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A TAXONOMIC AND ECOLOGICAL STUDY OF ACRIDINAE OF UTAH
(ORTHOPTERA-LOCUSTIDAE)

by

Herald C. Bennion

A thesis submitted in partial fulfillment of the requirements
for the degree of
Master of Science
in
School of Arts and Sciences

Utah State Agricultural College

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INTRODUCTION

Orthoptera, especially the family Locustidae, is one of the most important and most interesting orders of insects in the state of Utah. It includes a polyphagous group of great economic importance in the state. The topography and climate of Utah varies from forested alpine slopes to hot arid desert wastes, several life zones being represented. This great variation from desert to alpine in Utah presents a rather unique region for taxonomic and ecological studies of the Orthoptera.

The most familiar representatives of the insect order Orthoptera are the long-horned grasshoppers, locusts, crickets, katydids, and cockroaches. Orthoptera are characterized by Comstock (4) as those insects having mouth parts fitted for chewing, gradual metamorphosis, nymphal development terrestrial, with 2 pairs of wings or with wings vestigial or wanting. In winged forms the fore wings are more or less thickened, but have distinct venation; the hind wings, when at rest, are folded in plaits like a fan.

The family Locustidae, called Acrididae by many authors, includes the locusts or short-horned grasshoppers, which are characterized by having short antennae, 3-jointed tarsi, and a short ovipositor in the female. The ovipositor has 4 separate spines and an egg guide for ovipositing. The 4 separate spines are used to penetrate the ground to a depth corresponding to the length of the abdomen. The eggs are then placed 1 at a time in regular order by the egg guide. During the process of egg-laying a fluid is secreted which hardens and binds the eggs together into a definite mass. The organs of hearing are situated on the first abdominal segment.

There are 4 subfamilies of Locustidae. The Acrydiinae, commonly called pigmy locusts, have the pronotum extending over the entire dorsum

of the abdomen; the claws of the tarsi have no arolium between them. The other 3 subfamilies have the pronotum extending, at most, only over the base of the abdomen, and the claws of the tarsi have an arolium between them. The Cyrtacanthacrinae (Locustinae), or spur-throated locusts, have the prosternum armed with a distinct conical tubercle. The Oedipodinae, or banded-winged locusts, lack the prosternal tubercle and have the head rounded at the union of the vertex and front. The Acridinae, commonly called slant-faced locusts, is the subfamily under consideration in this paper. The slant-faced locusts have a low median pronotal carina which is cut by one transverse sulcus; the front and vertex usually meet in an acute angle.

REVIEW OF LITERATURE

Stal (25) first characterized the subfamily Acridinae in 1873. Cyrus Thomas (27), in agreement with Stal, recognized a group of locusts in which the head was produced in front in the form of a cone or pyramid; this group he called Tryxalini. In 1897 Scudder (21) gave an English translation of the detailed description which was written in Latin by Stal. The original description by Stal is well-founded and quite complete, but some difficulties arose in early times concerning distinctions between Acridinae and Oedipodinae. In 1897 McNeill (14) tabulated in column form the differences between the 2 subfamilies.

Scudder did much outstanding work on orthopterous groups. In 1899 and again in 1900 Scudder (23) (24) presented works containing a number of original descriptions and keys in Acridinae. Among the recent publications is a particularly valuable paper in 1926 by Hebard (5).

THE SUBFAMILY ACRIDINAE

Acridinae are more closely related to Oedipodinae than any other subfamily. The following comparison of the 2 subfamilies, condensed from McNeill (14), may help to show that they are really very distinct.

Oedipodinae.

1. Vertex declivent, and when seen from the side, united with the face by a curved line.
2. Front nearly perpendicular.
3. Lateral foveolae present and visible from above.
4. Antennae almost always filiform.
5. Median carina of the pronotum cut by 1, 2, 3, or no sulcus.
6. Median carina usually crested.
7. Posterior angle of the metazona usually sharp angulate.
8. Pronotum generally wrinkled.
9. Wings generally bright-colored.
10. Intercalary vein of the tegmina commonly present.
11. Prozona shorter than the metazona.

Acridinae.

1. Vertex horizontal or ascending, and when seen from the side, united with the face forming an angle.
2. Front usually oblique.
3. Lateral foveolae sometimes absent or invisible from above.
4. Antennae often subensiform, triquetrous, clavate, or acuminate.
5. Median carina always cut by one sulcus.
6. Median carina never crested.

7. Posterior angle of the metazona never sharp angulate.
8. Pronotum smooth.
9. Wings never brightly-colored.
10. Intercalary vein of the tegmina generally absent.
11. Prozona almost always longer than the metazona.

Blatchley (1) has called the species of this subfamily the "slant-faced locusts". This is a useful and appropriate name, but all members of the subfamily are not slant-faced. Aulocara ellioti Thom., for example, is an Acridinae without a slanted face. Nor do all slant-faced locusts belong to this subfamily. Leptysma mexicana (Saussure) is a slant-faced locust with a prosternal tubercle; it is a member of the subfamily Cyrtacanthacrinae (Locustinae). However, most of the species of Acridinae are slant-faced, and almost all slant-faced locusts fall in this subfamily.

Blatchley (1) points out that eastern members of Acridinae frequent the borders of marshes and damp prairie meadows, making their home among the tall rank grasses and sedges. Several species delight in sandy or clayey places where clumps of bunch-grass and wire-grass furnish them protection and food. They usually move by flying, making no noise while on the wing.

Records on specimens collected in Utah indicate that most species of the subfamily Acridinae inhabit range and waste lands where there are clumps of tough desert grass or other green vegetation. Some species of the subfamily have been collected in large numbers from dry-farm grain and alfalfa fields. Species of Acridinae are usually found more abundantly on dry-farms than on irrigated farms.

Kirby (11) lists 141 genera of Acridinae in the world, 54 for North America and 42 for western United States from the Great Plains to the

Pacific. There are 15 genera of Acridinae in Utah. Kirby recognizes 632 species of Acridinae in the world, 180 in North America and 99 in western United States. Since the completion of Kirby's catalogue a number of species have been found synonymous. There are 19 species of Acridinae in Utah.

In the preparation of the following key to Utah genera, I have drawn freely from Hebard (5). (For characteristics see figures 1 to 9 page .)

KEY TO THE GENERA OF UTAH ACRIDINAE

- A. Lateral foveolae of vertex forming a right angle or acute angle with the plane of the fastigium, so that they are invisible from above.
- B. Antennae strongly ensiform.
- C. Tegmina usually abbreviated, tips acuminate; wings usually half as long as tegmina. Fastigium with a distinct medio-longitudinal carina. Pseudopomala Morse.
- CC. Tegmina and wings fully developed. Fastigium with a medio-longitudinal carina weak or absent. Mermiria Stal.
- BB. Antennae subensiform or simple.
- C. Pronotum sellate with surface hirsute. Fastigium strongly ascending, not carinate. Slightly flattened antennae very elongate. Metazona subequal in length to prozona. Pedioscirtetes Thomas.
- CC. Pronotum not sellate; surface smooth or weakly hirsute.
- D. Fastigium with surface largely convex.
- E. Internal spurs of caudal tibia very unequal.
- F. Lateral carinae of pronotum prominent, straight and parallel. Short subensiform antennae. Size below medium. Tegmina and wings about three-fourths the length of the abdomen. Opeia McNeill.

- FF. Lateral carinae of pronotum moderately constricted. Tegmina and wings fully-developed. Size medium. Eritettix Bruner.
- EE. Internal spurs of caudal tibia equal. Lateral carinae of pronotum usually absent; when present weak and feebly constricted. Slightly flattened antennae of medium length. Size medium. Amphitornus McNeill.
- DD. Fastigium of vertex with surface concave, with a conspicuous infra-marginal impression.
- E. Antennae subensiform. Internal spurs of caudal tibia moderately unequal. Marginal field of tegmina weakly fenestrate. Cordillacris Rehn.
- EE. Antennae simple. Internal spurs of caudal tibia equal. Marginal field of tegmina not fenestrate. Orphulella Giglio-Tos.
- AA. Lateral foveolae of vertex forming an obtuse angle with the plane of the fastigium, so that they are visible from above. Antennae never strongly ensiform.
- B. Antennae clavate in both sexes. (Internal spurs of caudal tibia equal. Lateral carinae of pronotal disk strongly constricted. Antennae and wings nearly as long as abdomen in male or fully-developed in female.) Aeropedellus Hebard.
- BB. Antennae simple, neither subensiform or clavate.
- C. Internal spurs of caudal tibia nearly equal. Tegmina with marginal field of male fenestrate.
- D. Constriction of lateral carinae of pronotal disk not augmented in appearance by the color pattern. Form moderately slender. Tegmina nearly unicolor, subequal to length of abdomen in male, and extending slightly beyond the middle of the abdomen in the female.

DD. Weak constriction of lateral carinae of pronotal disk, augmented in appearance by the color pattern. Form moderately robust. Tegmina usually spotted with brown, and equal in length to about two-thirds of the abdomen in the male and slightly shorter than half the abdomen in the female. Bruneria McNeill

CC. Internal spurs of caudal tibia not nearly equal; apical much longer than subapical. Tegmina with marginal field of male not fenestrated.

D. Median carina of pronotum percurrent and distinct.

E. Disk of pronotum with prozona longer than metazona.

F. Caudal tibia red. Ageneotettix McNeill

FF. Caudal tibia blue. Tegmina short and well-rounded.

Drepanopterna Rehn.

EE. Disk of pronotum with prozona shorter than metazona.

Psolocessa (Scudder)

DD. Median carina of pronotum obsolete in caudal portion of prozona. Tegmina and wings about as long as the abdomen.

Aulocara Scudder.

Genus Pseudopomala Morse, 1896

This small genus is confined to America, where it is represented by 2 species. According to Kirby (11) both species are found in eastern and 1 in western United States. Pseudopomala brachyptera (Scud.) is found in western United States and occurs in Utah.

Pseudopomala brachyptera (Scud.), 1862

Synonymous names

Opomala brachyptera Scud., 1862.

Pseudopomala brachyptera Morse, 1896.

Mermiria brachyptera Osborn, 1892.

The original description of Pseudopomala brachyptera (Scud.) was made by Scudder (19). Blatchley (1) added to the original. Blatchley's description follows:

Slender, strongly compressed. Above pale brown or drab, yellowish below; antennae, hind tibiae, knees and tibial spines with tips fuscous; tegmina and upper surface of head and pronotum often with small scattered fuscous dots. these sometimes merged to form a dark stripe along the side of head and pronotum. Disk of pronotum with hind margin truncate; metazona two-thirds as long as prozona, its surface finely rugose. Tegmina usually abbreviated, about three-fourths as long as hind femora, their tips sharply rounded, male, as long as head and thorax with tips acuminate, female; wings half as long as tegmina; both in occasional examples as long as hind femora and then with tips rounded in both sexes. Length of body, male, 23-27, female, 27-30; of head and pronotum, male, 7.3-8.5, female, 9.5-11.5; of antennae, male, 9.5-11.5, female, 8.5-10; of tegmina, short-winged, male, 9-12.5, female, 7-12; of tegmina, long-winged, male, 15.5-17, female, 18-22; of hind femora, male, 13.5-15.5, female, 14-19 mm.

Of its habits Morse (12) has written as follows:

This peculiar locust is not uncommon locally on the coarser grasses found in waste lands, especially upon a species of bunch-grass everywhere abundant. I have taken it also on beach-grass at Provincetown, and upon timothy. Though a good leaper and fairly active, it is not shy and seeks safety in attempting to escape observation by sidling around the grass stems rather than by active retreat.

Scant collectors' notes indicate that Pseudopomala brachyptera (Scud.) inhabits open country in Utah.

This species is rather scarce in the state. Thomas (26) mentioned that it was found from Iowa to Utah. McNeill (14) collected immature specimens in Cache Valley, Utah, which he thought were Pseudopomala brachyptera. The Insect Pest Survey (10) reported 1 specimen taken from legumes in Utah.

Genus Mermiria (Serville), 1839

Kirby (11) recognized 8 species for this genus in 1910, but Rehn (16), who did later and more extensive work on the genus, found 2 species to

be synonymous to M. alacris, making 6 species for the genus. The genus description formulated by Rehn (16) follows:

Form typically Truxaloid, elongate, alate. Head with facial line decidedly retreating; fastigio-facial angle evident; fastigium produced, angulate to rounded, weakly or not at all carinate, weakly or moderately impressed; lateral foveolae obsolete to appreciably indicated, sub-ventral in position, not visible from the dorsum; frontal costa sharply indicated, continuous, in part at least sulcate; lateral facial carinae prominent, diverging ventral: eyes ovoid to ovoid-elliptical, axis dorsocephalad to ventro-caudad, moderately prominent from dorsum: antennae ensiform, deplanate. Pronotum longitudinal, median carina indicated, with or without lateral carinae lateral lobes normal, with or without supplementary longitudinal carinae at middle, ventral margin of lateral lobes distinctly or scarcely thickened: caudal margin of disk arcuate or angulate: prozona of dorsum always longer than metazone. Tegmina and wings fully developed. Prosternum with low median protuberance or slight transverse ridge: mesosternal lobes separated by a distinct interspace or sub-attingent: metasternal lobes separated by a narrow interspace to attingent. Subgenital plate of male very bluntly, moderately or strongly conoid produced, hardly compressed. Cephalic and median limbs short, slender. Caudal femora moderately robust to slender, genicular lobes and angles not produced; caudal tibiae with spines of external margin more numerous than those of internal margin.

Species of this genus have a widely varied habitat. The following from Bruner (3) indicates the general ecology of the genus:

They occur chiefly in the arid portions of Northern Mexico and the adjoining regions of the United States. Several species, however, are much more widely distributed, and frequent localities as far distant as the New England States and even the adjoining Canadian territory. Most of them are partial to open country, where they make their homes among bunch grasses, although two or three of them also occur in sparsely timbered districts. They prefer sandy hill-sides and knolls to flat country, and become much more plentiful on grounds that have not been burnt over for several years.

Species of Mermiria were collected in Utah territory in a limited way by early geological and geographical surveys. The determinations made from these early, meager collections were often based on only a few specimens; closely related species were not adequately described;

and later, difficulties arose on characteristics to separate species of the genus.

Scudder (23) reported specimens of Mermiria bivittata (Serv.) from various western states which had been collected by Allen. More recent and extensive work by Rehn (16) indicates that the specimens collected by Allen were probably Mermiria maculipennis (Bruner). Rehn says that Mermiria bivittata (Serv.) inhabits rich grasslands and that it does not occur as far west or as high as the Great Plains region, being entirely a species of the humid district.

There are questionable records of Mermiria neo-mexicana (Thomas) occurring in Utah, but these records need confirmation; it has been collected in states surrounding Utah, and is probably in this state.

KEY TO UTAH SPECIES OF MERMIRIA

A. Lateral carina of pronotum present.

Mermiria neo-mexicana (Thomas).

AA. No lateral carina indicated on pronotum.

Mermiria maculipennis macclungi Bruner.

Mermiria neo-mexicana (Thomas), 1870

Synonymous names

Opomala neo-mexicana Thomas, 1870.

Mermiria belfragei Stal, 1873.

Mermiria neo-mexicana Scudder, 1876

The following original description is taken from Thomas (27):

Female.--Vertex elongate, semi-elliptical, slightly margined. Face more oblique than in O. bivittata, and head longer; tricarinate; the frontal costa sulcate. Antennae ensiform, triquetrous, reaching tip of the pronotum. Pronotum distinctly tricarinate; carina equal, straight, parallel. Elytra and wings about as long as the abdomen. Prosternal spine short and very obtuse.

Color (after immersion in alcohol).--Face yellow, dotted with red, paler below; a broad, roseate stripe on the occiput bordered with yellow. A reddish-brown stripe on each side from the eye to the posterior margin of the pronotum; median carina, same color; rest of the pronotum yellow. Elytra semi-pellucid; base and stripe along the dorsal sub-margin roseate. Wings transparent; nerves mostly ochreous, a few near the apex dusky. Legs pale rufous; femora reddish above, yellow beneath; spines tipped with black.

Male.--Much smaller; last ventral segment elongate, pyramidal, entire; the opening on the upper surface. Median stripe of the dorsum broader than in the female. This species is much like O. bivittata, possibly a variety.

Dimensions.--Length, female 1.62 inches; to tip of elytra, 1.50 inches; posterior femora, 0.88 inch. Length, Male 1.25 inches.

This species lives in coarse grass on the drier parts of the prairie plains. Rehn (16) says that it is quite at home on hills and slopes, and that it inhabits a variety of situations. The necessary requirement for its presence is sufficient area of coarse grass, which is as attractive when sun-cured as it is when fresh.

This insect is absent or very scarce in Utah. There are no specimens from Utah in the Utah State Agricultural College collection. McNeill (14) gives the range of the species as the eastern slopes of the Rocky Mountains from Wyoming to New Mexico and eastward to Georgia. Rehn (16) lists Yellowstone, west to southern Montana, west-central Colorado, Mexico, and southern Arizona as part of the range of the species. Thomas (28) reported immature specimens from Utah which he thought were Mermiria neo-mexicana.

Mermiria maculipennis macclungi Bruner, 1890

The original description of the species as formulated by Bruner (2) in 1889 is given below, followed by the distinguishing characteristics of the subspecies as formulated by Rehn (16) in 1919:

Large and robust, with the tegmina more or less mottled. Testaceous and brown.

Head large and wide, the occiput shorter than in M. neo-mexicana and M. alacris; face straight, less oblique than in those species; eyes large, quite wide, and prominent; vertex not quite so wide as in the species (M. texana) short and broadly rounded in front, not sulcate; lateral foveolae lunate and small; frontal costa moderately prominent above, slightly widening and fading below, gently sulcate above the ocellus (female) or throughout (male). Antennae long, of medium width near the base, apex acuminate. Pronotum broad, without lateral carinae, sub-cylindrical above, the posterior lobe expanding; anterior margin nearly straight, posterior margin subangulate. Tegmina extending just beyond the tip of the abdomen, with the nerves and veins prominent. Posterior femora robust, reaching past the tip of the body and wings in both sexes. Posternal spine quadrate, short, bluntly acuminate, directed gently to the rear.

Dull testaceous, in some specimens inclining to ferruginous, with the usual dark band along the sides of the head and pronotum, which extends upwards upon the edges of the disk of the latter; occiput furnished with two rather narrow, somewhat interrupted central brown stripes inclosing a still narrower one of yellow. Median carina of the pronotum sometimes occupied by a narrow brown stripe. Tegmina with a subcostal and dorsal yellow lines, remaining portion brownish cinereous, becoming translucent beyond the basal third; veins and cross veins brown. There are also a number of rather large dim fuscous blotches arranged along the middle field and a few smaller ones above and below. Posterior femora with the upper half of the outer face, together with the upper inner face, dusky; there is also a row of small dark spots along the lower outer edge; apex fuscous above; posterior tibiae light red, inclining to pinkish in the female, their spines black on the outer half. Antennae testaceous, lightest in the female. Besides the markings already mentioned there are, in some specimens of the female, small crescent-shaped black marks on the face below the ocellus, and interrupted bands of brown reaching from the lower edge of the eyes down the cheeks. Also a dim broad band just below the lower lateral edges of the pronotum.

Length of body, male, 36 mm, female, 46-52 mm; of antennae, male, 21 mm, female, 15 mm; of pronotum, male, 5.85 mm, female 8 mm; of tegmina, male, 27 mm, female, 37 mm; of hind femora, male, 21.5 mm, female 31 mm; of hind tibiae, male, 21 mm, female, 29 mm.

The following distinguishing characteristics of the subspecies is taken from Rehn (16):

This well-marked race can be distinguished in typical material from M. mac. maculipennis by the less attenuated and relatively more robust form, the shorter and relatively broader pronotum, which is not appreciably constricted mesad, the caudal

angle of the disk of the pronotum being more distinctly produced and angulate, the eyes of the female being less prominent from the dorsum and by the generally smaller size.

Rehn (16) says that this insect inhabits the grassy patches and stretches of sparse, short grass in a variety of situations. Information obtained from the Utah State Agricultural College collection confirms Rehn. We find specimens in the sparse, tall, tough, native grass of the sandy, desert hills and rocky benches. Specimens were collected in dry buffalo or Junegrass on foothills east of fields and orchards. Specimens have been taken in irrigated fields of alfalfa, wheat, sweet clover, and untilled weedy places. They were found more abundantly in the northern part of the state, particularly in Cache and Salt Lake Counties.

This species is not very abundant in Utah. It was reported in the state from legumes, orchards, and alfalfa by the Insect Pest Survey (8), (9), (10). Rehn (16) collected some specimens from Salt Lake Valley and gave the range of the species from the eastern coast of the United States west to northern Utah.

Genus Pedioseirtetes Thomas, 1873

This is another small American genus, being represented by only 2 species. According to Kirby (11) the genus is confined to western United States. A few specimens of 1 species have been collected in southern Utah.

Pedioscirtetes nevadensis Thomas, 1873. (Fig. 1 page 50.)

The original description formulated by Thomas (27) follows:

The tip of vertex separated from the portion between the eyes by a curved sulcus, which runs from the upper canthus of one eye to that of the other; this portion of the vertex obliquely ascending and triangular; no median or lateral foveola. Frontal costa prominent and narrow between the eyes, and slightly sulcate; the portion below the ocellus indistinct, a little broader than that above, expanding below and slightly sulcate; lateral carinae indistinct, parallel; face somewhat oblique, narrow. Eyes oblong, ovate, oblique. Antennae extending about one-fourth their length beyond the pronotum, robust, very slightly depressed, and apparently enlarged toward the apex. Front lobes of the pronotum rounded, sub-cylindrical; lateral carinae obsolete on the front lobes, obtuse on the posterior lobes; median carina is but an indistinct line; three transverse incisions distinct, but not profound, the posterior one situated a little behind the middle; the posterior border is regularly rounded, nearly semi-circular; the posterior lateral margin curves inward at the humerus, but makes no angle; the posterior lobe is distinctly broader than the head. Elytra of moderate width; wings rather narrow; both extend slightly beyond the abdomen. The abdomen comparatively enlarged and deep at the base; the valves of the ovipositor slender and acute. The posterior femora are quite slender, being but slightly enlarged at base; posterior tibiae cylindrical. The body and legs more or less covered with small hairs.

Color (after immersion in alcohol).--Dull greenish-yellow, showing the original color to have been green--probably light pea-green--which is almost entirely uniform on the head, thorax, elytra, and legs, without spots. The antennae are dusky at the tips. There is slight rufous tinge on the posterior lobe of the pronotum and base of the elytra; the apical portion of the later is translucent. Wings pale-yellow at base--probably greenish-yellow in the living individual--with a moderately broad fuscous band across the disk; apex transparent, with dark nerves. Spines of the posterior tibiae yellowish, very slightly or not at all tipped with black.

Dimensions.--female length, 1.25 inches; elytra, 0.80 inch; posterior femora, 0.60 inch; posterior tibiae, 0.65 inch; pronotum, 0.25 inch.

Notes taken by Dr. W. W. Henderson indicate that this insect inhabits the desert hills in southern Utah. There are no previous records of the occurrence of this species in the state of Utah that I am aware of. Two specimens were collected by Dr. W. W. Henderson on desert hills at Bryce Gorge, Utah, on August 5, 1932.

Genus Eritettix (Bruner), 1890

This genus is confined to America. Kirby (11) recognized 8 species for the genus, 6 from middle and western United States. One western species has been collected in Utah.

Bruner (3) says that the species of this genus lives through the winter in the nymphal stage among bunch-grass, and frequently hops about during midwinter when the temperature is high enough to thaw them out. Old pastures and unburnt prairies are their favorite haunts. They mate and lay their eggs in the early spring.

Eritettix variabilis Bruner, 1890

The original description formulated by Bruner (2) follows:

Very similar in size and general structure to Stenobothrus carinatus Thos., and like that insect also very variable as to color. In this latter species the antennae are acuminate instead of clavate, the vertex is narrower between the eyes, and the supplementary carinae of the pronotum and occiput are less prominent than there.

Size and color of carinatus.

This is the only species of the genus occurring in Utah and can be separated from other members of the subfamily by the decidedly unequal internal spurs of the caudal tibia, the constricted lateral carinae of the pronotum, and the fully-developed tegmina and wings.

This insect has been collected in very small numbers in Utah. It is indeed possible that it becomes mature, mates, lays eggs, and dies in the spring before any very extensive collections of Orthoptera are made in the state.

There are no previous records of the occurrence of this insect in the state of Utah that I am aware of. Two female specimens were collected by Fred C. Harmston at Etna, Utah, on April 23, 1938.

Genus *Amphitornus* McNeill, 1897

Kirby (11) recognized only 2 species for this small American genus; both are found in western United States. One species, containing 2 subspecies, is found in Utah.

This genus can be separated from closely related genera by the convex surface of the fastigium, the equal length of the internal spurs of the caudal tibiae, and the 12 to 15 external spines on the caudal tibiae.

Amphitornus coloradus ornatus McNeill, 1897. (Figure 7 page 53.)

Synonymous names

Stenobothrus bicolor Thomas, 1872.

Stenobothrus coloradus Thomas, 1873.

Amphitornus bicolor Thos., 1897.

The description of the species as formulated by Thomas (27) follows:

Lateral foveolae wanting. Two broad, brown stripes reaching from the vertex to the tip of the elytra.

Vertex scarcely expanding in front of the eyes; margins scarcely raised, obtuse; a slight, indistinct median carinae; the tip obtusely rounded. Face quite oblique, arcuate; frontal costa broad, expanding below, not sulcate, but slightly depressed at the ocellus; lateral carinae distinct, diverging rapidly; each side of the frontal costa there is a curved impression. Eyes ovate, oblique, acuminate above. Pronotum same length as the head, truncate in front, and obtusely rounded behind, sub-cylindrical, sub-tricarinate, the three carinae being very slight, close together, and parallel; the posterior transverse sulcus a little behind the middle, it alone cuts the median carina. Antennae somewhat flattened, not longer than the head and thorax. Elytra narrow, a little longer than the abdomen; wings nearly same length. Abdominal appendages of the female very short, the upper valves not passing the last abdominal segment; subanal plate of the male triangular, entire at the tip. The lateral carinae of the pronotum in the male are very indistinct and farther apart than in the female; in each sex these are but mere threads, not affecting the sub-cylindrical shape of the prothorax. Posterior femora about as long as the abdomen.

Color (dried after immersion in alcohol).--Parts of the mouth, venter, and sternum pale-yellow; face dull-yellow; eyes brown. Two very regular brown stripes, starting from the tip of the vertex (one from each side near the upper angle of the

eye), gradually enlarging, run along the sides of the head and pronotum, and along the central part of the elytra to the tip. The intermediate stripe along the dorsum and the space on the sides below the brown stripes are dull-yellow. An obscure, brownish band extends obliquely downward and backward from each eye, and a more distinct stripe of the same color marks the lower part of the sides of the pronotum, generally bordered by narrow but distinct yellow lines. Wings pellucid, the nervules near the apex dusky, the rest ochreous. Posterior femora with three dark bands. When living the posterior tibiae are blue, but after long immersion in alcohol they change to a dull-yellow; spines black at the tips. Anterior legs pale-brown. The brown markings are often tinged with a lilac shade.

Dimensions.--Female length, 0.81 to 0.90 inch; elytra, 0.65 inch; posterior femora, 0.52 inch. Male length, 0.62 inch; elytra, 0.60.

Var. unicolor.---The median or dorsal space brownish, which, uniting with the brownish stripes, gives the entire back a brownish color.

This subspecies lives in Chenopodium, weeds, Junegrass and native grasses among the sage or oak brush on sandy desert hills and waste places. Specimens have been collected on dry-farms. The Insect Pest Survey (10) reported specimens from mixed vegetation in 1938.

This insect is rather scarce in Utah; the first report of the species in the state was made by Rehn and Hebard (18). They collected specimens on the hills near Salt Lake City in August 1906. Specimens have been collected in several counties in the state by Utah collectors.

Amphitornus coloradus saltator Hebard

This subspecies of Amphitornus coloradus is easily separated from A. coloradus ornatus by the length of the tegmina and wings in both sexes. In A. coloradus ornatus the tegmina and wings reach to or, more generally, beyond the tip of the abdomen. In A. coloradus saltator the tegmina and wings are reduced, reaching about two-thirds the length of the abdomen.

Quite a number of these short-winged Amphitornus were collected by Dr. W. W. Henderson in Beaver County, Utah, on July 4, 1924. On July 10,

1938, Dr. D. M. Hammond made a collection of this subspecies from Emery County, Utah. They are very scarce in the state.

Genus Opeia McNeill, 1897

This genus is confined to America, where it is represented by 6 species. In 1910 Kirby (11) reported 3 species in western and no species in eastern United States. Two of the species reported by Kirby are now considered synonymous, making only 2 species for the genus in western United States. One species occurs in Utah.

The following generic description is condensed from McNeill (14):

The vertex forms an acute angle with the plane of the fastigium. The vertex is nearly horizontal and shorter than the distance between the eyes. The lateral foveolae are invisible from above; they are small sulci which extend from the ocelli toward the vertex and are not clearly separated from the front. The surface of the fastigium is largely convex, lacking a conspicuous inframarginal impression. The lateral carinae of the vertex are prominent. The frontal costa is sulcate except at the apex, and its margins are slightly and evenly expanded downward. The subensiform antennae are shorter than the head and pronotum. The lateral and medial carina are distinct; all 3 are cut by the principal sulcus only, much behind the middle. The lateral carinae are straight and parallel. The posterior margin of the pronotum is rounded angulate. The lateral lobes of the pronotum have a nearly horizontal carina extending from the middle to the posterior margin. The posterior femora extends somewhat beyond the end of the abdomen. The internal spurs of the caudal tibia are very unequal. The tegmina are a little shorter than the abdomen, with the marginal field moderately fenestrate.

Bruner (3) says that this genus seems to be restricted to the arid and semi-arid regions of the table lands of Mexico and the south-western portions of the United States. In Utah specimens have been collected from arid flats among clumps of desert-grass and rabbit-brush.

Opeia obscura obscura (Thomas). (Figure 8 page 53.)

Oxycooryphus obscurus Thomas, 1871. Opeia testacea is synonymic to Opeia obscura obscura. The following original description of the species is from Thomas (27):

Female.--Head conical; occiput ascending; the vertex ascending in the same line with it, convex, with a slight median carina, most distinct in front; margins of the vertex slightly elevated, obtuse, and terminating behind at the upper canthus of the eye; the vertex sub-conical; tip glabrous. Face quite oblique, nearly straight; frontal costa sulcate, parallel to the ocellus, below which it gradually and regularly expands; lateral carinae distinct, sharp, curving slightly forward at the top in front of the eyes, nearly straight and rapidly diverging below. Antennae somewhat ensiform, flattened, a little longer than the head; joints short. Eyes elongate, pyriform, acuminate above, oblique. Pronotum a little longer than the head, tricarinate; the carinae equal, distinct, and parallel; sides compressed, perpendicular; subtruncate in front; posterior margin obtuse-angled; transverse incision behind the middle; posterior lobe thickly covered with shallow punctures; the posterior lateral angle is a right angle. The elytra narrow, about three-fourths the length of the abdomen. Wings nearly as long as the elytra. Abdomen carined; valves of the ovipositor obtuse, hairy on the margins, the upper ones strongly curved. The legs slender; the femora compressed; posterior femora nearly as long as the abdomen.

Color (dried after long immersion in alcohol).--Pale rufous. Elytra semi-transparent toward the apex. Wings pellucid, with pale rufous nerves.

Dimensions--Length, 0.93 inch; elytra, 0.5 inch; posterior femora, 0.5 inch; posterior tibiae, 0.42 inch.

Bruner (3) says that this insect occurs in short grass where the climate is arid. In Utah, collections have been made on desert flats and waste lands in salt-grass, mint-weed, and clumps of desert broad-leaf grass among greasewood, sagebrush, and rabbit-brush.

This species is scarce in Utah. Rehn and Hebard (18) reported specimens taken from the Salt Lake Valley in 1906. Specimens have been collected by Drs. D. M. Hammond, G. F. Knowlton, and W. W. Henderson in Wayne, Iron, Millard, and other counties in Utah.

Cordillaeris Rehn, 1901

Kirby (11) recognized 5 species for this western United States genus; some of them have been shown to be synonymous. At the present time Utah is represented by 3 species, but the complete relationship of the genus has not yet been fully worked out.

The generic description condensed from McNeill (14) and Hebard (5) is given below. The specimens on hand from Utah fit the following description:

The head is about as long as the pronotum. The vertex forms a right or acute angle with the plane of the fastigium; vertex with rather heavy lateral carinae which meet in a blunt point; fastigium has a conspicuous inframarginal impression, lacking a medio-longitudinal carina. The lateral foveolae are present, but often not clearly separated from the front. The frontal costa is narrow above the ocellus; its sides are more or less strongly divergent, while its lateral carinae are heavy and distinct. The subensiform antennae are longer than the head and pronotum. The lateral carinae of the pronotum are well-indicated in color, but are obsolete in contour on the prozona and subobsolete on the metazona. The median carina is rather slight and cut by the sulcus behind the middle. The metazona has its posterior margin gently rounded. The internal spurs of the caudal tibia are moderately unequal and much stronger than those on the outside. The tegmina and wings are fully-developed or reduced.

Bruner (3) says that the genus is characteristic of the arid and semi-arid regions of the Rocky Mountains and southward. This is a species of the public domain in Utah; specimens were taken in the sandy desert wastes of central and southern part of the state in sparse, native grass and Chenopodium among the sagebrush.

Some of the following characteristics used to separate the species are taken from Bruner (3):

KEY TO UTAH SPECIES OF CORDILLACRIS

- A. Larger. Median carina of the pronotum cut much behind the middle. Disc of the tegmina provided with rather small dark spots.
- B. Front margin of the scutellum of the vertex nearer to the apex of the vertex than a line drawn at the level of the front margin of the eyes. Cordillacris occipitalis (Thos.) 1873.
- BB. Front margin of the scutellum of the vertex nearer a line drawn at the level of the front margin of the eyes than to the apex of the vertex. Cordillacris affinis Morse, 1903.
- AA. Smaller. Median carina of the pronotum cut very little behind the middle. Disc of the tegmina provided with large dark blotches which run together. Cordillacris crenulata (Bruner), 1893.

Cordillacris occipitalis (Thomas), 1873. (Figure 2 page 50).

Synonymous names

Stenobothrus occipitalis Thomas, 1873.
Oxycoryphus occipitalis Thomas, 1876.
Alpha occipitalis (Thomas), 1897.

Several races of this species occur in the state of Utah. Specimens of C. occipitalis occipitalis (Thomas), C. occipitalis cinerea (Bruner), a short-winged phase of C. occipitalis, and probably other distinct biologic races have been collected in the state. The complete relationship of subspecies for Cordillacris occipitalis (Thomas) has not yet been fully worked out; no attempt is made here to separate these subspecies.

The original description of Cordillacris occipitalis (Thomas) as formulated by Thomas (27) follows:

Head ascending, pyramidal; occiput elongate, convex; vertex short, not expanding in front of the eyes, sub-hexagonal, margins raised; no regular lateral foveolae, but on each side, under the projecting front, there is often a shallow, triangular depression. Face quite oblique, straight; frontal costa distinct and narrow above the ocellus; fading and diverging below it, upper portion sharply sulcate; lateral carinae distinct, curving outward. Antennae about as long as the head and thorax, slightly enlarged near the base, and acuminate at the paex, sub-triquetrous or slightly flattened. Pronotum about as long as the head, slightly constricted in the middle; median carinae slight; lateral carinae nearly obliterated, especially on the anterior lobes, slightly approximating in the middle, nearly parallel thence to the front, diverging posteriorly; hind border sub-truncate. Elytra and wings about as long as the abdomen. Hind femora reach the extremity of the abdomen.

Color (dried after immersion in alcohol).--A broad, brown stripe on each side extends from the upper corner of the eye, widening on the head, extending along the upper part of the side of the pronotum, and reaching to the hind margin, a small portion passing over the diverging part of the lateral carinae; usually a brownish stripe extends from the vertex along the back of the head to the pronotum. Elytra pale-brown, with a row of fuscous dots along the disk.

Dimensions.--female length, 0.78 inch; elytra, 0.6 inch. Male length, 0.62 inch.

The range of this insect, as given by McNeill (14), is both slopes of the Rocky Mountains, extending from New Mexico and Arizona to Idaho and Montana and as far east as western Nebraska and Dakota. In Utah collections were made in a variety of situations, ranging from wheat,

and bunch-grass among the cedars and sagebrush in good soil at an elevation of about 4,700 feet, to forests of pine and aspen in rocky-sandy soil of mountainous country at an elevation of about 9,000 feet. Typically, this insect lives in tall, tough, native, desert-grass, Junegrass, and wheatgrass among the shadscale, sagebrush, and rabbit-brush of central and southern Utah. However, the Insect Pest Survey (9) reported specimens taken from meadow land in 1937. Numerous specimens have been taken in alfalfa adjoining desert wastes by Dr. W. W. Henderson; they are a rather common species of the desert wastes in the state.

Cordillacris affinis Morse, 1903,

The original description formulated by Morse (13) follows:

One male, five females, Ormsby Co., Nev., July 6. These specimens agree in size, general form, proportions, and markings with C. occipitalis but differ as follows: the front margin of the scutellum of the vertex is farther removed from the apex and external margin of the vertex, being nearer a line drawn at the level of the front margin of the eyes than to the apex of the vertex--in occipitalis the reverse is true,-- and the fuscous stripe on the dorsal part of the outer face of the hind femora is broken up into narrow transverse fasciae. The name Cordillacris has been proposed by Rehn (Can. Ent., Vol. 33, p. 271) to replace Alpha (Brunner Rev. Syst. Orth., p. 121, 1893) which is preoccupied in Hymenoptera.

This species is less common in the state than the preceding species. Specimens were collected in Buckskin Valley, Iron County, and on Beaver Creek hills, Beaver County, Utah, by Rehn (15).

Cordillacris crenulata (Bruner), 1893. (Figure 6 page 52).

Synonymous names

Ochrilidia crenulata Bruner, 1890.

Alpha crenulata (Bruner), 1897.

Cordillacris pima Rehn, 1907.

Cordillacris apache Rehn and Hebard, 1909.

The original description of Bruner (2) follows:

Related to O. occidentalis (Stenobothrus occidentalis Thos.), from which it differs in its smaller size, shorter occiput, and in its markings.

Occiput rather short and slightly rounding; the vertex between the eyes about as wide as the length of the basal antennal joints, the front margined by a blunt carina, forming at the fastigium a right angle, with the apex, gently rounded; lateral foveolae missing; frontal costa prominent above, where it is very narrow, widening evenly below, sulcate throughout, the lateral walls sharp. Eyes pyriform, not prominent. Face straight, very oblique. Pronotum short, nearly as broad as long, the lateral carinae greatly bowed, faint; median carina visible throughout, severed about the middle by the last transverse impressed line; anterior edge slightly ascending upon the occiput; posterior edge broadly rounded. Tegmina narrow, the anterior edge bowed, the posterior edge straight; the veins of the disk not uniting and forming cells. Posterior femora slender, in the female just reaching, but in the male surpassing, the tip of the abdomen about one-third of their length. Interior apical spines of the posterior tibiae fully twice as long as those on the outside, the lower one much the longest. Antennae long, with the basal joints somewhat flattened, and the apex acuminate.

General color light testaceous, striped, and marked with brown. Frontal costa and a quite broad median line reaching from the fastigium to the front edge of the pronotum, a similar one extending from the lower edge of each eye down the face to the corner of the clypeus; in some specimens this line is separated into two by the very narrow yellow front border of the cheeks; there is a third line or band of the same color directed backwards from the middle of the eyes, widening as it goes, and continued upon the sides of the pronotum, of which it covers a little more than the upper half. This last band is partially interrupted on the front edge of the pronotum by a pointed streak of yellow which reaches nearly to the lateral carinae. Disk ferruginous, with two lateral triangular brown spots on the posterior lobe, that appear as if separated from the coloring of the sides by the narrow yellow lines along the carinae. Tegmina with the disk brown to the apex, the anterior edge of which is much the darkest and deeply crenulate or waved, remainder grayish, becoming somewhat transparent apically. Wings pellucid, with the veins and nerves of the apical third infuscated. The posterior femora, with the upper carina and the upper half of the outer face brown, also with indications of two dusky bands on the upper edge. Posterior tibiae dirty grayish-yellow, becoming infuscated apically. Venter dull yellow. Antennae testaceous, in some specimens inclining to lavender.

Length of body, male, 13 mm, female, 18.5 mm; of antennae, male, 9 mm, female, 7 mm; of pronotum, male, 2 mm, female, 2.92 mm; of tegmina, male, 9 mm, female, 12.5 mm; of hind femora, male, 8.6 mm, female, 11 mm; of hind tibiae, male, 7.65 mm, female 10 mm.

This insect inhabits the range lands and waste places of central and southern Utah. Specimens were taken in Russian thistle and sparse Chenopodium among grease-wood or sagebrush. The Utah State Agricultural College collection contains specimens from Grand, Emery, Wayne, Carbon, Kane, Piute, and Millard Counties; the insect is quite common in waste lands of these counties.

McNeill (14) gives the range of this insect as both slopes of the Rocky Mountains from the southern to the northern boundaries of the United States. I find no previous records of the occurrence of this insect in the state of Utah.

Genus Orphulella Giglio-Tos, 1894

Forty-one species were known in the world for this genus when Kirby (11) completed his catalogue in 1910. Thirteen of these were found in America; all were reported from western United States. Blatchley (1) found only 4 species in eastern United States. Several species have been reported from Utah, but these are probably all synonymous. At the present time only Orphulella pratorum desereta Scudder can be reported from Utah. This species is widely distributed and very variable in color, with a number of synonyms.

Orphulella pratorum desereta Scudder, 1899

The original description of the species as given by Scudder (22) follows:

Green or brown, generally the latter, marked variably with fuscous, but generally with a broad and distinct blackish fuscous postocular stripe on head and pronotum, cut on the latter by the luteous lateral carinae; head occasionally with a pair of vertical fuscous stripes, enclosing a median testaceous stripe, in which case the disk of the pronotum and anal area of the tegmina are also testaceous. Head

rather large and prominent, the face not very oblique; fastigium well advanced, considerably depressed behind the well elevated margins, which are rectangulate (male) or obtus-angulate (female) in front; lateral foveolae obscure, sublinear; frontal costa much compressed and narrowed above, gently enlarging below, feebly sulcate; eyes rather large; antennae somewhat longer (male) or a little shorter (female) than the head and pronotum together, testaceous, apically a little infuscated, the post-basal joints feebly depressed. Pronotum rather long, subtruncate but obtus-angulate behind, the lateral carinae arcuate, diverging considerably both in front and behind, but especially behind. Tegmina, at least in the male, generally considerably surpassing the hind femora, the median area often maculate with fuscous, the discoidal area of basal half of female tegmina not narrowed distally nor narrower than the ulnar area, irregularly reticulate with more than a single row of cells; ulnar area of male with a distinct spurious vein dividing it so as to form a double row of cells. Hind femora surpassing the abdomen, moderately slender, often clouded with fuscous, the hind tibiae often with a pallid postgenicular annulus.

Length of body, male, 21 mm., female, 24 mm.; antennae, male, 7.5 mm., female, 7.4 mm.; pronotum, male, 4 mm., female, 4.5 mm.; tegmina, male, 18 mm., female, 20 mm.; hind femora, male, 12 mm., female, 14.5 mm.

This insect is widely distributed, but not very numerous, in the state. Specimens have been taken from summit-mountain meadows to salt-grass and wire-grass pasture land in the valleys; they are most numerous in alfalfa, dry pastures, or dry-farm fields. The Insect Pest Survey (9), (10) reported specimens taken from legumes and meadows in 1937 and 1938.

Genus Psoloessa Scudder, 1875

Kirby (11) reported 4 species for this American genus, all from western United States. One species has been collected in Utah.

Psoloessa delicatula delicatula (Scudder), 1876. (Figure 3 page 51)

Synonymous names

Stirapleura decussata Scud., 1876.
Psoloessa coloradensis Thom., 1876.
Scyllina delicatula Scud., 1876.

Hebard (7) regards Stirapleura decussata and Stirapleura delicatula as synonymous under Psoloessa delicatula delicatula.

The original description of Scyllina delicatula formulated by Scudder (20) follows:

Fastigium of vertex moderately broad, with prominent margins, slightly approaching each other in a curve posteriorly, acute-angled in front; lateral foveolae rather large, rhomboidal, closely approximate; frontal costa with straight sides, regularly divergent, rather deeply sulcate, sparsely punctate, like the rest of the face; cheeks smooth; antennae about as long as the head and pronotum together. Pronotum obtuse-angled posteriorly, the median carina equal, moderately prominent, severed scarcely in advance of the middle; the lateral lobes with a secondary, blunt, irregular, rugulose carina, extending from a little above the middle of the front border to the posterior extremity of the lateral carinae. Color dusky-brown above, ashen or yellowish brown below, the front pallid brownish, the cheeks and vertex livid, the later with a pair of dusky streaks extending backward from the lateral carina of the fastigium. Pronotum enlivened above with a reddish tinge, the lateral lobes more or less marked with blackish above, the lower third pale yellowish, with a yellowish longitudinal ruga on the middle of the posterior half. Tegmina surpassing the femora, fuligino-pellucid, flecked with small, quadrate, more or less distinct, blackish spots along the median area, the base of upper area and the veins brown; wings scarcely shorter than the tegmina, pellucid, with a slight fuliginous stigma next the extremity of the front margin, the veins of the upper half of the wing blackish. Hind femora extending much beyond the abdomen, bluish livid, with a basal dash, and an oblique premedian streak of black on the outer side and above, and a slight infuscation along the upper margin; hind tibiae pale reddish, the color fading toward the base; spines tipped with black.

Length of body, 12.5 mm; of antennae, 5 mm; of tegmina, 13 mm; of hind femora, 8.5 mm.

Information from material at the Utah State Agricultural College indicates that this is a species of the hills. Specimens were taken between 4,800 and 10,000 feet elevation. The habitat of this insect varies from dry-farms and desert waste lands to small meadowy clearings in willow and cotton-wood or mountain forests.

This species is rather scarce in Utah. It was collected by Rehn (15) in Buckskin Valley, Iron County, and on the Beaver Creek hills, Beaver County. Specimens have been collected in several counties of the

state by Utah collectors.

Bruneria McNeill, 1897

Kirby (11) recognized 4 species for this American genus, 1 for eastern and 3 for western United States. One species occurs in Utah.

Bruneria alticola (Rehn), 1906. (Figure 5 page 52)

Synonymous name

Platybothrus alticola Rehn, 1906.

The original description formulated by Rehn (15) is given below:

Type.--Male; Beaver Range Mountains, 8,000-10,000 feet, Beaver and Piute Counties, Utah. (Brooklyn Inst. Arts and Sciences.)

Differing from P. brunneus (Thomas) in the considerably smaller size, the slightly more angulate fastigium, the more inflated tegmina and more robust caudal femora. From P. sordidus (McNeill) it differs in the tegmina being hardly shorter than the tip of the abdomen, in the pronotum being divided about in the middle and in the smaller size.

Size small; form robust. Head with the occiput moderately inflated, the vertex gently declivent to the fastigium, which, when viewed dorsad, is rectangulate with the margins very slightly concave; foveolae strongly oblong, nearly three times as the greatest width, strongly impressed; face slightly retreating arcuate; frontal costa broad, slightly narrowing dorsad, failing to reach the clypeal sulcus by a considerable distance, biseriate and irregularly punctate, not sulcate; eye but little longer than broad, in length very slightly greater than the infra-ocular sulcus; antennae in length somewhat greater than the length of the head and pronotum together, depressed, blunt. Pronotum slightly longer than the head, carinae distinct, the lateral subparallel to the first transverse sulcus, slightly and regularly expanding to the caudal margin; cephalic and caudal margins broadly obtuse-angulate, that of the caudal margin more marked than of the cephalic, principal transverse sulcus cutting the median carina about in the middle; lateral lobes regularly but not greatly narrowed ventrad, the ventral width contained about once and a half in the depth. Interspace between the mesosternal lobes nearly twice as broad as long; interspace between the metasternal lobes cuneiform. Tegmina reaching to the tips of the cerci, inflated the broad costal field extending practically to the apex, which is narrowly rounded and nearer the sutural than the costal margin; anal field with its margin

gently arcuate. Wings considerably shorter than the tegmina. Cephalic and median limbs not inflated. Caudal femora slightly longer than the tegmina, the greatest width contained about three and a half times in the length; caudal tibiae with thirteen spines on the external margin.

General color ecru drab marked with seal brown. Head with a line ventrad of the foveolae, the infra-ocular sulcus and a line behind the eyes seal brown, while the dorsal aspect of the head is broccoli brown; antennae drab except proximad where the general color is present. Pronotum with the maculations on the lateral lobes usually found in this genus seal brown, with a general tone of broccoli brown dorsad, marked mesad of the lateral lobes with clove brown, which fades toward the median carina. Tegmina wood brown with a number of irregularly placed faint maculations. Abdomen marked with clove brown as usual in the genus. Caudal femur with three oblique fasciae on the dorsal half of the lateral face, seal brown in color, a cloud of the same color is present at the base of the ventral section of the genicular lobes and the genicular arches are clove brown; caudal tibiae vermilion, pale proximad and distad, spines black in their apical half.

Length of body-----14.5 mm.

Length of pronotum----- 3 mm.

Length of tegmen----- 8.5 mm.

Length of caudal femur----- 9.6 mm.

This is a species of the mountains; it lives in open, grassy spaces among the pines and aspens at an elevation of about 8,000 to 10,000 feet. This insect is very scarce in the state; most of the specimens have been collected in Logan Canyon, Utah, by Dr. W. W. Henderson. Rehn (15) took specimens from the Beaver Range Mountains in 1906.

Genus Ageneotettix McNeill, 1897

There were 6 species for this American genus, according to Kirby (11). Blatchley (1) found only 1 species occurring east of the Mississippi. Kirby (11) accredited 5 species to western United States, but A. australis and A. occidentalis of Kirby are now found to be inseparable from A. decorum decorum. One species has been collected in Utah.

The characteristics of the genus condensed from McNeill (14) and Hebard (3) are given below:

The vertex forms an obtuse angle with the plane of the fastigium. The vertex is without a median carina, bounded by straight, sharp, but slight carinae which meet at the front at an angle greater or less than a right angle. The lateral foveolae are sub-quadrate, very distinct from above. The frontal costa is about half as wide at the vertex as at the clypeus, slightly sulcate with low broad carinae along the sides. The antennae are filiform; they are longer than the head and pronotum. The lateral carinae of the pronotum are rather weak, strongest on the metazona and well-indicated in color. The prozona is longer than the metazona. The posterior margin of the metazona is obtuse angulate. The lateral carinae constriction is moderately strong. The median carina is percurrent and distinct. The marginal field of the tegmina in the male is not fenestrated. The fully-developed wings are irregularly and obscurely flecked. The posterior femora usually has three well-marked sub-triangular brown spots on the upper face. The hind tibia is red. The internal spurs of the hind tibia are unequal; the inner spur being about twice as long as the outer one.

McNeill (14) says that the members of this genus are partial to sandy and rather barren soil. Bruner (3) gives the habitat of the group as hillsides covered with short grass and plains in arid and semi-arid regions. The ecology of the Utah form will be discussed under the species.

In all the literature examined I found no record of the occurrence of A. Scudderi (Bruner) in Utah; however, it is found in surrounding states and may be found in Utah by further collecting. I find no specimens in our collection. The student is referred to characteristics used by Bruner (3), given below, to separate A. deorum (Scudder) from A. Scudderi (Bruner):

- A. Smaller. The fastigium of the male slightly acute-angled. The tegmina and wings about as long as the abdomen in both sexes.

Ageneotettix deorum (Scudder)

- AA. Larger. The fastigium in the male forming a right angle, or a little obtuse. Wings slightly surpassing the abdomen in the male.

Ageneotettix Scudderi (Bruner)

Ageneotettix deorum deorum (Scudder), 1876

Synonymous names

Chrysochraon deorum Scudder, 1870.

Eremnus deorum McNeill, 1897.

Ageneotettix deorum Bruner, 1905.

Ageneotettix australis Bruner, 1905.

Ageneotettix occidentalis Bruner, 1905.

The original description formulated by Scudder (20) follows:

Head large, prominent; fastigium of vertex broad, scarcely acute-angled in front; lateral foveolae scarcely depressed, subquadrate, nearly twice as long as broad, the inner angle rounded, the edges shining; frontal costa with straight edges, scarcely broadening below, flat, distantly punctate in two rows, below the ocellus vanishing; whole front faintly and very sparsely punctate, the cheeks smooth. Pronotum gently constricted in the middle, the front border a little full, the hind border very obtusely angled; median carina equal, slight. The general color is brown, the face and antennae with a reddish tinge, the cheeks a little ashen, the vertex pallid, with a pair of narrow, blackish stripes next the upper edge of the eyes, which follow along and are intenser upon the lateral edges of the fastigium, and extend backward to the pronotum. There is a broad dusky band behind the middle of the eyes, which extends over the lateral margin of the pronotal disk, broken by a slender, oblique, yellowish-brown line, which extends forward from the base of the tegmina, and, having divided this belt, faintly follows its upper margin to the eye. The tegmina are shorter than the abdomen, pallid, brown on the basal third of the upper area, the basal two-thirds of the median area, and the upper edge of the lower area; beyond, a few coarse brownish flecks. Wings scarcely shorter than tegmina, pellucid, the upper veins dusky, the middle ones bluish. Hind femora reddish-brown, more or less infuscated along the upper margin, the apex black; hind tibiae red, black at extreme base, the spines red at base, black at tip; abdomen yellowish, tinged above with orange. Length of body, 15 mm; of antennae,

8.25 mm; of tegmina, 8.25 mm; of hind femora, 10 mm. A single male was taken in the Garden of the Gods, Col., July 13.

In Utah, collections are made in desert wastes where there are almost no plants, in rocky-sandy hills on Chenopodium among the sagebrush, in green, valley pasture grass, or in fields where Russian thistle and rabbit-brush have taken the place of dry-farm crops. It is an insect of range lands and often becomes sufficiently numerous to cause injury to irrigated and dry-farm crops adjoining desert wastes. The Insect Pest Survey (8), (9), (10) reported specimens from alfalfa, legumes, and mixed vegetation in 1936, 1937, and 1938.

Genus Drepanopterna Rehn, 1927

This small American genus was erected by Rehn (17) for Aulocara femoratum Scudder. Drepanopterna femoratum (Scudder) is the genotype; it occurs in Utah. The only other species belonging to the genus is found in Mexico.

Drepanopterna femoratum (Scudder)

Synonymous name

Aulocara femoratum Scudder, 1899.

The original description formulated by Scudder (23) follows:

Of minor size, the head well rounded and rather prominent, cinereo-testaceous, a little infuscated above; summit tumid, the fastigium deeply excavate, considerably longer than broad, the margins rather sharply elevated, the lateral parallel, the front acutangulate; lateral foveolae triangular, of moderate size, distinctly impressed, but with obsolescent or no inferior margin; frontal costa rather narrow, subequal but slightly compressed above, obsolete below, more or less but generally feebly sulcate; antennae testaceous, infuscated except near base, of unusual length though not quite so long as the long hind femora. Pronotum testaceous, the disk somewhat infuscated, considerably constricted mesially, the lateral lobes with a large and distinct, quadrate, subcentral

but superior, fuscous patch, the metazona plane, the hind margin subtruncate but feebly angulate, the median carina distinct, equal, percurrent, the lateral carinae blunt and obscure except where marked with pale testaceous, strongly divergent in front and behind. Tegmina short and well rounded, when closed not nearly covering the abdomen, testaceous, sometimes feebly infuscated or minutely and obscurely flecked with fuscous; wings hyaline with glaucous veining. Hind femora of unusual length, much surpassing the abdomen, testaceous, obliquely bianulate with blackish fuscous, the geniculation broadly black; hind tibiae glaucous, basally pallescent.

Length of body, 15 mm.; antennae, 9.5 mm.; tegmina, 7.5 mm.; hind femora, 10.75 mm.

This is a species of the public domain in Utah. Specimens were taken from sandy-clay, desert wastes among the Russian thistle, cactus, and Chenopodium; they were collected at 8,000 feet in mountainous country and in desert adjoining alfalfa fields in the valley. Utah counties represented in the collection include: Wayne, Millard, Emery, Cache, Duchesne, and Uinta. The first report of this species in Utah was made by Scudder (23). He reported specimens in 1899 at Provo, Utah, in the latter part of August.

Aulocara Scudder, 1876

Kirby (11) recognized 5 species for the genus in 1910. Since the completion of Kirby's catalogue, A. rufum Scudder was transferred to Heliaula rufa; the genus Drepanopterna was erected by Rehn for Scudder's A. femoratum; A. parallelum Scudder was found to be a color phase of A. elliotti (Thomas). One member of the genus occurs in Utah.

The species of this genus range from medium-sized to rather small, and live in the arid regions. Bruner (3) says that all of the known members of the genus have blue hind tibia.

Aulocara ellioti (Thomas), 1873

Synonymous names

Stauronotus ellioti Thomas, 1873.
Oedocara Elliotti Bruner, 1885,
Aulocara caeruleipes Scudder, 1876.
Aulocara decens Scudder, 1876.
Oedocara strangulatum Scudder, 1876.
Aulocara parallelum Scudder, 1899.

The following original description is taken from Thomas (27):

Male and female.--Head large, widest below; face sub-vertical; vertex slightly deflexed; foveolae shallow, the central one broad, the lateral sub-triangular, the points of the three meeting in a sharp angle midway between the upper angle of the eye and the base of the antennae; frontal costa not sulcate, narrowed above; lateral carinae distinct, strongly divergent. Eyes medium size, ovate. Pronotum short, sub-truncate in front; posterior angle obtuse and rounded; the three transverse incisions distinct and closely approximate, first shortest, second and third connected at their termini on the sides by an oblique impression; the median carina distinct, not elevated; lateral carinal distinct on the posterior lobe, and sub-distinct on the front of the anterior lobe; the spaces on the anterior lobe between the median and lateral carinae depressed like shallow basins. Elytra and wings about as long as the abdomen. Posterior femora inflated near the base, attenuate near the tips. Pectus not broader than the head. Antennae filiform, as long as the head and pronotum. Anal appendages of the female very short and blunt.

Color (siccus).---Yellow, varied with brown. Head yellow; occiput dotted with brown, sometimes forming imperfect, wavy lines; antennae pale at the base, the remainder brown. Pronotum with a pale-yellow cross on the back; beginning at the posterior lateral angles of the disk, the stripes converge anteriorly, and, crossing about the middle, fade on the anterior lobe; there is a triangular brown spot between these stripes on the posterior lobe; sides brownish, fading below. Elytra brown; a yellow stripe along the inner margin; lower half dotted with dark-brown. Wings transparent; veins white, except at the apex, where they are dusky (it is possible these are slightly tinged with blue when living). Posterior femora yellow, with two or three oblique brownish spots near the upper edge, which cross and become distinct bands on the inside; knee brown; tibiae dusky above and at the tips, rest yellow (bluish in living specimens).

Dimensions.---Female length, 1.07 inches; to tip of elytra, 1.10 inches; to end of pronotum, 0.34 inch; posterior femora, 0.62 inch. Male length, 0.88 inch; posterior femora, 0.60 inch.

According to Bruner (3) this is the most widely distributed species of the genus; it is an insect of the public domain and waste places

and frequently becomes sufficiently numerous to materially injure irrigated and dry-farm crops as well as the grasses on the cattle ranges. It is found most abundantly in or near dry or irrigated alfalfa fields and abandoned dry-farms adjoining desert wastes.

There are numerous records of the occurrence of this insect throughout the state. The Insect Pest Survey (8), (9), (10) report specimens from crops of alfalfa seed, alfalfa, small grains, legumes, mixed range and meadow land.

Genus Aeropedellus Hebard, 1935

Kirby (11) reported 20 species known in the world for the genus when he completed his catalogue in 1910. Three of these were reported in North America, 1 of them being confined to the Rocky Mountains. Hebard (6) mentioned the 3 North American species of Kirby as synonymous and described another new species for the genus. One species of this genus occurs in Utah.

Aeropedellus clavatus clavatus (Thomas), 1873. (Figure 4 page 51)

Synonymous names

Gomphocerus clavatus Thomas, 1873.

Gomphocerus carpenterii Thomas, 1874.

Gomphocerus clepsydra Scudder, 1875.

Stenobothrus carpenterii Thos., 1876.

The original description from Thomas (27) follows:

Male.--Small size; antennae clavate; elytra without spots. Vertex scarcely expanding in front of the eyes; the margins obtuse, elevated, meeting in front in an angle a little less than a right-angle; apex obtuse; lateral foveolae distinct, linear. Face oblique and slightly rounded; frontal costa very prominent, not sulcate at any point, gradually expanding below, it and the entire face densely punctured; the lateral carinae distinct; the sulcus that extends from the eye downward sharp and distinct. Antennae passing the thorax; the joints in the middle portion

somewhat distinct; the apex formed into a flattened club, very distinct; the cylindrical, basal portion consists of about seventeen joints, usual form; the club of about seven joints, much shortened. Pronotum broadest and slightly swollen near the front, somewhat contracted posteriorly; the three carinae about equally distinct, approximate, the lateral curve inwardly, making the nearest approach to each other a little in advance of the middle; sub-truncate in front, very obtusely rounded behind. Elytra and wings nearly as long as the abdomen; the nervules of the disk and lower field of the former scalariform. Sub-anal plate elongate, prow-shaped, keeled, entire at the tip, which is sub-acute. Venter and pectus densely punctured. Anterior tibiae grooved externally, and broad toward the apex.

Color (dried after immersion in alcohol).--Face and cheeks mottled with testaceous and brown; back of the head reddish-brown. Disk of the pronotum reddish-brown, with a brassy luster; sides with the upper portion brown, the lower margin testaceous. Elytra pale-brownish, without spots. The abdominal segments marked on each side with a black spot, those on the basal segment largest, decreasing in size toward the apex, where they are almost obliterated. Ventral portion pale yellow.

Anterior legs carneous; posterior femora with the upper portion of the external face rufous, yellow beneath; internal face black near the base; tibiae pale reddish-yellow, spines black. Club of the antennae dusky, rest yellow.

Dimensions.--Length, 0.56 inch; elytra, 0.37 inch; posterior femora, 0.38 inch; posterior tibiae, 0.32 inch.

Bruner (3) suggests mountain regions and plateaus as the habitat of this species. Collectors' records from Utah verify Bruner. Collections were made in mountainous country at an elevation of between 8,000 and 9,000 feet in meadow grass and alpine flowers and in clearings among the pines.

There are no previous records of the occurrence of this insect in the state of Utah that I am aware of; it is scarce in Utah. Specimens have been collected by Dr. W. W. Henderson from Duchesne, Sevier, Emery, and Iron Counties in mountainous country. Specimens were taken between July 13 and September 10.

Genus Chorthippus Harr., 1841

There were 12 species known in the world for the genus when Kirby (11) completed his catalogue in 1910. Five of these were reported for America,

1 from eastern and 4 from western United States. Since Kirby completed his catalogue, several of the species have been placed in synonymy under parallelus. At present there are 2 species reported from the United States. One occurs throughout this country as well as in Europe; it can be found in Utah. The other species has been reported as being from Colorado.

Chorthippus longicornis (Latr.), 1804

Synonymous names

Acrydium longicorne Latreille, 1804.
Gryllus parallelus Zetterstedt, 1821.
Locusta (Chloealtis) curtipennis Harris, 1841.
Stenobothrus oregonensis Scudder, 1899.
Stenobothrus acutus Morse, 1903.

According to Hebard (7) there are a number of other names that have been placed in synonymy under parallelus. Stenobothrus longipennis Scudder, 1862, and Stenobothrus coloradus McNeill, 1897, have been assigned to synonymy under C. curtipennis. Chorthippus curtipennis is a synonym to Chorthippus longicornis (Latr.).

The original description is not available; the student is referred to the description formulated for the synonym, Stenobothrus longipennis Scudder (19):

Vertex of the head as in S. melanopleurus, but with no median ridge, and having very distinct foveolae, long, narrow, deep; lateral carinae of pronotum equally prominent with the median, approximate, convergent anteriorly, divergent at posterior border; coarse, shallow punctures on the posterior half of pronotum; posterior border arcuated; wing-covers longer than body; wings scarcely shorter than wing-covers.

Head and thorax brown; a broad, black band on the sides, behind the eye, extending to hind edge of pronotum, limited above by the lateral carinae, below merging into the brown; a narrow, straight longitudinal streak on top of head, starting from inner border of the eye; parts of the mouth yellowish; antennae yellowish brown at base, the rest brown or black; legs yellowish brown; hind tibiae, except the black base, and

slender portion of hind femora reddish brown, extremity black; abdomen yellow beneath, above brown; wing-covers uniform brown.

Length of body, male .55 in., female .7 in.; of antennae, male .36 in., female .28 in.; of hind femora, .44 in.; of wing-covers, .65 in. 7 specimens.

According to Blatchley (1) this insect lives in the low, wet prairies, swales, and damp meadows. Collectors' reports of Utah specimens verify Blatchley. In Utah the insect lives in the fall, meadow grass of valley floors or in damp, grassy clearings of willow country. These insects sometimes leave the grassy pasture country in numbers and become of economic importance on irrigated forage crops.

There are numerous reports of this species occurring in Utah. Thomas (28) collected a few specimens at Spring Lake, Utah, and other points in the same territory. In 1936 and 1937 the Insect Pest Survey (8) and (9) reported specimens from alfalfa, meadow, and legumes in Utah.

GLOSSARY

- acuminate, acuminate, acuminatus: tapering to a long point.
- alate: winged; any winged form when the apterous also occurs.
- anal: in the direction of, pertaining or attached to the anus or to the last segment of the abdomen.
- anal angle: on the hind wing, the angle nearest the end of the abdomen when the wings are expanded; the angle between the inner and outer margins of any wing; hind angle of the fore wings.
- anal area: the hinder or anal part of a wing supported by the anal veins; axillary area.
- annulus: a ring encircling a joint, segment, spot or mark; sometimes applied to the inner ring encircling the mouth opening.
- annulate, annulatus: ringed; surrounded by a ring of a different color; formed in ring-like segments; ring-like.
- antenna (pl., antennae): the paired segmented sensory organs, borne 1 on each side of the head, commonly termed horns or feelers.
- anterior: in front; before.
- apex (pl., apices): that part of any joint or segment opposite the base by which it is attached; that point of a wing furthest removed from base or at the end of the costal area.
- apical: at, near or pertaining to the apex of any structure.
- arcuate, arcuatus: arched; bow-like; arquate.
- arolium (pl., arolia): a cushion-like pad on the tarsi of many insects, 1 of the lobes of the pulvillus; in Orthoptera, the terminal pad between the claws.
- attenuate, attenuated, attenuatus: gradually tapering apically; drawn out; slender.
- attingent: touching.
- basal: at or pertaining to the base or point of attachment to or nearest the main body.
- base: that part of any appendage or structure that is nearest the body; on the thorax that part nearest the abdomen; on the abdomen that part nearest the thorax; the bottom on which anything stands.
- bilobate, bilobatus, bilobed: divided into 2 lobes.

- biserrate, biserratus:** double saw-toothed; with a saw-tooth on each side of each antennal joint.
- brassy:** yellow with the lustre of metallic brass.
- canthus:** the chitinous process more or less completely dividing the eyes of some insects into an upper and lower half.
- carina (pl., carinae):** an elevated ridge or keel, not necessarily high or acute.
- carinate, carinatus:** keeled; having keels or carinae; with 1 or several, longitudinal narrow raised lines.
- carneose, carneous, carneus:** flesh-like in substance; flesh-color; white tinged with red.
- caudal:** of or pertaining to the cauda or to the anal end of the insect body.
- cephalic:** belonging to or attached to the head; directed toward the head.
- cercus (pl., cerci):** an appendage (generally paired) of the tenth abdominal segment, usually slender, filamentous, and segmented.
- cinereous, cinereus:** ash-colored; gray tinged with blackish.
- clavate, clavatus:** clubbed; thickening gradually toward the tip.
- clypeal suture:** the suture marking the division between the clypeus and the epicranium; the suture separating the post-clypeus and the preclypeus.
- clypeus:** that part of the head of the insect below the front, to which the labrum is attached anteriorly.
- compressed, compressus:** flattened by lateral pressure; flattened laterally as against flattened vertically or depressed.
- concave, concavus:** hollowed out; the interior of a sphere as opposed to the outer or convex surface.
- converging:** approaching each other toward the tip.
- convex:** the outer curved surface of a segment of a sphere, opposed to concave.
- crenulate, crenulatus:** with small scallops, evenly-rounded and rather deeply-curved.
- costa:** any elevated ridge that is rounded at its crest; the thickened anterior margin of any wing, but usually the forewings.
- crest:** a prominent, longitudinal carina on the upper surface of any part of the head or body.

- cristate, cristatus (crested):** with a prominent carina or crest on the upper surface; crested.
- cuneate, cuneatus, cuneiform:** wedge-shaped; elongate triangular.
- deflexed:** abruptly bent downward.
- deplanate, deplanatus, complanate, complanatus:** compressed; flattened above and below.
- depressed, depressus:** flattened down as if pressed; often used in opposition to compressed.
- disc, disk:** the central upper surface of any part; all the area within a margin; the central area of a wing; in Orthoptera, the obliquely ridged outer surface of hind femur in Saltatoria.
- discoidal area:** the middle area or field of an organ, especially the wings; in Orthoptera, that area of the tegmina between the posterior or anal and the anterior or costal areas; discoidal field.
- divergent:** spreading out from a common base.
- dorsal:** of or belonging to the upper surface.
- dorsum:** in general, the upper surface.
- elliptical, ellipticum:** oblong-oval; the ends equally rounded, together forming an even ellipsoid.
- elytra:** the anterior leathery or chitinous wings of beetles, serving as coverings to the hind wings, commonly meeting in a straight line down the middle of dorsum in repose; also applied to the tegmina in Orthoptera; also applied by some writers to the hemelytra of the Heteroptera.
- ensate, ensatus, ensiform:** sword-shaped; 2-edged, large at base, and tapering to the point.
- fascia:** a transverse band or broad line; termed common when it crosses both wings or wing covers.
- fastigium:** in Orthoptera, the extreme point or front of vertex; in some insects a prominent angle between the vertex and the face.
- femur (pl., femora):** the thigh; usually the stoutest segment of the leg, articulated to the body through trochanter and coxa and bearing the tibia at its distal end.
- fenestrate, fenestrated, fenestratus:** with transparent or window-like, naked spots.
- filiform:** thread-like; slender and of equal diameter.

frons, front: the unpaired sclerite of the head lying between the arms of the epicranial sutures; it bears the median ocellus.

frontal: referring to the front of the head or to the anterior aspect of any part.

frontal costa: in Orthoptera, a prominent vertical ridge of the head which may be median or lateral. (See median carina and lateral carina.)

fuliginous, fuliginosus: sooty or smoky-brown.

fuscous, fuscus: dark-brown, approaching black; a plain mixture of black and red.

gena (pl., genae): the cheek; the part of the head on each side below the eyes, extending to the gular suture.

genicular arc: in Orthoptera, a curved, dark marking on the posterior knee-joint.

geniculate, geniculatus: knee-jointed; abruptly bent in an obtuse angle.

glaber, glabrate, glabrous: smooth, hairless, and without punctures or structures.

glaucous, glausus: sea-green; pale, bluish-green.

hirsute, hirsutus: clothed with long, strong hair; shaggy.

hyaline, hyalinus: transparent or partly so; water-like in color; glassy.

impressed, impressus: having shallow, depressed areas or markings.

impression: any indentation or depression on a surface.

inframarginal: situated below or behind the marginal cell of the wing, or behind or below any margin.

infraocular: below and between the eyes.

infusate, infuscated, infuscatus: smoky gray-brown, with a blackish tinge.

intercalary: additional, interpolated, or inserted between, as a wing vein or other structure.

intercalary vein: any added or supplementary wing vein.

interspace: a deep incision or sulcus on the posterior margin of the metasternum in certain grasshoppers.

laterad: toward the side and away from the median line.

lateral: relating, pertaining, or attached to the side.

lateral carinae: in Orthoptera, those on the head extending downward from the front margin of the eyes; those on prothorax extending along each lateral margin of the dorsum.

lateral foveolae: in Orthoptera, foveate depressions on the margins of the vertex near the front border of the eye.

lateral lobe: the deflexed part of the pronotum which covers the sides of the prothorax in many Orthoptera.

linear: straight; in the form of a straight line.

livid, lividus: lead-color; liver-color; a combination of black with blue; a pale purplish-brown.

lunare, lunaris, lunate: crescent-shaped.

luteous, luteus: clay-color; brownish-yellow; deep-yellow with a tint of red.

maculate, maculated, maculatus: spotted or marked with figures of any shape, of a color differing from the ground.

maculation: the ornamentation or pattern of markings.

marginal: of, belonging to, or near the margin.

marginal field: in tegmina, the costal field.

medial: referring to, or at the middle.

median: in or at the middle; of or pertaining to the middle.

median carina: in Orthoptera, in the head, a median dorsal carina; it has been also used for that which extends down the middle of front from the fastigium, and then is frontal costa; of the prothorax, that along the middle of pronotum; any keel set medianly on a part of an insect.

mesad: toward or in the direction of the median plane of the insect body, or meson.

mesosternal lobes: in Orthoptera, the mesosternellum.

mesosternum: the underside or breast of the mesothorax.

mesosternellum: in Orthoptera, 2 median lobes of the mesosternum, 1 on each side of the deep median notch; in general, the sternellum of the mesothorax.

mesothorax: the second or middle thoracic ring which bears the middle legs and the anterior wings.

- metamorphosis: the series of changes through which an insect passes in its growth from the egg through the larva and pupa to the adult; complete when the pupa is inactive and does not feed; incomplete when there is no pupa or when the pupa is active and feeds.
- metathorax: the third thoracic ring or segment, which bears the hind legs and second pair of wings; variably distinct; sometimes closely united with the mesothorax and sometimes appearing as part of the abdomen.
- metazona: in Orthoptera, the dorsal surface of the prothorax behind the principal sulcus.
- nervules, nervures: the rod- or vein-like structures supporting the membranes of wings; veins, veinlets.
- oblique, obliquus: slanting; any direction between perpendicular and horizontal.
- oblong, oblongus: longer than broad; with the longitudinal diameter more than twice the transverse.
- obsolete, obsoletus: almost or entirely absent; indistinct; not fully-developed.
- obtuse-angulate: forming an obtuse angle; as markings or angles.
- occiput: the hinder part of the epicranium between the vertex and the neck; rarely present as a distinct sclerite.
- ocellae, ocelli: the lateral simple eyes in larvae; 1 of the small or simple eyes.
- ochraceous, ochraceus, ochraeus, ochreous, ochreus: yellow with a slight tinge of brown.
- pallescent: becoming pale or light in color or tint.
- pallid, pallidus: pale or very pale.
- pectus: the ventral part of the thorax; variably applied.
- pellucid, pellucidate, pellucidus: transparent, whether clear or colored.
- percurrent: running through the entire length; continuous.
- posterior: hinder or hindmost; opposed to anterior.
- postgenal: of or pertaining to the postgena; situated behind the gena or cheek.
- postocular: back of or behind the eyes.
- premedia: in Ephemeroidea, an apparently distinct vein between radius and media.

- pro-:** Latin prefix; anterior, before, forward, fore or forth.
- pronotal carina:** in Orthoptera and certain Heteroptera, the main or median carina or keel on pronotum.
- pronotum:** the upper or dorsal surface of the prothorax.
- prosternal:** of or belonging to the prosternum.
- prosternal spine:** the cone or tubercle between fore-legs in some Orthoptera.
- prosternum:** the fore-breast; the sclerite between the fore-legs.
- prothorax:** the first thoracic ring or segment; it bears the anterior legs but no wings.
- protuberance:** any elevation above the surface.
- proximal:** that part of an appendage nearest the body.
- prozona:** the anterior part of the pronotum in certain insects.
- punctate:** set with impressed points or punctures.
- pyramidal, pyramidate, pyramiform:** resembling a pyramid in form; angular conical.
- pyriform:** pear-shaped.
- quadrate, quadratus:** square or nearly so.
- rectangular, rectangulate, rectangulatus:** in the form of a right angle or rectangle.
- reticular, reticulate, reticulated, reticulatus reticulose, reticulous, reticulosus:** covered with a net-work of lines; meshed; netted.
- rhomb, rhombus:** an equal-sided, 4-sided figure with opposite sides parallel and with 2 opposite angles acute and the other 2 obtuse.
- rhomboid, rhomboidal:** having the form of a rhomb.
- roseate, roseous, roseus:** rose color.
- rufous, rufus:** pale red.
- ruga (pl., rugae):** a wrinkle.
- rugose, rugosus, rugous:** wrinkled.
- rugulose, rugulosus:** minutely wrinkled.

scalariform: ladder-like; applied to venation when the veinlets between two longitudinal veins are regularly arranged like the rungs of a ladder.

scutellum (pl., scutelli): the posterior division of the notum; the third dorsal sclerite of the meso- and metathorax. The sunken or impressed portion of the vertex (Henderson).

sellate: saddle-shaped.

stigma (pl., stigmata): a spiracle or breathing pore; a dense, often discolored part of the costal margin of a wing, usually at the end of the radius.

sub: a Latin prefix meaning under; slightly less than; not quite so.

subanal plate: in Orthoptera, the subgenital lamina.

subcosta: the longitudinal, generally unbranched vein extending parallel to the costa and reaching the outer margin before the costa.

subgenital plate: a plate or process serving to cover the gonopore from below.

subgenitalis: the subgenital plate is the eighth abdominal sternite.

subquadrate: not quite a square.

sulcate, sulcated, sulcatus: deeply-furrowed or grooved; with deep grooves.

sulcus (pl., sulci): a furrow or groove; a groove-like excavation.

summit: the very top.

sutural: of or pertaining to a suture.

suture: a seam or impressed line indicating the division of the distinct parts of the body wall.

tegmina (pl., tegmina): a covering; the hardened, leathery or horny fore wing in Orthoptera and certain Homoptera.

terminal: situated at the tip or extremity; opposed to basal.

testaceous, testaceous: bearing a test or hard covering; brownish-yellow.

translucent: semi-transparent; admitting the passage of light, but not of vision.

Transverse, transversus: broader than long; running across; cutting the longitudinal axis at right angles.

transverse sulci: the transverse grooves of the pronotum in many Orthoptera.

tricarinate: with 3 carinae or keels.

triquetral, triquetrous, triquetrum: triangular in section, with 3 flat sides.

truncate, truncatus: cut off squarely at tip.

tubercle, tubercule, tuberculus (pl., tuberculi): a little solid pimple or small button.

tumid, tumidus: swollen; enlarged; puffed up.

ulnar area: in Orthoptera, median area.

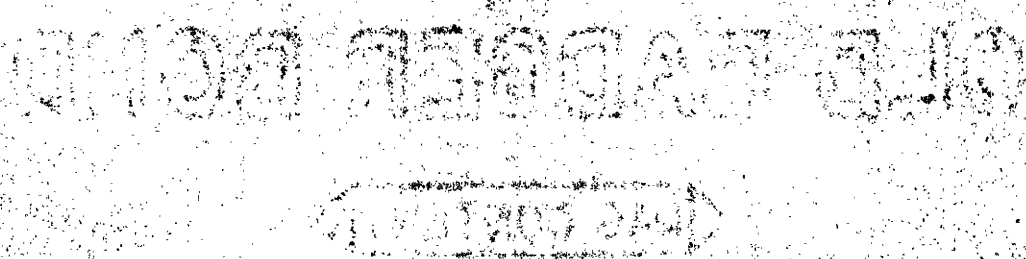
uni-: Latin prefix; 1.

venter: the belly; the under surface of the abdomen as a whole.

ventrad: toward the venter; in the direction of the venter.

ventral: pertaining to the under surface of the abdomen.

vertex: the top of the head between the eyes, front and occiput.



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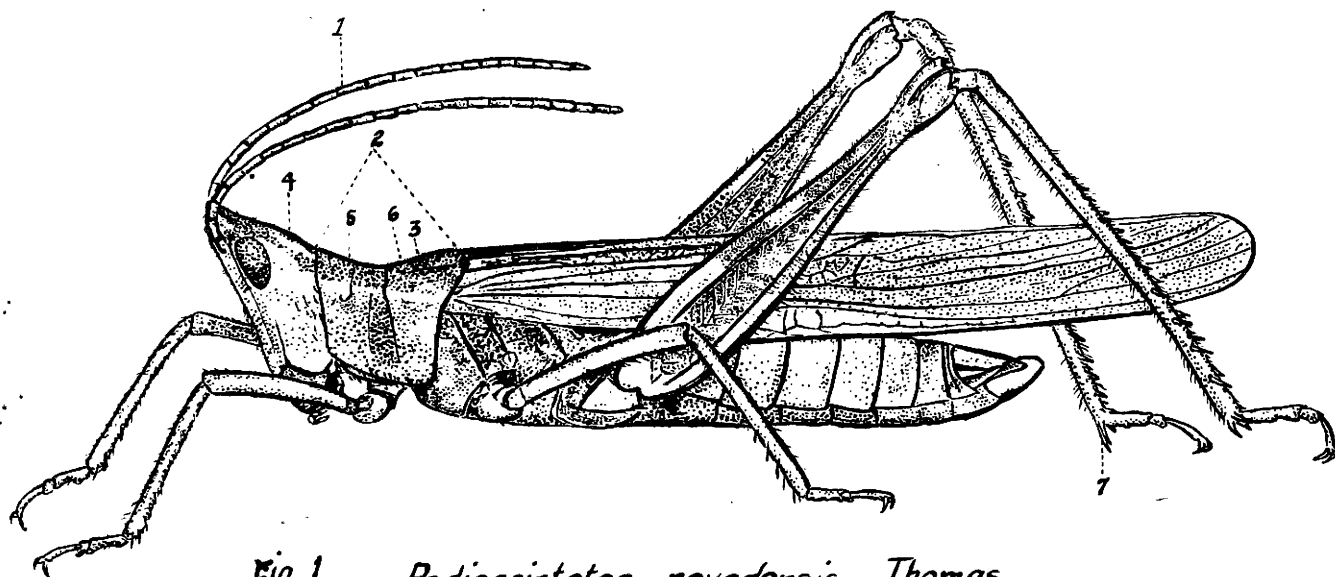


Fig. 1 *Pedioscirtetes nevadensis* Thomas

1. Subensiform antennae
2. Pronotum sellate
3. Hirsute pronotum
4. Ascending fastigium
5. Prozona
6. Metazona
7. Internal spurs of caudal tibia slightly unequal in length.

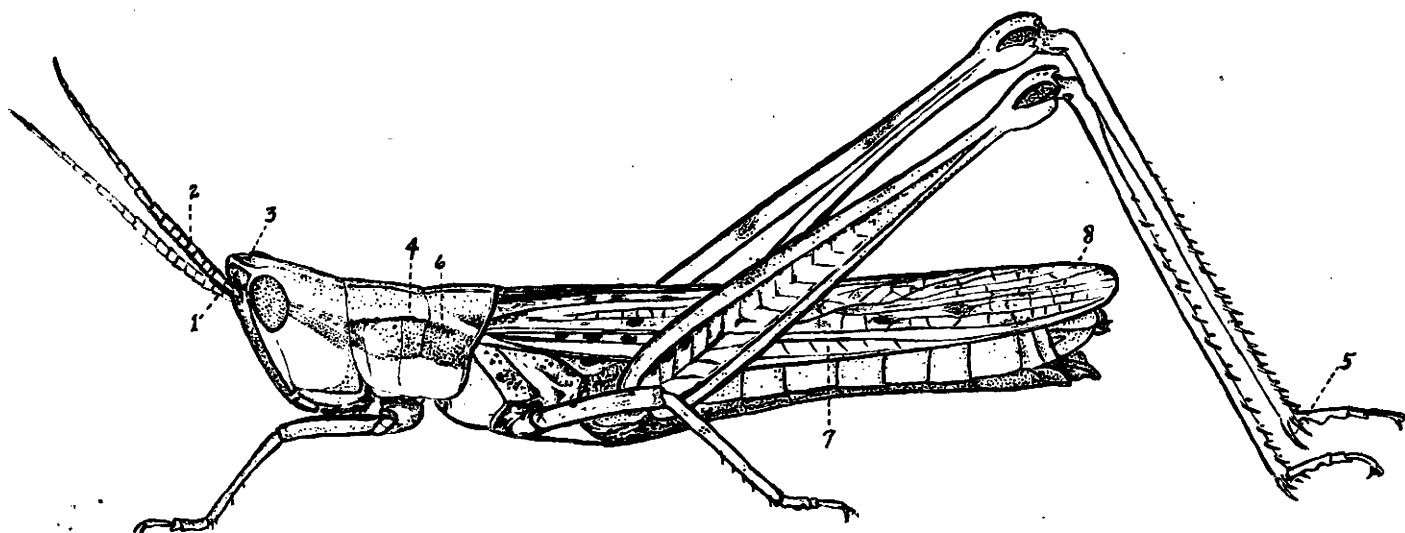


Fig. 2 *Cordillacris occipitalis* (Thomas)

1. Foveolae invisible from above
2. Antennae subensiform
3. Fastigium concave
4. Lateral carina
5. Internal spurs of caudal tibia moderately unequal
6. Lateral carina well indicated in color
7. Fenestrate of marginal field of tegmina
8. Wings fully developed

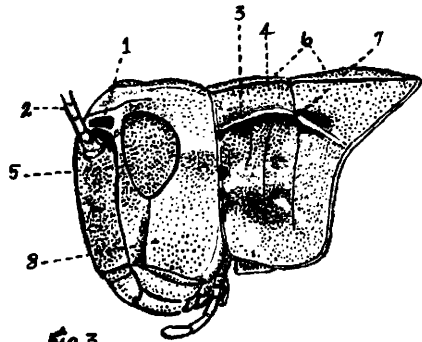


Fig. 3

Psoloessa d. delicatula (Scudder)

1. lateral foveolae decided and visible from above.
2. Antennae simple.
3. lateral carina of pronotum delicate.
4. Median carina percurrent and distinct.
5. Eyes short.
6. Prozona shorter than metazona
7. lateral lobes of pronotum distinctly compressed.
8. Cheeks not too inflated.

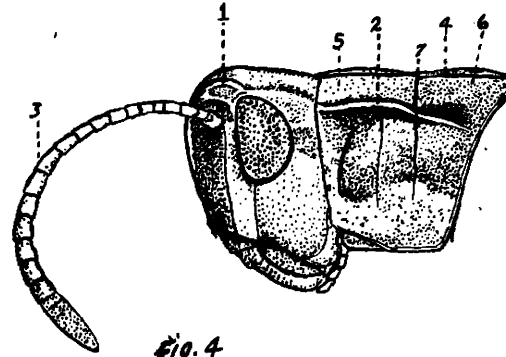


Fig. 4

Aeropedellus clavatus (Thomas)

1. lateral foveolae visible from above
2. lateral carina present and strongly constricted.
3. Antennae clavate
4. Median carina
5. Prozona
6. Metazona
7. Transverse sulcus, of pronotum.

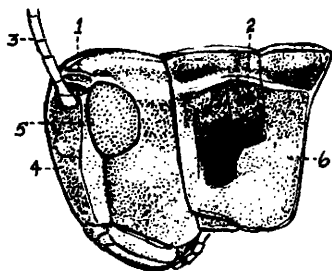


Fig. 5

Bruneria alticola (Rehn)

1. Lateral foveolae visible from above.
2. Lateral carina weakly arcuate constricted, augmented in appearance by color pattern.
3. Antennae simple, normal.
4. Face rounded.
5. Eyes almost vertical
6. Pronotal lateral lobes with dorsal length less than depth.



Fig. 6 *Cordillacris crenulata* (Bruner)

Wing showing block arrangement, which run together.

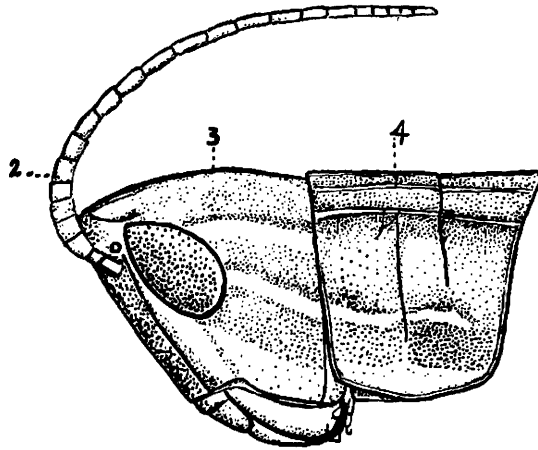


fig. 7. *Amphitornus coloradus ornatus*

1. Lateral foveolae invisible
2. Antennae slightly subensiform
3. fastigium convex
4. Supplementary lateral carina of pronotum (sometimes absent).

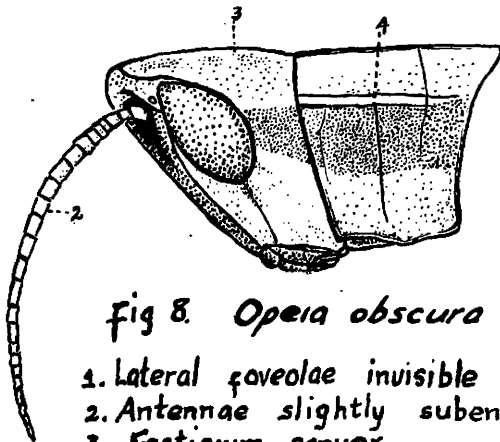


fig 8. *Opeia obscura obscura* (Thomas)

1. Lateral foveolae invisible
2. Antennae slightly subensiform
3. fastigium convex
4. Straight lateral carina of pronotum

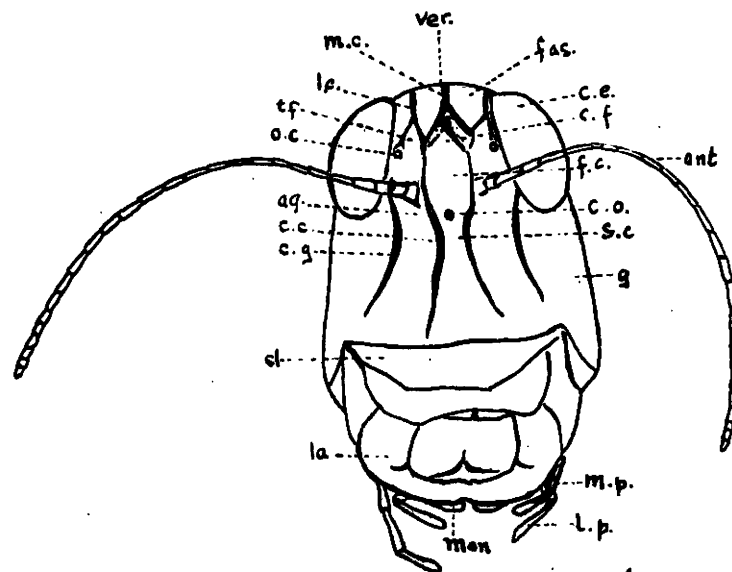


Fig. 9 front view of head, showing parts
 ver. - Vertex; m.c. - Median carina of the fastigium;
 lc. - Lateral carina of the fastigium; tf. - Tempora,
 temperal foveola; oc. - Ocellus; ag. - Antennae groove,
 c.c. - Lateral carina of the frontal costa; cg. - Carina of
 the antennae groove; cl. - Clypeus; la. - Labrum; man -
 Mandible; fas. - Fastigium of the vertex; c.e. - Compound
 eye; cf. - Central foveola; fc. - Frontal costa;
 ant - Antennae; co - Central ocellus; sc - Sulcation
 of the frontal costa; g - Gena, cheek; mp - Maxillary
 palpus; lp - Labial palpus.

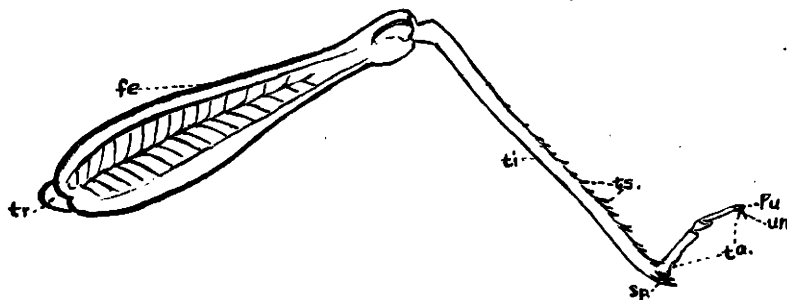


Fig. 10 Diagram of leg showing parts
 fe - Femur; ti - Tibia; ts - Tibial spines
 sp - Spurs; ta - Tarsi; pu - Pulvillus;
 un - Ungues; tr - Trochanter.