## Grasshoppers and related insects of Northwest Territories and adjacent regions

P. M. Catling



**Above**, The northern part of the unglaciated Plains of Abraham (foreground), a rolling, patterned limestone tundra at 5000 ' in the MacKenzie Moutains (64.5077 N, -127.4933 W), west of Norman Wells. **Right**, This is the habitat of he flightless grasshopper, *Bohemanella frigida* subsp. *frigida*, in Canada found only in Beringia (the unglaciated area of Alaska, Yukon and Northwest Territories). Photos by P.M. Catling on 1 Aug. 2007.



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### **Cover Photographs**

**Above**, The northern part of the unglaciated Plains of Abraham (foreground), a rolling, patterned limestone tundra at 5000 ' in the MacKenzie Moutains (64.5077 N, -127.4933 W), west of Norman Wells. **Right**, This is the habitat of he flightless grasshopper, *Bohemanella frigida* subsp. *frigida*, in Canada found only in Beringia (the unglaciated area of Alaska, Yukon and Northwest Territories). Photos by P.M. Catling on 1 Aug. 2007.

## GRASSHOPPERS AND RELATED INSECTS

## (ULONATA)

## OF NORTHWEST TERRITORIES

AND

ADJACENT REGIONS

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## CONTENTS

ABSTRACT
WHY GRASSHOPPERS?
MORE ABOUT GRASSHOPPERS
HABITATS IN NORTHWEST TERRITORIES
BIOGEOGRAPHY
STUDY OF GRASSHOPPERS IN NORTHWEST TERRITORIES
GATHERING INFORMATION
IDENTIFICATION, GLOSSARY OF TERMS
IDENTIFICATION KEYS TO GRASSHOPPER RELATIVES - DERMAPTERA,
NOTOPTERA, DICTUOPTERA, GRYLLOPTERA)
IDENTIFICATION KEYS TO GRASSHOPPERS - ORTHOPTERA14
DISTRIBUTIONS, STATUS AND OTHER NOTES ON THE SPECIES
SPECIES OF ADJACENT REGIONS
NOTES ON DISTRIBUTION MAPS AND DATABASE
DISTRIBUTION MAPS
TABLE 1. CHECKLIST OF ULONATA FOR NW NORTH AMERICA AND ADJACENT REGIONS
ACKNOWLEDGEMENTS
REFERENCES
INDEX

**FRONT COVER:** Above, The northern portion of the unglaciated Plains of Abraham, a rolling, patterned limestone tundra at 5000 ft in the Mackenzie Mountains (64.5077 N, -127.4933 W), west of Norman Wells. This is the habitat of the flightless grasshopper, *Bohemanella frigida frigida*, shown to the lower right, in Canada found only in Beringia (the unglaciated area of Alaska, Yukon and Northwest Territories). Photos by P.M. Catling on 1 Aug. 2007

**BACK COVER**: Grasshoppers of Northwest Territories. *Stethophyma lineata* from a fen E of Kakisa River, 60.9484 °N, -117.14604 °W, 5 Aug. 2007. *Camnula pellucida* from grassy fields at Hay River Airport the airport, 60.8384 °N, -115.7794 °W, 5 Aug. 2007. *Chloealtis abdominalis* and *Melanoplus fasciatus* both from an alvar W of Hay River, 60.8492 °N, -116.6181 °W, 5 Aug. 2007. *Melanoplus borealis*, all three photos from grassy edge of a polje at Lost City Sink Holes, 65.8607 °N, -125.4087 °W, 31 July 2007. *Trimerotrpis verruculata* from the beach on Great Slave Lake at Hay River 60.8624 °N, -115.7388 °W, 5 Aug. 2007. Photos by P.M. Catling.

ABSTRACT: There are 22 species of grasshoppers and 3 grasshopper relatives in Northwest Territories. Ten additional species occur in adjacent regions of northwestern North America. Eight taxa including *Aeropedellus arcticus*, *Bohemanella frigida frigida*, *Bruneria yukonensis*, *Grylloblattus campodeiformis athapaska*, *G. campodeiformis nahanni*, *Melanoplus gordonae Melanoplus packardii brooksi* and *Xanthippus brooksi*, and are essentially confined to unglaciated parts of Alaska, Yukon and Northwest Territories. A number of species that occur in open habitats are disjunct from the prairie region. Orthopteroid insects are present in all habitats, sometimes in large numbers, and they are important as a source of food for birds and mammals and as environmental indicators. Much of the information on grasshoppers in Northwest Territories was gathered around 1950 as part of the general Northern Insect Survey. Although much is known, more study is required. Identification keys and notes on the habitats and distinguishing characteristics of the species are included.

### INTRODUCTION

This book is intended for teachers, students, field biologists, and researchers (particularly ecologists) doing research in the north. It began as a collection of personal notes prepared to assist in the identification of northern grasshoppers, since no single publication provided all the information needed. Interest and requests for information led to the improvement of the notes, with the result that they were assembled into a short book that could serve the needs of field biologists, teachers, students and scientists. It is intended to assist in identification and monitoring in connection with environmental research and biodiversity protection. It may also provide a basis for status ranking and for continuing research on the evolution, classification and ecology of grasshoppers and other northern insects.

Information is provided here on 22 species of grasshoppers and related insects (orthopteroid insects) in Northwest Territories. There are 19 grasshoppers, as well as one species of earwig, one species of cockroach and one species of katydid in Northwest Territories. Eight species occurring in adjacent regions are included in keys and notes. Both Yukon and Alaska have 18 othopteroid insects (Vickery and Scudder 1987).

### WHY GRASSHOPPERS?

Grasshoppers are important in the north for three reasons. Firstly they often occur in large numbers and have substantial impact on plant communities. Secondly they provide a major source of food for other insects, mammals and birds. Thirdly they can be useful indicators of environmental change and its consequences.

Grasshoppers may eat their weight in plant tissue each day. Some species feed on some plants more than others and thus influence the composition of plant communities. They hasten the degradation of cellulose and contribute in a significant way to the cycling of nutrients in ecosystems.

Sandhill Cranes feed on the relatively large *Stethophyma lineata* in fens and on *Camnila pellucida* along roads (and regularly at Hay River airfield). Grasshoppers are 50-75% crude protein and thus highly nutritious. More than 200 species of North American birds feed on grasshoppers (McAtee 1953). Also reptiles and amphibians are major consumers. Some birds and mammals probably rely heavily on grasshoppers whereas others simply take advantage of periodic large numbers. In central Alaska, savannah sparrows feed mostly on grasshoppers during an outbreak, but then revert to other food after collapse of the grasshopper population (Miller et al. 1994).

Hundreds of other insects feed on, or parasitize grasshoppers. Some feed only on grasshopper eggs. Some of the flies that parasitize grasshoppers use the sounds that the grasshoppers make to find them.

The diversity, functional importance, sensitivity to disturbance, ease of identification and ease of sampling make grasshoppers potentially useful bioindicators for land management. Grasshopper assemblages have been shown to respond to disturbances associated with human land use and their responses do not simply reflect those of plants (Anderson et al. 2001).

### MORE ABOUT GRASSHOPPERS

Grasshoppers (including locusts), crickets, katydids, cockroaches, mantids, termites, rock-crawlers (also called grylloblattids), earwigs and stick insects are all closely related. There is no common name other than "orthopteroid insects" that applies to them all. In Canada there are approximately 250-300 species and at least 266 taxa (250 species and 16 additional subspecies) in this group (Vickery and Kevan 1985). The numbers are approximate because it is unclear whether or not some introduced species are established. The total includes up to 155 grasshoppers (Orthoptera), 104 katydids and crickets(Grylloptera), 24 mantids, termites and cockroaches (Dictuoptera), 7 earwigs (Dermaptera), 4 rock crawlers (Notoptera) and 3 stick insects (Cheleutoptera). Orthopteroid insects are much more diverse in the tropics where there are over

#### 31,000 species.

The orthopteroid insects, particularly the grasshoppers, are of extreme economic importance in agricultural regions since some are serious pests of crops. In many cases much can be saved by knowing what species are abundant in the spring or the previous fall in order to predict outbreaks and determine if they are the species likely to damage crops. Although many grasshoppers may occur in huge numbers, only some grasshoppers are serious pests, many being neutral or beneficial (Johnson 2005). Healthy diverse grasslands and associated wildlife reduce the incidence and impacts of damaging grasshopper outbreaks (McEwen 1982), but to a degree the variations in population size are a natural phenomenon. As noted above grasshoppers have many natural controls. "What happened to this grasshopper?" is a frequent question when people find dead grasshoppers clinging to the stems of plants. It is usually the result of a pathogenic fungus, Entomophthora grylli.

In the prairies many species of grasshoppers appear consecutively in large numbers, thus providing an important continuous food supply for grassland birds. The endangered Burrowing Owl sometimes feeds extensively on *Xanthippus corallipes latefasciatus*, a close relative of the *X. brooksi* which is confined to the unglaciated regions of the northwest.

Some orthopteroid insects have complex behaviour patterns, both auditory and visual. The chirping or whistling-like sounds that they make can often be used to identify the species. These sounds are made by rubbing one part of the body against another and are referred to as stridulation.

Anyone wanting more information on grasshoppers can obtain it from the Orthopterists' Society (<u>www.orthoptera.org</u>), formerly the Pan American Acridological Society. This international scientific organization is devoted to facilitating communication. The society fosters research and publishes the refereed biannual Journal of Orthoptera Research. A research fund is available for graduate students and young researchers.

## HABITATS IN THE NORTHWEST TERRITORIES

The greatest variety of grasshoppers in Northwest Territories is found in dry or moist, open places dominated by grasses and/or sedges but with high floristic diversity. Such habitats occur beside streams and lakeshores and along roads and include several species of Melanoplus as well as Camnula pellucida. However, grasshoppers occur in all habitats (Figure 1). Bohemanella frigida frigida and Aeropedallus arcticus are abundant in rich, limestone tundra. Stethophyma lineatum is sometimes abundant in fens and marshes. Trimerotropis verruculatus occurs in dry, open rocky, sandy or gravelly habitats. Metrioptera sphagnorum occurs in sphagnum bogs. Some of the species of *Tetrix* occur in woodlands and woodland edges as well as in a open areas. Melanoplus fasciatus is associated with heath shrubs. Chothippus curtipennis curtipennis occurs in a variety of habitats. Blatella germanica occurs in buildings and Forficula auricularia occurs in urban areas.

### BIOGEOGRAPHY

Since most of Canada was under mile deep ice only 10,000 years ago, the grasshopper fauna that we have now migrated from the unglaciated regions to the south in the USA (not far from the present Canadian border) or from unglaciated Beringia (parts of Alaska, Yukon, and Northwest Territories) and possibly also from a few possibly unglaciated coastal regions of the northern maritimes. See Vickery (1989) for a more detailed account of earlier origins of the orthopteroid fauna

Based on their present geographic distributions the orthopteroid insects of northwestern North America north of 60°N can be grouped into several categories suggesting their origin over the past 10,000 years (Figure 2). There are 17 species present in northwestern North America that are widespread and abundant across most of southern Canada (listed below). These likely followed the receding glacier northward into Canada from an extensive range to the south. Some are confined to cool boreal openings, parklands or wetlands and this pattern suggests there previous occurence during Wisconsin times at or very near to the ice front. Included in this latter subgroup are Melanoplus bruneri and M. fasciatus and perhaps also Stethophyma lineata and S. gracile.

Three species in Northwest Territories have their main distribution in the prairie region of North America but are disjunct into the Peace River prairies and to the prairie remnants and prairie-like habitats of the northwest. Included in this category are *Melanoplus kennicottii kennicottii*, *Arphia conspersa*, and *Aeropedellus clavatus*. This pattern can also be seen in certain pairs of closely related species such as *Areopedellus arcticus*, and *A. clavatus* and *Bruneria yukonensis* and *B. bruneri*.

A particularly interesting pattern is demonstrated by 5 species in the northwest, three of which occur in Northwest Territories. This is the Beringian distribution associated with the unglaciated area of Alaska, Yukon and Northwest Territories called Beringia. This was a largely (although probably not completely) treeless steppe tundra with a combination of plant species characteristic of tundra and grassland. Surrounded by glaciers and rivers depositing sand gravel and finer material and with strong winds, sand dunes and newly created habitats were widespread, but habitats



Figure 1. Some habitats of grasshoppers in Northwest Territories. Upper left: turfy dolomite tundra on the Mt. Kindle formation at 2420' looking east toward the Mackenzie River (upper centre) on east side of the Mackenzie Mountains (64.9620 °N, -127.3108 °W). Habitat of *Aeropedellus arcticus* and *Melanoplus bruneri*. Upper right: Fen east of the Kakisa River on south side of Great Slave Lake (60.9484 °N, -117.1460 °W). Habitat of *Stethophyma gracile*, *S. lineatum* and *Chorthippus curtipennis curtipennis*. Lower left: Flat, open limestone alvar west of Enterprise on south side of Great Slave Lake (60.7649 °N, -116.5338 °W). Habitat of *Aeropedellus clavatus*, *Cloealtis abdominalis*, *Melanoplus fasciatus*, and *Trimerotropis verruculata*. Lower right: Rich grass and sedge meadow surrounded by willows in a polje at 1240' on the south side of Great Bear Lake (65.8607 °N, -125.4087 °W). A bull Muskox lurks in background (centre) Habitat of *Melanoplus borealis* and *M. sanguinipes*. Photos - P.M. Catling.

also likely included long established tundra and scree slopes. Here flora and fauna survived when the rest of Canada was under glacial ice. The Beringian flora and fauna spread to the south and east during the decay of the Wisconsin ice sheet but the rate and consequently the extent of spread varied with different species. Some were confined by habitat requirements while others were restricted by lack of mobility due to being flightless. Those that could not spread rapidly into recently deglaciated landscapes across Canada remained. in the relict Beringian habitats outlining the approximate extent of the Beringian region. Included in this category are: Bohemanella frigida frigida, Melanoplus gordonae, Xanthippus brooksi, Aeropedellus arcticus, and Bruneria yukonensis. The newly developed boreal forest spread in a broad band across Canada and into Beringia changing grasslands into forest and the remnants of Beringian environments became confined so that many Beringian species now have restricted distributions within the Beringian region.

A final category includes those species introduced by man and associated with habitations. *Forficula auricularia* and *Blattella germanica* are included here.

Unlike the situation with many other groups of insects there are very few invasive alien grasshoppers of natural habitats in Canada. Some species may have expanded or contracted their ranges but there is insufficient information in the north to show such trends.

### Widespread species

Metrioptera sphagnorum Tetrix subulata Tetrix brunnerii Tetrix ornata ornata Melanoplus borealis borealis Melanoplus femurrubrum femurrubrum Melanoplus sanguiunipes sanguinipes Pardalophora apiculata Camnula pellucida Trimerotropis verruculata Stethophyma lineata Stethophyma gracile Chloealtis abdominalis Chloealtis conspersa Chorthippus curtipennis curtipennis Melanoplus bruneri Melanoplus fasciatus

### Species characteristic of the prairies

Melanoplus kennicottii kennicottii Arphia conspersa Aeropedellus clavatus

#### **Beringian species**

Bohemanella frigida frigida Melanoplus gordonae Xanthippus brooksi Aeropedellus arcticus Bruneria yukonensis

#### Species associated with human habitation

Forficula auricularia Blattella germanica

## STUDY OF GRASSHOPPERS IN NORTHWEST TERRITORIES

The earliest collections examined from Northwest Territories are those of F. Harper in 1914 from Fort Resolution (CNC). T.N. Freeman collected at Great Bear Lake in 1917. As with our knowledge of most northern insects, it was during the Northern Insect Survey around 1950 that most of the information about occurrence of grasshoppers in the north was gathered. The important and most extensive collections made at this time were those of W.G. Helps and J.B. Wallis at Fort Smith,, S.D. Hicks



Figure 2. Exemplary North American distribution patterns of grasshoppers occurring in Northwest Territories. **Upper left**, *Chorthippus curtipennis*, a widespread species. **Upper right**, *Bohemanella frigida frigida*, a Beringiam species of tundra. **Lower left**, *Xanthippus brooksi*, a Beringian species of grassland. **Lower right**, *Arphia conspersa*, a western prairie species.

at Norman Wells, E.F. Cashman at Yellowknife, D.P. Whillans at Fort Simpson and P.R. Erhlich at Hay River. In 1969, G.E. Shewell collected at Norman Wells and Wrigley. In 1971, M. Wood collected at Tuktoyaktuk. The author studied the grasshoppers in the general regions of Norman Wells and Great Slave Lake in 2007.

Dr. Vernon R. Vickery (Figure 3), previously curator of the Lyman Entomological Museum and Research Laboratory at McGill University and co-author of the classic textbook on Canadian orthopteroid insects, has contributed most to our knowledge of grasshoppers in northwestern North America. In 1967 and 1983 he published distributional information including reference to specific locations and location of specimens and distribution maps. Maps including Northwest Territories were part of the classic monograph of Vickery and Kevan (1985). Vickery's study of orthopteroid insects of the Yukon (Vickery 1984) included maps for the Yukon, but the keys are useful for Northwest Territories and much valuable information about the biology of these insects in the north is included in that publication. In particular the identification keys provided by Vickery (1969, 1984) and Vickery and Kevan (1985) were useful in developing the keys included here.

#### **GATHERING INFORMATION**

The grasshopper fauna of many parts of the north is still poorly documented. Collections, particularly from remote areas, are therefore valuable. The easiest way to collect grasshoppers is to put the insect in an envelope with date and location written on the envelope and then place the envelope in a dry place. Since dry insects are fragile and subject to destruction by other insects, it is desirable to keep the envelopes in an air-tight box. Envelopes can made by folding a piece of paper. One valuable collection that was received was in triangles made out of newspaper and placed in a shoe box. Staff of the natural resources department can pass collections on to appropriate experts.



Figure 3. Dr. Vernon R. Vickery, previously Curator of the Lyman Entomological Museum and Research Laboratory at McGill University, has been the major contributor to knowledge of orthopteroid insects in northwestern North America.



Figure 1 (continued from page 4). A polje where water collects following the snow melt in spring but then drains underground into limestone rock leaving a lush meadow. *Melanoplus borealis* and *M. sanguinipes* were abundant here. Photo by P.M. Catling at 65.8504° N, -125.3959° W, SW of Great Bear Lake.

### Identification

There is no simple and well illustrated identification guide to the grasshoppers of the Northwest Territories, although Vickery's (1967, 1983, 1984) work has paved the way. The recent field guide of Capinera et al. (2004) is useful for southern Canada, but is incomplete, especially for the north. Kirk and Bomar (2005) have produced one of the most impressive recent regional guides which is useful for central and eastern Canada and Bland (2003) also serves well for central Canada. Several articles by Johnson (2001, 2002, 2003, 2007) on prairie grasshoppers have many colour illustrations and are extremely useful, but do not include some of the northern species. Distributions are still not completely understood and some species in adjacent regions may occur further north or may move further north. Thus the following key and notes include species found near to Northwest Territories. If a key to a much broader region is required then the keys in Vickery and Kevan (1985) are recommended.

Identification is much easier for adults (identified by their fully developed, but sometimes short, wings and relatively large size) than it is for the immatiure nymphs which may not display features used in the key. Immature grasshoppers often grow quickly and can be kept in a large bottle or terrarium and soon develop into adults. Vegetation has to be changed every few days. Keeping grasshoppers can reveal their food preferences and provide information about their behaviour. Sometimes there are changes in colouration as they become adults.

Body length in the keys and descriptions is measured from the front of the head excluding the antennae, to the tip of the abdomen or the tip of the forewing, whichever is longer. In the Melanoplini, the males are more easily identified than females. Important characters include forewing length, whether or not the hind femur is banded, shape of the cercus and shape of the subgenital plate viewed from the rear and the length of the furculae. Five species have furculae relatively long (about 1/3 or more the length of the supra-anal plate). These are: *M. borealis, bruneri, femerrubrum, gordonae* and *sanguinipes.* The remaining species of *Melanoplus* and *Bohemanella frigida,* have furculae less than 1/5 as long as the supra-anal plate.



Figure 4. Basic parts of a grasshopper showing locations of structures mentioned in the keys and text. Redrawn from Capinera & Sechrist (1982).

### GLOSSARY OF TERMS

For convenience several terms used in the more technical literature, but not here, are included.

abdomen: the third or posterior of three body divisions in insects.

antenna(ae): paired, elongate sensory structures located on the head.

**Beringia, beringian**: derived from the name of the Danish explorer, Vitus Bering, refers to an area of unglaciated land that connected eastern Siberia (Kolyma River in far eastern Russia) with Alaska, Yukon and Northwest Territories (Mackenzie River). The connection by the **Bering Land Bridge**, 1,600 km wide, was possible because sea levels were much lower due to water being concentrated in continental glacial ice. Beringia not only allowed an exchange between the flora and fauna of Asia with that of North America, it also developed a unique flora and fauna, remnants of which exist to this day making it a biodiversity hotspot in North America. The unglaciated land (the Beringian region) of the Northwest Territories includes parts of the Mackenzie Mountains and the Mackenzie delta region including some coastline to the east.

brachypterous: with wings so short as to be non-functional for flight.

carina: an elevated ridge.

**cercus(i)**: one (both) of the paired terminal or subterminal projections on the 10<sup>th</sup> abdominal **segment**: a ring-like or cylindrical section.

crepitation: crackling or snapping sounds that grasshoppers produce in flight with their wings.

fastigium: depressed or flattened area at front of head.

femur: stout segment of the leg above the tibia.

forb: a broad-leaved herbaceous plant (as opposed to grasses and woody plants).

foveolae: depressions with well defined edges.

furculae: a pair of processes on the back of the 9<sup>th</sup> abdominal segment.

macropterous: with long fully developed wings suggesting the capability of flight.

mesosternum: underside of second thoracic sement.

metasternum: underside of third thoracic segment.

ovipositor: structure at tip of abdomen of female used to deposit eggs.

**pronotum**: dorsal plate of the first thoracic segment behind the head

**prosternal tubercle**: a knob on the underside of the first thoracic segment between the forelegs **stridulation**: sound produced by rubbing one part of the body against the other.

**subgenital plate**: the last terminal plate of the abdomen that covers the genital area from below. **submarginal**: just inside the edge.

sulcus(i): a groove, slit or depression.

supra-anal plate: the 11<sup>th</sup> and last dorsal plate of the abdomen.

tarsus: the final segment of the leg serving as the foot.

tegmen (pl. tegmina): the thickened forewings of grasshoppers.

thorax: the second or middle of three body divisions in insects.

tibia: the long, thin, fourth segment of the leg between the femur and the tarsus.

trochanter: second segment of the leg from its base.



Figure 5. Heads of *Tetrix* species viewed from above. Redrawn from Vickery and Kevan (1985).



Figure 6. Heads of *Tetrix* species viewed laterally. Redrawn from Vickery and Kevan (1985).



Figure 7. Oblique lateral view of a head of a Melanopline grasshopper showing knob at base of neck. Redrawn from Capinera & Sechrist (1982).



Figure 8. Interspace between the lateral backward projecting lobes of the underside of the second thoracic segment (metasternum) of *Bohemanella frigida* (above) and *Melanoplus sanguinipes* (below). *Bohemanella frigida* from Plains of Abraham, Mackenzie Mountains (64.5077 °N, -127.4933 °W, 2007-08-01, P.M. Catling). *Melanoplus sanguinipes* from Bonus Lake, Mackenzie Mountains (64.5445 °N, -126.6843 °W, 2007-08-02, P.M. Catling). Camera lucida drawings by P.M. Catling.



Figure 9. Tip of abdomen of male grasshopper viewed from the side. Redrawn from Capinera & Sechrist (1982).



Figure 10. Tip of abdomen of female grasshopper viewed from the side. Redrawn - Capinera & Sechrist (1982).



Figure 11. Tip of abdomen of male grasshopper, drawn from above. P.M. Catling.



Figure 12. Outlines of the cerci of Melanopline grasshoppers. Redrawn from Vickery and Kevan (1985).



Figure 13. Foveolae on top front of head of two closely related species. Redrawn from Vickery and Kevan (1985).



M. saguinipes sanguinipes



M. bruneri



M. packardii brooksi



M. kennicottii kennicottii



M. fasciatus



B. frigida frigida









M. gordonae



M. borealis



Figure 14. Subgenital plates of Melanopline grasshoppers viewed from behind. Modified by P.M. Catling from Vickery & Kevan (1985).



Figure 15. Pronota of band-winged grasshoppers viewed from the side. *Xanthippus corallipes* of prairies and montane grasslands is very similar to *X. brooksi*, endemic to northwestern grasslands. Drawings by P.M. Catling.

## KEY TO GRASSHOPPER RELATIVES - DERMAPTERA, NOTOPTERA, DICTUOPTERA, GRYLLOPTERA

The following keys are derived from keys provided by Vickery 1969 and Kevan and Vickery (1985).

1a. Cerci strong and moveable, forming forceps at the tip of the abdomen (Fig. 16) Order Demantera - <i>Forficula auriculata</i>
1b. Cerci not, forming forceps at the tip of the abdomen    2
2a. Body elongate, wingless; eyes reduced; thoracic segments independent (Fig. 24)
2a. Body elongate or not, with wings; eyes not reduced; thoracic segments combined
3a. Pronotum square, 4 - 4.5 mm long[subspecies athapaska]3b. Pronotum shield-like, 4.8 - 5 mm long[subspecies nahanni]
4a. Antennae long and thin, usually much longer than the body
4b. Antennae much shorter than the body and relatively thick Order - Orthoptera (next key)
5a. Hind legs with femora thick and modified for jumping (Fig. 18)
5b Hind legs with femora neither thick nor modified for jumping (Fig. 19)

## KEY TO GRASSHOPPERS AND RELATIVES OF NORTHWESTERN NORTH AMERICA AND ADJACENT REGIONS

1a. Pronotum greatly extended backward (Fig. 19) suborder Tetrigodea - 2
1b. Pronotum not extended backward suborder Acridodea - 4
2a. Fastigium truncate to convex from above with median carina projecting (Fig. 5)
Tetrix ornata ornata
2a. Fastigium acute from above with median carina not projecting (fig. 5)
3a. Body slender; middle femur 3.8 - 4.7 times as long as broad; top of face weakly emarginate in lateral
view (Fig. 6) Tetrix subulata
3a. Body robust; middle femur 3.0 - 3.4 times as long as broad; top of face prominently emarginate in
lateral view (Fig. 6)

4a. With a knob (prosternal tubercle) at base of neck (Figure 7) subfamily Melanoplinae - 5 4a. Without a knob (prosternal tubercle) at base of neck
5a. Wings not or barely reaching tip of abdomen65b. Wings extending beyond tip of abdomen12
6a. Wing extending to fourth abdominal segment76b. Wing extending beyond sixth abdominal segment9
7a. Interspace between the lateral backward projecting lobes of the underside of the second thoracic segment (metasternum) broader than long and broader than a lobe (Figure 8)
7b. Interspace between the lateral backward projecting lobes of the underside of the second thoracic segment (metasternum) distincly longer than broad in males, quadrate in females, but in both narrower than a lobe (Figure 8)
8a. Subgenital plate of male with prominent terminal tubercle and angular shoulders (Figure 14)
8b. Subgenital plate of male with terminal tubercle barely rising above lateral edges and shoulders rounded (Figure 14)
9a. Large species with light yellow lines extending dorsally from the head to the tip of the wings; hind femur striped         9b. Smaller species either without light yellow lines or these lines restricted to the head and thorax; hind femur banded or unmarked         10
10a. Hind femur not banded on outer face (back cover)
10b. Hind femur banded on outer face    11
11a. Hind femur mainly dark; male cercus downcurved (Figure 12, back cover)
11b. Hind femur mainly pale; male cercus upcurved (Figure 12, 20, front cover)
12a. Males

### MALES

13a. Cercus symmetrical, spatulate (Figure 12)[Melanoplus packardii brooksi]13b. Cercus asymmetrical, lobelike or subquadrate14
14a. Cercus strongly tapered in apical half (Figure 12) <i>Melanoplus femurrubrum femurrubrum</i>
14b. Cercus not tapered in apical half, broad or quadrate (Figure 12) 15
<ul> <li>15a. Cercus large and rectangular with rounded apex bent dorsally; subgenital plate rounded or or truncate (Figure 12)</li></ul>
16a. Apex of subgenital plate trilobate (Figure 14)
17a. Subgenital plate much wider than long: furculae less than 1/3 as long as supra-anal plate (Figure 14)
17b. Subgenital plate as long as wide; furculae more than 1/3 as long as supra-anal plate (Figure 14)

### FEMALES

18a. Dorsal angle of ovipositor valve 90-105 °    [Melanoplus points]      18b. Dorsal angle of ovipositor valve greater than 105 °    [Melanoplus points]	ackardii brooksi]
19a. Hind femur reddish below (unlikely rare specimens with unusually long wings)19b. Hind femur yellow or pink below	20 21
20a. Hind femur not banded on the outer face (back cover)	borealis borealis noplus fasciatus
21a. Hind femur not banded on the outer face	22
21a. Hind femur with bands at least on the upper half	23
22a. Cercus concave on both edges	m femurrubrum
22b. Cercus convex on both edges	oplus gordonae]
23a. Wings not exceeding tip of hind femur; forewings spotted	
23b. Wings exceeding tip of hind femur; forewings spotted or not    Melanoplus kenni	<i>cottii kennicottii</i>

24a. Hind femur entirely yellowish below; upper side of cercus straight
24b. Hind femur with pink or reddish stripe below; upper side of cercus convex
25a. Top front of head rounded in lateral view and frontal lateral profile of head more or less vertical 
25b. Top front of head angular in lateral view and frontal lateral profile of head oblique
26a. Pronotum with median carina high, and entire (without slits, Figure 15)
26b. Pronotum with median carina low, with one or two slits (sulci) conspicuous (Figure 15) 27
27a. Median carina of pronotum cut by two slits (sulci, Figure 15)
28a. Hindwing black basally with pale yellow border[Dissosteira carolina]28b. Hindwing transparent or yellowish or reddish basally with a black border (Figure 21)29
29a. Pronotum smooth or slightly wrinkled in front, posterior half without tubercles; hindwing transparent
29b. Pronotum roughened in front, posterior half with small tubercles; hindwing pale yellow or reddish      30
30a. Pronotum with median carina not distinct in front of sulcus; tubercles of pronotum large (Figure 22)
30b. Pronotum with median carina distinct in front of sulcus; tubercles of pronotum small (Figure 21)
31a. Body medium-sized, 19-36 mm long; wings extending 4-5 mm beyond end of body subfamily
31b. Body small, 12-28 mm, not extending beyond end of body except in <i>Bruneria</i> Gomphocerinae, 33
32. Forewing with pale submarginal stripe (back cover); lateral carina of pronotum cut by three sulci
32b. Forewing without pale submarginal stripe; lateral carina of pronotum cut by first and third sulci Stethonhyma gracile

33a. Fastigium without foveolae (Figure 13)3433b. Fastigium with foveolae that are visible from above35
34a. Head above antennae and side of pronotum black    Chloealtis conspersa      34b. Head above antennae and side of pronotum pale or speckled (back cover)    Chloealtis abdominalis
35a. Lateral foveolae (depressions with well defined edges on front of head) relatively narrow and about4 times as long as long as wide (Figure 13)35b. Lateral foveolae (depressions with well defined edges on front of head) relatively wide and no morethan 3 times as long as long as wide (Figure 13)38
36b. Antennae not clubbed; knees (tip of femur) blackChorthippus curtipennis curtipennis36a. Antennae more or less clubbed; knees (tip of femur) not black37
37a. Body slender; pronotal disc elongate; males with strongly clubbed antennae (Figure 23)
37a. Body more robust; pronotal disc constricted; males with slightly clubbed antennae (Figure 20)
38a. Head more than 1/5 length of body; wings barely reaching end of abdomen
38b. Head about 1/5 length of body; wings reaching beyond end of abdomen       [Bruneria brunnea]

# DISTRIBUTIONS, STATUS AND OTHER NOTES ON THE SPECIES OF NORTHWEST TERRITORIES

Complete synonymy for most of the species treated here is provided by Vickery (1967). The order used is the taxonomic sequence of of tribes following Vickery and Kevan (1985) within which the name are in alphabetical sequence within orders and genera.

ORDER DERMAPTERA Forficula auricularia Linnaeus EUROPEAN EARWIG Male and female 10-12 mm long. This species is introduced from the south in vehicles but may not persist in the north. In some parts of southern Canada, very high populations build up. Under such



Figure 16. *Forficularia auricularia*. Courtesy of the U. S. Dept. of Agriculture.

conditions, and being nocturnal, earwigs look for shelter and enter buildings. They are omnivorous but when abundant may destroy garden plants especially flower petals. These characteristics along with their scary appearance (realistically though they are very small) result low popularity. In fact they eat pest insects and are thus beneficial in many respects. High populations typically decline to "background level" after a few years. The "forceps" at the tip of the abdomen are distinctive.

### ORDER DICTUOPTERA Blattella germanica (Linnaeus) GERMAN COCKROACH

Male and female 10-12 mm long. In the north this species occurs only in buildings, especially those with cracks and holes. It is a small, dull brownish-yellow, flattened insect with two dark longitudinal stripes on the pronotum. A pest of houses, restaurants, and any kind of food storage areas, it is the basis for the pest control industry in many temperate region cities. It was reported from Northwest Territories by Vickery (1984), although not mapped for this area later (Vickery and Kevan 1985). It occurs around the world and is likely to be present in all of the larger southern settlements in Northwest Territories. It is known from Dawson and Whitehorse in



Figure 17. *Blatella germanica* occurs only in buildings in the southern parts of Northwest Territories. The specimen (in CNCI) is from Ottawa Ontario *E.C. Becker* 13 June 1960. Photo by P.M. Catling.

adjacent Yukon. Cool conditions are a limiting factor. It moves around behind walls obtaining moisture from condensation on water pipes. In larger and older buildings it is difficult to control. Adults take one to two months to mature and live for 128 to 153 days.

ORDER GRYLLOPTERA Metrioptera sphagnorum (F. Walker) BOG KATYDID (Sphagniana sphagnorum) Male and female 15-20 mm. This species occurs in swampy areas where Black Spruce is predominant. It is widespread but is not frequently encountered in Canada. It reaches its northern limit at Fort Smith. This species extends further north than any other North American katydid, and it is the only North American katydid not known to occur in the United States. Collections at Fort Smith were made between 14 July and 21 August in 1950.

The long antennae and prominent pronotum are distinctive. The wings cover only 1/4 of the abdomen in females and from 1/2 (brachypterous form) to beyond tip of abdomen (macropterous form) in males in males.



Figure 18. *Metrioptera sphagnorum* of bogs reaches only the southern portion of Northwest Territories. The specimen (in CNCI) is from Trewartha Lake, English River, Ontario *G.K. Morris* 20 July 1970. Photo by P.M. Catling..

### ORDER ORTHOPTERA SUBORDER TETRIGODEA *Tetrix brunnerii* (Bolivar) BRUNNER'S GROUSE GRASSHOPPER

Males 8-12 mm, females 9.5-13.5 mm. A species of meadows, bogs and swamps, *Tetrix brunneri* is found throughout much of Canada excepting the prairie region.

Very similar to *T. subulata* this species has a more robust middle femur 3-3.4 times as long as broad rather than 3.8-4.7 times as long as broad as in *T. subulata*.

### Tetrix ornata ornata Say

ORNATE GROUSE GRASSHOPPER Males 8-10 mm, females 9-10.4 mm. Widespread across Canada, this species occurs most often in grassy places, either wet or dry. Since it overwinters as adults, like *T. subulata* and *T. brunneri*, it can be seen early in spring.

Very similar to the other *Tetrix* species, *T. ornata* differs in having the front of the head flat or emarginate with a small central projection. This is a variable species, the forms of which require more study.

### *Tetrix subulata* (Linnaeus)

GRANULATED GROUSE GRASSHOPPER Males 10-10.5 mm, females 12-13 mm.

Found throughout Canada this grasshopper occurs in moist locations on sandy soils and sometimes in drier areas. It flies readily when disturbed. It is believed to feed on mosses and algae. They overwinter as adults which are seen in the spring, early summer and autumn.

Little more than one cm long, these tiny grasshoppers have the front of the head pointed rather than rounded or flattened (from above) as in their close relatives.



Figure 19. *Tetrx ornata* is common in Northwest Territories and is one of the most widespread grasshoppers in North America. The pronotum extends back almost to the tips pf the wings. Photo taken by P. M. Catling at Almonte ( 45.2609 °N, -76.1456 °W), Ontario on 28 Aug. 2007.

### SUBORDER - ACRIDODEA Bohemanella frigida frigida (Boheman) TUNDRA GRASSHOPPER

(Fig. 20)

Males 17-21 mm, females 22-27 mm. (*Melanoplus f. frigidus* (Boheman) )

This species is brachypterous (with wings so short as to be non-functional for flight). Most, if not all, of its North American range is within unglaciated (during the Wisconsin) territory and it is considered to be a Beringian relict (a species that survived the last glaciation (which ended 10,000 years ago) in the unglaciated areas of Alaska, Yukon and Northwest Territories). The recent discovery of this flightless grasshopper on limestone plateaus, at 2550-5000', west of Norman Wells suggests that these areas were unglaciated during the Wisconsin advance, a point over which experts have disagreed. It could not have invaded since it cannot fly so the habitat was always there and it could not have left for the same reason. The very limited dispersal from unglaciated territory is one reason that parts of northwestern North America (called Beringia) are a biodiversity hotspot. With continuous suitable habitat a flightless grasshopper might move as much as 100 metresy a year which could lead to 800 km since glaciation, but in fact the landscape includes inappropriate habitats such as woodlands, wetlands, inhospitable peaks of bare rock and open water. These are either absolute barriers or greatly slow down the distance moved by requiring that the insect go around. The Mackenzie River and its associated wetlands probably represent an absolute barrier. This grasshopper was not found in the McKay Mountains isolated in the Mackenzie lowlands near Tulita nor in the Franklin Mountains on the east side of the Mackenzie River near Norman Wells. Other barriers, along with sedentary behaviour, likely limit movement to much less than 100 km from source populations and actual spread of a flightless insect from non-glaciated territory may actually be in the order of 0-10 km over 8000 years. Thus these insects are a fairly reliable indicator of glacial boundaries.

The species also occurs in Scandinavia and northern Asia. There is a single generation in Lapland and possibly also in Northwest Territories. A rapid growth of nymphs may be possible due to the extremely long northern daylength.

Short wings, banded hind tibia and red hind femur with black basal annulus are distinctive characteristics of this restricted arctic and subarctic species. According to Vickery (1984) it can be separated from *Melanoplus* by the interspace between the lateral backward projecting lobes of the underside of the second thoracic segment (metasternum) which is broader than long and as broad as or broader than a lobe, whereas in Melanoplini this space is distincly longer than broad in males, quadrate in females, but always narrower than a lobe (Figure 8).

The subgenital plate of males terminates in an elevated rounded projection and the male cercus has a prominent lobe on the upper side at the base. Couplet 16 of Vickery and Kevan's (1985) key does not allow one to reach this species. With short wings it should separate out with *M. dodgei* and *M. huroni* to which it seems to be related. Specimens from the Mackenzie Mountains west of Norman Wells have been referred to this species due to the more prominent tubercle on the subapical plate, but the cercus is relatively narrow and is a better match to *M. huroni*. Specimens from the Bear Rock formation and Plains of Abraham in the Mackenzie Mountains near Norman Wells (see cover) compare well with those from Tuktoyaktuk collected by M. Wood in 1971 (CNC) and a specimen collected in the Richardson Mountains in Yukon by M. Wood in 1982 (CNC) both identified as B. frigidus by Vickery in 1983.

Vickery (1984, pp. 18-19) notes that he moved this species from Melanoplini to Podismini based on the close match of male genitalia to species of *Bohemanella* from Finland and Siberia, but he did not, as part of this work, examine other North American *Melanoplus* some of which may also be better placed with *Bohemanella*. Litzenberger and Chapco (2001) have recently supported the view that *Bohemanella frigida* is best placed in the tribe Melanoplini with its original name *Melanoplus frigidus*, but more study is required to support this change (see also Skareas and Hsiung 1999).

Figure 20. Bohemanella frigida frigida and Aeropedellus arcticus from the Bear Rock Limestone Plateau, 2550 ft, Mackenzie Mountains, 65.1697 °N, 126.0508 °W, 30 July 2007. Photos by P.M. Catling. ◄



### *Melanoplus borealis borealis* (Fieber) NORTHERN GRASSHOPPER

Males16-20 mm, females 20-24 mm. *Melanoplus borealis* is found throughout most of Canada. It is common in Northwest Territories. It generally occurs in cool, moist places, especially in the south, and is absent from the drier parts of the prairies. It occurs in marshy and boggy places in both forested and prairie regions and above treeline. It is reported to feed primarily on herbaceous plants. In Fairbanks, Alaska, it completes its life cycle in one year, overwintering in the egg stage (Vickery 1984).

This species has the outer surface of the hind femur dull yellow or brown and not barred. The male subgenital plate is almost flat with pointed shoulders and the male cercus is broad, gradually tapered and upcurved. Some specimens referred to this species from Lost City Sink Holes east of Norman Wells (P.M. Catling, 2007-07-31, CNC) have much maroon colouration on the face and pronotum and the wings extend well beyond the tip of the abdomen (3 mm beyond in males).

### *Melanoplus bruneri* Scudder BRUNER'S GRASSHOPPER

Males 20-25 mm, females 22-29 mm. This species is widespread in the west but rare in the east. It occurs along woodland edges and feeds on both grasses and forbs.

The notched subgenital plate (tip of abdomen notched on upper side when viewed from behind) is useful but shared with *M. sanguinipes*. Vickery and Kevan (1984) report that some specimens of *M. bruneri* closely resemble *M. sanguinipes* and cannot be distinguished without microscopic examination of genitalia. Females have shorter wings than *M. sangunipes*.

### *Melanoplus fasciatus* (F. Walker) HUCKLEBERRY GRASSHOPPER

Males 17-20 mm, females 20-25.5 mm. Widespread in Canada (but confined to the norther parts of the US), this species occurs in association with heath plants, especially blueberries. It is said to climb to the tops of shrubs at night remaining until warmed by the sun the following day (Vickery and Kevan 1985). In Yukon it has been found only in July and August (Vickery 1984).

The hind femur is red beneath and banded. Some distinctive colour patterns have been reported from Yukon including buffcoloured hind tibia from Sheep Mountain in Kluane (Vickery 1984). The male cercus is broadly rounded and distinctively downcurved at the apex. The male subgenital plate is broadly flattened at the top (not narrowly as in *M. kennicottii*).

## *Melanoplus femurrubrum femurrubrum* (De Geer)

### REDLEGGED GRASSHOPPER

Males 16-23 mm, females 18-28 mm. The Redlegged Grasshopper occurs throughout southern Canada north to central Saskatchewan. Occurrences at Fort Smith, Fort Simpson and in the Mackenzie valley are disjunctions from this main range and may represent introductions by humans. It mostly feeds on plants other than grasses (a forb feeder) and may cause damage to crops. It seems to reach higher numbers in damper areas and to be more abundant in the east than the west.

The hind tibia is bright red and the hind femur is black above and pale beneath.

#### *Melanoplus kennicottii kennicottii* Scudder KENNICOTT'S GRASSHOPPER

Males and females 17-23 mm. This species occurs in the prairies including the Peace River, the Mackenzie Valley and central Alaska. It is one of a number of species (both plants and animals) that are disjunct from the prairies into dry grassland remnants of the far north. It occurs on dolomite pavement with low vegetation in the Mackenzie Mountains west of Norman Wells.

Wings are speckled dorsally. The male cercus is wide, smoothly curved on the lower side and bent upward. The subgenital plate is triangular with a flattened top. Specimens from Northwest Territories that I have examined are relatively small for the genus.

## *Melanoplus sanguinipes sanguinipes* (Fabricius),

MIGRATORY GRASSHOPPER Males 17-21 mm, females 16-27 mm. This grasshopper is widespread in western North America but more confined in the east to the Great Lakes and New England. It is common in Northwest Territories and occurs around habitations and also in remote areas in the lush vegetation around sinkholes south of Great Bear Lake. Immature individuals eat mostly forbs but adults feed mainly on grasses. It is the most important pest grasshopper of western Canada, capable of reaching pest proportions within a season when conditions are favourable. In sometimes causes severe damage to crops but this is limited to 20 m from the field edge. The extinct Rocky Mountain Locust (Melanoplus spretus) that plagued the Red River Settlement in Manitoba from 1818 to 1821, is closely related and was once suspected of being a migratory phase of this species.

The Migratory Grasshopper always has long wings and the males have a distinctively notched subgenital plate (tip of abdomen notched on upper side when viewed from behind).

### SUBFAMILY LOCUSTINI TRIBE LOCUSTINAE Arphia conspersa Scudder SPECKLED RANGELAND GRASSHOPPER (Figure 21) Males 19-21 mm, females 22-28 mm. An early summer species of open places that feeds mostly on grasses and sedges. Found in the Great Plains and interior Rockies reaching its northern limit in Yukon and Northwest Territories. Both sexes crepitate (produce sound

in flight). It overwinters as a sub-adult nymph so that adults appear early in the season from early June through July.

The median carina of the pronotum is not obviously cut by a sulcus. A pale line where the wings meet is often clearly developed. The red or yellow colouration on the front edge of the hindwing is distinctive. Most of the specimens from Northwest Territories have yellow wing bases but there may be a pattern of variation from north to south with red more frequent southward. Of 20 specimens from Fort Smith, half have pinkish-red wing bases whereas only 1 of 20 from Wrigley has pinkish-red wing bases and all of seven from Norman Wells have yellow wing bases.

### *Camnula pellucida* (Scudder) CLEAR-WINGED GRASSHOPPER

(back cover)

Males 17-21 mm, females 19.5-29 mm. In Northwest Territories *C. pellucida* occurs in areas of tall grasses such as *Bromus inermis* along roadsides. It is widespread in western North America extending eastward across the Great Lakes to the Atlantic coast. In the west it has a pattern of disjunction from from the prairies ecozone north to the isolated



Figure 21. Colourful Band-winged Grasshoppers (Locustiniae) of Northwest Territories (first three) and the Canadian prairies (all).

Arphia conspersa: female, Norman Wells, 12 July 1949, S.D. Hicks; male, Fort Smith, 23 May 1950, J.B. Wallis; lower right, McLeod, 26 June 1902, J. Fletcher.

*Pardalophora apiculata*: female, Marmora, Ontario, 28 May 1944, *G.H. Hammond*; male, Marmora, Ontario,5 June 1944, *G.H. Hammond*.

*Trimerotropis verruculata*: male, Norman Wells, 12 August 1969, *G.E. Shewell*; female, Marmora, Ontario, 15 August 1941, *G.H. Hammond*. *Xanthippus corallipes*: female, Aweme, Manitoba, 19May 1925, *N. Criddle*; male, Aweme, Manitoba, 28 May 1932, *N. Criddle*. See also *Xanthippus brooksi* from Northwest Territories (Figure 22). Photos by P.M. Catling.

4

Peace River prairies, southwestern Yukon and Great Slave Lake area. It is abundant on the airfield at Hay River where Sandhill Cranes congregate to feed on it. *Camnula pellucida* is mainly a grass feeder and sometimes causes severe damage to cereal crops. It is one of the primary pest grasshoppers in Canada. Since its numbers are known to be restricted by lower temperatures, increasingly warm temperatures in the north may lead to higher populations. Adults appear in July and August.

The hindwing is clear, an unusual condition in subfamily Locustini. Pale brownish overall colour and wings with large black blotches are distinctive. There is no crepitation (crackling sounds in flight) Pardalophora apiculata (Harris) CORAL-WINGED GRASSHOPPER (Figure 21) Males 30-36 mm, females 40-46 mm. Generally a species of sandy soils in openings of Pine and Spruce woods. It occurs throughout a large region of North America reaching its northern limit in Northwest Territories where it is disjunct from the Peace River and main prairie regions. It does not occur in Yukon. It is an early summer species, the adults found mainly in June.

The median carina of the pronotum is cut by one sulcus and the hindwing disc is distinctively red. There is no crepitation in flight. Adults appear in early summer. A pale Vshaped marking on the folded wings is also distinctive.

### *Trimerotropis verruculata* (Kirby) CRACKER GRASSHOPPER

(Figure 21)

Males 21-25 mm, females 25-28 mm. This conspicuous grasshopper feeds on forbs (plants other than grasses). The noisy and spectacular flight displays of males (and to a lesser extent females) last for a minute or more. The snapping sounds are characteristic but a few other band-winged grasshoppers also make these kind of sounds in flight. It is widespread in western North America extending to the Atlantic coast through Ontario and the Great Lakes. Adults appear in July and August.

*Trimeroptropis verruculata* inhabits open rocky, gravelly or sandy places including granite balds, alvar (limestone barrens), rivershores, beaches and recently disturbed (by fire or bulldozing) open ground. It is frequent in parts of Northwest Territories and common at Norman Wells where it appears to occupy the same niche as the Carolina Locust (*Dissosteira carolina*) in many southern cities. It is the also reported from the tundra regions of Nunavut (Lake Garry area, Vickery and Kevan 1985, map 198) but this occurrence is not shown by Otte (1984). Its occurrence on islands several km from the shore of Great Slave Lake suggests an ability to fly continuously over relatively long distances. This species takes advantage of burned areas in the rocky parts of the boreal forest which are slow to return to dense forest. As a result of its dark colour it resembles a flake of charcoal but in warm weather is more likely to fly to avoid predation than to rely on camouflage.

*Trimerotropis verruculata* is characteristically darkly coloured. The inner hindwing is pale yellow or greenish-yellow with an outer crossband and the apical quarter is transparent and brownish at the tip. The median carina of the pronotum has two sulci. Crepitation (the production of snapping or crackling sounds made by the wings in flight) is characteristic of this species. The snapping sounds are produced in pairs with a relatively constant interval between.

### Xanthippus brooksi Vickery BROOK'S PINK-SHANKED GRASSHOPPER

(Fig. 22)

(Xanthippus corallipes brooksi Vickery) Males  $\pm$  23 mm, females  $\pm$  37 mm.

This species is largely Beringian being confined to southwestern Yukon, southeastern Alaska and the Mackenzie Delta region. It was described in 1967 (Vickery 1967). Vickery and Kevan (1985) noted that typical specimens were known only from the type locality which is Reindeer Depot, Northwest Territories (collected 7 July 1948 by W.J. Brown (male) and same location but 18 July 1948 by J.R. Vockeroth (female)). Thus in the strict sense, it is a grasshopper unique to a very small area of Northwest Territories. Although treated as a subspecies by Vickery and Kevan (1985), it was treated as a species by Otte (1984) who explained his decision which seems reasonable. It is most closely related to *Xanthippus corallipes* of the prairie grasslands. See Vickery (1967) for a discussion of its relationships to *X. corallipes buckelli* Hebard of British Columbia and *X. corallipes latefasciatus* of the prairie provinces.

The habitat of X. brooksi is not well documented but includes "grassy areas in northern tundra" (Vickery and Kevan 1985). This is certainly one of the most interesting grasshoppers in the Northwest Territories and one that deserves much more study. Judging by its very restricted distribution, it probably existed with the mammoths, lions (3 species), antelopes, horses and bison of the Beringian Mammoth Steppe Tundra that existed in Alaska, Yukon and Northwest Territories only several thousand years ago when almost all of the rest of Canada was under mile deep ice. Conditions changed, the boreal forest invaded, but although many of the larger mammals disappeared, there is evidence that some of the resident insects survived in relict pockets of tundra grassland, dunes and rocky slopes. Brook's Pink-shanked Grasshopper appears to be one of them.

The median carina is cut by one sulcus and hind tibia are mostly yellowish and the basal area of the hindwing is pale yellow. Adults have been collected throughout the summer (Otte 1984).

<sup>Figure 22. Xanthippus brooksi, type specimens.</sup> In its purest form, this species is endemic to the Mackenzie Delta of Northwest Territories (a similar and restricted taxon occurs elsewhere in Beringia and has most recently been considered conspecific). Male above, Reindeer Depot, 1948-07-07, J.R. Brown, HOLOTYPE - CNCI 14093. Female below, Reindeer Depot, 1948-07-18, J.R. Vockeroth, ALLOTYPE -CNCI 14093. Photos by P.M. Catling.



Xanthippus corallipes brooksi

TRIBE EPACROMIINI Stethophyma gracile (Scudder) GRACEFUL SEDGE GRASSHOPPER

Males 19-23 mm, females 26.5-31 mm. This species has not previously been reported for Northwest Territories. It was found in a fen east Kakisa River on south side of Great Slave Lake where it occurred with *Stethophyma* lineatum and Chorthippus curtipennis (2007-07-31, P.M. Catling, CNCI). Previously its northern limit was considered to be McMurray in Alberta 400 km to the southeast. It is widespread in North America but extends further to the south in the prairie region than S. lineata.

Stethophyma gracile has the lateral carina of the pronotum cut by one or two sulci and lacks the longitudinal white streak on the forewings that distinguishes S. lineata. *Stethophyma gracile* also is without black colouration on the side of the pronotum. Nevertheless the separation of these two species requires more study.

### Stethophyma lineata (Scudder) STRIPED SEDGE GRASSHOPPER

(back cover)

Males  $\pm 26$  mm, females  $\pm 36$  mm.

A species of marshes and fens, Stethophyma lineata occurs over a large area of northern North America. It is currently known in Northwest Territories only from the Great Slave Lake area but is probably more widespread because it occurs north of 65° N in Alaska (Otte 1984, Vickery and Kevan 1985). It is said to feed mainly on sedges. Females can fly but more often drop and remain motionless to avoid predation. This relatively large species is sometimes locally abundant and may be

important in the diet of Sandhill and Whooping Cranes. Stethophyma lineata has the lateral carina of the pronotum cut by three sulci and has

10 mm

a longitudinal white streak on the forewings as well as black colouration on the side of the pronotum. Vickery (1967) refers to a small, dark specimen with indistinct lateral stripes taken at Resolute Bay, Cornwallis Island. The true origin and abnormality of this specimen requires study.

### SUBFAMILY GOMPHOCERINAE Aeropedellus arcticus Hebard ARCTIC CLUB-ORNEDGRASSHOPPER (Figure 20)

Males and females 12-21 mm. This species is largely restricted to the unglaciated areas of Northwest Territories, Yukon and Alaska. In the Mackenzie Mountains it inhabits turfy limestone tundra and also occurs on Herschel Island in the Arctic Ocean.

It is relatively robust but not easy to identify. Males have longer, less heavily clubbed antennae than A. clavatus. The two species are difficult to distinguish and require more study. Adding to the problem is the fact that A. articus resembles Bruneria yukonensis and Bruneria brunnea of the prairies partly due to its less clubbed antennae and general colour pattern. The latter has a more rounded head in lateral view (top front). A variety of colour forms have been observed including green, brown and grey-speckled. Specimens (all females) from the Bear Rock formation in the Mackenzie Mountains west of Norman Wells have lateral foveolae 3.1 times as long as wide which would bring them close to Bruneria, but the lateral ridges (carinae) of the pronotum are much more restricted than in specimens of Bruneria brunnea from the prairies. The females of Aeropedellus arcticus evidently have broader foveolae than males. The relationship between this and A. clavatus requires study (see Vickery (1967) for a summary of information).



Figure 23. Aeropedellus clavatus male, a widespread and frequent grasshopper of the prairie region, the males of which have distinctly clubbed antennae. Photo by P.M. Catling of a specimen in CNCI collected at Fort Smith on 15 July 1950 by J.B. Wallis.

### Aeropedellus clavatus (Thomas) CLUB-HORNED GRASSHOPPER

(Figure 23)

Males and females 12-21 mm. With a prairie distribution in North America (main region and Peace River), this species is disjunct into the Great Slave Lake area. The two species of *Areopedellus* meet only in Northwest Territories where *A. arcticus* occurs around Norman Wells and at the western end of Great Bear Lake. In the prairies it occurs in arid, often sandy places but is also present in some alpine areas of the Rockies. It is said to feed principally on grasses and may be a pest of crops in the prairie region. This species is more slender than *A. arcticus*. Males have short, heavily clubbed antennae.

### *Chloealtis abdominalis* (Thomas) COW GRASSHOPPER

Males 18-19 mm, females 23-28 mm. This species occurs in cool glades and grasslands. It is widespread in the west and extends eastward in the Great Lakes region to Gaspé where an unusually dark form occurs on Mt. Albert. It reaches its northern limit in the Mackenzie delta region (Vickery and Kevan 1985). The common name was first applied by Criddle (1930) referring to the fact that it lays eggs in the droppings of large ungulates.

In males the lateral pronotum is black or dark above and the hind femur is lacking bands or pale spots. Females have the side of the abdomen brown in the basal segments. In both sexes the lower marginal area of the hind femur is greyish or brownish. Most females have short wings and are flightless but occasional macropterous (having fully developed wings implying the ability to fly) individuals are found.

### Chloealtis conspersa Harris SPRINKLED BROAD-WINGED GRASSHOPPER

(Back cover)

Males 15-20 mm, females 20-28 mm. Widespread across most of the central portion of North America. Although not reported from north of Peace River, Alberta by Vickery and Kevan (1985), *C. conspersa* is shown to occur in Northwest Territories at approximate position of Fort Simpson by Otte (1984). It usually occurs in dry woodland edges and thickets.

In males the lateral pronotum is entirely black and the hind femur is banded on the outer face or with a pale spot (although the banding may be indistinct in females). Females have the side of the abdomen black in the basal segments. In both sexes the lower marginal area of the hind femur is greyish or brownish. Most females have short wings as in C. abdominalis.

### *Chorthippus curtipennis curtipennis* (Harris) MARSH MEADOW GRASSHOPPER

Males 12.5-16 mm, females 16-22 mm. In eastern North America, macropterous (having fully developed wings implying the ability to fly) forms occur in abundance some years and are rare in others. Such variations in Northwest Territories have not yet been observed. This species has an extraordinarily widespread distribution in North America and it occurs in a remarkable variety of habitats including heath bogs, fens, marshes, dry prairies and tundra. It is said to feed primarily on grasses and sedges.

*Chorthippus curtipennis* is a small distinctive grasshopper with a prominently slanted face and black knees (tip of the femur). The lateral foveolae (grooves on front of the head) are narrow, rectangular and visible from above.

Figure 24. The unglaciated Mackenzie Mountains (shown here) are one of the most biodiversity-rich parts of Northwest Territories, but the grasshoppers of this region had not been studied until 2007 when a few hours were spent at several locations. Although much useful information is available, there is still much work to do in order to achieve a satisfactory understanding of grasshoppers and other insects in northwestern North America. Photo by P.M. Catling at 64.50777° N, -127.49335° W. ✓


## SPECIES OF ADJACENT REGIONS

#### *Panchlora nivea* (L.) CUBAN COCKROACH

The Cuban Cockroach has been introduced to Alaska but did not persist Vickery and Kevan 1985; Vickery and Scudder 1987).

### Grylloblata campodeiformis athapaska Kamp ATHAPASKA ROCK-CRAWLER

(Figure 25)

Males and females  $\pm 17$  mm.

This subspecies is known only from Mt. St. Paul in Stone Mountain Provincial Park in northern British Columbia. This is only 200 km from Northwest Territories. Occurrences of *Grylloblatta* species are associated with glacial refugia since they do not fly. The subspecies athapaska is believed to be a late Pleistocene relict that survived glaciation in an unglaciated



Grylloblatta campodeiformis athapaska

### Figure 24. Grylloblatta campodeiformis

athapaska collected at Summit Lake, 1500 m asl, Mt. St. Paul, in Stone Mountain Provincial Park, mile 392 on the Alaska highway, 20 June 1959, R.E. Leech (CNCI).

refugium along the Nahanni and Liard Mountains (Kamp 1979). If it was located closer to or within this proposed unglaciated refugium, there would be some support for this hypothesis. Regardless of support, a crossing of the Liard valley to colonize Mt. St. Paul seems unlikely, but a better (more plausible) explanation including transport by wind or animals has not been presented.

The genus and the family was first discovered moving about like centipedes under stones by E.M. Walker and T.B. Kurata on a talus slope at 6500' on Sulphur Mountain in Banff (Walker 1914).

## Grylloblattus campodeiformis nahanni Kamp

## NAHANNI ROCK-CRAWLER

Males and females  $\pm 17$  mm. This subspecies is known only from the Mt. McDane and Limestone Peak in the

Cassier range of northern British Columbia. Like subspecies athapaska, it is believed to have survived glaciation in refugia of the Liard and Nahanni valleys (Kamp 1979).

Subspecies athapaska has a more or less square pronotum whereas in subspecies nahanni it is shield-like. The cerci of subspecies athapaska are 4.4 -4.5 mm whereas those of subspecies nahanni are 4.8 - 5 mm.

#### Melanoplus bivittatus (Say) TWO-STRIPED GRASSHOPPER

Males 26.5-28 mm, females 31-35 mm. This distinctively large grasshopper occurs north to Fort St. John in British Columbia and at McMurray in Alberta. Although it tolerates a variety of conditions, it prefers moist sites and is a common roadside

species over most of southern Canada. With a warming climate in the north, this species is one to be expected. Although females do not fly much, dispersal capability is substantial since they may become airborne in strong winds and are carried for great distances (Vickery and Kevan 1985). A more likely method of introduction is by vehicles. One of these grasshoppers sat on a wiper blade of a car moving 100 km per hour for 2 hours, thus travelling 200 km. It is an omnivorous species but feeds mainly on plants and more on forbs than grasses and shrubs.

# Melanoplus gordonae Vickery GORDON'S GRASSHOPPER

Males 16-23 mm, females 18-28 mm (based on Vickery's (1969) statement that the size is similar to *M. femurrubrum*.

Described in 1969 from near Fairbanks, Alaska (2 miles along Gilmore Trail, collected by V. Gordon on 13 August 1968, type series in Lyman Entomological Museum). In 1985 it was still known only from the type locality (Vickery and Kevan 1985). It was named after Vivian Gordon of Fairbanks. In the northwest, the related *M. femurrubrum* is known only from Fort Smith (Salt Plain), Fort Providence, and one site in the Mackenzie valley, these localities being disjunct from the prairies and a more or less continuous range across southern Canada.

This species resembles *M*. *femurrubrum*. The subgenital plate is distinctly trilobate at the apex and the cerci are broader, especially apically and sometimes emaginate at the apex. Although Vickery's 1969 key (which accompanied the description) indicates that the hind femur of this species is banded, this appears to be a mistake based on his illustration of the type and indication that there is no banding in the later Vickery and Kevan (1985) key.

## *Melanoplus huroni* Blatchley HURON GRASSHOPPER

Males 19-21 mm, females 28-32 mm. Another likely relict of the *Picea* parkland in front of the Wisconsin ice sheet, this species occurs largely in the Great Lakes region, the northern edges of the prairie parklands and the parkland mountain slopes. It is not known north of Fort St. John on the Peace River in British Columbia. The straight and narrow cerci and very short furculae are helpful in identification of males.

# Melanoplus packardii brooksi Vickery PACKARD'S GRASSHOPPER

Males and females 23-31 mm. This subspecies is confined to two regions: (1) the region of the corridor which opened up between the the western cordilleran and eastern continental glaciers in late Wisconsin times and (2) the northern limit of the prairie parklands. It is not known north of the Peace River neat the Alberta-British Columbia border. Possibly another Wisconsin ice-front relict, it inhabits forests and parklands, unlike the nominate subspecies which occurs in prairie.

Dorsal bands on the hind femur are prominent unlike those of subspecies *packardii* which are indistinct. The broadly rounded and straight cerci are useful for identification of males.

### Dissosteira carolina (L.) CAROLINA GRASSHOPPER

Males 26-30 mm, females 34-40 mm. An apparently reliable report from Alaska (Cordova - Vickery 1967) is believed to be a result of a non-persisting introduction by ship. Vickery (1984) noted that it does not breed north of 56°N. It is abundant in the south and is bound to be introduced from time to time. It may persist in the future, especially if the climate becomes warmer.

This species is readily distinguished

from all others by its large size and black wings with pale margins.

### Bruneria yukonensis Vickery YUKON GRASSHOPPER

Males and females 18-25 mm (according to Vickery 1984). This species was described in 1969 from an open grassy slope on the west shore of Lake Laberge (collected 23 August 1961 by D. Marsh, specimen in Lyman Entomological Museum). It is also known from Sheep Mountain in Kluane, Aishihik River and Sulphur Lake, but has not been reported outside Yukon.

The relatively smaller head (in proportion to the body), wings not quite reaching tip of abdomen and lateral foveolae decreasing in width at apices (instead of regularly rectangular) distinguish this from the closely related *B. brunnea* of the prairies.

## Bruneria brunnea Thomas PRAIRIE BROWN GRASSHOPPER Males and females 18-25 mm. This species occurs in the Peace River region of Alberta. It is a common prairie species and there is reason to anticipate disjunction into the poorly studied prairie habitats of southern Northwest Territories. This kind of distribution pattern is well established in some other more conspicuous species such as Arphia conspersa. The femur has 3 dark stripes.

### NOTES ON DISTRIBUTION MAPS AND DATABASE

The distribution maps that follow are in a alphabetical order (unlike the preceding notes on species which are in taxonomic order which forces related taxa together rehardless of name changes). The distribution maps were generated directly from the database using Arc Info software.

The database for grasshoppers in the northwest includes 684 unique records. The locations of all records is shown on the first map. A unique record as a unique species, date, location and collector. For example, 100 specimens of the same species collected on the same date from the same location by the same collector count as a single site record. The records are derived from the collections of P.M. Catling (at the Agriculture Canada Collection in Ottawa, acronym CNCI), from other collections in CNCI, from collections in other research centres and from the literature as indicated in a "source" field.

The points on maps are plotted with varying degrees of accuracy. An accuracy field is included in the database to enable the actual locations to be better understood. For this field: 1 = high accuracy, within 100 metres, 2 = medium accuracy, within 500 metres, 3 = medium accuracy, within 1000 metres, 4 = 10w accuracy, within 5000 metres, 5 = 10w accuracy, within 10000 metres (10 km), 6 = very lowaccuracy, within 100 km. An old literature report indicating occurrence on the south side of Great Slave Lake probably refers to Fort Resolution and the co-ordinates of Fort Resolution were entered into the database, but since the collection locality is not definitely Fort Resolution, it is assigned an accuracy value of 6 indicating that the actual locality of the collection may be up to 100 km away from Fort Resolution. Labels of older collections tend to indicate only the nearest habitation so if a specimen was collected at Fort Smith we can only assume that it was collected within 5 km of Fort Smith. The latitude and longitude for Fort Smith is entered in the database but it is recognized with an accuracy of 3 or 4 that this was added to the label information and is not likely an accurate location (although it is likely within 1 to 5 km). Now, with modern global positioning devices, it is possible to be much more accurate and the location data is obtained in the field, appears on the label, and is accurate to within 100 metres and accompanied by an accuracy value of 1. Not all locations are possible to pinpoint. There are 7 places called "Moose Creek" in the Yukon but only one Moosehide (said to be named after the shape of the nearby slide at Dawson). Some older labels with "NWT" actually refer to the previously much more extensive Northwest Territories and the locations are actually in Alberta or Saskatchewan. Mistakes can occur in labelling data and in transcribing label data. As long as these limitations are understood, data and databases are extremely useful.







































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Figure 25., The Yukon Grasshopper (*Bruneria yukonensis*) is endemic to Yukon and known from only 4 localities. Photo by D. Johnson near Haines Junction, 13 July 2006.

TABLE 1. CHECKLIST OF ULONATA FOR NORTHWESTERN NORTH AMERICA [Species currently unknown in Northwest Territories are in square brackets]

ORDER DERMAPTERA Forficula auricularia Linnaeus, EUROPEAN EARWIG **ORDER NOTOPTERA** [Grylloblata campodeiformis atapaska Kamp], ATHAPASKA ROCK-CRAWLER [Grylloblattus campodeiformis nahanni Kamp], NAHANNI ROCK-CRAWLER ORDER DICTUOPTERA Blattella germanica (Linnaeus) - GERMAN COCKROACH ORDER GRYLLOPTERA Metrioptera sphagnorum (F. Walker), BOG KATYDID ORDER ORTHOPTERA SUBORDER TETRIGODEA *Tetrix brunnerii* (Bolivar), BRUNNER'S GROUSE GRASSHOPPER *Tetrix ornata ornata* Say, ORNATE GROUSE GRASSHOPPER Tetrix subulata (Linnaeus), GRANULATED GROUSE GRASSHOPPER SUBORDER ACRIDODEA FAMILY ACRIDIDAE SUBFAMILY MELANOPLINAE Bohemanella frigida frigida (Boheman), TUNDRA GRASSHOPPER [Melanoplus bivittatus (Say)], TWO-STRIPED GRASSHOPPER Melanoplus borealis borealis (Fieber), NORTHERN GRASSHOPPER Melanoplus bruneri Scudder, BRUNER'S GRASSHOPPER Melanoplus fasciatus (F. Walker), HUCKLEBERRY GRASSHOPPER Melanoplus femurrubrum femurrubrum (De Geer), REDLEGGED GRASSHOPPER [Melanoplus gordonae Vickery], GORDON'S GRASSHOPPER [Melanoplus huroni Blatchley], HURON GRASSHOPPER Melanoplus kennicottii kennicottii Scudder, KENNICOTT'S GRASSHOPPER [Melanoplus packardii brooksi Vickery]. PACKARD'S GRASSHOPPER Melanoplus sanguiunipes sanguinipes (Fabricius), MIGRATORY GRASSHOPPER SUBFAMILY LOCUSTINAE TRIBE LOCUSTINI Arphia conspersa Scudder, SPECKLED RANGELAND GRASSHOPPER Camnula pellucida (Scudder), CLEAR-WINGED GRASSHOPPER [Dissosteira carolina (L.)], CAROLINA GRASSHOPPER Pardalophora apiculata (Harris), CORAL-WINGED GRASSHOPPER Trimerotropis verruculata (Kirby), CRACKER GRASSHOPPER Xanthippus brooksi Vickery, BROOKS' PINK-SHANKED GRASSHOPPER **TRIBE EPACROMIINI** Stethophyma gracile (Scudder), GRACEFUL SEDGE GRASSHOPPER Stethophyma lineata (Scudder), STRIPED SEDGE GRASSHOPPER SUBFAMILY GOMPHOCERINAE Aeropedellus arcticus Hebard, ARCTIC CLUB-HORNED GRASSHOPPER Aeropedellus clavatus (Thomas), CLUB-HORNED GRASSHOPPER

[Bruneria yukonensis Vickery], YUKON GRASSHOPPER [Bruneria brunnea Thomas], PRAIRIE BROWN GRASSHOPPER Chloealtis abdominalis (Thomas), COW GRASSHOPPER Chloealtis conspersa Harris, SPRINKLED BROAD-WINGED GRASSHOPPER Chorthippus curtipennis curtipennis (Harris), MARSH MEADOW GRASSHOPPER

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## INDEX TO SPECIES

Bold names indicate species known from Northwest Territories. Bold numbers and cover codes indicate illustrations. BC = back cover. FC = front cover

Aeropedellus arcticus Hebard, ARCTIC CLUB-HORNED GRASSHOPPER	30
Aeropedellus clavatus (Thomas), CLUB-HORNED GRASSHOPPER	30
Arphia conspersa Scudder, SPECKLED RANGELAND GRASSHOPPER	25, <b>26</b>
Blattella germanica (Linnaeus) - GERMAN COCKROACH	19, <b>20</b>
Bohemanella frigida frigida (Boheman), TUNDRA GRASSHOPPER	. 21, <b>23, FC</b>
Bruneria brunnea Thomas, PRAIRIE BROWN GRASSHOPPER	35
Bruneria yukonensis Vickery, YUKON GRASSHOPPER	35
Camnula pellucida (Scudder), CLEAR-WINGED GRASSHOPPER	25, <b>BC</b>
Chloealtis abdominalis (Thomas), COW GRASSHOPPER	31, <b>BC</b>
Chloealtis conspersa Harris, SPRINKLED BROAD-WINGED GRASSHOPPER	31
Chorthippus curtipennis curtipennis (Harris), MARSH MEADOW GRASSHOPPER	32
Dissosteira carolina (L.), CAROLINA GRASSHOPPER	34
Forficula auricularia Linnaeus, EUROPEAN EARWIG	19
Grylloblata campodeiformis atapaska Kamp, ATHAPASKA ROCK-CRAWLER	33
Grylloblattus campodeiformis nahanni Kamp, NAHANNI ROCK-CRAWLER	33
Melanoplus bivittatus (Say), TWO-STRIPED GRASSHOPPER	33
Melanoplus borealis borealis (Fieber), NORTHERN GRASSHOPPER	24, <b>BC</b>
Melanoplus bruneri Scudder, BRUNER'S GRASSHOPPER	24
Melanoplus fasciatus (F. Walker), HUCKLEBERRY GRASSHOPPER	24, <b>BC</b>
Melanoplus femurrubrum femurrubrum (De Geer), REDLEGGED GRASSHOPPER	24
Melanoplus gordonae Vickery, GORDON'S GRASSHOPPER	34
Melanoplus huroni Blatchley, HURON GRASSHOPPER	34
Melanoplus kennicottii kennicottii Scudder, KENNICOTT'S GRASSHOPPER	25
Melanoplus packardii brooksi Vickery, PACKARD'S GRASSHOPPER	34
Melanoplus sanguiunipes sanguinipes (Fabricius), MIGRATORY GRASSHOPPER	25
Metrioptera sphagnorum (F. Walker), BOG KATYDID	20
Pardalophora apiculata (Harris), CORAL-WINGED GRASSHOPPER	26, 27
Stethophyma gracile (Scudder), GRACEFUL SEDGE GRASSHOPPER	30
Stethophyma lineata (Scudder), STRIPED SEDGE GRASSHOPPER	30, <b>BC</b>
Tetrix brunnerii (Bolivar), BRUNNER'S GROUSE GRASSHOPPER	21
Tetrix ornata ornata Say, ORNATE GROUSE GRASSHOPPER	21
Tetrix subulata (Linnaeus), GRANULATED GROUSE GRASSHOPPER	21
Trimerotropis verruculata (Kirby), CRACKER GRASSHOPPER	. <b>26</b> , 27, <b>BC</b>
Xanthippus brooksi Vickery, BROOKS' PINK-SHANKED GRASSHOPPER	28, <b>29</b>

