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Spur-throated grasshoppers of the Canadian Prairies and Northern Great Plains

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The spur-throated grasshoppers have become the most prominent grasshoppers of North American grasslands, not by calling attention to themselves by singing in the vegetation (stridulating) like the slant-faced grasshoppers, or by crackling on the wing (crepitating) like the band-winged grasshoppers, but by virtue of their sheer numbers, activities and diversity. Almost all of the spur-throated grasshoppers in North America are members of the subfamily Melanoplinae. The status of Melanoplinae is somewhat similar in South America, where the melanopline *Dichroplus* takes the dominant role that the genus *Melanoplus* holds in North America (Cigliano et al. 2000). The biogeographic relationships are analysed by Chapco et al. (2001). The grasshoppers are characterized by a spiny bump on the prosternum between the front legs, which would be the position of the throat if they had one. This characteristic is easy to use; I know elementary school children who can catch a grasshopper, turn it over for a look and say “melanopline” before grabbing the next.

The subfamily Melanoplinae is represented by the most commonly known grasshopper in North America, *Melanoplus sanguinipes*, the lesser migratory grasshopper. This subfamily is also the most diverse grasshopper group, with hundreds of species adapted to living in many grassland and forested ecoregions, from arctic to tropics, and from alpine to desert. Most of the melanopline grasshoppers have a one-year life cycle and eggs that overwinter in soil, but the diversity in habitat and food preferences can be extreme. The group contains flightless species that inhabit meadows and mountaintops, as well as excellent long-distance fliers like the lesser migratory grasshopper and *M. spretus*, the Rocky Mountain locust, the now extinct (or merely extir-



pated, and hiding in the valleys?) scourge that wiped out so much of mid-western agriculture in the 1870's.

Approximately 40 species of grasshoppers in the subfamily Melanoplinae (mainly Tribe Melanoplini) can be found on the Canadian grasslands, depending on weather and other factors affecting movement and abundance. The following notes provide a brief look at representative spur-throated grasshoppers that I have collected and observed during more than 20 years of frequent collecting on grassland mainly in Alberta and Saskatchewan, with emphasis on species that are significant in agroecosystems or unique in some way. I focus in this article on lower grassland ecozones, but I include a few grasshoppers that represent higher elevation grassland faunas (which could form a separate article in a montane survey newsletter). I also include some species whose distributions overlap the boundaries of grassland, parkland, boreal and montane ecoregions.

The descriptions, in alphabetical order, give a few details on the lives of these grasshoppers and how to recognize them. The accompanying



photos show examples of how they appear in western Canadian grassland and regions immediately south of the border (color, size and appearance vary with geography to some extent). Actual species identification for the purposes of diversity

studies must be based on detailed examination of anatomy (for example male furculae, genital plates and cerci), but for the purpose of this article I have tried to rely only on characters observable with the unaided eye.

***Aeoloplides turnbulli* (Thomas)**



I once proposed (1995 Annual Meeting of the Entomological Society of Canada) that *Psoloessa delicatula*, a slant-faced grasshopper (this subfamily is the subject of a future article) be classified as a beneficial species because of its dominance in the diet of grassland songbirds early in the spring. There are other beneficial grasshoppers that deserve beneficial status, not

Russian thistle grasshopper (also called thistle grasshopper or Turnbull's grasshopper)

for being food items, but rather for feeding on weeds. *A. turnbulli* is known to feed mainly on tumbleweed (also known as Russian thistle), Kochia and other plants in the family Chenopodiaceae, some of which are considered to be weeds. This choice of food plant is interesting, because I have seen plenty of evidence since 1983 that melanopline pest species, such as the lesser migratory grasshopper, will starve in the presence of kochia, and eat every other plant except this weed, which sometimes results in a pure stand of young kochia plants in drought-stricken pastures.

You can recognize the Russian thistle grasshopper by the robust pronotum (shield covering the thorax), three bands on the hind femur, and general greenish color, often with nicely contrasting orange antennae. Some keys refer to tegmina (hindwings) being shorter than the abdomen, but often this is not the case.

***Buckellacris nuda* (E.M.Walker)**

When considering grassland biomes, we might forget how widespread and distinct the montane and alpine grasslands are in the world. In Canada, the montane and alpine grass meadows are limited to narrow and fractured zones that nonetheless harbor their special grasshoppers. Buckell's timberline grasshopper is so adapted to alpine living, among the avens (dryas), alpine bluegrass, and heather, that it cannot come down to the lower levels and survive. I have collected grasshoppers in transects from the lower grasslands to the tops of mountains, from the US border north to Kananaskis, Banff, Lake Louise, Jasper and Yoho, and, if present at

Buckell's timberline grasshopper



A male at Waterton Lakes National Park, where grassland meets the mountains.



A pair at the top of Mt. Norquay, Banff, AB, on a south-facing grass-sedge meadow.

all, this species is always at the top of the vegeta-

tion zone, after the lesser migratory, Dawson's, boreal, huckleberry, montane and alpine grasshoppers have dropped out, usually in that order. *B. nuda* represents the tenacity of life under harsh and fluctuating conditions, and it is well worth a trip to the mountains just to see it. You can recognize this species by the dark eyes, snakeskin pattern on the back, complete lack of any vestige of wings (apterous), and the fact that you are probably standing 1500 to 2600 m above sea level.

All of the grasshopper species mentioned in this report are in the family Acrididae, subfamily Melanoplinae, and tribe Melanoplini, except *B. nuda*, which is in tribe Podismini.

***Hesperotettix viridis pratensis* Scudder**

The meadow purple-striped grasshopper (in the US, also called the snakeweed grasshopper and the green-striped grasshopper) is never abundant, but when found it is usually near its preferred food plants, including some classed as weeds by ranchers: ragweed (*Ambrosia*), snakeweed (*Xanthocephalum*), goldenrod (*Solidago*), and sage (*Artemisia*).

Meadow purple-striped grasshopper

H. viridis pratensis can be recognized by colour. It is striped with bright green, white and pink on all femora, and often with pink antennae and a fine black chevron on the hind femora (the part shaped like a drumstick in grasshoppers).

***Melanoplus alpinus* Scudder**

This species lives in the upper reaches of the foothills fescue grassland and in montane and sub-alpine grassland meadows, where it eats a mixture of grass and forbs. In some lists you will see it reported as common in Canadian foothills, but during the past 20 years it has been almost absent, except in periods with several years of warm, dry summers and mild winters.

This grasshopper is usually yellowish in color, with gray-green coloration on the head and pronotum. The wings are long, extending past the end of the abdomen, but it rarely flies as readily or as far as other species found in the same middle elevation zone (for example, the clear-winged grasshopper discussed in the previ-

Alpine grasshopper





ous article in this series, Johnson 2001). The species is easily distinguished from other *Melanoplus* species by the unique male cerci shaped like an antler (staghorn). Most melanopline cerci are shaped more like a fingernail or flattened thorn. The only other species

with a staghorn-shaped cercus is *M. infantilis*, a much smaller grasshopper which in Canada tends to occur on lower, drier grassland sites (although the species may occur together in US grasslands).

***Melanoplus bivittatus* (Say)**



Adult female of *M. bivittatus*.

This species feeds on a wide range of plants, unlike many grasshoppers which avoid plant defences by feeding mainly on grasses (Johnson et al. 2001). This natural readiness to eat broad-leafed plants has resulted in pest status on a wide range of new crops (Johnson and Mündel 1987). It was recently discovered that this grasshopper has unique mechanisms that allow it to feed on toxic plants such as timber milkvetch (Johnson et al. 2001). It is one of the heavier species, with high rate of consumption of green plant tissue and a high rate of reproduction. Because of these attributes, the appearance of Europeans and farming transformed this species from one that was probably restricted to small trampled or lush spots on the grassland, into one of the most damaging insect pests of cereal crops, forages and even oilseed crops. Among the melanopline grasshoppers, it is the first to hatch and often does so in large numbers.

Two-striped grasshopper

In 1984-86, it caused losses of tens of millions of dollars worth of cereal crops in Alberta and Saskatchewan, and was reduced in numbers somewhat by an isolate of the fungus *Entomophaga grylli* that mainly attacks this species (Erlandson et al. 1988).

It is a favorite food of larger birds; the hind femora are commonly found in the regurgitated pellets of Burrowing Owls, and during a research study on bird diets we once collected a



5th instar of *M. bivittatus*.

ring-billed gull with 585 5th instars and adults of this species, plus a ham sandwich (Johnson and Dore, unpublished). This species can be recognized by the prominent longitudinal stripes on the dorsal surface, solid black stripes on the hind legs, and green and yellow color (but note that nymphs can be brown, tan, lime green, or yellow-orange, like the fifth-instar in the photograph).



***Melanoplus borealis* (Fieber)**

This species feeds on grass and sedge, with occasional forbs. Unlike many of the melanopline grasshoppers found on the lower elevation grasslands, it is capable of thriving in cool and moist habitats. It is one of a small number of grasshoppers near the northern treeline (I have collected it at Porter Lake, NE of Great Slave Lake). It rarely flies, and can be collected by flushing and watching for short jumps which it expertly directs into



Female *M. borealis* with an attached red mite (*Eutrombidium locustarum*).

Northern grasshopper



Male *M. borealis* from the interface of grassland and forest at Kananaskis, AB.

nearby vegetation. The life cycle of this and some other grasshoppers living at higher elevation or latitude requires two years for completion, and numbers tend to fluctuate in odd and even years at some sites, perhaps indicating part mortality events. When collecting in northern foothills or lower montane grassy sites, you can spot this species by the blood-red hind tibiae and lower ridge of the hind femora, which is quite striking when seen from below, and the lack of bands on the hind femora.

***Melanoplus dawsoni* (Scudder)**

This is one of the smaller melanopline grasshoppers on Canadian grasslands, similar in size to *M. infantilis* discussed below. Dawson's grasshopper is a short-winged, flightless grasshopper that is usually restricted to open ground in otherwise dense grassland. Fescue grassland that has been opened up by overgrazing or erosion seems to favor higher numbers. Dawson's grasshopper occurs in low numbers throughout southern Alberta, Saskatchewan and Manitoba in the short grass, mixed grass, fescue grass and aspen parkland ecoregions, but it reaches its highest densities in fescue grassland. Rarely it will appear with long wings (I have seen this only in 1984 and 1996, during regular sampling in Alberta from 1983-2002), and move more into the shortgrass transition, although it flies only a little better with wings than it does without.

Dawson's grasshopper



The species is easily recognized by the short wings, which look like bracts on a tiny spruce cone, and the bright yellow underside. The hind femora usually have a chevron of fine black lines on a yellow and reddish background.



***Melanoplus fasciatus* (F.Walker)**

This species can sometimes be found in significant numbers on grassy, south-facing high-elevation slopes at the transition from lower grasslands to montane grassland and forest. They probably eat forbs. The legs are reddish below, but banded, unlike *M. borealis*. This grasshopper has a prominent dark band on the side, more so than other species, a generally slim outline, and a “perky” stance (as opposed to some sluggish grasshoppers).

Huckleberry grasshopper



***Melanoplus femurrubrum* (DeGeer)**



M. femurrubrum has an unfortunate name, because although femurrubrum does actually mean red leg, the part of the leg that is red is the tibia, not the femur. It feeds on forbs and grasses, and has even made itself a pest of corn in the US. It is common in eastern Canada and in the US, but rare in Alberta until recent warm, dry years, although numbers are still low. The numbers of this species

Red-legged grasshopper

in general collections have gone from less than one in 10,000 to more than 1 per 1,000.

M. femurrubrum appears similar to *M. sanguinipes*, discussed below, but it can be distinguished by its bright yellow underside. (It also has long and pointed male cerci, but to see that requires a hand lens.)





***Melanoplus infantilis* Scudder**

The little spur-throated grasshopper is often the most numerically abundant grasshopper on Canadian grassland in Alberta and Saskatchewan, not in terms of biomass, but because of its small size. This small size makes the species an important food for grassland songbirds ([Martin et al. 2000](#)).

This species can be distinguished by the tiny staghorn-shaped cerci (claspers) on the end of the male abdomen. Once a male is identified, the females of the species can be recognized and separated from other *Melanoplus* species based on comparative size and markings. The photograph shows the relative size of *M. infantilis* and *M. sanguinipes*.

Little spur-throated grasshopper



With aggressive posture and actions, a male *M. sanguinipes* causes a smaller male *M. infantilis* to move along.

***Melanoplus packardii* Scudder**



The Packard grasshopper is a common grasshopper of pastures, alfalfa fields and roadsides, often sharing habitat with *M. bivittatus*, *M. sanguinipes* and *Camnula pellucida* (discussed in Johnson 2001). During years with warm, dry summers, the Packard grasshopper increases in numbers in regions with sandy soil.

This species is somewhat similar in appearance to the two-striped grasshopper, in that as an adult it has two stripes on the back, but the

Packard grasshopper

stripes of the Packard grasshopper are diffuse and usually slightly salmon-colored, or maybe even blue. The nymphs of both species may be lime green or brown. You can easily tell them apart by looking for the peppery black spots on the back of the immature Packard, where the two-striped immature already has two stripes. *M. foedus* Scudder is a rare but similar species that is not easily recognized as being separate from *M. packardii*, without microscopic examination of male genital anatomy, preferably using grasshoppers collected from the same site.





***Melanoplus sanguinipes* (Fabricius)**

This is a very successful species in North America, and certainly the most widely distributed species in the subfamily. The grasshopper faunas of the Canadian Prairies and Florida have about the same number of species of *Melanoplus* (26 listed by Capinera et al. 1999), and *M. sanguinipes* is the only one in common (other than *M. keeleri*, which has been rarely found in Alberta and Saskatchewan). On the Canadian grasslands, *M. sanguinipes* occurs in every ecoregion, and exhibits remarkable variability in color and proportions, such as length of the wings. It is polyphagous (omnivorous), eating most green plants. In grassland community studies (e.g., Johnson 1989) it is typically the most common species of grasshopper. *M. sanguinipes* (formerly called *M. mexicanus* and *M. bilituratus*) is probably the closest living relative of *M. spretus*, the Rocky Mountain locust, which is found now only in centuries-old deposits of glaciers of Montana.

It is good practice to separate melanopline grasshoppers on the basis of details of adult anatomy, but *M. sanguinipes* can be recognized in the immature stages and adult by the strong



Lesser migratory grasshopper



A rare magenta *M. sanguinipes*, which is normally gray. I have seen and photographed the magenta characteristic in this species, and also in *M. bivittatus*, *M. packardii* and *C. pellucida*.

stripe on the side of the head and thorax. The adult strongly displays the fenestrated tegmina (hindwings look like they have tiny windows or a grid) that are also found on some other *Melanoplus* species. It can be distinguished from *M. gladstoni*, a common grassland species that hatches later in the summer, by the more robust and ashen appearance of the latter species. The hind tibiae of *M. sanguinipes* are usually bright red (but may be orange, blue, white, gray, yellow...). At higher elevations it is often found to be darker in color, to almost black, which is in keeping with our models of how grasshoppers bask to attain optimum high body temperature (Lactin and Johnson 1998).

The male subgenital plate (spoon-shaped rounded tip of the abdomen) is clearly notched on *M. sanguinipes*, and not on any other melanopline (but it is also notched on the easily distinguishable males of *Schistocerca emarginata* (Scudder) a member of a related spur-throated grasshopper subfamily, Cyrtacanthacridinae, represented on Canadian grasslands by this rare species: Vickery and Kevan 1986).



Phoetaliotes nebrascensis (Thomas)



This species was rare on the Canadian grasslands until a period of above-average rainfall in 1992-93 resulted in great increase in growth of grasses and forbs. Within two years, *P. nebrascensis* became one of the top three species at many grassland sites in southern Alberta. For example, of 4,333 individuals collected

Large-headed grasshopper

from *Stipa-Boutelloua* grass pasture near Barnwell, AB, in 1994, we found that 37% were this species (Martin et al. 1998). Typically it is from 5% to 15% of the grasshopper community in southern Alberta (Johnson 1994).

After examining the other melanopline species, this one will seem as though it has a head that is too big for its body. The female of this species is flightless, while the male may have either long or short wings. Even the short-winged male disperses better than the short-winged female, because it is smaller. In 1994-95, I observed a case on the Suffield Canadian Armed Forces base in which grass fires killed thousands of these grasshoppers. Examination of the crisp cadavers left behind, and sweeping surrounding grassland, indicated that mostly females of the species had died, shifting the normal grasshopper sex ratio of 1:1 to a more male population.

Collections were made during work for Agriculture and Agri-Food Canada, for the University of Lethbridge, personal collecting, or under research permits provided by Parks Canada. All photos were taken by the author.

Literature cited

- Capinera, J.L., C. W. Scherer and J.M. Squitier. 1999. Grasshoppers of Florida. a pdf internet publication, 70 pp.
<http://www.ifas.ufl.edu/~entweb/ghopper/ghopper.html>
- Chapco, W., G. Litzenger and W. R. Kuperus. 2001. A molecular biogeographic analysis of the relationship between North American melanopline grasshoppers and their Eurasian and South American relatives. Molecular Phylogenetics and Evolution 18: 460-466.
- Cigliano, M.M., S. Torrusio and M.L. de Wysiecki. 2000. Grassland grasshopper (Orthoptera: Acridoidea) communities composition and temporal variation in the Pampas, Argentina. International Conference of Orthopteroid Insects, Aug 19-22, 2001, Montpellier, France.
- Erlanson, M.A., D.L. Johnson and O.O. Olfert. 1988. Entomophaga grylli (Fresenius) infections in grasshopper (Orthoptera: Acrididae) populations in Saskatchewan and Alberta, 1985-1986. The Canadian Entomologist 120: 205-209.
- Johnson, D.L. 1989. The effects of timing and frequency of application of *Nosema locustae* (Microspora: Microsporida) on the infection rate and activity of grasshoppers (Orthoptera: Acrididae). Journal of Invertebrate Pathology 54: 353-362.
- Johnson, D.L. 1994. Grasshopper species collected from the Canadian Forces Base Suffield National Wildlife Area in 1994. Submitted to the Canadian Wildlife Service (G. Trottier). 19 pp.
- Johnson, D.L. 2001. Band-winged grasshoppers of the Canadian Prairies and Northern Great Plains. Newsletter, Arthropods of Canadian Grasslands 7: 5-12.
- Johnson, D.L. W. Majak and M.H. Benn. Submitted/accepted 2001. Excretion of miserotoxin and detoxification of the aglycone by grasshoppers (Orthoptera: Acrididae). Phytochemistry 58: 739-742.
- Johnson, D.L., and H.-H. Mündel. 1987. Grasshopper feeding rates, preferences, and growth on safflower. Annals of Applied Biology 111: 43-52.



- Lactin, D.J., and D.L. Johnson. 1998. Environmental, physical, and behavioural determinants of body temperature in grasshopper nymphs (Orthoptera: Acrididae). The Canadian Entomologist 130: 551-577.
- Martin, P.A., D.L. Johnson, D.J. Forsyth and B.D. Hill. 1998. Indirect effects of the pyrethroid insecticide, deltamethrin on reproductive success of Chestnut-collared Longspurs. Ecotoxicology 7: 89-97.
- Martin, P.A., D.L. Johnson, D.L. Forsyth and B.D. Hill. 2000. Effects of two grasshopper control insecticides on the food resources and reproductive success of two species of grassland songbird. Environmental Toxicology and Chemistry 19: 2987-2996.
- Otte, D. Orthoptera species file, and illustrated catalogue of Orthoptera.
- <http://viceroy.eeb.uconn.edu/OrthSoc/publications.htm>
- Pfadt, R. E. 1986. Field guide to common grasshoppers. USDA APHIS, Wyoming Agricultural Experiment Station.
- Vickery, V.R. and D.K. McE. Kevan. 1986. The Grasshoppers, Crickets, and Related Insects of Canada and Adjacent Regions (Ulonata: Dermaptera, Cheleutoptera, Notoptera, Dictuoptera, Grylloptera, and Orthoptera). Part 14, in: The Insects and Arachnids of Canada. Research Branch, Agriculture Canada, Ottawa, pp.1-918.

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