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NOTES ON THE ORTHOPTERA OF NORTH DAKOTA

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During the summers of 1919 and 1920 field studies of the Orthoptera of North Dakota were made by Miss Ada Olson and the writer in a number of localities representative of some of the principal faunal conditions found in the state. This work was undertaken as a part of a biological survey of the state which is being carried on by the North Dakota Biological Station in coöperation with the Museum of Zoology of the University of Michigan, under the direction of Crystal Thompson, Curator of the Station Museum. It was made possible through the efforts and coöperation of Dr. R. T. Young, Director of the State Biological Station.

Comparatively little has been known regarding the Orthoptera of the state. Records from North Dakota are few and for the most part scattered, although in the adjacent regions of Minnesota, Manitoba, and Montana there has been a fair amount of investigation of this group. In the present paper

no attempt has been made to gather together these scattered records; this is in no sense a list of the Orthoptera of the state, but is intended merely as a contribution to the knowledge of its fauna. It makes no pretense to completeness; indeed, another season's work in the northeastern, southeastern, and western parts of the state, where it is most urgently needed, might easily add 15 or 20 species to the 78 here listed. With the addition of previously published records, the number of species definitely known from the state must be in the neighborhood of 85 or 90. The fact that the earlier authors seldom gave a more specific locality than "Dakota" makes the placing of many of their records difficult or impossible.

All of the collections of the season of 1919 were made by Miss Olson with the assistance of Miss Thompson, those of 1920 in large part by the writer. A number of the specimens which have been included in this report were taken by other collectors, whose names are noted in the annotated list of species. In this paper there is recorded a total of 4,805 specimens from North Dakota and 39 from other localities, representing a total of 78 species. The entire collection is preserved in the Museum of Zoology of the University of Michigan, with the exception of a synoptic series deposited in the Biological Station at Devils Lake, and of a number of specimens of species determined by Rehn and Hebard, which are in the collection of the Academy of Natural Sciences of Philadelphia.

The writer wishes here to acknowledge his indebtedness to Miss Crystal Thompson, under whose direction the work was carried on; to Dr. R. T. Young; and to Messrs. James A. G. Rehn, Morgan Hebard, and Dr. A. P. Morse, by whom a number of species were determined and many of the author's determinations verified. Acknowledgments are also due in particular

In considering the various questions involved in the present paper, the writers have endeavored to approach each case in a judicial manner and under the restrictions imposed by the Code. We have attempted to dismiss from our minds everything that has been written by other writers, and without predisposition, prejudice or bias, to consider each case solely on the merits of the original description. The descriptions of Lamarck are to be subjected to the same rules and have been accordingly so treated.

The references given under each form discussed do not represent a synonymy, but are intended to furnish a list of those places in literature which in each case bear upon the question in hand.

At the inception of the work it was agreed by the authors that their conclusions should be submitted to Dr. H. A. Pilsbry for his criticism and that in all cases where they were unable to agree his decision should be final and accepted by the authors. Dr. Pilsbry very kindly consented to act in that capacity, and the authors are under great obligations to him for his interest in the project and for the large amount of time that he has taken in examining the many problems that were thus submitted to him. We have adopted his decisions in all of the contested cases and have quoted largely from his remarks upon others. As now issued, the paper represents the unanimous opinion of all three of us on questions of nomenclature.

We are also very much indebted to Dr. C. W. Stiles, of Washington, D. C., Secretary of the International Commission, for his advice as to the proper interpretation and application of the Code to several cases which arose in the progress of the work.

*Prairies.* This marks the eastern boundary of the Drift Prairie Plain, which has a general elevation of from 1,500 to 1,800 feet, rising gradually toward the west. It is bounded in that direction by an abrupt escarpment 600 to 700 feet high, marking the eastern boundary of the Great Plains, and known as the *Coteau du Missouri*; this runs from near the northwest corner of the state in a general southeasterly direction to the southern border. Within the boundaries of the broader portion of the Drift Prairie Plain are two minor physiographic features, the Mouse River Valley and the Turtle Mountains, which depart somewhat from the general character of this region. That entire portion of the state, constituting approximately half of its area, which lies to the southwest of the *Coteau du Missouri* is occupied by the Missouri Plateau section of the Great Plains province. Its surface varies from 1,800 to considerably more than 2,700 feet elevation, increasing in height toward the southwest. Subordinate but striking topographic features are the valleys of the Missouri River and its tributaries, and the "Little Bad Lands" of the Little Missouri River near the western edge of the state.

The humidity decreases as one goes from east to west across the state; the Red River Valley is comparatively moist, the Drift Prairie Plain semi-arid, and the Great Plains section an arid, semi-desert steppe. The vegetation corresponds rather closely to this change in humidity; in the eastern part of the state the streams and lakes are bordered by heavy forest, and the prairie is covered with a fairly thick and sometimes tall growth of grasses and other herbaceous plants; as one proceeds westward the trees rapidly disappear, the vegetation becomes scantier and more stunted, and the characteristic plants of semi-desert regions, such as sage-brush and cacti, become more numerous. These changes are gradual. corre-

sponding to the gradual nature of the westward increase in aridity.

There is as yet too little data available on the distribution of the Orthoptera within the state to make generalizations possible, but this fauna will probably be found to resemble the flora in being characterized by comparative uniformity from north to south across the state, but by marked changes from east to west. Most of the species, in common with the vascular plants,<sup>4</sup> could probably be placed in three broad categories according to their distribution in North Dakota—(1) generally distributed, (2) eastern, and (3) western. Comparatively few could be designated as forms of northern or southern distribution within the state.

#### NOTES ON COLLECTING LOCALITIES

*Red River Valley.*—Only a small amount of collecting was done in this part of the state. A few days' collecting in the fields and groves bordering the Bois-de-Sioux River at Fargo, and a few specimens from Grand Forks and Pembina give an altogether inadequate idea of the fauna of the valley.

*Drift Prairie Plain.*—A. *Devils-Stump Lake Region* (Devils Lake, Ramsey and Benson counties; Stump Lake, Nelson County; Sheyenne River, Eddy and Nelson counties).—The region about Devils Lake is typical rolling drift prairie, but little dissected, with glacial lakes occupying many of the depressions. Devils Lake is the largest of these, with Stump Lake next in size; within a few miles are a considerable number of small lakes and ponds. All of these lakes at a not far distant time occupied a much larger area than they do at present; the rapid recession of the water in the lakes has left

<sup>4</sup> Stevens, O. A., 1920, The Geographical Distribution of North Dakota Plants. *Amer. Journ. Bot.*, vii, pp. 231-242, 1 fig.

large areas of mud and sand flats and stony beach exposed, which are among the striking features of the region. The neighborhood is largely under cultivation, and almost no areas of untouched prairie of any size remain. The only natural wooded areas occurring in this part of the state are found about the margins of the lakes and streams; these forests are largely of oak, mingled with elm, aspen, and other trees, and are of considerable extent, being from a quarter to one-half mile in depth in places around the margins of Devils and Stump lakes. There are, however, large numbers of planted groves everywhere on the prairies, usually of poplars or other swift-growing trees, which are probably exercising a considerable influence on the fauna. From among the woods on the south side of Devils Lake there rises a dry, grassy elevation of considerable height, known as Sully's Hill, where were found *Melanoplus conspersus* and *Phoetaliotes nebrascensis*, not taken elsewhere in the eastern part of the state. The cultivated fields, grassy prairie, exposed sandy and gravelly flats around the lakes, woodland, the grassy swales in the moist depressions and the marshes about the margins of the lakes and ponds constitute the principal Orthopteran habitats in this region. Although collections were made at a large number of localities in the vicinity of Devils Lake, in this paper no attempt has been made to mention them in detail; instead they have been grouped under the general name of Devils Lake.

B. *Turtle Mountains* (Lake Upsilon, Rolette County; Lake Metagoshe, Bottineau County).—The Turtle Mountains lie midway across the Canadian boundary, occupying portions of Rolette and Bottineau counties in North Dakota, and projecting north into Manitoba; they have an area of from 600 to 800 square miles. They consist of a group of low, drift-covered hills forming a rough table-land, which rises abruptly

on all sides from the surrounding prairie; their surface lies from 400 to 800 feet above the plain, with a maximum elevation of 2,860 feet. They are covered with forests of aspen, balsam poplar, oak, paper birch, and alder, in most places with dense undergrowth; most of the trees are small on account of the destructive fires which have swept this region in the past. Some farming is carried on, and grassy or shrubby clearings surround the farmhouses scattered through the hills; abandoned clearings are also found in different stages of reversion to natural conditions. The region is well watered and poorly drained; many of the valleys are occupied by small glacial lakes, bordered by marshes or by sandy or gravelly beaches, and in the moist depressions there are numerous meadows and swales of tall grass and herbage.

C. *Mouse River Valley* (Bottineau, Bottineau County).—The only collecting done in this area was at Bottineau, near the southwestern foot of the Turtle Mountains. The region is an old lake plain, almost unbelievably level and monotonous; so far as vegetation and insect fauna are concerned it seems to be practically the same as the prairie in the vicinity of Devils Lake. Very little of the original prairie vegetation remains in this vicinity; most of the land is under cultivation, and much of the remainder is overrun with dense mats of Russian thistle.<sup>5</sup> During the summers of 1919 and 1920 crops in this vicinity were almost completely destroyed by plagues of grasshoppers, and for some years previous they had been very troublesome. An examination of the fields in the neighborhood during both summers showed that *Melanoplus mexicanus atlantis*, *Melanoplus bivittatus* and *Camnula pellucida* were the most abundant species in the swarms of grasshoppers which covered the plants and the ground beneath; other common

<sup>5</sup> *Salsola kali* L., var. *tenuifolia* G. F. W. Mey.

species which were present in numbers were *Melanoplus infan-tilis*, *Melanoplus packardii*, and *Melanoplus dawsoni*.

*Missouri Plateau Section of the Great Plains Province.*—

A. *Northern Portion* (Buford and Williston, Williams County).—During the latter part of July, 1920, Miss Thompson and Miss Olson spent a few days in this vicinity. Collecting was done chiefly on the flats of the Missouri River Valley and on the slopes and crests of the bluffs overlooking them. Orthoptera were abundant in the cultivated fields and among the xerophytic vegetation along the bluffs, but there were comparatively few on the clay bottom lands. These localities are the only ones where any collecting was done in the north-western part of the state.

B. *Southwestern Portion* (Medora, Billings County; Amidon, Slope County).—Four general topographic types are represented in this region: uplands, lowlands along the stream valleys, bad lands, and river terraces. The upland areas occupy most of the region; their surface is a rolling plain, the elevation of which varies from 2,700 to nearly 3,200 feet above sea level. The surface of the plain is studded with high buttes, standing 400 to 600 feet above the level of the surrounding plain, and forming a conspicuous feature of the landscape. The upland is well drained, being covered with a network of small watercourses, the majority of them dry throughout the year; lakes and ponds are of rare occurrence. The most prominent topographic feature of the region is the valley of the Little Missouri River and its bordering strip of Bad Lands. The river at Medora lies over 400 feet below the plains. Its valley at the bottom is one-half to one mile wide, and stretching away on each side are broad terraces several miles in width, intermediate in height between the lower valley and the plains above. The Bad Lands border the valley on each

side, and between Medora and Amidon average 15 to 20 miles across.

Medora is situated in the valley of the Little Missouri where the Northern Pacific Railroad crosses the river. The elevation of the town is approximately 2,250 feet. Miss Thompson and Miss Olson spent a few days here during July and August, 1920. Orthoptera were found in abundance on the dry, sandy flood-plain and the arid clay and sand slopes of the buttes and terraces, among the rather scanty growth of sage-brush, clumps of grasses, low cacti, and other xerophytic vegetation found in these situations; they were also abundant in cultivated fields on the terraces.

Conditions at Amidon are more typical of the region as a whole. The town is situated on the uplands, near the edge of the Bad Lands bordering the big bend of the Little Missouri River, to the southeast of Medora. The uplands in general are covered with thick, tough sod, but the vegetation of short grasses and low herbaceous plants is scanty and during the greater part of the season appears parched and brown. Rank growths of tall grasses and herbage are scarce, and are confined to small areas in the bottoms of the watercourses. The steep, sandy clay slopes in the Bad Lands are usually nearly bare, but the Bad Lands as a whole are covered with vegetation. The summits of the ridges and the broader level areas are covered with scanty growths of grasses, cacti, etc., and along the "breaks" (where the upland drops away into Bad Lands) there are often quite dense patches of low shrubbery and small groves or clumps of aspens. Some of the buttes rising above the plain support a growth of shrubs and small trees on their steep, rough slopes; the vegetation of their flat-topped summits is similar to that of the plain below. Near the "breaks" along the watercourses there are occasional scattered

groves of willows and aspens, but on the uplands themselves there is not a sign of tree or shrub to relieve the monotony. Much of the region is now being dry-farmed, and the areas of untouched upland are continually being encroached upon. All of the collecting in this region was done during the last week in August. Orthoptera were common on the upland areas, but somewhat less so among the Bad Lands.

LIST OF SPECIES<sup>6</sup>

## BLATTIDAE

*Blattella germanica* (Linnæus).—Fargo, Sept. 2, 1920, 5 females.

This species was common in one of the hotels.

*Nyctibora noctivaga* Rehn.<sup>7</sup>—Grand Forks, Grand Forks County, Sept. 6, 1891 (A. H. Eastgate), 1 male.

Collected under a street light. Adventive.

## MANTIDAE

*Litaneutria skinneri* Rehn?—Amidon, Aug. 24, 1920, 1 male; Medora, July 31, 1920, 1 juvenile.

The specimen from Amidon was taken in the edge of the Bad Lands, on a dry, sun-scorched hillside covered with a scanty growth of short grasses and other low plants. It was so colored as to be almost invisible when motionless on the ground among the brown grass tufts, and when it ran swiftly about among the low, scattered plants one could scarcely follow the shadow-like form with the eye. The nymph from Medora was taken in a similar situation on the side of a butte in the Bad Lands, among dry grasses and clumps of *Artemisia*.

The specimens are both males. The adult from Amidon

<sup>6</sup> All determinations and systematic notes in the following list are to be charged to the writer, unless otherwise noted.

<sup>7</sup> Determination verified by J. A. G. Rehn.

has tegmina and wings abbreviate, and agrees well with Rehn's description<sup>8</sup> of *skinneri*, described from southern Arizona, and since reported from Texas, New Mexico, California, Colorado, and Nebraska. However, as Caudell<sup>9</sup> has suggested, it is possible that males of other species of *Litaneutria* may sometimes be brachypterous, and that of *L. borealis* Scudder (described<sup>10</sup> very briefly from Nebraska and also known from Colorado) is unknown, so that there is some doubt about the correct determination of these specimens.

PHASMIDAE

*Diapheromera femorata* (Say).—Grand Forks, Grand Forks County, summer 1892 (A. H. Eastgate), 1 male.

Taken on shrubbery growing on the bank of the Red River.

ACRIDIDAE

ACRYDIINAE

*Acrydium granulatum* Kirby.—Stump Lake, July 24, 1920, 1 female; Lake Upsilon, Turtle Mountains, Aug. 4, 1920, 2 juveniles; Fargo, Aug. 31, 1920, 1 juvenile.

A single female was taken at Stump Lake near the edge of a spring on a wet, mucky hillside among clumps of bushes and tall shrubbery; several nymphs were swept from the grassy borders of the small stream flowing away from the spring. Nymphs of several instars of this species were very common on the gravelly beach of Lake Upsilon, among the thin growth of grasses and low herbaceous plants, and especially among the patches of moss which cover parts of the upper beach in places. At Fargo a single nymph was taken on a mass of dead, matted grass near the muddy margin of the Bois-de-Sioux River.

<sup>8</sup> *Proc. Acad. Nat. Sci. Phil.*, lix, 1907, pp. 26-28, fig. 1.

<sup>9</sup> *Proc. U. S. Nat. Mus.*, xlv, 1913, pp. 606-607.

<sup>10</sup> *Canad. Ent.*, xxviii, 1896, p. 209.

*Acrydium hancocki* (Morse).—Lake Upsilon, Turtle Mountains, Aug. 4, 1920, 1 male.

A single male was found in a small opening among the willows and aspens growing along the upper margin of the beach of Lake Upsilon, on a patch of nearly bare earth scattered with dead leaves and twigs and with occasional small patches of moss. An hour's search in the vicinity revealed no other specimens.

#### TRYXALINAE

*Pseudopomala brachyptera* (Scudder).—Medora, July 31, 1920, 1 juvenile male; Amidon, Aug. 25, 1920, 1 male.

The immature male from Medora was taken among scanty vegetation on the flood-plain of the Little Missouri River. The Amidon specimen was beaten from a thicket of herbaceous plants and bushes (among which wild roses were conspicuous) forming a growth about four feet tall, in the head of a gully in the "breaks" of the Bad Lands. It was the only one found, in spite of a considerable amount of collecting in this vicinity.

*Acrolophitus hirtipes* (Say).—Buford, July 23, 1920, 3 males; Amidon, Aug. 25, 1920, 1 male.

At Buford this species occurred in small numbers on a dry hillside among a scanty growth of xerophytic vegetation. The single specimen taken at Amidon was found on the edge of the Bad Lands among scattered clumps and patches of grass and sage-brush on the nearly bare, dry clay soil. When in flight it has considerable resemblance to *Spharagemon collare*, with which it was associated both at Buford and at Amidon.

*Eritettix tricarinatus* (Thomas).—Devils Lake, Aug. 26, 1919, 1 juvenile male.

A single nymph of this species was taken by Miss Olson on the dry, grassy slopes of Sully's Hill.

*Amphitornus coloradus* (Thomas).—Medora, July 30, 1920, 3 females; Amidon, Aug. 21-28, 1920, 8 males, 5 females.

At Medora this species was found among sparse, dry vegetation on the sides of a clay butte. At Amidon it was fairly common on the upland plains among the characteristic vegetation of dry grasses, clumps of *Artemisia*, etc. Specimens were taken on the top of Black Butte, on the plains at the base of Chalky or White Butte, among the "breaks" of the Bad Lands, and in pastures and fields near town. While quite numerous, on account of their great agility specimens were seldom taken except by sweeping, or in the case of the males by tracing them down by means of their stridulation.

This consists of a series of rather slow notes—zzzzz—zzzzz—zzzzz—zzzzz—repeated at the rate of approximately three in two seconds. The sound is apparently produced as follows: during each separate note the closed femur and tibia make one complete movement across the tegmina from the highest to the lowest position which they occupy in stridulation, and back to the highest, but this is not accomplished in a single uniform motion. During this movement through a comparatively large angle the leg is vibrated very rapidly back and forth over a much smaller arc at the estimated rate of 15 to 20 vibrations per second. The resulting note is rather faint.

*Opeia obscura* (Scudder).—Buford, July 23, 1920, 1 male, 2 juveniles; Medora, July 30-Aug. 3, 1920, 26 males, 12 females, 1 juvenile; Amidon, Aug. 21-28, 1920, 23 males, 54 females.

At Buford this species was scarce among dry grass and *Artemisia* patches on the sides of a barren hill; at Medora it was common in similar situations. In the vicinity of Amidon it was common and in places abundant on dry grassland; on the plains in the vicinity of town, on the slopes and summits

of the buttes, and on the patches of grass, *Artemisia*, *Opuntia*, etc., growing on the ridges and gentler slopes in the Bad Lands this species was one of those most constant in occurrence.

*Alpha cinerea* (Bruner).—Medora, July 29-30, 1920, 19 males, 21 females.

Found in considerable numbers on the dry, sparsely vegetated flood-plain of the Little Missouri River, and on the slopes and river terraces above the inner valley. It was taken among clumps of dry grass and sage-brush.

*Phlibostroma quadrimaculatum* (Thomas).—Bismark, Burleigh Co., Aug. 9, 1885, 1 male, 1 female (collection Mich. Agr. Coll.); Buford, July 23, 1920, 25 males, 8 females, 1 juvenile male; Medora, July 30-Aug. 3, 1920, 20 males, 19 females, 3 juveniles; Amidon, Aug. 25-27, 1920, 1 male, 4 females.

Common on the top and sides of a dry hill at Buford, among clumps of grass and sage-brush. At Medora it was common in similar situations, on the flood-plain and terraces. A single female was taken at Amidon on a dry, grassy hillside in the "breaks," and three specimens in a dry pasture near the town; two of the latter were in copula.

*Orphulella pelidna* (Burmeister).—Devils Lake, July 20-Aug. 16, 1920, 24 males, 8 females; Stump Lake, July 24, 1920, 8 males, 9 females; Bottineau, Aug. 1, 1920, 1 female; Fargo, Aug. 31, 1920, 1 male.

This species was fairly common throughout the eastern part of the state. It was taken in considerable numbers among the sparse vegetation of grasses, liquorice, and other plants on the dry sandy or stony flats around the margins of Devils Lake and Stump Lake, and was also common in the short grass of dry pastures and the taller and denser grass of roadsides and waste fields in the vicinity. The single specimen

from Bottineau was swept from the tall grass and herbage filling a small, dry watercourse where it ran through a bare pasture. One male was taken at Fargo with *O. speciosa* in a low, moist area among clumps of tall grass and occasional sedges.

*O. pelidna* makes a sharp, buzzing noise while in flight; the sound is short, a second or less in duration, and while distinct is not loud. It usually comes near the end of the flight, just before the insect dives into the grass. The species is very quick and agile, as well as being inconspicuously colored, which makes it rather hard to collect where it is not numerous.

*Orphulella speciosa* (Scudder).—Devils Lake, Aug. 7, 1920, 1 female; Stump Lake, July 24, 1920, 15 males, 10 females; Sheyenne River, Eddy Co., Aug. 8, 1920, 1 male, 4 females; Aug. 31-Sept. 2, 1920, 9 males, 5 females; Medora, July 31, 1920, 1 male; Amidon, Aug. 24, 1920, 6 males.

Common on sandy and loamy soils throughout the state. It was frequently taken in company with *Orphulella pelidna* in the eastern part of the state, but the latter species was not found in any of the western localities. In the Devils-Stump Lake region *O. speciosa* was common in dry fields and pastures, usually where the sandy or gravelly soil was rather sparsely covered with dry grass, with occasional clumps of such plants as goldenrod, *Grindelia squarrosa*, and *Artemisia*. At Fargo it was taken in similar situations, and also with *O. pelidna* in a low, moist area of mucky soil, among clumps of tall grasses and sedges. In the western part of the state it was found among dry grasses and clumps of *Artemisia* in the valley of the Little Missouri at Medora, and on dry, sandy clay soil covered with low, sparse vegetation among the "breaks" of the Bad Lands at Amidon.

*Chloecaltis conspersa* Harris.—Devils Lake, July 18-28, 1920,

4 males, 2 females; Stump Lake, July 24, 1920, 1 female; Lake Upsilon, Turtle Mountains, July 15, 1919, July 30-Aug. 4, 1920, 5 males, 5 females.

This species was found only in the vicinity of areas of natural woodland of some size. In the Devils-Stump Lake region it was rather common in brushy fields and along paths and roads through the woods and through patches of tall shrubbery bordering them. In the Turtle Mountains specimens were taken in the grassy margins of groves of aspen and balsam poplar, among scattered clumps of beaked hazel, raspberry bushes, and other shrubbery. Others were found along the edges of roads running through the woods and on the dry, gravelly beach of Lake Upsilon, near the edge of the willow-aspen thicket which bordered it.

*Chloealtis conspersa* is probably common throughout the Red River Valley and the Drift Prairie Plain regions, along the streams and around the lakes where they are bordered with natural forest. Neither this nor any of the other species of Orthoptera typically associated with woodland conditions were found in any of the small groves planted around farms on the originally treeless prairie, but it is probable that in time the distribution of these forms will be considerably modified by this artificial extension of forest habitats into the prairie region.

*Chortippus curtipennis* (Harris).—Devils Lake, July 9, 1919, 1 male; July 18-Aug. 16, 1920, 26 males, 13 females; Stump Lake, July 24-25, 1920, 5 males, 4 females; Sheyenne River, Nelson Co., July 25, 1919, 1 male; Gravel Lake, Turtle Mountains, July 15, 1919, 1 female; Lake Upsilon, Turtle Mountains, July 30-Aug. 6, 1920, 23 males, 29 females; Fargo, Aug. 31, 1920, 11 males, 6 females; Amidon, Aug. 21-26, 1920, 3 males, 2 females.

This species was one of the most abundant and ubiquitous of the grass-land inhabiting forms found in the eastern part of the state. It occurred in both wet and dry situations on all types of soil. Though commonest in rather tall vegetation in moist places, it was found in considerable numbers among sparse growths of grass and other herbaceous plants on dry soil. It was abundant in the marshes around the lakes in the Devils Lake and Turtle Mountain regions. This species seemed to be somewhat less common in the western than in the eastern part of North Dakota; it was not found at Buford, Williston, or Medora, and was not common at Amidon.

*Gomphocerus clavatus* Thomas.—Devils Lake, Aug. 7, 1919, 1 female; July 15-Aug. 7, 1920, 13 males, 23 females; Stump Lake, July 24, 1920, 8 males, 4 females; Sheyenne River, Eddy Co., Aug. 8, 1920, 1 female; Buford, July 23, 1920, 4 males, 1 female; Williston, July 24, 1920, 4 males, 2 females; Medora, July 29-Aug. 3, 1920, 2 males, 4 females; Amidon, Aug. 21-28, 1920, 12 males, 23 females.

This species was common in dry, grassy fields and pastures in the Devils-Stump Lake region; it probably occurs in similar situations throughout the eastern part of the state, although for some reason none were taken in the Turtle Mountains, at Bottineau, or at Fargo. It was one of the commonest species in the more arid western portion of North Dakota, where it occurred abundantly on the dry, grassy uplands and on the grassy slopes and ridges in the Bad Lands.

The males of this species are very agile and difficult to capture, much more so than the larger and more clumsy females. Their stridulation has been described by Rehn and Hebard<sup>11</sup> as “. . . -sik-sik-sik-sik—a sound louder but similar to that produced by *Stauroderus* [*Chortippus*] *curtipennis*.” While

<sup>11</sup> *Proc. Acad. Nat. Sci. Phil.*, lviii, 1906, p. 371.

the stridulation of a species is known to vary with changing conditions of temperature, humidity, etc., on none of the occasions on which notes were made on the stridulation of this species did it resemble that of *Chortippus curtipennis*. The closed caudal femur and tibia are held at a rather high angle with the body and vibrated back and forth very rapidly through a small arc, the resultant sound being a buzzing trill, reminiscent of the notes of some species of *Conocephalus*; some of the individuals observed prefaced each trill with a series of two to four brief clicks, still further increasing the resemblance. The notes of some of the specimens observed were approximately four seconds in length, separated by intervals of from three to six seconds; in other cases the notes were only one or two seconds long, separated by variable intervals up to five seconds in length. The coloration of this species is nearly as variable as that of *Chortippus curtipennis*.

*Platybothrus brunneus* (Thomas).—Amidon, Aug. 21, 1920, 2 males, 2 females.

Four specimens were taken in the course of an hour's collecting on the flat mesa top of Black Butte, south of Amidon, among the thin, very dry growth of grasses and other low herbaceous plants. It occurred in company with *Ageneotettix deorum*, but was very much less common than that species.

*Stirapleura decussata* Scudder.—Devils Lake, July 8, 1919, 1 female.

A single specimen of this species was collected by Miss Olson. It was taken by sweeping the rather sparse growth of grasses, liquorice, and other vegetation on the gravelly flats on the north shore of Devils Lake. In spite of careful collecting in the same vicinity for a period of several weeks the following season, no more specimens were found.

*Ageneotettix deorum* (Scudder).—Devils Lake, Aug. 12,

1920, 1 male; Lake Upsilon, Turtle Mountains, July 30, 1920, 1 female; Buford, July 23, 1920, 1 male, 2 females; Medora, July 30-31, 1920, 4 males, 1 female; Amidon, Aug. 21-28, 1920, 13 males, 13 females.

One specimen was taken in each of two localities in eastern North Dakota; in the west it was common at Buford and Medora, and very common in the vicinity of Amidon. In all cases this species was found among dry grasses, frequently where a considerable amount of bare soil was exposed among the scanty vegetation. At Amidon it was most numerous on the dry, grassy uplands, but also occurred among the xerophytic vegetation on the barren slopes in the Bad Lands. It seemed to be more abundant in the late summer and fall than in the earlier part of the season. The fact that most of the collecting in the eastern part of the state was done in July may account for its apparent scarcity in that region; although no nymphs were found, it may possibly become more numerous in August and September.

*Ageneotettix deorum* stridulates in somewhat the same manner as *Chortippus curtipennis*. Each series of notes consists usually of four or five rapid but distinct strokes, the whole occupying approximately one second; the periods of stridulation are separated by intervals of approximately the same length. It may be represented as follows: —sik-sik-sik-sik—sik-sik-sik-sik—sik-sik-sik-sik—.

*Aulocara elliotti* (Thomas).—Buford, July 23, 1920, 1 male; Amidon, Aug. 23-26, 1920, 2 females.

The specimen taken at Buford was found in dry grass at the side of a road on the bluffs above the flood-plain. At Amidon one female was found on the hard, sun-cracked clay margins of a small, shallow alkali lake on the uplands east of town, among scattered tufts of grass and chenopodious

plants; the other among short grass and occasional clumps of *Artemisia* in a dry upland pasture. It was one of the least common of the Acrididae in this region.

*Arcyptera gracilis* Scudder.—Lake Upsilon, Turtle Mountains, July 15, 1919, 1 male; Aug. 6, 1920, 10 males, 5 females.

This species was fairly common in some of the low, moist meadows and grassy marshes bordering the ponds and occupying the depressions in the Turtle Mountains. Specimens were also taken in low fields in growths of tall herbaceous plants, such as goldenrod, fireweed, *Helianthus*, nettles, and others; in this rank herbage it was especially numerous, but very difficult to capture on account of its habit of dropping to the ground and burrowing into the thickest parts of the tangled mass of vegetation when alarmed. No females would have been taken had it not happened that a low meadow of tall grass was being cut for wild hay, and a large number of specimens of this and other species were crowded into the small patch of uncut grass, sedges, and cat-tails bordering a small pond in the center of the field. In the field the females present considerable superficial resemblance in actions and appearance to large, lubberly females of *Melanoplus bivittatus*, the light coloring of the dorsal margins of the closed tegmina adding to the likeness.

#### OEDIPODINAE

*Arphia pseudonietana* (Thomas).—Devils Lake, Aug. 7-26, 1919, 3 males, 1 female; July 20-Aug. 13, 1920, 8 males, 2 females; Sheyenne River, Eddy Co., Aug. 8, 1920, 8 males, 7 females; Bottineau, Aug. 1, 1920, 1 male; Fargo, Aug. 31, 1920, 1 male; Medora, July 31-Aug. 3, 1920, 6 males, 2 juvenile females; Amidon, Aug. 21-28, 1920, 16 males, 7 females.

This species was common throughout the state on dry grass-

land and sparsely vegetated soils during the latter part of the season.

*Chortophaga viridifasciata* (DeGeer).—Stump Lake, July 24-25, 1920, 3 males, 1 female; Devils Lake, May 7-11, 1921 (N. A. Wood), 3 females.

A few specimens were taken on the sparsely vegetated flats on the south shore of Stump Lake in the latter part of July, but by this date the species seemed for the most part to have disappeared. Mr. Wood found it common in similar situations on the shores of Devils Lake in May, in company with *Hippiscus apiculatus*.

*Encoptolophus costalis* (Scudder).<sup>12</sup>—Devils Lake, Aug. 26, 1919, 1 male, 1 female; July 22-Aug. 16, 1920, 22 males, 12 females, 3 juveniles; Sheyenne River, Eddy Co., Aug. 8, 1920, 2 males, 8 females; Aug. 8, 1920, 2 males, 8 females; Stump Lake, July 24, 1920, 6 males, 4 females, 2 juveniles; Bottineau, Aug. 1, 1920, 1 female; Sept. 12, 1920 (A. H. Eastgate), 1 female; Fargo, Aug. 31-Sept. 2, 1920, 6 males, 3 females; Medora, July 29, 1920, 2 females; Amidon, Aug. 21-28, 1920, 16 males, 14 females, 2 juveniles.

This species apparently matures in the eastern part of the state in the latter part of July. On July 22 nymphs were very abundant at Devils Lake, but the only adults seen were three teneral specimens; a week later adults were common, though many were still found in the teneral condition. The species was quite generally distributed in North Dakota on dry, sparsely vegetated soils; it was common in dry pastures, waste lands, and on the flats around the lake shores in the east, while in the southwest it was abundant on the uplands and on grassy slopes and ridges among the Bad Lands. One

<sup>12</sup> Determined by J. A. G. Rehn.

specimen was attracted to a lighted sheet set up at night on the shore of Devils Lake near the edge of the woods.

*Camnula pellucida* (Scudder).—Devils Lake, July 9-Aug. 26, 1919, 6 males, 4 females; July 15-Aug. 17, 1920, 58 males, 25 females; Stump Lake, July 24, 1919, 1 male; July 24-25, 1920, 6 males; Sheyenne River, Eddy Co., July 25, 1919, 1 female; Aug. 8, 1920, 1 male, 2 females; Lake Upsilon, Turtle Mountains, July 14-18, 1919, 12 males, 5 females; July 30-Aug. 4, 1920, 11 males, 8 females; Lake Metagoshe, Turtle Mountains, July 16, 1919, 1 male; Bottineau, July 16, 1919, 2 males; July 31-Aug. 1, 1920, 3 males, 4 females; Fargo, Aug. 31, 1920, 2 males, 1 female; Pembina, Pembina Co., July 12, 1921 (C. Thompson), 1 female; Buford, July 23, 1920, 11 males, 15 females; Williston, July 24-25, 1920, 3 males, 5 females; Medora, July 30-Aug. 3, 1920, 1 male, 6 females; Amidon, Aug. 21-27, 1920, 7 males, 2 females.

This was one of the most abundant and generally distributed of the campestral species inhabiting the region. It was found in almost as many situations as *Melanoplus mexicanus atlantis*, and frequently in as great or greater abundance; but in common with that species its normal habitat is dry grassland. In the grassy fields and pastures of the eastern part of the state it frequently outnumbered all other species. Observations made by Miss Olson in the vicinity of Bottineau show that *Camnula pellucida* ranked about third in abundance—and probably also in destructiveness—in the grain fields of that region. It was surpassed only by *Melanoplus m. atlantis* and *Melanoplus bivittatus*. In the western part of the state it seemed in general to be somewhat less abundant than in the east; it was common on the grassy uplands and on grass-covered slopes and tops of buttes in the Bad Lands.

*Hippiscus haldemani* (Scudder).<sup>13</sup>—Amidon, Aug. 23, 1920, 1 female; ? Aug. 25, 1920, 1 juvenile.

A single female was taken on the grassy uplands near Amidon. A nymph taken two days later is placed here merely because it resembles this species more than it does *Metator pardalinum*, these being the only two species of this group which were found in the region.

*Hippiscus apiculatus* (Harris).—Devils Lake, May 11-18, 1921 (N. A. Wood), 1 male, 1 female.

Taken on the sparsely vegetated, sandy flats around the shore of Devils Lake. By the middle of July this species had entirely disappeared.

*Metator pardalinum* (Saussure).—Buford, July 23, 1920, 1 male, 4 females; Medora, July 29-Aug. 3, 1920, 2 females; Amidon, Aug. 22-28, 1920, 7 males, 3 females.

At Buford this species was found among sage-brush and scattered xerophytic vegetation on dry hillsides, and in dry, grassy situations on the bluffs above the valley; at Medora it was taken in similar habitats. It was only moderately common at Amidon, where it occurred on the grassy uplands, always where there was a considerable amount of bare soil exposed among the scanty vegetation.

*Dissosteira carolina* (Linnaeus).—Devils Lake, Aug. 8-26, 1919, 3 females; July 19-Aug. 16, 1920, 14 males, 5 females; Stump Lake, July 24, 1919, 1 female; July 24-25, 1920, 4 males; Sheyenne River, Eddy Co., Aug. 8, 1920, 3 males, 1 female; Lake Upsilon, Turtle Mountains, July 30-Aug. 6, 1920, 8 males; Bottineau, Sept. 12, 1920 (A. H. Eastgate), 1 female; Fargo, Aug. 31, 1920, 1 male; Buford, July 23, 1920, 8 males, 6 females; Williston, July 24, 1920, 18 males, 13 females;

<sup>13</sup> Determination verified by J. A. G. Rehn.

Medora, July 29-Aug. 3, 1920, 3 males, 3 females; Amidon, Aug. 21-23, 1920, 2 females.

Common along roads and in cultivated fields and sparsely vegetated areas throughout the state.

*Spharagemon aequale* (Say).<sup>14</sup>—Amidon, Aug. 21-28, 1920, 35 males, 17 females.

Common on the grassy uplands in the vicinity of Amidon, but rather local in distribution. Specimens were taken around the sparsely vegetated rocky edges of the mesa top of Black Butte and in bare, dry pastures near the town. It seemed to frequent drier and more sparsely vegetated areas than those preferred by *S. collare*, and was much less generally distributed than that species. In this region *S. collare* was frequently entirely absent from areas inhabited by *S. aequale*, and where the two species were found together the latter in most cases considerably outnumbered the former.

*Spharagemon collare* (Scudder).—Devils Lake, Aug. 7-26, 1919, 3 females; July 19-Aug. 15, 1920, 33 males, 22 females; Stump Lake, July 24, 1920, 12 males, 3 females; Sheyenne River, Eddy Co., Aug. 8, 1920, 1 female; Lake Upsilon, Turtle Mountains, July 30-Aug. 6, 1920, 15 males, 11 females; Bottineau, July 31-Aug. 1, 1920, 9 males, 12 females; Fargo, Aug. 31, 1920, 1 male; Buford, July 23, 1920, 1 male; Medora, July 29-30, 1920, 1 male, 1 female; Amidon, Aug. 21-28, 1920, 23 males, 17 females.

Common throughout the state in dry, grassy fields and similar situations. In the Turtle Mountains it was common in brushy fields and pastures. At Amidon it was very common on the grassy uplands, but no specimens were taken in the Bad Lands. *Trimerotropis monticola* frequently occurs with

<sup>14</sup> Determination verified by A. P. Morse and J. A. G. Rehn; according to the former, these specimens are "not typical."

this species, and bears considerable resemblance to the form with the light pronotum; in the southwest *S. collare* is quite often found with *S. aequale*, though it seems to prefer less barren habitats than that species.

A series of 60 specimens, representing all of the above localities, was sent for determination to Dr. A. P. Morse. All but three of these specimens were determined by him as *Spharagemon collare* (Scudder); the remaining three specimens, two males from Devils Lake and one male from Bottineau, were named *Spharagemon collare wyomingianum* (Thomas). A series of 35 specimens sent to Mr. J. A. G. Rehn was determined by him as *Spharagemon collare collare* (Scudder). On examining the entire series of 167 specimens I was unable to separate them into racial groups, although great differences of size and amount of development of the pronotal crest are evident. A number of the males from the eastern part of the state are similar to Michigan specimens of *S. c. wyomingianum* determined by Rehn and Morse, but the females seem too robust for that race, with more rounded head and less prominent eyes. This eastern material may represent a transitional group of the species with average intermediate characters, although there is great individual variation shown. The western material is much less variable, all of the specimens being typical *collare*, and averaging larger than the eastern material, though a number of the females from the eastern part of the state are fully as large as any of the western specimens.

*Derotmema haydenii haydenii* (Thomas).—Buford, July 23, 1920, 1 male; Medora, July 29, 1920, 1 male, 1 female; Amidon, Aug. 23, 1920, 11 males, 14 females.

At Buford and Medora this species was taken among sparse vegetation on arid hillsides. At Amidon a rather numerous colony was discovered on the dry, sparsely vegetated margins

of a small alkali lake on the grassy upland near the town; here they were common on the alkali-crusted flats among scattered tufts of grass and other low plants. Both red and yellow-winged forms occurred together in about equal numbers; of the 25 specimens captured, 15 have red and 10 yellow wings. The species was evidently local in occurrence in this region, as it was not found elsewhere in a week's collecting in the vicinity.

*Mestobregma kiowa* (Thomas).<sup>15</sup>—Devils Lake, July 8-15, 1919, 3 males, 1 female; July 19-Aug. 16, 1920, 22 males, 15 females; Stump Lake, July 24, 1920, 6 males, 8 females; Sheyenne River, Eddy Co., Aug. 8, 1920, 2 females; Lake Upsilon, Turtle Mountains, July 30-Aug. 6, 1920, 7 males, 3 females; Bottineau, July 31-Aug. 1, 1920, 5 males, 10 females; Buford, July 23, 1920, 5 males, 5 females; Williston, July 24, 1920, 4 males, 1 female; Medora, July 29-Aug. 3, 1920, 155 males, 128 females; Amidon, Aug. 21-27, 1920, 27 males, 24 females.

This species occurred throughout the state; it was extremely abundant on the western plains, but somewhat less numerous in the east. It was fairly common in grassy fields and pastures, roadsides, cultivated fields, and on the stony and sandy flats around the margins of the lakes in the Devils-Stump Lake region. On the western side of the state it was the most abundant of the bare-ground Oedipodinae in all of the localities where collecting was done. Its favorite habitat appears to be the dry uplands, where a considerable amount of bare soil is exposed among the scanty vegetation of grasses and xerophytic plants.

Great variability of color and color pattern exists in this

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<sup>15</sup> Determined by J. A. G. Rehn.

species. The ground color of the majority of individuals is dull brownish or grayish, without conspicuous markings of any kind, but a number of individuals with variegated and more or less conspicuous color patterns may be found in any large series. On August 28 the following types were observed in a barren pasture near Amidon: (1) uniform brownish gray, with rather indistinct fuscous markings (a common type); (2) dark brownish fuscous, markings obscured; (3) brownish gray, metazona of pronotum light brick red, light yellowish stripes along the dorsal angulations of the closed tegmina, ground-color light, markings distinct; (4) same general pattern as last, but metazona of pronotum brownish fuscous, and tegminal stripes reddish brown; (5) ground-color uniform gray or brown, markings distinct, closed tegmina with the overlapping anal fields forming a conspicuous light stripe, sometimes divided at base by a median dark stripe; (6) light brownish gray ground-color, markings distinct, posterior edge of pronotum narrowly edged with yellowish white, tegminal stripes faintly indicated; (7) ground-color light green, dark markings very strongly defined; (8) ground-color light gray or yellowish white, dark markings faintly visible. These are only a few of the many variations found in *Mestobregma kiowa*. This would seem to be a promising form for investigation from the genetical standpoint, the principal objection being that it is probably only single-brooded.

A single one of the entire series of 431 specimens has the wings slightly tinged with yellow near the base; this was the only individual among the thousands of specimens seen in the field in which any color was noticeable during flight. All of the other specimens have the wings either entirely hyaline or with very slight fuscous shadings, usually near the apex.

*Trimerotropis cincta* (Thomas).<sup>16</sup>—Amidon, Aug. 24, 1920, 1 male.

A single specimen of this species was taken in the road between a bare pasture and a wheat field on the uplands near Amidon. It is a swift flier, and was captured with difficulty. While in flight this species stridulates with a rapid buzz similar to that made by *Chortophaga viridifasciata* or *Encoptolophus costalis*.

*Trimerotropis monticola* Saussure.<sup>17</sup>—Devils Lake, July 19, 1920, 1 male; Lake Upsilon, Turtle Mountains, July 30-Aug. 4, 1920, 5 males, 2 females; Bottineau, July 31-Aug. 1, 1920, 15 males, 9 females; Amidon, Aug. 21-28, 1920, 17 males, 8 females; Ft. Buford, Williams Co., 1883, 1 female (collection Mich. Agr. Coll.).

This species was fairly common in the prairie and plains regions, in semi-arid situations. A single specimen was taken on the dry, grassy slopes of Sully's Hill on the south shore of Devils Lake. It was common in dry, grassy fields and pastures in the vicinity of Bottineau, and specimens were taken in brushy clearings in the Turtle Mountains among tall, dry grass. In the eastern part of the state it seemed to be more local in occurrence and not so abundant as farther west. At Amidon it was found in dry upland pastures, on the rock-strewn slopes and the grassy mesa top of Black Butte, and among the scanty vegetation on ridges and slopes in the "breaks" of the Bad Lands. It is everywhere accompanied by *Spharagemon collare*, to the collared form of which *T. monticola* bears a striking superficial resemblance.

*Trimerotropis bruneri* McNeill.—Devils Lake, Aug. 11-17, 1920, 37 males, 37 females; Amidon, Aug. 21-26, 1920, 4 females.

<sup>16</sup> Determination verified by J. A. G. Rehn.

<sup>17</sup> Determination verified by J. A. G. Rehn.

At Devils Lake this species was found in a restricted area on the flats bordering the lake at the Narrows, intermediate between the beach zone and the zone of tall herbage and low shrubbery on the upper part of the flats. In this area the vegetation was scanty and occurred in patches separated by nearly bare spaces of sandy or pebbly soil, in many places incrustated with a thin deposit of alkali; the conditions were distinctly xerophytic. This was the favorite habitat of *Trimerotropis vinculata*, which was found with *T. bruneri*, though present in much greater numbers. In the southwest *T. bruneri* was taken on the sparsely vegetated, rocky edges of the mesa top of Black Butte, and in dry fields and pastures in the vicinity of Amidon. Though scarce, the conditions under which it was found make it probable that it is of general occurrence in this region. In the field this species has much the appearance of a miniature *Hadrotettix*. In flight it stridulates with a rapid, crackling noise; it may stridulate during the entire flight or for only a brief portion of it at the start or near the end.

In this series of 78 specimens the following deviations from McNeill's description<sup>18</sup> can be noted: *Pronotum* with crest of prozona in nearly all specimens slightly or distinctly bilobed; no distinct light markings on lateral lobes in majority of specimens; posterior angle of metazona varying from slightly more to slightly less than a right angle. *Tegmina* with the basal band always distinct, solid; the area between the base of the tegmen and the basal band varies from light reddish brown, with the basal band standing out prominently as a narrow, dark bar at the basal third, to dark fuscous, fusing with the basal band to form a broad infuscation of the entire basal third of the tegmen; median band in most cases solid

<sup>18</sup> *Proc. U. S. Nat. Mus.*, xxiii, 1901, pp. 423-425.

and distinct, but in a few specimens reduced to a faint transverse shading and in others to an aggregation of fuscous spots; in several of the most intensively colored specimens a faint but easily distinguishable apical band present, but this is represented in most cases by scattered fuscous punctations. *Wings* with the wing-band varying in breadth from one-quarter to one-third the length of the wing from base to apex; taenia of the wing-band reaching from one-third to one-half the distance to the base. *Hind femora* yellow within, with a reddish suffusion strongest basally; the inner surface crossed by a distinct distal black band, a continuation of that on the outer face, but the two proximal bands described by McNeill represented in most of the specimens by a diffused infuscation of the basal half, strongest distally; the outer face crossed by a distinct subapical band, often with an infuscation extending from it proximad; a few specimens with indications of a second, median band on the upper surface and upper half of the pagina.

*Trimerotropis vinculata* Scudder?—Devils Lake, Aug. 8, 1919, 1 male, 1 female; July 20-Aug. 17, 1920, 62 males, 56 females, 2 juveniles; Stump Lake, July 24-25, 1920, 6 males, 9 females; Williston, July 24, 1920, 3 males, 5 females; Amidon, Aug. 23, 1920, 9 males, 7 females.

This species was found in great abundance on the dry flats bordering the lakes in the Devils-Stump Lake region. It was most numerous among the sparse vegetation of the middle flats, between the bare sandy or gravelly beach and the taller vegetation of the upper portion of the flats. Though most common in this type of habitat, it was also found in smaller numbers in dry pastures in the vicinity of the lakes, especially in the areas of more scanty vegetation. At Williston a number of specimens were collected on dry clay slopes sparsely

covered with xerophytic vegetation, and the Amidon specimens were all taken on the nearly bare clay flats around the margins of a small, shallow alkali lake on the uplands near the town, with the exception of a single male which was taken on a bare area of sun-baked clay soil in a dry upland pasture.

*Trimerotropis vinculata* evidently matures soon after the middle of July in the eastern part of the state, since many of the specimens taken between the 20th and the 25th of that month were in a teneral condition, and since many last stage nymphs were still present at that time. In this region this species is not very active nor a very swift flier; it seems to rely largely on its inconspicuous coloration for protection, and is rather hard to flush. When an individual is alarmed it starts up with a peculiar butterfly-like fluttering, which soon steadies into a direct, slightly undulating flight. They are usually silent in the air, but on a number of occasions their stridulation was heard; it reminds one somewhat of that of *Trimerotropis huroniana* in certain respects. The sound is a short buzz, repeated at brief intervals during the flight; in a flight of ten feet an individual may stridulate two or three times. At every repetition it appears to fall a little, recovering during the intervals of silence. The end of the flight is usually abrupt, the insect dropping suddenly to the ground in a way that is often bewildering.

What this form should be called is not clear. With regard to material determined as *Trimerotropis salina* McNeill by the author which was sent to Mr. J. A. G. Rehn for verification, he wrote as follows: "Regarding *Trimerotropis salina*—I wish we knew more about it. We have topotypes which came in the Bruner Collection, but the types are gone, like all the McNeill types, destroyed during a lengthy illness of his. . . . What *salina* will prove to be remains to be seen.

Width of wing-band *per se* is a dangerous feature in this genus. *Salina* may be distinct, it may be a geographic race of *vinculata*, or it may be valueless. I have been very conservative with regard to uncertain forms of this type, and used *vinculata* until I know more definitely about the status of *salina*." Later the specimens were returned with the following notes: "*Trimerotropis vinculata* group. Apparently two species, but at this writing (July, 1921) do not care to apply names, as it is too hazardous before intensive study." The specimens agree fairly well with McNeill's descriptions of *salina*, and are superficially very different in appearance from typical *vinculata* by reason of the very broad and heavy wing-band.

*Trimerotropis sordida* E. M. Walker.<sup>19</sup>?—Stump Lake, Nelson Co., July 24, 1920, 1 male.

This specimen was included with a lot of the preceding species which was taken on the gravelly beach of Stump Lake, among occasional clumps of grass and other herbaceous plants, and in an area about 100 yards from the shore, on sandy soil covered with a thin growth of short, dry grass.

*Aerochoreutes carlinianus carlinianus* (Thomas).—Buford, July 23, 1920, 11 males, 5 females; Williston, July 24, 1920, 1 female; Amidon, Aug. 23-28, 1920, 10 males, 3 females.

Common along the roads and in bare fields near Buford. At Williston one specimen was taken on a sparsely vegetated clay hillside. In the southwestern part of the state it was common on the sparsely vegetated clay flats around the margins of a small alkali lake on the uplands near Amidon, on nearly bare clay slopes among the "breaks" of the Bad Lands,

<sup>19</sup> Determined with some doubt by J. A. G. Rehn. Regarding it he writes: "I have never recognized this species before, and the specimen may not be it. As the condition is teneral, certain discrepancies from the description may thus be accounted for."

and in dry, grassy pastures where there were considerable areas of bare soil exposed. Although fairly common in this vicinity, it was much less numerous and more local in occurrence than *Circotettix rabula*, with which it was usually found in company.

*A. carlinianus* stridulates on the wing in a somewhat similar manner to the species of *Circotettix*. The sound produced is a loud, whirring noise, very different and very much less startling than the crackling of its companion *C. rabula*. While the sound is being produced the insects will hover in the air, often practically motionless, or moving slowly along, and rising and falling gently. They sometimes remain in the air stridulating for periods of a minute or more. This species is extremely alert and wary on bright, sunny days, but specimens are rather easily captured in cloudy weather.

*Circotettix rabula* Rehn and Hebard (showing tendencies toward race *nigrafasciatus* Beamer).<sup>20</sup>—Medora, July 30-Aug. 3, 1920, 4 males, 9 females; Amidon, Aug. 21-25, 1920, 14 males, 10 females.

This species was common in the southwestern part of North Dakota wherever exposures of bare, dry soil were found. It was common in the more sparsely vegetated areas on the dry, grassy uplands, in company with *Aerochoreutes carlinianus*, but more numerous than that species. In the region about Amidon it was found in large numbers on the rocky slopes and top of Black Butte and on the nearly bare clay slopes in the "breaks" of the Bad Lands. This species was by far the noisiest grasshopper found in the state, its loud, crackling stridulation being audible for a quarter of a mile or more on a still day.

<sup>20</sup> *Circotettix rabula* Rehn and Hebard (= *Cicottettix undulatus* of most authors).

*Circotettix azurescens* (Bruner).—Medora, July 30, 1920, 2 females; Amidon, Aug. 24-25, 1920, 27 males, 8 females.

Taken only in the valley of the Little Missouri River and its bordering Bad Lands in the southwestern part of the state. It was found on bare clay slopes among the Bad Lands, and was taken on a dry butte covered with a scattered growth of bunch-grasses and sage-brush in the river valley at Medora. It is apparently a much more characteristically xerophilous form than either *A. carlinianus* or *C. rabula*.

The coloration of this species is light, corresponding in a remarkable way with that of the whitish or grayish clay surfaces upon which it is normally found. When motionless against such a background it is almost impossible to distinguish individuals from their surroundings, even when the spot where they are resting has been marked down within a few inches. The disinclination of this form to take flight is probably connected with this fact. It seems to be a remarkably unwary species for a member of this genus; while alert and ready to take flight, it will allow a close approach before actually taking alarm, and then instead of flying a long distance it usually goes only a few yards, often circling around so as to alight a short distance from where it started. It will continue to do this even after several unsuccessful attempts to capture it have been made. The flight is usually low and direct. The stridulation of *Circotettix azurescens* is not loud; it consists of a rapid series of notes—zzzt-zzzt-zzzt-zzzt—uttered at the rate of one and a half or two per second for short periods while in flight.

#### LOCUSTINAE

*Hypochlora alba* (Dodge).—Amidon, Aug. 21-28, 1920, 11 males, 3 females.

In the vicinity of Amidon this species was fairly common on the dry, grassy uplands, on the slopes of the buttes, and among the "breaks" of the Bad Lands, always in close association with the white sage (*Artemisia* spp.). Most of the specimens were taken by sweeping patches and clumps of *Artemisia* with the net. A few individuals were found on other types of vegetation, but always in the immediate vicinity of patches of sage-brush. The color of *Hypochlora alba* absolutely reproduces that of its food-plant, and the grasshoppers are invisible when clinging to the *Artemisia* stems so long as they remain motionless.

*Hesperotettix prdtensis* Scudder.<sup>21</sup>—Lake Upsilon, Turtle Mountains, Aug. 6, 1920, 1 female; Williston, July 24, 1920, 1 male; Medora, July 29-Aug. 3, 1920, 5 males, 8 females; Amidon, Aug. 21-28, 1920, 5 females.

A single specimen of this species was taken near Lake Upsilon in a thick growth of tall weeds—goldenrod, fireweed, nettles, *Helianthus*, and many others—standing three to four feet high on the higher ground around the borders of a grassy marsh. In the Great Plains region it is fairly common, though it was not abundant in any of the localities visited. In this region it was found in dry, grassy fields and pastures on the uplands, and among sparse vegetation on barren clay and sandy soils in the Bad Lands and on the flood-plain of the Little Missouri River.

*Aeoloplus bruneri* Caudell.—Buford, July 23, 1920, 3 males, 3 females; Medora, July 29-Aug. 3, 1920, 21 males, 16 females; Amidon, Aug. 21-24, 1920, 15 males, 15 females.

Abundant on the uplands near Amidon, on the dry, sparsely vegetated flats and sloping banks around the margins of a small alkali lake. The insects are very active, and leap and

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<sup>21</sup> Determination verified by J. A. G. Rehn.

fly well, though only for short distances. Elsewhere in this neighborhood the species was found in small numbers, but was quite generally distributed; it was usually taken among sparse vegetation, seldom in bare areas. At Medora and Buford it was found on sage-brush-covered slopes and in dry, grassy situations.

*Melanoplus occidentalis* (Thomas).<sup>22</sup>—Amidon, Aug. 26-27, 1920, 2 males.

The only specimens of this species were found in a dry pasture on the uplands near Amidon, among a low growth of parched grasses and other plants interspersed with occasional clumps of *Artemisia* and Russian thistle.

*Melanoplus flavidus* Scudder.—Devils Lake, July 24, 1919, 1 male; Aug. 11-17, 1920, 4 males, 10 females; Buford, July 23, 1920, 2 males, 2 females; Medora, July 29-Aug. 3, 1920, 18 males, 25 females.

This species was fairly common on the sandy and stony flats around the shores of Devils Lake, in bare areas and among scanty vegetation of grasses, liquorice, *Grindelia squarrosa*, and many other plants. Here it was found with *M. packardii*, to which it bears considerable resemblance in the field. It was found in great abundance at Medora on the arid, sandy flood-plain and the sides of the valley of the Little Missouri River, among the dry grasses and sage-brush which compose the greater part of the scanty vegetation. At Buford it was scarce, occurring in similar situations.

*Melanoplus bruneri* Scudder.—Lake Upsilon, Turtle Mountains, Aug. 2, 1920, 3 males, 3 females.

Quite common in a dry clearing covered with low bushes and shrubs of various kinds (*Corylus rostrata*, young aspens, willows, birches, etc.) and tall herbaceous plants such as fire-

<sup>22</sup> Determination verified by J. A. G. Rehn.

weed and goldenrod, interspersed with small, grassy areas. This species and *M. m. atlanis* occurred together here in about equal numbers. *M. bruneri* was not taken elsewhere in the state, though some of the larger, heavier-bodied females of *M. m. atlanis* taken in the grain fields at Bottineau were mistaken for this species in the field.

*Melanoplus mexicanus atlanis* (Riley).—Devils Lake, July 25-Aug. 8, 1919, 4 males, 2 females; July 19-Aug. 17, 1920, 24 males, 17 females; Stump Lake, July 24, 1920, 1 male; Sheyenne River, Nelson Co., July 25, 1919, 1 male; Lake Metagoshe, Turtle Mountains, July 16, 1919, 1 male, 1 female; Lake Upsilon, Turtle Mountains, July 30-Aug. 6, 1920, 29 males, 18 females; Bottineau, July 16, 1919, 35 males, 17 females; July 31-Aug. 1, 1920, 20 males, 23 females; August, 1920 (A. H. Eastgate), 1 male; Buford, July 23, 1920, 24 males, 24 females; Williston, July 24-25, 18 males, 14 females; Medora, July 29-Aug. 3, 1920, 34 males, 47 females; Amidon, Aug. 21-28, 1920, 59 males, 45 females.

This species was probably the most abundant grasshopper occurring in the state. It was found in greatest numbers in dry fields of tall grass and on cultivated land, being especially abundant in grain fields. It occurred, however, in a considerable variety of habitats. In point of view of destructiveness this species surpasses all others in North Dakota. At Bottineau an examination of some of the devastated grain fields in the vicinity showed that this species outnumbered all others, although it was accompanied by great numbers of *Melanoplus bivittatus* and *Camnula pellucida*.

*Melanoplus dawsoni* (Scudder).—Devils Lake, July 23-Aug. 26, 1919, 4 males, 12 females; July 19-Aug. 15, 1920, 37 males, 37 females; Stump Lake, July 24-25, 1920, 1 male, 3 females; Sheyenne River, Nelson Co., July 25, 1919, 1 male,

1 female; Sheyenne River, Eddy Co., Aug. 8, 1920, 5 males, 10 females; Lake Upsilon, Turtle Mountains, July 30-Aug. 6, 1920, 10 males, 8 females; Bottineau, July 31-Aug. 1, 1920, 7 males, 5 females; Fargo, Aug. 31-Sept. 2, 1920, 21 males, 14 females; Williston, July 24, 1920, 1 male; Amidon, Aug. 21-28, 1920, 7 males, 7 females.

One of the most common of the campestral Orthoptera occurring in the eastern part of the state. In the eastern localities it was found in nearly all grassland habitats and was common and in many places abundant in dry pastures and stubble-fields and on the sandy flats around the lakes. In the Turtle Mountains it was very numerous in brushy clearings, and was also taken in a tall growth of rank herbage in a low, moist meadow. In the grain fields and on the waste lands covered with Russian thistle in the vicinity of Bottineau it was abundant; it is probably of considerable economic importance, in spite of its diminutive size. In the western part of the state *Melanoplus dawsoni* seemed to be less common; at Amidon it was rather scarce on the dry, grassy plains, on the slopes of the buttes, and on grassy ridges among the Bad Lands, while Miss Olson took only a single specimen at Williston, and did not find it at all at Buford or Medora. That this scarcity was not due to the lateness of the season is shown by the fact that after leaving Amidon I found it to be common at Fargo in similar situations to those in which it was taken at Devils Lake.

A number of macropterous specimens were taken in various parts of the state, as follows: Devils Lake, 1 male, 5 females; Sheyenne River, 1 male, 1 female; Turtle Mountains, 1 female; Fargo, 2 males, 1 female; Amidon, 1 female; in all a total of 4 males and 9 females. Most of these were taken by sweeping. The macropterous form is very rare in this part of the

range of the species, and seems to be unknown farther east.

*Melanoplus fasciatus* (F. Walker).—Lake Upsilon, Turtle Mountains, July 18, 1919 (Crystal Thompson), 1 male; July 30-Aug. 4, 1920, 11 males, 11 females; Pembina, Pembina Co., July 15, 1921 (Crystal Thompson), 1 male, 1 female.

This northern species has been taken in North Dakota only along the Canadian boundary. In the Turtle Mountains it was common in suitable habitats. Specimens were taken in brushy clearings among woods of aspen, balsam poplar, paper birch, and other trees; along roads through shrubbery and forest; and in open, grassy groves of birches and poplars. On August 2 a pair was taken in copula among the branches of a tall clump of willows on the edge of a grassy marsh. Other specimens were taken on the gravelly beach of Lake Upsilon, near the marginal thicket of willows and birches. The Pembina specimens were found in the margins of the woods along the Tongue River.

*Melanoplus femur-rubrum femur-rubrum* (DeGeer).—Devils Lake, July 9-Aug. 8, 1919, 4 males, 2 females; July 15-Aug. 17, 1920, 35 males, 42 females; Stump Lake, July 24, 1919, 1 female; July 24-25, 1920, 9 males, 4 females; Turtle Mountains, July 15-16, 1919, 3 males, 3 females; Lake Upsilon, Turtle Mountains, July 15, 1919, 3 males, 3 females; July 30-Aug. 6, 1920, 10 males, 7 females; Bottineau, July 16, 1919, 5 males, 3 females; July 31-Aug. 1, 1920, 23 males, 16 females; Buford, July 23, 1920, 2 males, 1 female; Williston, July 24, 1920, 6 males, 2 females; Medora, July 31, 1920, 1 male; Amidon, Aug. 21-27, 1920, 11 males, 8 females; Fargo, Aug. 31-Sept. 2, 1920, 8 males, 7 females.

Very common on the eastern side of the state, though less abundant than *M. m. atlantis*, *M. bivittatus*, and *Camnula pelucida*, except locally. On the gravelly and sandy flats around

the margins of the lakes in the Devils-Stump Lake region it was the most abundant species of the genus, with the exception of *M. angustipennis*. It is more frequent in moist habitats, or those characterized by thick growths of herbaceous plants, than in dry and sparsely vegetated ones, in this respect showing a nearly opposite type of habitat preference to that of *M. m. atlantis*. On the western side of the state *M. femur-rubrum* seems to be less common than in the east, presumably on account of the more arid conditions.

This species appears to be of secondary importance in this region from the economic standpoint. Observations made in the vicinity of Bottineau showed that while *M. femur-rubrum* was very abundant in the waste fields overrun with Russian thistle and other weeds, it was only fourth or fifth in relative abundance in the grain fields.

*Melanoplus borealis junius* (Dodge).—Devils Lake, Aug. 8, 1919, 1 male; July 23, 1920, 2 males, 3 females, 1 juvenile; Sheyenne River, Eddy Co., July 25, 1919, 1 male; Lake Upsilon, Turtle Mountains, July 15, 1919, 1 female; Aug. 6, 1920, 2 males, 4 females.

A few specimens were taken by sweeping the growth of sedges, grasses and tall herbage around the margins of a small pond on the flats between Devils Lake and East Bay; search of over an hour in this locality revealed only five adults, although nymphs which may have belonged to this species were fairly common. In the Turtle Mountains a single female was taken among a thick growth of tall herbaceous plants composed largely of goldenrod, fireweed, nettles, and Helianthus, bordering a low, marshy area, and others in a similar but somewhat drier situation on a hillside. One specimen was found among a clump of cat-tails bordering a small pond in the center of a marsh.

*Melanoplus angustipennis* (Dodge).—Devils Lake, July 9-25, 1919, 7 males, 11 females; July 19-Aug. 17, 1920, 41 males, 42 females; Stump Lake, July 24-25, 1920, 1 male, 2 females; Sheyenne River, Eddy Co., Aug. 8, 1920, 1 male, 1 female; Lake Upsilon, Turtle Mountains, July 30-Aug. 6, 1920, 3 males, 2 females; Buford, July 23, 1920, 1 female; Medora, July 23-Aug. 3, 1920, 7 males, 4 females; Amidon, Aug. 21-28, 1920, 6 males, 8 females.

This species occurred in great abundance on the flats around the shores of the lakes in the Drift Prairie region. It was common among sparse vegetation on dry soils throughout the state. Although in the eastern part of its range, in Illinois, Indiana, and Michigan, *M. angustipennis* is quite characteristic of light, sandy soils, in North Dakota there seemed to be no such correlation; the species was found to be almost as common on the grass-covered clay slopes in the Bad Lands of the southwest as on the sandy flats around the shores of Devils Lake.

The hind tibiae of this species are usually either red or blue; in the vicinity of Devils Lake the population seemed to be about equally divided between these two types, while at Amidon specimens with blue tibiae seemed to be about twice as numerous as those with red. A number of the specimens in this large series have the tibiae some shade of yellow, brown, or dull green.

*Melanoplus packardii* Scudder.—Devils Lake, July 9-Aug. 26, 1919, 2 females; July 19-Aug. 17, 1920, 3 males, 8 females; Stump Lake, July 24, 1920, 1 female; Sheyenne River, Nelson Co., July 25, 1919, 1 male; Lake Metagoshe, Turtle Mountains, July 16, 1919, 2 males; Lake Upsilon, Turtle Mountains, July 30-Aug. 6, 1920, 4 males, 2 females; Bottineau, July 16, 1919, 10 males, 15 females; July 31-Aug. 1, 1920, 2 males, 7 females;

August, 1920 (A. H. Eastgate), 1 female; Buford, July 23, 1920, 4 females; Williston, July 24, 1920, 3 males, 2 females; Amidon, Aug. 21-28, 1920, 14 males, 16 females.

Moderately common throughout the state, locally abundant, on dry, usually sparsely vegetated soils. Specimens were taken on the flats around Devils and Stump Lakes, in dry pastures and grain fields at Bottineau and Devils Lake, and in brushy clearings and roadside vegetation in the Turtle Mountains. The species was common in the grain fields and waste lands at Bottineau, but was surpassed in numbers by several others; elsewhere in the eastern part of the state it was of regular occurrence, but not numerous. In the more arid western part of North Dakota *M. packardii* seems to be considerably more abundant, to some extent taking the place occupied in the east by *M. bivittatus*. It was very common on the grassy uplands in the vicinity of Amidon, as well as on the rocky slopes and summit of Black Butte, on the sparsely vegetated clay slopes and ridges in the "breaks" of the Bad Lands, and in the thickets of tall herbage growing in the gullies and depressions on the uplands and in the edges of the Bad Lands.

In a series of 80 specimens the coloration of the hind tibiae is as follows: various hues of blue, 69; part blue and part yellow or pink, 2; pale yellowish white, 2; dark violaceous, nearly black, 1; red or pink, 5.

*Melanoplus conspersus* Scudder.<sup>23</sup>—Devils Lake, Aug. 26, 1919, 2 males, 1 female; Amidon, Aug. 23-28, 5 males, 4 females.

Apparently a rather scarce species. The only specimens from the eastern part of the state were taken by Miss Olson on the grassy slopes of Sully's Hill on the south shore of Devils Lake. Visits to this locality earlier in the season were

<sup>23</sup> Determination verified by J. A. G. Rehn.

made both in 1919 and 1920, but no specimens were then found; it may be more common than is supposed, having been overlooked on account of maturing late in the season. At Amidon specimens were taken in dry pastures and among roadside herbage on the uplands in the vicinity of the town; it was one of the less common of the Acrididae in this region. Two of the males, taken the 23d and 24th of August, were teneral. In the field the light markings on the pronotum and the striped hind femora make it quite conspicuous and easily distinguishable from its congeners.

*Melanoplus infantilis* Scudder.—Devils Lake, July 26, 1919, 1 female; July 15-Aug. 13, 1920, 28 males, 23 females; Stump Lake, July 24-25, 1920, 7 males, 5 females; Sheyenne River, Eddy Co., Aug. 8, 1920, 4 males, 3 females; Lake Upsilon, Turtle Mountains, July 30-Aug. 6, 1920, 18 males, 2 females; Bottineau, July 16, 1919, 2 males; July 31-Aug. 1, 1920, 2 males, 6 females; Buford, July 23, 1920, 2 males, 4 females; Williston, July 24, 1920, 6 males, 2 females; Medora, July 29-31, 1920, 23 males, 18 females; Amidon, Aug. 21-28, 1920, 10 males, 15 females.

This diminutive locust was abundant in most part of the state on dry grassland areas on sandy, gravelly, or clay soils. It was not taken at Fargo (where only a small amount of collecting was done, however), and is probably less common in the Red River Valley than in the other parts of the state, since this is near the border of its range; east of the Red River it is known only from Detroit and Fergus Falls, Minnesota.<sup>24</sup> In the dry pastures and stubble-fields at Devils Lake and Bottineau this species fairly swarms during July and August. On account of its small size and inconspicuous col-

<sup>24</sup> Somes, M. P., 1914, The Acridiidae of Minnesota. *Univ. Minn. Agr. Exp. Sta. Bull.*, No. 141, Technical, pp. 1-100, pls. i-iv (p. 90).

oration it attracts but little attention among the crowds of larger Melanopli, but it is probably responsible for a considerable amount of damage to crops in the central and western parts of the state.

*Melanoplus confusus* Scudder.—Devils Lake, July 23, 1919, 1 female; July 19-22, 1920, 6 males, 2 females; Stump Lake, July 24, 1920, 1 female; Williston, July 24, 1920, 3 males; Medora, July 29-31, 1920, 2 males, 1 female; Amidon, Aug. 21-25, 1920, 6 males, 2 females.

Though nowhere found in numbers, this species seemed to be rather generally distributed through the state in dry grassland habitats. In the east it was taken in dry pastures, stubblefields, and on the flats around the lake shores. At Williston it was taken on the grassy railroad right-of-way on the flats of the Missouri River. At Medora it was found among scattered vegetation of dry grasses and *Artemisia* on dry, sandy soil on the slopes of the buttes. It was rather scarce at Amidon; specimens were collected on the sparsely vegetated mesa top of Black Butte, on the plains near town, and on the sparsely vegetated slopes where the uplands "break" into the Bad Lands.

*Melanoplus keeleri luridus* (Dodge).—Devils Lake, Aug. 26, 1919, 2 males, 2 females; Fargo, Aug. 31, 1920, 15 males, 9 females.

This species is probably of common occurrence in the eastern part of the state, but owing probably to its late appearance in the adult stage it was taken in only two localities. At Devils Lake it was found on the grassy slopes of Sully's Hill; at Fargo, in a dry field among a sparse growth of low grass and weeds intermingled with patches of bare soil.

*Melanoplus bivittatus* (Say).<sup>25</sup>—Devils Lake, July 9-Aug. 26, 1919, 13 males, 13 females; July 18-Aug. 15, 1920, 21 males, 11 females; Stump Lake, July 24, 1919, 8 males, 10 females; July 25, 1920, 3 males, 1 female; Sheyenne River, Nelson Co., July 25, 1919, 8 males, 5 females; Sheyenne River, Eddy Co., July 25, 1919, 6 males, 1 female, 1 juvenile; Aug. 8, 1920, 3 males, 2 females; Lake Upsilon, Turtle Mountains, July 15-16, 1919, 9 males, 13 females; July 30-Aug. 6, 1920, 13 males, 7 females; Bottineau, July 16, 1919, 9 males, 13 females; July 31-Aug. 1, 1920, 4 males, 2 females; Aug. 9, 1920 (N. A. Wood), 1 female; Pembina, Pembina Co., July 12, 1921 (C. Thompson), 1 male; Fargo, Aug. 31, 1920, 1 female; Buford, July 23, 1920, 9 males, 7 females; Williston, July 24-25, 1920, 4 males, 4 females; Medora, July 30-Aug. 3, 1920, 3 males, 2 females; Amidon, Aug. 22-25, 1920, 1 male, 6 females.

In the eastern part of the state this was one of the most abundant and omnipresent of the Acrididae. It occurred in greater or less numbers in every habitat of the region, with the exception of the denser types of forest, but was less common in sparsely vegetated, arid situations than in more humid, thickly vegetated ones. In the grain fields and cultivated lands of this region it was often extremely abundant, and a considerable proportion of the locust injuries are undoubtedly due to the ravages of this species. *Melanoplus bivittatus* was common on the flats of the Missouri River at Buford and Williston, in grassland and cultivated fields. It was taken among xerophytic vegetation on the barren hillsides in the valley of the Little Missouri River at Medora, and occurred in rather small numbers on the plains in the vicinity of Ami-

<sup>25</sup> Determined as *Melanoplus bivittatus bivittatus* (Say) by Morgan Hebard.

don, in patches of tall vegetation along the roadsides and in depressions on the uplands, and in cultivated fields. It seemed to be somewhat less common in the southwest than in other parts of North Dakota.

All of the specimens of the very large series collected are of the typical *bivittatus* type, and not a single example of the red-legged *femoratus* was seen among the thousands of specimens observed in the field. However, it seems more likely that this difference in tibial coloration is in the nature of a response to local environmental conditions, such as food, humidity, etc., than that it is a genetic character of racial or varietal significance. The tibiae of these North Dakota specimens are usually at least in part yellow, and are almost always infuscated to a greater or less degree; but many of the specimens have bluish, brownish, purplish, or black tibiae, and in several specimens at hand they are dark yellow or brown, with the outer face faintly flushed with deep red.

*Phoetaliotes nebrascensis* (Thomas).—Devils Lake, Aug. 26, 1919, 1 male, 1 female; Amidon, Aug. 22-28, 1920, 3 males, 7 females.

Although this species was taken in only two localities, it is probably widely distributed and fairly common within the state. A single pair was taken on the grassy slopes of Sully's Hill on the south shore of Devils Lake. At Amidon it was found on a number of occasions in patches of tall weeds or clumps of low bushes in depressions on the uplands and in the "breaks" of the Bad Lands, sometimes on *Artemisia* in company with *Hypochlora alba*.

TETTIGONIIDAE  
PHANEROPTERINAE

*Scudderia pistillata* Brunner.—Devils Lake, July 19-Aug. 16, 1920, 6 males, 2 females, 1 juvenile; Stump Lake, July 25, 1920, 7 males, 17 females; Sheyenne River, Eddy Co., July 25, 1919, 1 female; Aug. 8, 1920, 3 males, 1 female; Lake Upsilon, Turtle Mountains, July 30-Aug. 6, 1920, 12 males, 7 females; Bottineau, Aug. 1, 1920, 1 female; Aug. 9, 1920 (N. A. Wood), 1 female; Buford, July 23, 1920, 1 female; Amidon, Aug. 25, 1920, 1 male.

In the eastern part of the state this species seemed to be quite common. It was numerous on the upper part of the flats around Devils and Stump lakes, among bushes and tall herbaceous vegetation; also in the margins of the woods bordering the lakes and streams of this region. In the Turtle Mountains the species was very common in similar habitats; specimens were taken in brushy clearings, roadside thickets, and meadows of tall herbage. At Bottineau specimens were found in a thick growth of low bushes—silverleaf, honeysuckle, and roses—mingled with tall Compositae and other plants, in a small depression on the prairie. *Scudderia pistillata* was less common in the drier western portion of the state; a single female was taken in tall grass along the side of a road on the flats of the Missouri River at Buford, and at Amidon a male was beaten from a thick tangle of low bushes and tall weeds in the head of a gully in the Bad Lands.

*Scudderia furcata furcata* Brunner.—Sheyenne River south of Warwick, Eddy Co., Aug. 8, 1920, 1 male, 3 females, 1 juvenile male; Fargo, Aug. 31, 1920, 1 male, 2 females.

Although only taken in two localities, this species is probably quite common in the eastern part of the state in suitable

habitats. In Eddy County it was found on shrubbery and young trees in the margins of the woods bordering the Sheyenne River; nymphs were more common here than adults. At Fargo specimens were taken in company with *Amblycorypha oblongifolia* in a clump of shrubbery and tall nettles, in the margins of an open grove near the banks of the Bois-de-Sioux River.

*Amblycorypha oblongifolia* (DeGeer).—Fargo, Aug. 31, 1920, 2 females.

Found with the preceding. Probably occurs at least throughout the southeastern part of the state.

#### CONOCEPHALINÆ

*Orchelimum gladiator* Bruner.—Devils Lake, July 18-Aug. 8, 1919, 3 males; July 19-Aug. 15, 1920, 33 males, 24 females; Stump Lake, July 25, 1920, 11 males, 9 females; Lake Upsilon, Turtle Mountains, Aug. 2-6, 1920, 2 males; Bottineau, Aug. 1, 1920, 2 males; Fargo, Aug. 31, 1920, 1 male.

Common in the Red River Valley and the Drift Prairie Plains region in a variety of grassland habitats, especially during the earlier part of the season. It occurred in large numbers on the flats around the margins of Devils and Stump lakes, and was extremely abundant in patches of pigweed growing on a rocky island in Devils Lake; in these habitats it was found in company with the next species. *O. gladiator* was also common in tall herbaceous vegetation on dry soil and in grassy and sedgy marshes in this region.

*Orchelimum concinnum* Scudder.—Devils Lake, Aug. 8, 1919, 1 male; July 21-Aug. 15, 1920, 32 males, 17 females.

Although not taken elsewhere in the state, this species proved to be very abundant in many places on the flats around Devils Lake, where it occurred in company with the less

graceful *O. gladiator*; the comparative numbers of the species varied from place to place, but in general they seemed to be about equally common. *O. concinnum* was usually the only one found in the thick patches of sedges which grow in places on the shores of the lake. Two specimens were taken in other habitats, one in a clump of honeysuckle in a bare pasture near the edge of the woods, the other in tall, dry grass in a dry coulee half a mile south of the lake.

*Conocephalus fasciatus fasciatus* (DeGeer).—Devils Lake, July 23, 1919, 1 male; July 19-Aug. 13, 1920, 32 males, 27 females; Stump Lake, July 24, 1919 (C. Thompson), 1 male; July 24-25, 1920, 2 males; Sheyenne River, Eddy Co., Aug. 8, 1920, 3 males, 1 female; Lake Upsilon, Turtle Mountains, Aug. 4-6, 1920, 9 males, 7 females; Fargo, Aug. 31, 1920, 8 males, 6 females.

Common in all grassland habitats in eastern North Dakota, where it was the most common Tettigoniid. It seems to prefer slightly more humid conditions than *C. viridifrons*, but the two species are very frequently found together. Specimens were taken on the dry flats around the lake shores, in grass and sedge marshes, in moist meadows, in brushy fields and pastures, in dry grassland, and in cultivated fields. *C. fasciatus* was not taken in the western part of the state.

*Conocephalus viridifrons* Blatchley.<sup>26</sup>—Devils Lake, July 23, 1919, 1 male, 2 females; July 18-Aug. 16, 1920, 40 males, 27 females, 1 juvenile female; Sheyenne River, Eddy Co., Aug. 8, 1920, 1 female; Stump Lake, July 24, 1920, 1 female; Lake Upsilon, Turtle Mountains, Aug. 2, 1920, 1 female; Bottineau, Aug. 1, 1920, 2 males, 2 females; Fargo, Aug. 31, 1920, 4

<sup>26</sup> Rehn, in letter, seems to doubt the distinctness of this species from *saltans* Sc.

males, 3 females; Amidon, Aug. 22-26, 1920, 7 males, 6 females.

Common in company with the last in nearly all the campestral habitats in the eastern part of North Dakota; while fairly common in moist situations such as marshes, grassy meadows, etc., it seemed to be more typical of dry grassland habitats. In the dry fields and pastures of the eastern part of the state it was usually more numerous than *C. fasciatus*, and in the western areas was common on the dry plains and in the Bad Lands in the vicinity of Amidon, where *fasciatus* was not found at all. *C. viridifrons* was found in the greatest abundance on the upper portions of the dry flats around the shores of Devils Lake, where the sandy soil was covered with a sparse growth of tall grasses, liquorice plants, and low shrubbery.

#### DECTICINAE

*Anabrus simplex* Haldeman, var. *maculatus* Caudell.—Stump Lake, July 25, 1920, 1 male; Bottineau, July 31-Aug. 1, 1920, 5 males; Sept. 12, 1920 (A. H. Eastgate), 1 male.

This species seemed to be fairly common on the dry prairies in the eastern part of the state. None were taken in the Red River Valley in North Dakota, but a male is at hand which was taken at Donaldson, in the valley on the Minnesota side of the river;<sup>27</sup> it is said to be quite common in that vicinity. The specimen taken at Stump Lake was found among a thick growth of dry grasses, clumps of *Artemisia* and goldenrod, and other herbaceous plants on the dry flats north of the lake. Attention was attracted to it by its very loud stridulation, audible at a distance of over one hundred yards. This consisted of sharp staccato notes, repeated in rapid succession at

<sup>27</sup> Minnesota: 5 miles west of Donaldson, Kittson Co., July 4, 1920 (O. B. Olson), 1 male.

the rate of three or four per second for an indefinite length of time. Before starting its song the insect usually assumes a position six to twelve inches above the ground on a stout weed stem; at the first sign of danger it drops to the ground and hides among the bases of the plants. Its characteristic notes were heard on several occasions near Devils Lake, coming from the vegetation of roadsides and dry pastures, but at times when it was impossible to stop to search for their source. In the vicinity of Bottineau *Anabrus simplex* was common in the waste lands and stubble-fields; the thick, tangled growth of Russian thistles covering much of the uncultivated land in the neighborhood seemed to be a favorite habitat for the species. No specimens were taken in the western part of the state, although it almost certainly occurs there.

STENOPELMATINAE

*Stenopelmatus fuscus* Haldeman.<sup>28</sup>—Marmarth, Slope Co., Sept. 12, 1920 (Chas. A. Kinnie), 1 male.

In a letter dated September 25, 1920, Mr. Kinnie gives the following information: "Since this was taken two more have been found. It is called by the Mexicans *mima* (niña?) or *childus*. They say that it is found on the west coast of Mexico, and that the bite is deadly, 'worse than a rattlesnake'—also that it is slow in biting; when approached it rears back with its legs in the air, and when it bites one it does not let go until all the poison is injected. There is no cure for the bite, and persons bitten will die in an hour. It is a close relative of the 'Vinegar Roan'; both bugs bore in the ground and come out at night. The three taken were all found after sundown." The belief concerning the poisonous nature of this insect seems to be widespread. The specimen is fully adult and of the extreme megacephalic type.

<sup>28</sup>Determination verified by J. A. G. Rehn.

## RHAPHIDOPHORINAE

*Ceuthophilus* sp.—Bottineau, Aug. 9-20, 1920 (A. H. Eastgate and N. A. Wood), 2 males, 3 females.

These specimens were collected in an outside covered staircase leading to the cellar of a house in Bottineau. Five other adults captured on the 10th of August were placed by Mr. Eastgate in a tin can, from which they escaped during the night by chewing their way through the cloth cover.

It has been impossible to get this species determined. Specimens sent to Mr. Rehn were returned with the statement that the western forms of this genus were in too much confusion to make it possible to say what this species was. The coloration, male genitalia, armature of the posterior femora, and female ovipositor are all distinctive, but the descriptions in Scudder's monograph<sup>29</sup> are so unsatisfactory that it has been impossible to place the species by their means.

*Ceuthophilus* sp.—Grand Forks, Grand Forks Co. (H. A. Shaw), 1 female.

A single specimen taken many years ago by Mr. Shaw was received from Mr. Eastgate. The remarks made concerning the last species apply also to this. It seems to be fairly close to *C. gracilipes* Haldeman (as used by Blatchley), but differs notably in the lighter coloration, less distinct dorsal stripe, larger size, and considerably smaller ovipositor.

*Ceuthophilus maculatus* (Harris).—Devils Lake, July 9, 1919, 2 males; (?) May 7-11, 1921 (N. A. Wood), 3 juveniles; Grand Forks, Grand Forks Co., July 20-21, 1921 (C. Thompson), 2 males, 5 females; Pembina, Pembina Co., July 15, 1921 (C. Thompson), 1 male, 2 females.

This species was taken in the woods bordering the lakes

<sup>29</sup> Scudder, S. H., 1894, The North American *Ceuthophili*. *Proc. Amer. Acad. Arts and Sci.*, xxx, 17-111.

and streams in the eastern part of the state. The specimens from Devils Lake were all taken under logs in the woods on the north shore or among tall shrubbery on the upper portion of the flats around the lake. The other specimens were taken in the woods bordering the Red River at Grand Forks and in the Tongue River woods near Pembina. It seems to be the most common of the forms occurring in this part of the country.

*Udeopsylla robusta* Haldeman.—Stump Lake, summer 1904 (A. H. Eastgate), 1 male; Elm Township schoolhouse, 5 miles southeast of Lansford, Bottineau Co., July 28, 1920 (A. C. Burrill), 1 male; Bottineau, Aug. 20, 1920 (A. H. Eastgate), 1 male.

The Stump Lake specimen was taken in an outhouse near the edge of the woods bordering the lake. According to Mr. Eastgate this species is common at times in the Turtle Mountains, in moist, shady situations along the shores of the lakes. All three specimens are of the typical form.

GRYLLIDAE

GRYLLINAE

*Nemobius fasciatus fasciatus* (DeGeer).<sup>30</sup>—Devils Lake, Aug. 7-15, 1920, 12 males, 11 females; Stump Lake, July 24-25, 1920, 3 females; Sheyenne River, Eddy Co., Aug. 8, 1920, 7 males, 20 females; Lake Upsilon, Turtle Mountains, July 30-Aug. 6, 1920, 7 males, 13 females; Fargo, Aug. 31-Sept. 2, 1920, 6 males, 19 females.

A very common species in the eastern part of the state, both on the dry, grassy uplands and in moist meadows and marshes on lower ground. Nymphs were very common everywhere during July, but it was not until the 24th of that month that the first adult specimens were seen; from then until the end of the collecting season they became increasingly abun-

dant. For some reason this species was not found in any of the western localities where collections were made.

These specimens belong to the typical race, *fasciatus fasciatus*, but they average somewhat smaller and darker than a similar series of Michigan specimens. No specimens of the northwestern race, *N. fasciatus abortivus* Caudell, were taken in any of the localities studied, but Caudell has reported *abortivus* from Portal, Burke County, in the northwestern part of the state close to the Canadian boundary, and just within the Drift Prairie region.<sup>31</sup>

It may be of interest to note that the caudal femur-ovipositor ratios of 24 female specimens, 12 from Devils Lake and 12 from the Turtle Mountains, when plotted according to the scheme devised by Hebard,<sup>32</sup> are distributed as follows: With few exceptions the plotted ratios lie close to the point of junction of the areas designated as typical of the three races, *fasciatus*, *abortivus*, and *socius*; a total of 16 fall within the *abortivus* area, 5 just over the line separating *abortivus* from *socius*, and 3 well within the *fasciatus* area. Hebard has emphasized the fact that no single character can be relied upon to distinguish these races, but that it is necessary to consider the sum of all of them in order to arrive at correct conclusions.

*Gryllus assimilis* (Fabricius).—Devils Lake, July 9, 1919, 1 juvenile female; July 19-Aug. 15, 1920, 26 males, 30 females; Stump Lake, July 24, 1919, 4 juveniles; Sheyenne River, Nelson Co., July 25, 1919, 1 juvenile female; Pembina, Pembina Co., July 12, 1921 (C. Thompson), 1 juvenile female; Bottineau, Aug. 1, 1920, 1 juvenile female; Aug. 9, 1920 (A. H.

<sup>30</sup> Determined by Morgan Hebard.

<sup>31</sup> *Proc. U. S. Nat. Mus.*, xxxiv, 1908, p. 81.

<sup>32</sup> *Proc. Acad. Nat. Sci. Phil.*, lxv, 1913, p. 413.

Eastgate), 1 male; Fargo, Aug. 31-Sept. 2, 1920, 4 males, 7 females; Amidon, Aug. 23, 1920, 1 male, 2 females.

This species is common in the same situations as the last; it is apparently more numerous in the eastern portion of the state than in the west. The series exhibits considerable variation, but the majority of the specimens are of the *luctuosus* type.

OECANTHINAE

*Oecanthus quadripunctatus* Beutenmuller.—Devils Lake, July 20-Aug. 14, 1920, 48 males, 35 females, 10 juveniles; Sheyenne River, Eddy Co., Aug. 8, 1920, 1 male, 4 females; Fargo, Aug. 31, 1920, 3 males, 7 females; Buford, July 23, 1920, 1 juvenile; Amidon, Aug. 21-27, 1920, 26 males, 17 females.

This species was common throughout the state in grassy fields, roadside vegetation, patches of tall herbage, and in the brushy margins of woods in the eastern part of the state. Although nymphs were very abundant during the earlier part of July, the first adult was not taken until the 28th of that month; adults were common by the end of the first week in August. This species was common on the upper flats around Devils Lake, among the tall herbaceous growth and low bushes; it seemed to be especially fond of the sticky flowers of *Grindelia squarrosa*, and in a patch of these plants almost every other blossom would have an *Oecanthus* stretched out across its disc. Nymphs were seen at Bottineau, but no adults were taken there.

All of the specimens in this large series (78 males, 63 females, 11 juveniles) are very light in coloration, without or with only the faintest traces of the fuscous markings characteristic of *Oecanthus nigricornis*. They undoubtedly all belong to the same species. Nevertheless, the antennal mark-

ings in this series vary from the rather light, narrow, and distinctly separated parallel marks characteristic of most eastern specimens of *quadripunctatus* to marks of a much broader, heavily infuscated, and frequently confluent type. The infuscation is usually confined to the markings themselves, the margins of which are sharply delimited; it does not tend to shade out over the remaining portions of the basal antennal segments, as is so frequently the case in *nigricornis*. In series at hand from Fort Sill, Oklahoma,<sup>33</sup> and Lawrence, Kansas,<sup>34</sup> all of the specimens are of this same type with the heavy antennal markings. In a series from Colorado Springs, Colorado,<sup>35</sup> one specimen is of the heavily marked type, the rest similar to eastern specimens, as are the other Colorado specimens examined. None of the eastern material of this species which I have examined shows this heavily infuscated type of antennal markings. It may be material of this type that Blatchley regards as intermediate between *nigricornis* and *quadripunctatus*.

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<sup>33</sup> Fort Sill, Comanche Co., Oklahoma, Sept. 27-Nov. 10, 1918 (T. H. Hubbell), 5 males, 3 females.

<sup>34</sup> Lawrence, Douglas Co., Kansas, Sept. 18-24, 1921 (Carl Brown), 3 males, 9 females.

<sup>35</sup> Colorado Springs, El Paso Co., Colorado (H. B. Baker), 15 males, 4 females.