entomology, pp. 9-33.)

THE MORE DESTRUCTIVE LOCUSTS OF AMERICA NORTH OF MEXICO.

If one were to describe or even to mention all of the locusts that are injurious to vegetation in this country every species would have to be included in such a list. Taken as a group there are no exceptions to the general rule in this particular case. Every member of the family is a vegetable feeder, and hence is to be considered as harmful from the agricultural standpoint. As certain restrictions are absolutely necessary in the preparation of this report, only a few from among the many of these insects will be treated, and these briefly. Accordingly herewith is appended a list of the different locusts or grasshoppers that have been known to occur in destructive numbers within the limits of North America north of the Mexican boundary during the past twenty or thirty years, together with such other species as are liable to become destructive in the future.

Every warm or temperate country of any extent of which a considerable portion is arid or semidesert, or where the climate is liable to variation, has its locust swarms. Of all insect pests these swarms of locusts are generally most dreaded, because of their manner of attack and the rapidity with which they can and do lay waste a country or district. Other insect enemies may do an equal amount of injury during the year, but as it is not done "right before our very eyes," we do not think so much of it.

These destructive locusts may be divided into two classes with respect to their habits, viz, they are either migratory or they are non-migratory. When the former, they move about over the country from one region to another and drop upon us without much warning. When the latter, they simply multiply, do their injury, and remain where they are. Likewise, these destructive locusts may belong to either the one or the other of two subfamilies, *i. e.*, the *Cedipodinae* and the *Aceridiinae*. Here in North America most of the destructive species belong to the subfamily *Aceridiinae*, while in the Orient the reverse is probably the rule.

The members of the subfamily *Cedipodinae* are at once recognizable by their colored hind wings, the unarmed sternum of the prothorax, and in having the cushions between the claws of the feet very small. The *Aceridiinae*, on the other hand, usually have the hind wings transparent, the prosternum always spined, and the feet provided with a rather large cushion between the claws. The members of the group *Cedipodinae* are usually further recognizable, from the fact that they

are, as a rule, provided with a more or less prominent median carina or ridge upon the pronotum, while in the Acridiinae this character is usually very obscure.

THE AMERICAN LOCUST.

(*Schistocerca americana* Drury.)

The accompanying illustration (Fig. 1) of a female specimen of this large, handsome insect will at once indicate to the reader which one of all our locusts should bear the above name. The following description will facilitate the identification of the species:

Female (large size).—Vertex between the eyes hexagonal, with a central depression; frontal costa solid and somewhat prominent above the ocellus, sides nearly parallel. Eyes elongate oval, rounded behind; straight in front. Pronotum expanding at the posterior lobe; median carina but slightly prominent; humeral angles subdistinct on the posterior lobe, obtusely rounded; anterior and middle lobes marked with minute shallow cells, each having a very minute tubercle in the center; posterior

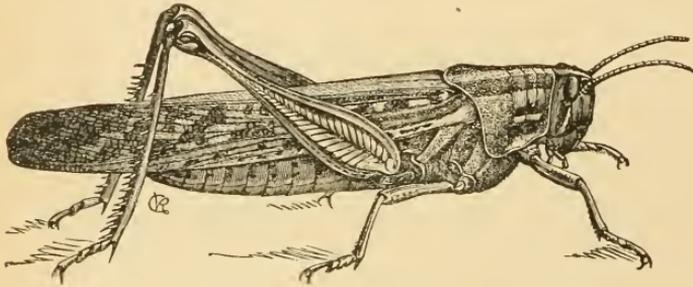


FIG. 1.—*Schistocerca americana*—natural size (after Riley).

lobe densely punctured; posterior margin about right-angled; apex rounded. Tegmina and wings passing the abdomen about one-third of their length. Posterior femora reaching the apex of the abdomen. Prosternal spine large, curved backward and hairy.

Reddish-brown, with a slight vermilion tint. A yellow stripe extends from the vertex along the middle of the head and pronotum, and also upon the suture of the closed tegmina as far as the tip of the abdomen. A dark brown line down the cheeks below the eyes. On the sides of the pronotum is a yellow stripe extending from the submarginal to the last cross-incision, directed a little obliquely downward; below this is a brown stripe; then a narrow yellow stripe directed obliquely upward; lower margin yellow. The tegmina are opaque and reddish at the base, the rest, semi-transparent yellow; a narrow white stripe on the lower margin, next the base; the disk and apical half marked with large cellular, fuscous spots. Wings transparent; the nerves at the base and inner portion yellowish-white, on the outer portions black. Legs, bright vermilion red. Posterior femora have a row of black dots along the upper and lower margins of the disk and one through the middle; spines of posterior tibiae yellow, tipped with black. Each segment of the abdomen has a ring of dusky dots on its posterior margin.

Male.—The male differs from the female in being much smaller. It has the sub-anal plate prolonged and deeply notched at the apex; the cerci are very broad, straight, and truncate at the apex.

Length of body—male, 1.7 inches; female, 2.1 inches; tegmina in both sexes same as body.

This handsome locust is most commonly met with in the region lying south of the fortieth degree of north latitude, but is by no means absent from all the territory north of that parallel. It occurs north of this line in Nebraska, South Dakota, Iowa, Illinois, Indiana, Michigan, Ohio, Pennsylvania, New Jersey, and perhaps even New York. It does not, however, become destructive much beyond the Gulf States. It is the chief destructive species of Yucatan, Central America, and southern Mexico. In fact, it is very closely allied to the large Wandering Locust of the Orient (*Schistocerca peregrina*), and by some authors is claimed to be only a variety of that species. Be this as it may, every warm country of the globe, island, or continent lying within the tropics or within the adjoining 15 degrees of the temperate zones has one or more of these large locusts that show a wonderfully close relationship to our *Schistocerca americana*. Most of them are also frequently destructive, while a number of them are exceedingly migratory in their habits.

THE LARGE GREEN BUSH-LOCUST.

(*Acridium shoshone* Thos.)

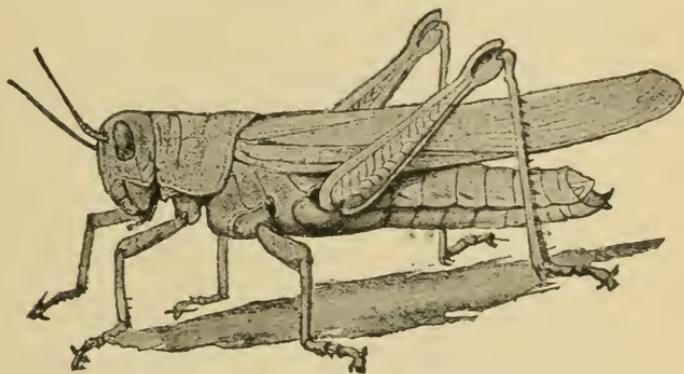


FIG. 2.—*Acridium shoshone*—natural size (original).

This insect is described by Prof. Thomas as follows in his report on the Orthoptera collected by the Wheeler Expedition in the Southwest:

Female.—Vertex nearly horizontal; sides angularly expanding in front of the eyes; flat frontal costa prominent, sides parallel, sulcate from the ocellus downward, above the ocellus somewhat gibbous and punctured; lateral carinae very prominent, parallel. Pronotum slightly expanding posteriorly, coarsely and reticulately punctured; median carina distinct, severed by the three transverse impressions. Tegmina and wings passing the abdomen. Cerci very short, broad at the base, narrowed and rounded at the apex. Posterior femora much enlarged at the base; posterior tibiae considerably enlarged at the apex. Prosternal spine robust, cylindrical, and nearly straight. Pectus punctured. Abdomen of the male somewhat elongated; cerci very broad and flat, very slightly and obtusely notched at the apex, which is bent upward over the last segment; subanal plate elongate, turned upward, with a distinct square notch at the apex.

Dark olive-green. Ocelli bright transparent amber; eyes brown; cheeks yellowish, with a dark green stripe extending downward from the eyes. The pronotum

has some pale spots on the sides, and sometimes the posterior lobe is tinged with brown. Tegmina uniform green, somewhat transparent at the apex, and in some specimens faintly tinged with brown. Wings hyaline; nerves and nervules dark brown. Posterior femora greenish above and below; pinnae of the disk alternately white and green, the white occupying the flat interspaces; inner face greenish yellow. Posterior tibiae bright vermilion, the under surface being striped with yellow; spines yellow at the base, tipped with black. Venter and pectus dark green, sometimes varied with dark brown.

Length of body—male, 1.6 to 1.75 inches; female, 2 to 2.25 inches; tegmina and wings about one-fifth less.

This magnificent locust, which is fully as large as *americana*, was first described from Nevada and Arizona, but has since been taken in Utah, California, New Mexico, Texas, and across the border in the States of Chihuahua and Durango in Mexico. Several years ago the writer found it quite abundant in the vicinity of El Paso, Tex.; and Prof. C. H. T. Townsend, of the New Mexico Agricultural College, reports it as destructive to the Mesquite bushes and probably also to grape-vines in portions of New Mexico. Being strictly an arboreal insect, *shoshone* is liable to become more or less of a tree pest when numerous. In Utah this insect was taken by me upon various low trees growing on the lower mountain slopes back of Ogden, Salt Lake City, and near Garfield Beach. It was also occasionally taken in the valleys on Willows, and even upon some of the rank-growing herbs; but I have never seen or taken a specimen of it upon the ground.

It has been treated here because of its occurrence in destructive numbers in 1891 in portions of New Mexico, and because its life as a tree-dweller is sure to favor its greater multiplication with the advance of civilization.

THE SMALL GREEN LOCUST.

(*Acridium frontalis* Thos.)

Another one of our locusts belonging to the genus *Acridium* that has quite recently shown a tendency towards becoming a pest is the one bearing the above name. It was found by Prof. H. Osborn in southwestern Kansas the past summer, where it was doing considerable injury to the sorghum crop of that region. It was also observed by me in central Texas in the spring of 1887, where it occurred in more than common numbers.

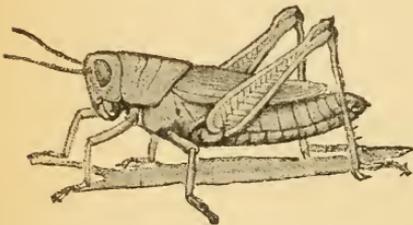


FIG. 3.—*Acridium frontalis*—natural size (original).

The insect appears to be growing more and more fond of cultivated grounds, as is shown by its habit of congregating along wagon roads and the edges of fields among the ranker growths of the vegetation that is common to such places. In its haunts and food habits *Acridium*

frontalis is inclined to be a little particular, just as are a number of other species of our North American insects belonging to this family; but its tastes can not be considered refined when it is known that chief on its bill of fare comes the wild Sunflowers so common throughout that portion of the West to which the insect is characteristic. It also seems to relish the Sorghum plant, which latter is entirely ignored by the Rocky Mountain Locust.

This locust can be recognized by the following description:

Vertex subconical. Small size. Tegmina and wings not passing the abdomen. General color, green.

Closely allied to *A. unilineatum* Walk.; caloptenoid in general appearance. Vertex regularly hexagonal, standing out in the form of a very short, truncated cone, the tip depressed in the center; face slightly oblique, straight, quadricarinate; carinae nearly parallel, the middle pair approaching each other immediately below the ocellus. Eyes elongate, oblique, straight in front. Pronotum scarcely enlarged behind; anterior lobes reticulately, and posterior lobe longitudinally, rugulose; median carina very distinct. Tegmina and wings narrow, rather shorter than the abdomen. Valves of the ovipositor prominent, lower pair much slenderer than the upper pair, and much exerted. Male cerci slender, tapering, and turned up; subanal plate (last ventral segment) narrow, tapering; subtruncate at the apex, entire. Prosterual spine subquadrate, pointed, and straight. Antennae passing the pronotum slightly. Posterior femora passing the abdomen.

Nearly uniform grass green. Face and pronotum sprinkled with dusky dots. The elevated lines of the pronotum pale yellow, more or less tinged with red. The upper edges of the posterior femora also more or less tinged with red. Antennae, orange color. Tegmina somewhat lighter green than body; transparent. Wings, pellucid.

Length of body—female, 1.06 inches; male, 0.82 inch. Length of tegmina—female, 0.63 inch; male, 0.5 inch.

Although *frontalis* is found as far north as Bismarck, N. Dak., it is essentially a southern insect. Especially is this true with respect to its presence in destructive numbers. It is a common species in Nebraska in certain localities, is found in eastern Wyoming rarely, and in eastern Colorado and northeastern New Mexico more frequently, while in Kansas and southward it becomes quite numerous, especially upon rolling, more or less sandy soil. To the eastward it reaches into western Iowa and central Missouri.

We have several other species of these large Acridians within the limits of the United States, all of which occasionally show a tendency toward uncommon multiplication.

These are *Acridium appendiculatum*, *A. rubiginosum*, *A. alutaceum*, *A. obscurum*, *A. unilineatum*, and *A. albolineatum*. The *Schistocerca vaga* also should be included among the latter species. All of these insects are arboreal in their habits, and live the greater portion of their lives above ground in wooded districts, and on this account are rather hard to deal with.

THE LONG-WINGED FOREST LOCUST.

(Dendrotettix longipennis Riley.)

This particular species is the one mentioned in Bulletin 13 of the Division of Entomology, U. S. Department of Agriculture, as the Post-oak Locust. I quote Prof. Riley's specific description of the insect:

Dendrotettix longipennis Riley.—General color testaceous with slight olivaceous hue, varied with faint yellow and piceous bands and lines; face dull olivaceous brown; occiput, especially back of the eyes, darker. Pronotum olivaceous with more or less yellow; median carina and the transverse impressed lines on the lateral

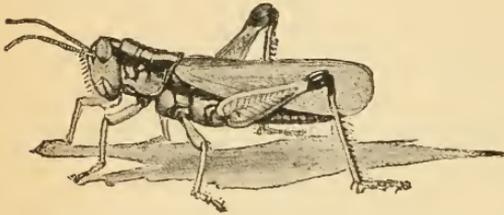


FIG. 4.—*Dendrotettix longipennis*—natural size (original).

bands piceous, generally darkest and most continuous in the ♂. Tegmina dull olivaceous brown, the veins being testaceous and giving the basal half a decidedly lighter coloring. Wings rather dark, becoming somewhat pellucid near their base, the veins dusky, especially on their apical half. Posterior femora with their

outer face dull olivaceous and marked with brown and black along their upper edges and crossing to the inner surface, which, with the lower sulcus, is bright sanguineous, this coloring showing through the somewhat transparent walls even on the outside; the apex black, preceded by a rather wide and very distinct lemon-yellow annulus; hind tibiae with a wide post-basal annulus of the same bright color; anterior and middle legs, also the tarsi of the hind legs gamboge-yellow, with the spines and claws black; antennae fuscous, olivaceous towards tip. Venter gamboge-yellow.

Average length ♂ 25^{mm}, ♀ 30^{mm}.

The short-winged forms agree in all other respects except that, as is the case with other genera, the tegmina do not ordinarily extend much beyond the second abdominal joint, and may be either perfectly rounded or slightly twisted at the apex. In some cases, however, they extend to one-half the length of the abdomen.

Described from 2 ♂♂ and 3 ♀♀ of the long-winged form, and 4 ♂♂ and 7 ♀♀ of the short-winged form. Received from E. H. Hill, Manor, Travis County, Tex., July 13, 1887, as injuring post oaks, and collected by Mr. Bruner.

The Long-winged Forest Locust or "Post-oak Locust" of Texas, as the name would imply, is also an arboreal insect. It is shown in the accompanying illustration (Fig. 4).

This locust was first noticed by the inhabitants of Washington County, Tex., about the year 1885, when it attracted their attention by defoliating the post-oak trees over a considerable extent of territory lying to the eastward of the town of Brenham. In the spring of the following year I had the privilege of studying the species to some extent while visiting the region to examine into a local outbreak of another locust that threatened the cotton and corn crops. The following in reference to its habits and mode of life is a copy from a report made at the time:*

"The egg pods are deposited in the ground about the bases of trees or indifferently scattered about the surface among the decaying leaves,

* Bull. No. 13, U. S. Dept. of Agriculture, Division of Entomology.

etc., like those of all ground-laying species. The young commence hatching about the middle of March and continue to appear until into April. After molting the first time and becoming a little hardened they immediately climb up the trunks of the trees and bushes of all kinds and commence feeding upon the new and tender foliage. They molt at least five or six times, if we may take the variation in size and the difference in the development of the rudiments of wings as criteria. The imago or mature stage is reached by the last of May or during the first part of June.

“The species is very active and shy in all its stages of growth after leaving the egg. The larva and pupa run up the trunks and along the limbs of trees with considerable speed, and in this respect differ considerably from all other species of locusts with which I am acquainted. I am informed that the mature insects are also equally wild and ‘fly like birds.’ They feed both by day and night; and I am told by those who have passed through the woods after night when all else was quiet, that the noise produced by the grinding of their jaws was not unlike the greedy feeding of swine.

“Aside from its arboreal nature there is but a single instance mentioned of its preference for growing crops. This was a small field of either cotton or corn, or perhaps both. If the nature of the crop was told me at the time, I have forgotten. At any rate the crop of one or the other of these two staples grew in a small clearing in the very midst of the most thickly visited area. The mature insects alone were the offenders in this instance. During the daytime they would leave the trees in swarms and alight upon the growing crop and feed until evening, when they would return to the trees. If, during the day, they were disturbed, they immediately took wing and left for the tops of the surrounding trees, to return shortly afterwards.”

Mature specimens of this locust have since been obtained, which show the insect to be congeneric with *Dendrotettix guercus* Riley MS., a species found upon the oaks of Missouri, southeastern Nebraska, and southern Iowa and Illinois. *Longipennis* occurs in two forms, *i. e.*, with either well-developed wings or with those appendages in a rudimentary condition.

THE DIFFERENTIAL LOCUST.

(*Melanoplus differentialis* Thos.)

Very conspicuous among the “native species” of locusts in the Mississippi Valley and southwestward is the one which entomologists call *Melanoplus differentialis*. This insect is fully as large as the common two-striped species that is familiar to everybody who has noticed any insects of this class, but differs from it in being yellowish throughout and lacking the two stripes along the sides of the back and wings. The Differential Locust is also less robust in form than the one with which

it is here compared. The accompanying figure (Fig. 5), that of a female specimen, is not quite typical of the species, but will greatly aid in its recognition. The following description of this locust is that given by Prof. Cyrus Thomas, who named it:

Large size, robust; tegmina passing the abdomen, unspotted; olive brown above, yellow beneath.

Vertex elongate, depressed, broadly sulcate, closed in front; frontal costa broad, flat, or slightly sulcate; sides parallel; lateral carinae distinct, slightly divergent. Antennae of males half as long as the body. Pronotum quadrate; sides perpendicular, parallel; lateral carinae or humeral angles obtusely rounded; median carina distinct, except on post-median lobe of the female; third transverse incision very distinct and deeply indented, others distinct. Posterior femora much enlarged near the base, the disk convex, about as long as the abdomen; posterior tibiae enlarged toward the apex, hairy. Prosternal spine cylindrical, bent slightly backward. Subanal plate of the male triangular; apex blunt, entire; cerci with basal half broad, an obtuse tooth about the middle of the posterior margin, above this bent and tapering.

Color (male).—Head and anterior lobes of the pronotum reddish or olive brown; sides paler, with from one to three oblique, black lines; transverse incisions dark on

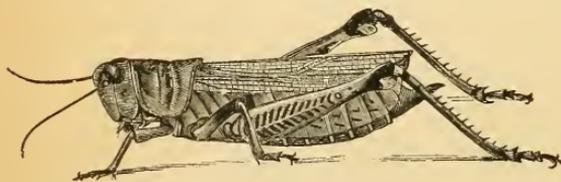


FIG. 5.—*Melanoplus differentialis*—natural size (after Riley).

the sides. Tegmina unspotted, olive brown; reddish at the base, semi-transparent. Wings pellucid; nerves of the apical and front portions dark, rest yellowish. Posterior femora yellow; three black spots on the upper edge; interspaces of the disk black, ribs pale yellow; tibiae yellow, spines black. Abdomen yellow, with small, black spots and stripes. Venter and pectus yellow. The female differs from the male in having the head and thorax olive; the legs and venter a brighter yellow than her mate.

Length of body—male, 1.2 inches; female, 1.5 to 1.7 inches; of tegmina—male, 1 inch; female, 1.25 inches.

This insect has very frequently multiplied in such numbers in limited areas over its range as to do considerable injury to cultivated crops growing upon low, moist ground; and has even been known very frequently to spread over higher and dryer lands adjoining these, its customary haunts. It is one of the few species of locusts that has thus far shown a tendency toward civilization. This it has done readily, since its habits are in unison with the cultivation of the soil. It is only since the settlement of the country where it originally occurred that it has multiplied so as to become sufficiently numerous to become a serious pest. *Differentialis* frequents plowed fields, and is a lover of rank-growing, juicy food, just such as is offered in Corn, Clover, Alfalfa, etc., as well as various garden products.

The eggs of *differentialis* are laid in cultivated grounds that are more or less compact, preferably old roads, deserted fields, the edges of weed patches, and well-grazed pastures adjoining weedy ravines. Egg-laying begins about the middle of August and continues into October, varying, of course, according to latitude and climatic conditions. Usually, but not always, only a single cluster of eggs is deposited by each

female. Frequently there are two, and in extreme cases perhaps even three, of these clusters deposited by a single female.

The range of this insect is not so extended as that of the Two-striped Locust, but nevertheless it is quite general west of the Allegheny Mountains and south of the forty-third degree of north latitude. It is common in Illinois, Indiana, Iowa, Kansas, Nebraska, Missouri, and is met with more or less frequently in southeastern Colorado, Indian Territory, New Mexico, Texas, Arizona, and California. In Kansas and Nebraska we often find black or nearly black specimens, while in California many of the insects of this species have the hind tibiae bright coral red. Aside from these color variations the species is very true to its typical characters.

THE ROBUST LOCUST.

(*Melanoplus robustus* Scudd.)

Next to *Melanoplus differentialis* and very similar to it in general appearance and size is the large yellowish-brown and gray locust that is known by the name of *Melanoplus robustus*. This insect appears to be of rather local distribution since it occurs only in Texas, so far as I am at present aware. It was this insect that was chiefly concerned in the injuries wrought in central Texas during the years 1885 and 1886, and upon which I reported in Bulletin No. 13 of the Division of Entomology.

The habits of this locust are given in that paper, and are briefly as follows:

“While the Rocky Mountain or Migratory Locust prefers rather solid soil upon somewhat elevated open fields and closely grazed pastures for depositing its eggs, all of these species now infesting central Texas appear to find more suitable conditions among rank herbage for the deposition of their eggs and subsequent development of the young larvæ. The large species especially finds the protected roots of grasses and corn best adapted to the sheltering of its eggs, and almost invariably selects the varieties which grow in clumps for this purpose. In digging I have found as many as 8 or 10 egg-pods inserted among the root-stalks of a single clump of grass. Possibly the sheltered nature of these eggs protects them from the numerous parasites which attack those of the Migratory Locust and other species which deposit in open or unprotected ground. It is

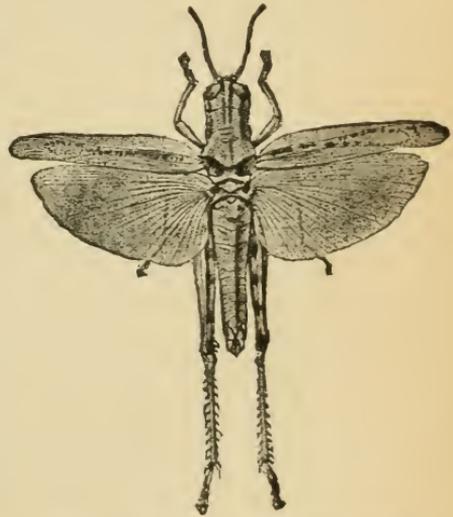


FIG. 6.—*Melanoplus robustus*—natural size (original).

asserted by different persons in this region that the present species lays an average of 150 eggs to the pod, which, judging from the fragments of egg-shells found by digging, is nearly correct; at any rate the estimate is not too high. Egg-depositing with this species commences rather later than with some of the other representatives of the genus, but just at what date I did not learn. There is but a single pod formed by each insect, the entire complement of eggs being deposited at once.

"The larvæ commence hatching during the latter part of March and continue to appear up to the middle of April, according to the forwardness or backwardness of the season. Wet, warm weather favors the hatching, while dry weather rather retards the process. The young

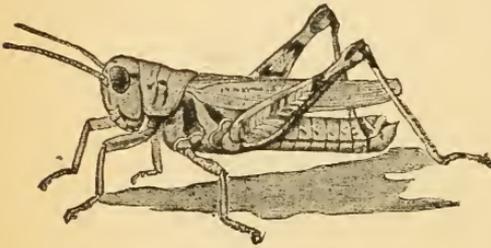


FIG. 7.—*Melanoplus robustus*—natural size (original).

molt five times, at intervals of from twelve to twenty days, according to the condition of the weather. Dry weather with hot days retards, while damp or wet weather favors, this process among insects by keeping the exuviae pliable during molting, as well as in furnishing the necessary moisture re-

quired in growth. The winged or mature insects appear about the middle of July or a little earlier and begin to copulate soon afterward, thus completing the cycle.

"Their mode of attack does not differ greatly from that of *M. spretus*, save in that the latter begin upon the crops immediately after hatching, while this species does not. They wait until they are from three to four weeks old before venturing far from the places of hatching. Like that species they have the habit of huddling together upon plants and among grasses and debris during cool nights and cloudy days. This appears to be a trait common to all insects when present in large numbers, and must be the result of some special instinct. When about half grown the larvæ become pretty well scattered over the fields and do not hop back to the weed patches on the outskirts in the evening, as they do while younger and when beginning their attacks upon the crops. The molting is the same as with other locusts, and need not be described here. The grown-hoppers do not migrate by flight, but do sometimes move in concert in certain directions by jumping. This can hardly be termed migration, since the change of location is merely performed for the purpose of obtaining food, while the act of migrating is toward obtaining more decided results. When feeding they can be driven like other locusts, and this trait in their nature has been taken advantage of at different times and by many of the planters as a means of partial protection to crops."

The description of this locust, as given by Mr. Scudder, is as follows:

Brownish fuscous with more or less of a cinereous tint. Front of head livid, very heavily mottled with dark brown; mouth parts pale, the tip of last palpal joint black, antennæ pale at base, beyond dull reddish more or less tinged with yellow, toward the tip infuscated. A slender blackish stripe passes from behind the eyes to the hind lobe of pronotum, sometimes interrupted, sometimes accompanied by an infuscation beneath, broadening the band; upper surface more or less flecked with dark brown, sometimes collected into a V-shaped catch opening forward, the apex at the middle of the posterior lobe; hind border dotted with blackish; posterior lobe profusely, rest of upper surface sparsely, all shallowly, punctate; sides of metathorax with a pale oblique stripe narrowing upward to a point; tegmina blackish or brownish fuscous, flecked rather distantly with brownish spots, relieved by similar pale ones along the middle; legs of the color of the under surface, the fore and middle femora a little deeper or duskier; hind femora broadly bifasciate with blackish, the apex black at the sides; hind tibiæ and tarsi yellow, occasionally tinged with red, paler next the base, with a black annulus; spines black. Vertex broader (δ) or much broader (♀) than the first antennal joint, the fastigium with a scarcely perceptible depression (♀) or slightly sulcate (δ), broadening in front; frontal ridge broad, nearly equal, a little sulcate below the ocellus. Median carina of pronotum slight, distinct only on the posterior and anterior lobe, cut by all the transverse furrows; lateral carinæ rather distinct, rounded. Last abdominal segment of the male a little produced, rounded; cerci very large and stout, compressed, broadening apically, well rounded, very similar to those of *M. ponderosus*, but not so broad at the tip.

Length of body—male, 29.5^{mm}; female, 34.5^{mm}; of tegmina—male, 21^{mm}; female, 24^{mm}; of antennæ—male, 13.5^{mm}; female, 15^{mm}; of hind femora—male, 17.6^{mm}; female, 21^{mm}.

Melanoplus robustus is also quite closely related to the insect described by Prof. Cyrus Thomas as *Pezotettix viola*, which occurs in Illinois, Indiana, and Missouri. It is also related to *Melanoplus ponderosus* Scudd., of central Texas.

THE TWO-STRIPED LOCUST.

(*Melanoplus bivittatus* Say.)

Perhaps the most familiar locust to the greatest number of people in the United States is the one shown in Fig. 8, unless it should be the ordinary Carolina Locust, *Dissosteira carolina*. Although the illustration is a pretty fair representation of this insect, the following description is inserted for the benefit of those who wish to see it:

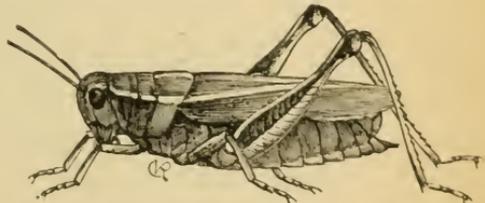


FIG. 8.—*Melanoplus bivittatus*—natural size (after Riley).

In this very common species the vertex of the female is convex or but slightly depressed, and the frontal costa not sulcate; in the male the frontal costa is more or less distinctly sulcate. Tegmina and wings but little longer than the abdomen. The last ventral segment of the male has the apical margin entire and circular. Pronotum with the sides straight, very slightly expanding posteriorly; posterior cross-incision distinct; posterior femora equal to or passing the abdomen.

Dull green or dull brown in color, with a distinct yellowish or pale stripe along each side extending from the upper angle of the eye, along the lateral angle of the body to the extremity of the tegmina. Mouth pale, face varies from pale yellowish to dark olive brown; as also do the tegmina; the latter sometimes have a few quite small dusky spots on the disk, but generally they are unspotted. Wings transparent, tinged with greenish or greenish yellow; nerves greenish brown or blackish. Hind femora generally with a dark stripe along the upper edge of the disk; yellow below; upper margin with two pale spots; posterior tibiae variable, ranging from yellow to dark leaden brown.

Length of body—male 1 inch to 1.4 inches; female, about 1.7 inches, but frequently larger or smaller.

This locust occurs in nearly every locality over the entire country from the Saskatchewan River in the north to the Gulf of Mexico at the south, and from ocean to ocean. It is found in the low valleys near the seashore and upon the mountain slopes of the Rocky range and the interior plateaus to an elevation of nearly 10,000 feet above tide water. In fact, this particular species appears to be able to withstand more climatic variations than any other of our North American species, without showing marked variations in color and form. In size it varies more than do some of the allies. No wonder, then, that it occasionally becomes sufficiently numerous over limited areas to do considerable injury to crops.

The Two-striped Locust, although it enjoys so wide a range, is usually limited over this range to certain favorite haunts. Like the *femor-rubrum* and *differentialis*, *bivittatus* is a lover of rank and succulent vegetation such as is found upon bottom lands, along the edges of cultivated fields, at the margins of woodlands, and on the shaded mountain slopes. When nature has specially favored the species, as it sometimes does, in the way of favorable climatic conditions, the absence of enemies, etc., and it develops in large numbers, then these haunts are forsaken to a greater or less extent and it spreads over cultivated fields, eating the choicest of everything. Unlike some of the other locusts of the genus *Melanoplus*, *bivittatus* seldom exhibits the migratory habit in any marked degree; hence, is always with us and its enemies.

The egg-laying habits of *bivittatus* differ considerably from those of the smaller migratory species, insomuch as but one or two clusters or pods are deposited by a single female. Nevertheless, just as many eggs are laid by each female insect. These eggs are deposited in prairie sod or any compact soil in the vicinity of the regular haunts or feeding places. Old roads and closely-cropped pastures when located handily are favorite resorts for the heavily-laden females when attending to this mission of theirs.

Melanoplus bivittatus was very common in a number of localities over the country during the past summer. In fact, it was one of the principal ones that was the cause of grasshopper injuries in the Red River Valley of the North, in Iowa, Indiana, Ohio, Michigan, New York, Mississippi, Alabama, Kansas, and Nebraska. Conditions which favor the rapid multiplication of other locusts, such as the migratory kinds,

also favor the increase of this one and others of our "native" species. Hence when we hear of the increase and spread of the former, we may also look for the latter to become more numerous.

By keeping down weed patches and by plowing waste places about fence corners, along ravines, the edges of groves and old roads, this insect can usually be kept moderately scarce and harmless.

THE DETESTABLE LOCUST.

(*Melanoplus fœdus* Scudd.)

The locust which is known by the above name has not yet become recognized as one of those which is considered injurious; but its presence in unusual numbers during the past two years in portions of Idaho are sufficient grounds for including it with these injurious species. Even if it has not yet committed such devastation, it is apt to do so in the near future should climatic and other conditions continue favorable. It can at once be recognized from the accompanying illustration (Fig. 9) and the following description:

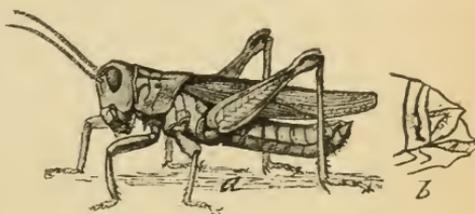


FIG. 9.—*Melanoplus fœdus*: a, male—natural size; b, female anal characters—enlarged (original).

Of medium, or rather large size. Head rather large, not elevated, slightly arched. Eyes pretty large, but not prominent; vertex between the eyes as broad or half as broad again as the first antennal joint; foveola shallow or moderate, with low, stout, nearly parallel bounding walls, and scarcely expanding in front; frontal ridge stout, well advanced, subequal, scarcely enlarged downward, above flat at the ocellus, and below a little and broadly sulcate. Pronotum simple, the posterior lobe coarsely and faintly punctate, expanding very slightly, and, on either side anteriorly, depressed a little above; the anterior lobe narrowed a little in front, but above only; both the transverse sulci equally distinct and continuous throughout, median carina slight and confined to the posterior lobe, lateral carinae sub-obsolete. Tegmina extending a little, or considerably beyond the tip of the abdomen. Terminal ventral segment of the male abdomen scoop-shaped, but slightly produced at the apex, the edge entire; supra-anal plate triangular, bluntly pointed, considerably longer than broad, the sides nearly straight, slightly puckered in the middle; the marginal apophyses of the preceding segment consist of a wavy, depressed, conical, pointed projection diverging at nearly right angles, about half as long as the cerci. Anal cerci forming very simple compressed laminae, the basal three-fifths straight, tapering a little and directed backward and a little upward, the apical two-fifths also straight, enlarging slightly, keeping the same direction but bent a little inward, the outer surface a little concave, the extremity squarely docked, its corners rounded; basal tooth of lower valves of the ovipositor of the female sharp, triangular, but much broader than long.

The general color is a dirty cinereous above, a dingy clay below; antennae dull testaceous, becoming somewhat ferruginous toward the tip; a pretty broad and usually distinct blackish brown or piecous band extends from behind the eye along the upper border of the deflected lobes of the pronotum as far as the posterior sulcus, and sometimes as a blurred and expanded continuation of it, across the pos-

terior lobe also. Tegmina brownish cinereous, the anal field sometimes a little lighter, the median field enlivened to a greater or less extent, but seldom conspicuously, by an alternation of blackish and pallid longitudinal quadrate spots. Hind femora dirty clay brown with dusky incisures, above with a median and subapical dusky or dark fuscous patch; hind tibiae red, with black-tipped spines.

Length of body—male, 24^{mm}, female, 30^{mm}; of antennæ—female, 12^{mm}, male, 13.5^{mm}; of tegmina—male, 21^{mm}, female, 24^{mm}; of hind femora—male, 14^{mm}, female, 16.5^{mm}.

This locust is in reality a mountain form that occurs at an elevation of about 5,000 feet above sea-level, and that frequents the edges of valleys and sunny slopes within the semiarid portion of the United States. It is met with in suitable localities in Colorado, Kansas, Nebraska, Wyoming, Utah, Nevada, Idaho, Montana, and the Dakotas, along with New Mexico.

Although the habits and life-history of this insect has never as yet been followed out, it is supposed that it does not differ materially from that of such other species of the genus as inhabit the same regions, and with which we are more or less familiar. In its general appearance and structure *M. fædus* is very much like the insect which is known by the name of *Melanoplus packardi* Scudder. In fact there is but little difference save in color between the two species.

THE DEVASTATING LOCUST.

(*Melanoplus devastator* Scudd.)

Quite prominent among the destructive species of the country is the one known as the Devastating Locust of California. This particular species is of about the same size as the lesser migratory one, and has

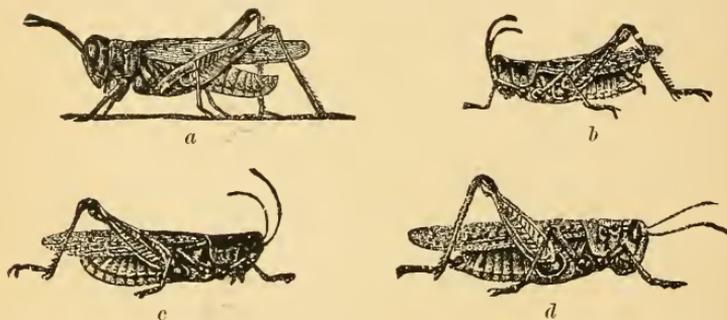


FIG. 10.—*Melanoplus devastator*: a, large female from California, 1885; b, small female, Reno, Nev., 1880; c, male, Fort Keogh, Mont., 1880; d, same as c, all natural size (after Trouvelot).

something of the same general form and appearance. The differences, however, can very readily be detected by the description which follows and by the illustrations given herewith (Figs. 10 and 11):

About the size of *M. atlantis*, and of the same general appearance. Head moderately large and broad, with large but not prominent eyes; vertex somewhat depressed, of medium width, quite deeply sulcate in the male, or but gently so in the female; frontal costa not very prominent but quite broad, the sides gently divergent below,

reaching to the clypeus, shallowly sulcate at the ocellus. Pronotum rather short and broad, slightly expanding on posterior lobe; median carina prominent throughout, cut about the middle by the last transverse impressed line; lateral carinae also quite prominent and forming right angles with the disk and sides. Tegmina and wings reaching beyond the tip of the abdomen in both sexes, but quite variable in this respect, the former quite narrow. Last ventral segment of the male abdomen somewhat tapering, with the apex gently notched; super-anal plate triangular, the apex acute, middle narrowly grooved one-half its length; marginal apophyses of preceding segment about half as long as the supra-anal plate, tapering to a point, the inner edges attinent for about one-third their length, their outer edge furnished with a blunt tooth near the base; cerci slender, equal, straight, nearly four times as long as broad, the apex gently sulcate from the outside. Prosternal spine broad, stout, the apex rounded. Posterior femora reaching beyond the tip of the abdomen in both sexes.

General color light testaceous to dull cinereous, more or less varied with brown and dull black. Band back of the eyes very obscure, never continuous, but confined to

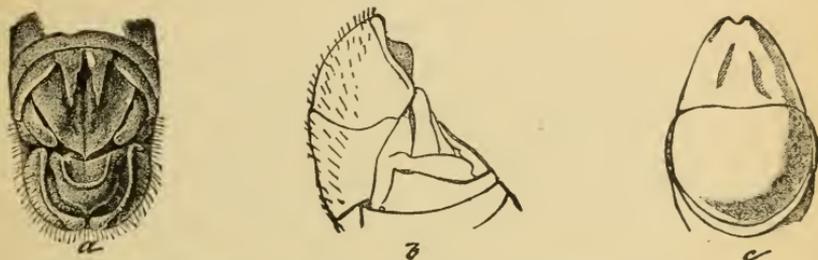


FIG. 11.—*Melanoplus devastator*: anal characters of male; a, from above; b, from side; c, from below—enlarged (after Emerton).

the upper edges of the lateral lobes as two small tapering patches and along the impressed lines. Tegmina provided with a row of discal quadrate spots and also usually a few others scattered above and below the central field. Posterior femora with the usual oblique dark bands; the hind tibiae either dull red or various shades of green and blue more or less obscured with brown, usually greenish, the spines black.

Length of body (average specimens)—male, 20^{mm}, female, 22^{mm}; of pronotum—male and female, 5^{mm}; of tegmina—male and female, 18^{mm}; of hind femora, male, 12^{mm}, female, 11.5^{mm}.

Melanoplus devastator is known to occur at suitable localities throughout the entire region west of the main divide of the Rocky Mountains, and even to extend beyond this limit in portions of Montana and Colorado. Notwithstanding this rather extended range, the insect has never, to my knowledge, been reported in destructive numbers beyond the confines of California, Arizona, Nevada, and Oregon. Like several others of our North American insects that are included in this brief report, *devastator* is rather inclined to frequent the country adjacent to or among the foot-hills of mountain ranges. It does not usually deposit its eggs high up the hillsides and mountain slopes, but rather seeks for this purpose waste lands low down in the valleys that are more or less wet. Its growth and transformations are practically the same as those of *spretus* and the other species that have so frequently been described.

During the latter part of the dry season as the herbage and grasses ripen and dry up these insects gather from the surrounding hills upon the moist grounds at the margins of the valleys to feed upon the green vegetation still found at such places. Here also and close at hand the eggs for the spring brood are laid. Those for the fall brood are laid at random among the hills. In portions of California and Arizona there are two broods of this insect annually.* Wherever this is the case, there is considerable difference in the size and general appearance of the members that make up these two distinct broods. Those of the spring brood are larger and of a brighter color than those of the fall brood.

The difference in size and "freshness" in general appearance between individuals of the two broods in this and other double-brooded locusts is evidently due to the climatic conditions and to the nature of the food supply at different times of the year.

THE NARROW-WINGED LOCUST.

(*Melanoplus angustipennis* Dodge.)

Quite closely related to the preceding is another of our North American locusts of the genus *Melanoplus* which should be included with the destructive species. While this insect, which we will call the Narrow-winged Locust, has never yet, to my knowledge, been sufficiently numerous to materially injure cultivated crops or even the grasses on the

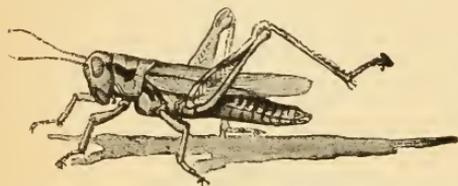


FIG. 12.—*Melanoplus angustipennis*—normal size (original).

prairies, it has been greatly on the increase for the past seven or eight years. As stated in a former report, "*Melanoplus angustipennis*, which only a few years ago was quite rare and confined to low land along the Elkhorn River, is now becoming

quite numerous. If the species continues to increase as rapidly during the next four or five years as it has during the past few, it will be equally as destructive as *femur-rubrum*, *decastator*, *atlanis*, and *differentialis*. When first described it seemed to be confined almost exclusively to *Artemisia ludoviciana* as a food plant. Now it seems to take to almost any food plant that presents itself. This Narrow-winged Locust is more nearly related to *M. decastator* than to any of our other especially injurious species. Should it really become a pest, as present indications would suggest, its arboreal habit will render it rather a difficult enemy with which to deal.

* Mr. D. W. Coquillett in Bull. No. 27, Div. of Entomology, U. S. Dept. of Agriculture (p.39), states that he has taken both forms of this species in August, 1891, and believes the species to be single-brooded, and not double-brooded, as stated by Mr. Bruner.—C. V. R.

The following description is that given by the author of the species:

Frontal costa depressed at the ocellus. Head but slightly elevated above the pronotum. Foveola of the vertex scarcely depressed. Carinae of the pronotum nearly obsolete; the median cut by the three transverse incisions. Hind lobe of pronotum slightly rugulose. Tegmina extending beyond the abdomen, unusually narrow. Male cerci small, narrow, straight, tip rounded and sulcate. Tip of abdomen notched, as in *M. spretus* but the notch is wider.

General color light brown. Upper part of pronotum and hind femora with a reddish tinge. Face sometimes mottled. Antennae light brown, infuscated apically. The usual black band behind the eye, broad and distinct, and reaching last division of pronotum, bounded below by a narrow white stripe. A broad white stripe from base of tegmina connects with a white stripe at insertion of posterior femora, forming a right angle. Outside of hind femora crossed by two indistinct dusky bands that extend upon the upper edge. Lower sulcation reddish. Knees black. Hind tibiae blue. Tegmina light brown, with very small black spots in the disk.

Length of body—male, 22.5^{mm}, female, 24^{mm}; of tegmina—male, 17^{mm}, female, 19^{mm}; of hind femora—male, 12.5^{mm}, female, 14^{mm}.

As intimated above, this locust at first appeared to be one of the few species that are confined to special food plants; but now it has forsaken the single plant and takes up with a great variety of others. Since its food was originally the *Artemisia ludoviciana* its distribution was necessarily limited to regions where that plant flourished. With the change in its food habits so as to take in other plants it also was permitted to spread over more country. Now it occurs both on high and low lands, but appears to be somewhat partial to old breakings and well-fed pastures of many years' use. It occurs in eastern Montana, North Dakota, South Dakota, Iowa, Nebraska, Kansas, and Texas.

THE HERBACEOUS LOCUST.

(*Melanoplus herbaceus* Bruner.)

During the fall of 1887 the writer, while spending a few days at El Paso, Tex., took a large number of a rather large but slender *Melanoplus* upon various kinds of weeds and other low vegetation growing in the vicinity of the town along the banks of the Rio Grande. This locust was present in large numbers and did some damage. Like the *M. angustipennis*, it is rather an above-ground insect than a ground frequenter, and for that reason would be more difficult to fight, were it to become numerous, than are many others.

Aside from these few notes nothing further of its life history and habits are known to me, but it is presumed that the insect does not differ greatly from the species of the genus with which we are familiar,

The following description of the present species is herewith added,

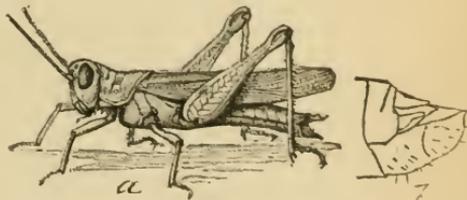


FIG. 13.—*Melanoplus herbaceus*: a, female—natural size; b, male anal characters—enlarged (original).

that the insect can the more readily be determined by those who care to do so for themselves:

A rather large but slender species. About the size of *M. spretus*, but with much narrower wings and tegmina. Usually of a light transparent grass-green color, but changing to a dull olive brown in some specimens during late fall. Related to *M. flavidus*, *M. cinereus*, and *M. bowditchi*, from which species it differs in its smaller head and more oblique face.

Vertex between the eyes quite narrow, somewhat prominent, the foveola elongate spatulate, rather deep in the male, less so in the female, the lateral walls strong, rounded; frontal costa very broad and prominent above, less prominent below, where its sides converge very perceptibly in the female, parallel in the male, deeply and roundly sulcate from just above the ocellus (♀) or throughout (♂). Antennæ very long in both sexes, longest in the male. Eyes large and prominent, those of the male subelliptical, of the female with the anterior edges nearly straight. Pronotum rather slender, rounded above and with the sides nearly parallel or gradually widening posteriorly; anterior lobes plain, posterior lobe minutely and closely punctate; anterior edge nearly straight, posterior edge roundly angulate; median carina present only on the posterior lobe, lateral carinae obsolete; transverse impressed lines plain, continuous, the last a trifle back of the middle. Tegmina and wings reaching beyond the tip of the abdomen in both sexes, the former rather narrow, lanceolate. Terminal segments of the male abdomen but slightly enlarged, gently upturned; the last ventral segment prow-shaped, the outer edge entire; supra-anal plate subquadrate, the lateral edges raised and somewhat sinuous, the apex gently depressed and slightly produced; in the middle there is a broad median carina terminating between two shorter ones near the apex; marginal apophyses of preceding segment very large, broad and fleshy, covering fully one-half of the underlying supra-anal plate, their inner edges touching for the first two-fifths of the distance from their bases and again at their apices, leaving a small, narrow, elliptical opening, their outer edges parallel, obliquely docked at the apex. Anal cerci a little more than twice as long as the basal width, the apical half finger-like, plain, the apex rounded, directed backwards and slightly inwards. Prosternal spine conical, rather long and slender, the point directed gently forward. Posterior femora normal, not quite reaching (♀), or slightly suppressing (♂) the tip of the abdomen; anterior and middle femora but very little enlarged in the male.

General color varying with the season and in different individuals from light grass green to dull olive brown, varied beneath and along the sides of the face, pronotum and thorax with dull white, yellow, and brown. The usual piceous band, which in this species reaches to the last transverse incision, is more or less plainly visible along the sides of the pronotum in different individuals. The tegmina are either pale green, dull olive, or drab, without spots; the wings with the apical veins and nerves more or less infuscated. Posterior femora without indications of bands along their upper edges and outer faces, a rather wide whitish line along the lower edge of the outer face, and also a tinge of light orange yellow below and on the inner face; posterior tibiæ deep sea-green, the spines with their extreme tips black. Antennæ reddish inclining to brown apically.

Length of body—male, 22^{mm}, female, 28.5^{mm}; of antennæ—male, 13^{mm}, female, 11^{mm}; of pronotum—male, 5^{mm}, female, 6.15^{mm}; of tegmina—male, 20^{mm}, female, 24^{mm}; of hind femora—male, 12.2^{mm}, female, 15^{mm}; of hind tibiæ—male, 10^{mm}, female, 13^{mm}.

The present species is confined to the river bottoms in the comparatively arid regions of our southwestern States, and also occurs across the line in Mexican territory for some distance.

THE ROCKY MOUNTAIN LOCUST.

(Melanoplus spretus Thos.)

Of all our destructive locusts native to North America this is the one that has caused the greatest amount of damage, and consequently attracted to itself the general attention of the public. It is likewise the best known when life-history, range, habits, etc., are considered. As already mentioned, its distribution is so well known that it is only necessary to refer to this feature here. In Bulletin No. 25 of the Division of Entomology, a brief, but at the same time, very comprehensive account of this and several other locusts is given. The reader is therefore referred to that publication for a more complete treatise upon the species now under consideration, also to the reports of the U. S. Entomological Commission for an extended account of its life-history and habits.

Briefly, the Rocky Mountain Locust can be said to be a permanent resident of the Rocky Mountain region from northern New Mexico northward as far as the North Saskatchewan River, or coincident with the northern limits of the prairies. This range also extends out upon the adjoining plains, and beyond, so as to include the greater portion of Wyoming, a little of northwestern Nebraska, more of the western part of South Dakota, nearly half of North Dakota, and much of Manitoba and other parts of British America west of Lake Manitoba. Of course the insect is not always to be met with in destructive numbers over this entire region; but it is within these limits that it is always to be found in a healthy condition. Adjoining this "permanent" region on the east is a strip of country of varying width of a hundred or more miles, that is termed the "sub-permanent" region. The insect is nearly as healthy and possibly equally as often to be met with here as in the permanent region. Beyond this secondary habitat is a still greater extent of country which is only occasionally visited by the moving swarms of the locust. This last region has on that account been termed the "temporary" region. This temporary region covers all of the remaining portions of the States mentioned above, besides extending into Minnesota, Iowa, Missouri, Kansas, Arkansas, Indian Territory, and Texas. This region is the one that has suffered most during past years from the ravages of this locust.

The description of this insect is herewith appended:

Female.—The face nearly perpendicular, sloping under toward the breast very slightly. The vertex between the eyes the same width as the frontal costa just above the ocellus; that portion in front of the eyes more or less distinctly channeled and deflexed at an angle of about 40 degrees from horizontal. Eyes nearly straight in front, about semicircular behind. Antennæ quite slender, reaching little if any beyond the tip of the pronotum. Pronotum, with the sides of the anterior lobes parallel, the posterior lobe expanding rapidly backward; median carinæ thread-like, but always distinct on the posterior lobe, usually obsolete on the anterior lobes; lateral carinæ obtuse but distinct on the posterior lobe and usually

so on the middle one, but becoming obsolete toward the front; posterior lateral margin, perpendicular from the humeral (entering) angle one-third the way down, then curving forward to the posterior lateral angle which is obtuse and rounded; the (entering) humeral angle is sharply defined, and in this respect differs from *M. femur-rubrum* and *M. atlantis*: the apex is obtuse-angled (about 100°) rounded at the point; posterior lobe minutely and shallowly punctured throughout; the anterior lobes smooth with a few or no punctures except along the lower margins of the sides. Tegmina and wings extending beyond the tip of the abdomen from one-fourth to one-third their length; the tegmina are of nearly uniform width throughout, slightly curving upward at their extremity; wings a little shorter than the tegmina, very thin and delicate; nerves and nervules very slender. Abdomen, and in fact the whole insect more slender than usual in this genus; but this appearance is partly due to the elongated wings; cerci very small, triangular or tooth-shaped, not extending across the segment on which they rest; valves of the ovipositor quite prominent, especially the upper pair which are more than usually exerted, sharp at the tips and deeply excavated above. The posterior femora usually extend to or about to the tip of the abdomen.

Color.—Reddish brown with fuscous spots. Head and pronotum back to the posterior sulcus, reddish brown, varying in depth of color in individuals; the face sometimes of a lighter and brighter red than the pronotum, sometimes darker, assuming a dark purplish hue; the posterior lobe of the pronotum is generally a pale olive brown, its lighter color contrasting somewhat distinctly with the darker shades of the anterior portion. Some individuals exhibit much lighter colors than here described, varying from dark brown to a dull yellow. The dark line on the side of the head and pronotum, usually so conspicuous in the closely allied species, is generally obliterated in this species by the dark-brown color; but it usually appears distinctly in specimens which have been immersed in alcohol, and is also manifest in the pale individuals, but is broken up by pale spaces and lines, and is rather narrow; the eyes, shining black; tegmina, ash brown, more or less tinged with reddish brown at the base and fading toward the apex; in the middle field, commencing near the base, where this field comes to a point, is an irregular row of fuscous dots, usually single to where the thin portion commences, now and then a double dot appearing; from this point to the apex they decrease in size and distinctness, and spread over the entire width; as a general rule the inner field is marked with a few fuscous dots; in some individuals a few quite distinct are seen, in others they are very minute and dim, and not unfrequently they are entirely wanting. Wings transparent, with a very slight yellowish tinge at the base; nerves and nervules of the costal area and apex black; rest pale. The abdomen is generally a glossy brown, with the posterior margins of the segments pale; venter yellowish or pale brown; sternum pale brown or yellow; anterior and middle legs usually rufous, but varying from reddish brown to pale honey yellow. Posterior femora with the disk reddish brown, sometimes showing dim outlines of oblique bands; the inner face and lower carinae yellowish, the latter usually tinged with red; the upper carina and upper portion of inner face yellowish, marked with three large black spots or partial bands—one at the base, the other two equally spaced in the middle area; apex or knee black, or with a black crescent each side. The posterior tibiae vary in color from bright red to pale yellow, and in some cases to bluish.

Male.—Differs from the female as follows: Is somewhat smaller and shorter, but the wings are about as long as those of the female; the abdomen is enlarged or widened posteriorly and strongly curved upward at the apex; the last ventral segment being elongated, rounded and narrowed upward like the prow of a boat, and is distinctly notched at the tip, the lips or lobes somewhat tubercular in form. This part of the apical segment is covered with minute scattering hairs. This notch forms one of the chief characteristics of the species, at least the most important one in distinguishing it from *femur-rubrum*. The supra-anal plate or triangular piece above the anal opening is sharply bicarinate longitudinally; the tooth-like append-

ages at the base, above, are narrow and slender. The cerci are somewhat longer than the width of the preceding segment, are broad and flat throughout, the width equalling two-thirds the length, not suddenly narrowed or constricted, moderately curved upwards and inwards; roundly narrowed and depressed at the apex. The prosternal spine (in both sexes) is subquadrate and large at the base, but distinctly transverse; robust and decidedly conical, gradually lessening to a blunt point.

Dimensions: Length of body—male, 22–24^{mm}, female, 25–27^{mm}; of tegmina—male 24–26^{mm}, female, 25–27^{mm}; of hind femora—male 12^{mm}, female, 14^{mm}.

THE LESSER MIGRATORY LOCUST.

(*Melanoplus atlanis* Riley.)

Next to *Melanoplus spretus* this is the most destructive of our North American locusts. It is the insect that has been known to devastate portions of the New England States at various times during the past hundred years. It has also been known to occur in destructive numbers in various parts of the interior, but chiefly northward.

This Lesser Migratory Locust, as the name implies, is somewhat smaller than *spretus*, to which it is much more closely related than to any of the other destructive locusts described in the present paper. It is to be distinguished from that species by such characters as are shown in Fig. 14; and also by its proportionately shorter and narrower wings.

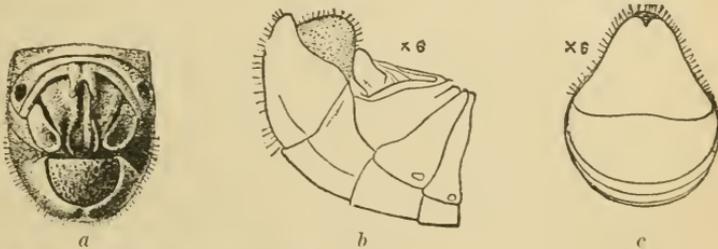


FIG. 14.—*Melanoplus atlanis*: anal characters of male: a, from above; b, from side; c, from behind, enlarged six times (after Emerton).

As is also implied in its name, it is migratory in habit, but to a much less degree than is *spretus*. In its distribution *atlanis* enjoys a much greater range than does the preceding, and for that matter, perhaps, than any other of our North American locusts, unless it be the *femor-rubrum*. While it occurs over such an extended territory, it appears to be more partial to hilly or mountainous regions rather than elsewhere. It seems also to prefer a wooded or mixed country to the open prairie or plains. It is common in all suitable localities from the Mexican boundary to the 53d degree of north latitude, and even beyond—in some instances nearly reaching the Arctic Circle—while it occurs both along the Atlantic and Pacific coasts.

The following original description, along with the illustrations referred to above, will at once enable the readers to distinguish the species from all others of our North American insects of this family:

At once distinguished from *femor-rubrum* by the notched character of the anal abdominal joint of the male and by the shorter, less tapering cerci; also by the greater

relative length of wings which extend on an average nearly one-third their length beyond the tip of the abdomen in the dried specimens; also by the larger and more distinct spots on the wings—in all of which characters it much more closely resembles *spretus* than *femur-rubrum*. From *spretus*, again, it is at once distinguished by the smaller size, the more distinct separation of the dark mark running from the eyes on the prothorax and of the pale line from base of wings to hind thigh; also by the anal joint in the male, tapering more suddenly, and by the two lobes forming the notch being less marked. From both species it is distinguished not only by its smaller size but by the deeper, more livid color of the dark parts, and the paler yellow of the light parts, the colors thus more strongly contrasting.

Just as the typical *femur-rubrum* is at once distinguished from the typical *spretus* by the characters indicated, so *atlanis*, though structurally nearer *spretus*, is distinguished from it at a glance by its much smaller size and darker, more marbled coloring. The contrast is all the greater in the living specimens, and I have seen no specimens of *spretus* that at all approach it in these respects.

Length of body—male, 17.5–21^{mm}, female, 19–23^{mm}; of hind femora—male, 11–12^{mm}, female, 12–13^{mm}; of tegmina—male, 19–23^{mm}, female, 20–24^{mm}.

As would naturally be expected, if one judged from its wide distribution, this particular locust presents some variations in its size, color, and to some extent, also, its structure, but not sufficiently so to render the identification of such forms at all difficult.

In regions where *M. atlanis* and one or two other species of the genus are double brooded, there is a very perceptible difference in the individuals of these broods, both in size and color. Both *atlanis* and *devastator* are notable examples of this kind. In California it is a common occurrence to find the latter insect during October and November apparently only recently fledged, but not much more than one-half the size of spring-reared individuals. Likewise, in the vicinity of Washington, D. C., late every fall numbers of very small *atlanis* are to be met with. These dwarfed specimens are always darker colored than the typical specimens of the early or spring brood; and they also frequently have the hind tibiae glaucous instead of red as in *atlanis*. I have also seen fall specimens of southern *femur-rubrum* with the hind tibiae glaucous instead of red. Several of our other Melanopli, as for example, *Melanoplus acinar* Scudd. and *M. packardii* Scudd., also have these parts either red or bluish green. My collection also contains specimens of the large *Melanoplus differentialis*, from California and Arizona, with red hind tibiae. A few of our species of locusts also have the tegmina and wings quite variable in length—some instances occurring where these appendages are quite rudimentary, or else, in other specimens of the same species, are fully developed. Wing length and color of hind tibiae do not, therefore, indicate difference in species.

THE RED-LEGGED LOCUST.

(*Melanoplus femur-rubrum* De Geer.)

The common Red-legged Locust (*Melanoplus femur-rubrum*) is probably the most generally and widely distributed insect of this family in America. It occurs from ocean to ocean and from the extreme north-

ern range of these insects to Central America. Unlike several others of our destructive locusts that are limited to moderately high altitudes, this one is a frequenter of low elevations ranging from near sea level to not much over 6,000 feet above. This is true with reference to it within the limits of the United States, but in Mexico I have taken it at altitudes of 8,000 feet and upwards. Although it is found over so great an extent of territory, it occurs only at certain suitable localities within these boundaries. Its distribution appears to be controlled altogether by climatic conditions, the chief of which is the presence of a certain amount of humidity. Like *bivittatus* and *differentialis*, it is a frequenter of low grounds, cultivated fields, shady margins of woods, etc., where vegetation is rank and tender. On account of these peculiarities in connection with its naturally wide distribution, it has become our commonest locust in the United States.

The breeding habits of *femur-rubrum* are such as to especially aid the insect in its life among cultivated fields, and hence it is that it has become such a general nuisance. Were it not so generally preyed upon by a great number of different birds, mammals, reptiles, and predaceous insects, as well as by several parasites, it would be a much greater pest than it is.

It can readily be recognized from the following description and illustration (Fig. 15):

As compared with *spretus* the only very marked difference between the females is the shorter wings of this species, yet there are other slight differences observable when a large number of specimens are compared. The eyes in *femur-rubrum* are slightly more prominent. The head, pronotum, and sides of the thorax are usually some shade of olive brown, varying from pale to almost black. The black line behind the eyes is quite broad, seldom broken up, and is distinct in the darkest specimens. The humeral (entering) angles of the posterior margin of the pronotum are more rounded and not so sharply defined as in *spretus*; the median carina is usually more distinct on the anterior lobes, while the lateral carinae are rather more obtuse and not so well defined; the punctures on the posterior lobe are more distinct. The wings extend but slightly beyond the extremity of the abdomen, usually less than one-tenth their length. In this species and *atlantis* the intercalate vein is present in the tegmina dimly and imperfectly, it is true, but it can be clearly distinguished for more than half the length of its course. In *spretus* it is wanting, its place being marked by the line of union between the two rows of cells. The fuscous spots or dots are not so conspicuous or widely spread over the apical portion of the wing, and the tegmina are narrower and straighter. As a very general rule the external face of the posterior femora is black or brown, the lower margin and lower half of the inner face bright coral red; when these colors are well defined there is a yellow space or stripe between the red and black, but these markings are subject to considerable variation, the red being sometimes entirely wanting, the external face dark, and the lower margin yellow; sometimes the dark is replaced by pale olive. The tibiae are most generally bright red, but this character is not without exceptions. Usually there is a pale ray extending from the base of the wings to the posterior femora, but is occasionally wanting in dark specimens, and is generally absent in *spretus*. The prosternal spine is not so distinctly quadrate



FIG. 15.—*Melanoplus femur-rubrum*—natural size (after Riley).

at the base as in *spretus*, transverse, flattened behind, and not regularly conical, but somewhat subcylindrical to the broadly rounded and very blunt apex.

Male.—The most constant differences between the species is found in the form of the last ventral segment of the male; in *femur-rubrum* this segment, although strongly curved upwards, as in *spretus*, is not so distinctly narrowed toward the end, but rounded, and, instead of being notched toward the end, is squarely truncate, presenting a sharp horizontal and almost semicircular margin. Below the tip, on the posterior face of the segment, is a rather large, transverse, gash-like indentation. The cerci are about the same length as those of the male *spretus*, and about the same width at the base. The little tooth-like appendages at the base of the supra-anal plate are elongate and slender, as in *spretus*, and are sinuate.

In addition to the characters mentioned in the original description of *atlanis*, I would call attention to the following differences between it and *spretus* on the one side and *femur-rubrum* on the other.

Female.—As compared with the female of *spretus* the wings are shorter, extending but very slightly beyond the tip of the abdomen, not differing perceptibly in this respect from *femur-rubrum*; the tegmina are narrower, curved upward very slightly at the apex, very few spots or dots on the apical portion, and these minute and dim; the inner field is always immaculate; the posterior half of the intercalate vein apparent. The wings pellucid, but, when living, have, next the base, a bluish-white tinge; a larger portion of the pronotum nearly always dark. The black stripe on the side of the pronotum nearly always apparent even in the darkest individuals; head and anterior lobes of the pronotum with the velvety appearance so marked in *spretus*, but here dark or olive-brown without the reddish tinge so common to that species; the pale, oblique, metathoracic ray usually apparent but often obliterated.

For further differences between this and other species of our destructive locusts, see ante, under the description of *atlanis* and *spretus*.

Unlike the Lesser Migratory Locust and the true or Rocky Mountain Locust, *femur-rubrum* seldom exhibits the migratory trait in a marked degree. True, it will sometimes gather in immense "swarms" and move in concert, but it never rises to great heights, drifting with the wind as do the others. The "kerosene pans" or "hopper-dozers" are admirably adapted as implements of warfare against this locust, even after it has acquired wings.

THE LEAD-COLORED LOCUST.

(*Melanoplus plumbeus* Dodge.)

This hopper approaches more closely to the common red-legged species than to any of our other locusts belonging to the genus *Melanoplus*; but it is very readily distinguishable from that species by its bright colors and by its more clumsy movements. In its distribution, however, *plumbeus* is confined to the plains of Wyoming, Colorado, Nebraska, and probably also of Kansas; but it is not generally distributed even here, being confined to limited areas in certain localities where it is quite common.

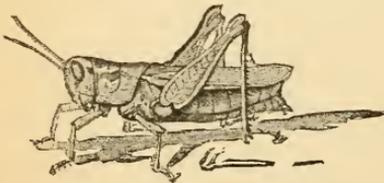


FIG. 16.—*Melanoplus plumbeus*—natural size (original).

Several years ago I found it quite abundant at a point about two miles south of Canyon City, Colo., so abundant, in fact, that, had it been

upon cultivated grounds, it would have injured the crops. But as it was confined to the gravelly bench lands no apparent damage was done by it.

The description of this locust as published by Mr. Dodge is as follows:

Frontal costa sulcate only at ocellus. Vertex slightly sulcate. Median carina of pronotum distinct, cut about the middle by last transverse furrow. Hind border of pronotum angled. Tegmina and wings extend beyond the abdomen. Cerci broadest at base and straight until near the apex, when they bend upward, and end in a blunt point. Tip of abdomen rounded.

Color, dark, inclining to blue. Pronotum with a red, longitudinal median stripe. Black band behind the eye, broadest on pronotum, ending at last sulcus. Yellow spots behind the eye on both sides of black stripe and below the same on side of pronotum. Cheeks bordered behind with yellow. Sometimes face yellow, mottled with blue. A yellow spot at base of antennæ, and a yellow stripe following the lateral carinae of pronotum on hind lobe, runs obliquely across base of tegmina to insertion of hind femora. Tegmina brown, with a few dusky dots along the disk. Wings tinged with blue. Upper outside face of hind femora dark blue, the upper edge crossed by the usual dark bands. Hind tibiae red with black spines. Antennæ light red. Entire under side of insect yellow.

Length of body—male, 21.5^{mm}; female, 25^{mm}. Of tegmina—male, 18^{mm}; female, 20^{mm}. Of hind femora—male and female, 12.5^{mm}.

PEZOTETTIX ENIGMA *Scudd.*

There is a normally short-winged locust throughout the region comprised of the States of Idaho, Nevada, Washington, Oregon, and California, which is often very abundant. In fact, it is to be classed among the destructive locusts of the country, since it appears to be quite plentiful if not numerous at all times and wherever it occurs.

This locust was described by Mr. Scudder as *Pezotettix enigma*. At about the same time he also described a long-winged form from the same locality that differs but little from the *enigma* save in length of wing. He called the long-winged insect *Melanoplus collaris*. Sometime prior to this Cyrus Thomas described the same insect under the name of *Caloptenus flavolineatus*. Since the short-winged form is apparently the typical condition under which the locust now under consideration occurs, the name *enigma* will best serve as that for the species.



FIG. 17.—*Pezotettix enigma* male—natural size (original)

The following description of the insect is that given by Scudder:

Pale brownish yellow, marked with darker brown and fuscous. Head large, tumid, all the angles rounded, the summit darker, with a sometimes inconspicuous median blackish stripe, broadening from in front backward; vertex between the eyes narrower than (σ) or equal to (φ) the frontal costa; fastigium very broadly and shallowly sulcate, most distinctly in the male; frontal costa broad and equal, very faintly punctate, with a scarcely perceptible narrow sulcus below the ocellus;

antennæ slightly infuscated at the tip. Pronotum short and rather stout, the anterior and posterior halves of the deflected lobes nearly symmetrical; dorsum with equal sides, quite distinctly tumid on the dorsum of the anterior lobe, the middle transverse sulcus nearly as close to the posterior sulcus as to the short one in front of it, and the posterior lobe fully three-fourths the length of the anterior; posterior margin angularly rounded; median carina, like in the preceding species, marked in form like all the transverse sulci; dorsum mottled with dark brown, the lateral carinæ marked with a more or less distinct narrow yellow stripe; the anterior margin of the deflected lobes clear yellow or pallid; prosternal spine straight, small, conical, bluntly pointed. Tegmina rather broad, ovate, overlapping, the tip scarcely produced, fully half as long as the abdomen, brownish fuscous, marked with yellow longitudinal veins, and flecked, principally along the median area, but also elsewhere, with longitudinal series of subquadrate blackish fuscous spots; wings a little shorter than the tegmina. Hind femora stout and full, yellow, the outer face marked with alternate, narrow, angulate, yellow and black stripes, often fainter in parts than in others, so as to show a tendency to transverse bands arranged as in *P. jucundus*; outer arc of genicular lobes broadly black; hind tibiæ yellow or greenish blue, the apical half of the spines black; arolium of either sex as in the preceding species (that is, either quadrate, rather narrow, longer than the claws (♂), or obpyriform, small, but little more than half as long as the claws (♀). Abdomen yellow, the upper portion infuscated, the middle of the dorsum marked frequently with a series of approximate, subdorsal, roundish, black spots, often inclosing white spots nearly as large as themselves, those of opposite sides separated only by a slender yellow line; the abdomen of the two sexes has the peculiarities of the preceding species (*Pez. jucundus*), the last joint of the male being also entire; the anal cerci of the male scarcely differ from those of that species, the slender apex only being a little less suddenly contracted.

Length of body—male, 22.5^{mm}, female, 24.4^{mm}; of antennæ—male, 9.25^{mm}, female, 7.5^{mm}; of pronotum—male, 6^{mm}, female, 6.9^{mm}; of tegmina—male, 8.25^{mm}, female, 10.75^{mm}; of hind tibiæ—male, 12.5^{mm}, female, 13.5^{mm}.

The habits of this locust are not yet very well known, since it has not been among the few species that have been made the theme for special study. In 1890, this insect was first seen by me in the central part of Idaho, about Shoshone and Boise City, where it occurred in large numbers along with *Camnula pellucida*, *Dissosteira obliterata*, *Melanoplus fædus* and *M. atlantis*. In ratio of numbers the *enigma* came next to *pellucida*. It was found to be partial in its distribution to the lower bench lands in and near cultivated fields. What its egg-laying habits are I can not say, since the females had not yet begun depositing, although many pairs of the insect were seen and taken in copulation about August 15. Judging from the structure of the terminal portion of the female abdomen, which is very blunt, I should suppose that rather loose, sandy, or loamy soil would be chosen for the purpose of deposition. Like most of the other destructive species, this locust always appears at its best during warm, dry seasons.

THE PELLUCID-WINGED LOCUST.

(*Camnula pellucida* Scudd.)

While the majority of the destructive locusts belonging to North America are members of the subfamily Acridinæ, we are not entirely without those which are classified in the subfamily CEdipodina. Of

the three species which are thus classed the Pellucid-winged Locust is the most important when taken according to the amount of injury that has been done by them. This locust is, and has been, a common destructive species in California, Nevada, and Oregon for a number of years; and more recently has occurred as such in Montana, Idaho, North Dakota, Minnesota, and Manitoba. It is found as a common species over a much more extended territory than that in which it has appeared as a pest, since it is found in Washington, Utah, Wyoming, Colorado, New Mexico, Texas, South Dakota, and the mountain districts of the Middle and New England States. This insect is rather a dweller of mountain valleys and high latitudes than of low elevations and southern climes. Still, its more recent actions would indicate that it is remarkably hardy, and that it quite frequently becomes acclimated in new regions. During the past ten years it has worked its way eastward from the valleys of the Gallatin across the divide into the valley of the Upper Yellowstone, and thence down that stream to its mouth, after which it has followed the Missouri to a point not far from Bismarck. It has also reached the extreme western part of Nebraska by following down the Platte River from the mountain districts of Colorado and Wyoming. Its range in British America is probably clear across the continent, and as far to the northward as the Peace River at least.

The insect is fairly represented at Fig. 18. Scudder's description is also given herewith:

Ash brown; face reddish brown; antennæ yellowish at base, dark brown toward tip; a triangular black spot behind eye, the apex touching it; a quadrate transverse black spot on the anterior upper portion of the sides of the pronotum; pronotum above, sometimes with a dark band down the middle; tegmina or wing-covers with the basal half dark brown, with small yellowish spots and transverse streaks, especially on front border; apical half clear, with dark brown rounded spots, prevalent along the middle, decreasing in size toward the tip; when closed, the upper surface is dark brown, with a rather broad yellowish vitta along each angle on the upper surface; wings pellucid, with black nervules; legs dark brown, the hind femora yellowish or reddish brown, with two or three rather broad diagonal dark brown streaks, dark at the apex; hind tibiae yellowish brown, reddish toward the tip, with a very narrow, generally faint, annulation of dark brown at the base; spines tipped with black.

Length of body, male, 16.25^{mm}; of female, 25^{mm}; spread of wings, male, 33^{mm}; female, 40^{mm}.

The habits and life-history of this locust are not so well known as are those of several others of our species, but can best be compared with those of *Melanoplus spectus*, which has so often been described. The eggs are laid in similar pod-like sacs in the ground, there being about 25 to 30 to the pod. More than a single batch are laid by each female, the intervals between the layings varying from eight days to



FIG. 18.—*Camnula pellucida*. a, female, natural size; b, anal characters of male, enlarged (original.)

two weeks. These hatch early in the spring and develop by a series of five skin molts between the time of leaving the egg and the appearance of the perfect winged individuals. As a rule, *pellucida* prefers and remains upon damp meadow lands among the hills and mountains; but when it becomes unduly common it shows decided tendencies toward migrating, and then spreads out over the adjoining country into grain fields, garden, and pasture lands, just as do most of our other destructive species when they become excessively numerous. Thus far this locust can not be said to have shown a tendency to move in certain directions in preference to others at given times of the year, as does the Rocky Mountain or true Migratory Locust of the United States. A further study of the Pellucid-winged Locust will, without doubt, add many new facts in relation to its life-history and habits that we do, as yet, not know.

THE LONG-WINGED LOCUST OF THE PLAINS.

(*Dissosteira longipennis* Thomas.)

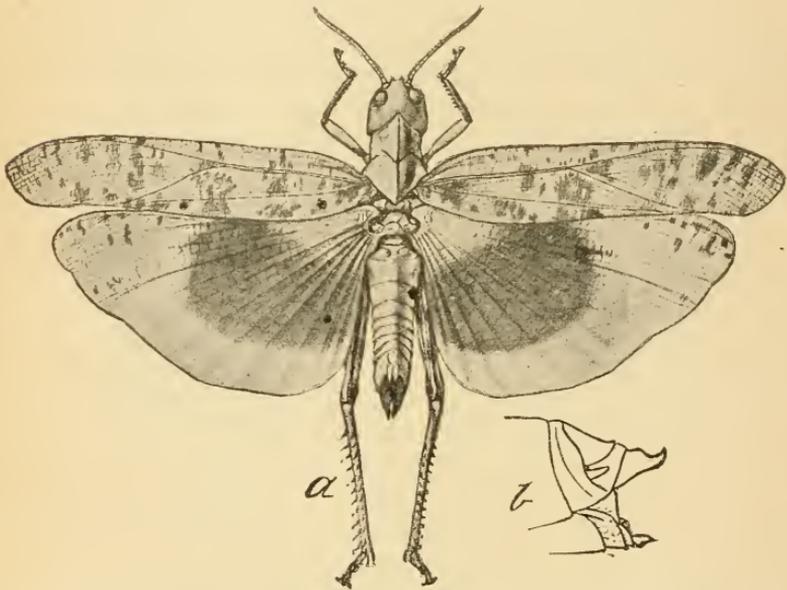


FIG. 19.—*Dissosteira longipennis*: a. female—natural size; b. anal characters—enlarged (original.)

Perhaps the greatest surprise to entomologists in the shape of injuries caused by locusts in this country was that occasioned during the past summer by the insect named above. Although it has been known to entomologists for twenty years, and has been twice described, this locust has been considered as belonging with our rarer representatives of the family of locusts. As stated in the preceding pages of this report, *longipennis* is rather restricted in its range, being found only upon the plains of western Nebraska, Kansas, southeastern Wyoming, eastern Colorado, and northeastern New Mexico, at an elevation of from 3,500

to 6,000 feet above sea level. It is also known to occur, for the most part, upon the gravelly slopes where vegetation is quite sparse.

During the autumn of 1876, when the true Migratory Locust was passing over the eastern part of Nebraska, a large specimen of this long-winged 'hopper was seen to alight at West Point, in that State, where the writer was at the time engaged in hay-making. It was captured and shortly afterwards described as *Edipoda nebrascensis*. This is the only record of the insect having been taken so far away from its native region as since ascertained. Several years later, August, 1881, while spending some time in the vicinity of Greeley, Colo., this species was very frequently met with both to the northward and southward of the town, upon the bench lands, in company with *Tropidolophus formosus*, a very striking species of locust. Again, in 1889, while collecting specimens of various kinds in the extreme western part of Nebraska, a few individual specimens of this insect were taken; while, a year or two previously, it was obtained from Prof. F. W. Cragin, of the Washburn College, located at Topeka, Kans., who collected it in Barbour county, in that State.

This insect is well represented in the accompanying illustrations, which show it with and without spread wings, Fig. 19, being that with them spread, and Fig. 20 that in which it is shown with them closed. The following description will render its determination quite easy:

Tegmina and wings longer than the body; the former spotted with brown, the latter blue at base, but gradually becoming black toward the disk.

Vertex between the eyes broad; middle foveola circular, open in front with a slight median carina; frontal costa rather narrow, somewhat expanded at the ocellus, sulcate, expanding at lower extremity. Lateral facial costa nearly parallel with frontal. Median carina of the pronotum crested, as in *Dissosteira carolina*, only much higher; cut in front of the middle by last transverse incision of pronotum. Posterior part highly areolate, anterior part nearly straight. Lateral carinae slight, approaching a little in front of middle, where they are cut by two transverse incisions; then running parallel to median carina to base of occiput. Posterior margin of pronotum a little less than a right angle; the front margin advancing slightly upon the occiput. Tegmina moderately wide, slightly areolate in front, nearly straight behind; about one-third longer than the abdomen. Wings about one eighth of an inch less, quite broad. Posterior femora not or but slightly channelled below, not quite reaching the tip of the abdomen in the female, or very slightly surpassing it in the male. Antennae about as long as the head and pronotum combined.

Color brownish testaceous. Head and pronotum cinereous, with a greenish tinge. Clypeus lurid. Tegmina dirty yellow, spotted with brown, the spots on outer half running together so as to form irregular narrow bands; median vein brown half its length, bordered by yellow; spots on inner portion large. Wings bluish at base for about one-fifth their length, outer third yellow, sprinkled with brown spots at apex,

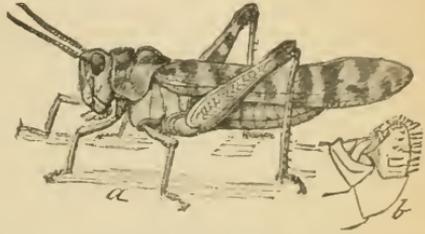


FIG. 20.—*Dissosteira longipennis*: a, male—natural size; b, anal characters—enlarged (original).

the disk black. Posterior femora crossed on the outer face by two light-brown bands; internally by two black bands. Apex black. Posterior tibiae yellow, with dark spines. Venter yellow. Dorsum blue with a yellow spot on center of each of segments 1-4, remainder brownish. Sides brown, antennae rufous.

Length of body—male, 28.5^{mm}, female, 43^{mm}; of tegmina—male, 31.5^{mm}, female, 47^{mm}; of posterior femora—male, 16^{mm}, female, 21^{mm}; spread of wings—male, 67^{mm}, female, 100^{mm}.

As would naturally be supposed, if we were to judge from the ample wings with which it is provided, this insect is an excellent flyer. It has shown a tendency to migrate during the past summer in Colorado, and is reported to have come into that region from the southward in 1890 prior to egg laying. These latter are deposited in the hard uncultivated ground in the localities most frequented by the mature insects. Whether or not more than a single cluster of them are laid by each female I have not yet ascertained. After hatching that spring, the young began feeding in droves, taking everything in the shape of grasses clean as they went; and at night, when not feeding, they clustered together upon the ground which they had bared. Although the insects were not so very numerous over the particular region examined by me, they nevertheless exhibited a decided desire for moving; still, they did not appear to want to leave the areas of bared ground above mentioned. Accordingly the country roads and edges of plowed fields were in great demand by them. During daytime the locusts would work out into the grasses for a few rods and feed, but as evening approached they reëntered the plowed fields, roads, and other spaces not covered with vegetation. Judging from what I had seen of the insect on former occasions, and knowing something of the habits and haunts of the mature form, I was led to believe that the great amount of rainfall and consequent luxuriant growth of vegetation over the entire region during the spring and early summer had much to do with the massing of this insect upon these bared areas. Even the bared areas about the nests of the red ant that builds the dome-like nests of small gravel of common in the region west of the one hundredth meridian, frequently formed centers about which droves of considerable size gathered. Such areas about ants' nests were frequently seen that had been enlarged to from several yards to a number of rods in diameter. Further to the southward, where Messrs. Snow and Popenoe had spent a week or more among the species, the insect was much more numerous and occupied the whole territory: hence these characteristics just mentioned were not so readily noticed.

The food habits of the Long-winged Locust of the plains appear to be rather limited, when compared to that of the Rocky Mountain and a few other species of these insects that are older acquaintances. Both my own observations and those of Messrs. Snow and Popenoe indicate that this insect is, so far at least, a decided epicure, and will only feed upon certain grasses native to that region where it occurs. These are the Grammas (*Bouteloua*) and the Buffalo Grass (*Buchloë dactyloides*).

Aside from these grasses, only a few instances are on record of its having injured cultivated crops, and these are only when the special food-plants had given out. Whether or not this same habit will continue, should the locust become habitually a pest, can not be foretold.

The habit of gathering or massing upon bared places, along with its clumsy nature, renders it an easy enemy to fight with the kerosene pans, etc. Hence, it can be easily controlled in future when desired.

THE PALE-WINGED LOCUST.

(*Dissosteira obliterata* Thos.)

Last year (1890) while investigating the Pellucid-winged Locust plague in central Idaho, a number of specimens of a large ample-winged species were observed among the *pellucida* in various places on the Shoshone side of the low mountain range lying between the Snake River Plain and the Camas Prairie. Upon capturing specimens of this locust it was found to be the insect which Prof. Cyrus Thomas described as *Edipoda obliterata*. Later in the course of that expedition this same locust was met with in large numbers in the foothills lying to the south of Boise City. In that

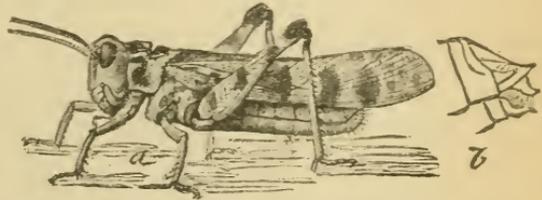


FIG. 21.—*Dissosteira obliterata*: a. male—natural size; b. female anal characters—enlarged (original)

particular locality this, with two other species of locusts, had almost entirely denuded the ground of its covering of grass vegetation. The other species were the *Melanoplus fadus* and *Pezotettix enigma*.

Dissosteira obliterata also occurs in Oregon, Nevada, and California, in all of which States it is quite plentiful over limited areas. It is a very variable insect as far as color goes, and has been described under another name by M. Henri Saussure in his *Prodromus Oedipodiorum*. This name is *Dissosteira spurcata*.

Its habits, while not positively known, are supposed to be very similar to those of *Dissosteira longipennis*. It is a native of the semi-arid regions of the States where found, and frequents rather elevated, gravelly, or sandy hillsides where the vegetation is composed of various short grasses which thinly clothe the surface. When disturbed it rises from the ground with apparent ease and flits along on its ample wings to a considerable distance before realighting.

The following description will enable one to recognize it:

Male and Female.—Length to tip of tegmina, 1.50; to tip of abdomen, 1.10 to 1.30 inches. Pale reddish-brown or dull yellowish, tinged with rufous, with irregular transverse bands of dark fuscous spots.

Occiput not prominent. Vertex broad, moderately deflexed margins, with sharp carinae forming a distinct subquadrate, median foveola, which is divided into two equal sections by a distinct longitudinal median carina that extends back part

way upon the occiput; sides of the foveola parallel between the eyes, and bending abruptly inward toward the fastigium in front, continuous with the sides of frontal costa; fastigium with a double indentation. Frontal costa slightly sulcate, subtricarinate at the fastigium, widening at the ocellus, and extending nearly or quite to the clypeus, but not expanding below. In the male the width is about uniform throughout. Pronotum with the median carina subcristate, distinctly and deeply notched about the middle by the posterior sulcus; anterior portion irregularly arched, more elevated than the posterior portion, which has only the front part arched; lateral carinae irregular and indistinct. The notch of the median carina is of the oblique type, more distinctly so in the male than in the female. Posterior lobe expanding rapidly from the posterior sulcus; nearly flat on the disk, which is more or less covered with elongate rugosities, more distinct and numerous in the female than in the male; posterior extremity obtuse-angled; anterior margin extended in a very obtuse angle upon the occiput. Tegmina extending about one-third their length beyond the abdomen, of medium width, sinuous, and obliquely excised at tip. Wings narrow, the length very nearly twice the width, and slightly undulate on the outer margin; the nervules unusually regular and straight. Posterior femora with sharp and elevated carinae above and below. Antennae rather short, scarcely flattened, and very slightly acuminate at the tip.

Color.—Female somewhat darker than the male; face pale purplish, dotted with fuscous; occiput and pronotum fuscous brown, the latter with a carneous stripe along each lateral carina, which connect at the anterior sulcus and fade out near the posterior extremity; the disk of the posterior lobe dark brown. Tegmina pale dirty yellow, slightly tinged with rufous, crossed by three irregular bands formed of dark fuscous spots, the middle one broadest and usually the best defined; apex with irregular cellular fuscous spots, those next the costal margin most distinct. Wings pellucid, with a narrow marginal, rather pale, fuscous band, commencing behind the subcostal area, where it is broadest, narrowing and fading toward the anal angle; the nerves and nervules, except in the apical portion of the subcostal area and in the fuscous band, pale yellow or white. Posterior femora crossed externally and internally by three oblique fuscous bands; posterior tibiae pale yellow, spines tipped with black.

