NOTES ON OREGON ORTHOPTERA WITH DESCRIPTIONS OF NEW SPECIES AND RACES

BY

B. B. FULTON.

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NOTES ON OREGON ORTHOPTERA WITH DESCRIPTIONS OF NEW SPECIES AND RACES.*

B. B. FULTON,
North Carolina State College.

While associated with the Oregon Agricultural Experiment Station, from 1919 to 1924, the writer collected and studied the Orthoptera of the state as opportunity permitted while carrying on the regular economic work. The more important results of these studies are brought together in this paper, which is not intended as a complete list of the Orthoptera of Oregon. The part on distribution and ecological relations is placed last so that reference to new species and races will not precede their description.

PART I.

DESCRIPTION OF NEW SPECIES AND RACES AND SPECIAL NOTES ON OTHER SPECIES.

Blattidæ

Parcoblatta americana (Scudder).

Large and very small nymphs found in the fall; adults in May. This species, like most of the family, leaves its hiding places at night and prowls about in search of food. One adult was observed chewing at a hole in an apple about six feet above the ground.

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Acrididæ.

Acrydium granulatum Kirby.

This is the most common grouse locust and seems to have practically state-wide distribution. It is found on damp ground whether in meadow or woods, mountain slope or marsh. Adults taken in June, July, August and October.

Telmatettix hesperus Morse.

This species has been found only on gravel and sand bars of rivers, where it is abundant. Adults were taken on the Willamette River at Corvallis in September, and at Eugene in November on the Umpqua at Roseburg in August, and by F. H. Lathrop on the Klamath River at Hornbrook, California in August.

Paratettix toltecus (Saussure).

This species was collected by F. H. Lathrop at the junction of the Klamath and Shasta Rivers near Hornbrook, Calif., a few miles south of the Oregon line. Hebard (8) records specimens collected at Corvallis, June 24, 1925, by E. R. Buckell.

Napaia aspasma (R. & H.).

Found at the border line of forest and meadow at Woodruff Meadows, Jackson County, and one specimen among St. John's-wort on the south slope of Jackson's Hill, Corvallis, about a hundred feet from the forest border. This species stridulates by rubbing the hind femora against the tegmina. The song resembles that of *Chloeatis conspersa*, being a series of faint rasps about three or four per second. The species was described from Syskiyou, Oregon, where it was taken around the border line of mountain-meadow and forest, as were the writer's specimens.

Chorthippus curtipennis oregonensis (Scudder).

This race is very poorly defined. All of the Oregon material in the writer's collection has smaller and shorter antennæ in the male sex than eastern specimens, but this is a very uncertain character for the difference is not great. In western Oregon the tegmina of the males are much shorter than the abdomen and those of the females are about equal to the head and pronotum. This does not hold true for specimens from Woodruff Meadows or eastern Oregon, in which the male tegmina reach

or exceed the tip of the abdomen. A median carina on the fastigium of the vertex and black marks on the sides of the metazone of the pronotal disk, characters used by Scudder to define *oregonensis*, may be found in both races.

Arphia saussureana Bruner.

This species was identified by comparison with a specimen from Albany, Oregon, in the Hebard collection, which contains many specimens from California. It is a common species all over western Oregon and is readily distinguished from *Arphia pseudonietana*, which is common east of the Cascades, by the yellowish ventral portions of the body. In the latter species this part of the body is dark brown or black.

Camnula pellucida (Scudder).

A striking difference in general color exists between specimens from western and eastern Oregon. In the west it usually has a dull brown ground color on which the dark brown spots are not conspicuous, while in the arid regions the ground color is pale yellowish buff with contrasting brown spots or the spots may be much reduced.

This species is primarily a grass land species and does not occur to any extent under true desert conditions. It may be found abundant in mountains, valleys or in marshes, in eastern Oregon, and in hilltop or valley prairies in western Oregon. It has the unique habit of congregating for egg laying. At Fox, a bunch grass valley in the Blue Mountains, they selected small knolls or foothills near the forest, for their egg beds. The soil here was of hard texture or stony. Near Silver Lake and Klamath Falls the egg beds were in strips of tule or patches of grass above the general level of the meadow where the soil was full of matted roots.

Conozoa wallula (Scudder).

Although a number of species have been described in this genus the writer has not been able to discover any differences in Oregon specimens that are not covered by the range of variation. Specimens from near the type locality do not appear distinct from specimens from other parts of the state. The carina of the prozone may be notched or deeply cut and the ventro-posterior angle of the lateral lobes varies from a rounded to an acute angle, but is not produced into a tooth. Color

varies from brownish gray to clay color, many having the metazone of contrasting yellowish color. Hind tibiæ vary from yellow to bright red.

Trimerotropis fontana Thomas.

This species is quite variable in most of the characters used by McNeill (9) in separating the species of the *caeruleipes* group. The bands of the tegmina vary from much reduced or indistinct bands confined to the anterior portion or bands very much broken into small spots to very conspicuous bands contrasting strongly with the ground color. The last variation is more common in the Rogue River Valley. The markings of the under side of the hind femora vary in all localities where large series were collected. They may vary from one preapical dark spot on a pale ground, through intermediate stages to those having a pale apical spot on a dark ground. The infuscation of the apical portion of the wing and the distinctness of the band also show considerable variation in any one locality.

Trimerotropis koebelei (Bruner).

Three males and three females from Upper Klamath Marsh compared with the type of this species from Placer Co., Calif., in the U. S. National Museum, appear to be the same species. The specimens were taken in an open pine forest near the marsh. The species is characterized by the dark bands of the tegmina being limited to the lateral field and by a conspicuous whitish band across the face below the eyes extending to the middle of the upper part of the lateral lobes of the pronotum. Part of a series of what is evidently *T. fontana* from McKenzie Bridge show these same color characters less conspicuously. It seems entirely probable that *koebelei* will prove to be no more than one of the numerous color varieties of *fontana*.

Flight Stridulation of the Oedipodinæ.

Arphia saussureana, *A. pseudonietana* and *Dissosteira carolina* produce a crackling flutter when they fly, the noise usually increasing as they suddenly descend from a horizontal flight. The sound may be compared to touching with a piece of paper a revolving wheel the spokes of which are evenly spaced. *Trimerotropis fontana*, *T. pallidipennis* and *Conozoa wallula* produce an undulating clatter in flight, a series of short

buzzing sounds not distinctly separated, at the rate of 3 to 5 per second for the first two and somewhat faster for *Conozoa*. The sound is like touching with a paper a revolving wheel which has a few spokes missing on one side. *Trimerotropis suffusus* produces a series of distinct snaps, about 4 per second. To carry out the analogy we may say that this sound is like touching a paper to the same wheel after removing all of the spokes but one. *Circotettix undulatus* and *C. shastanus* make much louder and sharper snaps which can best be compared to electrics parks, and vary this with an occasional snapping buzz. When not disturbed they may be seen hovering in the air while making the slower snapping noise about 12 to 20 times then suddenly dart with a spiral or looping movement while making the rapid snapping sound.

In a few experiments with some of the western Oregon Oedipodinæ the writer found that removal of the hind legs did not affect the sound. If the tegmina are removed a distinct fluttering sound is made but the louder clatter or snapping sound is absent. With only the tegmina present the grasshopper can fly a little but with no sound at all. When the posterior edge of the tegmina is trimmed off with a scissors the effect is the same as complete removal. Apparently the louder sounds are produced by striking the wings and tegmina against each other during flight.

All of these grasshoppers have a habit of jerking the hind femora upward while walking on the ground. This produces a faint rasping sound which cannot be heard unless the insect is quite close.

Hesperotettix brevipennis pratensis Scudder.

Specimens from La Grande are very similar to specimens of this species from Iowa but specimens from Ontario, Ore., are pale brown rather than greenish in color and have the median line of the pronotum pale with narrow black borders. The species of the genus are extremely variable and difficult to determine.

Melanoplus lovetti[2] new species. (Fig. 1—A, B, C, D, E.)

Type, male; Woodruff Meadows, Jackson County, Ore., Aug. 5, 1922. Types deposited in U. S. National Museum.

[2]Memorial to A. L. Lovett, who was with the writer when the species was collected.

Frontal costa between antennæ about as wide as interocular space, slightly wider below, narrowed above at junction with vertex to three quarters of width at antennæ; broadly and shallowly sulcate below ocellus, slightly convex above. Scutellum of vertex widest at anterior margin of eyes. Vertical width of eyes one and a quarter times horizontal width. Metazone of pronotum more tectiform than prozone, anterior pronotal margin truncate, posterior margin very broadly rounded, median carina distinct throughout, lateral margins of disk nearly parallel on prozone, diverging slightly posteriorly on metazone.

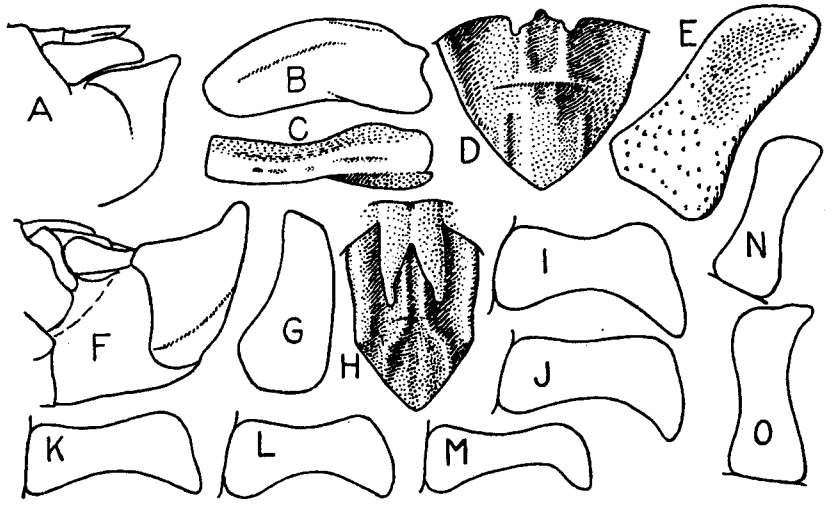

FIG. 1. A–E, *Melanoplus lovetti*. A, Lateral view of genital structures of type. B, Lateral view, middle femur, allotype. C, Dorsal view of same. D, Supra-anal plate, type. E, Cercus, type. F–H, *Melanoplus borealis palaceus*, type. F, Lateral view, genital structures. G, Cercus. H, Supra-anal plate. I–O, Cerci of saltator group of Melanoplus. I, *M. validus calapooyæ*, from Divide. J, K, *M. validus*, extremes of atypical series from Woodruff Meadows, L, *M. validus validus* from Medford. M, *M. validus pinicola* from Klamath Lake. N, *M. debilis?* from Holland. O, *M. validus*, atypical, from Upper Rogue River.

Prosternal spine cylindrical with short conical apex. Tegmina ovate, twice as long as broad, narrowly separated, apices angulate but rounded. Front and middle femora rather short and distinctly swollen, the ventral margins slightly concave in outline, the dorsal margins strongly arched. Middle femora with a rounded dorsal carina and dorso-lateral sulcus on the distal half. Interspace between mesosternal lobes quadrate; metasternal lobes sub-attingent. Dorsal surface of abdomen decidedly tectiform. Extremity of abdomen clavate and elevated. Supra-anal plate triangular; lateral margins broadly rounded in outline, depressed on proximal three fifths; median sulcus broad and deep on proximal third, interrupted at proximal two-fifths by a low narrow transverse carina beyond which narrowed median sulcus fades into an elevated broadly convex quadrate area bounded laterally by slightly higher,

short, parallel carinæ. Furcula, a pair of rounded lobes shorter than the segment bearing them. Cerci about as long as supra-anal plate but extending beyond; sides parallel at middle third, expanded at base to one and two-fifths times the middle width, lower margin nearly straight beyond middle, upper margin converging to a rounded tip, distal portion slightly hollowed externally. Subgenital plate with lateral margins straight in lateral view, sides below lateral margins and median portion distinctly concave so that the terminal portion is conical with a rounded apical tubercle.

Color: Top of head, pronotal disk, tegmina and dorsum of abdomen dull brownish (*Saccardo's umber to sepia* [3]). Underside *ivory yellow* to *cream buff*. Face *ivory yellow* on clypeus, *cream buff* to *chamois* above. Cheeks with a black patch extending below eyes, lower portion *cinnamon buff*. Sides of pronotum with a large black patch between the sulci with narrow extension above to anterior edge, remaining portion of anterior border and lower and posterior borders *cinnamon buff*. Sides of thorax and abdomen largely black except for narrow line of *cream buff* extending dorso-cephalad from hind coxæ. Sides of subgenital plate black. Supra-anal plate and distal portion of cerci *sepia*. Fore and middle legs *clay color* above, paler below. Outer side of hind femur *Naples yellow* at extreme base, shading to *clay color* distally, dorsal edge *clay color* with three patches of *snuff brown* which extend downward as obscure bands on the upper part of outer face; ventro-external face *rufous;* genicular lobes nearly black except distal halves of lower which are *cream buff*. Hind tibiæ pale dull yellow (*deep colonial buff*), spines black.

Allotype, female, same data as type.

Differs from the type in the following characters: Frontal costa between antennæ slightly narrower than interocular space and narrowing but little at junction with vertex. Pronotum relatively broader, with lateral margins of disk diverging more strongly and uniformly from anterior to posterior border, anterior and posterior margins of disk with very slight median emarginations. Tegmina relatively broader and more widely separated. Interspace between mesosternal lobes a little broader than long. Narrowest part of interspace between metasternal lobes about equal to length. Front femora not swollen. Middle femora more swollen than in the type, and decidedly arcuate, in dorsal view clavate and slightly sinuate the proximal three-fifths laterally compressed, the dorsal face flattened and sulcate distally.

Color: Generally lighter and more yellowish than type. Face, cheeks, most of lateral lobes and metazone of pronotum *Naples yellow*. Prozone and top of head *clay color*. Upper third of lateral lobes between the sulci *Saccardo's umber*. Legs *cinnamon buff*, hind femur with two obscure oblique bands of *clay color*. Abdomen and thorax *Saccardo's umber* dorsally, dark sepia on sides. Hind tibiæ pale brownish yellow with black spines.

[3]Names of colors in italics from Ridgway, Color Standards and Color Nomenclature, Washington, D. C.

Paratypes, 13 males, 4 females, same data as type.

MEASUREMENTS IN MILLIMETERS.

	BODY	PRONOTUM	TEGMINA	HIND FEMUR
Type	17.	4.	4.5	9.
Allotype	23.	5.	5.	11.
Paratypes:				
Males	16.–18.	4.	4. –4.5	9.–10.
Females	21.–22.	4.5–5.	4.5–5.	10.–11.

One female paratype is lighter and more yellowish than the allotype, while two have about the same coloration as the type, including the rufous color on the ventral face of the hind femora. The males agree closely with the type except that three lack the rufous color on the ventral face of the hind femora and five have the borders of the lateral lobes of pronotum of the same color as the disk.

The species resembles *M. immunis* Scudder, from around Corvallis and *M. rehni* Hebard from Glendale and Siskiyou. The males can be distinguished from these species by the cerci which curve downward rather than upward. The females are readily distinguished by the peculiar middle femora. This species was found on the south edge of Woodruff Meadows in a small area which is so situated as to be shaded by the forest during most of the day. The ground was covered with moss and short grass. It was found less abundantly at the west edge of the meadow where the ground was damp and covered largely with herbs. None were found in the central portions or on the eastern and northern borders where the ground was dryer.

Melanoplus immunis Scudder (12).

This species is common on Mary's Peak (type locality) and Jackson's Hill near Corvallis, but to the writer's knowledge has not been found elsewhere. Probably it is confined to isolated hilltop prairies. In commenting on a series of specimens collected by the writer in the above localities, Morgan Hebard states in a letter that they prove beyond question that *M. usitatus* Scudder (12) is a synonym. The types of the latter were from Corvallis and probably came from one of the above places.

Melanoplus borealis palaceus,[4] new subspecies. (Fig. 1—F, G, H.)

Type, male. Upper Klamath Marsh, Oregon, Aug. 11, 1922. Types deposited in U. S. National Museum.

Frontal costa at junction with vertex as wide as interocular space; margins diverging slightly to ocellus, below that point subparallel, sulcate below ocellus. Horizontal width of eye four-fifths of vertical width. Pronotum truncate anteriorly, obtuse angulate posteriorly with broadly rounded apex. Median carina low on prozone, well marked on metazone. Prosternal spine in anterior view, slightly clavate, the apex a broadly rounded knob. Mesosternum slightly swollen, but uniformly so and in no sense tuberculate. Interspace between mesosternal lobes quadrate. Metasternal lobes attingent. Tegmina equal extremity of abdomen. Extremity of abdomen somewhat elevated. Subgenital plate long and with apex considerably elevated, in caudal view broadly truncated, caudal face flattened and slightly hollowed just below the apex. Furcula a pair of elongated flattened lobes reaching nearly to the middle of supra-anal plate, the external margins subparallel with each other, the inner margins attingent for two-fifths of length, beyond diverging to apices. Supra-anal plate with sub-parallel high rounded lateral margins on basal three-fifths and with a pair of rather sharp but lower median carinæ, the latter parallel as far as an obscure transverse carina near middle of plate, beyond that point diverging strongly as far as limits of raised lateral margins and beyond that point more elevated and diverging only slightly. Apical two-fifths of supra-anal plate triangular in outline and nearly plane except for the carinæ described above and an obscure median groove. Cerci narrowing to apex, upper margin concave, lower slightly convex, apex obliquely truncated forming an acute but rounded angle with the upper margin; basal width about twice the preapical width.

Color: Top of head and prozone *dark olive*, face and cheeks *citrine drab*. Lateral lobes and metazone *olive brown*. A black bar extends from eye to posterior sulcus of lateral lobe covering dorsal half of lobe. Tegmina *sepia*, with row of obscure darker spots in middle of lateral field. Antennæ, fore and middle legs and base of hind femora *clay color*. Dorsal face of hind femora *olive brown*, external face *olive brown* mixed with *clay color*, ventral face and hind tibiæ and tarsi *vinaceous rufous*. Sides of thorax and base of abdomen black. Ventral side of abdomen nearly to apex of subgenital plate *chamois*, the sides with ground color of the same, heavily mottled with black. Sides and apex of subgenital plate black.

Allotype, female; same data as type. Similar to type but considerably larger and stouter and with relatively more abbreviated tegmina, which fall short of tip of abdomen by 6. mm. Colors similar to those of type but of slightly darker shades. Antennæ have the same color as the hind tibiæ.

[4]Pala, a shovel or spade, referring to shape of male subgenital plate.

Paratypes, 4 males, 7 females; same data as type. All males have the tegmina about equalling the tip of the abdomen. In the females the tegmina fall short of tip of ovipositor, from 2 to 7 millimeters. Little variation in color. One male has sides of subgenital plate *sepia* instead of black.

MEASUREMENTS IN MILLIMETERS

	BODY	PRONOTUM	TEGMINA	HIND FEMUR
Type	21.	4.5	14.5	11.5
Allotype	30.	6.	15.5	15.
Paratypes:				
Males	19.–21.	4.3–4.7	12.5–15	11.5–12.5
Females	26.–30.	5.5–6.5	13.5–16.5	13.5–15.

These grasshoppers were found near the pine woods on the border of a large meadow land known as Upper Klamath Marsh, situated on the plateau between Crater Lake and Silver Lake. It differs from *M. borealis monticola* Scudder known from B. C. and Colo. in the elevated apex of the subgenital plate which shows no resemblance to the *femur-rubrum* group. In this respect it more nearly resembles *M. borealis* (Fieber), but judging by Scudder's figure (11) of that species it differs from it by having the subgenital plate more elevated than prolonged, the cerci less curved, and in lacking the sudden constriction of the elevated lateral margins of the supra-anal plate near its middle. In the shape of the subgenital plate it resembles *M. bruneri* Sc. and *M. excelsus* Sc. but differs from those species in the absence of a prominent tubercle on the mesosternum.

THE SALTATOR GROUP OF MELANOPLUS.

Melanoplus saltator was described by Scudder (11) from Portland and Oregon City. His figure does not show the usual form of the cerci and was either taken from an aberrant specimen or incorrectly drawn. Normally the apex is sub-truncate and with the caudo-ventral angle slightly produced into a rounded lobe. Later Scudder (12) described four more species in this group but did not so place them. They are as follows: *Ascensus* from Mt. Shasta, Calif., *validus* from Divide, Roseburg and Grants Pass with which were listed specimens from Portland, Corvallis, Philomath, Drain, Roseburg and Glendale; *algidus*

from Mary's Peak; and *debilis* from Ashland and Siskiyou. The Willamette Valley specimens which Scudder listed with *validus* must have belonged to *saltator* if they were correctly labelled, but it seems strange that he would not recognize them for the male supra-anal plate is distinctly different from that of any of the other members of the group. Hebard (7) described another member of the group, *calapooyæ* from specimens collected at Divide and Drain and states that Scudder's specimens of *validus* from the former locality would belong to this species, and restricts *validus* to the more southern localities.

The writer collected specimens of this group whenever opportunity permitted in an effort to delimit the range of the various species more accurately. Specimens from Portland, Forest Grove, Salem, Mary's Peak, Alsea Mountain, Corvallis and from various points on the Corvallis-Eugene road up to the north edge of Eugene, all proved to be *saltator* and exhibit very little regional variation. The series from Mary's Peak shows that Scudder's *algidus* is undoubtedly a synonym. Two miles southeast of Eugene *saltator* was absent but in exactly the same type of habitat the writer found typical *calapooyæ*. This was also found at Cresswell, Cottage Grove, Divide (Fig. 1, I) and Drain, showing that the range extends over the divide from the Umpqua Valley to the upper portions of the Willamette. South of Drain the writer's collections are more fragmentary but four males from Medford (Fig. 1, L) and one each from Ashland, Canyonville, and Roseburg are indistinguishable by any characters yet discovered and are assumed to be Scudder's species *validus*. Three males from Holland (Fig. 1, N) in the upper part of the Illinois Valley are doubtfully assigned to *M. debilis** since part of Scudder's series came from Siskiyou in the same range of mountains further east. One of the characters given by Scudder for this species is that most of both sexes have glaucous hind tibiæ. In the other species the hind tibiæ of the females are pink, red or reddish brown. Unfortunately no females were collected by the writer at this locality.

The three males mentioned above and the males of all specimens ascribed here to *validus* have the hind tibiæ *bluish glaucous* or *dark bluish glaucous*. The males of *calapooyæ* have

*Since this manuscript was written one of the above specimens wes sent to Hebard who identified it as the closely related *M. ascensus* described from Mt. Shasta.

the hind tibiæ a *cinnamon buff* with the proximal half more or less suffused with brown on the ventral side and *bluish glaucous* on the dorsal side between the rows of spines. In *saltator* the male hind tibiæ are generally dull *bluish glaucous* blended with *cinnamon buff* distally. A few have practically the same color of tibiæ as *calapooyæ*. The females from all localities have the hind tibiæ light or dark red but in the vicinity of Eugene a large number of both *saltator* and *calapooyæ* have this color strongly obscured with brown.

A series of 19 specimens from Woodruff Meadows (Fig. 1, J, K) and 4 from farther up the Rogue River toward Crater Lake (Fig. 1, O) had *coral red* hind tibiæ in both sexes. The male cerci of these series were compared to those from other localities by means of drawings made to the same scale by means of a cross lined eyepiece micrometer. As a group the cerci were intermediate in form between those of *validus* and *calapooyæ*. Some proved to be almost identical with those of specimens from Medford or Drain. The Woodruff series also occupied an intermediate position in regard to the structure of the male subgenital plate which has a somewhat higher median production of the free margin in *calapooyæ* than in *validus*. The writer was unable to separate the two on the characters of the supra-anal plate and is forced to the conclusion that *calapooyæ* is of subspecific rank. The differences other than those mentioned are the slightly larger size, more robust form and generally darker color of the latter. In general color the Woodruff series is like *calapooyæ* except in the color of the hind tibiæ which is like the new subspecies described below from regions farther east.

Melanoplus validus pinicola,[5] new subspecies. (Fig. 1, M.)

This representative of the saltator group found in the pine forest east of the cascade divide seems worthy of subspecific rank. In linear arrangement *validus* would come between this form and *calapooyæ*.

Type, male, west side of Klamath Lake, Oregon, Aug. 7, 1922. Types deposited in the U. S. National Museum.

General structure similar to *M. validus validus*. Tegmina slightly longer than pronotum, attingent, twice as long as broad, apical portion rectangular but apex rounded. Supra-anal plate with rectangular

[5]Pinicola = pine dweller.

basal portion and triangular apical portion of about equal length; basal portion one and a half times as broad as median length, with a median groove bounded by low ridges, lateral margins elevated; triangular portion with lateral margins not elevated and slightly convex in outline, median portion with broad groove bounded by low ridges which diverge anteriorly and with increased elevation curve outward and meet the lateral margins at the base of the triangular portion. Cerci narrowest near the middle, length nearly five times middle width, base twice the middle width; concave on both margins, the apex curved strongly inward and prolonged caudo-ventrad. Subgenital plate slightly elevated at apex; very similar in structure to that of *M. validus validus*.

Color: Face and cheeks *olive-buff*. Ventral side of body, ground color of legs, and oblique bar on metapleura, *cinnamon-buff*. Dorsal portions of body a very dark brown. Lateral portions of meso- and metathorax and abdomen black. Shiny black postocular bar reaches to metazone. Fore and middle femora tinged with brown distally. Hind femora largely black on outer and dorsal faces, outer face with base and a V-shaped bar near middle *cinnamon-buff*, inner dorsal face with two bands of *cinnamon-buff*, ventral face deeply suffused with *coral red*. Hind tibiæ *coral red*.

Allotype, female; same data as type.

Shows no structural characters to distinguish it from the female of *M. validus validus*. Color similar to type except that face and cheeks are olive brown and ventral faces of hind femora are less strongly suffused with red.

Paratypes, 3 males, 2 females, same data as type; 2 males, 2 females, Upper Klamath Marsh, Aug. 11, 1922; 1 male, 1 female, Anna Creek, on road from Crater Lake to Fort Klamath, Aug. 7, 1922.

MEASUREMENTS IN MILLIMETERS.

	BODY	PRONOTUM	TEGMINA
Type	17.	4.	4.8
Allotype	22.	4.7	4.5
Paratypes:			
Males	17.–19.	4.	3.2–4.8
Females	20.–22.5	4.5–5.4	3.8–5.5

Males of the paratypic series are all very similar to the type in color, but the females show some color phases of the same kind that occur in the females of other members of the saltator group. The two females from the type locality are similar to the allotype, the one from Anna Creek is entirely buff in color

with no dark marks, one from the upper marsh is buff with brown markings and the other is similar but with a decided reddish cast to the dorsal area. All of the paratypes have the *coral red* hind tibiæ but about half of them lack any reddish color on the ventral face of the hind femora.

Melanoplus mexicanus bilituratus (F. Walker).

After studying a large number of specimens from all parts of the state the writer has concluded that all of the *mexicanus* (*atlanis*) group of *Melanoplus* in the collection should be placed in this race. The proportions of the male cerci vary from a little less than twice as long as middle width to nearly three times as long as broad as measured under a microscope with an eyepiece micrometer. The prevailing color of the hind tibiæ over most of the state is red but specimens with glaucous tibiæ occur in series from Corvallis, Hood River, Baker, Drain and Malin. In the Malin series there are only a few with red tibiæ and this series also has consistently narrower male cerci. This series approaches closely to the *devastator* group, and may possibly represent another geographical race but certain specimens from other series approach them so closely that the degree of difference is very slight. This condition agrees with a note by Scudder (11) to the affect that examples from British Columbia and Washington come closer to *atlanis* than those from Nevada.

Melanoplus bruneri Scudder.

Six males from Drain and two males from Grants Pass agree with specimens of this species from South Dakota and Colorado The elevated tip of the subgenital plate is rounded, truncated or slightly notched. In one of the Drain specimens it is decidedly rounded and differs in no important respect from the specimens from the known range of *bruneri*. For this reason these specimens are placed there rather than under *alaskanus*. All were taken in rather hot and dry valley fields.

Melanoplus devastator Scudder.

This species which has practically state-wide distribution exhibits a considerable range of variation even in the same locality. In the majority of specimens the cerci are about three times as long as middle width by actual measurement. At Corvallis it was noted that in certain dry fields and on hilltops the specimens averaged smaller than usual and that the

cerci were relatively more slender attaining a length of four times the middle width. In the shape of the cerci and subgenital plate there is slight difference between extremes of this species and the series of *M. mexicanus bilituratus* from Malin. The shape of the furcula, supra-anal plate and swelling on the mesosternum help to distinguish the two species. Two specimens from Ontario, Calif. have the usual form of supra-anal plate and mesosternum but with cerci only slightly more slender than the Malin specimens mentioned above and with a furcula very much like that of *bilituratus*.

Oedaleonotus enigma (Scudder).

Three males and one female from Hermiston and two females from La Grande. All have the tegmina slightly longer than pronotum. In a series from Wieser, Idaho, four males and one female have tegmina as above, two males and two females have longer tegmina up to one and a half times the pronotum. Of three females from Ontario one has tegmina as long as pronotum, another has tegmina and wings about twice as long as pronotum, and the third has these organs exceeding the hind femora.

Oedaleonotus borckii borckii (Stal).

One male and three females from Grants Pass agree with this species in large size and relatively larger females and form of the mesosternal interspace, but contrary to Scudder's key, (11, 12) all have the dark color of the pronotal lateral lobes extending over the metazone, but in two females the dark band is reduced and confined to the upper margin on the metazone.

Oedaleonotus borckii pacificus (Scudder).

Twelve males and three females from Woodruff Meadows, agree with this race in the size and equality of sexes and in form of mesosternal interspace but in all the dark band of the lateral lobes is confined to the prozone. According to Scudder (11, 12) this color character applies to *borckii*.

Oedaleonotus borckii orientis Hebard (7).

Two males and four females from Merrill found in sage brush desert at edge of marsh bordering lower Klamath Lake. This record extends the known range of the species several hundred miles, the nearest previous record being northeastern Nevada.

Tettigoniidæ.

Phaneroptera furcata furcata, (Brunner).

The stridulation of this species may be of three kinds. The note most frequently heard is a single sharp "zip" made at infrequent intervals by simply separating tegmina and bringing them together again. Another note frequently heard is like the single note rapidly repeated three or four times as if the tegmina were vibrated, while bringing them together. The third form of stridulation has never been observed by the writer outside of Oregon. It consists of a ticking noise like that produced by picking the tip of one thumb nail with the other. The sound is usually repeated several times in series but the frequency varies from two or three seconds apart to a rate too rapid to count. In late afternoon in patches of oak scrub the males perch on the uppermost leaves and appear to be sending Morse code messages to each other. This is probably the most common sound made but is less often heard because it does not carry far. The sound is made by rotating the tegmina on their axes so as to raise the dorsal areas and suddenly bring them together again. Since the sound can be produced if the distal portions of the tegmina are removed it seems probable that it is caused by striking the stridulatory veins together. The female occasionally produces a somewhat fainter sound in the same manner.

The writer has watched the process of egg laying in the margins of leaves and his observations agree with those of Riley (10) except that the insect grasped both the edge of the leaf and the ovipositor with the mandibles instead of merely holding the ovipositor. In this manner the ovipositor was held against the thin chewed edge of the leaf while the sawing process of sliding one set of blades on the other split of the leaf.

In mating the male places the posterior end of the body in front of the female and elevates the wings without spreading them. The abdomen is bent downward and the female licks at the dorsal surface working toward the base of the wings. The male moves backward and extends the tip of the abdomen. The transfer of the spermatophore was not observed. At one time two males were observed with one female. The female moved away after licking the back of one male and the second male took her place and licked at the back of the first male for several minutes. The latter apparently became suddenly aware

of the substitution and kicked the other male with one hind leg and moved away giving vent to several "zips" that seemed to be an expression of irritation. The writer could find no trace of any glandular secretion or of any gland openings on the male but the mating process is very similar to that of the tree crickets in which an alluring gland is known to be present.

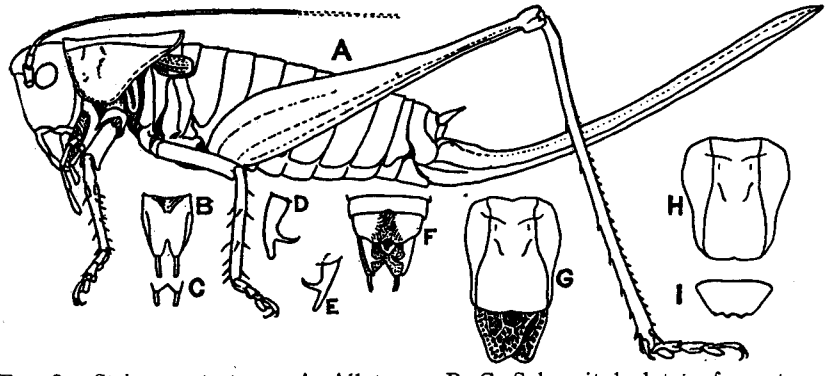

FIG. 2. *Steiroxys strepens*. A, Allotype. B, C, Subgenital plates of paratypes showing extreme conditions in form of terminal notch (B) from Corvallis, (C) from Woodruff Meadows. D, Cercus of Woodruff Meadows paratype. E, same, of type. F, Dorsal view, tip of abdomen, type. G, Pronotum and tegmina, type. H, Pronotum, allotype. I, Subgenital plate, allotype.

Steiroxys strepens[6] new species. (Fig. 2).

Type, male, from top of Jackson's Hill 6 miles North of Corvallis, Ore., July 9, 1922. Types deposited in U. S. National Museum.

Vertex well rounded in profile joining the occiput with scarcely any change in curvature. Eyes nearly circular in outline. Pronotum with well marked median and lateral carinæ. Lateral carinæ converge slightly to the first sixth, diverge to the posterior two-fifths, remaining portions parallel. Disk of pronotum nearly flat, truncate anteriorly, slightly rounded posteriorly; anterior margin three-fourths as broad as posterior margin. Lateral lobes one and three-fourths times as long as deep; posterior margin distinctly sinuate. Tegmina project a little less than half the length of pronotum; outer margins sharply inflected beneath a stout curved vein so as to be invisible from above. Front tibiæ armed above with three spines on outer border and below with six spines on both borders. Middle tibiæ with four rows of spines but only two in upper anterior row. Hind femora unarmed. Distal three-fourths of hind tibiæ with a few short spines on both margins below and with numerous close set short spines on both margins above;

[6] *strepens* = noisy.

with short and long subequal pairs of apical spurs below and a short pair above. Abdomen without a trace of raised median carina. Tenth abdominal segment notched posteriorly; dorsal median portion for full length of segment of sunken soft integument covered with fine hairs. Supra-anal plate appears as a triangular projection deeply hollowed above. Subgenital plate with sub-parallel lateral carinæ extending to bases of finger-shaped styles; a V-shaped notch between the styles. Cerci gently curved throughout on outer border; terminal portion finger-shaped, nearly straight and with rounded apex. A curved spine projects perpendicularly inward just beyond the middle of the cercus and terminates in a sharp claw.

Color: Grass green when alive. Dry specimen a light yellowish brown with greenish cast on legs.

Allotype, female, same data as type.

Disk of pronotum narrower than in the male and less expanded posteriorly. Tegmina small ovate pads projecting from under the posterior portion of the lateral lobes. Subgenital plate with posterior border about half the anterior border; sides nearly straight; posterior border with a shallow rounded median notch and a pair of smaller lateral excavations. Ovipositor slender, strongly curved at base but with distal half nearly straight.

Paratypes, 5 males, 7 females, same data as type, and 11 males from Woodruff Meadows, Jackson County, Ore., about thirty miles southwest of Crater Lake, altitude 2800 feet. In the shape of the pronotum, tegmina and last dorsal segment of abdomen the series holds fairly constant. There is some variation in the proportions of the male cerci and subgenital plate in the series from both localities. The male cerci of the Woodruff Meadows series have on the average a stouter and shorter apical portion and a longer and more slender inner spine. The notch of the male subgenital plate varies from a slightly obtuse to a slightly acute angle in the southern specimens and from an acute angle to a deep acuminate V-shaped notch in the Corvallis series. The styles of the subgenital plate are also more slender in the latter series.

In color all agree with type except one of the Woodruff Meadows series which appears to have been light brown when alive. The hind femora of this specimen have numerous dark brown transverse streaks near the base; the lateral lobes of the pronotum are dark brown with buffy ventral and posterior borders; the vertex is outlined on sides and anteriorly with a blackish U-shaped mark.

The species differs from others of the genus in the shape of the male cerci. From specimens at hand of what appears to

be *S. pallidipalpus* they differ in the absence of any trace of abdominal median carina, broader pronotal disk, more slender ovipositor, larger size and in the shape of the hind tibiæ, which are narrower in longitudinal diameter. From the lateral view the hind tibiæ are not much broader than from the posterior view, while in *S. pallidipalpus* the lateral width is fully twice the posterior width.

MEASUREMENTS IN MILLIMETERS.

	PRONOTUM	HIND FEMUR	HIND TIBIA	OVIPOSITOR
Type	7.2 x 4.4	19.	18.5	
Allotype	7.4 x 3.9	23.	21.	27.
Paratypes: (extremes)				
Males—				
Corvallis	7. x 4.2	20.	19.	
	8. x 4.8	21.	20.	
	7.6 x 4.			
	7.8 x 5.			
Woodruff M.	6.8 x 4.6	18.5	17.	
	7.8 x 5.	19.5	18.	
	7.4 x 4.4			
Females	6.8 x 4.2	21.	20.	24.
Corvallis	7.4 x 4.	22.5	21.5	26.
	7. x 3.7			

The presence of these insects was revealed by their song which is a series of very short rasping chirps. It starts with a few notes per second but quickly increases the speed to a rapid flutter which is kept up for a long period. On Jackson's Hill north of Corvallis it was common on the northwest side of the summit and in a small patch of prairie in a pass between that hill and the next one to the north. It was usually found where somewhat taller prairie plants and patches of brake fern occurred. At Woodruff Meadows it was common in clumps of grass or herbs over most of the meadow except the wet central portion.

On Jackson's Hill the species was found in the first and second instars on April 26, 1923, and in the last and next to last nymphal instars on May 25, 1924. In the first instar the ground color is very pale brownish gray, with the sides of thorax and abdomen entirely black except the posterior borders of the lateral lobes which are ivory. An ivory line borders the black

above on the abdomen and the median line is bounded by narrow black lines from vertex to tip of abdomen. In the second instar the black lines are partly faded and the black of the sides reduced to the extreme upper portion, while the remainder of the sides is pale green. In both first and second instars the vertex protrudes forward as a rounded knob.

Neduba carinata Walker.

An account of the habits, life history and remarkable range of color variation of this species has been published elsewhere.(6)

Cyphoderris piperi Caudell.

This species was originally described as a subspecies of *monstrosa* by Caudell (1). When a series of males collected by the writer near Woodruff Meadows were compared with males of *C. monstrosa* collected in British Columbia by E. R. Buckell it was found that the genitalia were strikingly different. Drawings of the genital armatures were compared with the types of *monstrosa* and *piperi* by Nathan Banks and A. N. Caudell respectively and both agreed that they represented distinct species; the British Columbia specimens corresponding with the type of *monstrosa* and the writer's specimens with *piperi*. The writer first encountered this insect in the forest near Woodruff Meadows. While setting up camp by a small river at dusk my attention was attracted by a song that sounded like a small cricket in a clump of small bushes a few feet away. It was a high pitched metallic trill one to three seconds in duration and repeated at a rate of about fifteen times per minute. When the apparent source of the sound was reached the singer still seemed to be several feet away and it soon became evident that the song produced an auditory illusion of nearness that was very deceptive. After stalking the sound back into the woods about a hundred yards I discovered the insect sitting on a branch of a small fir a few feet above ground. At close range the sound was loud, penetrating and shrill and with a rapid pulsation or beat. Mr. A. N. Caudell told the writer that he experienced the same auditory illusion when he collected the type on Mt. Ranier. The first few specimens caught were grabbed at quickly so as to give no opportunity for escape but later the writer decided to test the insect's agility. When the antennæ were touched it moved backward along the branch and when the body was touched it simply dropped to the ground and remained motionless. When

touched again it turned over on its back as if dead. With further stimulation it would try to crawl away or remain motionless. They would stop singing at the slightest jar of the ground but were not disturbed by a flash light. Most of them were on low branches but one was found on the ground and another about ten feet above ground. The latter was not disturbed at first and several hours later was found in the same place and induced to drop to the ground by touching it with a stick. At Crater Lake they were usually beyond reach in the trees, the exact height difficult to estimate. In the evening one was observed there to have twenty notes per minute. They sing from dusk until the temperature drops too low for activity.

Tropidischia xanthostoma (Scudder).

Notes on this species have been published (5).

Ceuthophilus agassizii (Scudder).

On Oct. 8, 1923, several adult specimens were found in some old rat or gopher holes under a board near the college barns at Corvallis. They were kept in a cage for several weeks and fed on pieces of meat and apple. The mating process observed differs so much from other Tettigoniidæ that it seems worthy of mention. The male would walk backwards toward the female and on touching her would twist the abdomen so as to bring the ventral side of the tip in contact with the base of the ovipositor. They would remain for a minute or two with heads in opposite directions. Many attempts seem to be necessary before mating actually takes place. The process was observed several times and no spermatophore was formed. These specimens and one collected by L. P. Rockwood at Forest Grove were identified by T. H. Hubbell.

Gryllidæ.

Oecanthus.

This genus is represented in Oregon by three species, *californicus*, *nigricornis*, *argentinus* and *niveus*. The last is represented by two physiological races an account of which has been published (2). A general account of the species with detailed description of *califonicus* (3), and a special study of the *nigricornis* group (4), have also been published.

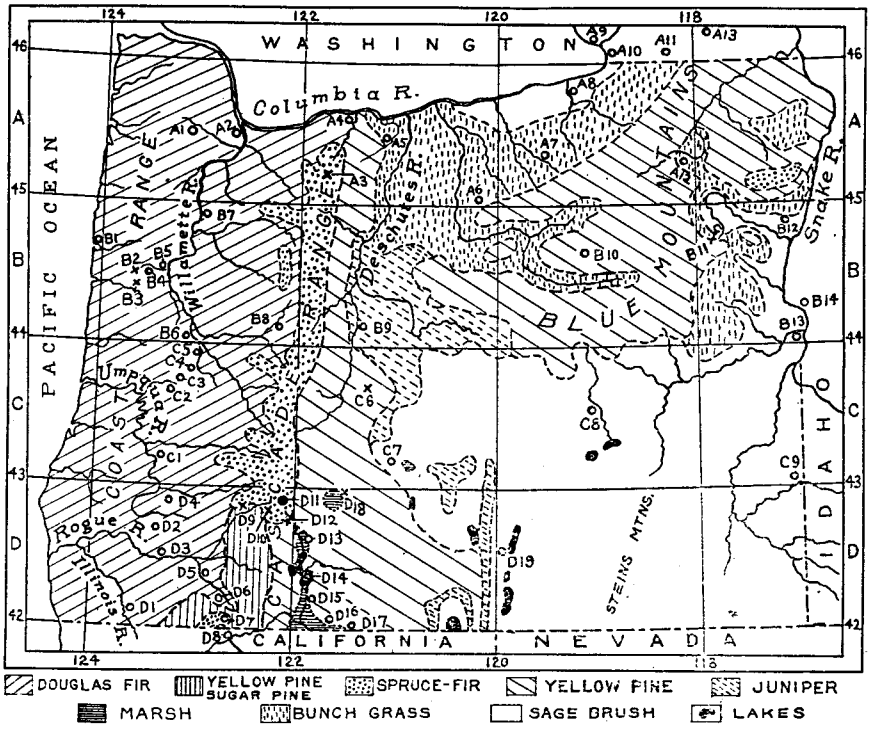

FIG. 3. Map showing natural vegetation areas of Oregon. (Copied from Shantz and Zon, 13.) Localities mentioned are listed alphabetically with numbers appearing on the map. Letters refer to horizontal grouping between the parallels of latitude; each group is numbered from west to east. Cities and villages are indicated by circles, other localities by crosses.

Alesa Mountain.....B 3	Glendale.....D 2	Newport.....B 1
Anna Creek.....D 12	Grants Pass.....D 3	Ontario.....B 13
Ashland.....D 6	Halfway.....B 12	Pasco, Wash.....A 9
Baker.....B 11	Heppner.....A 7	Paulina Mtns.....C 6
Bend.....B 9	Hermiston.....A 8	Philomath.....B 4
Burns.....C 8	Holland.....D 1	Plush.....D 19
Canyonville.....D 4	Hood River.....A 4	Portland.....A 2
Cottage Grove.....C 4	Hornbrook, Calif....D 8	Ronan, Wash.....A 13
Crater Lake.....D 11	Jordan Valley.....C 9	Roseburg.....C 1
Creswell.....C 5	Klamath Falls.....D 15	Salem.....B 7
Divide.....C 3	Klamath Lake.....D 14	Silver Lake.....C 7
Drain.....C 2	La Grande.....A 12	Siskiyou.....D 7
Dufer.....A 5	McKenzie Bridge....B 8	Upper Klamath
Eugene.....B 6	Malin.....D 17	Marsh.....D 18
Forest Grove.....A 1	Mary's Peak.....B 2	Upper Rogue River..D 10
Fort Klamath.....D 13	Medford.....D 5	Walla Walla, Wash..A 11
Fossil.....A 6	Merrill.....D 16	Wieser, Idaho.....B 14
Fox.....B 10	Mt. Hood.....A 3	Woodruff Meadows..D 9

PART II.

Distribution and Ecological Relations.

The state of Oregon is divided into two uneven portions by the high Cascade Range which reaches a maximum elevation of over eleven thousand feet at Mt. Hood. The western third has a broad central depression in which are three main river valleys, Willamette, Umpqua, and Rogue. These are separated by low mountain divides and the Rogue is separated from California by the much higher Siskiyou range. Between the valleys and the coast is the much dissected Coast Range. The eastern two thirds of the state is largely an arid plateau. The Blue Mountains cover a considerable portion of the northeast quarter of the state, and reach an elevation of over nine thousand feet in the Wallowa Range.

The natural vegetation areas of the state and localities mentioned are shown in the map (Fig. 3). On account of the diversity of habitats a discussion of the Orthopteran fauna can be facilitated by dividing it into three parts, namely, Western Oregon, the Alpine Cascade regions and Eastern Oregon.

WESTERN OREGON.

This area is shown on the map as the Douglas fir area. The western portion of the Coast Range and the west slope of the Cascades are entirely forested. In the central valleys where the annual precipitation is lower there were originally extensive prairies covering most of the large valley plains. A large part of this area is now under cultivation but the Orthopteran fauna has probably not changed much. The small streams are mostly bordered by deciduous forest containing Oregon ash (*Fraxinus oregana*), the broad leafed maple (*Acer macrophyllum*) and Garry oak (*Quercus garryana*) and other deciduous trees and shrubs.

The valley prairie may merge with the hill prairie extending over the south facing slopes to the summits of hills bordering the valley. More frequently the two are separated by an irregular strip of woods composed largely of Garry oak. This extends upward along the gullies and often forms a border also between hill prairie of the south slope and the fir forest on all other slopes. Part of this oak area is kept in a scrubby con-

dition by recurrent prairie fires. In the valley prairie and lower portions of the hill prairie are numerous thickets of wild rose, and poison oak.

In the virgin condition the heavy Douglas fir forests are inhabited by only one species of Orthoptera, the cave cricket, *Tropidischia xanthostoma* (Scudder) which has been found abundant under log bridges crossing the mountain streams. It probably also occurs in any natural dark cavities along the streams. *Neduba carinata* Walker also occurs in the fir forest along roads, in burns or wherever the forest is more open. It is more strictly a border species.

In the prairies Orthoptera are abundant. Since there is some difference between the fauna of the northern and southern parts of western Oregon the Willamette valley will be considered first. The following more strictly prairie species are universally present at the proper seasons: *Chorthippus curtipennis oregonensis* (Scudder), *Camnula pellucida* (Scudder), *Arphia saussureana* Bruner, *Melanoplus devastator* Scudder, *M. femur-rubrum* (De Geer), *M. mexicanus bilituratus* (F. Walker) and *Oecanthus nigricornis argentinus* Sauss. *Conocephalus fasciatus vicinus* (Morse) and *Acrydium granulatum* Wm. Kirby are found in more moist portions of the area. *Parcoblatta americana* (Scudder) and *Pristoceuthophilus pacificus* (Thomas) are found under boards, logs, stones and in gopher holes. The former is very common among rocks at the hilltops and has not been found in the valley plain. *Conocephalus occidentalis* (Morse) is found at the edge of prairies bordering the river in the valley plain. *Dissosteira carolina* (Linn), *Trimerotropis fontana* Thomas and *Gryllus assimilis* (Fab.) are more versatile and may be found either in prairie or in open woodland. *Melanoplus saltator* Scudder is found along the borders of woods, in open woodland, or among clumps of shrubs. *Trimerotropis suffusus* Scudder is found in hilltop prairies but on the slopes it remains fairly close to the woods. It is not found in the valley plain except at certain points in woods immediately bordering the river.

Another group is made up of those species associated with the deciduous woods or thickets. These include *Neduba carinata* living on the ground mostly where covered with deciduous dead leaves but also among more open fir forest or borders; *Oecanthus niveus* (De Geer), physiological race A,

mostly in ash and oak trees; *O. niveus*, race B, in thickets of rose, scrub oak and wild brambles; *O. californicus* Saussure in thickets containing a small species of rose used as a depository for the eggs; *Phaneroptera furcata furcata* (Brunner) mostly on small oaks.

On the gravel bars along the Willamette River two species that are more typical of the eastern desert regions are found, namely *Trimerotropis pallidipennis pallidipennis* (Burm.) and *Conozoa wallula* (Scudder). These strong flyers spread over into nearby fields but are not found far from the river. Where small plants are growing on the gravel the grouse locust *Telmatettix hesperus* Morse is found.

A few other species of this general region are of rare occurrence or irregular in distribution. *Melanoplus immunis* Scudder is found abundant in a meadow at the summit of Mary's Peak, at an altitude of about 4,000 feet, and on some of the lower hills. It is more common near the forest borders. *Podisma polita* Scudder is abundant on the same mountain but only on a steep slope of jumbled rocks overgrown with thimble berry in a small opening in the forest near the summit. A few specimens have also been found on other near-by mountains and hills near Corvallis. The occurrence of *Napaia aspasma*, *Steiroxys strepens* and *Ceuthophilus agassizii* near Corvallis has been previously mentioned. *Pristoceuthophilus celatus* (Scudder) is apparently rare about Corvallis. *Mymecophila oregonensis* Bruner was found in ants nests in a valley of the coast range west of Corvallis.

Most of the common species mentioned above range westward through the coast range. The prairies disappear but there are old burned areas, pastures and roadways where the prairie and border species find suitable conditions. Near the ocean the number of species and individuals is reduced. In a sand dune area near Newport only three species were found, *Melanoplus mexicanus bilituratus* in grassy places between dunes and *Dissosteira carolina* and *Trimerotropis suffusus* near wooded dunes.

The somewhat hotter and dryer regions of the Umpqua and Rogue River valleys of southwestern Oregon are inhabited by a larger number of species. All of the Northern species mentioned have been found in this region or have been recorded in literature from southern Oregon or Califonia except *Ceuthophilus agassizii*

and the two species mentioned below which are replaced in southern Oregon by closely related species. *Melanoplus saltator* is replaced south of Eugene by *M. validus calapooyæ* and this in turn is replaced further south by typical *validus*. *M. immunis* is apparently replaced by *M. rehni*, both hilltop species whose exact range is not known. These species occupy the same ecological niche as the species they replace, and species common to both regions show the same choice of habitat.

Species common in the southern valleys but not represented in the Willamette are *Dissosteira spurcata* Saussure and *D. venusta* (Stal), both strong flying prairie and woodland border species.

Other species of more local distribution that have been found are: *Oedaleonotus borckii borckii* (Stal), open field, Grants Pass; *Melanoplus bruneri* Scudder, fields, Drain, Grants Pass; *Arphia ramona* Rehn, wooded mountain ridges and rock outcrops near Ashland.

In the Rogue River Valley *Melanoplus devastator*, *M. femur-rubrum* and *Camnula pellucida* occurred in destructive numbers in 1922.

The writer did not have opportunity to collect in yellow pine-sugar pine area shown on the map (Fig. 3) lying west of the Cascade Divide in southern Oregon.

ALPINE AREAS.

On the heavily forested west slopes of the Cascade Range Orthoptera are most common in clearings, burns and along roads. Such places present about the same fauna as the coast range. In the higher valleys are many small natural prairies where Orthoptera are very abundant. These are probably developed from ponds or bogs. Their isolation and diverse conditions as to moisture and temperature tend to give them a more or less individual fauna. Few of these areas have been investigated and they offer an unusual opportunity for anyone interested in ecology or taxonomy.

On August 5, 1922 the writer visited a small prairie called Woodruff Meadows about thirty miles southwest of Crater Lake, at an altitude said to be about 2800 feet. While this can hardly be considered Alpine conditions it is similar to such areas found more commonly at higher altitudes. There was a striking zonation of the vegetation. The center contained some

surface water and was covered with a high sedge and large lupines. Surrounding this was a wide zone of damp ground with shorter swamp grasses, and another zone of dryer ground bordering the forest and covered mostly by herbs. In the central area the only abundant species was *Melanoplus bivittatus* (Say). In the middle zone *Chorthippus curtipennis oregonensis* was most abundant but this zone also contained many of the first species. At the eastern end of this zone was a crescent shaped dryer area of short grasses where *Camnula pellucida, Oedaleonotus borckii pacificus* (Scudder) and *Steiroxys strepens* were abundant. The latter was also found in grass clumps over most of the meadow except the central portion. The commonest species in the herb border was the red-legged *Melanoplus validus*, showing characters of intergradation between the three races previously discussed. On the south side of the meadow a shaded lobe with damp mossy ground and short grass, contained *Acrydium granulatum, Melanoplus lovetti* and *Steiroxys strepens.* The forest borders were dryer, with short grass or partly bare ground and there the common species were *Trimerotropis fontana* and *Cratypedes neglectus* (Thomas). *Napaia aspasma* (R. and H.) occurred along the southeast border.

Neduba carinata is common in more open parts of the Cascade forest slopes but apparently it does not extend to the higher alitudes of the divide. *Cyphoderris piperi* was found in the forest near Woodruff Meadows and at the timber line at Crater Lake. The writer heard an insect which was probably this species singing in trees at the timber line on Mount Hood. It was described from Mt. Rainer much farther north.

The isolated alpine meadows of the higher parts of the Cascade divide contain some species which are not found at lower altitude. These regions also offer a rich field for further investigation. In the meadows at Crater Lake the writer found *Bradynotes deplanata* Hebard and *Camnula pellucida* abundant in an area of short grass. *Trimerotropis suffusus* occurred on ridges in the same general area and *Circotettix shastanus* Bruner on and near rocky cliffs. The writer also has specimens of *Melanoplus alpinus* Scudder and *M. montanus* (Thomas) and has seen specimens of *Bruneria shastana* (Scudder), all collected by L. P. Rockwood in the Crater Lake meadows. A pair of the last species was collected by the

writer at the summit of Paulina Mountain, an isolated volcanic crater south of Bend. The lower portions of the meadow of Crater Lake where plants were waist high contained few Orthoptera. Alpine species of the Mt. Hood region include *Melanoplus oreophilus* Hebard, *Pristoceuthophilus cercalis* Caudell and *Prixocnemis oregonensis* Caudell. A specimen of the last species was collected by W. J. Chamberlin from a slab pile in Josephine County, at the western end of the Siskiyou Mountains. The writer has two specimens of *Acrydium acadicum brunneri* (Bolivar) collected by J. C. Bridwell at Cash Creek on the Santiam road and one collected by W. J. Chamberlin labelled Santiam National Forest.

EASTERN OREGON.

The territory east of the Cascade Divide includes the following natural vegetation areas: (1) The yellow pine forests of the eastern slope of the Cascades and adjacent plateau and of the Blue Mountains in the northeast, (2) the juniper woodland between the two yellow pine areas and in smaller areas to the south, (3) areas originally in bunch grass including the valleys and lower mountain slopes in the Northeastern quarter, (4) sage brush desert including most of the southeastern quarter and a part of the Columbia Valley, (5) isolated marsh or tule areas the largest of which is around Klamath Lake.

The Orthoptera of eastern Oregon have been collected by the writer only on occasional trips for other purposes and consequently the species discussed represent only a part of the rich Orthopteran fauna of this region.

The yellow pine forests contain many species common along forest borders in western Oregon. They are most common in the open spots but on account of the more open nature of the pine forest are more generally distributed here than in the fir forest. The common species are *Trimeroptopis suffusus*, *T. fontana* and *Cratypedes neglectus*, the last more common at higher altitudes. *Neduba carinata* and *Melanoplus validus pinicola* occur in the Cascade area but have not been found in the Blue Mountains. *Camnula pellucida*, *Conozoa wallula* and *Dissosteira carolina* are found in the small prairies that occur in the pine forest. A specimen of *Dissosteira venusta* from Klamath Lake is probably from such a situation also.

The second, third, and fourth natural vegetation areas can be discussed together for they all represent desert or semi-desert conditions, and all contain a large proportion of various kinds of sage brush. A list of the identified species in the writer's collection with localities follows:

Parabacillus coloradus (Scudder). Boardman.

Acrydium granulatum Kirby. LaGrande. On a mountain slope where seepage modified the moisture conditions.

Pseudopomala brachyptera (Scudder). Hermiston.

Amphitornus coloradus (Thomas). La Grande, Hermiston.

Alpha occipitalis occipitalis (Thomas). Ontario.

Alpha occipitalis cinerea (Bruner). Bend.

Orphulella speciosa (Scudder)*. Ontario, small marsh.

Chorthippus curtipennis (Harris). Jordan Valley. (George Orr) Probably from meadows.

Agneotettix deorum (Scudder). Hermiston, La Grande, Ontario.

Psoloessa delicatula (Scudder). Burns. (B. G. Thompson).

Aulocara elliotti (Thomas). Merrill, Burns, La Grande, Ontario, Jordan Valley.

Arphia pseudonietana (Thomas). Baker, Freewater (near Walla Walla, Wash.), La Grande.

Camnula pellucida (Scudder). Merrill, Silver Lake, Hermiston, Walla Walla, Wash., La Grande, Halfway. Found where grass grows abundantly.

Xanthippus corallipes buckelli Hebard. Steins Mtns. and Plush (W. J. Chamberlin), La Grande, Fox. Prefers hills.

Dissosteira carolina (Linnaeus). Hermiston, statewide.

Spharagemon aequale (Say). Fossil (L. P. Rockwood), Boise, Idaho (A. L. Lovett).

Trachyrhachis kiowa kiowa (Thomas). Ontario.

Metator pardalinus (Saussure). Ronan Mt. Wash. (W. C. Handlin)

Conozoa wallula (Scudder). Hermiston, Ontario, Baker, Merrill.

Trimerotropis fantana Thomas. Hermiston, La Grande, Baker, Burns. Near or among trees.

T. pallidipennis pallidipennis (Burmeister). Hermiston, La Grande, Baker, Ontario, Merrill.

T. latifasciata Scudder. Ontario.

T. caeruleipennis Bruner. Tule Lake (near Malin, M. M. Reeher) Pasco, Wash. (A. L. Lovett).

T. cyaneipennis Bruner. Hermiston. Found on a small sage covered hill.

T. suffusus Scudder. Burns, Dufer, La Grande, Ontario. Found most common in or near woodlands.

Circotettix undulatus (Thomas). Hood River, Bend, Merrill, Hermiston, Baker. Found on open hilltops or rock outcrops.

Schistocerca venusta Scudder.[7] Hermiston. Taken in a garden; probably a river border species.

[7]Assignment questionable due to need of revisionary work in genus.

Hesperotettix brevipennis pratensis Scudder. La Grande, Ontario.

Melanoplus bivittatus (Say). Ontario, Halfway, Baker. From irrigation ditches; not a desert species.

M. femur-rubrum femur-rubrum (De Geer). Hermiston, Ontario, Malin.

M. mexicanus bilituratus (Walker). Hermiston, Baker, La Grande, Malin, Ontario.

M. packardi packardi Scudder. Hermiston, La Grande, Ontario.

M. cinereus cinereus Scudder. Dufer, Hermiston, Baker, Wieser, Idaho.

Bradynotes deplanata Hebard. Merrill. Among sage brush near marsh.

Phoetaliotes nebrascensis (Thomas). La Grande. From mountain slope under more moist conditions.

Oedaleonotus enigma (Scudder). Hermiston, La Grande, Baker, Wieser, Idaho.

O. borckii orientis Hebard. Merrill.

Phaneroptera furcata furcata (Brunner). Dufer, female nymph (F. H. Lathrop). From an irrigated area.

Anabrus simplex Haldeman. Klamath Falls, (H. F. Wilson).

Apote notabilis Scudder. Heppner (N. Currin).

Gryllus assimilis (Fabricius). Ontario.

Oecanthus nigricornis argentinus Saussure. La Grande. Most common in weedy places or praries, but also on rabbit brush.

Oecanthus californicus Saussure. La Grande. In thickets of wild rose in mountain gully.

In the marsh areas of eastern Oregon several species of grasshoppers are extremely abundant. *Camnula pellucida* frequently occurs in such numbers as to destroy large areas of vegetation. This is the earliest of the common species to mature. On Aug. 9, 1922 the writer found *Conozoa wallula* and *Dissosteira carolina* more abundant than Camnula in the drained Tule Lake region south of Klamath Falls. *Melanoplus mexicanus bilituratus* was also found there in destructive numbers. Some of these species may have migrated in from surrounding deserts. In the Upper Klamath Marsh on Aug. 11, and 12, *Camnula* was found in destructive numbers but was disappearing rapidly. Other species found there were *Acrydium granulatum, Chorthippus curtipennis, Melanoplus mexicanus bilituratus* and *M. borealis palaceus.*

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