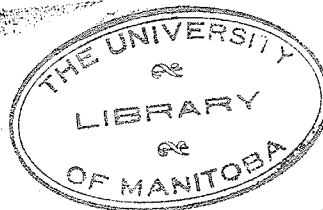


ORTHOPTERA OF MANITOBA

A Thesis
Presented to
The Department of Entomology
Faculty of Agriculture and Home Economics
The University of Manitoba
Winnipeg

In Partial Fulfillment
of the Requirements for the Degree
Master of Science

by
Walter Romanow
March 1952



ACKNOWLEDGEMENTS

The writer wishes to express his indebtedness to Professor A.V. Mitchener, Chairman, Department of Entomology, The University of Manitoba, who suggested the problem, and under whose guidance the project was carried out. Grateful acknowledgement is made to Dr. R.D. Bird, Entomologist in Charge, Field Crop Insect Laboratory, Brandon, Manitoba, for his valuable advice, and permission for carrying out this work as part of a project on grasshopper investigations. Thanks are tendered to Mr. J.A.G. Rehn, Curator of Insects, The Academy of Natural Sciences of Philadelphia, for his kind interest and assistance in clarifying certain taxonomic problems, and to Mr. J.T. Robertson, Laboratory Technician, Field Crop Insect Laboratory, Brandon, Manitoba, for the photographic work entailed.

TABLE OF CONTENTS

CHAPTER	PAGE
I. INTRODUCTION	1
The problem	2
Importance of the study	2
Organization of remainder of the thesis	3
II. REVIEW OF THE LITERATURE	4
Literature on the Orthoptera of Manitoba and the midwestern United States	4
Classification	6
Synonymy	6
Source of material	7
III. KEY TO THE FAMILIES OF ORTHOPTERA	8
IV. FAMILY BLATTIDAE	10
Key to the subfamilies of Blattidae	10
Subfamily Pseudomopinae	10
Genus <u>Blattella</u> Caudell	10
Subfamily Blattinae	11
Key to the genera of Blattinae	11
Key to the species of <u>Periplaneta</u> Burmeister	12
Genus <u>Blatta</u> Linnaeus	12
Genus <u>Periplaneta</u> Burmeister	13
Adventive Blattidae of tropical origin	14

CHAPTER	PAGE
Subfamily Epilamprinae	14
Subfamily Panchlorinae	14
Subfamily Blaberinae	14
V. FAMILY PHASMATIDAE	15
Genus <u>Diapheromera</u> Gray	15
VI. FAMILY TETRIGIDAE	16
Key to the subfamilies of Tetrigidae	16
Subfamily Tetriginae	16
Key to the species of <u>Tetrix</u> Latreille	16
Genus <u>Tetrix</u> Latreille	17
Subfamily Batrachidinae	19
Genus <u>Tettigidea</u> Scudder	19
VII. FAMILY ACRIDIDAE	22
Key to the subfamilies of Acrididae	22
Subfamily Acridinae	23
Key to the genera of Acridinae	23
Key to the species of <u>Orphulella</u> Giglio-Tos	28
Key to the species of <u>Stethophyma</u> Thomas	28
Genus <u>Opeia</u> McNeill	29
Genus <u>Cordillacris</u> Rehn	29
Genus <u>Amphitornus</u> McNeill	30
Genus <u>Phlibostroma</u> Scudder	30

CHAPTER

PAGE

Genus <u>Orphulella</u> Giglio-Tos	31
Genus <u>Chloealtis</u> Harris	32
Genus <u>Neopodismopsis</u> Bei Bienko	33
Genus <u>Aulocara</u> Scudder	34
Genus <u>Stethophyma</u> Thomas	35
Genus <u>Aeropedellus</u> Hebard	36
Genus <u>Chorthippus</u> Feiber	37
Genus <u>Bruneria</u> McNeill	38
Genus <u>Psoloessa</u> Scudder	39
Genus <u>Ageneotettix</u> McNeill	40
Subfamily Oedipodinae	40
Key to the genera of Oedipodinae	40
Key to the species of <u>Arphia</u> Stål	46
Key to the species of <u>Spharagemon</u> Scudder	46
Key to the species of <u>Circotettix</u> Scudder	47
Key to the species of <u>Trimerotropis</u> Stål	47
Genus <u>Chortophaga</u> Saussure	48
Genus <u>Encoptolophus</u> Scudder	49
Genus <u>Camnula</u> Stål	50
Genus <u>Dissosteira</u> Scudder	52
Genus <u>Arphia</u> Stål	53
Genus <u>Pardalophora</u> Saussure	54
Genus <u>Hadrotettix</u> Scudder	56

CHAPTER	PAGE
Genus <u>Spharagemon</u> Scudder	56
Genus <u>Cratypedes</u> Saussure	57
Genus <u>Xanthippus</u> Saussure	58
Genus <u>Metator</u> McNeill	60
Genus <u>Trachyrhachis</u> Scudder	61
Genus <u>Aerochoreutes</u> Rehn	61
Genus <u>Circotettix</u> Scudder	62
Genus <u>Trimerotropis</u> Stål	63
Subfamily Cyrtacanthacridinae	64
Key to the genera of Cyrtacanthacridinae	64
Key to the males of <u>Melanoplus</u> Stål	66
Key to the females of <u>Melanoplus</u> Stål	71
Genus <u>Hesperotettix</u> Scudder	78
Genus <u>Hypochlora</u> Brunner	79
Genus <u>Schistocerca</u> Stål	80
Genus <u>Phoetaliotes</u> Scudder	80
Genus <u>Melanoplus</u> Stål	81
VIII. FAMILY TETTIGONIIDAE	146
Key to the subfamilies of Tettigoniidae	146
Subfamily Phaneropterinae	146
Key to the species of <u>Scudderia</u> Stål	146
Genus <u>Scudderia</u> Stål	147
Key to the genera of subfamily Conocephalinae	149

CHAPTER

PAGE

	Key to the species of <u>Conocephalus</u> Thunberg . . .	149
	Key to the species of <u>Orchelimum</u> Serville . . .	150
	Genus <u>Conocephalus</u> Thunberg	150
	Genus <u>Orchelimum</u> Serville	151
	Subfamily Decticinae	152
	Genus <u>Anabrus</u> Haldeman	153
	Genus <u>Metrioptera</u> Wesmael	153
IX.	FAMILY GRYLLACRIDIDAE	157
	Subfamily Rhabdiphorinae	157
	Key to the genera of Rhabdiphorinae	157
	Key to the males of <u>Ceuthophilus</u> Scudder . . .	
	(modified after Hubbell 1936)	158
	Key to the females <u>Ceuthophilus</u> Scudder . . .	
	(modified after Hubbell 1936)	159
	Genus <u>Tachycines</u> Adelung	160
	Genus <u>Ceuthophilus</u> Scudder	160
	Genus <u>Udeopsylla</u> Scudder	162
X.	FAMILY GRYLLIDAE	163
	Key to the subfamilies of Gryllidae	163
	Subfamily Gryllinae	164
	Key to species of <u>Acheta</u> Linnaeus	164
	Genus <u>Acheta</u> Linnaeus	164
	Subfamily Nemobiinae	166
	Key to the species of <u>Nemobius</u> Serville	166

CHAPTER	PAGE
Genus <u>Nemobius</u> Serville	167
Subfamily Oecanthinae	168
Key to the species of <u>Oecanthus</u> Serville . .	
(modified after Fulton 1926)	168
Genus <u>Oecanthus</u> Serville	169
XI. FAMILY TRIDACTYLIDAE	174
Genus <u>Tridactylus</u> Olivier	174
XII. LIST OF ORTHOPTERA RECORDED IN MANITOBA . . .	175
Glossary (after Torre-Beuno 1937)	181
Localities	190
BIBLIOGRAPHY	197

LIST OF FIGURES

FIGURE	PAGE
1. Dorsal View of Head and Anterior Margin of Pronotum of <u>Tettigidea lateralis lateralis</u> (Say)	20
2. Dorsal View of Head and Anterior Margin of Pronotum of <u>Tetrix subulata</u> (Linnaeus) . . .	20
3. Dorsal View of Head and Anterior Margin of Pronotum of <u>Tetrix ornata</u> (Say)	21
4. Dorsal View of Head and Pronotum of <u>Opeia</u> <u>obscura</u> (Scudder)	96
5. Dorsal View of Head and Pronotum of <u>Cordillacris</u> <u>occipitalis cinerea</u> (Bruner)	97
6. Dorsal View of Head and Pronotum of <u>Amphitornus</u> <u>coloradus</u> (Thomas)	98
7. Dorsal View of Head and Pronotum of <u>Phlibostroma</u> <u>quadrimaculatum</u> (Thomas)	99
8. Dorsal View of Head and Pronotum of <u>Orphulella</u> <u>pelidna pelidna</u> (Burmeister)	100
9. Lateral View of Tegmina of the Male of <u>Chloealtis conspersa</u> (Harris)	101

FIGURE	PAGE
10. Lateral View of Tegmina of the Female of <u>Chloealtis conspersa</u> (Harris)	101
11. Lateral View of Tegmina of the Male of <u>Neopodismopsis abdominalis</u> (Thomas)	102
12. Lateral View of Tegmina of the Female of <u>Neopodismopsis abdominalis</u> (Thomas)	102
13. Lateral View of the Posterior Pair of Apical Spurs of the Hind Tibia of <u>Chorthippus</u> <u>longicornis</u> Latreille	103
14. Lateral View of the Posterior Pair of Apical Spurs of the Hind Tibia of <u>Psoloessa</u> <u>delicatula delicatula</u> (Scudder)	104
15. Lateral View of <u>Chorthippus longicornis</u> Latreille	105
16. Lateral View of <u>Bruneria brunnea</u> Thomas	105
17. Dorsal View of Hind Wing of <u>Arphia conspersa</u> Scudder	106
18. Dorsal View of Hind Wing of <u>Spharagemon</u> <u>collare</u> (Scudder)	107
19. Dorsal View of Head and Pronotum of <u>Arphia</u> <u>conspersa</u> Scudder	108

FIGURE	PAGE
20. Dorsal View of Head and Pronotum of <u>Pardalophora apiculata</u> (Harris)	109
21. Dorsal View of Head and Pronotum of <u>Hadrotettix trifasciatus</u> (Say)	110
22. Dorsal View of Head and Pronotum of <u>Spharagemon collare</u> (Scudder)	111
23. Lateral View of Pronotum of <u>Cratypedes neglectus</u> (Thomas)	112
24. Dorsal View of Hind Wing of <u>Cratypedes neglectus</u> (Thomas)	113
25. Dorsal View of Head and Pronotum of <u>Hadrotettix trifasciatus</u> (Say)	114
26. Dorsal View of Head and Pronotum of <u>Xanthippus corallipes latefasciatus</u> Scudder	115
27. Lateral View of Pronotum of <u>Metator pardalinus</u> (Saussure)	116
28. Dorsal View of Hind Wing of <u>Metator pardalinus</u> (Saussure)	117
29. Dorsal View of Hind Wing of <u>Aerochoreutes carlinianus carlinianus</u> (Thomas)	118
30. Dorsal View of Hind Wing of <u>Circotettix verrucullatus</u> Kirby	119

FIGURE	PAGE
31. Dorsal View of Hind Wing of <u>Trimerotropis</u> <u>campestris</u> McNeill	120
32. Dorsal View of Hind Wing of <u>Arphia conspersa</u> Scudder	121
33. Dorsal View of Hind Wing of <u>Arphia pseudo-</u> <u>nietana pseudonietana</u> (Thomas)	122
34. Dorsal View of Hind Wing of <u>Circotettix</u> <u>verrucullatus</u> Kirby	123
35. Dorsal View of Hind Wing of <u>Circotettix rabula</u> <u>rabula</u> Rehn and Hebard	124
36. Lateral View of Pronotum of <u>Trimerotropis</u> <u>agrestis</u> McNeill	125
37. Mesosternal Lobes of <u>Schistocerca lineata</u> Scudder	126
38. Mesosternal Lobes of <u>Melanoplus femur-rubrum</u> <u>femur-rubrum</u> (De Geer)	126
39. Lateral View of Male Genitalia of <u>Hesperotettix</u> <u>viridis pratensis</u> Scudder	127
40. Dorsal View of Male Genitalia of <u>Melanoplus</u> <u>dawsoni</u> (Scudder)	128

FIGURE

PAGE

41.	Dorsal View of Male Genitalia of <u>Melanoplus</u> <u>islandicus</u> Blatchley	129
42.	Dorsal View of Male Genitalia of <u>Melanoplus</u> <u>borealis junius</u> (Dodge)	130
43.	Lateral View of Male Genitalia of <u>Melanoplus</u> <u>fasciatus</u> (F. Walker)	131
44.	Lateral View of Male Genitalia of <u>Melanoplus</u> <u>huroni</u> Blatchley	132
45.	Lateral View of Male Genitalia of <u>Melanoplus</u> <u>confusus</u> Scudder	133
46.	Lateral View of Male Genitalia of <u>Melanoplus</u> <u>infantilis</u> Scudder	134
47.	Lateral View of Male Genitalia of <u>Melanoplus</u> <u>keeleri luridus</u> (Dodge)	135
48.	Lateral View of Male Genitalia of <u>Melanoplus</u> <u>bivittatus</u> (Say)	136
49.	Dorsal View of Male Genitalia of <u>Melanoplus</u> <u>flavidus flavidus</u> Scudder	137
50.	Dorsal View of Male Genitalia of <u>Melanoplus</u> <u>femur-rubrum femur-rubrum</u> (De Geer)	138
51.	Lateral View of Male Genitalia of <u>Melanoplus</u> <u>angustipennis</u> (Dodge)	138

FIGURE	PAGE
52. Lateral View of Male Genitalia of <u>Melanoplus</u> <u>bruneri</u> Scudder	139
53. Dorsal View of Male Genitalia of <u>Melanoplus</u> <u>bruneri</u> Scudder	140
54. Dorsal View of Male Genitalia of <u>Melanoplus</u> <u>mexicanus mexicanus</u> Saussure	141
55. Dorsal View of Male Genitalia of <u>Melanoplus</u> <u>gladstoni</u> (Scudder)	142
56. Lateral View of Male Genitalia of <u>Melanoplus</u> <u>packardii</u> Scudder	143
57. Lateral View of Male Genitalia of <u>Melanoplus</u> <u>foedus foedus</u> Scudder	144
58. Lateral View of Female Genitalia of <u>Melanoplus</u> <u>angustipennis</u> (Dodge)	145
59. Dorsal View of Last Dorsal Segment of the Male of <u>Scudderia furcata furcata</u> Brunner . . .	155
60. Dorsal View of Last Dorsal Segment of the Male of <u>Scudderia pistillata</u> Brunner	155
61. Dorsal View of Last Dorsal Segment of the Male of <u>Scudderia curvicauda borealis</u> Rehn and Hebard	155

FIGURE	PAGE
62. Lateral View of Pronotum of <u>Orchelimum</u> <u>gladiator</u> Bruner	156
63. Lateral View of Pronotum of <u>Orchelimum</u> <u>vulgare</u> Harris	156
64. Proximal Antennal Segment of <u>Oecanthus</u> <u>nigricornis quadripunctatus</u> Beutenmuller .	172
65. Proximal Antennal Segment of <u>Oecanthus</u> <u>nigricornis nigricornis</u> F. Walker	172
66. Proximal Antennal Segment of <u>Oecanthus</u> <u>nigricornis argentinus</u> Saussure	173
67. Map of Manitoba Showing Localities (Represented by Number) from which Material Has Been Secured	196

CHAPTER I

INTRODUCTION

The order Orthoptera is represented in Manitoba by eight families. Of these, grasshoppers, family Acrididae, have been by far the most important economically. Grasshopper infestations have been a menace to agriculture in Manitoba, at recurrent intervals, for over one hundred and thirty years.

The advent of agriculture, with large areas of open grassland converted to cultivated farmland interspersed with small range areas, has resulted in a marked change in the distribution of the native grasshopper species. Those species which bred in native sod, and were specific feeders in the original prairie plant associations, have become limited in their distribution to the present localized areas of their food plants and have become less abundant. Species which fed on a wider variety of plants, and found the new environmental conditions favorable, have become more abundant and widespread.

Studies regarding recognition, habits, habitat, and distribution of Orthoptera have been carried out in the states (Minnesota, North Dakota, and Montana) adjacent to

Manitoba, and similar studies have been proposed for the Orthoptera of Saskatchewan, Alberta, and British Columbia.

The problem

It was the purpose of this study (1) to record the species of the order Orthoptera that have been taken in Manitoba; (2) to prepare keys for the identification of the species recorded; and (3) to review the literature and present data on the distribution and behavior of the species within the Province.

Importance of the study

The importance of the order Orthoptera cannot be overemphasized. The depredations of certain members of this order, including grasshoppers, crickets, cockroaches, and walkingsticks, have been a menace to man for a long time. Grasshoppers, more so than other members of this order, have been of great economic importance in Manitoba, and will probably continue to be one of the major insect pests in the Province in years to come. Recognition of the species involved and a knowledge of their habits, habitat, and distribution are important in biological studies and are also a basic requirement in carrying out surveys upon which

grasshopper abundance and distribution is forecast. This serves to indicate the need for such a study.

Organization of remainder of the thesis

The remainder of the thesis is divided into eleven chapters. In Chapter II a review of the literature, system of classification followed, sources of synonyms, and materials used are presented. A key to the families of Orthoptera is presented in Chapter III. Chapter IV deals with the family Blattidae and consists of keys to subfamilies, genera, and species, with annotations for each species. The families Phasmatidae, Tetrigidae, Acrididae, Tettigoniidae, Gryllacrididae, Gryllidae, and Tridactylidae are dealt with in a similar manner in Chapters V, VI, VII, VIII, IX, X, and XI, respectively. A list of the Orthoptera of Manitoba, a glossary, and a map showing the localities, in Manitoba, from which material has been secured are presented in Chapter XII. This is followed by the bibliography.

CHAPTER II

REVIEW OF THE LITERATURE

Literature on the Orthoptera of Manitoba and the midwestern United States

Most of the early work on the biology and ecology of Orthoptera in Manitoba was carried out by the late Mr. N. Criddle. Many of his studies were not published and are scattered throughout reports at the Field Crop Insect Laboratory, Brandon. No attempt will be made to review his unpublished material here, but reference will be made to it throughout the text of the present study.

Criddle (1924) described the nymphs of six Melanoplus species, and three species of the family Oedipodinae. In his next paper Criddle (1926) characterized the Acridinae, Oedipodinae, and Cyrtacanthacridinae, and described a number of species in each subfamily. Criddle (1930) described the nymphal instars of Neopodismopsis abdominalis (Thomas) and discussed its habits and life history. Criddle (1931) outlined the life history and habits of the species attacking cultivated crops and gave a brief key to the first stage grasshoppers of the injurious species. Criddle (1932) described the nymphal instars of Schistocerca lineata

Scudder. In addition to these studies, Criddle (1933) presented a comprehensive paper on the ecological associations, food preferences and habits of many Manitoban species.

Handford (1946) described and compared the nymphs of twenty-one species of Melanoplus, eighteen of them from Manitoba. Sex differentiation in the nymphal stages, structural characters, and color and color pattern were discussed in this study. He also included a key for the recognition of nymphal instars, a key for Melanoplus nymphs, and a tentative key to the adult females.

The earliest available list of the Orthoptera of Manitoba was prepared by Walker (1910a,b,c,d) in which he reported sixty-two species and races. One of the species in this list was recorded under three names, another under two names, and three species which were possibly inaccurately determined were included. Much nomenclatorial change has taken place since this list was published.

Within the last thirty years, Morgan Hebard has carried out a comprehensive study of the Orthoptera of the midwestern United States and Alberta. He also has examined much material from Manitoba.

Hebard (1925) recorded one hundred and forty-nine

species and races of Orthoptera from South Dakota. He included in this paper data on abundance, habits, duration of adult appearance, and distribution of the species. Following this study Hebard published similar papers on the Orthoptera of Montana (1928), Colorado (1929), Alberta (1930), Kansas (1931), Minnesota (1932), Illinois (1934), and North Dakota (1936).

Classification

The classification system used in this study follows very closely that of Hebard (1936). The changes that have since taken place as outlined by Rehn (1952) have also been followed.

Synonymy

Prior to Hebard's studies, very little revisionary work had been done on the species of the Great Plains. This resulted in much synonymy in the literature, and the status of many species and races was uncertain. Hebard has brought order to this confused state.

The synonyms listed in this study have been taken from Hebard's papers on the Orthoptera of the midwestern United States and Alberta, and from publications by Scudder (1897, 1898); McNeill (1897, 1901); Caudell (1907); Rehn and Hebard (1915); Blatchley (1920); Hubbell (1936) and Gurney (1940).

Source of material

The basic sources of material for the present study were the collections of the late Mr. N. Criddle, the Field Crop Insect Laboratory at Brandon, the Department of Entomology of the University of Manitoba, and the author's personal collection.

Over four thousand specimens, representing eighty-eight species and races, one migratory phase, and six adventive cockroaches, were examined. Orchelimum vulgare Harris is the only species recorded for which specimens were not examined because of lack of material.

CHAPTER III

KEY TO THE FAMILIES OF ORTHOPTERA

1. Hind femora not enlarged for jumping 2
Hind femora enlarged for jumping 3
2. Body flattened and oval in shape; head completely
or almost completely concealed beneath shield-
like pronotum; cerci segmented Blattidae
Body slender and elongate; head not concealed by
pronotum; cerci not segmented Phasmatidae
3. Abdomen terminating in 4 slender, tapering,
bristly appendages; female with ovipositor
not exposed; antennae 11-segmented; tarsi of
fore and middle legs 2-segmented, of hind
legs one-segmented or absent Tridactylidae
Abdomen not terminating in 4 slender, tapering,
bristly appendages; females with ovipositor
exposed; antennae with more than 11 segments;
hind tarsi 3- or 4-segmented 4
4. Pronotum narrowed posteriorly, covering all or
nearly all of the abdomen; tegmina rudimentary,
hind wings well developed; tarsi of fore and
middle legs 2-segmented, of hind legs 3-segmented;
size small, length of body less than 17 mm.
. Tetrigidae

Pronotum normal, not covering the abdomen; if
tegmina are reduced or absent, wings also reduced
or absent; tarsi 3- or 4-segmented 5

5. Antennae much shorter than the body; hearing or-
gans situated on basal abdominal segment; ovi-
positor composed of 2 pairs of curved valves
. Acrididae

Antennae as long as or longer than the body;
hearing organs when present situated near the
base of the fore tibiae; ovipositor compact,
forming sword-shaped blade or an elongate spear 6

6. Tarsi 3-segmented; ovipositor cylindrical and
spear-shaped Gryllidae

Tarsi 4-segmented; ovipositor forming a strongly
compressed sword-shaped blade 7

7. Tegmina and hind wings present, sometimes abbrev-
iated and concealed by pronotum; hearing organs
situated near base of fore tibiae . . . Tettigoniidae

Tegmina and hind wings absent; hearing organs
absent Gryllacrididae

CHAPTER IV

FAMILY BLATTIDAE

Key to the subfamilies of Blattidae

1. Size small; length of body less than 13 mm.;
styles of male small processes of unequal length;
subgenital plate of female simple . . . Pseudomopinae
- Size large; length of body much more than 13 mm.;
styles of male slender, elongate straight pro-
cesses of equal length; subgenital plate of
female compressed and divided so as to be
bivalved Blattinae

Subfamily Pseudomopinae

Genus Blattella Caudell

1. Blattella germanica (Linnaeus)

Established synonyms of this species are Ischnoptera bivittata Thomas, Blatta obliquata Doldorff, and Blatta germanica Linnaeus.

The German cockroach was introduced from Europe and is now cosmopolitan. It is found throughout the entire inhabited area of Manitoba.

This species reproduces continuously, and adults and nymphs may be seen at any time of the year.

The German cockroach is a household pest and because of its close association with humans is of economic importance. It commonly infests houses, restaurants, stores, or any other habitat that provides food, moisture, warmth, and a convenient hiding place. Adults and nymphs are omnivorous and because of their feeding habits and disagreeable odor are objectionable.

Subfamily Blattinae

-Key to the genera of Blattinae

1. Tegmina of male reduced covering two-thirds of abdomen; represented by tegminal pads in female; interocular space as wide as that between the bases of the antennae; length of body 18-24 mm. Blatta Linnaeus

Tegmina fully developed in both sexes extending well beyond apex of abdomen; interocular space much narrower than that between the bases of the antennae; length of body 27-34 mm. Periplaneta Burmeister

Key to the species of Periplaneta Burmeister

1. Supra anal plate prolonged beyond subgenital plate; apex of supra anal plate rounded and deeply notched; tegmina reddish brown
 americana (Linnaeus)

Supra anal plate not prolonged beyond subgenital plate; apex of supra anal plate truncate and concave or weakly notched; tegmina reddish brown, the basal third with a narrow yellow submarginal stripe
 australasiae (Fabricius)

Genus Blatta Linnaeus

2. Blatta orientalis Linnaeus

Periplaneta orientalis Burmeister and Stylopyga orientalis Fischer are established synonyms of this species.

According to Blatchley (1920) the oriental cockroach was introduced from Asia and is now widely distributed. It is not common in Canada, but is occasionally brought in with imported goods.

There is no record of this species having estab-

lished itself in Manitoba.

Specimens have been taken at Baldur and Brandon.

The oriental cockroach, like the German cockroach, is a household pest, with similar habits.

Genus Periplaneta Burmeister

3. Periplaneta americana (Linnaeus)

An established synonym is Blatta americana Linnaeus.

The American cockroach is the largest of the house-infesting roaches. It is occasionally brought in with goods imported from the United States.

Specimens have been taken at Winnipeg and Brandon.

MacNay (1949) reports several records of infestation in Ontario, an indication that this species could probably become established in Manitoba.

4. Periplaneta australasiae (Fabricius)

The Australian cockroach is occasionally introduced in goods imported from the United States.

Specimens of this species have been taken at Winnipeg and Altona.

Adventive Blattidae of tropical origin

The following species are of tropical origin and are infrequently introduced with bananas and other tropical fruit.

Subfamily Epilamprinae

5. Nyctibora noctivaga Rehn

This species has been recorded from Aweme.

Subfamily Panchlorinae

6. Panchlora cubensis Saussure

Specimens of Panchlora cubensis Saussure have been taken at Winnipeg, Brandon, and Graysville.

Subfamily Blaberinae

7. Blaberus craniifer Burmeister

Blatchley (1920) states this is the largest cockroach found in the United States. Specimens of this species have been taken at Dauphin and Winnipeg.

CHAPTER V

FAMILY PHASMATIDAE

Subfamily Heteronemiinae

Genus Diapheromera Gray.

8. Diapheromera femorata (Say)

Established synonyms are Spectrum femoratum Say and Diapheromera sayi Gray.

According to Walker (1910a) Scudder collected this species in the vicinity of the Selkirk settlement on the Red River in 1862. Other distribution records are Selkirk, Morden, and Miami. These specimens were taken between July 25 and August 14.

This insect lives on forest trees and ornamentals, causing severe defoliation when present in large numbers. Close observation is required to locate individuals, due to their resemblance to twigs, and their slow movements.

The scarcity of the walkingstick, and its inability to become established in Manitoba, may be attributed to the severe winter weather.

CHAPTER VI

FAMILY TETRIGIDAE

Key to the subfamilies of Tetrigidae

1. Antennae with 12 to 14 segments; pronotum with dorsal anterior margin subtruncate or feebly angulate Tetriginae
- Antennae with 20 to 22 segments; pronotum with dorsal anterior margin rounded or angulate, produced forward over the head (Fig. 1, page 20) Batrachidinae

Subfamily Tetriginae

-Key to the species of Tetrix Latreille

1. Fastigium triangularly produced, with median carina not projecting beyond the sides; body slender (Fig. 2, page 20) . . . subulata (Linnaeus)
- Fastigium with sides convex, and median carina projecting beyond the sides (Fig. 3, page 21) 2

2. Median carina of pronotum elevated and compressed before and between the shoulder; frontal costa viewed in profile distinctly concave between the eyes; size larger . . . acadica acadica (Scudder)

Median carina of pronotum not elevated and compressed before and between the shoulder, frontal costa viewed in profile slightly curved between the eyes; size smaller . . . ornata (Say)

Genus Tetrix Latreille

9. Tetrix subulata (Linnaeus)

Established synonyms of this species of grouse locust are: Acrydium subulatum (Linnaeus), Acrydium granulatum (Kirby), Acrydium granulatum granulatum Morse, Tettix biggeri Hancock, Tettix morsei Hancock, Tettix granulatus variegatus Hancock, Tettix granulatus (Kirby), Gryllus subulatum Linnaeus, and Tetrix granulatus (Kirby).

This species is widely distributed in Manitoba, specimens having been taken at Sandilands, Arnaud, Brandon, Birtle, and Lyleton. These were taken between March 23 and September 28.

It overwinters as an adult beneath logs, leaves,

rocks or any other suitable spot providing shelter. The edges of creeks, rivers, lakes, and sloughs are the most common habitat of this species.

10. Tetrix acadica acadica (Scudder)

Established synonyms are Acrydium acadicum acadicum Scudder and Tettix hancocki Morse.

Specimens of T. acadica acadica (Scudder) have been taken at Arnaud, Aweme, Brandon, and as far north as Churchill. These were taken between May 26 and June 27.

This species is commonly taken in association with T. subulata (Linnaeus), indicating that it prefers a similar type of habitat. T. acadica acadica (Scudder) overwinters as an adult.

11. Tetrix ornata (Say)

Established synonyms are Acrydium ornatum (Say), Tettix crassus Morse, and Tettix triangularis Scudder.

This species has been taken at Sandilands, Baldur, Plumas, Aweme, Onah, Stockton, and Lyleton between May 1 and August 24.

Hebard (1936) states that Aweme was the northern limit point of this species. Specimens were taken at Plumas, fifty miles northeast of Aweme, since this, estab-

lishing Plumas as the northern limit point of this species at present.

Subfamily Batrachidinae

Genus Tettigidea Scudder

12. Tettigidea lateralis lateralis (Say)

One female taken at Arnaud on May 27, 1938, is the only record of occurrence of this race in Manitoba.

Hebard (1936) states that T. lateralis lateralis (Say) is known as far northwest as Plummer, Minnesota, and Big Stone, South Dakota. He believes that it is also present in southeastern North Dakota. The record from Arnaud is probably the most northerly known for this race in North America at the present time.

FIGURE 1. DORSAL VIEW OF HEAD AND ANTERIOR MARGIN OF
PRONOTUM OF TETTIGIDEA LATERALIS LATERALIS (SAY).

FIGURE 2. DORSAL VIEW OF HEAD AND ANTERIOR MARGIN OF
PRONOTUM OF TETRIX SUBULATA (LINNAEUS).

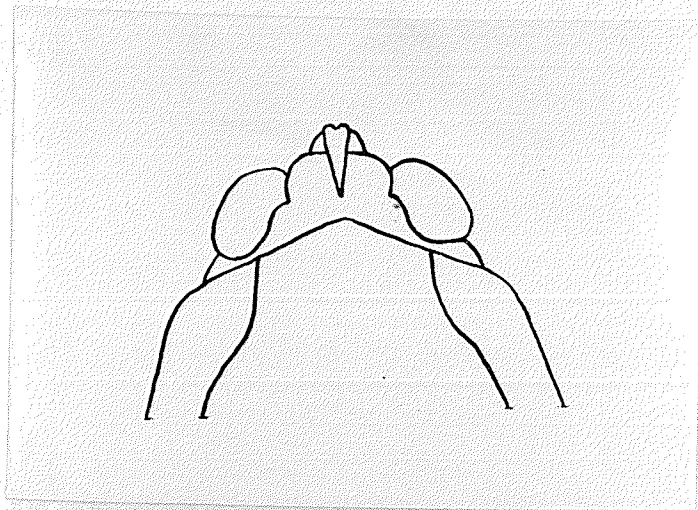


FIGURE 1. Enlarged 25x¹

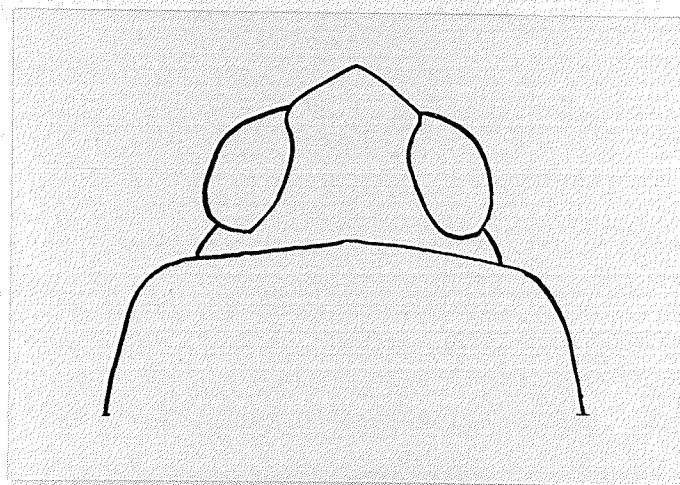


FIGURE 2. Enlarged 25x

¹This and subsequent magnifications are approximate only.

FIGURE 3. DORSAL VIEW OF HEAD AND ANTERIOR MARGIN OF
PRONOTUM OF TETRIX ORNATA (SAY).

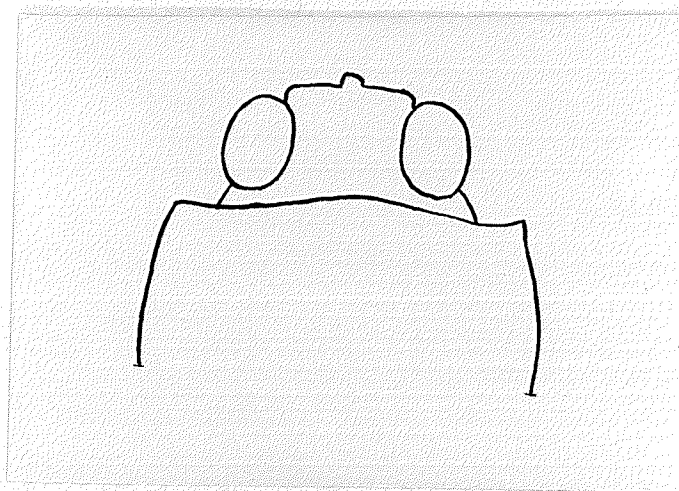


FIGURE 3. Enlarged 25x

CHAPTER VII

FAMILY ACRIDIDAE

Key to the subfamilies of Acrididae

1. Prosternum not armed with a median spine between
the front pair of legs 2
Prosternum armed with a median spine between the
front pair of legs; disk of pronotum flat,
never rugose or tuberculate; lateral carinae
of pronotum indistinct Cyrtacanthacridinae
2. Face usually slanting, meeting fastigium at
an acute angle; pronotal disk produced very
little posteriorly, generally truncate or
convex; median carina of pronotum low, never
cut by more than one sulcus; tegmina and hind
wings may be reduced in some cases; disk of
wings never brightly colored Acridinae
- Face nearly vertical, rounding into fastigium
at point of union; pronotal disk generally
produced posteriorly; median carina of pro-
notum raised or crested, cut by one or two sulci
(except Arphia); tegmina and hind wings always
fully developed; disk of wings often brightly
colored Oedipodinae

Subfamily Acridinae

-Key to the genera of Acridinae

1. Lateral foveolae of vertex absent or not visible from above; face slanting or sloping gradually downward 2
- Lateral foveolae of vertex visible from above; face slanting or nearly vertical 8
2. Antennae sword-shaped or strongly depressed at the base 3
- Antennae simple, sometimes slightly depressed at the base 4
3. Lateral carinae of pronotum parallel and elevated; postero-ventral spur of hind tibiae 1 1/4 times as long as postero-dorsal spur; color, green to straw (Fig. 4, page 96) Opeia McNeill
- Lateral carinae of pronotum not parallel, drawn inward medially on prozona, and elevated very slightly on metazona only; length of postero-ventral spur of hind tibiae not 1 1/4 times that of postero-dorsal spur; head with a brown post-ocular stripe, which extends posteriorly across the lateral pronotal lobes (Fig. 5, page 97) Cordillacris Rehn

4. Head with broad oblique yellowish stripe starting near base of antennae, extending down each cheek, and back across lower edge of lateral pronotal lobes; broad yellow stripe extends from vertex to posterior margin of pronotum, and is bordered on both sides by a brown stripe; hind tibiae blue (Fig. 6,

page 98) Amphitornus McNeill

Color pattern of head and pronotum not as above;

hind tibiae not blue 5

5. Lateral carinae of pronotum drawn inward on prozona, strongly divergent on metazona; tegmina with 3 or 4 irregularly triangular dark spots; color predominantly brown and green; female robust, much larger than male; hind tibiae orange (Fig. 7, page 99)

. Phlibostroma Scudder

Lateral carinae of pronotum not drawn conspicuously inward on prozona, not strongly divergent on metazona; tegmina when strongly marked does not bear dark triangular spots as above;

hind tibiae not orange 6

6. Fastigium with a conspicuous infra marginal impression; tegmina very narrow and fully developed in both sexes (Fig. 8, page 100)

. Orphulella Giglio-Tos

Fastigium without a conspicuous infra marginal impression; tegmina of female abbreviated, of male fully developed with the costal area expanded 7

7. Tegmina of male fully developed with three distinct longitudinal veins in the marginal field; tegmina of female abbreviated, with marginal field forming approximately one-third of the width of the tegmina (Fig. 9 and 10, page 101) Chloealtis Harris

Tegmina of male fully developed with one distinct longitudinal vein in the marginal field; tegmina of female abbreviated with marginal field forming one-half the width of the tegmina (Fig. 11 and 12, page 102)

. Neopodismopsis Bei-Bienko

8. Hind tibiae blue; head unusually full and disproportionately large in relation to thorax; prozona with sulci very prominent . Aulocara Scudder
Hind tibiae not blue 9
9. Female large, length of body 30-36 mm.; male with subgenital plate acutely produced; disk of vertex with a prominent median carina
. Stethophyma Thomas
Female smaller, length of body less than 30 mm.; male with subgenital plate not acutely produced; disk of vertex with median carina faint or absent 10
10. Antennae of males strongly, of females weakly, clubbed; wings of females less than half the length of abdomen Aeropedellus Hebard
Antennae not clubbed; wings of female fully developed or at least half the length of abdomen 11
11. Hind tibiae with posterior pair of apical spurs nearly equal (Fig. 13, page 103) 12
Hind tibiae with posterior pair of apical spurs very unequal (Fig. 14, page 104) 13

12. Face and eyes slanting; prozona and metazona
 nearly equal, prozona usually slightly longer;
 form slender; color predominantly straw, with
 tegmina unicolorous; hind tibiae buffy (Fig. 15,
 page 105) Chorthippus Feiber

Face and eyes nearly vertical; metazona longer
 than prozona, form robust; color predom-
 inantly brown with tegmina spotted, hind tibiae
 orange (Fig. 16, page 105) . . . Bruneria McNeill

13. Lateral carinae of pronotum very prominent
 on prozona and metazona; metazona slightly
 longer than prozona; hind tibiae buffy;
 adult appears early in season . . . Psoloessa Scudder

Lateral carinae of pronotum distinct on meta-
 zona, absent or faintly indicated in color
 on prozona; prozona slightly longer than
 metazona; hind tibiae orange
 Ageneotettix McNeill

-Key to the species of Orphulella Giglio-Tos

1. Fastigium usually blunt with central depression
 little developed and near apex of fastigium;
 lateral carinae of pronotum about equally sep-
 arated at both the anterior and posterior
 pronotal margins speciosa (Scudder)

Fastigium rectangular to acute with central
 depression removed from apex of fastigium
 1/3 to 1/4 the width of vertex; lateral
 carinae of pronotum more widely separated
 at posterior margin of pronotum than at the
 anterior pelidna pelidna (Burmeister)

-Key to the species of Stethophyma Thomas

1. Tegmina with a conspicuous pale submarginal
 stripe along the basal two-thirds of the
 costal area lineatum (Scudder)

Tegmina without a conspicuous pale submarginal
 stripe gracile Scudder

Genus Opeia McNeill13. Opeia obscura (Scudder)

An established synonym is Oxycoryphus obscurus Thomas.

This species is not very common in Manitoba. It has been taken at Lyleton only, between August 11 and September 9.

Criddle (1928) states that this species is most commonly found in semi-alkaline areas and along margins of alkaline lakes.

Genus Cordillacris Rehn14. Cordillacris occipitalis cinerea (Bruner)

Cordillacris cinerea (Bruner) is an established synonym.

Walker (1910a) recorded this race from Aweme as the synonymous Cordillacris cinerea (Bruner).

Criddle (1933) states that this insect prefers a sandy habitat and is commonly found on dry gravelly hills or on the margins of drifting sand.

Genus Amphitornus McNeill15. Amphitornus coloradus (Thomas)

Established synonyms of this species are: Amphitornus bicolor Thomas, Stenobothrus bicolor Thomas, Stenobothrus coloradus Thomas, Stenobothrus unicolor Thomas, Akentetus unicolor McNeill, and Acentetus carinatus Scudder.

Hebard (1936) states that this species was recorded from Aweme as the synonymous Akentetus unicolor McNeill, by Rehn and Hebard in 1911. Other distribution records are: Turtle Mountains, Goodlands, Hartney, Onah, Treesbank, Lyleton, Carberry, and Souris. The specimens examined were taken between July 13 and November 1.

According to Hebard (1936) Aweme was the northeastern limit point of this species. The record from Carberry is now the northeastern limit point.

Criddle (1933b) writes that this grasshopper is an upland prairie species preferring gravelly and sandy soil.

Genus Phlibostroma Scudder16. Phlibostroma quadrimaculatum (Thomas)

Established synonyms are: Phlibostroma pictum Scudder, Stenobothrus quadrimaculatus Thomas, and Steno-

bothrus laetus Uhler.

Walker (1910a) reported that Criddle took this species from Aweme in 1905. Criddle (1928) stated that this grasshopper had not been collected at that point since.

This insect is not common in Manitoba and has been recorded from only one other point, Lyleton. These specimens were taken between August 2 and September 2.

Genus Orphulella Giglio-Tos

17. Orphulella speciosa (Scudder)

Established synonyms are: Stenobothrus speciosus Scudder, Stenobothrus aequalis Scudder, Stenobothrus bilineatus Scudder, Stenobothrus gracilis Scudder, Orphula decora McNeill, Orphulella obliquata Scudder, and Orphulella picturata Scudder.

This species has been taken at Arnaud, Snowflake, Lyleton, Carlowrie, Morden, Boissevain, Pierson, Aweme, Brandon, Hartney, Melita, Griswold, and Turtle Mountains. The specimens examined were taken between August 4 and September 20.

O. speciosa (Scudder) is commonly found in pastures but also shows preference for sandy and gravelly areas

where the vegetation grows somewhat sparingly.

Smith (1947) reported that this species is parasitized by the Sarcophagid Acridiophaga aculeata (Ald.) and the nematode Agamermis decaudata Cobb Steiner Christie.

18. Orphulella pelidna pelidna (Burmeister)

Established synonyms of this race are: Gomphocerus pelidnus Burmeister, Stenobothrus maculipennis Scudder, Stenobothrus propinquans Scudder, and Orphulella pratorum Scudder.

This race has been recorded from Arnaud, Tolstoi, Marquette, Aweme, Arden, Kelwood, Hartney, Baldur, Goodlands, Boissevain, and Minto.

According to Criddle (1933) this grasshopper inhabits semi-dry alkaline flats.

Genus Chloealtis Harris

19. Chloealtis conspersa Harris

Locusta abortiva Harris is an established synonym of this species.

Walker (1910a) reports that Scudder recorded this species from Dog's Head on the east shore of Lake Winnipeg in 1862.

This species has also been taken at Aweme, Winnipeg, Arnaud, Dauphin, Deloraine, Fort Garry, Birch River, Gimli, Ethelbert, Lyleton, Morden, Onah, Sandilands, Sprague, Oak Lake, Swan River, Turtle Mountains, and Victoria Beach. The specimens examined were taken between June 22 and September 1.

C. conspersa Harris occurs from the eastern border of the Province to its western extremity, but is local in its distribution, being confined to open woods or their borders.

Criddle (1928) gives an interesting account of the egg laying habits of this species. He states that the females lay their eggs in dead logs, fence rails, bits of board, or in old cattle dung. He also noted that the females avoided sunny exposures, always laying their eggs in the shady side of the log.

Genus Neopodismopsis Beí-Bienko

20. Neopodismopsis abdominalis (Thomas)

Established synonyms of this species are Chrysochraon abdominalis Thomas and Chloealtis abdominalis (Thomas).

Walker (1910a) reports that this species was taken

by Alexander at Grandview and by himself from the vicinity of Carberry and Neepawa in 1906. It was recorded as the synonymous C. abdominalis (Thomas).

Other records of distribution are: Arnaud, Aweme, Piney, Marchand, Sprague, Novra, Lyleton, Sandilands, Ethelbert, Turtle Mountains, Onah, Hayfield, Cowan, Morden, Tolstoi, Goodlands, Melita, Pierson, and Gladstone. The specimens examined were taken between July 20 and September 2.

Criddle (1930a) states that he has taken this grasshopper among open pine woods, sandy uplands, and along margins of poplar trees, indicating that it may be adaptable to a wide range of habitats. The females of this species lay their eggs in cattle dung, and because of their egg-laying peculiarities are limited to localized areas.

Genus Aulocara Scudder

21. Aulocara ellioti (Thomas)

Established synonyms of this species are Stauronotus ellioti Thomas, Aulocara coeruleipes Scudder, Aulocara decens Scudder, and Oedocara strangulatum Scudder.

This species has been taken at Arnaud, Lyleton,

Miniota, and Turtle Mountains between July 9 and September 26.

According to Criddle (1929) this grasshopper inhabits dry arid situations as provided by ridges and coulees.

Genus Stethophyma Thomas

22. Stethophyma lineatum (Scudder)

Arcyptera lineata Scudder and Mecostethus lineatus (Scudder) are established synonyms of this species.

This insect has been recorded from Aweme, Onah, Winnipeg, Carberry, Marchand, Cowan, Swan River, Roblin, and McAuley. The specimens examined were taken between June 30 and October 11.

S. lineatum (Scudder) inhabits the edges of bogs and marshes where it feeds on the sedges.

23. Stethophyma gracile (Scudder)

Established synonyms of this species are Arcyptera gracilis Scudder and Mecostethus gracilis (Scudder).

Walker (1910a) reports that this species was taken at Swan River by Alexander and at Winnipeg by himself in 1906. In both instances it was recorded as the synonymous Mecostethus gracilis (Scudder).

Other records of distribution are Russell, Gimli, Marchand, Dropmore, Sundown, Snowflake, Ethelbert, Salt Lake, Aweme, Onah, Douglas, Birtle, Deepdale, and McAuley. The specimens examined were taken between July 30 and September 26.

S. gracile (Scudder) also inhabits the edges of marshes and bogs.

Genus Aeropedellus Hebard

24. Aeropedellus clavatus (Thomas)

Established synonyms are: Gomphocerus clavatus Thomas, Gomphocerus clepsydra Scudder, and Gomphocerus carpenterii Thomas.

Walker (1910a) states that this species was taken in the vicinity of the Souris River by Scudder in 1875. It was recorded as the synonymous Gomphocerus clavatus Thomas.

A. clavatus (Thomas) has also been taken at Trees-bank, Aweme, Arnaud, Birtle, Brandon, Carlowrie, Goodlands, Hartney, Lyleton, Griswold, Marchand, Morden, Onah, Melita, Souris, Snowflake, Hartney, Napinka, Tolstoi, Turtle Mountains, Stockton, Rosa, St. Rose, and Winnipeg. The

specimens examined were collected between June 12 and September 24.

According to Criddle (1927) this insect in Manitoba is closely associated with the gramma grass Bouteloua oligostachya (Nutt.).

The eggs of A. clavatus (Thomas) hatch very early in the spring and it is one of the first species to reach maturity.

Genus Chorthippus Feiber

25. Chorthippus longicornis (Latreille)

Established synonyms are: Chorthippus curtipennis (Harris), Locusta (Chloealtis) curtipennis Harris, Stenobothrus longipennis Scudder, Stenobothrus coloradensis McNeill, Acrydium longicorne Latreille, Gryllus parallelus Zetterstedt, Stenobothrus oregonensis Scudder, Stenobothrus acutus Morse, and Stenobothrus coloradus McNeill.

This species is widely distributed in Manitoba, probably more so than any other species. Specimens have been taken at Sifton, Senkiw, Arnaud, Aweme, Pine River, Brandon, Birch River, Lyleton, McKelvie, Cowan, Snowflake, Newbridge, Winnipeg, Teulon, Victoria Beach, Marquette, Rosa, Elkhorn,

Gilbert Plains, and Churchill. The examined specimens were taken between June 22 and September 24.

Hebard (1936) states that C. longicornis (Latreille) is the most widely distributed holarctic species known.

Smith (1947) reported that this species is parasitized by two Sarcophagids, Sarcophaga reversa Ald. and Tephromyiella atlanis Ald., and by the nematode Agamermis decaudata Cobb Steiner Christie.

Genus Bruneria McNeill

26. Bruneria brunnea (Thomas)

Established synonyms are Platybothrus brunneus (Thomas) and Stenobothrus brunneus Thomas.

The Entomological Record (1923) reported the first occurrence of this species in the Province of Manitoba. It was taken at Goodlands by Criddle in 1923.

B. brunnea (Thomas) is not common in Manitoba and has only been taken in the southwestern part of the Province, at Lyleton and Turtle Mountains. These specimens were taken between July 20 and September 1.

Genus Psoloessa Scudder27. Psoloessa delicatula delicatula (Scudder)

Established synonyms are: Stirapleura delicatula (Scudder), Psoloessa coloradensis Thomas, Stirapleura decussata Scudder, Scyllina delicatula Scudder.

According to Walker (1910a) this species was taken at Aweme by Criddle in 1904. It was recorded as the synonymous Stirapleura decussata Scudder.

Other records of distribution are: Lyleton, Aweme, Stockton, Napinka, Goodlands, Morden, Onah, Carberry, Melita, Oak Lake, Souris, Snowflake, and Turtle Mountains. The specimens examined were collected between May 13 and July 3.

The eastern limit of this insect in the northern portion of its range is Morden.

This species is the only member of the family Acridinae that hatches in the late summer and passes the winter as a partly grown nymph. It overwinters in the fourth or fifth instar and develops into the adult in late April or during May, depending on the advancement of spring.

Genus Ageneotettix McNeill28. Ageneotettix deorum deorum (Scudder)

This race has been taken at Aweme, Lyleton, Brandon, Hartney, Melita, Onah, Pipestone, Goodlands, Treesbank, Turtle Mountains, and Souris. The specimens examined were taken between July 3 and September 25.

A. deorum deorum (Scudder) shows preference for habitats of short sparse vegetation within sandy areas.

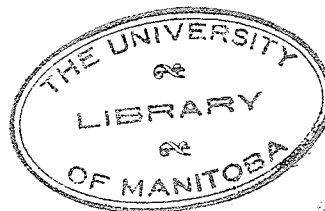
Smith (1947) reported that this grasshopper is parasitized in Manitoba by three Sarcophagids, Protodexia hunteri (Hough), Sarcophaga reversa Ald., and Tephromyiella atlanis (Ald.), and the Anthomyiid Acridomyia canadensis Snyder.

Subfamily Oedipodinae

-Key to genera of Oedipodinae

1. Median carina of pronotum entire, or incised
 by one transverse sulcus 2
- Median carina of pronotum incised by two trans-
 verse sulci; anterior incision sometimes less
 distinct and weaker than the posterior one 9

2. Disk of wings hyaline, sometimes faintly
yellow with the submarginal area dusky 3
Disk of wings colored, often bordered by a
dark submarginal band 5
3. Prozona of pronotum roof-like with the lateral
carinae absent; disk of wing usually tinged
faintly yellow with the submarginal area
dusky; color predominantly green with 3/4
of tegmina brown, or color wholly brown;
adult appears early in the season
. Chortophaga Saussure
- Prozona of pronotum flat, with lateral
carinae present 4
4. Tegmina with three dark bands; disk of
wings often tinged faintly yellow with
area beyond dusky; hind tibiae blue
. Encoptolophus Scudder
- Tegmina irregularly spotted, having a light
yellow stripe extending posteriorly from
the humeral angle of pronotum; wings trans-
parent, sometimes faintly dusky at tips;
hind tibiae buffy Camnula Stål



5. Disk of wings black with a pale border;
wings greatly exceed abdomen; body slender
and strongly compressed . . . Dissosteira Scudder
Disk of wings not black with a pale border . . . 6
6. Submarginal band of hind wing with spur
reaching to, or nearly to, the base of
wing; median carina of vertex prominent,
extends back over occiput (Fig. 17,
page 106) 7
Submarginal band of hind wing with spur
short; median carina of vertex usually
absent, if present very weak and evanes-
cent posteriorly (Fig. 18, page 107) 8
7. Median carina of vertex divided at posterior
limit of fastigium by curved transverse
impression; lateral lobes of pronotum $1 \frac{1}{4}$
to $1 \frac{1}{2}$ times as deep as long; lateral
foveolae of vertex large, square or nearly
square; tegmina densely and irregularly
netted (Fig. 19, page 108) Arphia Stål
Median carina of vertex not divided at the
posterior limit of fastigium by a curved

transverse impression; lateral lobes of pronotum subequal in depth and length; lateral foveolae small, triangular; tegmina irregularly spotted (Fig. 20, page 109)

. Pardolophara Saussure

8. Median carina of pronotum weakly developed, shallowly incised by sulcus; inner face of hind femur dark blue with a light band apically (Fig. 21, page 110) . Hadrotettix Scudder

Median carina of pronotum roof-like or nearly roof-like, deeply incised by sulcus; inner face of hind femur not as described above (Fig. 22, page 111)

. Spharagemon Scudder

9. Median carina of pronotum with one deep incision, the anterior one shallow 10

Median carina of pronotum with two deep incisions 12

10. Lateral lobes of pronotum produced slightly posteriorly at the postero-ventral angle; disk of hind wing yellow, submarginal band broad with a prominent spur (Figs. 23 and 24, pages 112 and 113) Cratypedes Saussure

- Lateral lobes of pronotum normal, not produced posteriorly at the postero-ventral angle 11
11. Pronotum smooth or punctate; tegmina with three conspicuous dark bands; inner face of hind femur dark blue with a light band apically (Fig. 25, page 114) . . . Hadrotettix Scudder
- Pronotum prominently rugose and tuberculate; tegmina not banded, irregularly spotted; hind femur not as described above (Fig. 26, page 115) Xanthippus Saussure
12. Lateral lobes of pronotum drawn into a right or acute angle at the postero-ventral angles; hind tibiae blue (Fig. 27, page 116) 13
- Lateral lobes of pronotum rounded at the postero-ventral angles; hind tibiae not blue 14
13. Disk of wings pink or yellow, submarginal band broad with a prominent spur; tegmina with a light yellow stripe extending posteriorly from humeral angle of the pronotum;

- median carina bilobate on prozona; inner
face of hind femur conspicuously blue
(Fig. 28, page 117) Metator McNeill
- Disk of wings hyaline; median carina bi-
lobate on prozona; inner face of hind
femur not as described above
. Trachyrhachis Scudder
14. Disk of wings tinged dark brown with area
beyond transparent; radial veins of hind
wings dark brown (Fig. 29, page 118)
. Aerochoreutes Rehn
- Disk of wings not as described above; radial
veins of hind wings dark only in the area
of the submarginal band 15
15. Submarginal band almost absent, or when
present narrow with outer margin very
irregular; margin of wings lobed, first
4 radial veins thickened (Fig. 30,
page 119) Circotettix Scudder
- Submarginal band prominent, broad with
outer margin even; margin of wings behind
first region nearly even; radial veins not
thickened (Fig. 31, page 120) . Trimerotropis Stål

-Key to the species of Arphia Stål

1. Disk of wings pink or yellow with sub-
marginal band narrow; hind tibiae pale,
sometimes with darker bands at apex and
just before the middle; adult appears early
in the season (Fig. 32, page 121) . conspersa Scudder

Disk of hind wings rich pink (rarely yellow)
with submarginal band broad, occupying
more than 1/3 of wings area; hind tibiae
brownish black with a proximal pale band
(Fig. 33, page 122)

. pseudonietana pseudonietana (Thomas)

-Key to the species of Spharagemon Scudder

1. Median carina of pronotum strongly crested
and deeply incised; posterior margin of
prozona projected posteriorly covering the
whole or part of the notch; hind tibiae
pink collare (Scudder)

Median carina of pronotum weakly crested;
hind tibiae pink with a proximal dull yellow
annulus followed by a brown annulus . bolli Scudder

-Key to the species of Circotettix Scudder

1. Wings with submarginal band narrow and irregular, followed by a slightly suffused area to the more heavily suffused apex; wings with second, third, and fourth radiate veins moderately thickened (Fig. 34, page 123)

. verruculatus Kirby

- Wings with submarginal band almost absent; area beyond submarginal band immaculate; wings with first 4 radiate veins prominently thickened (Fig. 35, page 124)

. rabula rabula R.&H.

-Key to the species of Trimerotropis Stål

1. Lateral lobes of pronotum with the lateroventral angles triangularly produced downward; disk of hind wings yellow; species found only on loose sand (Fig. 36, page 125)

. agrestis McNeill

- Lateral lobes of pronotum with the lateroventral angles rounded 2

2. Hind tibiae pink; hind femur distinctly banded on the outer face; disk of metazona

lighter than prozona and with smooth
 rounded elevations campestris McNeill
 Hind tibiae dull yellow; hind femur not
 banded on the outer face; disk of metazona
 not as described above
 pallidipennis salina McNeill

Genus Chortophaga Saussure

29. Chortophaga viridifasciata (De Geer)

Established synonyms are: Acrydium viridifasciatum
 De Geer, Gryllus virginianus Fabricius, Locusta infuscata
 Harris, Locusta radiata Harris, Tomonotus zimmermanni
 Saussure, and Tragacephala viridifasciata Harris.

This species has been recorded from Brandon, Arnaud,
 Treherne, Aweme, Senkiw, Virden, Salt Lake, McGregor, Snow-
 flake, Lyleton, Winnipeg, Hartney, and Baldur. The specimens
 examined were taken between May 24 and July 24.

C. viridifasciata (De Geer) overwinters in one of
 the later instars and becomes active as soon as the snow
 disappears. The adults appear towards the end of April or
 in May, depending upon the advancement of spring. Criddle
 (1929) states that eggs are deposited from the middle of

May to August, and the young nymphs begin to appear during the latter half of August. This insect inhabits margins of woods, and areas around low shrubs, in sandy situations. The nymphs, as winter approaches, bury themselves among the fallen leaves or in a clump of grass, where they remain until spring.

Genus Encoptolophus Scudder

30. Encoptolophus sordidus costalis (Scudder)

Established synonyms are: Encoptolophus costalis (Scudder), Encoptolophus parvus Scudder, Encoptolophus coloradensis Bruner, Encoptolophus montanus Bruner, and Oedipoda costalis Scudder.

Walker (1910b) recorded this race from Aweme as the synonymous E. costalis Scudder.

Other records of distribution are: Arnaud, Winnipeg, Birtle, Brandon, Hartney, Lyleton, Dufrost, Snowflake, Deloraine, McKelvie, Douglas, Tolstoi, Emerson, Transcona, Roblin, Morden, Teulon, Matlock, Onah, Portage la Prairie, Ashville, and Wheatland. The specimens examined were taken from July 17 to September 12.

E. sordidus costalis (Scudder) shows preference for

areas of short vegetation, particularly overgrazed pasture where it is often taken in association with Trachyrhachis kiowa kiowa (Thomas).

Genus Camnula Stål

31. Camnula pellucida (Scudder)

Established synonyms of this important species are: Camnula tricarinata Stål, Oedipoda pellucida Scudder, Oedipoda atrox Scudder, and Stenobothrus obionus Thomas.

Camnula pellucida (Scudder) has been taken at Aweme, Deloraine, Portage la Prairie, Plum Coulee, Brandon, Alexander, Lyleton, Lake Atikemag, Marchand, Arnaud, Winnipeg, Menisino, Snowflake, Victoria Beach, Blue Lake, Birtle, and The Pas. This economic species occurs throughout all of Manitoba, but is probably most prevalent in the Red River Valley.

The clear-winged grasshopper is one of the few species in Manitoba that feeds on cultivated crops, causing serious economic losses. This species lays its eggs in sod along roadways and in overgrazed pastures. In some cases it has been known to deposit large numbers of eggs in stubble fields. The majority of the eggs, however, are

concentrated in "egg beds" of varying size. In these preferred spots thousands of eggs may be found in a square foot.

The females are capable of producing seven to eight pods in a season. The pods are compact, and each contains eighteen to twenty eggs. The eggs are cream-colored, tinted with reddish brown in the form of streaks, or irregular stripes, and are generally found clustered in among the grass roots in the top three-quarter inch of soil.

The eggs remain in the soil over winter, and hatching takes place about the time the leaves of the aspen poplar appear, or later, depending on the season. The clear-winged grasshopper is the fastest maturing of the economic species and is usually adult early in July. Egg laying commences about the third week of July and is generally completed by mid-August.

The adult males are small, dull yellow, mottled with dark brown markings. The females are larger, greyish-brown, with the same mottled appearance as the males. Both sexes take on a characteristic yellowish tinge during outbreak years, the males more so than the females.

This species feeds mainly on grains and grasses and is most destructive on the young grain early in the season.

It may also do considerable damage to pastures and rangeland throughout the season.

According to Smith (1947), C. pellucida (Scudder) is parasitized by the following Sarcophagids: Acridiophaga aculeata (Ald.), Blaesoxiphotheca coloradensis (Ald.), Protodexia hunteri (Hough), and Tephromyiella atlanis (Ald.); the Anthomyiid Acridomyia canadensis Snyder; the Nemestrinid Parasymmictus clausus O.S.; and the nematode Agamermis decaudata Cobb, Steiner, Christie.

Genus Dissosteira Scudder

32. Dissosteira carolina (Linnaeus)

Locusta carolinus Linnaeus is an established synonym of this species.

This species has been recorded from Aweme, Gimli, Victoria Beach, Lyleton, Elva, Arnaud, Marchand, Winnipeg, Morden, Brandon, and Pierson. Specimens examined were taken between August 8 and August 23.

D. carolina (Linnaeus) is widely distributed throughout Manitoba and is most common in areas where the soil is sandy and drift ridges exist.

Griddle (1932a) reported that this species appeared

in unusually large numbers in 1932 in the southwestern part of the Province and did considerable damage to the grain fields.

Genus Arphia Stål

33. Arphia conspersa Scudder

Established synonyms of this species are Arphia frigida Scudder and Arphia arcta Scudder.

This grasshopper has been recorded from Aweme, Camp Hughes, Marchand, Arnaud, Brandon, Beausejour, Carman, Carlowrie, Chater, Douglas Lake, Little Souris, Lyleton, Menisino, Onah, Piney, Riding Mountains, Rosa, Cowan, Turtle Mountains, Sandilands, Hartney, Birch River, and Virden. The specimens examined were taken from May 12 to July 21.

This species hibernates in one of the later instars and is one of the first to attain maturity in the spring. Criddle (1933b) states that this insect is an inhabitant of sandy areas in upland situations and frequently associated with margins of wooded areas or the open pine woods.

34. Arphia pseudonietana pseudonietana (Thomas)

Established synonyms are: Arphia sanguinaria Stål,
Arphia tenebrosa (Scudder), Tomonotus theresiae Brunner,
Tomonotus nietanus Thomas, Tomonotus pseudonietanus Thomas,
 and Oedipoda tenebrosa Scudder.

Walker (1910b) states that this race was recorded from the vicinity of the Souris River by Scudder in 1875. Walker himself recorded it from Brandon, the vicinity of Souris and Boissevain, and between Carberry and Neepawa in 1906.

Other records of distribution are: Carlowrie, Arnaud, Winnipeg, Aweme, Lyleton, Birtle, Emerson, Morden, Portage la Prairie, Ashville, Melita, and Roblin. The specimens examined were taken between July 2 and September 22.

This race differs from A. conspersa Scudder in that it overwinters in the egg stage and does not appear as an adult until midsummer.

Genus Pardalophora Saussure

35. Pardalophora apiculata (Harris)

Established synonyms are: Locusta apiculata Harris,
Hippiscus tuberculatus Beauvois, Hippiscus apiculatus

(Harris), and Oedipoda obliterated German.

Walker (1910b) recorded this species from Aweme as the synonymous H. tuberculatus Beauvois.

This insect has also been taken at Carlowrie, Arnaud, Brandon, Birtle, Clear Lake, Senkiw, Victoria Beach, Riding Mountains, Winnipeg, Sandilands, Tolstoi, Goodlands, Pierson, Onah, Birch River, Cowan, and Griswold. The specimens examined were taken from June 3 to July 3.

The eggs of this species are laid during June and July, and the resulting grasshoppers usually appear in August and overwinter in the fourth or fifth instar. This grasshopper is among the largest of our native species; this applies particularly to the females, which are so heavy that they seldom fly.

Criddle (1933b) states that this species inhabits areas around or in openings in woodlands, but is rarely found on the open prairie. He has also noted that it shows preference for broad-leaved plants such as dandelion, eating grass very sparingly.

Genus Hadrotettix Scudder36. Hadrotettix trifasciatus (Say)

Established synonyms are Oedipoda pruinosa Thomas and Oedipoda hoffmanii Thomas.

This species is not very common in Manitoba and has only been taken in the southwestern part of the Province at Lyleton and Napinka, between August 14 and August 27.

Genus Spharagemon Scudder37. Spharagemon collare (Scudder)

Established synonyms are: Oedipoda collaris Scudder, Oedipoda wyomingiana Thomas, Spharagemon wyomingianum Thomas, and Spharagemon oculatum Morse.

This species is widely distributed throughout Manitoba and has been taken at the following points: Souris, Aweme, Arnaud, Victoria Beach, Ashville, Lyleton, Carlowrie, Alexander, Menisino, Onah, Pine River, Tolstoi, Teulon, Fort Garry, Darlingford, Birtle, Deloraine, Pierson, Griswold, Carberry, Vassar, Winnipeg, and Dauphin. The specimens examined were taken between July 9 and September 14.

Criddle (1933b) states that S. collare is an upland species and rarely enters woods, though it is found around

their margins. He also writes that it shows a marked preference for firm, cultivated soil in which to deposit eggs, though at times it will also oviposit in pocket gopher mounds. This species, though generally not economic, had, according to Criddle (1928), become sufficiently abundant in sandy areas in 1923 to do appreciable harm to grain crops.

38. Spharagemon bolli Scudder

Spharagemon balteatum Scudder is an established synonym of this species.

This grasshopper has been taken at Aweme, Onah, Dauphin, Victoria Beach, Transcona, Marchand, and Turtle Mountains.

According to Criddle (1933b), this species is most common in habitats near woods. He also states that it shows a preference for broad-leaved plants such as dandelion and some of the vetches.

Genus Cratypedes Saussure

39. Cratypedes neglectus (Thomas)

An established synonym is Hippiscus neglectus (Thomas).

Walker (1910b) recorded this species from Aweme as the synonymous H. neglectus (Thomas).

To date this species has only been taken along the margins of drifting sand at Aweme and Onah. The specimens examined were taken between July 12 and July 25. According to Hebard (1936), Onah is the known eastern limit of this species.

Criddle (1929) states that this species inhabits areas of sparse vegetation among sand dunes in open spruce woods, where it appears to be definitely associated with juniper, prairie clover, green milkweed, mountain rice, and ragwort.

Genus Xanthippus Saussure

40. Xanthippus corallipes latefasciatus Scudder

Walker (1910b) recorded this species from Aweme as Hippiscus zapotecus Saussure, H. tigrinus Scudder, and H. latefasciatus Scudder.

This insect has also been recorded from Camp Hughes, Onah, Lyleton, Goodlands, Hartney, Souris, Fort Garry, Melita, and Griswold. The specimens examined were taken between May 13 and August 23.

The eggs of this species are laid in early summer and hatch in August. By fall they have usually attained one of the later instars and overwinter as such. In spring they emerge from hibernation and reach maturity by the middle of May.

41. Xanthippus corallipes montanus (Thomas)

Racial status was assigned to the Manitoban specimens of montanus by Hebard. Because of a lack of a representative series of specimens, and suitable diagnostic characters, a key to separate Xanthippus corallipes latefasciatus Scudder and Xanthippus corallipes montanus (Thomas) was not presented in this study.

Hebard (1936) states: "The exact status of montanus remains a problem. From some angles it appears to be a distinct species, from others it would seem to constitute merely the response in corallipes latefasciatus to an environment of loose sand. The Manitoba specimens are not typical but are we feel, the response in the insect to the most boreal conditions under which it can exist. Detailed field observations with close regard to the immediate environment of colonies and extreme of variation in different colonies, combined with breeding experiments, are needed."

This race has been recorded from Aweme, Onah, and Douglas. The specimens examined were taken between May 11 and July 3.

X. corallipes montanus (Thomas), like corallipes latefasciatus, overwinters in one of the later nymphal instars.

Criddle (1928) states that this species was frequently found associating with X. corallipes latefasciatus Scudder, but unlike the latter shows preference for more sandy situations and attains its greatest numbers on the margin of drifting sand.

Genus Metator McNeill

42. Metator pardalinus (Saussure)

Psinidia pardalina Saussure is an established synonym of this species.

This species has been taken at Lyleton, Carlowrie, Alexander, Beresford, Goodlands, and Turtle Mountains. The specimens examined were taken between June 20 and September 8.

According to Criddle (1933b), this grasshopper in-

habits very dry prairies, and in food selection is partial to Agropyron smithii Rydb.

Genus Trachyrhachis Scudder

43. Trachyrhachis kiowa kiowa (Thomas)

Established synonyms are: Mestobregma kiowa kiowa (Thomas), Oedipoda kiowa Thomas, Mestobregma pulchella Bruner, and Mestobregma kiowa Hubbell.

This race has been taken at Aweme, Souris, Boiss-evain, Brandon, Carlowrie, Lyleton, Birtle, Douglas, Emerson, Morden, Cartwright, Deloraine, Hartney, Melita, Winnipeg, and Gladstone. The specimens examined were secured between July 9 and September 12.

This insect is most commonly found on overgrazed pasture, and on sandy or gravelly hills.

Genus Aerochoreutes Rehn

44. Aerochoreutes carlinianus carlinianus (Thomas)

An established synonym of this race is Oedipoda carliniana Thomas.

This grasshopper is not very common in Manitoba and

has only been recorded from Brandon, Lyleton, and McAuley. The specimens examined were taken between July 19 and August 15.

Genus Circotettix Scudder

45. Circotettix verrucullatus (Kirby)

An established synonym of this species is Locusta verrucullata Kirby.

This species has been recorded from Marchand, Aweme, Beausejour, Blue Lake, Novra, Piney, Sundown, Victoria Beach, Birch River, and Sandilands. The specimens examined were taken between June 22 and September 7.

C. verrucullatus (Kirby) inhabits the margins and open glades in pine woods. According to Criddle (1929), this species feeds upon a number of broad-leaved plants, but rarely eats grass.

46. Circotettix rabula rabula Rehn & Hebard

Circotettix undulatus Thomas is an established synonym.

Walker (1910b) recorded this race from Aweme as the synonymous Circotettix undulatus Thomas.

Aweme is the only distribution record available for this insect.

Criddle (1928) states that this grasshopper inhabits cliffs which face south, and which consist of a mixture of clay and sand.

Genus Trimerotropis Stål

47. Trimerotropis agrestis McNeill

This species has been recorded from Onah, Aweme, and Treesbank. The specimens examined were taken between July 3 and September 9.

This grasshopper is only encountered on or close to areas of drifting sand. To date it has only been taken in the sand dune area south of Carberry.

48. Trimerotropis campestris McNeill

Trimerotropis monticola McNeill is an established synonym.

This species has been taken at Aweme, Stockton, Melita, and Lyleton. The specimens examined were taken between August 2 and September 6.

49. Trimerotropis pallidipennis salina McNeill

Established synonyms of this race are Trimerotropis salina McNeill and Trimerotropis vinculata Hubbell.

This race has been recorded from Baldur, Shoal Lake, Aweme, Whitewater, Ashdown, Riding Mountains, Victoria Beach, Strathclair, Winnipeg, and Winnipegosis. The specimens examined were taken between July 18 and August 22.

T. pallidipennis salina inhabits salty, alkaline areas and is commonly found around the margins of ponds and lakes where the soil is more or less permeated with alkali.

Subfamily Cyrtacanthacridinae

-Key to the genera of Cyrtacanthacridinae

1. Lobes of mesosternum longer than broad, inner margins converging posteriorly; size large, tegmina of female 30 mm. or more in length; male subgenital plate deeply notched

(Fig. 37, page 126) Schistocerca Stål

- Lobes of mesosternum broader than long, inner margins rounded; size smaller, tegmina of females seldom over 25 mm. (Fig. 38, page 126) 2

- 2. General coloration melanistic or brownish
 - yellow 4
 - General coloration not melanistic or brownish
 - yellow 3
- 3. General coloration green tinged with purplish
 - pink; organs of flight fully developed;
 - male subgenital plate with a preapical tubercle (Fig. 39, page 127) . Hesperotettix Scudder
 - General coloration greenish white or brownish
 - white; tegmina represented by lanceolate pads; organs of flight seldom fully developed;
 - male subgenital plate without a preapical tubercle Hypochlora Brunner
- 4. Head large in proportion to thorax; male
 - cerci styliform; tegmina represented by lanceolate pads, sometimes fully developed Phoetaliotes Scudder
 - Head not large in proportion to thorax; male
 - cerci not styliform; tegmina fully developed or represented by lanceolate or ovate pads Melanoplus Stål

-Key to the males of Melanoplus Stål

1. Tegmina shorter than abdomen, often no longer than pronotum (except in occasional specimen of Melanoplus dawsoni, borealis junius, and fasciatus) 2
- Tegmina as long as or longer than abdomen 6
2. Tegmina represented by lanceolate or ovate pads 3
- Tegmina half as long as abdomen or longer 4
3. Furcula large and slender, at least $1/3$ the length of the supra anal plate; tegmina represented by lanceolate pads, with dorsal margins touching or slightly overlapping; dorsal surface of abdomen ringed with shining black, ventral surface yellow (Fig. 40, page 128) dawsoni (Scudder)
- Furcula short and oblong; tegmina represented by ovate pads with dorsal margins separated; small sylvan species confined mainly to jack pine areas in Manitoba (Fig. 41, page 129) islandicus Blatchley

4. Furcula elongate parallel finger-like
 projections lying on the crests of the
 basal halves of the median ridges of the
 supra anal plate (Fig. 42, page 130)
 borealis junius (Dodge)
 Furcula small, widely separated, lying
 outside the median ridges of the supra
 anal plate 5
5. Cerci spatulate, slightly wider toward the
 apex than at the base (Fig. 43, page 131)
 fasciatus (F. Walker)
 Cerci not spatulate, strongly tapering with
 apex bluntly pointed; large sylvan species
 (Fig. 44, page 132) huroni Blatchley
6. Cerci forked, or with a projecting angulation
 on the ventral margin 7
 Cerci not as described above 9
7. Cerci with a projecting angulation almost
 medially on the ventral margin (Fig. 45,
 page 133) confusus Scudder
 Cerci with apices forked 8

8. Cerci with dorsal arm of fork much shorter,
and directed horizontally inward (Fig. 46,
page 134) infantilis Scudder
- Cerci with dorsal arm of fork much longer
and broader (Fig. 47, page 135)
. keeleri luridus (Dodge)
9. Cerci with apices conspicuously expanded;
color greenish yellow with two yellow
stripes extending from back of head to
near the apex of the tegmina (Fig. 48,
page 136) bivittatus (Say)
- Cerci with apices not conspicuously
expanded 10
10. Male cerci broad basally, tapering strongly
toward the middle with apices bluntly or
obliquely truncate and narrower than one-
half the width of the base 11
- Cerci not as described above 12
11. Furcula subequal to cercus in length; basal
half of furcula broad and flat, apical half
obliquely narrowed with apices thickened
(Fig. 49, page 137) . . . flavidus flavidus Scudder

Furcula much shorter than cercus; basal third of furcula flat, apical two-thirds tapering with apices subacuminate; subgenital plate large and broadly rounded (Fig. 50, page 138)

. femur-rubrum femur-rubrum (De Geer)

12. Apex of subgenital plate truncate and usually notched or bisinuate 13
- Apex of subgenital plate rounded, not notched or bisinuate 16
13. Cerci with apical expansion slightly greater ventrally, and outer face of apical third concave (Fig. 51, page 138) . angustipennis (Dodge)
- Cerci with apices not as described above, outer face of apical third not concave . . . 14
14. Furcula elongate with arms subparallel and about $1/2$ the length of the supra anal plate; subgenital plate strongly elevated, apex with a weak median notch or a subapical impression; sylvan species (Figs. 52 and 53, pages 139 and 140) . . bruneri Scudder
- Furcula slender with arms diverging and about $1/3$ the length of supra anal plate;

- subgenital plate weakly elevated, apex with
a distinct median notch (Fig. 54, page 141) . . . 15
15. Tegmina extending beyond the hind femora by
not more than the length of pronotum, often
less; prozona subquadrate; cerci about twice
as long as broad . mexicanus mexicanus (Saussure)
Tegmina extending beyond the hind femora by at
least the length of pronotum, or by the length
of head and pronotum combined; prozona much
broader than long; cerci about half as long
again as broad phase spretus (Walsh)
16. Furcula weakly developed, represented by a
pair of conical teeth (Fig. 55, page 142)
. gladstoni (Scudder)
Furcula larger, with definite divergent
tapering arms 17
17. Aedeagus with dorsal lobe and apical processes
equally projecting (concealed under pallium
in normal position); disk of pronotum
longitudinally striped; hind tibiae blue
or pink (Fig. 56, page 143) . . . packardii Scudder
Aedeagus with apical processes projecting
well beyond the apex of the dorsal lobe

(concealed under pallium in normal position)

(Fig. 57, page 144) 18

18. Coloration dark brown; dark bands on outer face of hind femur prominent; hind tibiae generally pink; confined to pine wood areas stonei Rehn

Coloration light brown to grey-brown; dark bands on outer face of hind femur less prominent or absent; hind tibiae generally pink foedus foedus Scudder

-Key to the females of the genus Melanoplus Stål (after Handford, 1946)

1. Brachypterous species (tegmina and wings commonly shorter than abdomen) 2

Macropterous species (tegmina and wings commonly extending beyond tip of abdomen) 6

2. Wings rounded at tip, very small; posterior margin of pronotum broadly rounded, margin of disk directly in line with margins of lateral lobes; small sylvan species confined mostly to areas of jack pine in Manitoba M. islandicus Blatch.

- Wings pointed at tip, variable in size;
 posterior margin of pronotal disk variable
 but not directly in line with posterior
 margin of lateral lobes 3
3. Metasternal lobes separated by a distance at
 least equal their length; eyes separated at
 vertex by a distance of one and one-third
 times width of frontal costa at median
 ocellus; light mark at base of antenna broad,
 conspicuous, and continuous; large sylvan
 species associated with islandicus
 M. huroni Blatch.
- Metasternal lobes separated by a distance
 of less than their length; eyes separat-
 ed at vertex by a distance not greater than
 width of frontal costa at median ocellus;
 light mark at base of antenna usually interr-
 upted at centre, and if not then narrow and
 inconspicuous 4
4. Prongs of upper valvulae almost straight,
 their dorsal edges parallel with main axis
 of valvulae; latero-posterior projections

- of eighth sternite absent; abdomen not
ringed with shining black
. M. borealis junius (Dodge)
Prongs of upper valvulae distinctly curved . . . 5
5. Latero-posterior projections present on
eighth sternite but very small; abdomen
not ringed with shining black
. M. fasciatus (F. Walker)
Latero-posterior projections lacking on
eighth sternite; abdomen ringed with
shining black M. dawsoni (Scud.)
6. Upper valvulae with high shoulders approxi-
mating a right angle (Fig. 58, page 145) . . . 7
Upper valvulae with rounded shoulders, or if
approximating a right angle then distinctly
serrate and shoulders not clearly defined . . . 11
7. Latero-posterior projections of eighth sternite
lacking 8
Latero-posterior projections present on eighth
sternite 9

8. Prongs of upper valvulae short and not strongly curved; prosternal tubercle blunt with sides subparallel; light mark near base of antennae broad and continuous; longitudinal marks on outer face of posterior femur broken by transverse light marks . . . M. confusus Scud.

Prongs of upper valvulae elongate and strongly curved; prosternal tubercle more or less pointed with sides convergent; light mark near base of antenna rarely continuous and if so then narrow; longitudinal marks on outer face of hind femur continuous M. flavidus flavidus Scud.

9. Length to tip of abdomen less than twenty-five millimetres; latero-posterior projections of eighth sternite small and inconspicuous; structures in general delicate M. angustipennis (Dodge)

Length more than 25 millimetres; latero-posterior projections of eighth sternite quite distinct; structures in general more robust 10

10. Tibiae mostly pink; general colour dark
 brown; contrastingly pale transverse marks
 on outer face of hind femur; confined to
 pine woods area in association with M.
islandicus, etc. M. stonei Rehn
- Tibiae mostly glaucous; general colour
 light brown to gray-brown; transverse
 pale marks on outer face of hind femur
 either absent or inconspicuous
- M. foedus foedus Scud.
M. packardii Scud.
11. Latero-posterior projections present on
 eighth sternite 12
- Latero-posterior projections of eighth
 sternite lacking 14
12. Length to tip of abdomen less than 25
 millimetres; latero-posterior projections
 of eighth sternite less than half as long
 as egg guide; general colour fuscous with
 innumerable minute gray maculations
 M. gladstoni (Scud.)
- Length to tip of abdomen commonly much more
 than 25 millimetres; latero-posterior

projections of eighth sternite at least half as long as egg guide; general colour yellow with sharply contrasting fuscous markings 13

13. Latero-posterior projections half as long as egg guide; pronotal disk bordered by yellow stripes that continue on the tegmina; fuscous stripe on outer face of hind femur continuous and confined to upper half M. bivittatus (Say)

Latero-posterior projections as long as egg guide; pronotal disk and tegmina without yellow stripes; fuscous on outer face of hind femur commonly replaced by yellow on posterior margin of each chevron, and always encroaching on lower half of femur M. differentialis (Thom.)

14. Lighter mark near base of antenna continuous; outer face of hind femur without transverse light bands or spots 15

Lighter mark near base of antenna interrupted at middle; outer face of hind femur with transverse light bands or spots 16

15. Outer face of hind femur covered with heavy fuscous, lighter marks occasionally encroaching slightly on upper margin; prongs of upper valvulae curved but slightly; prosternal tubercle of medium length, sides slightly to distinctly converging

. M. keeleri luridus (Dodge)

Outer face of hind femur typically bluish gray; prongs of upper valvulae strongly curved; prosternal tubercle long, blunt, sides subparallel on distal third, and pointing well back to hide rest of sternum; cerci with concave sides tapering to slender tip (see mexicanus)

. M. femur-rubrum femur-rubrum (DeG.)

16. Length to tip of abdomen usually much more than 20 millimetres 17

Length less than 20 millimetres 18

17. Distribution general; prosternal tubercle commonly short, vertical at least posteriorly, sides distinctly converging, tip more or less pointed; cerci comparatively

broad, sides convex (see femur-rubrum)

. M. mexicanus mexicanus (Sauss.)

Confined to shrubby or wooded areas; otherwise
not clearly differentiated from mexicanus

. M. bruneri Scud.

18. Caudal tibiae pink; general colour dark brown
to fuscous above, bright yellow beneath;

comparatively robust M. dawsoni (Scud.)

19. Caudal tibiae glaucous; general colour brown
to yellowish brown above, pale yellow or
cream beneath; comparatively slender and

delicately constructed M. infantilis Scud.

Genus Hesperotettix Scudder

50. Hesperotettix viridis pratensis Scudder

An established synonym is Hesperotettix pratensis
Scudder.

This race has been recorded from Turtle Mountains,
Goodlands, Lyleton, Brandon, and Carman. The specimens
examined were taken between July 22 and September 12.

According to Criddle (1933b), this insect in its

food preferences is definitely associated with members of the family Compositae, particularly of the genus Solidago, the goldenrods.

H. viridis pratensis Scudder is probably more widely distributed than present records indicate.

Genus Hypochlora Bruner

51. Hypochlora alba (Dodge)

Pezotettix alba Dodge is an established synonym of this species.

Walker (1910c) stated that this species was recorded from Manitoba by Bruner in 1885.

This species has been recorded at Goodlands, Lyleton, and Aweme. The specimens examined were taken between July 21 and September 4.

Hypochlora alba (Dodge) is probably the most specific feeder of all the grasshoppers found in Manitoba. It appears to be restricted to the southwestern part of the Province and there it is further limited to areas in which the common white sage, Artemisia ludoviciana Nutt., grows.

Criddle (1933b) states that this insect's diet is restricted to the common white sage and that it seldom leaves the plant except for egg-laying.

Genus Schistocerca Stal52. Schistocerca lineata Scudder

This species has only been recorded from Lyleton in the southwestern part of the Province. The two males and two females captured were probably migrants, as this insect has not been recorded in the Province since its last occurrence in 1939. The specimens were taken between August 13 and September 1. Lyleton is the northeastern limit point of this species.

Genus Phoetaliotes Scudder53. Phoetaliotes nebrascensis (Thomas)

Established synonyms of this species are: Pezotettix nebrascensis Thomas, Pezotettix autumnalis Dodge, Melanoplus phoetaliotiformis Scudder, Melanoplus harrisii Morse, Caloptenus sanguinocephalus La Munyon, and Caloptenus volucris Dodge.

This species is not very common in Manitoba and has only been recorded from Brandon, Goodlands, and Lyleton in the southwestern part of the Province. The specimens examined were taken between August 11 and September 20.

According to Criddle (1930c), this insect shows preference for undulating country and is usually most abundant in narrow valleys or coulees where it inhabits the denser vegetation.

Genus Melanoplus Stål

54. Melanoplus dawsoni (Scudder)

Established synonyms of this species are: Melanoplus acutus Scudder, Melanoplus dawsoni completus Scudder, Pezotettix dawsoni Scudder, Pezotettix tellustris Scudder, and Pezotettix abditum Dodge.

This species is widely distributed in Manitoba and specimens have been recorded from the following points: Brandon, Alexander, Birtle, Carlowrie, Justice, Gimli, Baldur, Pierson, Arnaud, Menisino, Piney, Novra, Deepdale, Marchand, Lyleton, Vassar, Sundown, Sifton, Senkiw, Neepawa, Souris, Boissevain, Aweme, Winnipeg, and Rosa. The specimens examined were taken between July 20 and September 24.

M. dawsoni (Scudder) is one of the commonest roadside species encountered in Manitoba. The adults are among the last of the Melanopli to disappear in the autumn.

Smith (1947) reported that in Manitoba this species

is parasitized by the following Sarcophagids: Blaesoxiphotheca coloradensis (Ald.), Protodexia hunteri (Hough), Sarcophaga reversa Ald., and Tephromyiella atlanis (Ald.).

55. Melanoplus islandicus Blatchley

Established synonyms of this species are Melanoplus mancus islandicus Blatchley and Melanoplus abortivus Walker.

M. islandicus Blatchley is a sylvan species and has only been recorded from the jack pine belt in eastern Manitoba. Specimens have been taken at Marchand, Sandilands, the vicinity of Dawson Road and Whitemouth River, between July 13 and August 30.

According to Criddle (1933b), its chosen habitat appears to be near or among blueberry shrubs, upon the leaves of which it feeds to some extent, but its preferred food is the leaves of the small lily Maianthemum canadense Desf.

56. Melanoplus borealis junius (Dodge)

Established synonyms of this race are: Melanoplus extremus Scudder, Melanoplus borealis Morse, and Pezotettix junius Dodge.

This race has been recorded from Aweme, Onah, Arnaud,

Winnipeg, Senkiw, Russell, Birch River, Cowan, Carrick, and Churchill. This insect is one of the earliest of the Melanopli to reach maturity. The specimens examined were taken between June 13 and August 30.

57. Melanoplus fasciatus (F. Walker)

Established synonyms of this species are: Melanoplus alleni Scudder, Melanoplus rectus Scudder, Melanoplus curtus Scudder, Melanoplus volaticus Scudder, and Melanoplus baconi McNeill.

This northern sylvan species has been recorded from Sifton, Mafeking, Novra, Sandilands, Whitemouth, Piney, Aweme, Benito, Onah, Birch River, Victoria Beach, and Sprague. The specimens examined were taken between July 2 and September 11.

This species is restricted to the forested areas, and according to Criddle (1933b), in Manitoba M. fasciatus (F. Walker) seems to thrive among the scattered spruce and bearberry in the sand dune country.

58. Melanoplus huroni Blatchley

An established synonym of this species is Melanoplus dodgei huroni Blatchley.

This boreal sylvan species has been recorded from Sandilands, Atikemag Lake, Blue Lake, Cowan, and Victoria Beach. The specimens examined were taken between June 14 and September 20.

This species is limited to wooded areas in sandy situations.

59. Melanoplus confusus Scudder

Established synonyms of this species are Melanoplus minor (Scudder) and Melanoplus mutatus Caudell.

Walker (1910c) recorded this species from Aweme as the synonymous Melanoplus minor (Scudder).

Other records of distribution are: Onah, Lyleton, Carlowrie, Stockton, Camp Hughes, Piney, Morden, Goodlands, Hartney, Birtle, and Souris. The specimens examined were taken between June 12 and July 28.

This species appears as an adult early in the season and is widely distributed in Manitoba. It inhabits pastures and areas adjacent to open woods. According to Criddle (1928), Melanoplus confusus Scudder, during years of abundance, moved from outlying areas into grain fields and did appreciable damage. He also states that the females deposit their eggs in bare spots between clumps of vegetation, or in stubble fields.

60. Melanoplus infantilis Scudder

This species has been recorded from the following points: Aweme, Boissevain, Morden, Goodlands, Hartney, Brandon, Deloraine, Melita, Griswold, Ethelbert, Ashville, Deepdale, Roblin, Souris, Carlowrie, Napinka, Baldur, and Lyleton. The specimens examined were taken between June 22 and September 24.

61. Melanoplus keeleri luridus (Dodge)

Established synonyms of this race are Caloptenus luridus Dodge and Melanoplus collinus Scudder.

This race has been recorded from Menisino, Arnaud, Brandon, Aweme, Hartney, Victoria Beach, Griswold, Souris, and Birtle. The specimens examined were taken between July 20 and September 19.

M. keeleri luridus is rather widely distributed in Manitoba but seems to be confined to sandy or gravelly areas. According to Criddle (1928), this insect deposits its eggs in bare spots or around the margins of grass and weeds. He also states that at times M. keeleri luridus has reached sufficient numbers to do a certain amount of damage to growing grain.

62. Melanoplus bivittatus (Say)

Established synonyms of this species are: Gryllus bivittatus Say, Caloptenus femoratus Burmeister, Melanoplus femoratus Scudder, Acridium milberti Serville, Acridium flavovittatum Harris, and Pezotettix edax Saussure.

This species is widely distributed throughout Manitoba and has been taken from the eastern to the western boundaries of the Province. Adults may be seen from mid-July to the end of October.

The two-striped grasshopper is so named because of the two yellowish stripes extending from just behind the head to the tip of the wings.

The females lay their eggs in a variety of places but tend to concentrate them in ditch crowns, drift ridges, fence rows, and bare spots among weeds. Each female is capable of laying three to four pods containing between fifty and seventy-five, loosely-packed, dull orange eggs. The pods are large, elongate, and usually slightly curved. Both diapause and non-diapause eggs may be present in the same pod.

The eggs remain in the soil over winter and commence to hatch about the last week in May or later, depending

upon the advancement of spring. The nymphs moult five or six times and reach the adult stage about mid-July. Egg laying commences about the end of July and continues throughout August and September.

M. bivittatus (Say) is a general feeder and in 1932 stripped thousands of acres of the common sow thistle, Sonchus arvensis L., doing much toward the destruction of this weed.

In the fall of 1951 the eggs of this species were heavily parasitized by the wasp parasite Scelio. According to Smith (1947), the nymphs and adults of M. bivittatus (Say) are parasitized in Manitoba by the Sarcophagids Acridiophaga aculeata Ald., Blaesoxiphotheca caudata Tns., Blaesoxiphotheca coloradensis (Ald.), Kellymyia kellyi (Ald.), Protodexia hunteri (Hough), Sarcophaga reversa Ald., Sarcophaga sinuata Meig., and Tephromyiella atlanis Ald.; the Tachinids Acemya tibialis Coq., and Hemithrixion oestriforme B.&B.; the Anthomyiid Acridomyia canadensis Snyder; and the nematode Agamermis decaudata Cobb, Steiner, Christie.

63. Melanoplus flavidus flavidus Scudder

Established synonyms of this race are Melanoplus incisus Scudder and Melanoplus cenchri McNeill.

This grasshopper has been taken at Onah, Lyleton, Treesbank, and Hartney. The specimens examined were taken between August 6 and September 17. M. flavidus flavidus Scudder is limited to sandy areas but probably more widely distributed in Manitoba than the present records indicate.

64. Melanoplus femur-rubrum femur-rubrum (De Geer)

Established synonyms of this species are: Acrydium femur rubrum De Geer, Melanoplus femur rubrum Blatchley, Melanoplus interior Scudder, Gryllus erythropus Gamelin, Acridium femorale Olivier, Caloptenus devorator Scudder, Caloptenus sanguinolentus Provancher, and Caloptenus plumbeus Dodge.

This species has been recorded from the following points: Ingelow, Senkiw, Aweme, Alexander, Marquette, Lyleton, Miami, Arnaud, Sifton, Birtle, Carlowrie, Portage la Prairie, Brandon, Stockton, and Winnipeg. The specimens examined were secured between June 26 and October 10.

The life history of this grasshopper is similar to that of M. bivittatus Say, differing only in that it attains

maturity a little later. M. femur-rubrum femur-rubrum (De Geer) does considerable damage to crops in some parts of Canada but has not as yet proved troublesome in Manitoba.

According to Smith (1947), this species is parasitized in Manitoba by the Sarcophagids Acridiophaga aculeata Ald., Blaesoxiphotheca coloradensis (Ald.), Protodexia hunteri (Hough), Sarcophaga reversa Ald., Tephromyiella atlanis Ald., Opsophyto opifera (Coq.); the Tachinids Acemya tibialis Coq. and Hemithrixion oestriforme B.&B.; the Anthomyiid Acridomyia canadensis Snyder; and the nematode Agamermis decaudata Cobb, Steiner, Christie.

65. Melanoplus angustipennis (Dodge)

Established synonyms of this species are Melanoplus comptus Scudder, Caloptenus angustipennis Dodge, and Melanoplus coccineipes Scudder.

This insect has been recorded from Onah, Aweme, Winnipeg, Victoria Beach, Goodlands, Lyleton, Stockton, Ingelow, Alexander, Brandon, Hartney, Souris, and Melita. The specimens examined were taken between June 20 and September 10.

This species is widely distributed in Manitoba but is most commonly encountered in sandy situations.

Smith (1947) reports that M. angustipennis (Dodge) is parasitized in Manitoba by the Sarcophagids Protodexia hunteri (Hough) and Sarcophaga reversa Ald.

66. Melanoplus bruneri Scudder

This boreal sylvan species has been recorded from Snowflake, Piney, Novra, Swan River, Winnipeg, Steinbach, Cowan, Ethelbert, Sprague, Birch River, Goodlands, Dauphin, Sandilands, and Marchand. The specimens examined were taken between July 20 and September 7.

M. bruneri Scudder is widely distributed in Manitoba, but is confined to localized areas and thus is not very common.

67. Melanoplus mexicanus mexicanus (Saussure)

Established synonyms of this species are Melanoplus mexicanus atlanis (Riley), Caloptenus atlanis Riley, and Acrydium spretis Thomas.

This species has been recorded from the following points: Carlowrie, Marchand, Sifton, Aweme, Novra, Lyleton, Blue Lake, Carberry, Cowan, Arnaud, Swan River, Winkler, and Altona. The specimens examined were taken between July 17 and September 21.

The lesser migratory grasshopper inhabits all the prairie country of Western Canada, and in Manitoba has been known to occur in enormous numbers as far north as Swan River and eastward to the Ontario boundary. In recent years it has been the least abundant of the economic species in Manitoba.

This grasshopper is often referred to as the "stubble" grasshopper because it lays the majority of its eggs in stubble fields. However, it may also lay them in drift ridges and recently abandoned fields. The females lay seven to eight pods in a season. The pods are elongate, cylindrical, and moderately curved, and contain eighteen to twenty neatly arranged, cream colored eggs.

The eggs remain in the soil over winter and begin hatching in late May and early June. The resulting nymphs moult five times and reach the adult stage in late July. The mature females lay their eggs during August and September.

According to Smith (1947), this species is parasitized in Manitoba by the Sarcophagids Acridiophaga aculeata Ald., Blaesoxiphotheca coloradensis (Ald.), Opsophyto opifera (Coq.), Protodexia hunteri (Hough), Sarcophaga reversa Ald., and Tephromyiella atlanis Ald.; the Tachinids

Acemya tibialis Coq. and Hemithrixion oestriforme B.&B.; the Anthomyiid Acridomyia canadensis Snyder; and the nematode Agamermis decaudata Cobb, Steiner, Christie.

68. Melanoplus mexicanus migratory phase spretus (Walsh)

The migratory phase spretus was last recorded in Manitoba at Aweme by Criddle in 1909.

The specimens examined were taken between July 12 and July 26.

Prior to 1900 the devastating outbreaks of grasshoppers in Manitoba were the result of invasion from the south and west by the long winged migratory phase of mexicanus.

69. Melanoplus gladstoni (Scudder)

Established synonyms of this species are Melanoplus conspersa Scudder and Melanoplus compactus Scudder.

This species has been recorded from Aweme, Lyleton, Treesbank, Griswold, Ashville, Hartney, Souris, Goodlands, Melita, Snowflake, Pilot Mound, Carlowrie, Onah, and Douglas. The specimens examined were taken between July 17 and August 23.

According to Criddle (1928), this grasshopper is essentially an upland species which is very largely confined

to sandy or gravelly areas where the vegetation is of moderate density.

70. Melanoplus packardii Scudder

Melanoplus packardii rufipes Cockerell is an established synonym of this species.

This species has been recorded from Lyleton, Treesbank, Miami, Morden, Waskada, Arnaud, Elva, Mafeking, Rathwell, Stockton, Brandon, Coulter, Novra, Melita, Cypress River, Turtle Mountains, Aweme, Souris, Hartney, Deloraine, Griswold, and Napinka. The specimens examined were taken between July 27 and September 5.

M. packardii Scudder is most commonly encountered in the lighter soil areas of Manitoba where the vegetation is tall and sparse.

According to Criddle (1928), this species generally confines its egg laying operations to soil that has been disturbed, but will also lay in deserted fields, overgrazed pastures, and stubble fields.

Smith (1947) reports that this grasshopper is parasitized in Manitoba by the Sarcophagids Blaesoxiphotheca coloradensis (Ald.), Opsophyto opifera (Coq.), Protodexia hunteri (Hough), Sarcophaga reversa Ald., and Tephromyiella

atlanis Ald.; the Anthomyiid Acridomyia canadensis Snyder; and the nematode Agamermis decaudata Cobb, Steiner, Christie.

71. Melanoplus stonei Rehn

This species has been recorded from Cowan, Marchand, Piney, Menisino, Victoria Beach, Sprague, Mafeking, Dropmore, and Onah. The specimens examined were taken between July 3 and September 7.

M. stonei Rehn inhabits openings in jack pine woods and the sandy beaches of lakes. It occurs in the pine wood area east of the Red River and in similar habitats in northern Manitoba. Criddle (1931) states that this species does not thrive on grasses but feeds primarily on bearberry and dandelion.

72. Melanoplus foedus foedus Scudder

This species occurs in the sandy sections from Morden to north of Rathwell, west to Elva, and north to Mafeking. M. foedus foedus Scudder has been recorded from the following points: Melita, Onah, Elva, Aweme, Stockton, Brandon, Cameron, Cypress River, Lyleton, Lazare, Marchand, and Mafeking. The specimens examined were taken between June 20 and August 31.

According to Criddle (1933b), this grasshopper prefers to lay its eggs in semi-soft ground such as is provided by old pocket gopher mounds, but will also utilize grain fields or stubble fields for this purpose.

Smith (1947) reports that M. foedus foedus Scudder is parasitized by the Sarcophagids Blaesoxiphotheca coloradensis (Ald.), Protodexia hunteri (Hough), Sarcophaga reversa Ald., and Tephromyiella atlanis (Ald.), and the Anthomyiid Acridomyia canadensis Snyder.

FIGURE 4. DORSAL VIEW OF HEAD AND PRONOTUM OF OPEIA OBSCURA
(SCUDDER).



FIGURE 4. Enlarged 12x

FIGURE 5. DORSAL VIEW OF HEAD AND PRONOTUM OF CORDILLACRIS
OCCIPITALIS CINEREA (BRUNER) .



FIGURE 5. Enlarged 12x

FIGURE 6. DORSAL VIEW OF HEAD AND PRONOTUM OF AMPHITORNUS
COLORADUS (THOMAS).

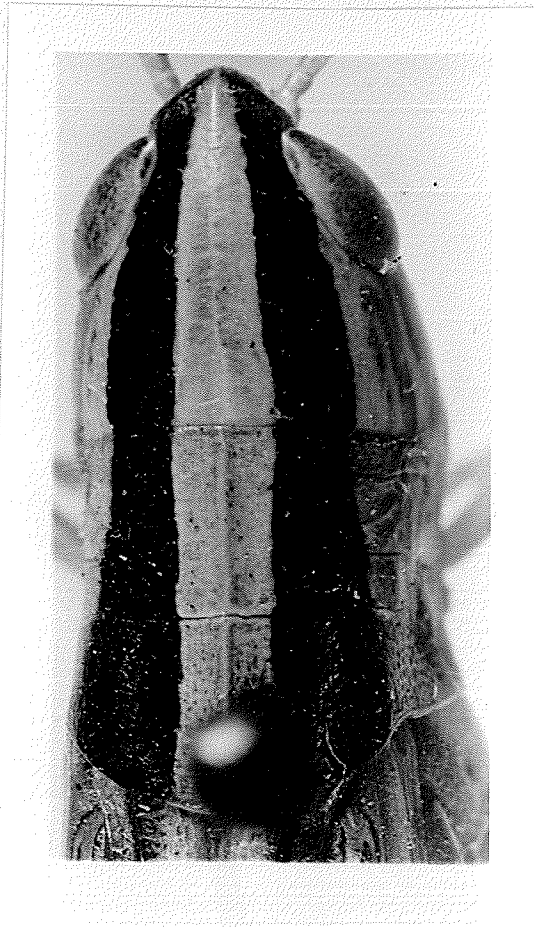


FIGURE 6. Enlarged 12x

FIGURE 7. DORSAL VIEW OF HEAD AND PRONOTUM OF PHLIBOSTROMA
QUADRIMACULATUM (THOMAS).



FIGURE 7. Enlarged 12x

FIGURE 8. DORSAL VIEW OF HEAD AND PRONOTUM OF ORPHULELLA
PELIDNA PELIDNA (BURMEISTER).

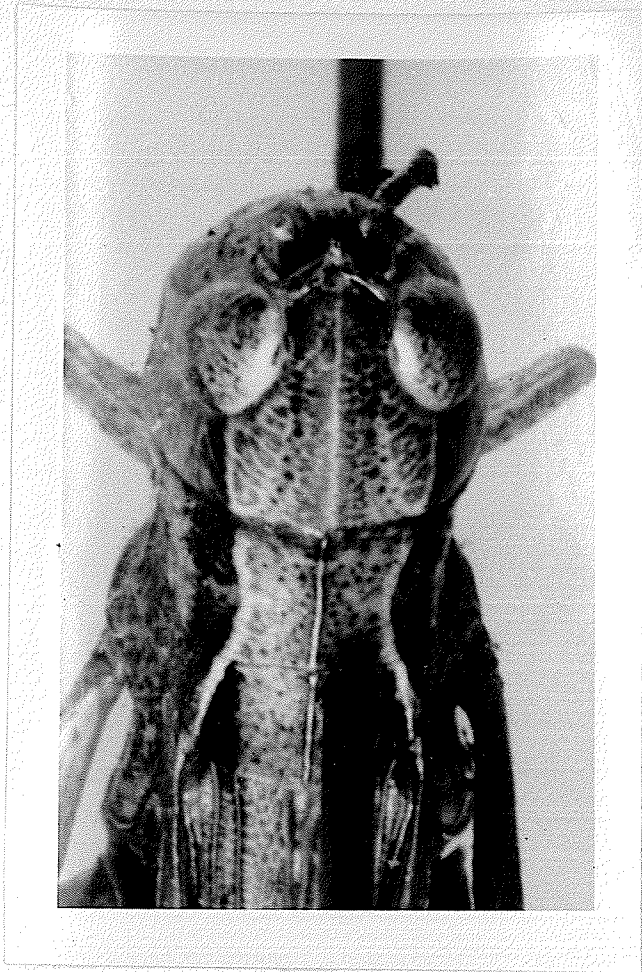


FIGURE 8. Enlarged 10x

FIGURE 9. LATERAL VIEW OF TEGMINA OF THE MALE OF CHLOEALTIS
CONSPERSA (HARRIS).

FIGURE 10. LATERAL VIEW OF TEGMINA OF THE FEMALE OF
CHLOEALTIS CONSPERSA (HARRIS).



FIGURE 9. Enlarged 8x



FIGURE 10. Enlarged 8x

FIGURE 11. LATERAL VIEW OF TEGMINA OF THE MALE OF
NEOPODISMOPSIS ABDOMINALIS (THOMAS).

FIGURE 12. LATERAL VIEW OF TEGMINA OF THE FEMALE OF
NEOPODISMOPSIS ABDOMINALIS (THOMAS).



FIGURE 11. Enlarged 8x



FIGURE 12. Enlarged 8x

FIGURE 13. LATERAL VIEW OF THE POSTERIOR PAIR OF APICAL
SPURS OF THE HIND TIBIA OF CHORTHIPPUS
LONGICORNIS LATREILLE.

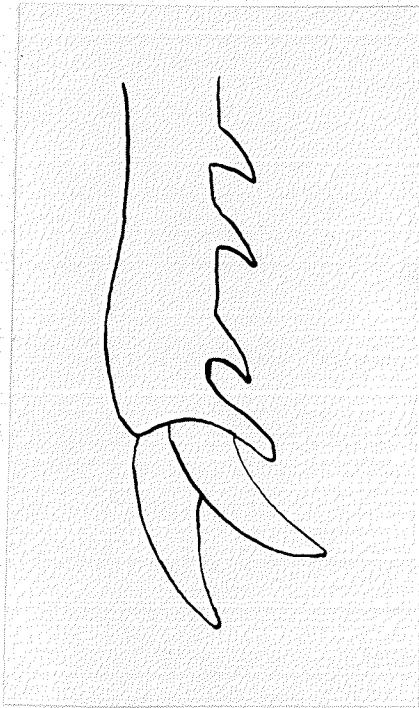


FIGURE 13. Enlarged 50x

FIGURE 14. LATERAL VIEW OF THE POSTERIOR PAIR OF APICAL
SPURS OF THE HIND TIBIA OF PSOLOESSA DELICATULA
DELICATULA (SCUDDER).

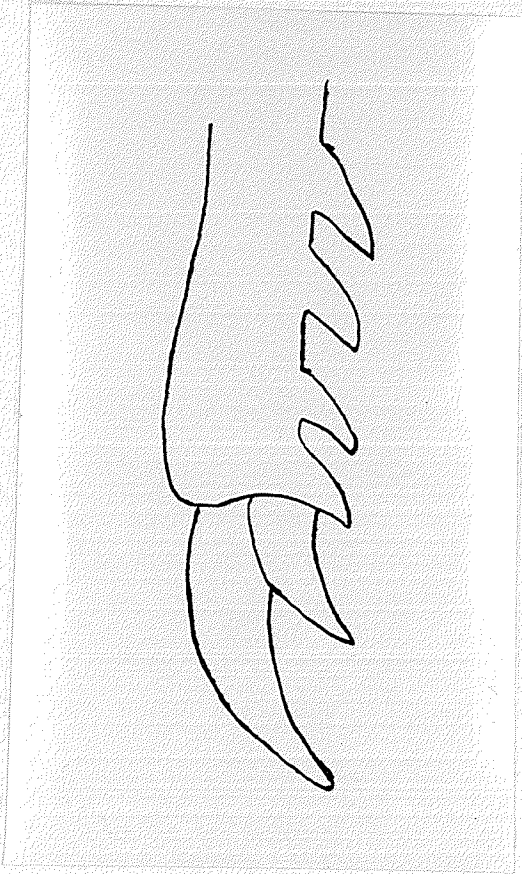


FIGURE 14. Enlarged 50x

FIGURE 15. LATERAL VIEW OF CHORTHIPPUS LONGICORNIS
LATREILLE.

FIGURE 16. LATERAL VIEW OF BRUNERIA BRUNNEA THOMAS.

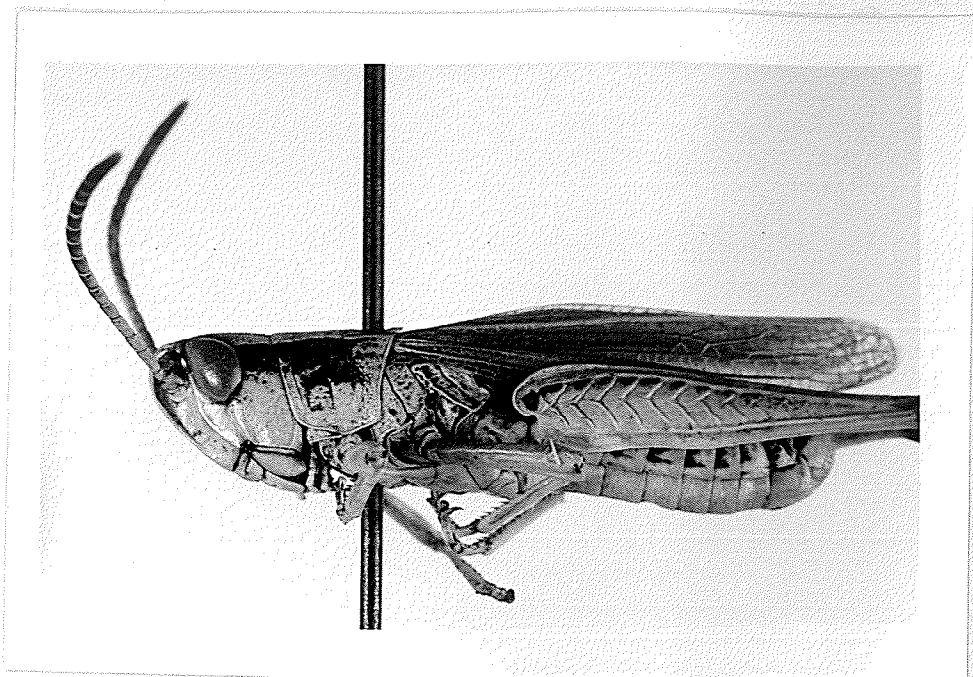


FIGURE 15. Enlarged 6x

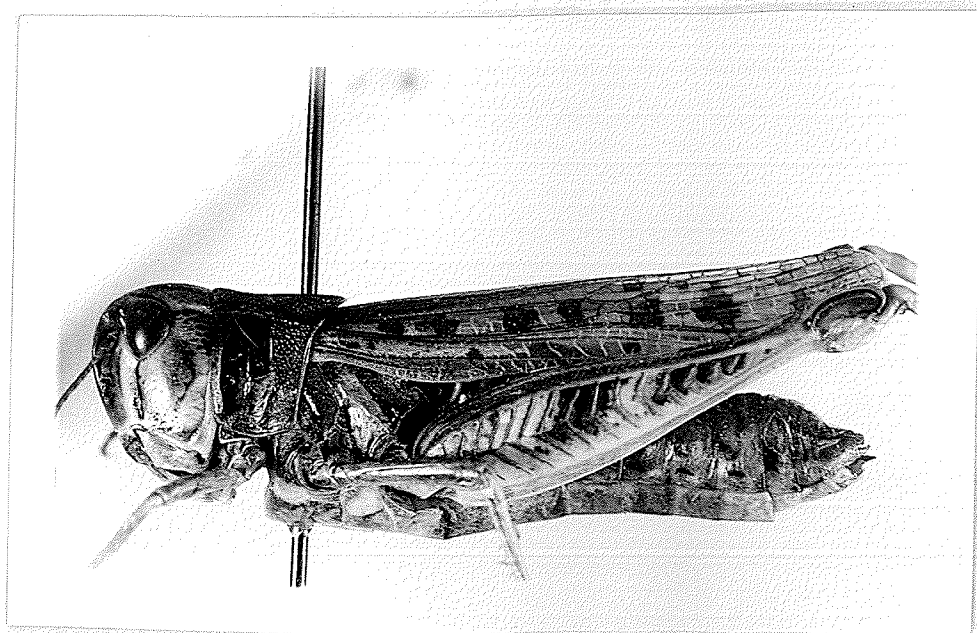


FIGURE 16. Enlarged 6x

FIGURE 17. DORSAL VIEW OF HIND WING OF ARPHIA CONSPERSA
SCUDDER.



FIGURE 17. Enlarged 2.5x

FIGURE 18. DORSAL VIEW OF HIND WING OF SPHARAGEMON
COLLARE (SCUDDER).

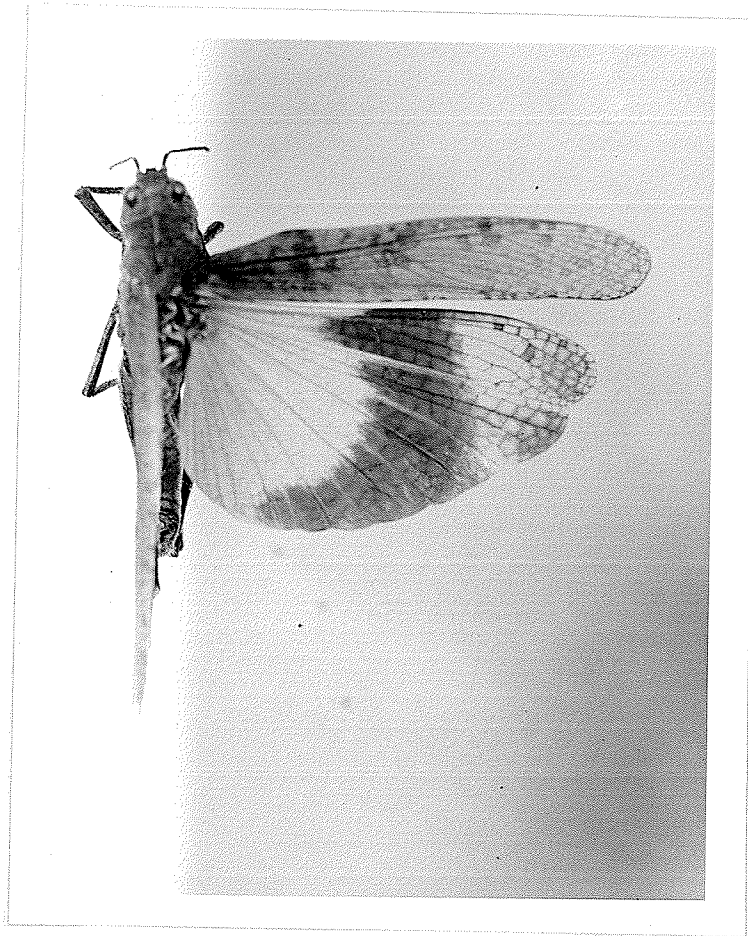


FIGURE 18. Enlarged 2.5x

FIGURE 19. DORSAL VIEW OF HEAD AND PRONOTUM OF ARPHIA
CONSPERSA SCUDDER.

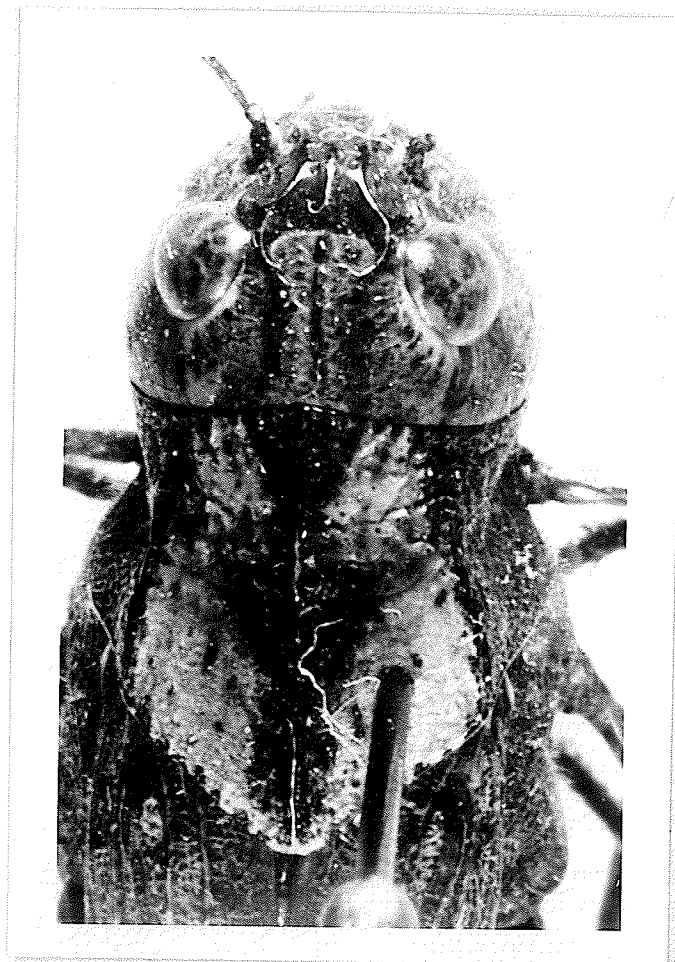


FIGURE 19. Enlarged 10x

FIGURE 20. DORSAL VIEW OF HEAD AND PRONOTUM OF PARDALOPHORA
APICULATA (HARRIS).

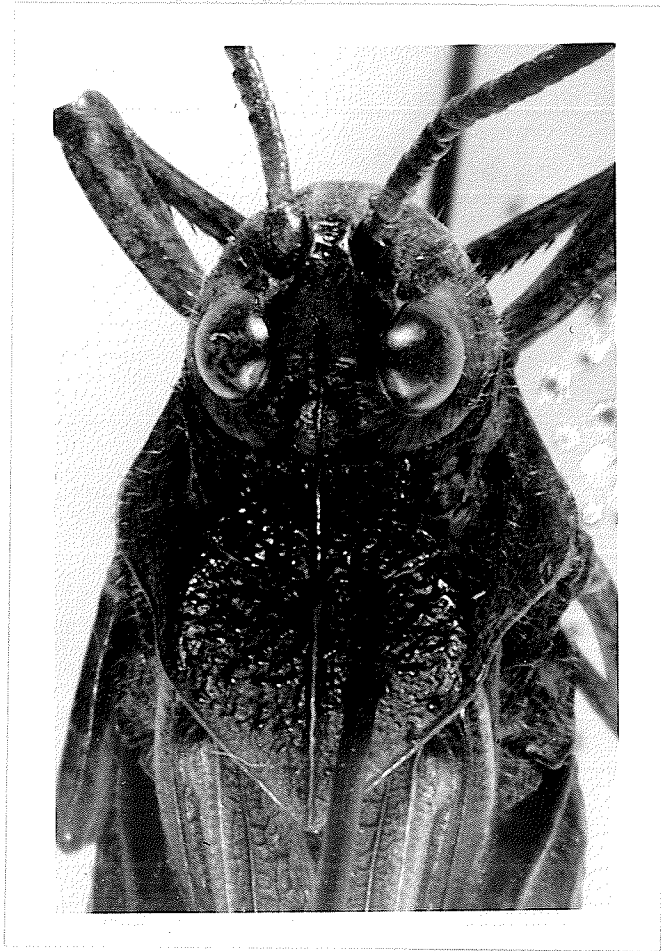


FIGURE 20. Enlarged 10x

FIGURE 21. DORSAL VIEW OF HEAD AND PRONOTUM OF HADROTETTIX
TRIFASCIATUS (SAY)



FIGURE 21. Enlarged 8x

FIGURE 22. DORSAL VIEW OF HEAD AND PRONOTUM OF SPHARAGEMON
COLLARE (SCUDDER).

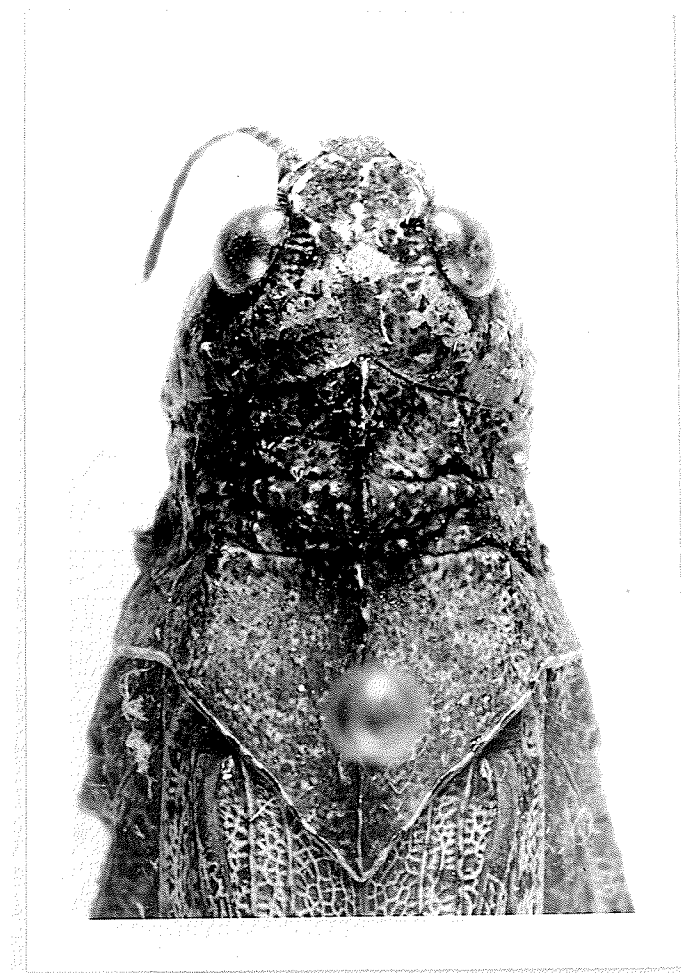


FIGURE 22. Enlarged 8x

FIGURE 23. LATERAL VIEW OF PRONOTUM OF CRATYPEDES NEGLECTUS
(THOMAS).

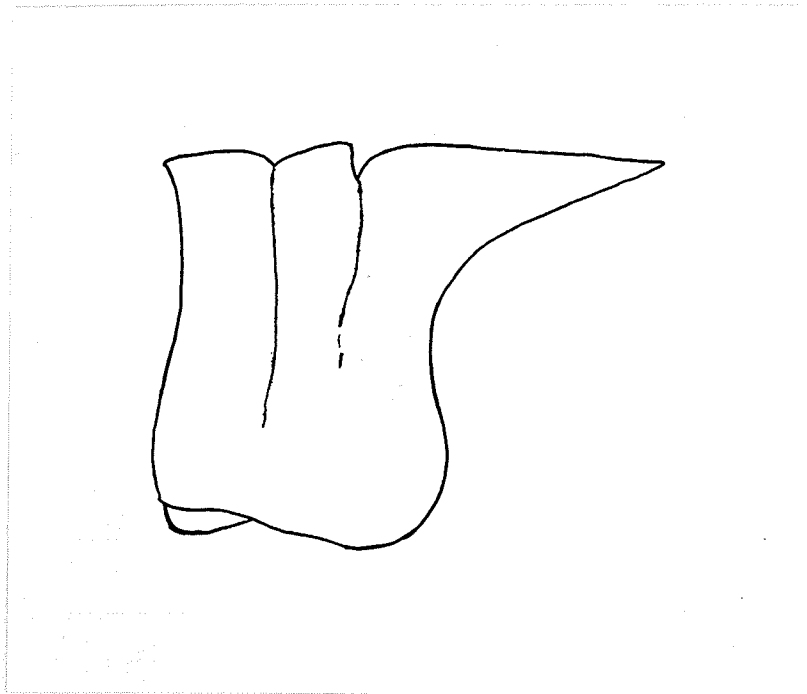


FIGURE 23. Enlarged 10x

FIGURE 24. DORSAL VIEW OF HIND WING OF CRATYPEDES NEGLECTUS
(THOMAS).

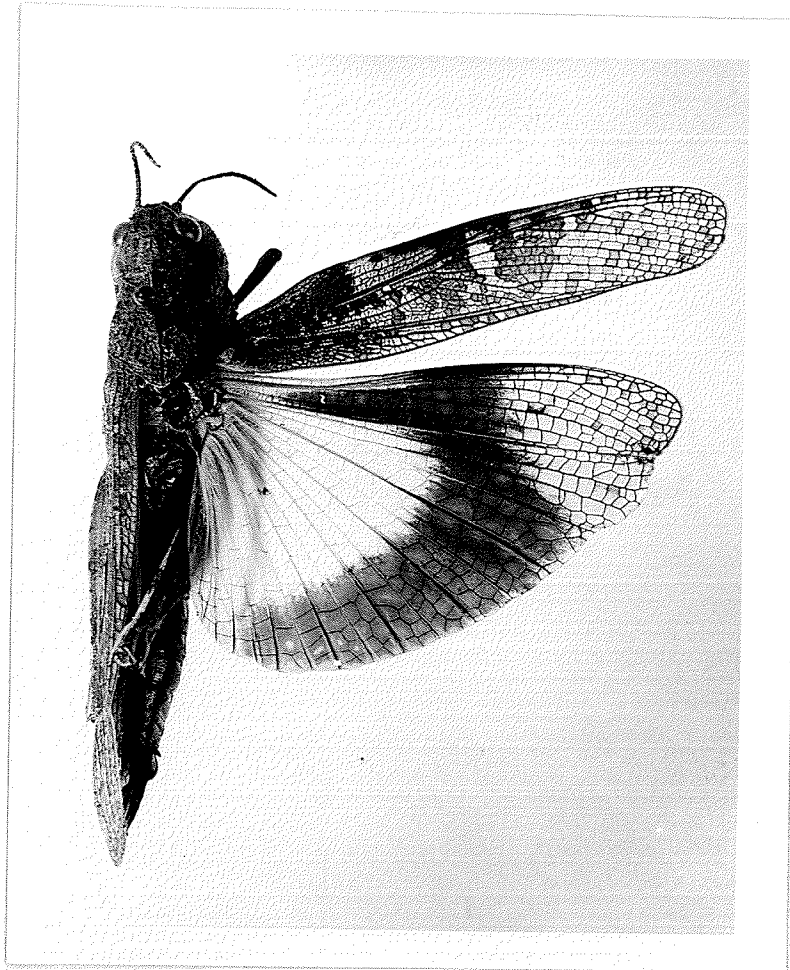


FIGURE 24. Enlarged 2.5x

FIGURE 25. DORSAL VIEW OF HEAD AND PRONOTUM OF HADROTETTIX
TRIFASCIATUS (SAY).



FIGURE 25. Enlarged 8x

FIGURE 26. DORSAL VIEW OF HEAD AND PRONOTUM OF XANTHIPPIUS
CORALLIPES LATEFASCIATUS SCUDDER.

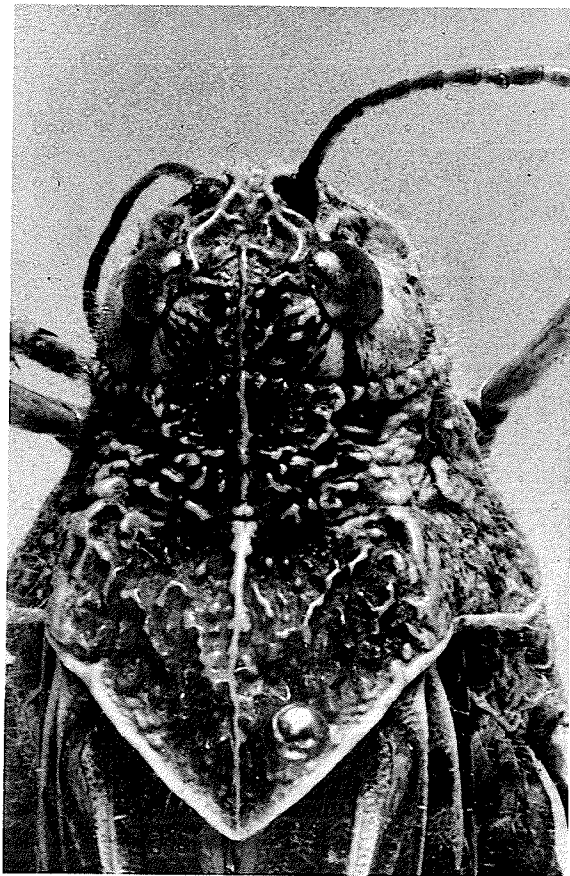


FIGURE 26. Enlarged 8x

FIGURE 27. LATERAL VIEW OF PRONOTUM OF METATOR PARDALINUS
(SAUSSURE).

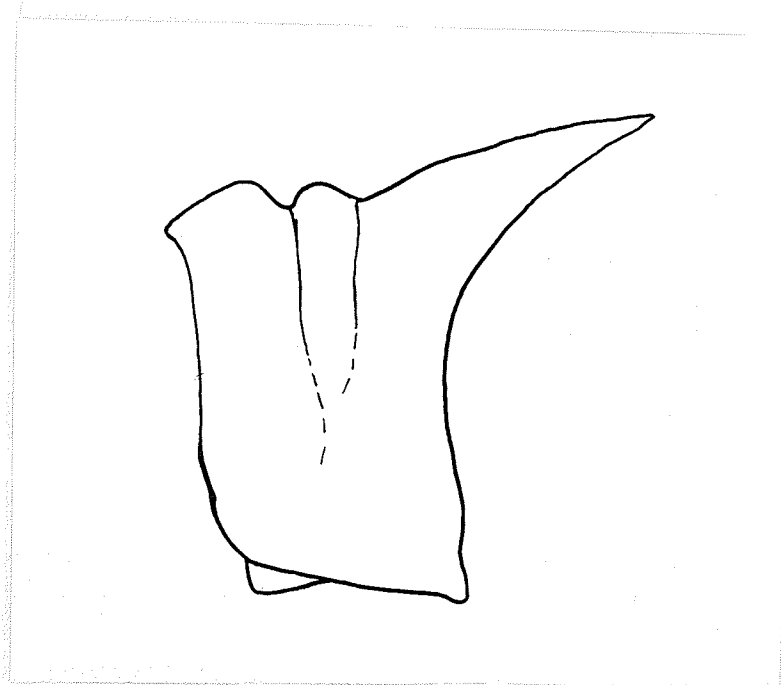


FIGURE 27. Enlarged 10x

FIGURE 28. DORSAL VIEW OF HIND WING OF METATOR PARDALINUS
(SAUSSURE).

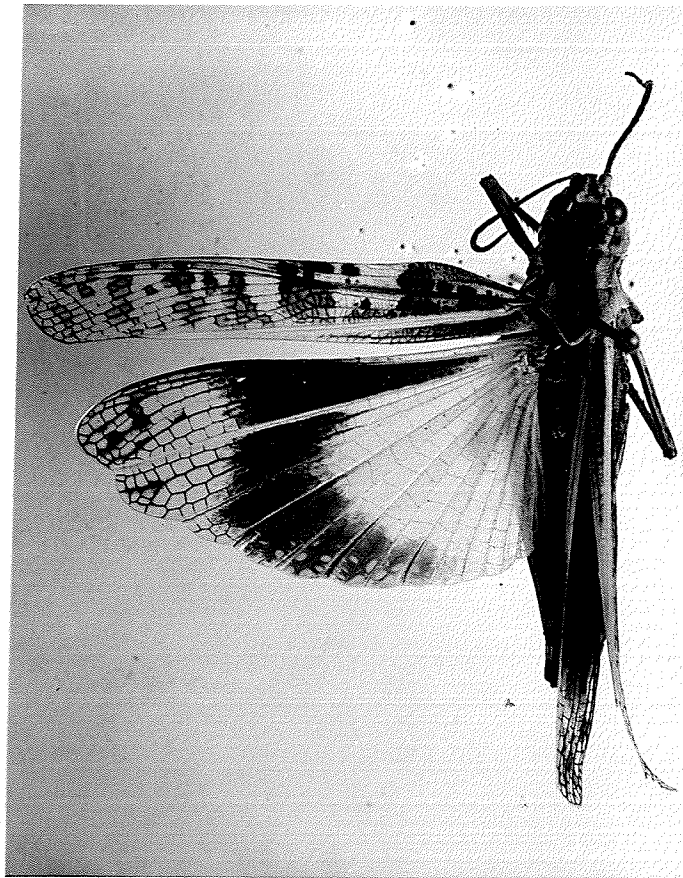


FIGURE 28. Enlarged 2.5x

FIGURE 29. DORSAL VIEW OF HIND WING OF AEROCHOREUTES
CARLINIANUS CARLINIANUS (THOMAS).

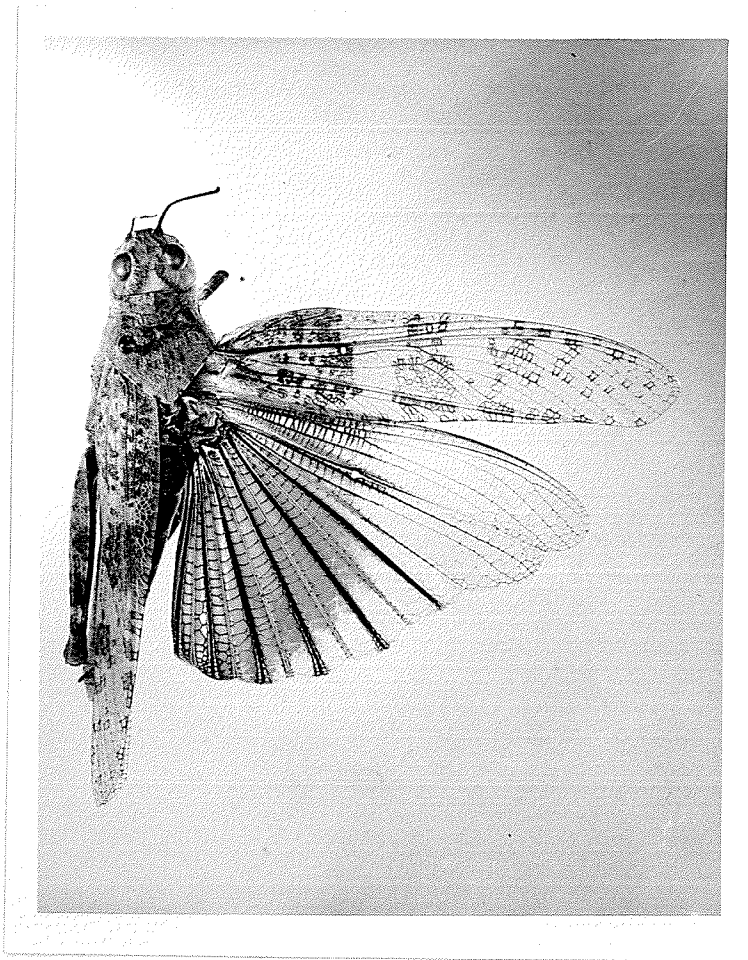


FIGURE 29. Enlarged 2.5x

FIGURE 30. DORSAL VIEW OF HIND WING OF CIRCOTETTIX
VERRUCULLATUS KIRBY.



FIGURE 30. Enlarged 2.5x

FIGURE 31. DORSAL VIEW OF HIND WING OF TRIMEROTROPIS
CAMPESTRIS McNEILL.

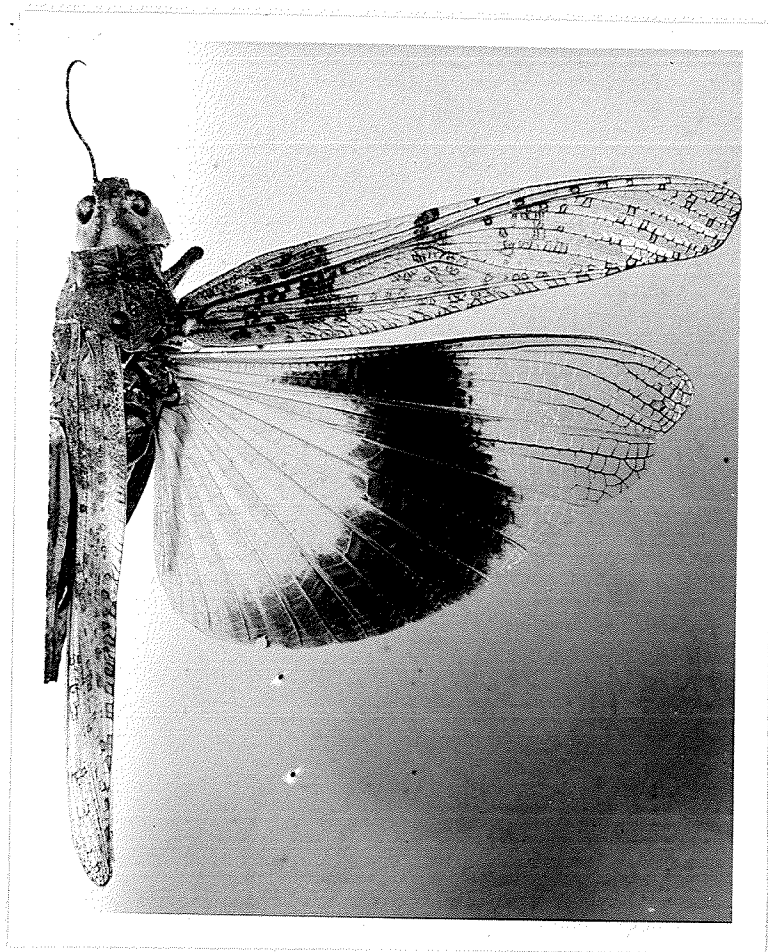


FIGURE 31. Enlarged 2.5x

FIGURE 32. DORSAL VIEW OF HIND WING OF ARPHIA CONSPERSA
SCUDDER.

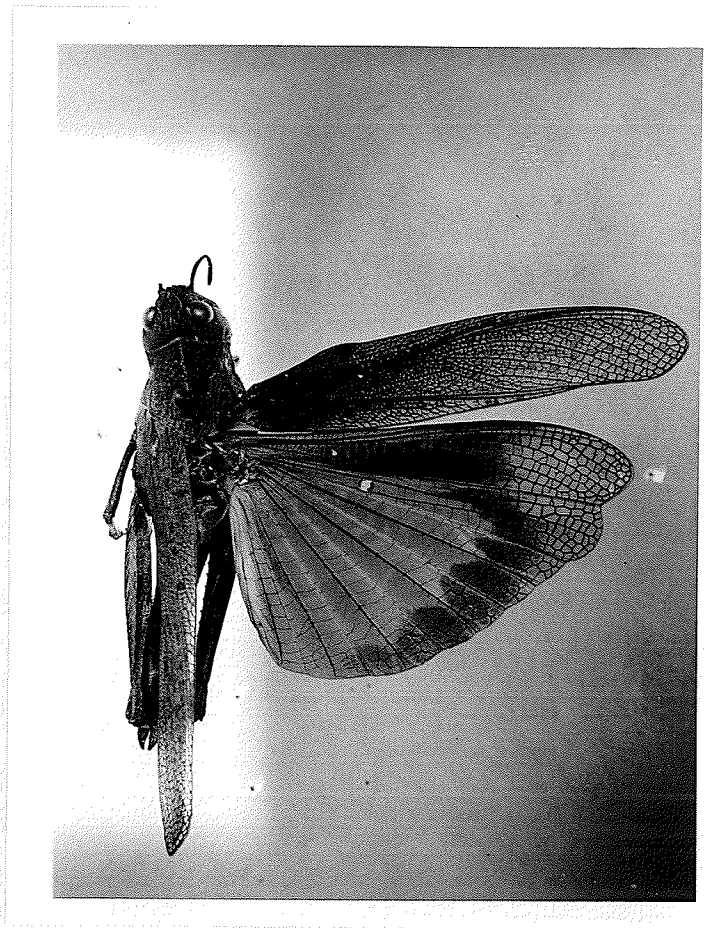


FIGURE 32. Enlarged 2.5x

FIGURE 33. DORSAL VIEW OF HIND WING OF ARPHIA PSEUDONIETANA
PSEUDONIETANA (THOMAS).

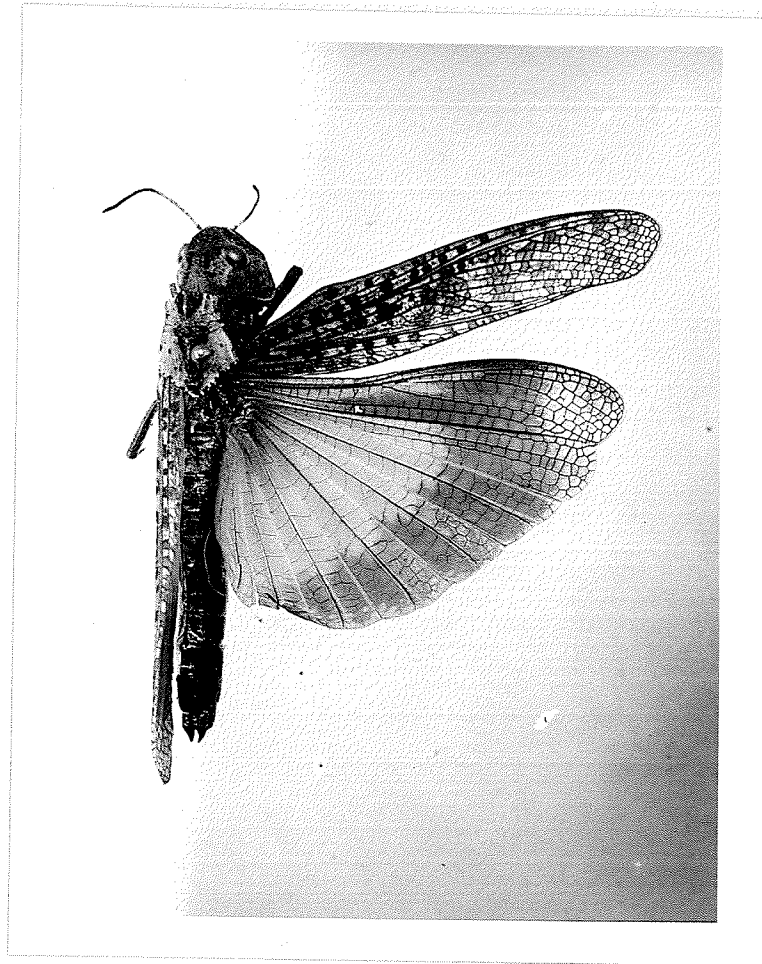


FIGURE 33. Enlarged 2.5x

FIGURE 34. DORSAL VIEW OF HIND WING OF CIRCOTETTIX
VERRUCULLATUS KIRBY.



FIGURE 34. Enlarged 2.5x

FIGURE 35. DORSAL VIEW OF HIND WING OF CIRCOTETTIX RABULA
RABULA REHN AND HEBARD.



FIGURE 35. Enlarged 2.5x

FIGURE 36. LATERAL VIEW OF PRONOTUM OF TRIMEROTROPIS
AGRESTIS McNEILL.

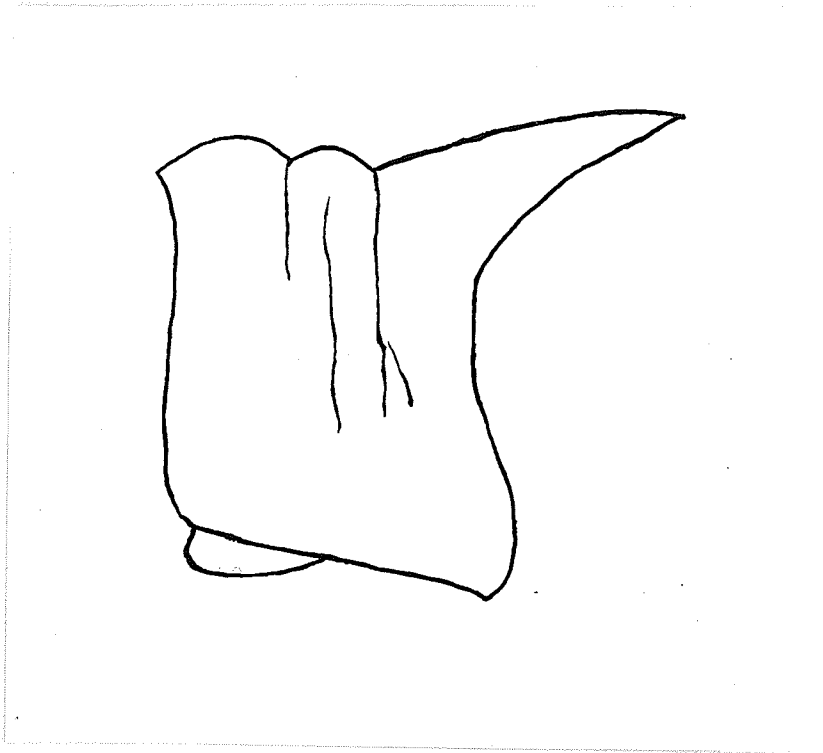


FIGURE 36. Enlarged 10x

FIGURE 37. MESOSTERNAL LOBES OF SCHISTOCERCA LINEATA
SCUDDER.

FIGURE 38. MESOSTERNAL LOBES OF MELANOPLUS FEMUR-RUBRUM
FEMUR-RUBRUM (DE GEER).

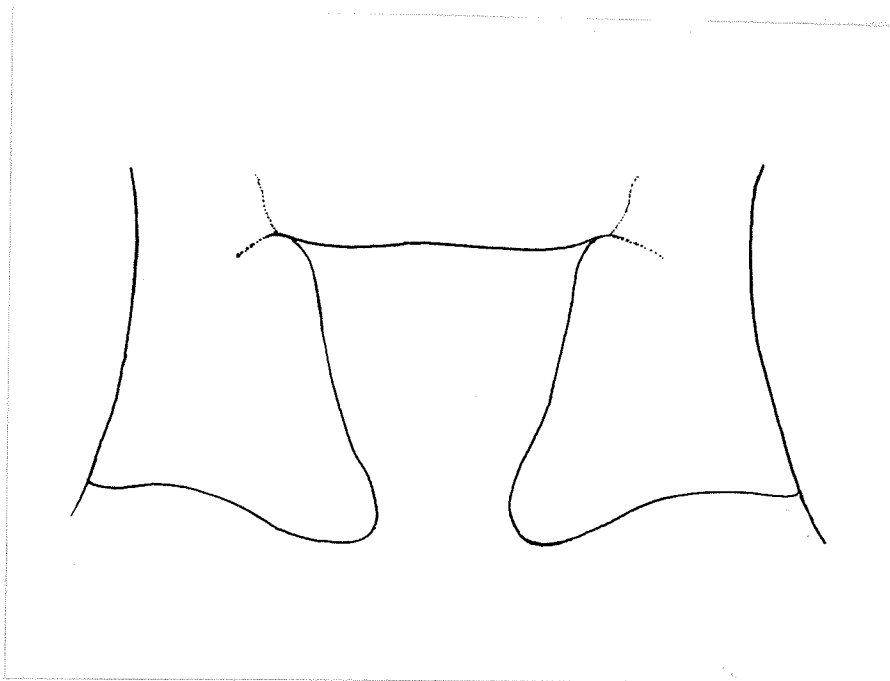


FIGURE 37. Enlarged 25x

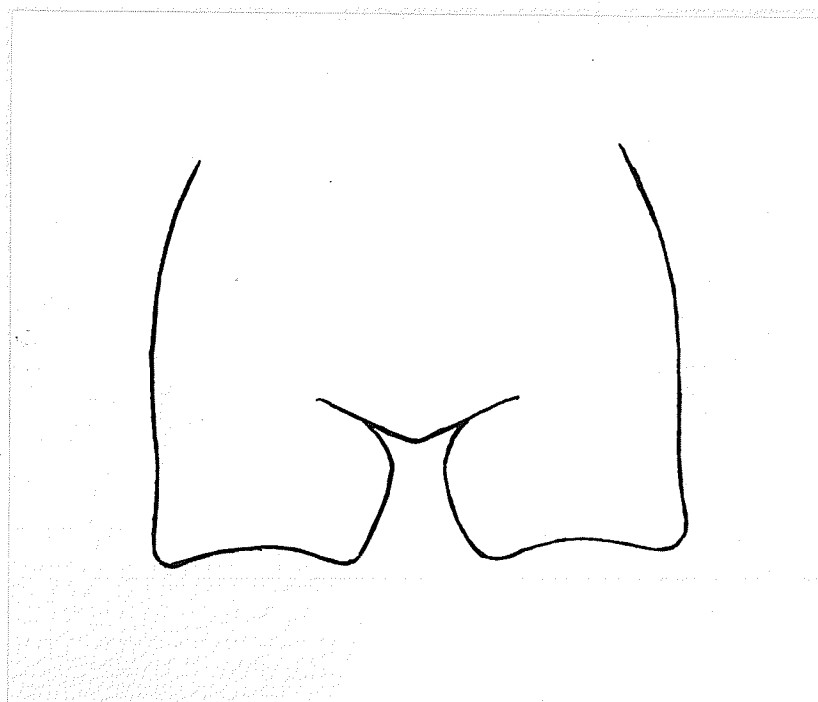


FIGURE 38. Enlarged 25x

FIGURE 39. LATERAL VIEW OF MALE GENITALIA OF HESPEROTETTIX
VIRIDIS PRATENSIS SCUDDER.

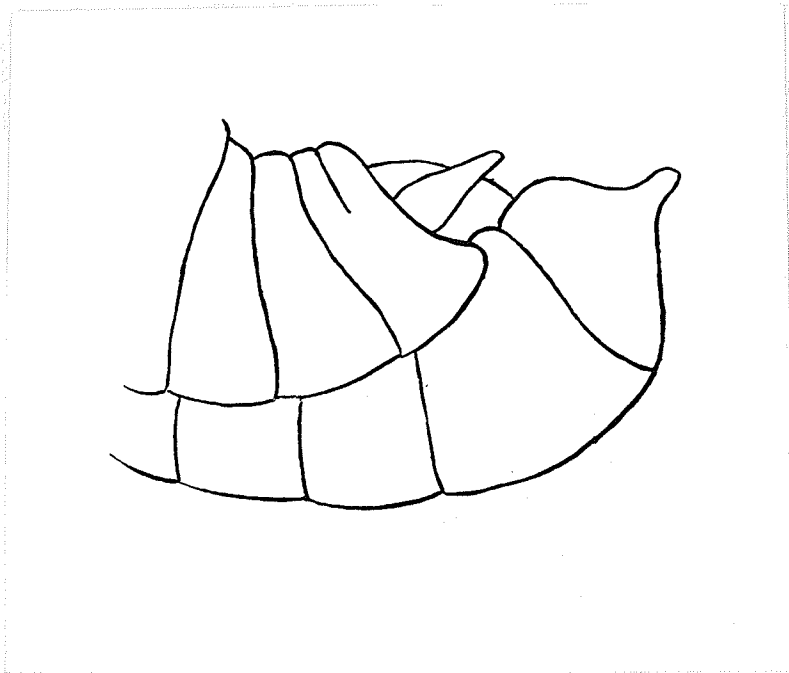


FIGURE 39. Enlarged 15x

FIGURE 40. DORSAL VIEW OF MALE GENITALIA OF MELANOPLUS
DAWSONI (SCUDDER).

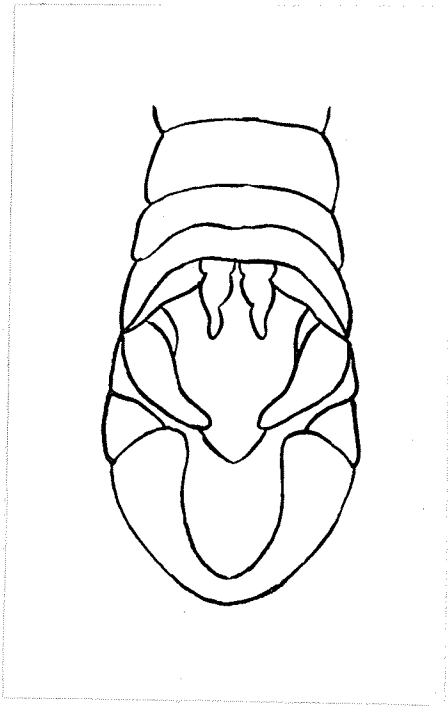


FIGURE 40. Enlarged 15x

FIGURE 41. DORSAL VIEW OF MALE GENITALIA OF MELANOPLUS
ISLANDICUS BLATCHLEY.

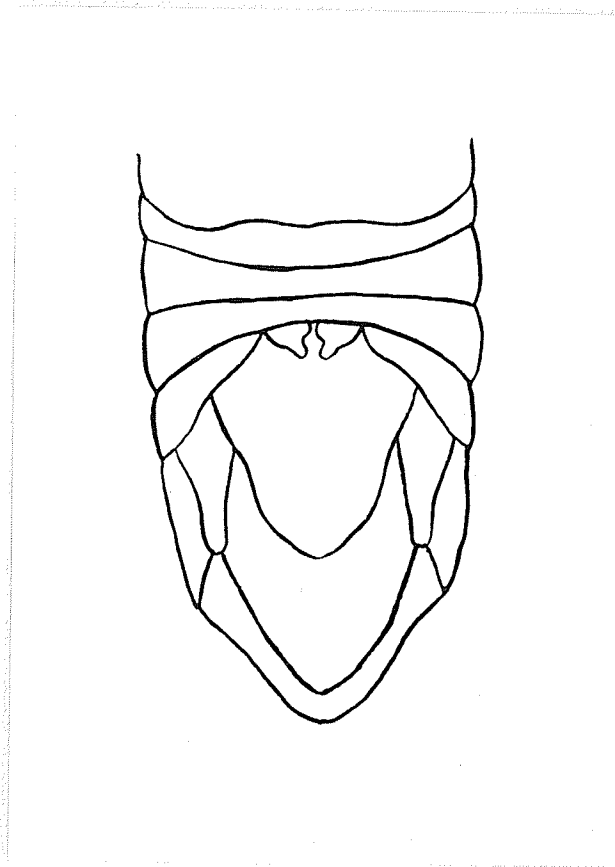


FIGURE 41. Enlarged 20x

FIGURE 42. DORSAL VIEW OF MALE GENITALIA OF MELANOPLUS
BOREALIS JUNIUS (DODGE).

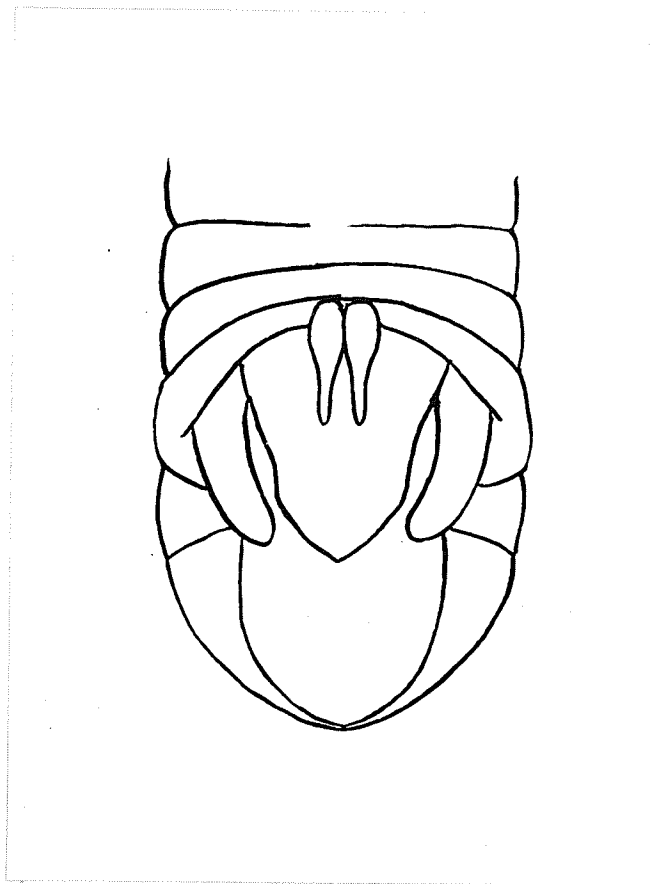


FIGURE 42. Enlarged 20x

FIGURE 43. LATERAL VIEW OF MALE GENITALIA OF MELANOPLUS
FASCIATUS (F. WALKER).

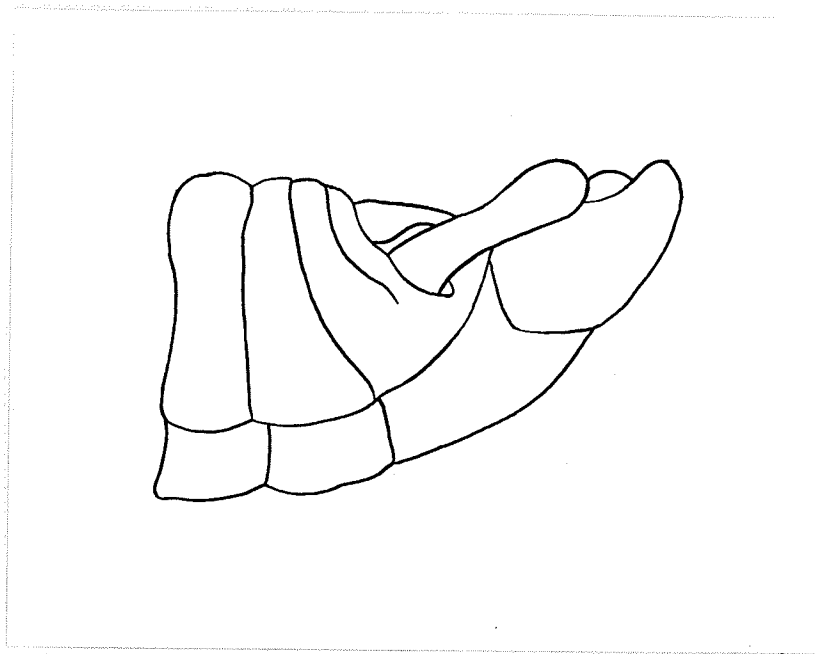


FIGURE 43. Enlarged 10x

FIGURE 44. LATERAL VIEW OF MALE GENITALIA OF MELANOPLUS
HURONI BLATCHLEY.

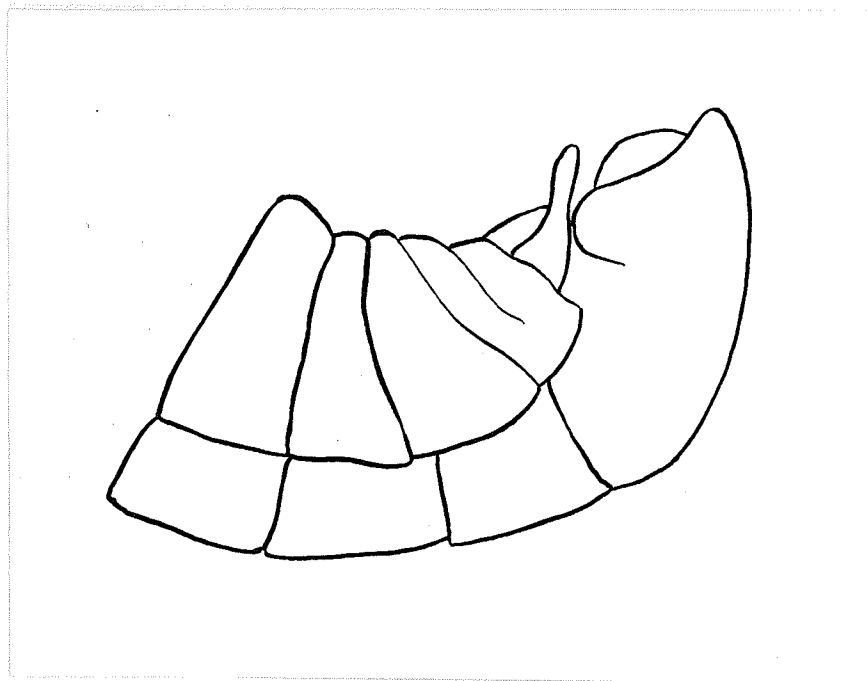


FIGURE 44. Enlarged 12x

FIGURE 45. LATERAL VIEW OF MALE GENITALIA OF MELANOPLUS
CONFUSUS SCUDDER.

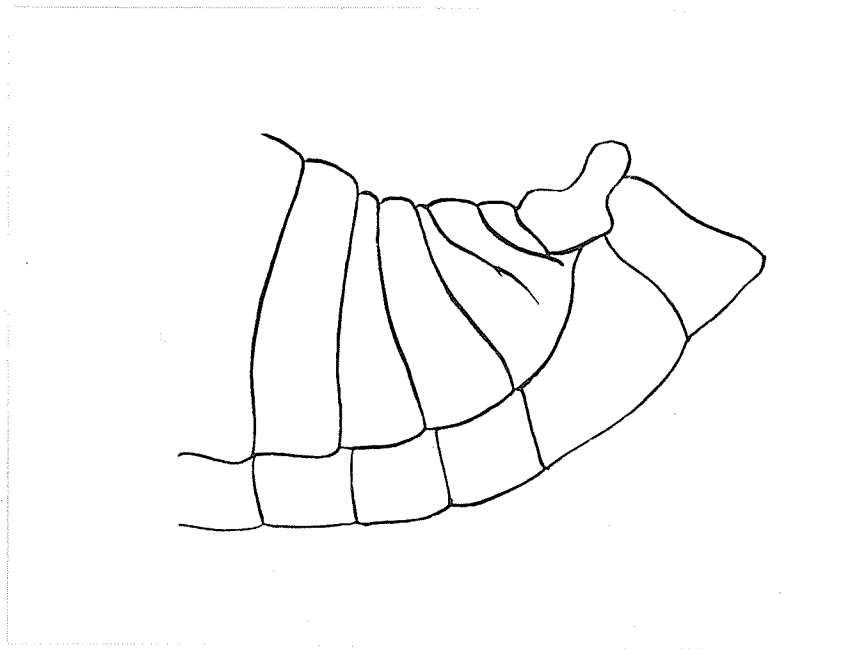


FIGURE 45. Enlarged 12x

FIGURE 46. LATERAL VIEW OF MALE GENITALIA OF MELANOPLUS
INFANTILIS SCUDDER.

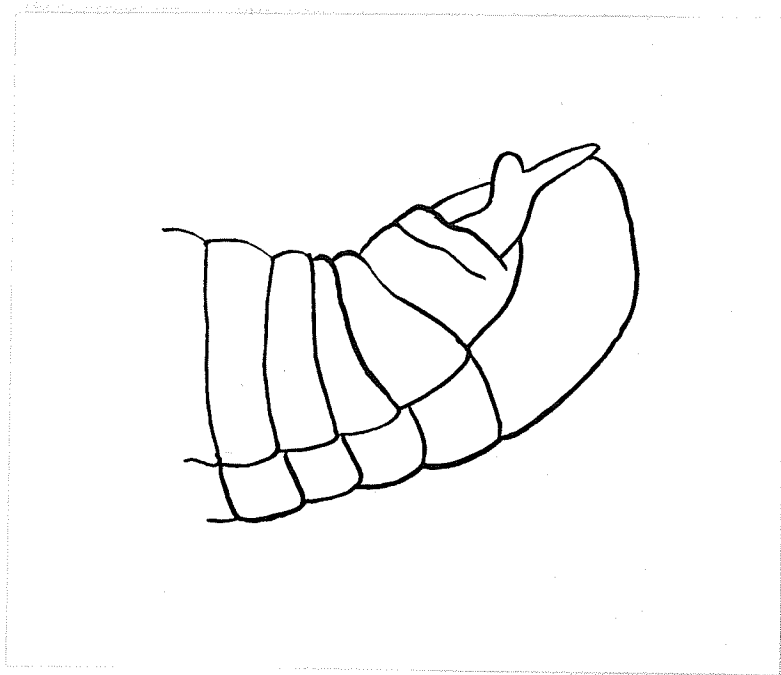


FIGURE 46. Enlarged 12x

FIGURE 47. LATERAL VIEW OF MALE GENITALIA OF MELANOPLUS
KEELERI LURIDUS (DODGE).

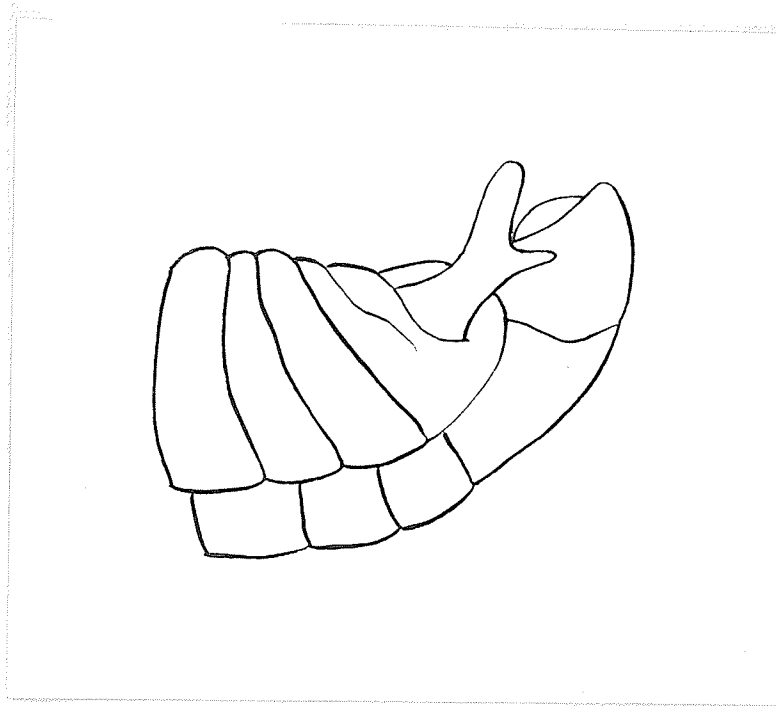


FIGURE 47. Enlarged 12x

FIGURE 48. LATERAL VIEW OF MALE GENITALIA OF MELANOPLUS
BIVITTATUS (SAY).

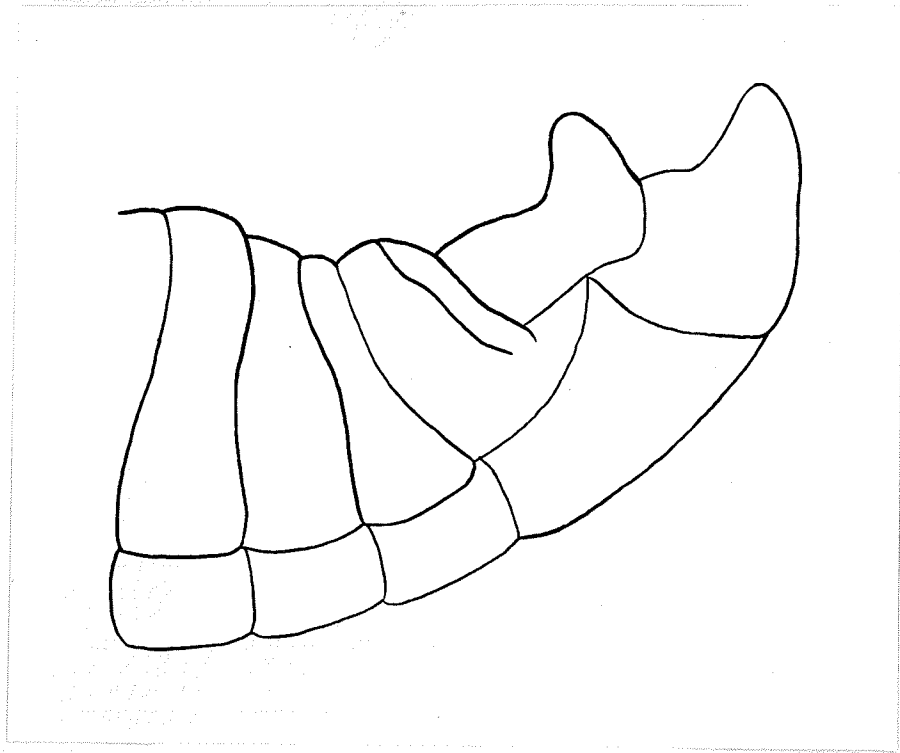


FIGURE 48. Enlarged 15x

FIGURE 49. DORSAL VIEW OF MALE GENITALIA OF MELANOPLUS
FLAVIDUS FLAVIDUS SCUDDER.

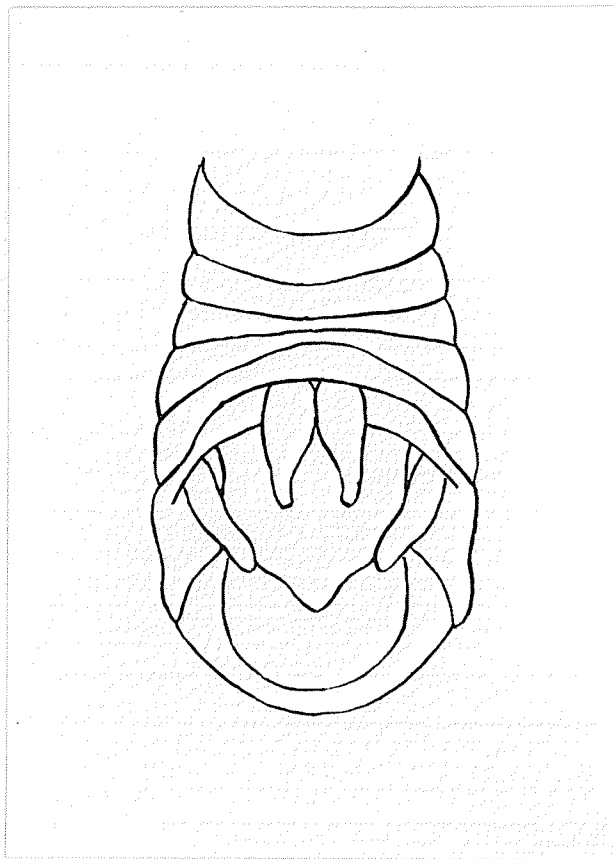


FIGURE 49. Enlarged 15x

FIGURE 50. DORSAL VIEW OF MALE GENITALIA OF MELANOPLUS
FEMUR-RUBRUM FEMUR-RUBRUM (DE GEER).

FIGURE 51. LATERAL VIEW OF MALE GENITALIA OF MELANOPLUS
ANGUSTIPENNIS (DODGE).

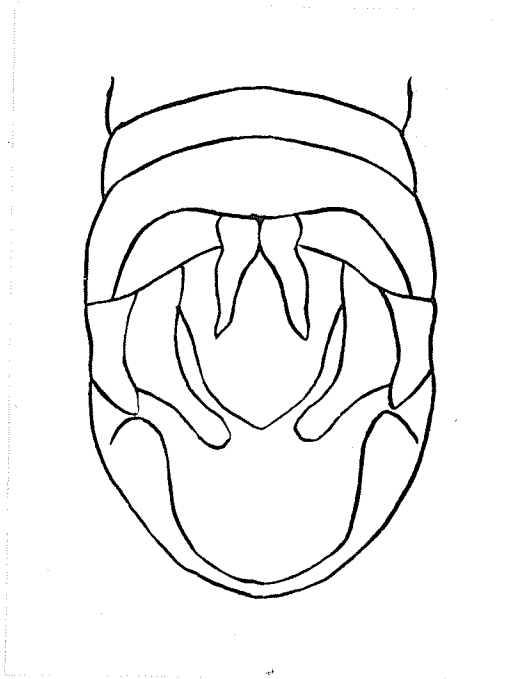


FIGURE 50. Enlarged 15x

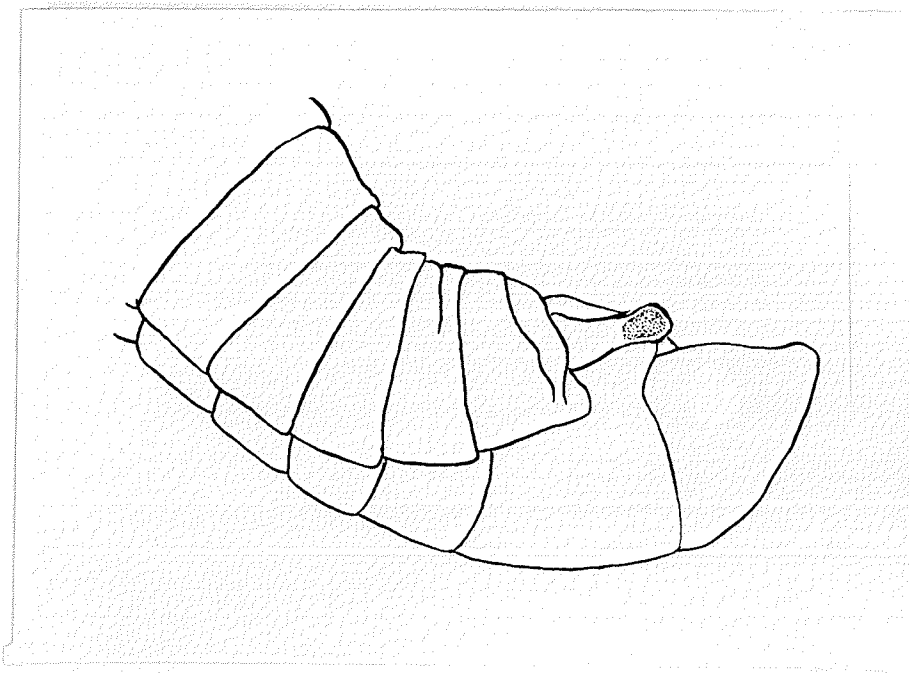


FIGURE 51. Enlarged 12x

FIGURE 52. LATERAL VIEW OF MALE GENITALIA OF MELANOPLUS
BRUNERI SCUDDER.

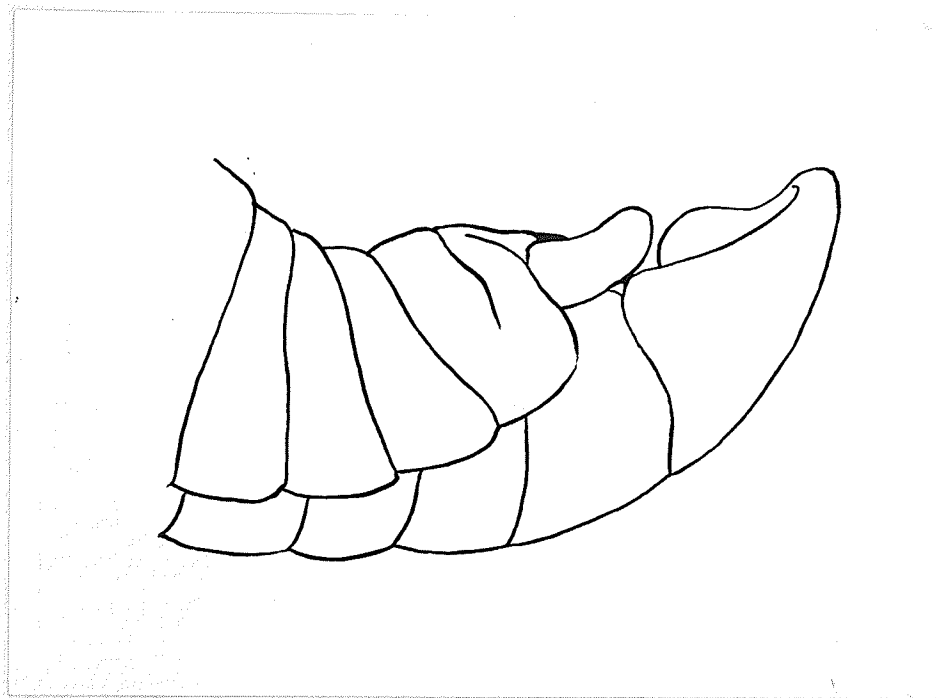


FIGURE 52. Enlarged 12x

FIGURE 53. DORSAL VIEW OF MALE GENITALIA OF MELANOPLUS
BRUNERI SCUDDER.

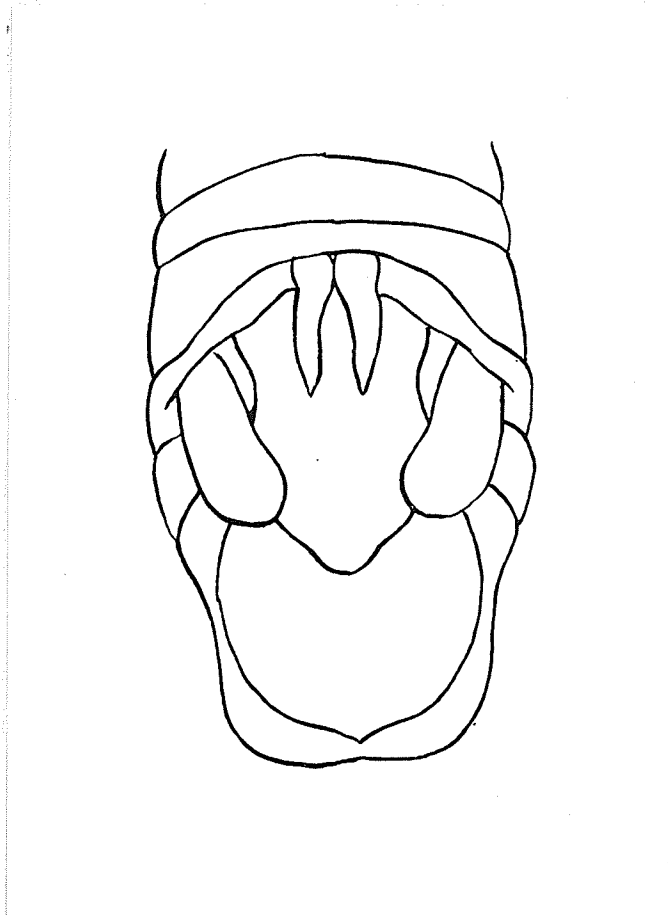


FIGURE 53. Enlarged 15x

FIGURE 54. DORSAL VIEW OF MALE GENITALIA OF MELANOPLUS
MEXICANUS MEXICANUS SAUSSURE.

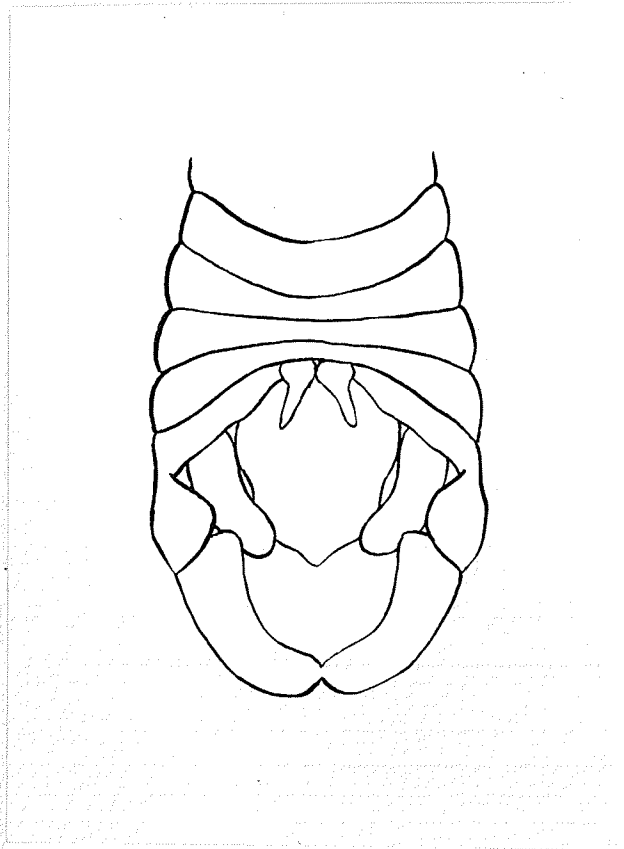


FIGURE 54. Enlarged 15x

FIGURE 55. DORSAL VIEW OF MALE GENITALIA OF MELANOPLUS
GLADSTONI (SCUDDER).

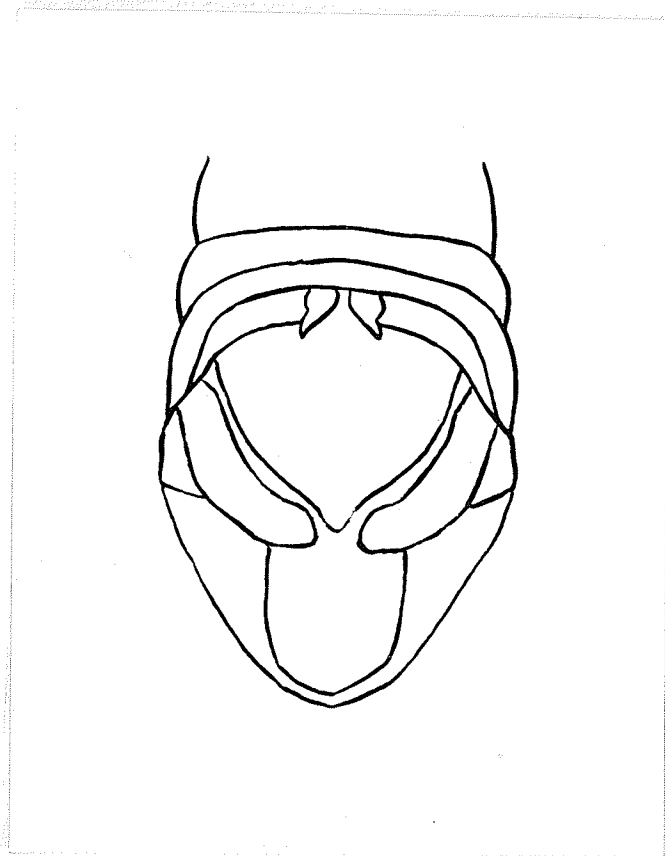


FIGURE 55. Enlarged 15x

FIGURE 56. LATERAL VIEW OF MALE GENITALIA OF MELANOPLUS
PACKARDII SCUDDER.

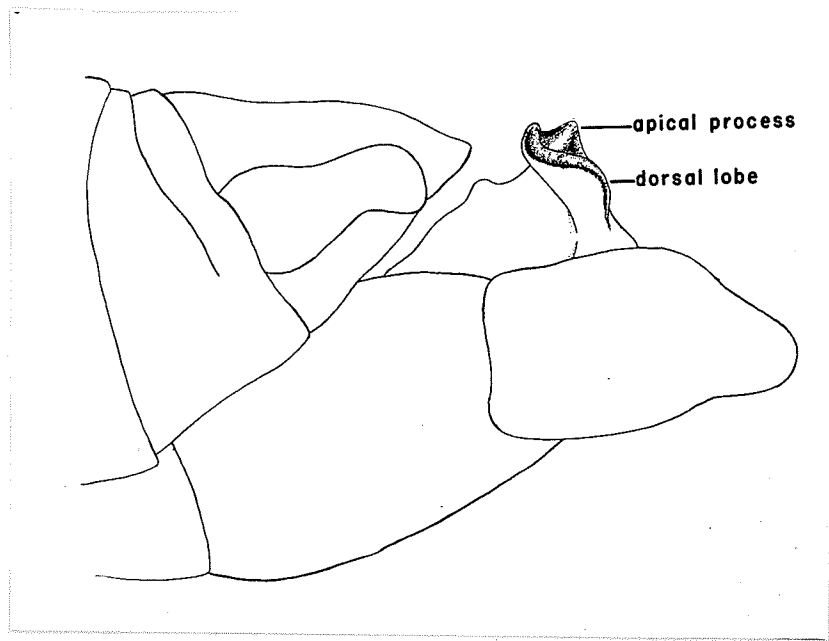


FIGURE 56. Enlarged 25x

FIGURE 57. LATERAL VIEW OF MALE GENITALIA OF MELANOPLUS
FOEDUS FOEDUS SCUDDER.

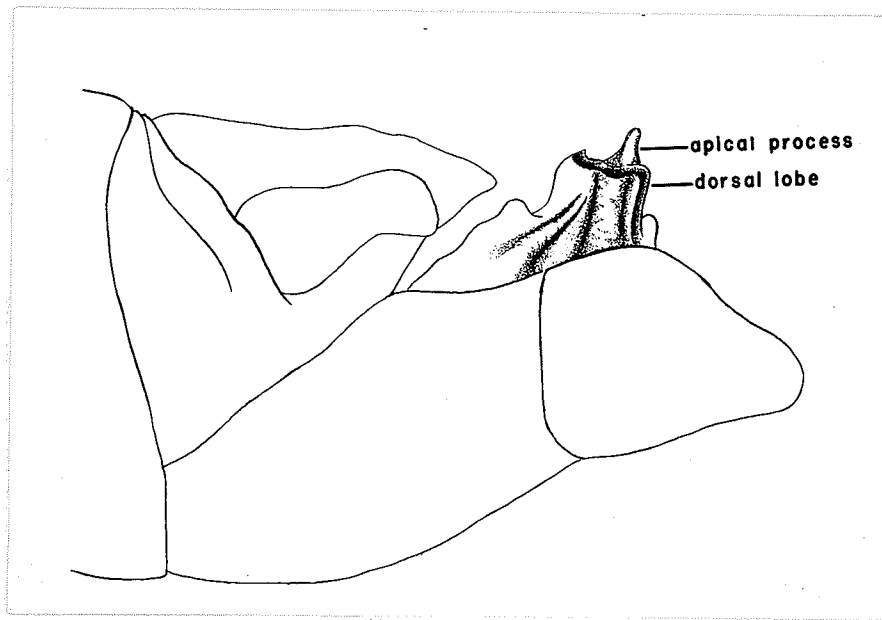


FIGURE 57. Enlarged 25x

FIGURE 58. LATERAL VIEW OF FEMALE GENITALIA OF MELANOPLUS
ANGUSTIPENNIS (DODGE).

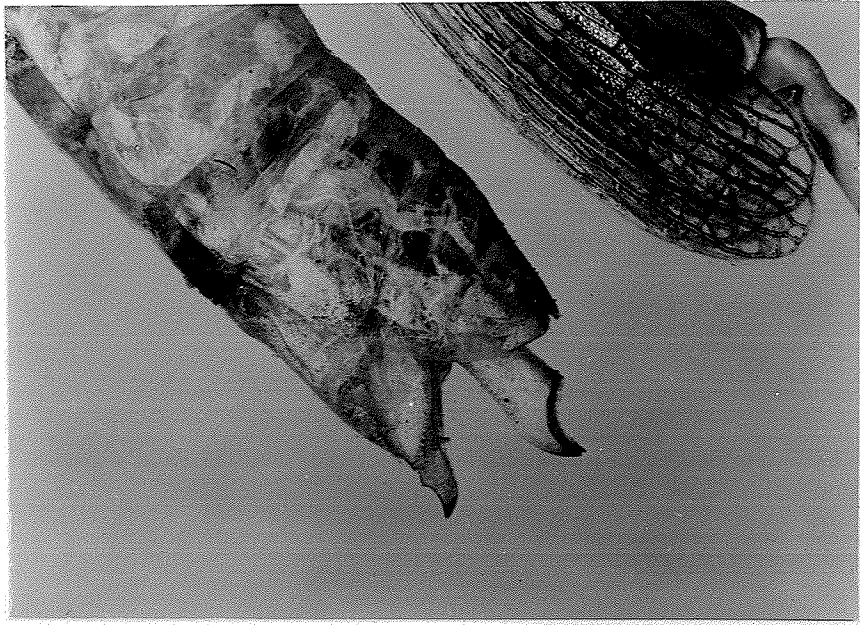


FIGURE 58. Enlarged 12x

CHAPTER VIII

FAMILY TETTIGONIIDAE

Key to the subfamilies of Tettigoniidae

- 1. Vertex projected forward in the form of a blunt rounded tubercle Conocephalinae
- Vertex not projected forward in the form of a blunt rounded tubercle 2
- 2. Tegmina fully developed and shorter than wings; vertex with fastigium ending in a blunt deflexed spine; general color green Phaneropterinae
- Tegmina reduced or rudimentary, rarely fully developed; vertex sloping gradually downward; general color brown Decticinae

Subfamily Phaneropterinae

-Key to the species of Scudderia Stål

- 1. Last dorsal segment of male with apical process deeply forked; disk of pronotum of female with sides parallel or nearly parallel (Fig. 59, page 155) furcata furcata Brunner

- Last dorsal segment of male with apical process narrowly notched; disk of pronotum of female broadening posteriorly 2
2. Lobes of apical process of last dorsal segment subtriangular and distinctly tapering apically when viewed from above; tegmina of female less than 4 times as long as broad (Fig. 60, page 155) pistillata Brunner
- Lobes of apical process of last dorsal segment well rounded and subequal in width when viewed from above; tegmina of female nearly 5 times as long as broad (Fig. 61, page 155) curvicauda borealis R.&H.

Genus Scudderia Stål

73. Scudderia furcata furcata Brunner

Established synonyms of this race are Scudderia fasciata Beutenmuller and Phaneroptera furcata furcata (Brunner).

One male specimen was recorded from Arnaud, August 3, 1950, by the writer. This is the first record of this insect's occurrence in Manitoba.

74. Scudderia pistillata Brunner

Phaneroptera pistillata (Brunner) is an established synonym of this species.

This katydid has been recorded from Aweme, Onah, Cowan, Winnipeg, Roland, Deloraine, Turtle Mountains, Birch River, Snowflake, Napinka, Teulon, and Bell River. The specimens examined were taken between July 22 and August 18.

75. Scudderia curvicauda borealis Rehn & Hebard

An established synonym of this race is Phaneroptera curvicauda borealis Rehn & Hebard.

Walker (1910d) recorded this northern race as curvicauda from Aweme.

The only other distribution record is Onah. The specimens examined were taken between July 19 and September 17.

According to Criddle (1929), S. curvicauda borealis Rehn & Hebard inhabits sandy areas, where it feeds mainly on bearberry and pin cherry.

-Key to the genera of subfamily Conocephalinae

1. Male with subgenital plate subtruncate; ovipositor of female slender, straight or nearly so; tegmina usually abbreviated, shorter than abdomen in most species . . . Conocephalus Thunberg

Male with subgenital plate emarginate; ovipositor of female stout, usually distinctly foliate or upcurved; tegmina fully developed, surpassing the abdomen in all species Orchelimum Serville

-Key to the species of Conocephalus Thunberg

1. Hind tibiae armed at apex with one pair of spurs; prosternum without spines; tegmina pad-like, very rarely fully developed saltans (Scudder)

Hind tibiae armed at apex with three pairs of spurs; prosternum bispinose; tegmina always fully developed fasciatus fasciatus (De Geer)

-Key to the species of Orchelimum Serville

1. Lateral lobes of pronotum with humeral sinus comparatively indistinct; male cerci with tooth as long as apical portion of shaft; ovipositor with dorsal margin beyond the base straight (Fig. 62, page 156) . . . gladiator Bruner

Lateral lobes of pronotum with humeral sinus distinct; male cerci with tooth shorter than apical portion of shaft; ovipositor with dorsal margin evenly curved (Fig. 63, page 156) vulgare Harris

Genus Conocephalus Thunberg

76. Conocephalus saltans (Scudder)

Established synonyms of this species are: Xiphidium saltans Scudder, Xiphidium taeniatum Redtenbacher, Xiphidium modestum Bruner, and Conocephalus viridifrons Blatchley.

This species has been recorded from Aweme, Dauphin, Goodlands, Griswold, Deloraine, Snowflake, Turtle Mountains, Senkiw, Alexander, Lyleton, and Brandon. The specimens examined were taken from July 9 to August 31.

Criddle (1929) states that this insect is assoc-

iated with a variety of herbaceous plants such as western wall-flower, dill, goldenrods, and aster.

77. Conocephalus fasciatus fasciatus (De Geer)

Established synonyms of this race are Locusta fasciata De Geer and Orchelimum gracilis Harris.

This race has been recorded from Baldur, Aweme, Napinka, Carman, Sprague, Tolstoi, Kelwood, Victoria Beach, Hartney, Birch River, Ingelow, Sifton, Arnaud, Altona, Winkler, Garland, and Douglas. The specimens examined were taken between August 12 and September 7.

This race is common throughout Manitoba and is most abundant in low-lying areas.

Genus Orchelimum Serville

78. Orchelimum gladiator Bruner

Orchelimum manitobense E.M. Walker is an established synonym of this species.

O. gladiator Bruner has been recorded from Ashdown, Napinka, Douglas, Turtle Mountains, and Neepawa. The specimens examined were taken between July 20 and September 6.

This species is more widely distributed than records indicate and is probably present throughout most of the

eastern part of the Province.

79. Orchelimum vulgare Harris

This species has only been recorded from Winnipeg.

Subfamily Decticinae

-Key to the genera of Decticinae

1. Tegmina of male projecting slightly beyond pronotal disk, of female concealed; male cerci with apex forked; ovipositor long (18 mm. to 23 mm.), slender, and curved slightly and uniformly upward Anabrus Haldeman

Tegmina of male as long as or longer than pronotum, of female half the length of pronotum; male cerci simple, armed at base with a spine on the inner edge and sometimes with a short apical spine; ovipositor short (11 mm. to 14 mm.), stout, abruptly tapering to a sharp point Metrioptera Wesmael

Genus Anabrus Haldeman80. Anabrus simplex Haldeman

Established synonyms of this species are: Anabrus purpurascens Uhler, Anabrus coloradus Thomas, Anabrus similis Scudder, Acheta nigra Lord, and Thamnotrizon purpurascens Thomas.

This species has been taken at Darlingford, Aweme, Melita, Stockton, Ninga, Morden, Lyleton, Altona, Starbuck, Holmfield, Carman, and Emerson. The specimens examined were taken between July 7 and September 7.

The Mormon cricket occurs throughout most of the agricultural part of Manitoba but is never present in sufficient numbers to be of economic importance.

Genus Metrioptera Wesmael81. Metrioptera sphagnorum (F. Walker)

Established synonyms of this species are Idionotus brevipes Caudell, Idionotus sphagnorum (F. Walker), and Platycleis fletcheri Caudell.

Walker (1910d) recorded this species from Aweme as the synonymous Idionotus brevipes Caudell.

M. sphagnorum (F. Walker) has also been recorded

from Marchand and McAuley. The specimens examined were taken between July 9 and August 17.

This species has been recorded from three widely-separated points and was taken in different habitats each time, indicating that it may be adaptable to a wide range of conditions and more common than the present records indicate.

FIGURE 59. DORSAL VIEW OF LAST DORSAL SEGMENT OF THE MALE
OF SCUDDERIA FURCATA FURCATA BRUNNER.

FIGURE 60. DORSAL VIEW OF LAST DORSAL SEGMENT OF THE MALE
OF SCUDDERIA PISTILLATA BRUNNER.

FIGURE 61. DORSAL VIEW OF LAST DORSAL SEGMENT OF THE MALE
OF SCUDDERIA CURVICAUDA BOREALIS REHN AND HEBARD.

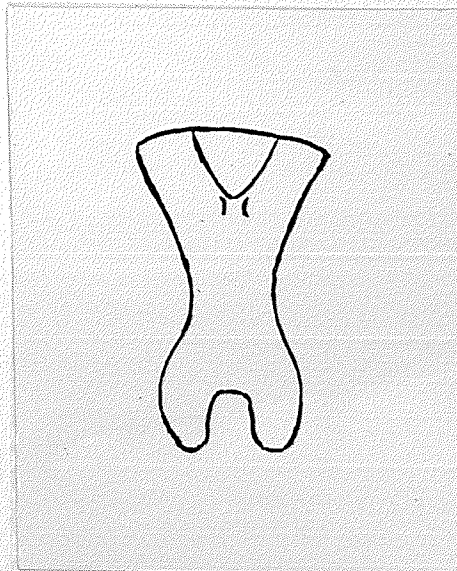


FIGURE 59. Enlarged 10x

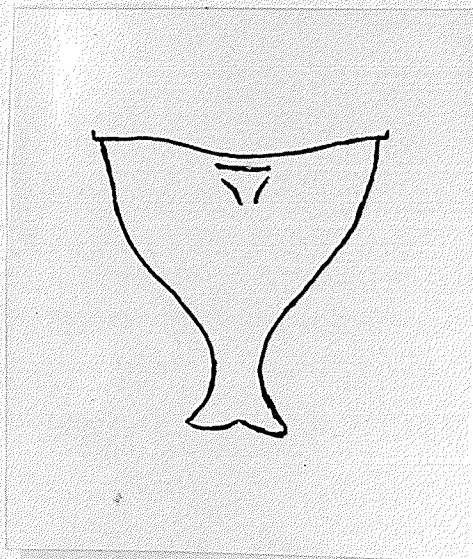


FIGURE 60. Enlarged 10x

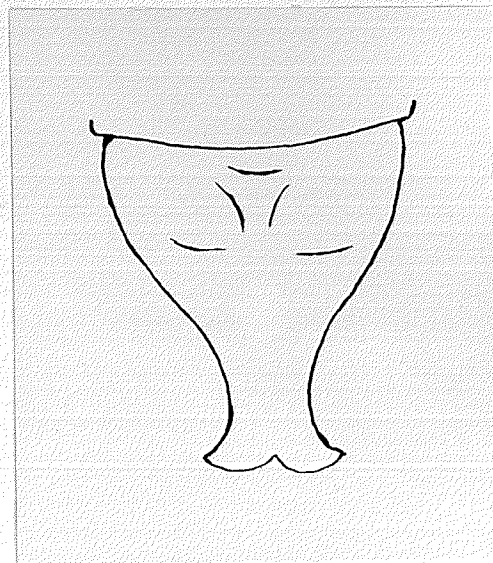


FIGURE 61. Enlarged 10x

FIGURE 62. LATERAL VIEW OF PRONOTUM OF ORCHELIMUM GLADIATOR
BRUNER.

FIGURE 63. LATERAL VIEW OF PRONOTUM OF ORCHELIMUM VULGARE
HARRIS.

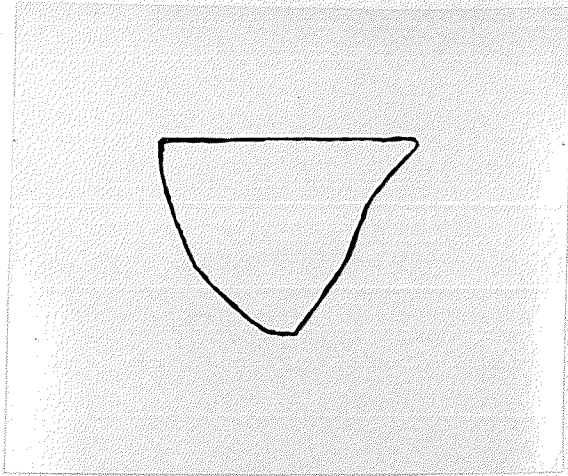


FIGURE 62. Enlarged 10x

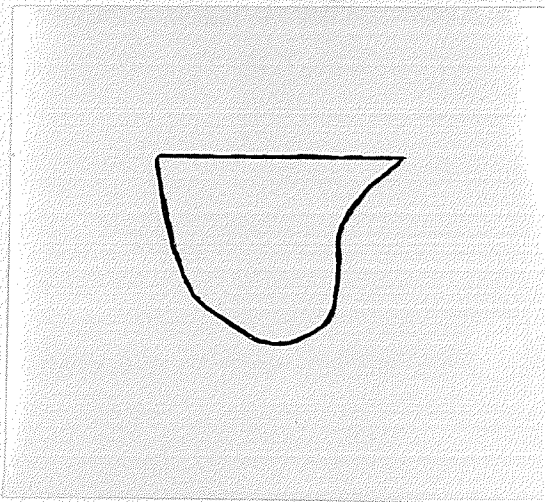


FIGURE 63. Enlarged 10x



CHAPTER IX

FAMILY GRYLLACRIDIDAE

Subfamily Rhapsidophorinae

-Key to the genera of Rhapsidophorinae

1. Fastigium a pair of narrow conical tubercles
between the antennae; long movable genicular
spurs present on outer face of fore femur
and both faces of middle femur; basal segment
of hind tarsi prolonged above second segment
into a short sharp spine . . . Tachycines Adelung

Fastigium subplanate, or very feebly tuberculate;
genicular lobes of fore and middle femur
unarmed or with only a small fixed spine;
basal segment of hind tarsi not prolonged
above second segment into a short sharp spine . . . 2

2. Dorsal surface of fore tibia armed with a stout
spine slightly distad of middle of the inner
margin; hind tibia armed ventrodistad with
5 to 9 spurs in addition to apical pair
. Udeopsylla Scudder

Dorsal surface of fore tibia unarmed except
 at apex; hind tibia armed distoventrally with
 0 to 5, usually 1 or 2, small spurs in addition
 to apical pair Ceuthophilus Scudder

-Key to the males of Ceuthophilus Scudder
 (Modified after Hubbell 1936)

1. The eighth abdominal tergite strongly produced,
 completely concealing the dorsal portion of
 the ninth abdominal tergite fusiformis Scudder

The eighth abdominal tergite not produced and
 does not conceal the dorsal portion of the
 ninth abdominal tergite 2

2. Posterior margin of the ninth abdominal tergite
 not emarginated pallidus Thomas

Posterior margin of the ninth abdominal tergite
 emarginated medially 3

3. The ninth abdominal tergite produced back in
 the dorso-lateral regions and forms a pair
 of short oblique triangular lobes with abrupt-
 ly rounded lateral apices separated by a wide
 shallow median emargination maculatus (Harris)

The ninth abdominal tergite strongly produced
 mesad and forms a pair of triangular lobes with

apices separated by a deeply angulate emargination pallescens Bruner

-Key to the females of Ceuthophilus Scudder
(Modified after Hubbell 1936)

1. Ventral valves of ovipositor with teeth stout and triangular in shape . . . maculatus (Harris)
- Ventral valves of ovipositor with teeth slender and needle-shaped 2
2. Ovipositor more than two times as long as pronotum; anterior margin of all tergites behind pronotum bordered with infuscated bands pallescens Bruner
- Ovipositor less than two times as long as pronotum; color pattern of anterior margin of tergites not as described above 3
3. Ventrocephalic carina of hind femora with 6 to 8 very small, widely and evenly spaced denticulations pallidus Thomas
- Ventrocephalic carina of hind femora with approximately 31 small spinulose denticulations fusiformis Scudder

Genus Tachycines Adelung82. Tachycines asynomorus Adelung

An established synonym of this species is Diestramenna japonica Blatchley.

This species was recorded from Winnipeg as the synonymous Diestramenna japonica Blatchley by Mitchener in 1932.

The only other record of this insect's occurrence is Brandon, where it was taken by the writer in a local greenhouse on June 6, 1950.

This species was introduced from Japan and is now found throughout parts of Canada and the United States.

Genus Ceuthophilus Scudder83. Ceuthophilus maculatus (Harris)

Established synonyms of this species are Machamala armata F. Walker, Ceuthophilus latebricola Scudder, and Ceuthophilus scriptus F. Walker.

This species has been recorded from Winnipeg and Sandilands. The specimens examined were taken between July 12 and October 2.

According to Hubbell (1936), Lake Winnipeg is the western limit of this insect in Canada.

84. Ceuthophilus pallescens Bruner

There are no synonyms. Hubbell (1936) states that Ceuthophilus pallescens Bruner was erroneously synonymized under uniformis by Hebard in 1925.

This species has been recorded from Aweme, Boiss-evain, and Glen Souris between September 20 and October 26.

According to Hebard (1936), Aweme is the eastern limital point of this species in Canada.

85. Ceuthophilus pallidus Thomas

Established synonyms of this species are: Ceuthophilus bruneri Scudder, Ceuthophilus inquinatus Scudder, Ceuthophilus discolor Scudder, and Ceuthophilus tuckeri Rehn.

This cave cricket has been recorded from Brandon, Douglas, Aweme, and Deloraine between August 20 and September 2.

Hubbell (1936) states Douglas is one of the northern limital points of this species in Canada.

86. Ceuthophilus fusiformis Scudder

Ceuthophilus testaceus Scudder is an established synonym of this species.

This camel cricket has been recorded from Aweme and Glen Souris. The specimens examined were taken between May 14 and October 30.

Genus Udeopsylla Scudder

87. Udeopsylla robusta (Haldeman)

Established synonyms of this species are: Udeopsylla nigra Scudder, Udeopsylla compacta Bruner, Udeopsylla devius Scudder, Marsa arcuata Walker, Ceuthophilus politus Scudder, Ceuthophilus devius Scudder, Ceuthophilus niger Scudder, Daihinia gigantea Bruner, and Ceuthophilus ater Scudder.

This camel cricket has been recorded from Aweme and Brandon. The specimens examined were taken between July 15 and September 18.

Udeopsylla robusta (Haldeman) is the largest and most robust of the camel crickets occurring in Manitoba.

CHAPTER X

FAMILY GRYLLIDAE

Key to the subfamilies of Gryllidae

1. Head elongate and horizontal; hind femora slender;
hind tibiae armed with delicate spines with
minute teeth between them; ocelli absent; color
white or pale green Oecanthinae
- Head short, vertical or nearly so; hind femora
stout; hind tibiae armed with stout spines
without teeth between them; ocelli present;
color black or brown 2
2. Size large, length of body seldom less than
15 mm.; hind metatarsus flat above with a row
of very small teeth on each side; hind tibiae
armed dorsally with short fixed spines . . Gryllinae
- Size small, length of body less than 13 mm.;
hind metatarsus rounded above, unarmed but
clothed with long hairs; hind tibiae armed
with movable elongate spines; large bristles
present on body and legs Nemobiinae

Subfamily Gryllinae

-Key to the species of Acheta Linnaeus

1. Color dark brown or black; head not barred;

species campestrian assimilis Fabricius

Straw colored; head with distinct brown bars,

between the eyes and the bases of the antennal

sockets; species domiciliary . . . domestica Linnaeus

Genus Acheta Linnaeus88. Acheta assimilis Fabricius

Gryllus assimilis (Fabricius) is an established synonym of this species.

The specimens examined were recorded from Napinka, Starbuck, Winnipeg, Arnaud, Brandon, Ingelow, Aweme, and Lyleton, and were taken between May 10 and September 27. The field cricket is common throughout all of the agricultural areas of Manitoba and at times becomes very abundant in the Red River Valley.

This insect is represented in Manitoba by two races, Acheta assimilis pennsylvanicus Burmeister and Acheta assimilis luctuosus Serville.

These two races are not satisfactorily separated

by the usual taxonomic characters of a morphological nature, but may be separated by their physiological characters.

Criddle (1925) made a study of these two races in Manitoba and proposed the following key, which may be used as a guide in the separation of these two races.

- "A. Adults present from May 1 to August 1.
Oviposition period June and July.
Young appear in August and winter as
nymphs. pennsylvanicus
- B. Adults present from August 1 to
winter. Oviposition period September
and October. Young appear in June
and develop into adults the same
year. luctuosus"

The eggs of the field cricket are elongate, cylindrical, cream yellow and are not deposited in pods like those of the grasshopper but are laid singly in the earth.

The field cricket can be present in large numbers and do little or no damage to the crops. Their habit of collecting in the stocks of grain and cutting the binder twine on the sheaves added considerably to the farmer's

labors and cost of operation until this was overcome by treating the binder twine with a repellent. They also attack flax bolls, and according to Criddle (1925) did a considerable amount of damage to this crop in 1923.

89. Acheta domestica Linnaeus

Gryllus domesticus Linnaeus is an established synonym of this species.

The house cricket was recorded from Winnipeg, March 10, 1927, and November 20, 1930, by Mitchener. This is the only record of this insect's occurrence in Manitoba.

Subfamily Nemobiinae

-Key to the species of Nemobius Serville

1. Occiput with pale longitudinal markings; lower part of face not darker than other portions; ovipositor with apical teeth prominent but not sharp fasciatus fasciatus (De Geer)

Occiput with markings not distinguishable; face below antennae shining black; ovipositor with teeth irregular and sharply cut griseus griseus E.M. Walker

Genus Nemobius Serville90. Nemobius fasciatus fasciatus (De Geer)

Established synonyms of this species are Acheta hospes Fabricius, Acheta vittata Harris, and Nemobius utahensis Scudder.

This race has been recorded from Dugald, Baldur, Glen Souris, Aweme, Winnipeg, and Napinka. The specimens examined were taken between August 20 and September 28.

N. fasciatus fasciatus (De Geer) is probably more widely distributed throughout the Province than present records indicate.

91. Nemobius griseus griseus E.M. Walker

Nemobius fasciatus abortivus Caudell is an established synonym of this race.

Walker (1910d) recorded this race from Aweme and Elkhorn as the synonymous Nemobius fasciatus abortivus Caudell.

This insect has also been taken at Birtle in the northwestern part of the Province.

Subfamily Oecanthinae

-Key to the species of Oecanthus Serville
(Modified after Fulton 1926)

1. Proximal antennal segment with a broad white
or ivory colored swelling at the inner edge;
swelling and second antennal segment with a
rounded or oval black spot . . . niveus De Geer
- Proximal antennal segment without the swelling
at the inner edge; first and second antennal
segments each with two black marks which are
distinct or confluent 2
2. Proximal antennal segment with the space
between the line and the spot varying from
one to three times the width of the line
(Fig. 64, page 172)
. nigricornis quadripunctatus (Beutenmuller)
- Proximal antennal segment with the space
between the line and spot about one-half
the width of the line, or the line and spot
are confluent 3
3. Head and pronotum usually with a fuscous
median stripe; sternites of abdomen typic-
ally black, atypically lightly infuscated;

proximal antennal segment with line and spot separated by a space of one-half the width of the line, confluent, or pattern obscured by a general dark infuscation (Fig. 65,

page 172) nigricornis nigricornis F. Walker

Head and pronotum without a fuscous median stripe; sternites of abdomen pale or lightly infuscated laterally; proximal antennal segment with line and spot separated by a space one-half the width of the line, or confluent (Fig. 66, page 173)

. nigricornis argentinus Saussure

Genus Oecanthus Serville

92. Oecanthus nigricornis quadripunctatus (Beutenmuller)

Walker (1910d) recorded this race from Aweme.

Fulton (1926), in his study of geographical variation in the nigricornis group of Oecanthus, recorded fourteen out of thirty-five specimens from Aweme as Oecanthus nigricornis quadripunctatus (Beutenmuller).

This race has also been recorded from Napinka, Winnipeg, Morris, Starbuck, and Brandon. The specimens

examined were taken between July 20 and August 10.

O. nigricornis quadripunctatus (Beutenmuller)
occasionally becomes an economic pest on raspberries in
Manitoba.

The females drill a hole in the canes of the raspberry and deposit a single pale yellow egg in it. The eggs are laid in a single row along one side of the cane, and the number of eggs in a row varies.

The egg punctures serve as an entrance for disease organisms and also weaken the canes, causing them to break or split easily. The eggs remain in the canes over winter and hatch the following summer about two weeks before blossom time.

93. Oecanthus nigricornis argentinus Saussure

This race has been recorded from Lyleton, Morris, Winnipeg, Napinka, Starbuck, Aweme, and Coulter. The specimens examined were taken between July 20 and August 9.

94. Oecanthus nigricornis nigricornis F. Walker

Fulton (1926) referred eighteen of thirty-five specimens from Aweme to this race.

This race has also been recorded from Winnipeg,

Brandon, Morris, Hartney, Arnaud, and Melita. The specimens examined were taken between August 5 and September 10.

95. Oecanthus niveus De Geer

The snowy tree cricket has been recorded from Winnipeg and Aweme. The specimens examined were taken between August 17 and September 14.

FIGURE 64. PROXIMAL ANTENNAL SEGMENT OF OECANTHUS NIGRICORNIS
QUADRIPUNCTATUS BEUTENMULLER.

FIGURE 65. PROXIMAL ANTENNAL SEGMENT OF OECANTHUS NIGRICORNIS
NIGRICORNIS F. WALKER.

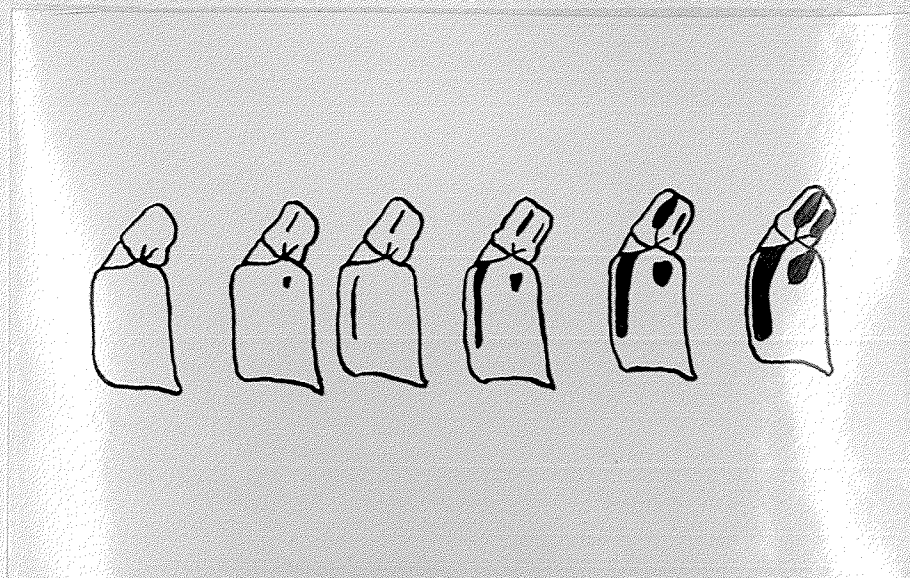


FIGURE 64. After Fulton 1926.

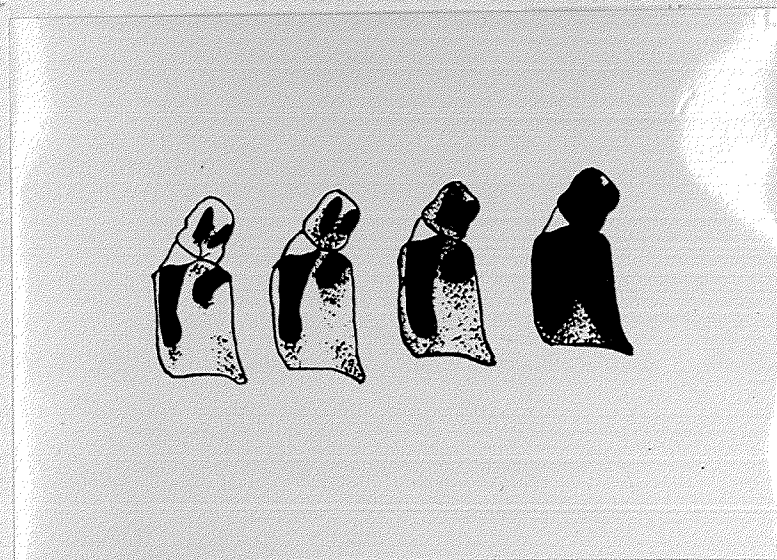


FIGURE 65. After Fulton 1926.

FIGURE 66. PROXIMAL ANTENNAL SEGMENT OF OECANTHUS NIGRICORNIS
ARGENTINUS SAUSSURE.

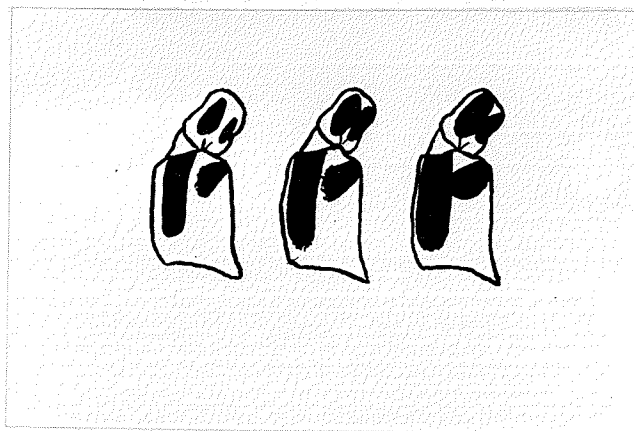


FIGURE 66. After Fulton 1926.

CHAPTER XI

FAMILY TRIDACTYLIDAE

Genus Tridactylus Olivier

96. Tridactylus apicalis Say

The sand cricket, T. apicalis Say, was taken at Marchand by Criddle in July 1928. This is the only record of its occurrence in Manitoba.

CHAPTER XII

LIST OF ORTHOPTERA RECORDED IN MANITOBA

FAMILY BLATTIDAE

Subfamily Pseudomopinae

Blattella germanica Linnaeus

Subfamily Blattinae

Blatta orientalis Linnaeus

Periplaneta americana Linnaeus

Periplaneta australasiae Fabricius

Subfamily Epilamprinae

Nyctibora noctivaga Rehn

Subfamily Panchlorinae

Panchlora cubensis Saussure

Subfamily Blaberinae

Blaberus craniifer Burmeister

FAMILY PHASMATIDAE

Subfamily Heteronemiinae

Diapheromera femorata (Say)

FAMILY TETRIGIDAE

Subfamily Tetriginae

Tetrix subulata (Linnaeus)

Tetrix acadica acadica (Scudder)

Tetrix ornata (Say)

Subfamily Batrachidinae

Tettigidea lateralis lateralis (Say)

FAMILY ACRIDIDAE

Subfamily Acridinae

Opeia obscura (Scudder)

Cordillacris occipitalis cinerea (Bruner)

Amphitornus coloradus (Thomas)

Phlibostroma quadrimaculatum (Thomas)

Orphulella speciosa (Scudder)

Orphulella pelidna pelidna (Burmeister)

Chloealtis conspersa Harris

Neopodismopsis abdominalis (Thomas)

Aulocara ellioti (Thomas)

Stethophyma lineatum (Scudder)

Stethophyma gracile (Scudder)

Aeropedellus clavatus (Thomas)

Chorthippus longicornis (Latreille)

Bruneria brunnea (Thomas)

Psoloessa delicatula delicatula (Scudder)

Ageneotettix deorum deorum (Scudder)

Subfamily Oedipodinae

Chortophaga viridifasciata (De Geer)

Encoptolophus sordidus costalis (Scudder)

Gamnula pellucida (Scudder)

Dissosteira carolina (Linnaeus)

Arphia conspersa Scudder

Arphia pseudonietana pseudonietana (Thomas)

Pardalophora apiculata (Harris)

Hadrotettix trifasciatus (Say)

Spharagemon collare (Scudder)

Spharagemon bolli Scudder

Cratypedes neglectus (Thomas)

Xanthippus corallipes latefasciatus Scudder

Xanthippus corallipes montanus (Thomas)

Metator pardalinus Saussure

Trachyrhachis kiowa kiowa (Thomas)

Aerochoreutes carlinianus carlinianus (Thomas)

Circotettix verrucullatus (Kirby)

Circotettix rabula rabula Rehn and Hebard

Trimerotropis agrestis McNeill

Trimerotropis campestris McNeill

Trimerotropis pallidipennis salina McNeill

Subfamily Cyrtacanthacridinae

Hesperotettix viridis pratensis Scudder

Hypochlora alba (Dodge)

Schistocerca lineata Scudder

Phoetaliotes nebrascensis (Thomas)

Melanoplus dawsoni (Scudder)

Melanoplus islandicus Blatchley

Melanoplus borealis junius (Dodge)

Melanoplus fasciatus (F. Walker)

Melanoplus huroni Blatchley

Melanoplus confusus Scudder

Melanoplus infantilis Scudder

Melanoplus keeleri luridus (Dodge)

Melanoplus bivittatus (Say)

Melanoplus flavidus flavidus Scudder

Melanoplus femur-rubrum femur-rubrum (De Geer)

Melanoplus angustipennis (Dodge)

Melanoplus bruneri Scudder

Melanoplus mexicanus mexicanus Saussure

Melanoplus mexicanus migratory phase spretus (Walsh)

Melanoplus gladstoni (Scudder)

Melanoplus packardii Scudder

Melanoplus stonei Rehn

Melanoplus foedus foedus Scudder

FAMILY TETTIGONIIDAE

Subfamily Phaneropterinae

Scudderia furcata furcata Brunner

Scudderia pistillata Brunner

Scudderia curvicauda borealis Rehn and Hebard

Subfamily Conocephalinae

Conocephalus saltans (Scudder)

Conocephalus fasciatus fasciatus (De Geer)

Orchelimum gladiator Bruner

Orchelimum vulgare Harris

Subfamily Decticinae

Anabrus simplex Haldeman

Metrioptera sphagnorum (F. Walker)

FAMILY GRYLLACRIDIDAE

Subfamily Rhaphidophorinae

- Tachycines asynomorus Adelung
Ceuthophilus maculatus (Harris)
Ceuthophilus pallescens Bruner
Ceuthophilus pallidus Thomas
Ceuthophilus fusiformis Scudder
Udeopsylla robusta (Haldeman)

FAMILY GRYLLIDAE

Subfamily Gryllinae

- Acheta assimilis (Fabricius)
Acheta domestica Linnaeus

Subfamily Nemobiinae

- Nemobius fasciatus fasciatus (De Geer)
Nemobius griseus griseus E.M. Walker

Subfamily Oecanthinae

- Oecanthus nigricornis quadripunctatus (Beutenmuller)
Oecanthus nigricornis argentinus Saussure
Oecanthus nigricornis nigricornis F. Walker
Oecanthus niveus De Geer

FAMILY TRIDACTYLIDAE

- Tridactylus apicalis Say

GLOSSARY (After Torre Bueno 1937)

- abbreviate, disproportionate shortness in a part; cut short;
not of usual length.
- abdominal, belonging to or pertaining to the abdomen.
- acuminate, tapering to a long point.
- acute, pointed; terminating in or forming less than a right
angle.
- angulate, forming an angle; when two margins or lines meet
in an angle.
- annulus, a circular transverse band.
- antenna (pl., antennae), the paired segmented sensory organs,
borne one on each side of the head, commonly termed
horns or feelers.
- apex (pl., apices), that part of any joint or segment oppo-
site the base by which it is attached.
- apical, at, near or pertaining to the apex of any structure.
- apically, toward or directed toward the apex.
- basal, at or pertaining to the base or point of attachment
to or nearest the main body.
- bilobate, divided into two lobes.
- bisinate, having two curved incisions or emarginations.
- bispinose, armed with two spines.

bivalved, made up of two parts or valves united to form a tube.

brachypterous, with short or abbreviated wings.

bristle, a stiff hair, usually short and blunt.

buffy, dull yellow.

carina (pl., carinae), an elevated ridge or keel, not necessarily high or acute.

cephalic, belonging to or attached to the head; directed toward the head.

cercus (pl., cerci), an appendage (generally paired) of the tenth abdominal segment; flap like appendages on each side of male genitalia.

compressed, flattened by lateral pressure; flattened laterally as against flattened vertically or depressed.

concave, hollowed out; the interior of a sphere as opposed to the outer or convex surface.

convex, the outer curved surface of a segment of a sphere opposed to concave.

costa, any elevated ridge that is rounded at its crest; the thickened anterior margin of any wing, but usually of the forewings.

costal, of or pertaining to the costa.

crested, with a prominent carina or crest on the upper surface.

deflexed, abruptly bent downward.

denticulate, set with little teeth or notches.

disk, the central upper surface of any part; all the area within a margin; the central area of a wing in Orthoptera; the obliquely ridged outer surface of hind femur in Saltatoria.

distal, near or toward the free end of any appendage; that part of a segment farthest from the body.

divergent, spreading out from a common base.

dorsal, of or belonging to the upper surface.

dusky, somewhat darkened; pale fuscous.

emarginate, notched; with an obtuse, rounded or quadrate section cut from a margin.

fastigium, in Orthoptera, the extreme point or front of the vertex.

femur (pl., femora), the thigh; usually the stoutest segment of the leg, articulated to the body through trochanter and coxa and bearing the tibia at its distal end.

foveola (pl., foveolae), a depression with well marked sides; a small pit.

frontal costa, in Orthoptera a prominent vertical ridge of the head which may be median or lateral.

furcula, a forked process; in Orthoptera a pair of backwardly directed appendages which overlie in a more or less forked position the base of the supra anal plate.

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

genicular, pertaining to the knee.

humeral, relating to the shoulder.

humeral angle, in Orthoptera, the obtusely rounded angle formed by the deflection of the sides of the pronotum from the dorsum.

incised, notched or deeply cut into.

incision, any cut into a margin or through a surface.

inframarginal, situated below or behind any margin.

infuscated, smoky grey brown with a blackish tinge.

interocular, between the eyes.

lanceolate, lance or spear shaped; oblong and tapering to the end.

lateral lobes, in Orthoptera the deflexed part of the pronotum which covers the sides of the prothorax.

macropterous, long or large winged.

medially, referring to or at the middle.

melanistic, dark or blackish.

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

metasternal, relating or attached to the metasternum.

metazona, in Orthoptera, the dorsal surface of the prothorax behind the principal sulcus.

notched, indented, cut or nicked; usually of a margin.

oblique, slanting; any direction between perpendicular and horizontal.

oblong, longer than broad; with the longitudinal diameter more than twice the transverse.

occiput, the back part of the head.

ocelli, the small lenses between the eyes on the front of the head.

ovate, egg shaped in outline.

ovipositor, the tubular or valved structure by means of which the eggs are placed; usually concealed, but sometimes extended far beyond the end of the body.

pronotum, the upper or dorsal surface of the prothorax.

prosternum, the fore-breast; the sclerite between the fore-legs.

proximal, that part of an appendage nearest the body.

prozona, the anterior part of the pronotum.

punctate, set with impressed points or punctures.

quadrate, square or nearly so.

rudimentary, undeveloped.

rugose, wrinkled.

sinuate, cut in sinuses; wavy; curved; specifically of edges or margins.

sinus, a more or less profound curvilinear indentation; an excavation as if scooped out; a curved break in an otherwise straight margin.

spatulate, flattened club shaped, the apex rounded.

spine, a multicellular more or less thorn like process or outgrowth of the cuticula not separated from it by a joint.

- spinulose, set with little spines or spinules.
- spur, a spine like appendage of the cuticula, connected to the body wall by a joint (Comstock).
- sternite, the ventral piece in a ring or segment; a subdivision of a sternal plate or any one of the sclerotic components of a definitive sternum (Snodgrass).
- subequal, similar, but not equal in size, form or other characters.
- subgenital plate, a plate or process underlying the genital organs in Orthoptera.
- submarginal, the part of a surface just within the margin.
- subplanate, not quite flat.
- suffused, clouded or obscured by a darker color.
- sulcus (pl., sulci), a furrow or groove; a groove like excavation.
- supraanal plate, a triangular sclerite covering the anal cavity above.
- sylvan, inhabiting the forests or woodland areas.
- tarsus (pl., tarsi), the foot; the jointed appendage attached at the apex of the tibia, bearing the claws and pulvilli; the distal part of the insect leg, consisting of from one to five segments or joints.

tegmina (pl., tegmina), the hardened leathery or horny forewing in Orthoptera.

tergite, a dorsal sclerite or part of a segment, especially when such part consists of a single sclerite.

thorax (pl., thoraces), the second or intermediate region of the insect body bearing the true legs and wings, made up of three rings named in order, pro-, meso-, and metathorax; when the prothorax is free as in Orthoptera, the term thorax is commonly used in descriptive work for that segment only.

tibia (pl., tibiae), the fourth division of the leg, articulated at the proximal end to the femur and bearing on the distal end the tarsi; generally slender and frequently equalling or exceeding the former in length.

transverse, broader than long; running across; cutting the longitudinal axis at right angles.

truncate, cut off squarely at tip.

tubercle, a little solid pimple or small button.

tuberculate, covered or furnished with tubercles.

unicolorous, of one color throughout.

valve, in Orthoptera one of the corneous pieces of the ovipositor.

valvula (pl., valvulae), a little valve; any small valve-like process.

ventral, pertaining to the under surface of abdomen.

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

LOCALITIES

The map (Fig. 67, page 196) shows the localities in Manitoba from which material has been secured. The localities are given in numerical order beginning in the northwest corner of the Province and ending in the southeast corner. The following alphabetized list keys each locality. The section, township, and range of the locality are also given.

	<u>Sec.</u>	<u>Twp.</u>	<u>Rge.</u>
47. Alexander	17	10	21 W
84. Altona	8	2	1 E
55. Arden	13	15	14 W
101. Arnaud	27	3	3 E
12. Ashville	24	25	21 W
62. Aweme	4	9	16 W
70. Baldur	13	5	14 W
95. Beausejour	36	12	7 E
67. Belmont	20	5	15 W
4. Benito	15	34	29 W
43. Beresford	12	9	21 W
21. Birtle	6	17	26 W
7. Blue Lake area		30	25 W

	<u>Sec.</u>	<u>Twp.</u>	<u>Rge.</u>
39. Boissevain	24	3	20 W
49. Brandon	23	10	19 W
30. Cameron	31	1	1 W
58. Camp Hughes	35	10	16 W
59. Carberry	30	10	14 W
102. Carlowrie	3	4	4 E
79. Carman	30	6	4 W
108. Carrick	28	3	11 E
69. Cartwright	6	2	2 W
50. Chater	27	10	18 W
Churchill - south of 54th parallel, on Hudson Bay.			
31. Coulter	2	2	27 W
5. Cowan	26	35	28 W
71. Cypress River	7	7	12 W
77. Darlingford	8	3	7 W
11. Dauphin	19	25	19 W
14. Deepdale	13	27	29 W
37. Deloraine	3	3	23 W
51. Douglas	2	11	17 W
16. Dropmore	26	28	29 W
100. Dufrost	1	5	3 E

	<u>Sec.</u>	<u>Twp.</u>	<u>Rge.</u>
97. Dugald	34	10	5 E
3. Durban	22	34	28 W
25. Elkhorn	34	11	28 W
32. Elva	18	3	27 W
85. Emerson	4	1	2 E
8. Ethelbert	31	29	21 W
88. Fort Garry	30	10	3 E
13. Gilbert Plains	9	25	22 W
92. Gimli	16	19	4 E
57. Gladstone	29	14	11 W
36. Goodlands	3	2	24 W
46. Griswold	25	9	23 W
41. Hartney	16	6	23 W
53. Ingelow	9	12	16 W
52. Justice	12	12	18 W
18. Kelwood	14	19	15 W
2. Kenville	13	35	28 W
Lake Atikemag - north of The Pas			
29. Lyleton	22	1	28 W
72. MacGregor	33	11	10 W
106. Marchand	36	5	8 E

	<u>Sec.</u>	<u>Twp.</u>	<u>Rge.</u>
90. Marquette	6	13	2 W
61. Martinville	20	9	18 W
23. McAuley	10	15	29 W
33. Melita	1	4	27 W
110. Menisino	36	1	10 E
78. Miami	8	5	6 W
24. Miniota	36	13	27 W
40. Minto	19	5	19 W
81. Morden	5	3	5 W
86. Morris	Lot 111	5	1 E
34. Napinka	19	4	25 W
54. Neepawa	33	14	15 W
45. Oak Lake	23	9	24 W
60. Onah	1	10	16 W
28. Pierson	1	3	29 W
75. Pilot Mound	9	3	11 W
6. Pine River	32	32	22 W
111. Piney	36	2	11 E
27. Pipestone	9	7	26 W
56. Plumas	20	16	12 W
83. Plum Coulee	2	3	3 W

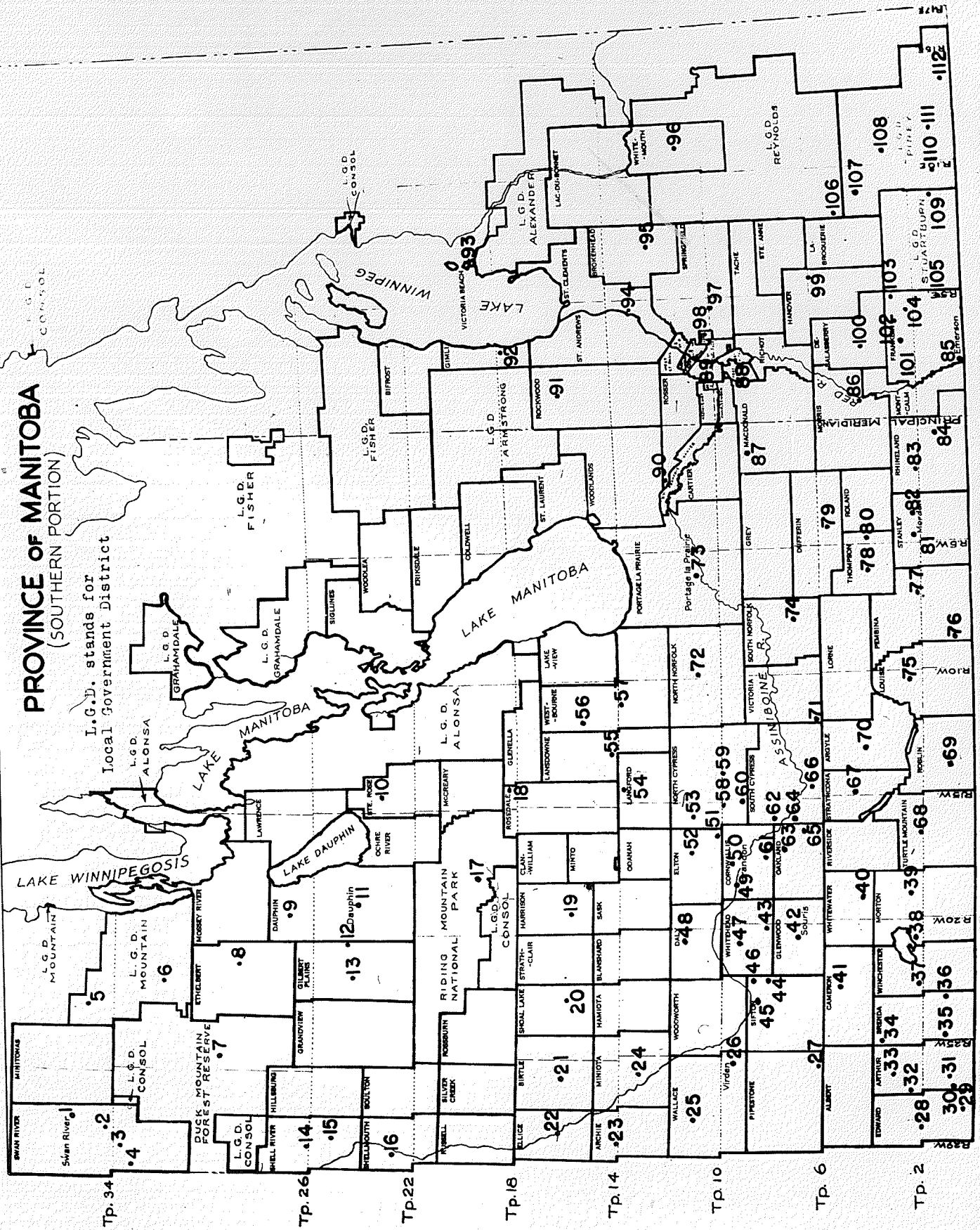
	<u>Sec.</u>	<u>Twp.</u>	<u>Rge.</u>
73. Portage la Prairie	36	11	7 W
44. Ralston	12	9	23 W
72. Rathwell	7	8	8 W
17. Riding Mountain National Park	27	23	25 W
15. Roblin	8	26	28 W
103. Rosa	22	3	5 E
80. Rosebank	5	5	5 W
63. Rounthwaite	24	8	18 W
22. St. Lazare	17	17	28 W
10. St. Rose	8	24	15 W
107. Sandilands	22	14	9 E
94. Selkirk	34	13	5 E
104. Senkiw	8	3	5 E
20. Shoal Lake	9	17	23 W
9. Sifton	36	27	20 W
76. Snowflake	19	1	9 W
42. Souris	33	7	21 W
112. Sprague	15	1	14 E
87. Starbuck	25	9	2 W
99. Steinbach	35	6	6 E
66. Stockton	21	7	15 W

	<u>Sec.</u>	<u>Twp.</u>	<u>Rge.</u>
19. Strathclair	35	16	22 W
109. Sundown	2	2	9 E
1. Swan River	21	36	27 W
91. Teulon	21	16	2 E
The Pas	1	56	27 W
105. Tolstoi	35	1	5 E
98. Transcona	5	11	4 E
64. Treesbank	5	8	16 W
68. Turtle Mountains - southern part of Morton Municipality			
93. Victoria Beach	9	20	7 E
26. Virden	22	10	26 W
35. Waskada	5	2	25 W
65. Wawanesa	26	7	17 W
48. Wheatland	21	12	21 W
96. Whitemouth	36	11	11 E
38. Whitewater	7	3	21 W
82. Winkler	4	3	4 W
89. Winnipeg	1	11	3 E

FIGURE 67. MAP OF MANITOBA SHOWING LOCALITIES (REPRESENTED BY
NUMBER) FROM WHICH MATERIAL HAS BEEN SECURED.

PROVINCE OF MANITOBA (SOUTHERN PORTION)

L.G.D. stands for
Local Government District



BIBLIOGRAPHY

- Beamer, R. 1917. Grasshoppers of Kansas. Part II. Univ. Kansas, Dept. Ent. Bul. 11:53-126.
- Blatchley, W.S. 1920. Orthoptera of Northeastern America. Nat. Pub. Co. 1-784.
- Caudell, A.N. 1907. The Decticinae (A Group of Orthoptera) of North America. Proc. U.S. Nat. Mus., Vol. 32:285-410.
- Caudell, A.N. 1916. The Genera of the Tettigoniid Insects of the Subfamily Rhabdophorinae Found in America North of Mexico. Proc. U.S. Nat. Mus., Vol. 49:655-690.
- Claassen, P.W. 1917. Grasshoppers of Kansas. Part I. Univ. Kansas, Dept. Ent. Bul. 11:6-50.
- Criddle, N. 1918. Egg-laying Habits of Acrididae. Can. Ent. Vol. 50(5):145-151.
- Criddle, N., et al. 1923. The Entomological Record. Ann. Rept. Ent. Soc. Ont. 101.
- Criddle, N. 1925. Field Crickets in Manitoba. Can. Ent. Vol. 57(4):79-84.
- Criddle, N. 1927. Orthoptera. Treesbank Summary Rept.
- Criddle, N. 1928. Orthoptera. Treesbank Summary Tech. Rept. 211-355.
- Criddle, N. 1929. Orthoptera. Treesbank Summary Tech. Rept. 65-191.
- Criddle, N. 1930a. Life History of the Cow Grasshopper, Chryschraon abdominalis Thomas, in Manitoba. Can. Ent. Vol. 62(2):25-28.
- Criddle, N. 1930b. Life History Studies of Orthoptera. Treesbank Summary Tech. Rept. 160-193.
- Criddle, N. 1931. Studies in Orthoptera. Treesbank Summary Tech. Rept. 158-217.

- Criddle, N. 1932a. Studies in Orthoptera. Treesbank Summary Rept. 130-178.
- Criddle, N. 1932b. The Life History of Schistocerca lineata Scudder. Can. Ent. Vol. 64(5):98-102.
- Criddle, N. 1933a. Notes on the Habits of Injurious Grasshoppers in Manitoba. Can. Ent. Vol. 65(5):97-102.
- Criddle, N. 1933b. Studies in the Biology of North American Acrididae Development and Habits. Reprint Proc. World's Grain Exhibition and Conference, 474-494.
- Fulton, B.B. 1926. Geographical Variation in the nigricornis Group of Oecanthus (Orthoptera). Reprint Iowa Sta. Coll. Jour. Sci. Vol. 1(1):43-62.
- Fulton, B.B. 1931. A Study of the Genus Nemobius (Orthoptera Gryllidae). Ann. Ent. Soc. Amer., Vol. 24:205-237.
- Gurney, A.B. 1940. A Revision of the Grasshoppers of Genus Orphulella Giglio-Tos, from America North of Mexico (Orthoptera; Acrididae). Reprint Entomologica Americana Vol. 20(3):85-157.
- Gurney, A.B. 1951. The Names of the Field and House Crickets. Jour. Econ. Ent. Vol. 44(4):611.
- Hancock, J.L. 1902. The Tettigidae of North America. Lakeside Press, R.R. Donnelley and Sons Co., Chicago. 1-188.
- Handford, R.H. The Identification of Nymphs of the Genus Melanoplus of Manitoba and Adjacent Areas. Reprint Sci. Agric. Vol. 26(4):147-180.
- Handford, R.H., and L.G. Putnam. Grasshopper Control. Canada, Dept. Agr., Div. Ent., Ottawa, Processed Publication No. 115:1-20.
- Hebard, M. 1913. A Revision of the Species of the Genus Nemobius (Orthoptera: Gryllidae) Found in North America North of the Isthmus of Panama. Proc. Acad. Nat. Sci. Phila. Vol. 65:394-492.

- Hebard, M. 1922. New Genera and Species of Melanopli Found Within the United States and Canada (Orthoptera; Acrididae). Trans. Amer. Ent. Soc. Vol. 48:49-66.
- Hebard, M. 1925. The Orthoptera of South Dakota. Proc. Acad. Nat. Sci. Phila., Vol. 77:33-155.
- Hebard, M. 1928. The Orthoptera of Montana. Proc. Acad. Nat. Sci. Phila., Vol. 80:211-306.
- Hebard, M. 1929. The Orthoptera of Colorado. Proc. Acad. Nat. Sci. Phila., Vol. 81:303-425.
- Hebard, M. 1930. The Orthoptera of Alberta. Proc. Acad. Nat. Sci. Phila., Vol. 82:377-403.
- Hebard, M. 1931. The Orthoptera of Kansas. Proc. Acad. Nat. Sci. Phila., Vol. 83:119-227.
- Hebard, M. 1932. The Orthoptera of Minnesota. Univ. Minn. Agr. Expt. Sta. Tech. Bul. 85:1-61.
- Hebard, M. 1934. The Dermaptera and Orthoptera of Illinois. Ill. Nat. Hist. Surv. Bul. Vol. 20(3):125-279.
- Hebard, M. 1936. The Orthoptera of North Dakota. N.D.A.C. Tech. Bul. 284:1-66.
- Hubbell, T.H. 1922. Notes on the Orthoptera of North Dakota. Univ. Mich. Bul. No. 113:1-56.
- Hubbell, T.H. 1925. Melanoplus stonei in Michigan (Orthoptera; Acrididae). Ent. News Vol. 36:168-173.
- Hubbell, T.H. 1936. A Monographic Revision of the Genus Ceuthophilus (Orthoptera, Gryllacrididae, Rhabdophorinae). Univ. Florida Pub. Vol. 2(1):1-551.
- MacNay, C.G. 1949. Cockroaches and Their Control. Canada, Dept. Agr., Div. Ent., Ottawa, Processed Publication No. 109:1-10.
- McNeill, J. 1897. Revision of the Truxalinae of North America. Reprint Proc. Davenport Acad. Nat. Sci., Davenport, Iowa. Vol. 6:179-274.

- McNeill, J. 1901. Revision of the Orthopteran Genus Trimerotropis. Proc. U.S. Nat. Mus. Vol. 23:393-449.
- Muesebeck, C.F. 1950. Common Names of Insects Approved by the American Association of Economic Entomologists. Reprint Jour. Econ. Ent. 43(1):117-138.
- Parker, J.R. 1930. Some Effects of Temperature and Moisture upon Melanoplus mexicanus mexicanus Saussure and Camnula pellucida Scudder (Orthoptera). Univ. Mont. Agr. Expt. Sta. Bul. No. 223:1-132.
- Rehn, J.A.G., and M. Hebard. 1906. A Contribution to the Knowledge of the Orthoptera of Montana, Yellowstone Park, Utah, and Colorado. Proc. Acad. Nat. Sci. Phila. Vol. 58:358-418.
- Rehn, J.A.G., and M. Hebard. 1915. Studies in American Tettigoniidae (Orthoptera). Trans. Amer. Ent. Soc. Vol. 41:155-224.
- Rehn, J.A.G. 1921. Descriptions of New and Critical Notes upon Previously Known Forms of North American Oedipodinae (Orthoptera; Acrididae). Trans. Amer. Ent. Soc. Vol. 47:171-197.
- Rehn, J.A.G. 1937. A New Subspecies of Psoloessa delicatula (Orthoptera; Acrididae). Trans. Amer. Ent. Soc. Vol. 63:325-332.
- Rehn, J.W.H. 1951. Classification of the Blattaria as Indicated by Their Wings. Mem. Amer. Ent. Soc. No. 14: 1-129.
- Roberts, R.H. 1941. Nomenclature in the Orthoptera Concerning Genotype Designations. Trans. Amer. Ent. Soc. Vol. 67:1-34.
- Shotwell, R.L. Life Histories and Habits of Some Grasshoppers of Economic Importance on the Great Plains. U.S.D.A. Tech. Bul. No. 774:1-48.

- Scudder, S.H. 1897. Revision of the Orthopteran Group Melanopli (Acrididae) with Special Reference to North American Forms. Proc. U.S. Nat. Mus. Vol. 20:1-421.
- Scudder, S.H. 1899. Supplement to a Revision of the Melanopli. Proc. Davenport Acad. Nat. Sci. Davenport, Iowa. Reprint Vol. 7:157-205.
- Snodgrass, R.E. 1935. The Abdominal Mechanisms of a Grasshopper. Smithsonian Misc. Coll. Vol. 94(6):1-89.
- Smith, R.W. 1944. Observations on Parasites of Some Canadian Grasshoppers. Can. Ent. 76(2):28-33.
- Smith, R.W. 1947. Grasshopper Parasite Investigations. Unpublished.
- Smith, R.W., and T.U. Finlayson. 1950. Larvae of Dipterous Parasites of Nymphal and Adult Grasshoppers. Reprint Can. Jour. Res. 28:81-117.
- Torre-Bueno, J.R. De La. A Glossary of Entomology. Brooklyn Ent. Soc. Brooklyn, N.Y. 1-336.
- Walker, E.M. 1910a. The Orthoptera of Western Canada. Can. Ent. Vol. 42(8):269-276.
- Walker, E.M. 1910b. The Orthoptera of Western Canada. Can. Ent. Vol. 42(9):293-300.
- Walker, E.M. 1910c. The Orthoptera of Western Canada. Can. Ent. Vol. 42(10):333-340.
- Walker, E.M. 1910d. The Orthoptera of Western Canada. Can. Ent. Vol. 42(11):351-356.