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Updates:

Grasshoppers on the Canadian Prairies, 2004

Dan Johnson

This update is now out-dated, but can be accessed on the web at

<http://people.uleth.ca/~dan.johnson/htm/update04.htm>

(These updates begin with the earlier ones at the top, so scroll to the bottom for the latest. [More general forecast information is also available.](#))

See the July 19 entry for information on disease killing grasshoppers.



Jan 28	Forecast map released: Expected grasshopper risk, June 2004, for Alberta (TIF) The late summer 2003 survey data was conducted by the Association of Alberta Agricultural Fieldmen , with assistance from AAFC (D. Johnson, Craig Andrews) and additional data from a special AAFRD program (Lethbridge assistants: Ian Cosman and Shane Clark), and AAFRD staff in Edmonton.
	No formal egg survey was conducted.
Feb 10	Notes on biology of current and previous grasshopper activity
March 29	Condition of overwintering non-pest species indicates above-average development
April 10	Collections indicate some overwintering non-pest species are lower in numbers than recently (pest species of grasshoppers will still be high in numbers; they hatch in late May)
April 14	Light rain overnight might offer some benefit to soil and crops, but will not harm grasshoppers. Contrary to the general beliefs reported in some news reports, moisture at this time benefits grasshoppers . No formal spring survey of hatching is conducted.
April 15	What can rain to reduce the problem? Moisture during the weeks following hatching can reduced survival of hatchlings. Migration and development are most rapid in warm, dry conditions. Many species do not move from grass to crops, but hatchlings of the major pest species congregate in large numbers and can move considerable distances, especially the clear-winged grasshopper, and especially when food

	supplies are low.
April 16	Snow and freezing conditions following the warm weather has had no effect on pest species grasshoppers, which are still in the egg stage. Embryonic condition, based on a small number of samples, is being assessed.
	Current map: the map released in January still shows the current probable risk, based on where adult grasshoppers were seen in 2003. An updated map will be posted in May, before hatching begins. The beginning and ending dates of the hatch "window" in late May and June are close together if warm, dry weather prevailed during the previous fall and the current spring. Cooler or variable weather will slow growth and extended the period of hatching.
	Egg development and hatching in recent years: soil heat differences among years
	What to watch for: Immature grasshoppers are often called hoppers. The pest species of grasshoppers are small, and mainly tan to dark brown: photos of newly hatched pest species of grasshoppers (Canola Council of Canada)
	What to not worry about: how to tell pest and non-pest grasshoppers species apart; now available . Or, download this large PDF file suitable for printing, 10 Mb
April	<p>Grasshoppers are being seen in Alberta and Saskatchewan now (April and early May), but hoppers seen during this time are not the pests and cause no problems. Pest grasshoppers come later, mainly after June 1. The following natural history guides that I produced for two Alberta nature centres will show you what to look for.</p> <p>Early spring grasshopper identification guides (prepared for education at nature centres):</p> <p>Helen Schuler Coulee Centre spring grasshopper guide (with notes for Lethbridge)</p> <p>Police Point Park spring grasshopper guide (with notes for Medicine Hat and Swift Current)</p> <p>Johnson, D.L. 2001. Band-winged grasshoppers of the Canadian Prairies and Northern Great Plains. Arthropods of Canadian Grasslands 7: 5-12. Published by the Biological Survey of Canada, Ottawa. Download full size.</p> <p>Johnson, D.L. 2002. Spur-throated grasshoppers of the Canadian Prairies and Northern Great Plains. Arthropods of Canadian Grasslands 8: 16-25. Published by the Biological Survey of Canada, Ottawa. Download full size.</p> <p>Johnson, D.L. 2003. Slant-faced grasshoppers of the Canadian Prairies and Northern Great Plains. Arthropods of Canadian Grasslands 9: 5-16. Published by the Biological Survey of Canada, Ottawa. Download full size. (or download reduced version, suitable for screen-viewing)</p> <p>Johnson, D.L. 2004. Long-horned grasshoppers, katydids and crickets of the Canadian Prairies and Northern Great Plains (available later).</p>

	<p>Johnson, D.L. 2004. How to scout for pest and non-pest grasshoppers. Grainmagazine, Diseases, Insects & Weeds 2004: 32-33. Farm Business Communications, P.O. Box 9800, Winnipeg, MB, Canada, RC3 3K7. Download: large PDF file suitable for printing, 10 Mb</p> <p>Grasshopper Management, AAFRD Agdex 622-27 (low-res version) A practical guide, with more photos.</p> <p>Photos of newly hatched pest species of grasshoppers (Canola Council of Canada)</p> <p>Movies of grasshoppers basking, eating, etc.</p>
April 27	<p>Q: what will the snow and rain today and later this week do to grasshopper eggs?</p> <p>A: at the moment, because of their condition and the recent weather, there will be no damage to the eggs, and in fact there will be a slight improvement. The soil moisture at field sites that we tested April 26 (Berg, Powell and Johnson) was typically 15 to 19%, with some small moist spots going higher. That is a little too dry even for grasshopper eggs, so the rain will have a slight beneficial effect for the grasshoppers. The more important point is that it will benefit crops and natural vegetation.</p>
May 4-6	<p>Cold soil has slowed embryonic growth, delaying hatch a day for each day that the soil temperature is below 12 C. This does not kill the eggs. A small number of eggs have been examined. There is no egg survey.</p>
May 9	<p>Sweeps in southern Alberta indicate no hatching of Melanoplus or Camnula, the main pest species</p>
May 13	<p>As noted in previous updates, grasshopper embryonic growth (degree of development in the eggs, currently about 2 cm in the soil) is advanced this year, compared to previous years. This was known based on weather in 2003, and by examining samples of eggs.</p> <p>The snow and current cool conditions will slow growth while the cold lasts, delaying hatch slightly. This will bring us back to a more normal hatching distribution (probably peaking during the first week of June, and then tailing off by mid-June). The hatch this year is expected to be about one week earlier than in 2003, and more than 2 weeks earlier than 2002.</p> <p>Note: the "hatch" is the time of emergence of hoppers from the eggs. It does not mean the dates when people happen to notice immature hoppers moving or feeding, which can happen in waves over the summer. A "second hatch" may appear in early June when cool weather temporarily pauses hatching. Sometimes a "second hatch" later in the summer is reported because people become aware of older hoppers renewing their activity and growth in warm weather, or because other, less abundant species emerge in pastures. Hatching of pest species begins this year in the second half of May. It will peak in early June, and continue at a lower rate until the end of June.</p>



Image:

This grasshopper, the club-horned, is moderately common this spring. It should not be confused with grasshoppers that damage crops.

This one is not a pest.

May 14

First hatch. Sentinel sites that I checked the evening of May 14 had small numbers of newly hatched hoppers. These sites are checked each spring. Hatching has begun in the warmer, exposed soil across the southern Canadian Prairies, although progress has been slowed by the recent snow. No significant hatching had occurred before May 13. Sites near Calgary had no hatching hoppers on May 14, but sites near Woodhouse, Granum and Barnwell (Alberta) had first-instar grasshoppers approximately 1 day old, in low numbers (10-25 per 50 sweeps). Older hatchings are rare (0-1 per 50 sweeps). So far, over 95% of the hatchings are two-striped grasshopper. I estimate the hatch so far to be less than 1% of the total. Migratory and Packards grasshoppers appears ready to emerge next, followed by the clear-winged grasshopper.



- DJ

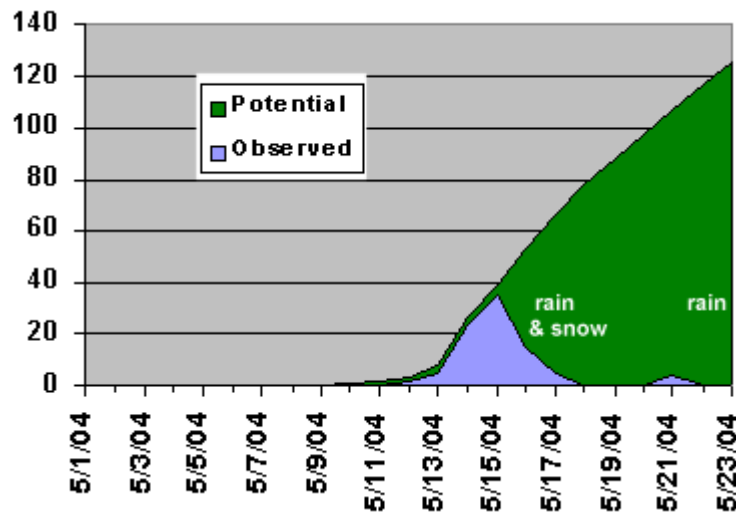
Photos of newly hatched hoppers can be seen below:

[Helen Schuler Coulee Centre spring grasshopper guide](#)

or

[Canola Council of Canada](#)

	<p>Newly hatched two-striped grasshopper:</p> <p>(may be darker tan, brown or slightly violet)</p> <p>May cause damage when abundant during warm weather.</p> <p>Presence of a small number of hoppers is normal and not cause for control unless crop damage is extreme.</p>	
<p>May 17</p>	<p>Some continued hatching observed at reduced levels</p>	
<p>May 18-20</p>	<p>Rain and snow reduce observed numbers; mortality of early hatchers expected. Rain in southern Alberta continued May 21-23, stopping hatching and probably killing some of the early hatch.</p>	
<p>May 21</p>	<p>Only small numbers observed along Highway 2 (Fort Macleod to Calgary), and Highway 3 (Lethbridge to Fort Macleod). Small numbers hatching have been reported in southern and central Alberta.</p>	
	<p>First instar clear-winged grasshopper</p>	
	<p>Claresholm, Granum and Fort Macleod</p> <p>This graph was made from observations made during a small number of visits (normally limited to Friday evening, Saturday and Sunday) to sites in southern Alberta. The y-axis is the number of hoppers captured in 50 sweeps. These are mainly first-instar and second-instar (earliest stages) two-striped grasshoppers. The green graph shows what the approximate hatching potential that was delayed by the cold, wet weather.</p>	



Sampling with sweepnets at sentinel sites in southern Alberta indicated that a small amount of early hatching occurred as early as May 14. Hatching was ahead of the normal schedule (because of the warm conditions in 2003), but it was subsequently delayed by the snow and cold conditions May 12-13. May 14-16 samples of 50 sweeps (38-cm diam. net, 180 degrees at vegetation height) yielded 15 to 30 hoppers at several locations. Species collected in nets were two-striped grasshopper (>90%) and migratory grasshopper. Average densities were mainly 0 to 2 per sq. m. Precipitation (May 20-23) has stopped hatching for now, and probably killed only a small portion of the early hatchers. Hatching will quickly resume when the soil surface dries and soil temperature exceeds 15 C.

The graph above shows the probable reduction in early hatchers in southern Alberta, based on counts around Fort Macleod, Lethbridge, Barons, Claresholm and Calgary. Keep in mind that the potential number represents only the first 5% or so of the hatch. Also keep in mind that cool weather temporarily halts hatching but does not kill eggs. The result is that the cool wet weather of May 20-23 will not significantly reduce grasshopper numbers, but has slowed the onset of hatching.

Conditions vary every year, but long-term data indicates that earlier hatching may become the norm.

I expect the clear-winged grasshoppers to be noticed hatching in the Youngstown - Hanna area around May 25. More extensive hatching and movement will be noticed by June 2 and following. Crop damage may not be significant until later. Control actions should not be taken unless numbers are large and heavy crop damage is apparent. Some two-striped grasshoppers occur in the area in limited numbers, and will emerge earlier than the clear-winged this year.

Note: fungal grasshopper diseases are not a factor at this time. They may become important later in the summer, but incidence was low in 2000-2003. Refer to the [note on this topic, posted in March.](#)

May 31

Some good news. Recent rains have apparently reduced numbers (by 20-50%?) in the zone between Nanton to Fort Macleod and east to Lethbridge. There is almost no early damage in this area. One May 31, some site that had significant numbers in mid-May showed declines, and reduced rate of growth. None of these southern sites have

	<p>clear-winged 1st instars yet, but had did have 2 to 10 per square metre of the following:</p> <p>instars 1-3 migratory, instars 2-3 Packards, instars 2-3 two-striped (and a few 4ths), and also many non-pest 5-A club-horned. Photos available on request.</p>
June 2	<p>Samples sent to me by Kim Z. indicate that clear-winged grasshoppers had hatched in central and east-central Alberta by May 25 or so. They should appear as 2nd instar by now.</p>
June 3	<p>Although there is no formal spring survey, we stop when we happen to be on the road. Here are the results of my drive from Lethbridge to Edmonton June 2-3. The rain must have had a significant impact. Many sites have lower numbers than before, and the age distribution of the indicator species indicates that the rain and cool days slowed growth and reduced numbers, and shifting the age distribution to later dates by temporarily halting hatching, and by causing mortality among the early hatchers.</p> <p>Lethbridge: mainly overwintering, non-pest species are out, with a small number of two-striped</p> <p>Fort Macleod: an obvious drop in numbers; sites with two-striped are down more than half from counts in the third week of May.</p> <p>Granum: high numbers of two-striped, Packard's and migratory, but very few clear-winged yet. Age structure shows a dip during the period in which we had rain, but this area was not suppressed as much</p> <p>Claresholm: marked reduction in the early hatching; the remainder are newly hatched hoppers (mainly two-striped), with only a few of the mid-May and late-May hatching surviving. Hatching will resume with the warm weather.</p> <p>Nanton: almost no hoppers yet</p> <p>Calgary: low, but this is not unexpected</p> <p>Red Deer: lush growth and few hoppers</p> <p>High River: quite delayed; few hoppers out yet. Even the early species show reduced rates of development.</p> <p>St. Albert, north of Edmonton: only a few clear-winged are out; very few other species. Heat has been adequate lately, as evidence by adult stage of the club-horned. Some grasshoppers of moderate pest status are still entirely underground as of June 3, and will hatch next week and the following week. The recent storm of May 28-31 near Edmonton probably is responsible for high mortality of the grasshoppers that hatched previous to May 28. Hatching will resume with warmer weather, but the number of hatching eggs is now reduced (by an unknown amount; probably 10 to 25%)..</p>
June 4	<p>Hot weather, over 30 C in Lethbridge and in the high 20s at other locations, will cause hatching to resume.</p>

This 4th instar two-striped grasshopper (right), 3rd instar migratory grasshopper (below left) and 3rd instar Packard's grasshopper (below right) are remnants of the early hatches that emerge around May 14. Hoppers hatching during the renewed wave following the warm weather of early June will be much smaller at first. Such mixed size differences are mistaken for "second hatches". Smaller species such as the tiny spur-throated grasshopper may resemble the migratory grasshopper, but the tiny spur-throated grasshopper is found in pastures and not in cereal crops.

Note: two-striped grasshoppers may be green, brown, yellow or magenta. Packard's may be gray, green or tan.

(Photographed June 4, 2004, at Lethbridge).

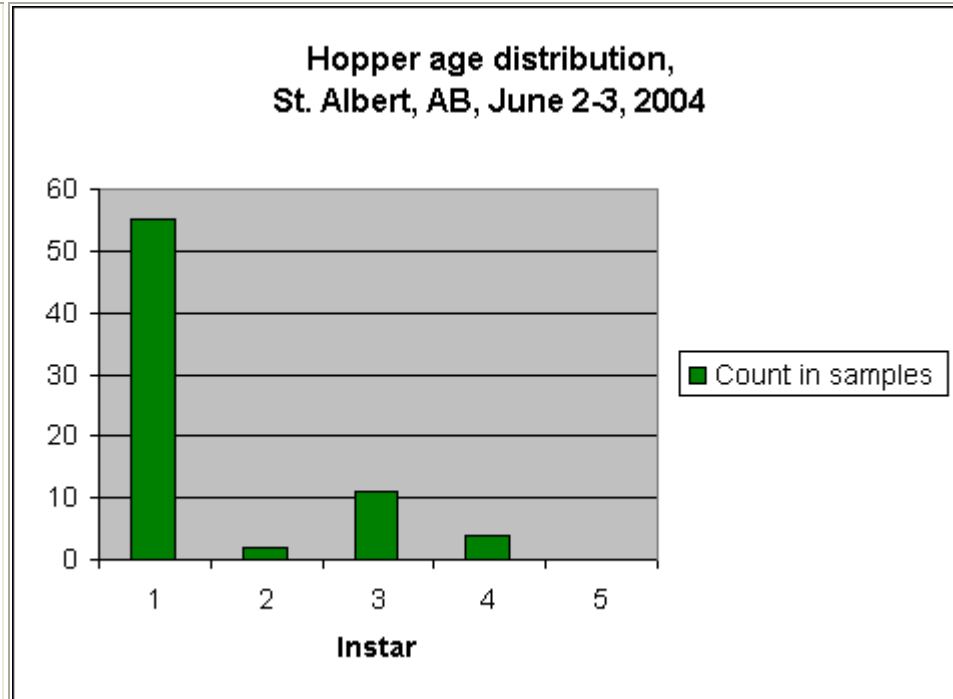


Recent rain (May 20-21, May 28-31, June 5, and others) has resulted in a biomodel age structure for pest species of grasshoppers that began hatching in mid-May. The graphs below are from sweep net sampling at sites near St. Alberta, Granum and Lethbridge (the y-axis gives the percentage; these example graphs are based on n=72, 94 and 66, respectively).

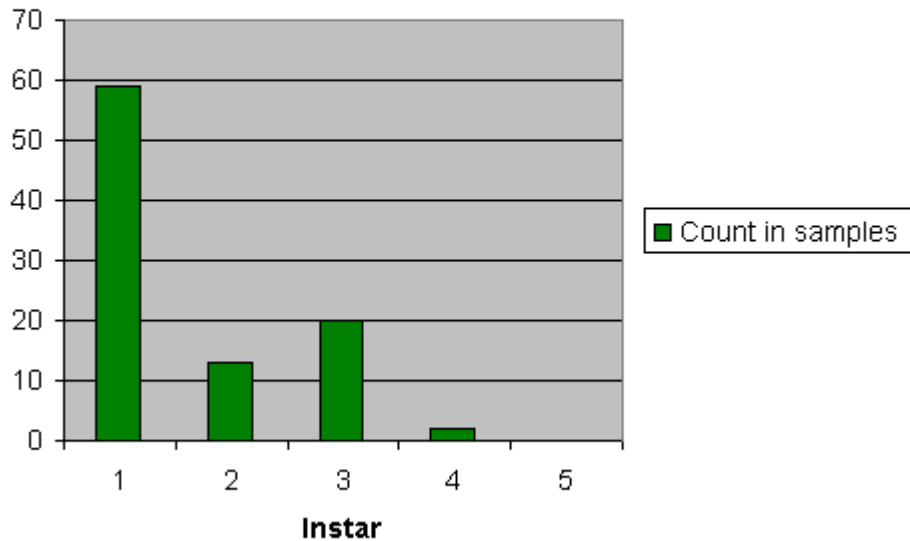
The low counts in the central age classes (mainly second instar) probably resulted

from mortality caused by the rain and subsequent wet, cool conditions. Rains were heavy enough to cause some direct mortality, possibly followed by an increase in disease. The resurgence of newly hatched hoppers after the rain is indicated by the first instar bars.

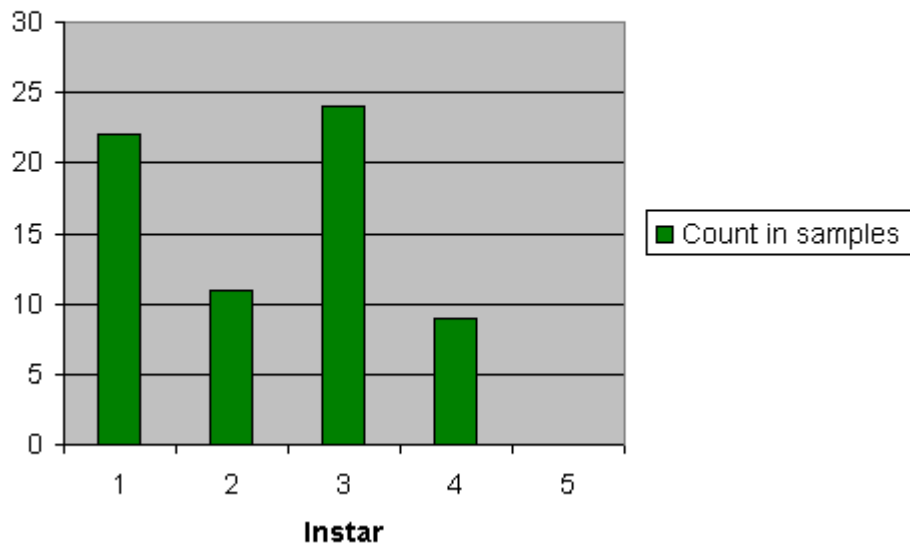
Graphs for Fort Macleod are similar to Lethbridge (normally more similar to Granum and Claresholm). Red Deer and High River had counts that were too low to graph. - DJ



Hopper age distribution,
Granum, AB, June 2-3, 2004



Hopper age distribution,
Lethbridge, AB, June 2-3, 2004



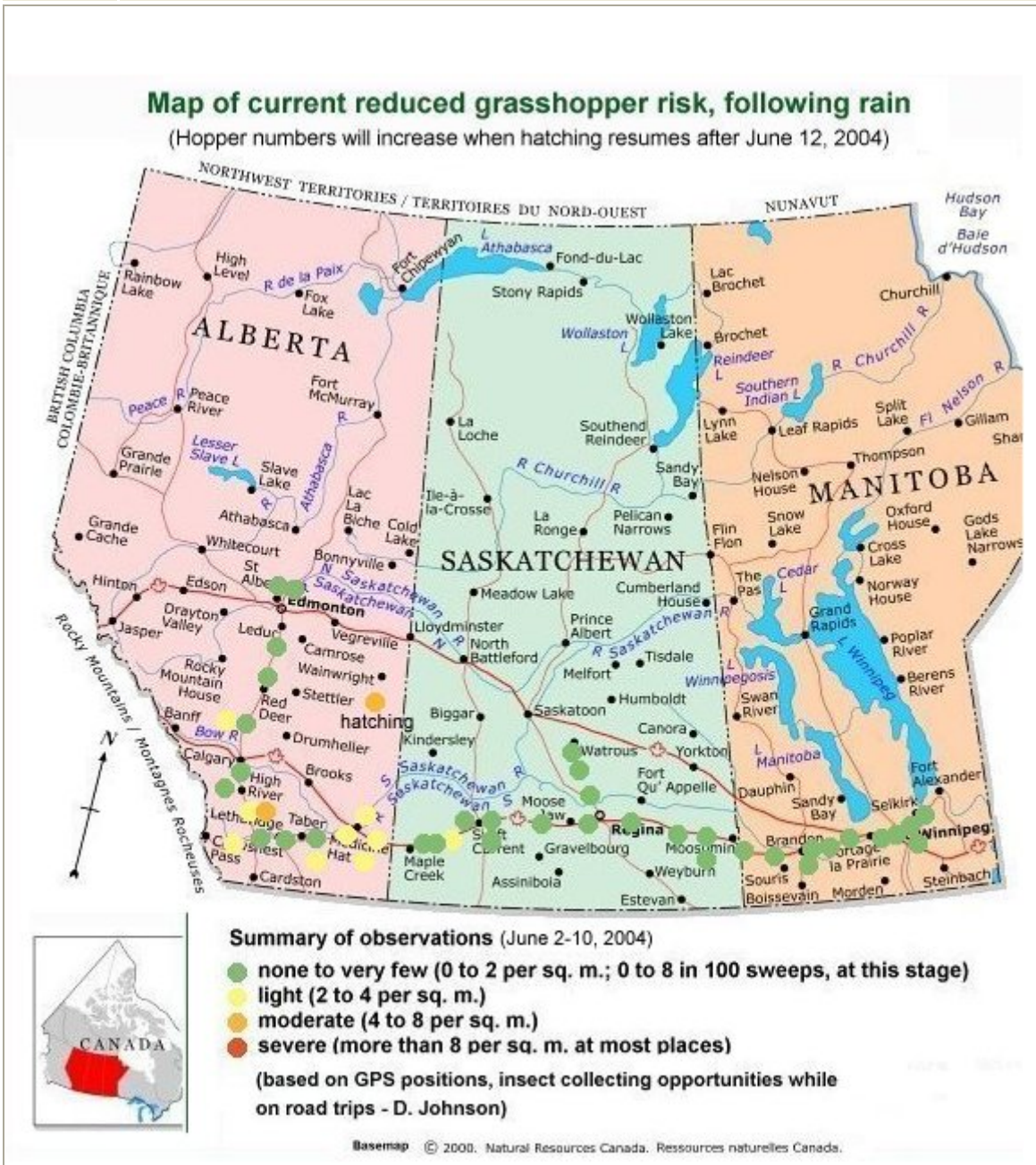
June 8-
10, 2004

Current situation report for June 8-10, 2004, based on field assessments of species and ages at > 40 locations:

Rain and cool weather has reduced numbers of hoppers that had emerged, and delayed the hatching of the remaining eggs. Sites from Lethbridge to Winnipeg have

	<p>negligible levels of damaging grasshopper species. Most sites have only instars 1 to 3, at low numbers. Eggs are ready to hatch once warm weather resumes, but overall risk is reduced for all sites. Some areas, particularly east-central Alberta, have significant numbers of grasshoppers which have hatched, despite the cool conditions.</p> <p>Click here to see the original forecast map for potential infestations in Alberta (TIF format; released Jan 28).</p> <p>Click here to obtain a June 10, 2004 situation map for Alberta in TIF format, indicating general areas of reduction in risk).</p> <p>2-province map for the Prairies, based on field observations June 2-10</p>
<p>June 10, 2004</p>	<p>Click here to see the original forecast map for potential infestations in Alberta (TIF format; released Jan 28).</p> <p>Click here to obtain a June 10, 2004 situation map for Alberta in TIF format, indicating general areas of reduction in risk).</p>
	<p>Map of observations at sites along highways 2, 3, and 1. The dots indicate the sites visited. Density class is based on counts observed at each site, and on sweep samples (either 50 or 100 180-degree sweeps with a canvas net).</p> <p>All types of grasshoppers do not hatch at the same time, and order is not necessarily the same at all sites. The following is a general summary of grasshopper pest species hatched so far (sampling from roadsides and field margins by DJ; June 2-5, Edmonton to Lethbridge; June 6-10, Lethbridge to Winnipeg; east central region not sampled but hatching has been widely reported).</p> <p>Species shown are the dominant and subdominant; rare species or as yet unhatched species are not included in this summary. All are low in density at this point, following rain in late May and early June. Hatching and development will resume with warmer and drier conditions (mid-June).</p> <p>Southwestern and western Alberta: two-striped, migratory (also little spur-throated, clear-winged, speckled and club-horned) Southern Alberta: two-striped, clear-winged (also Packard's, migratory and speckled) East central Alberta: clear-winged, two-striped (also Packard's and migratory) Southeastern Alberta: two-striped, Packard's (also Packard's, brown-spotted, little spur-throated and migratory) Southwestern Saskatchewan: Packard's, two-striped (also Packard's, club-horned, and migratory) South central Saskatchewan: two-striped, migratory (also Packard's, club-horned, and migratory) Southeastern Saskatchewan: two-striped, Packard's Southwestern Manitoba: two-striped, Packard's (also migratory) Southeastern Manitoba: two-striped, migratory, immature katydids</p> <p>Northern green-striped grasshopper (not a pest) is more common this year than normal, and can be seen flying on warm days (especially southwestern SK).</p> <p>The map below shows the summary of field sampling, to June 10. These are</p>

approximate GPS locations for sites visited.



"Short explanation:

June 11, 2004

Pest species: The rain and cool weather halted hatching several times, and caused some mortality of hoppers. Although development was advanced and an early hatch was anticipated, subsequent to the rainy weather, the hatching progression is from 1 to 3 weeks behind typical patterns.

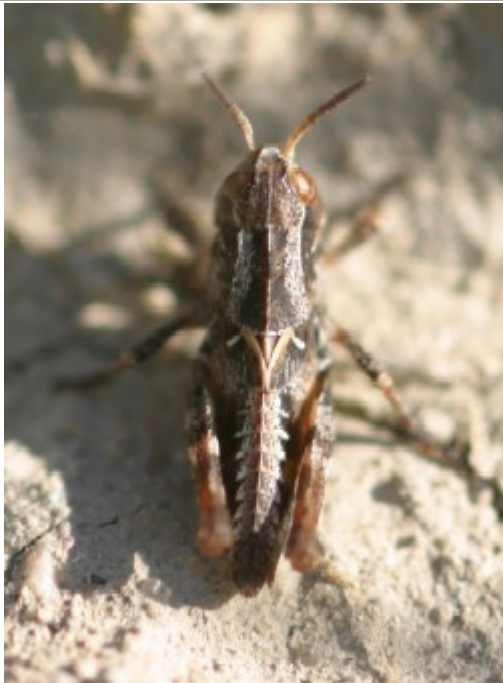
In most places on the Prairies this year, the [two-striped grasshopper](#) emerged first, around May 13 to 20. The start of hatching was earlier than normal, because of the warm conditions in 2003. Probably about 10% emerged by the third week of May. The rain and snow that followed killed a significant portion of these early hatchers. More

	<p>two-striped grasshoppers and some migratory grasshoppers hatched when conditions warmed in late May, and were again set back by subsequent rain. (The two-striped grasshopper appeared mainly in the brown form in the west, and mainly in the green form in the eastern Prairies.) Cool weather slowed hatching, and resulted in a depression in the age structure at these dates (example demographics shown in the June 4 entry above).</p> <p>The clear-winged grasshopper hatched after the rain, but was reduced in numbers by the rain June 7 and following. the migratory grasshopper began hatching around June 1. Subsequent hatching will result in infestations, especially by the clear-winged in east central Alberta, but at a reduced rate (without survey data, the extent of reductions cannot be confirmed). Damage to crops will be significant in some areas (mainly east central Alberta, parts of Saskatchewan and parts of southern Alberta), but less than would have been the case without the rain.</p> <p>Most small grasshoppers congregating in pastures or fields after June 15 will be pest species. General differences in appearance can be see in this short grasshopper guide: "Recognizing common grasshoppers", and previously posted forecast information: Grasshopper Forecast .</p> <p>Non-pest species: Two species of non-pest overwintering grasshoppers (pdf) remained abundant and advanced in development, but two other overwintering species were lower in numbers than normal. Katydid's hatched early and were more abundant than usual in some places (absent in others; detailed data is available for some locations). Spring field crickets were abundant across the Prairies." - DJ</p>
June 21	<p>I checked sites between Calgary and Lethbridge, on my way back from the airport. The rain has severely reduced numbers. Development is slower in some sites (this is why degree-days and other simple methods do not offer much over simply having a look or guessing, unless the models include detailed of species reactions to other factors). Counts are low except in some isolate spots. Near Granum, two-striped and Packard's grasshoppers are mainly instars 2-5, and at moderate levels that probably do not require control. Nearer Claresholm, numbers are lower (mainly about 2 per sq. m. but up to 10-25), and younger (mainly two-striped and mainly 2-3). On June 22 I will stop along southern Alberta roads, on my way to Manyberries. I will stop near Oyen and other locations on my way to Saskatoon June 23.</p>
June 24-26	<p>Grasshopper numbers have continued their rain-induced plummet, and in some parts of the prairies their development is up to 2 weeks behind normal. They may present local problems, particularly in isolated spots of east-central Alberta, but the problem cannot recover to more than a fraction of what would have been the case without the almost perfectly timed rain this year!</p> <p>On June 24-25, I drove from Lethbridge to Medicine Hat, Leader, Rosetown and Saskatoon. Densities of pest species of grasshoppers (indicated by counts of immature hoppers in roadsides and field margins) were very low in the great majority of sites, as has been noted for other sites I visited across the prairies while on other duties. The expected massive infestations of hoppers, based on the reproduction that resulted from grasshopper eggs laid in the late summer of 2003, has been largely averted.</p> <p>Crops across Alberta, Saskatchewan and Manitoba show very little evidence of</p>

damage, except in a few places (local damage can be extreme, granted, but this is only a few percent of the pre-rain potential). The rainy weather of late May and much of June has saved many millions of dollars in damage, and greatly reduced the extent of application of insecticide in response to the problem. Over 98% of all sites I have checked have shown evidence of great reductions in hopper numbers, almost certainly resulting from the rain. On June 25, stops along the route west of Saskatoon to Oyen and then south indicated only one spot with significant numbers (counts between 40 and 250 per sq. m., within 10 km of Oyen; about 80% clear-winged, 12% two-striped, 4% Packard, 1% migratory, and 3% non-pest at this location). Current grasshopper age structure varies with species, but instars 2, 3 and 4 are predominant for key pests. No pests are winged yet and flying, and this will be noticed one to two weeks later than normal (expect to see a small number flying by July 1, and more flying in mid-July). All grasshoppers seen flying before June 26 of this year are not pest species. (Do not assume this is the case in other years!)

Note: this evidence does not mean that there will be no grasshoppers or damage in July. There will still be smaller zones with high numbers and damage, particularly in zones in the central or northern areas that received less rain and more warm weather than did the southern Prairies this year. But the problem will be much less than it would have been without the almost perfectly time intervention of the rain. The problem will be much more manageable, even under the current lack of anything resembling a grasshopper outbreak response strategy.

- Dan



Clear-winged grasshopper immature. The local severe spot shown in the June 10 update map has increased in density to well over 100 per sq. m. Most sites are well below the threshold as of June 25, but these local infestations persist in areas in which the timing and amounts of soil heat and rain allowed survival of the early immature stages.

June 27, 2004

In July, flying clear-winged grasshopper will be encountered in fields and roads in east-central Alberta (Hanna, Youngstown, Oyen, etc.) but they will be fewer in number than in 2002 and 2003, and will appear about a week later. The two-striped and Packard grasshoppers are less common in Saskatchewan than in 2003, but will still be noticed moving on roads and in fields in July. The entire outbreak has been set back to a fraction of the potential, except in isolated dry zones.

High numbers have been reported from some spots in the Peace River region; I would

be willing to receive samples and identify the species.

- DJ

July 1,
2004


On the road update: The continued rainy weather has set back the grasshopper development and survival. Some northern Alberta populations have flying grasshoppers now, but this will be found so far mainly in isolated dry zones that had sufficient heat for development. Southern locations in Prairie Canada have very few flying pest grasshoppers, and appear to be about 10 days behind the normal grasshopper schedule. Grasshoppers are growing slowly, suffering some mortality from rain, and experiencing longer periods in which they can die from predation and disease.

Although the grasshopper risk was greatly reduced by the rain, isolated areas may still suffer from damage from hoppers that hatch late and feed on crops. This damage will be much lower than it could have been earlier in the season. Spraying should not be considered unless crop damage is obvious and progressing. The photo below shows an example of an isolated patch of grasshopper damage that I found along the Alberta-Saskatchewan border on June 25, 04. In this case, the grasshoppers were mainly dark brown 3rd and 4th instars (immatures with tiny wing buds visible) of the clear-winged grasshopper. Without the unusual cool, rainy weather this year, this damage would have been earlier and over much more of the field.





<p>June - July</p>	<p>The PFRA Drought Watch maps serve as rough indicators of where grasshoppers are going to be behind schedule. The risk of drought is low in most of the southern Prairies, and this is the zone in which the weather has slowed or even halted the hatching, growth and activity of grasshoppers. Drought and grasshopper risk are not always so closely related, but this year the rain and cooler temperatures hit the hoppers in the most susceptible stages.</p>
<p>July 1-3, 2004</p>	<p>While returning to Lethbridge by car, I took the opportunity to stop at locations between Calgary and the US border, to note grasshopper development, numbers and diseases. The continued (and very unusual) cool, wet weather continues to keep the grasshoppers behind schedule, and reduce their numbers. Developmental stage (age structure) illustrates this slow growth. In most of the last 20 years, by July 1, many of the key grasshoppers that act as crop pest species on the Canadian Prairies would be reaching maturity. It would not be unexpected to see 20% of them in the adult stage (with wings), although this varies. This year, almost none are mature at this point, especially in the southern portions of the Prairie Provinces (see map in the June 10 update) where cold weather has delayed them. Most of the two-striped, migratory, Packard's and clear-winged grasshoppers are still in the 3rd and 4th immature stages (out of five). Some 1st instar hoppers are still found, because as indicated earlier this month, they continue to hatch from eggs in the soil when a warm day allows. They are NOT forming a second generation, and in fact many will be unable to complete the cycle of development and egg-laying to their full potential.</p> <p>Diseases such as <i>Entomophaga grylli</i> (general description; scroll down) were noticeable by this date in 2003 and 2002, but low in disease incidence rate (despite reports in the news, based on unknown data sources). This year, the grasshopper diseases have a physical environment that would encourage the survival, dispersal and infectivity of the microbes (at least in the case of fungal diseases), but the inoculum is low, and the host is younger than usual. This means that the reduction in the numbers of grasshoppers that results from disease might not be as great as someone might guess, based on a general knowledge of insect pathology.</p>
<p>July 4, 2004</p>	<p>Rain and cool weather continues to hold down grasshopper activity and growth. A good indicator of how slow the growth has been is the condition of the club-horned</p>

	<p>grasshopper (<i>Aeropedellus clavatus</i>), a non-pest that hatches very early in the spring. Normally, on the Canadian Prairies, the last immatures of this species have matured by mid-June, and they have begun to decline in numbers by early July. This year, there are still some 5th-instar individuals of this species (around 5%), indicating slow maturation, and no obvious die-off in numbers. Other early season species have shown the results of increased and decreased rates of growth, as weather changes. The rates vary within and among years and sites, and to make sense of it requires repeated observations.</p>
<p>The club-horned grasshopper. This species is not a pest, but serves as an indicator of the heat that has been available for hatching and development of pest grasshopper species.</p>	
<p>July 6, 2004</p>	<p>Today I was sampling insects, while working on a rare plant study in the far southeast corner of Alberta. The club-horned grasshopper is very abundant on pastures. This species (with clubs at the end of the antenna, as seen above) will not move out of pastures, and will not cause significant damage either in or outside of pastures. The small green and brown pest species might normally move out of pastures, but the dense forage that we have this year will reduce their movement. Don't take control action unless crop is actually being lost.</p>
<p>July 7, 2004</p>	<p>The areas that did not receive rain will soon show noticeable hopper activity and damage. The cooler temperatures have hidden them, but warm weather will allow them to move from the immatures stages (currently mainly instar 3 and 4) to maturity, and increase movement and feeding.</p>
<p>July 9, 2004</p>	<p>The vanguard of mature, flying grasshoppers have just begun to appear. (Grasshoppers flying in May and June were not the crop pest types.) This is about 2</p>

weeks later than in recent years.

On July 7, I saw about 1% maturity in clear-winged grasshoppers in southeastern Alberta (and 0% for spur-throated grasshoppers). On July 8 and 9, I saw significant numbers of new adult clear-winged grasshoppers in southern, southwestern Alberta. Newly fledged (meaning they have obtained their wings) grasshoppers have soft wings. Within about one week, they become reproductively mature. The lower numbers that resulted from the rain, and the later maturation caused by the cool weather, means that even if they recove somewhat and begin to mature and move now, they will still lay only moderate numbers of eggs. The result will be that the 2005 population that results from breeding this August will not be as high as it could have been.



Clear-winged grasshopper adult



	<p>The female is larger and darker than the male.</p> <p>All photos on this site are by Dan Johnson. Use with permission.</p>
	<p>Watch for increasing numbers in dry regions of the Prairies. Although they will not reach their former levels, local damage will still occur in some areas. Fortunately, the crop is well advanced and prepared for absorbing some damage.</p>
	<p>We are in an unusual situation in which grasshoppers, mainly the clear-winged grasshopper above, are now mature and flying in the Peace River region of Alberta two weeks before they are mature and flying in southern Alberta and Sask!</p>
July 12-13, 2004	<p>Heavy rain events in Alberta set hoppers back even farther in the Edmonton area.</p>
	<p>Weather reduces grasshopper threat - news, Globe and Mail</p>
Note	<p>The forecasted warmer weather for July 14 and following will allow the surviving grasshoppers to mature and become more noticeable, but the numbers will still be much less than would have been the case without the rain and cool weather of June and early July. Grasshoppers currently in the last immature stage will mature. Some will soon be noticed by drivers on Prairie highways (about 2 weeks later than usual). Some fields will sustain losses of crops, mainly wheat and barley. The crops can withstand much more damage now than they could have in early June. Risk to crops may still be severe in spots, but this will be scattered and much lower than the maximum potential that was expected in forecasts made up to late May.</p> <p>Note that dry, warm weather does not always result in grasshopper outbreaks. The warm and dry weather must be combined with high reproduction from the previous year, in order to result in significant risk.</p>
terms	<p>Grasshoppers have almost all hatched now, but the cold weather has slowed their passage through their immature stages. There may be a misconception that grasshoppers have not hatched, but this could be related to a confusion with terms. When fly-fishing enthusiasts use the term "hatch" in relationship to aquatic insects such as mayflies and stoneflies, they are referring to the emergence of the adult insect (also called the imago). Grasshoppers "hatch" from their eggs in the spring, and this event is now past for most of them. Their development and progression through the immature stages has been slowed by the cold, and wet weather had somewhat reduced their survival (but not as much as it could if we developed and released biocontrol agents). When they emerge from the last molt of the immature stages, we call that fledging.</p>
July 13 and following	<p>Get ready... Although numbers of hoppers are much reduced and behind in their development (approximately 2 weeks behind normal, in some sites), the hot weather expected this week (30 C and up) will bring them out. While doing other work on plants, wildlife, soil and other insects (almost no grasshopper research is currently funded), I have noticed many sites with moderate numbers residing unnoticed in vegetation, only moderately active. The warmer conditions will make them appear, as though they just hatched. Watch for clipping of heads of wheat and barley, or feeding directly on heads. The vegetation should keep them away from heads for a while, but high temperatures will encourage rapid feeding, even though numbers are reduced to a manageable level.</p>

July 15, 2004	<p>The two-striped grasshopper is common across southern and central Alberta and Saskatchewan, and southern Manitoba. About 20% of the two-striped grasshoppers are now adults. The adult (or imago) has wings that run the length of the body. They are soft just after molting, and begin feeding later that day. Within about 5 days of warm weather they will be ready for mating. Males are darker green and smaller. So far, egg-laying has been very rare. If eggs are laid behind schedule, they can still catch up in development because the embryo grows in the egg only to a certain stage, and then waits for winter. Packard's grasshopper is similar, but the stripes on the back are not as clear. Both of these species will consume canola, cereal crop leaves, grass or alfalfa. Feeding may not be severe unless the weather is hot, and even then they are not going to move as much as they would in a year with little food available to them!</p> <p>Watch for head-clipping, but never you insecticides to control grasshoppers unless the damage is already apparent and significant.</p> <p>- DJ</p>

Adult female two-striped grasshopper,
behind schedule

Dan Johnson
July, 15, 2004
Welling, Alberta



elsewhere

Clear-winged grasshoppers are more numerous in parts of the U.S., and control programs have to take complicated environmental and ranching issues into account. [News item.](#)

July 16,
2004

A minor question might come up from those who look at grasshoppers in roadsides in the southern Prairies now. The bunch-grass grasshopper (sometimes called the toothpick grasshopper in the US) is now mature. It will often be found in brome grass. This species was reported to be rare on the Prairies before 1980. I have mapped collections that have made of this species over the last 20 summers. This grasshopper is moving north in distribution and seems to be following the roadsides. This is interesting because it is flightless, so it must be walking these corridors north, as the weather and grass allows. This species looks like a walking stick to some people, but it is a slant-faced grasshopper, and causes no pest damage at all. The song is a rising sandpapering sound for a little more than one second, skitch-skitch-SKITCH-SKITCH-

SKITCH.

More on slant-faced grasshoppers.

Johnson, D.L. 2003. **Slant-faced grasshoppers** of the Canadian Prairies and Northern Great Plains. *Arthropods of Canadian Grasslands* 9: 5-16. Published by the Biological Survey of Canada, Ottawa. [Download](#). (or download [reduced version, suitable for screen-viewing](#))

More information on [recognizing prairie grasshoppers](#).

[Kids' version](#) of above.



Fungal disease that causes infected grasshoppers to climb to a high point and die is just starting to appear (photos below). It will probably only kill a small proportion of the grasshoppers, as is usually the case. It will be more noticeable by late July and through August. It is appearing later than usual. In 2002 and 2003, for example, I found it as early as July 1, peaking around July 15. In many years, it is seen first around irrigated fields.

July 19,
2004

The microbial agent responsible, *Entomophaga grylli*, occurs naturally. (Call it *E. grylli*, with a capital E and a space; pronounced ee grill eye.) I have seen grasshoppers killed by this disease in moderate numbers during all but 3 of the last 20 years, on the Canadian Prairies. Several of those years had high rates of infection. I've seen it across the US midwest, and in Sahelian Africa.

The disease generates considerable interest when it appears on the Canadian Prairies, and to those unfamiliar with the normal progression of the disease it may seem that it could bring the demise of the grasshopper outbreak. Although this has happened once or twice in the last 40 years, in most years it probably kills less than 5%. It has been low during 1999 to 2003, as is typical of dry years. Warm and moist conditions could increase the incidence this year. In some cases the symptoms are not as easy to spot, and DNA methods would be required to approach an accurate

estimate.

There are two main pathotypes, one that kills mainly band-winged grasshoppers such as the clear-winged grasshopper, and one that kills mainly spur-throated grasshoppers (chiefly the two-striped). In the 1980s, I tried various ways of germinating the spores, and found that spraying them in water resulted in small local infections among two-striped grasshoppers (funded by FFF and AAFC), but the infection rates were so low, less than 1%, that although it demonstrated the concept it would not have a significant effect on the population. (In fact, in the late 1980s, the scientific journal *Entomophaga* refused to publish my research paper on low fungal infection rates, because reviewers considered the successful infection rate too low to be useful for control. This is one reason that results in the scientific literature are biased toward insect diseases that infect at higher rates, causing so-called meta-analysis of previously published results to give an incorrect representation of the pathology.)

Examples are shown below - all photos are by Dan Johnson, Lethbridge.



This is how clear-winged grasshoppers (*Camnula pellucida*) will appear when killed by *E. grylli*. They climb, splay the hind legs, and wrap the front ones in a bear hug before dying. The higher position increases the spread of the spores. (In this photo, I used the road as the background.)

Near Lethbridge, AB



Fifth-instar clear-winged grasshopper killed by *E. grylli*, near Cardston, AB.



Conidiophore (fungal spore-producing structure) on the abdomen of a Carolina grasshopper, from Turin, AB.



D Johnson 1988

Germinating spores (conidia) from a clear-winged grasshopper.



Two-striped grasshopper (*Melanoplus bivittatus*) killed by *E. grylli* (Saskatchewan)




Little spur-throated grasshopper (*Melanoplus infantilis*) killed by *E. grylli*. This species is a common grasshopper but not a serious pest.



Two-striped grasshopper killed by *E. gryll* (a photo from a similar angle was recently published in the Blue Jay, the journal of the Saskatchewan Natural History Society).

I took this photo near Indian Head, SK.

In the mid-1980s, this pathotype was much more common than the pathotype that kills the clear-winged, but during recent years (1999-2004) the clear-winged is also commonly seen with the symptoms of this disease.

		<p>Resting spores removed from an infected two-striped grasshopper. These will kill grasshoppers next year.</p> <p>(Subject of a previous AAFC/FFF study.)</p>
	<p>Note: the steep declines in grasshoppers that have been described above, throughout June and July, do not apply to the northern areas. The Peace region reports widespread infestations of grasshoppers. The numbers may not be as high as a bad outbreak in the southern regions, but compared to the low numbers usually experienced in the north (except for rare eruptions of the clear-winged grasshopper), this is a bad year for them.</p> <p>More information. Click here for a world review of research and opportunities regarding biological control of grasshoppers and locusts:</p> <p>Lomer, C.J., Bateman, R.P., Johnson, D.L., Langewald, J., and Thomas, M.B., 2001, <i>Biological control of locusts and grasshoppers. Annual Review of Entomology</i> 46: 667-702.</p> <p>Protozoa can also infect grasshoppers, and work in dry weather. Review article:</p> <p>Johnson, D.L., 1997, Nosematidae and other Protozoa as agents for control of grasshoppers and locusts: current status and prospects. <i>Memoirs of the Entomological Society of Canada</i> 171: 375-389.</p>	
<p>Nanton, July 23; Manyberries July 24.</p>	<p>While working on other grassland issues, I take along a net and note the numbers and species of the grasshoppers found outside of cropland. Rangeland grasshoppers are also reduced this year in Alberta and southwestern Saskatchewan, although one species, the little spur-throated grasshopper (<i>Melanoplus infantilis</i>), is still found at higher levels than during most of the last ten years. Some crop pest grasshoppers (for example, Packard's grasshopper and the migratory grasshopper) are also currently found on pastures, but most of the grasshopper species on native range are not the ones that threaten crops. At the moment, most rangeland grasshoppers are just reaching maturity during July 20 - Aug 5, later than usual. Loss of grazing potential this year is light. In some previous years, such as in the mid-1980s, grasshoppers removed most of the grazing potential in some foothills range and also shortgrass range pastures. Alfalfa damage is expected to be light overall but severe in patches in</p>	

the Peace River, east central Alberta, and parts of southern Alberta and Saskatchewan.


Wanted: katydid records. I know from personal experience and searching that the katydids shown here were rare or nonexistent in most of the Prairies during 1983-1999. They increased in numbers in 2000, and since then they are more common in Alberta and Saskatchewan (especially the latter). I would be interested in hearing from people who have seen them in Canada.

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<p>July 23-29</p>	<p><i>E. grylli</i> disease is much more common now, especially among the clear-winged grasshoppers, and especially in central and northern regions. If this trend continues, the disease may have an extra impact in reducing grasshopper numbers. In most years, and so far this year, it is a local effect only.</p>
<p>Aug 1</p>	<p>Drought in northwestern Alberta has resulted in higher survival and activity of clear-winged grasshoppers (similar to two outbreaks of this species in the last 15 years, in this area). They are now in their reproduction season. I will be in the area for other reasons and will note numbers, species and disease later.</p>
<p>Aug 3</p>	<p>At many points in the Alberta foothills, the current dominant species is the clear-winged grasshopper, at densities of around 1% of the number in early June, because of mortality induced by the cool, wet weather in June and July. <i>Melanoplus</i> species have suffered even greater declines. Egg-laying in 2004 will be greatly reduced. Grasshoppers in southern and central Alberta and Saskatchewan have not declined as markedly, but numbers are currently much lower than at hatching. The decline has been much greater than during more typical years that lacked the cool, moist weather of 2004.</p>
<p>Aug 3-14</p>	<p>Reproduction is behind schedule, and few cases of mating and oviposition are apparent. Grasshopper oviposition occurs when the female inserts her abdomen into the soil and places the eggs in pods in the soil. In some areas, the two-striped and clear-winged grasshoppers occur in sufficient numbers that even with the reduction in reproduction, they can produce enough eggs for infestations in 2005, but it will be generally more moderate than 2001-2003 in any case.</p>

	One big change is that the Packard's grasshopper has resurged in numbers and area.
Aug 15	Pasture grasshoppers have increased in numbers, and densities of 20 to 50 per square meter are not hard to find in some areas (for example, east of Lethbridge). Most of these species are not crop pests. Some, but not all, can reduce pasture forage quantity and quality.
Aug 22-23	The cool, rainy conditions we are experiencing have brought egg-laying to a halt for now, and will further reduce the numbers of grasshopper eggs that carry over to spring. A survey of egg number and condition would reduce the uncertainty in forecasting the 2005 grasshopper numbers. Local sites can be searched for eggs by sifting a shovelful of soil from the upper 8 cm (3 inches) of soil, using a coarse screen. The sifting can be conducted in the fall or early spring, as long as the soil is dry. Grasshopper eggs look like brown rice.
Aug 7	<p>Although most roadside populations are down this year for reasons stated in the updates above, I have seen many pastures with higher than average densities. The weather and vegetation condition have resulted in some grasshoppers increasing, while most of the pest species have declined. The large-headed grasshopper and red-legged grasshopper have both increased noticeably in some areas, as has Packard's grasshopper. Some range grasshoppers that are normally rare in Canada and not serious pests, have increased greatly over previous typical densities (such as the four-spotted grasshopper and the striped slant-faced grasshoppers. I can post photos of all of these if there is interest. Or, see:</p> <p>Johnson, D.L. 2001. Band-winged grasshoppers of the Canadian Prairies and Northern Great Plains. Arthropods of Canadian Grasslands 7: 5-12. Published by the Biological Survey of Canada, Ottawa. Download full size.</p> <p>Johnson, D.L. 2002. Spur-throated grasshoppers of the Canadian Prairies and Northern Great Plains. Arthropods of Canadian Grasslands 8: 16-25. Published by the Biological Survey of Canada, Ottawa. Download full size.</p> <p>Johnson, D.L. 2003. Slant-faced grasshoppers of the Canadian Prairies and Northern Great Plains. Arthropods of Canadian Grasslands 9: 5-16. Published by the Biological Survey of Canada, Ottawa. Download full size. (or download reduced version, suitable for screen-viewing)</p>
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