

# 2023 Western Canadian grasshopper populations and prospects for 2024

## Agronomy Update 2024

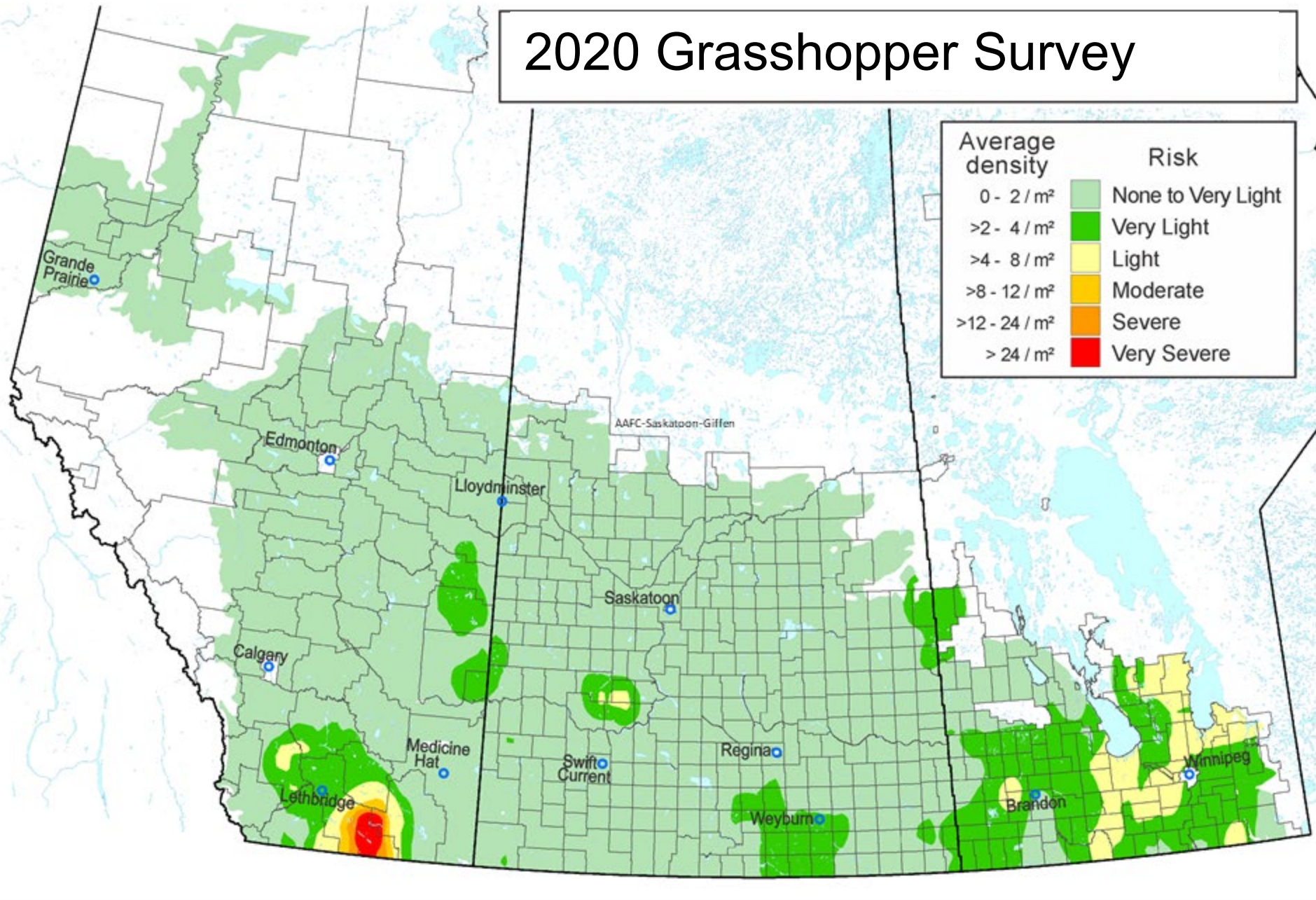
James A. Tansey<sup>1</sup>, Ross Weiss<sup>2</sup>, and John Gavloski<sup>3</sup>

1- Saskatchewan Ministry of Agriculture

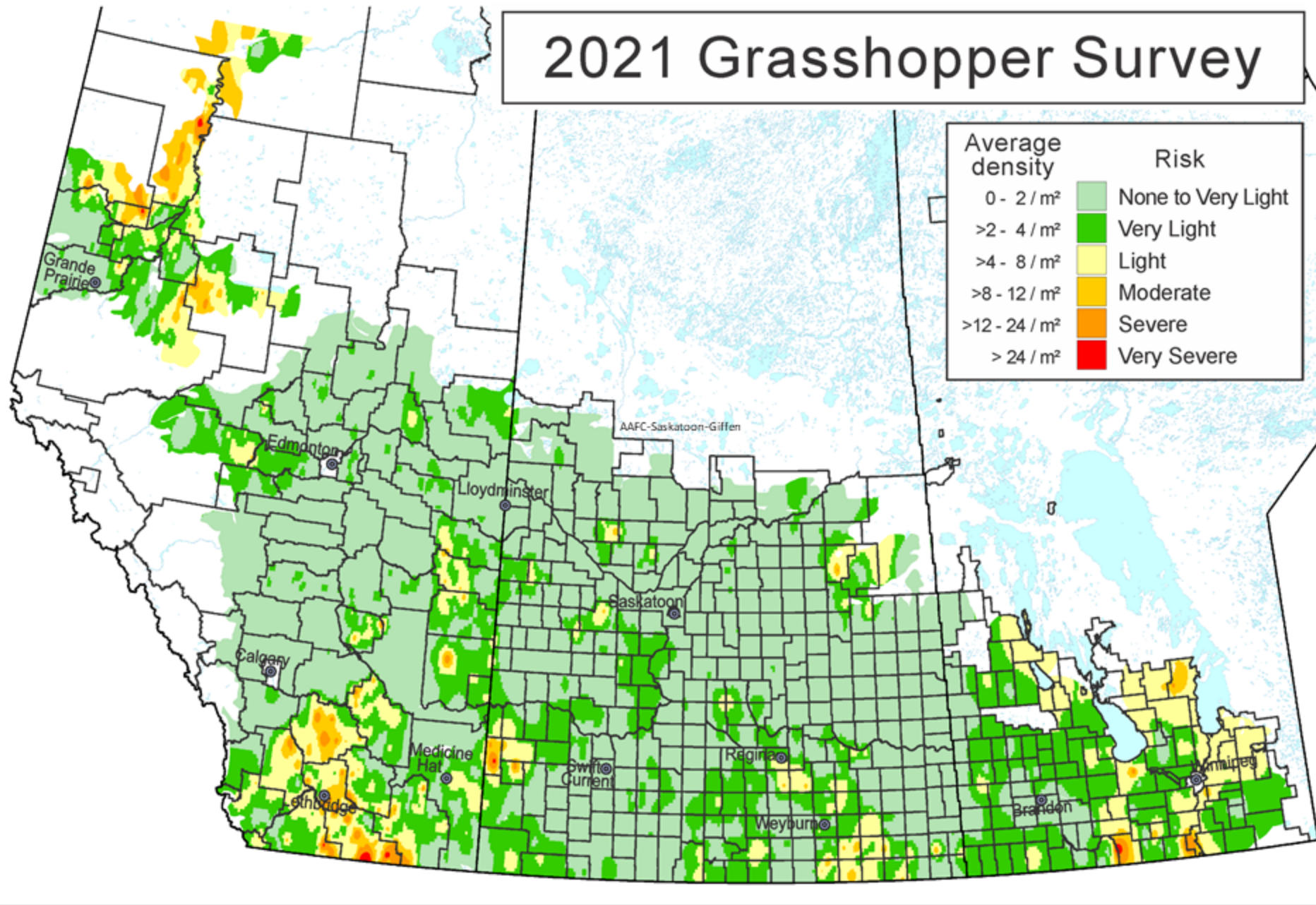
2-Agriculture and Agri-Foods Canada (Retired)

3-Manitoba Agriculture

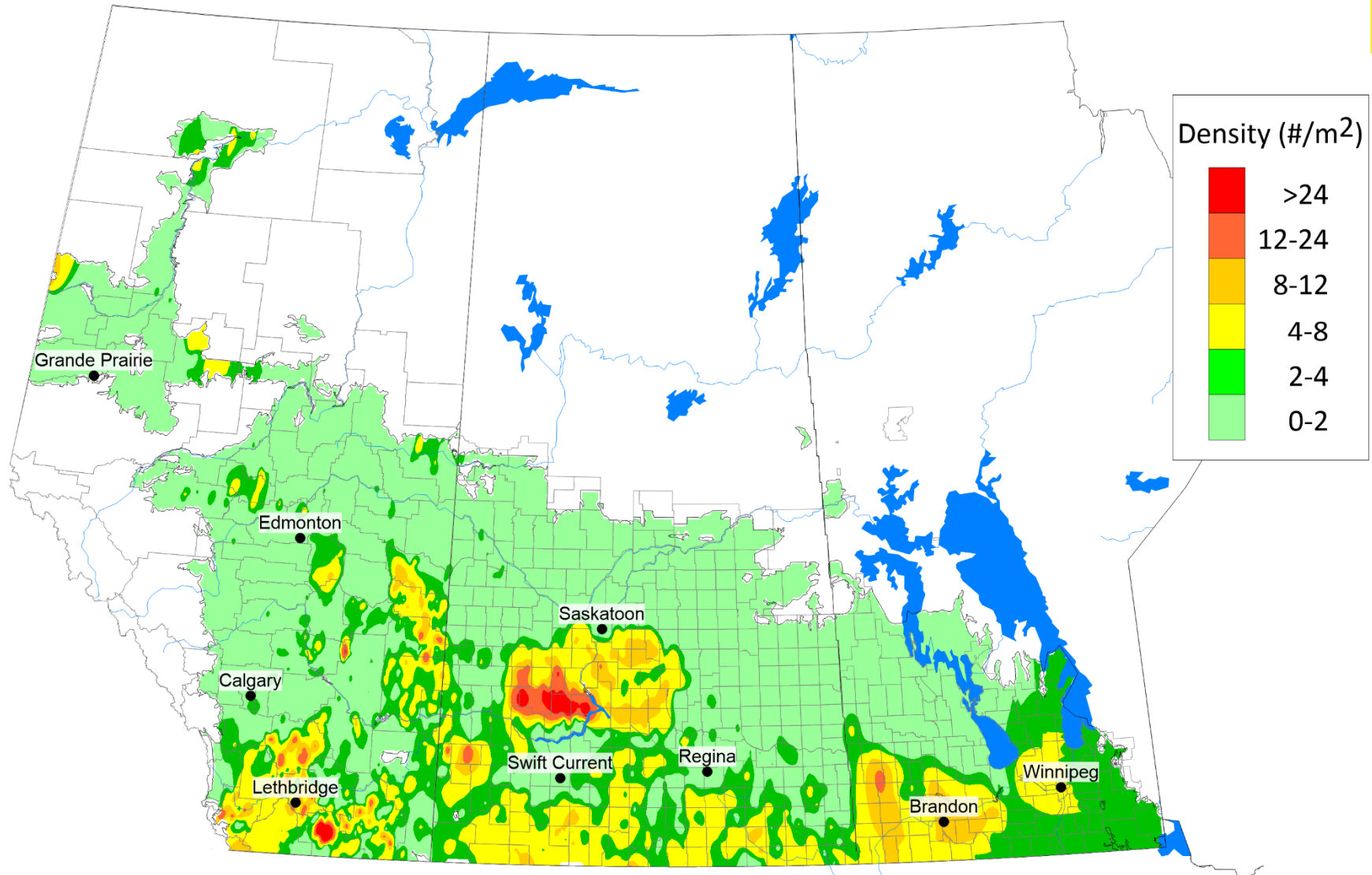
# 2020 Grasshopper Survey



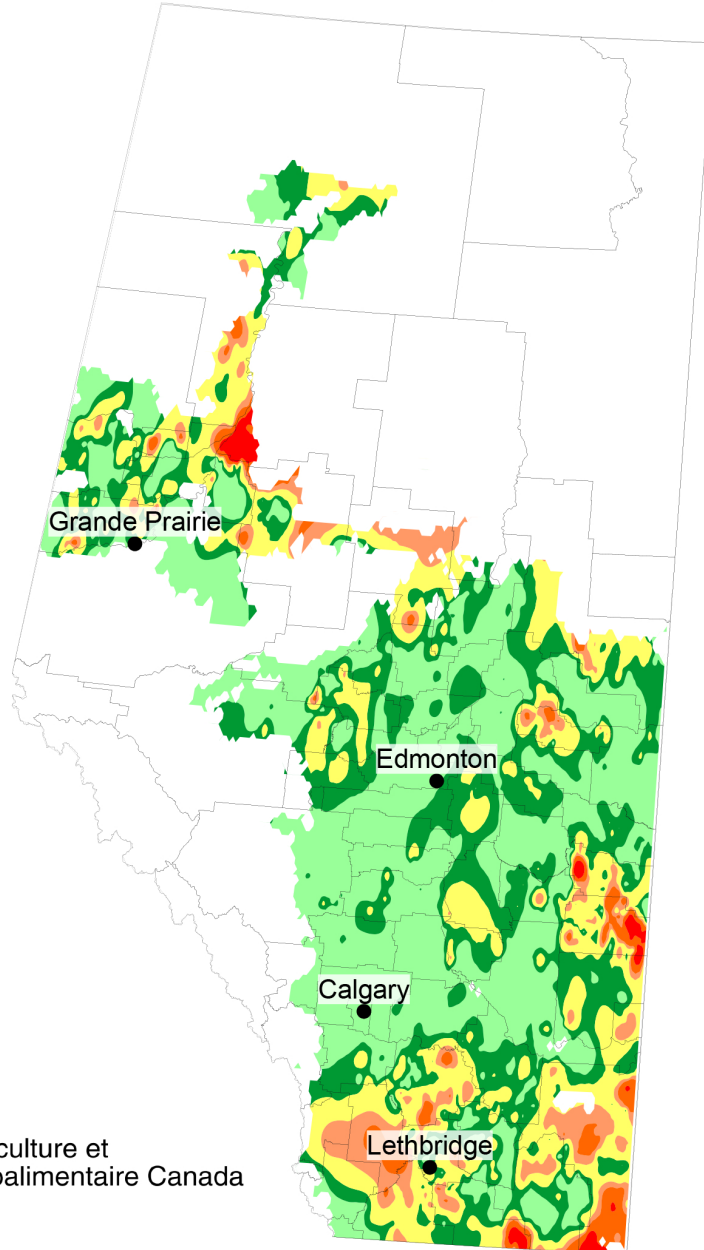
# 2021 Grasshopper Survey



# Grasshoppers 2022 Survey



# Grasshopper 2023 Survey



Risk rating for June-July 2024	Density (#/m <sup>2</sup> )
Very Severe	>24
Severe	12-24
Moderate	8-12
Light	4-8
Very Light	2-4
None	0-2



Agriculture and  
Agri-Food Canada

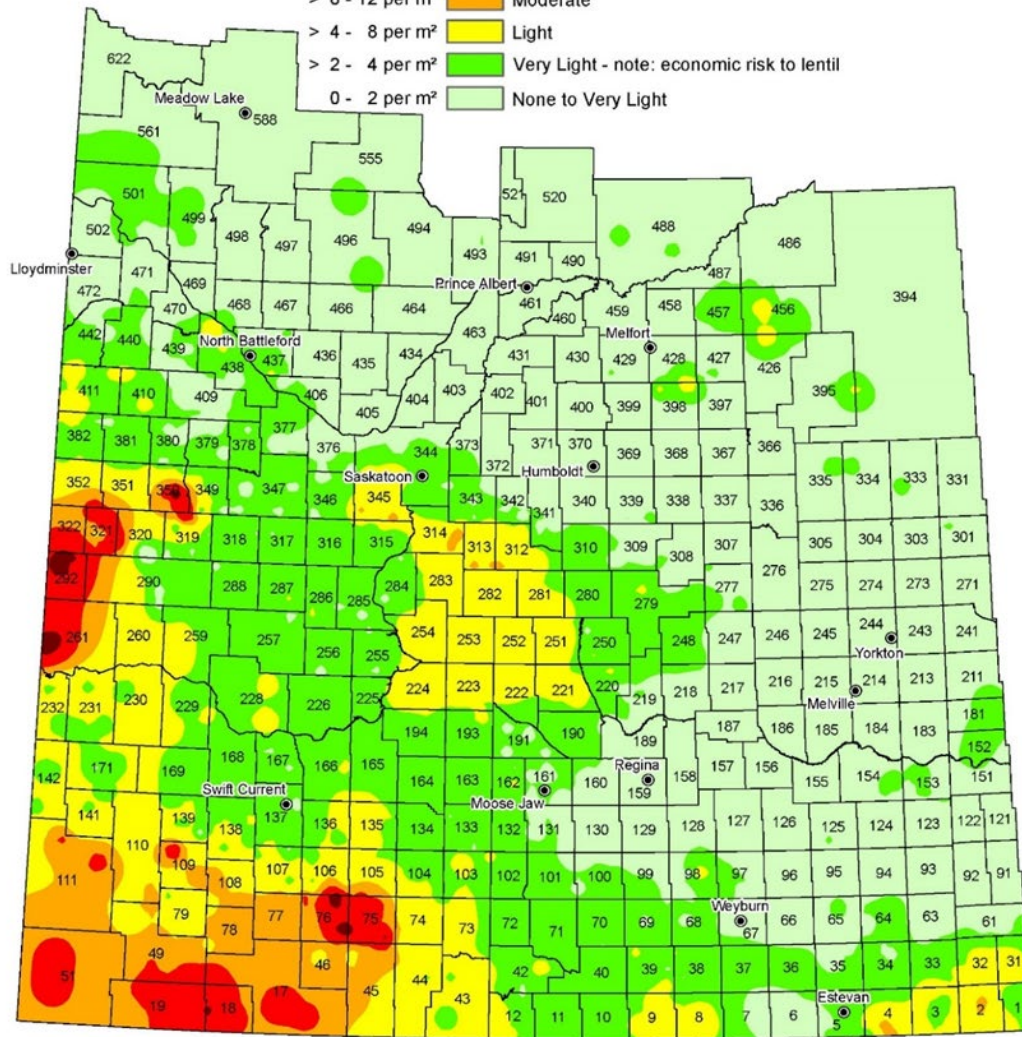
Agriculture et  
Agroalimentaire Canada

# 2023 Grasshopper Survey


based on adult grasshopper counts

Infestation Risk - Cereals

- > 24 per m<sup>2</sup> Extreme
- > 12 - 24 per m<sup>2</sup> Severe
- > 8 - 12 per m<sup>2</sup> Moderate
- > 4 - 8 per m<sup>2</sup> Light
- > 2 - 4 per m<sup>2</sup> Very Light - note: economic risk to lentil
- 0 - 2 per m<sup>2</sup> None to Very Light



NOTE: Since techniques used to smooth the transition between zones can affect the values in localized areas, this map should be used for regional analysis only.



**SCIC**  
SASKATCHEWAN CROP  
INSURANCE CORPORATION

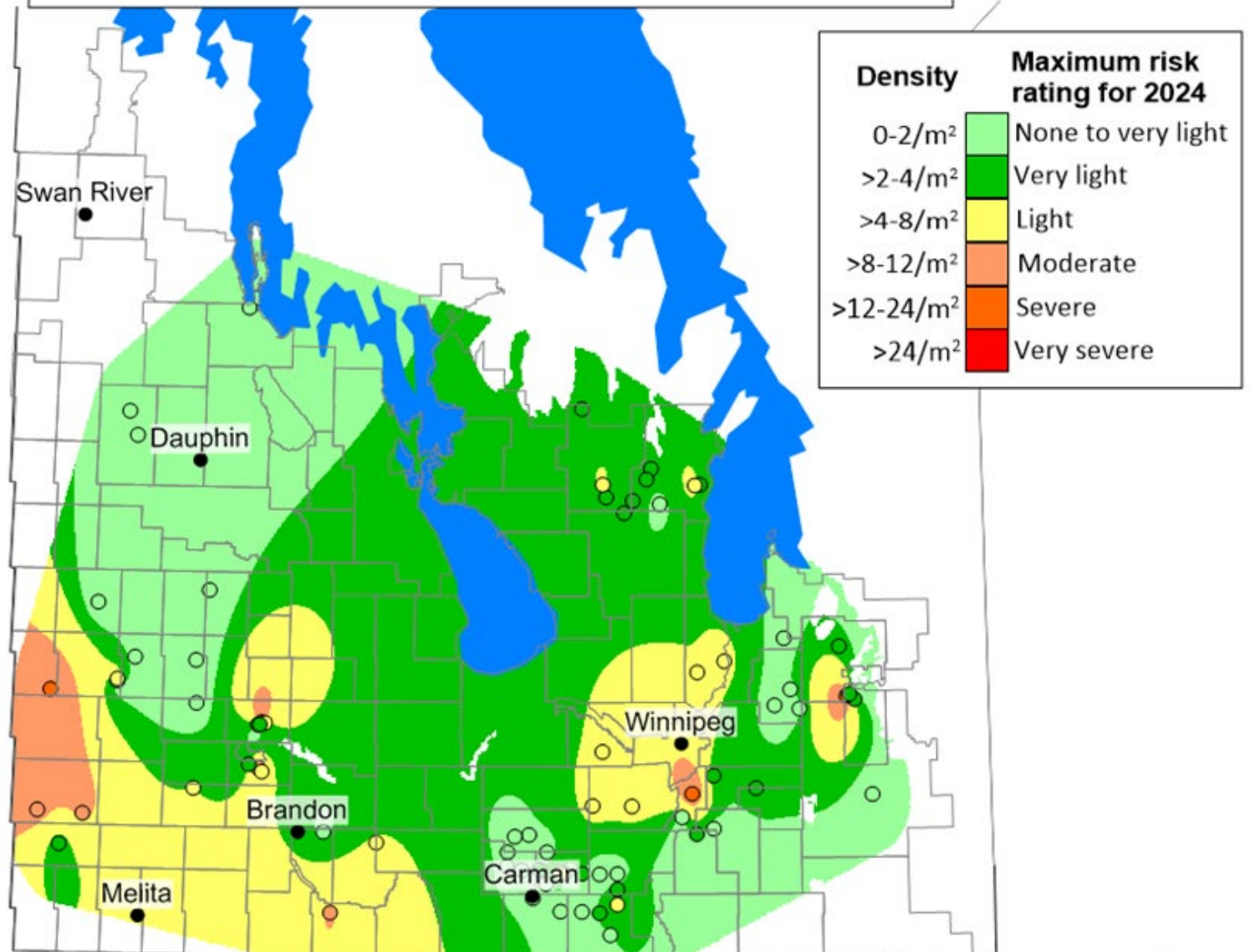
0 25 50 100  
Kilometers

Projection: UTM Zone 13 Datum: NAD83

Data Source:  
Grasshopper Count - Saskatchewan Crop Insurance Corporation  
Field Staff

Geomatic Services, Ministry of Agriculture    October 26, 2023

# Manitoba Grasshopper Survey - 2023



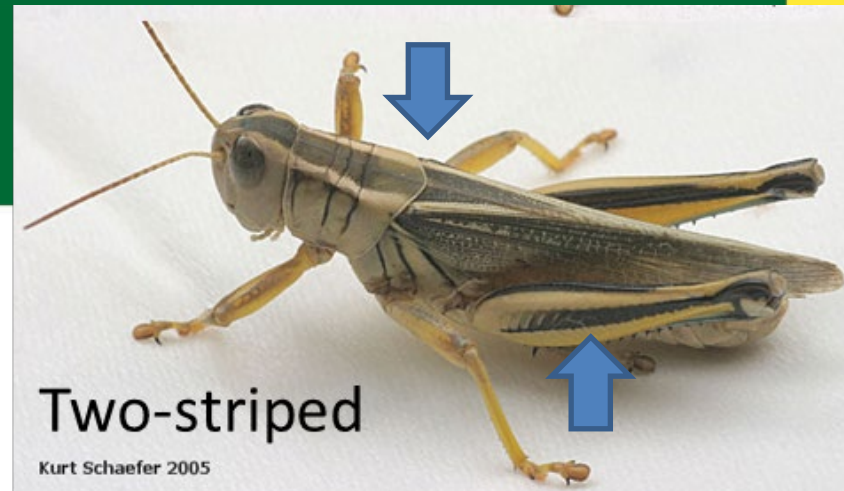
# Species detected in surveys

- AB
  - NW – Several species but Bruner's significant
  - South - Fewer migratory than in 1980s. Two striped and clearwing prevalent
    - Data courtesy Dr. Dan Johnson
- SK
  - Two-striped dominant most locations
  - NE and NC – Mostly two-striped but some pockets of Bruner's
  - Migratory pops restricted to south
  - Some pockets of Packard's reported near Saskatoon, Moosejaw
- MB
  - Two-striped dominant at most locations, with significant clearwing and migratory also reported as dominant in some locations
  - Katydid dominant at a few sites
    - Data courtesy Dr. John Gavloski



# The Pests

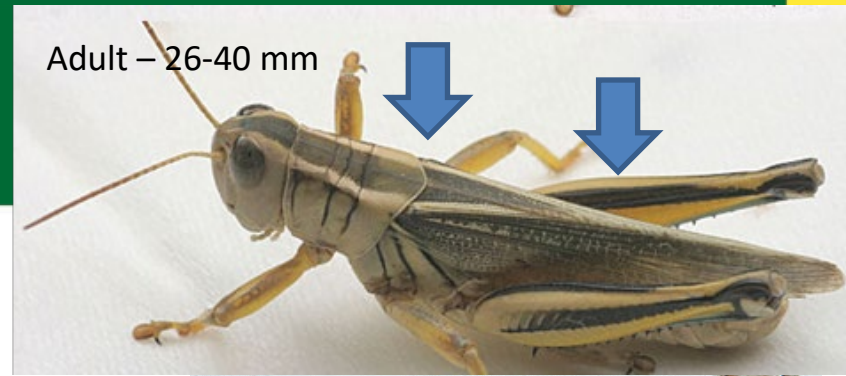
- **Two-Striped Grasshopper, *Melanoplus bivittatus***
  - 26 – 40 mm (1.0 to 1.6 inches)
  - Two pale stripes extending from eyes to tip of forewings
  - Hind femur with black stripe
  - Prefers lush habitat
    - Heavier textured soil zones
  - Hosts: prefers lush foliage such as weed species found in marshes and roadside ditches
  - Pest of alfalfa and other crops
  - Will feed on cereals



# The Pests

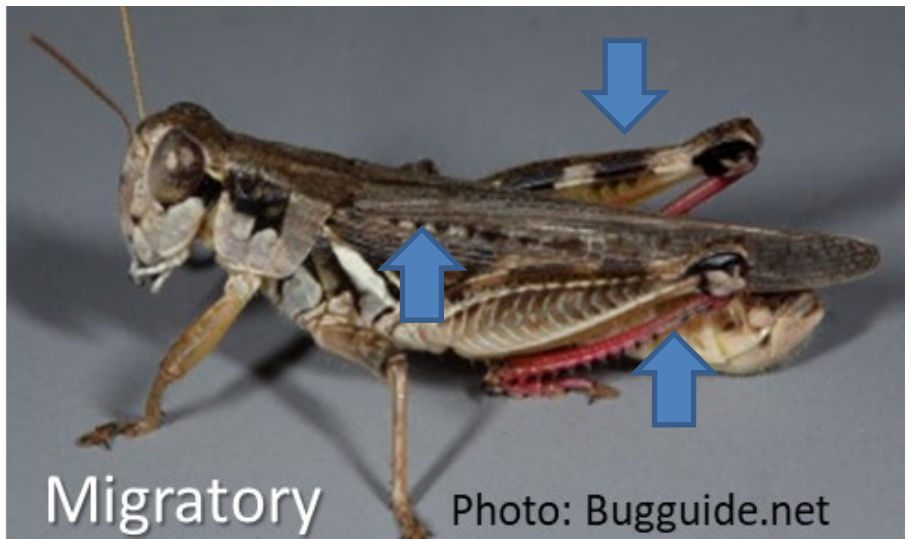
- **Two-Striped Grasshopper**

- Prevalent pest species in Saskatchewan
- OW as eggs
- Eggs start to hatch 8-10 d ahead of migratory grasshopper
- Eggs concentrated in roadsides, ditches



# The Pests

- **Migratory Grasshopper, *Melanoplus sanguinipes***
  - Sometimes confused with Bruner's grasshopper
  - Adults: 23-28 mm (0.9 to 1.1 inches)
    - Back - dark grayish-brown tinged with red
    - Belly - yellowish
    - Hind legs marked with two black bands
    - Forewings: spotted pattern
    - Hind tibia: red, but can be blue, or yellowish



# The Pests

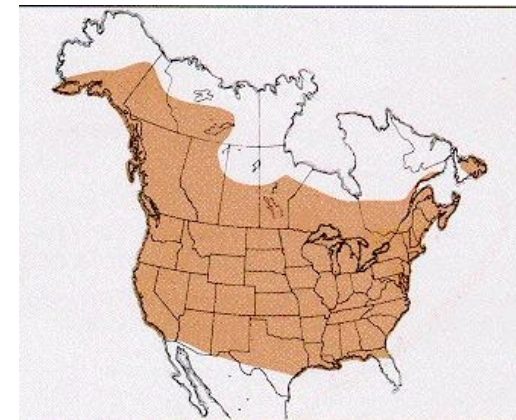
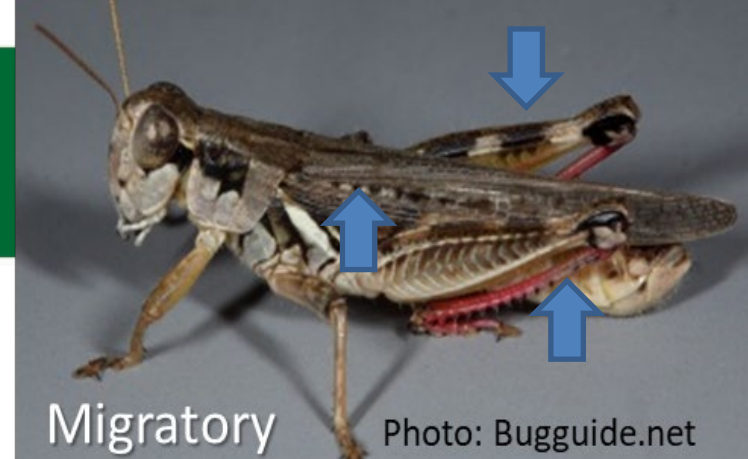
- **Migratory Grasshopper,**

- Omnivorous

- Prefers forbs, grasses, wheat, barley, and other crops
    - Scavenges on ground litter, dead insects, and dried manure
    - During outbreaks, this species consumes just about all plants including trees and ornamentals, and small grains at all growth stages

- Outbreaks

- Behaviour changes at high densities: gregarious
    - Nymphs (later instars) may migrate in large groups 16 km/day (10 miles)
    - Adult swarms: 1938, 1000 km from SD to SK
    - Commercial pilots report strikes at 3000 ft

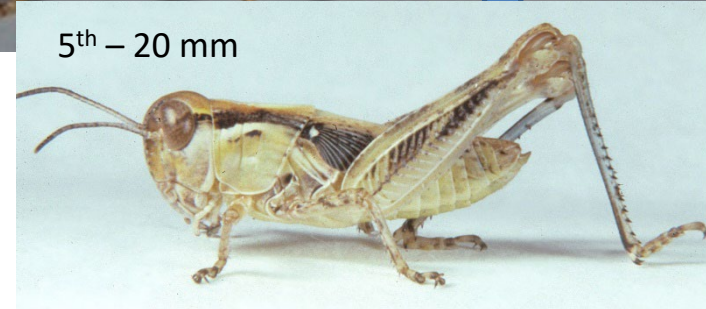
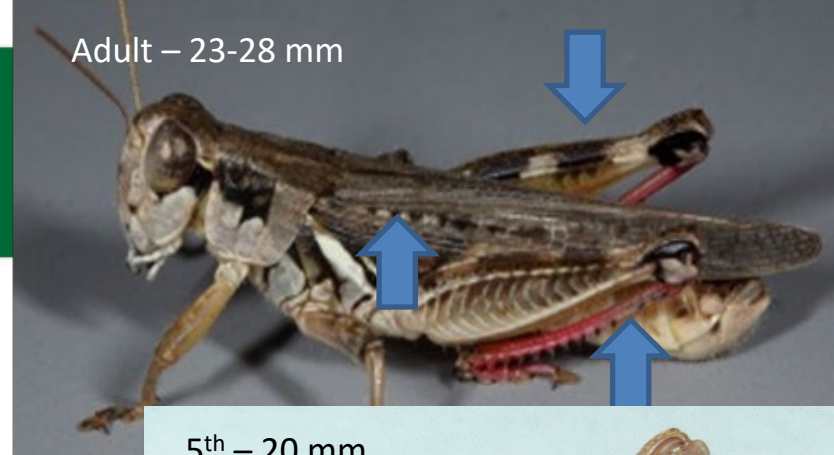


# The Pests

- **Migratory Grasshopper**

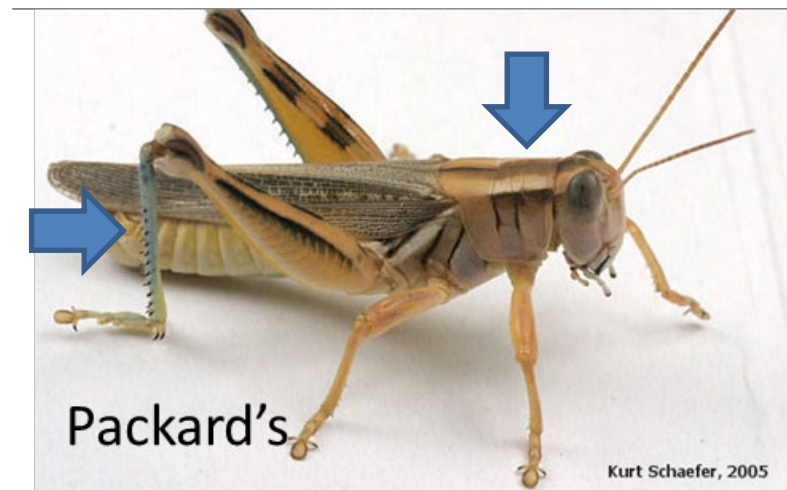
- Overwinter as eggs

- Groups of 18 to 24 eggs laid in soil late summer: depth 2 cm
- 250/ eggs female
- Hatch May
- Hatching starts along open south slopes, in fields and rangeland with little vegetative cover, and in sandy soils
- Five nymphal instars in 35 -55 days



# The Pests

- **Packard's Grasshopper, *Melanoplus packardii***
  - Gray to dark yellow
  - 27-32 mm (1.1 to 1.3 inches)
  - Prefers open habitat, light textured soils
  - Two light-coloured stripes extend from just behind the eyes
  - Blue tibia on hind legs
  - Greater pressure in N range
  - Hosts: vegetables, small grains, legumes, thistles

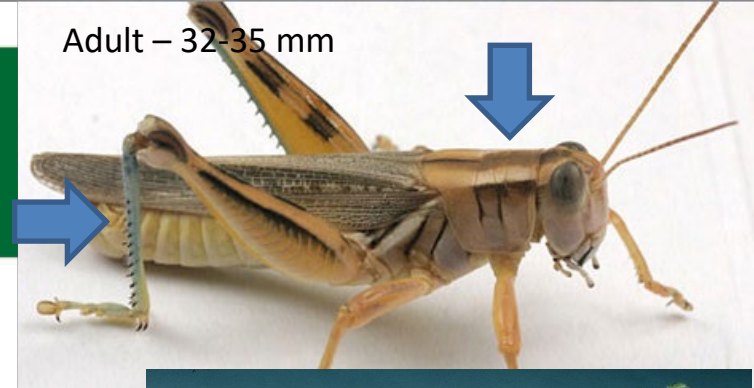


# The Pests

- **Packard's Grasshopper**

- OW as eggs
- Hatch May/June
- 5 nymphal instars

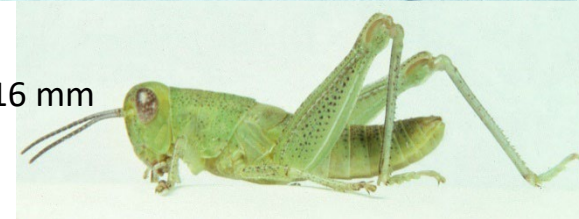
Adult – 32-35 mm



5<sup>th</sup> – 24 mm



4<sup>th</sup> – 16 mm



3<sup>rd</sup> – 9 mm



2<sup>nd</sup> – 6 mm



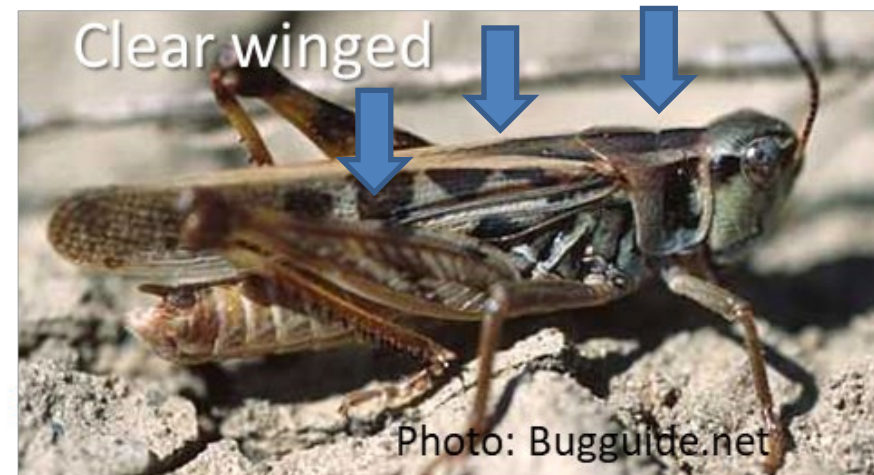
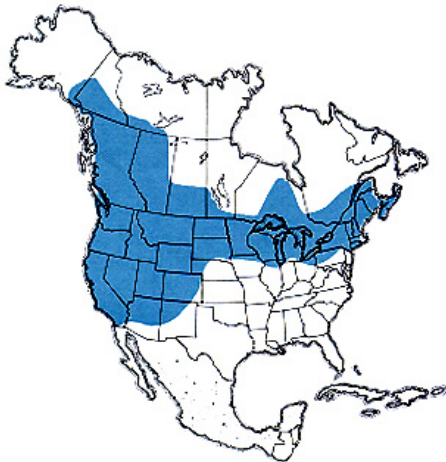
1<sup>st</sup> – 5 mm



Photos – USDA APHIS

# Pests

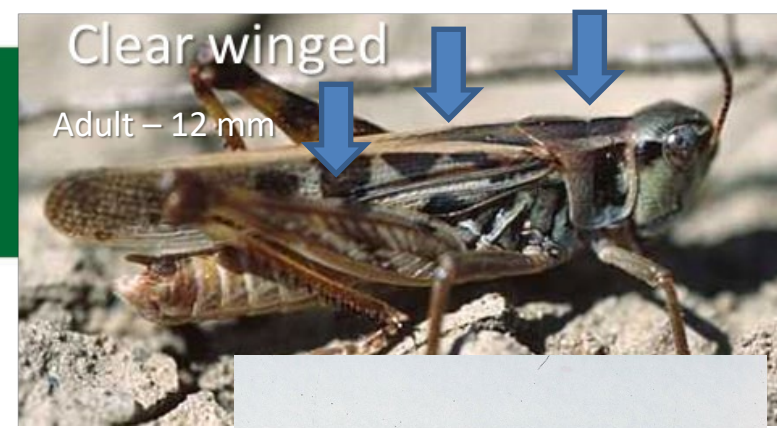
- Clear-winged grasshopper, *Camnula pellucida*
  - Primarily a grass feeder
  - Also called 'California migratory locust'
  - Yellow to brown, mottled forewings and transparent hindwings, light stripes that converge
  - Carinae (keels) on pronotum





# Pests

- Clear-winged grasshopper, *Camnula pellucida*
  - OW as eggs
  - Nymphs in May/June
  - Hatchlings emerge in morning when temps rising rapidly, especially after evening shower



5<sup>th</sup> – 17 mm



4<sup>th</sup> – 12 mm



3<sup>rd</sup> – 8 mm



2<sup>nd</sup> – 4.5 mm



1<sup>st</sup> – 4.5 mm



# Pests

- Slant-faced grasshoppers (multiple species)
  - Occasionally damaging
  - Usually found along the borders of marshes and in wet meadows
  - Some members of this group are also common in dry, grassy fields and pastures
  - Feed primarily on rangeland grasses and sedges

Photo: Mathew L. Brust



*Eritettix simplex*

# Non-pests

- Long antennae (not grasshoppers at all)
- 85 species grasshoppers in W Canada, most are harmless to agriculture
- Not a pest if...
  - Wings before late June
  - Brightly-coloured hind wings
    - Speckle-winged rangeland grasshopper
    - Carolina grasshopper/ road duster
  - Noisy flyers
  - Callers/chirpers



Photo – Frank Krebs



Photo: Sara Simpkins

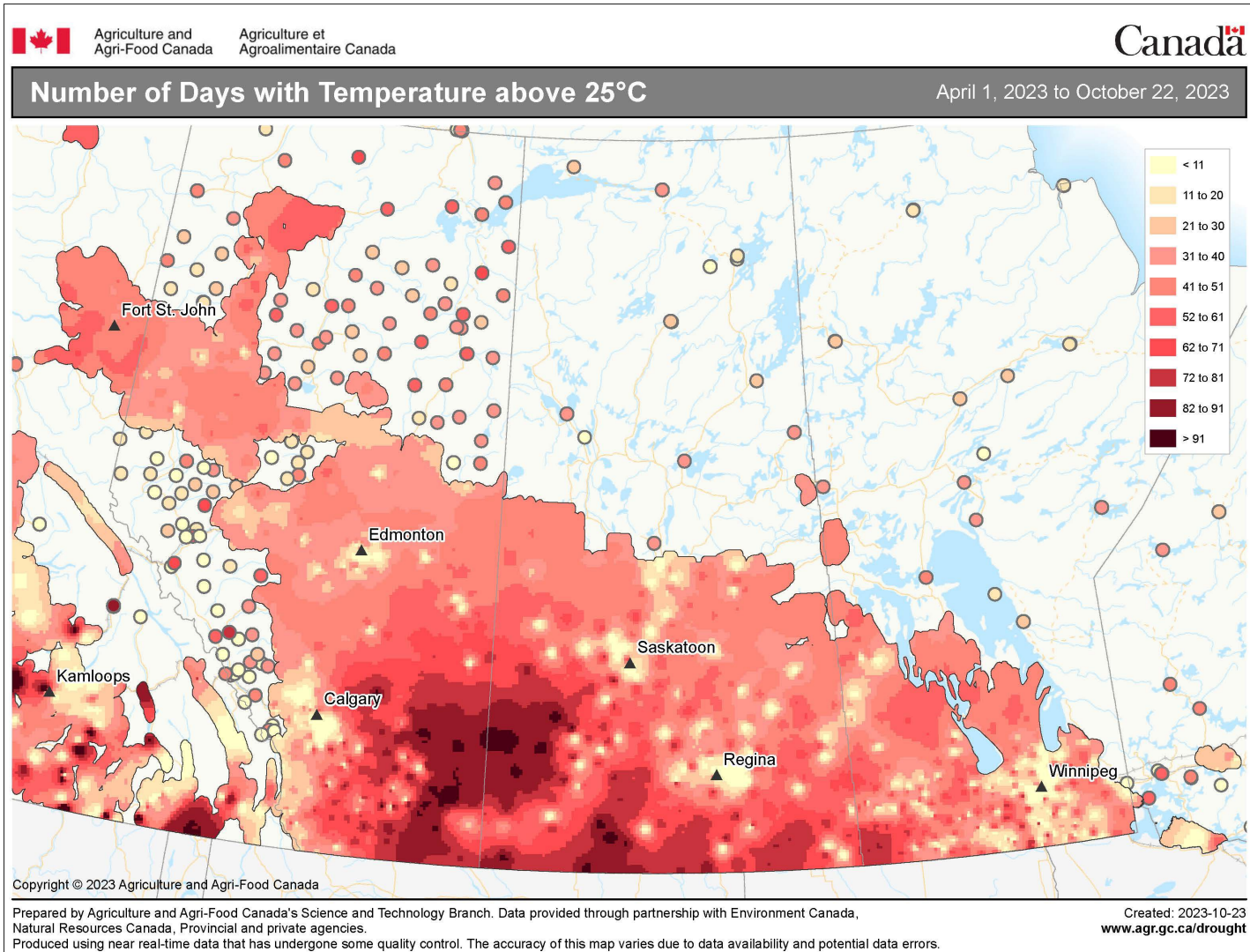


©2006 University of Colorado Museum of Natural History

# 2023

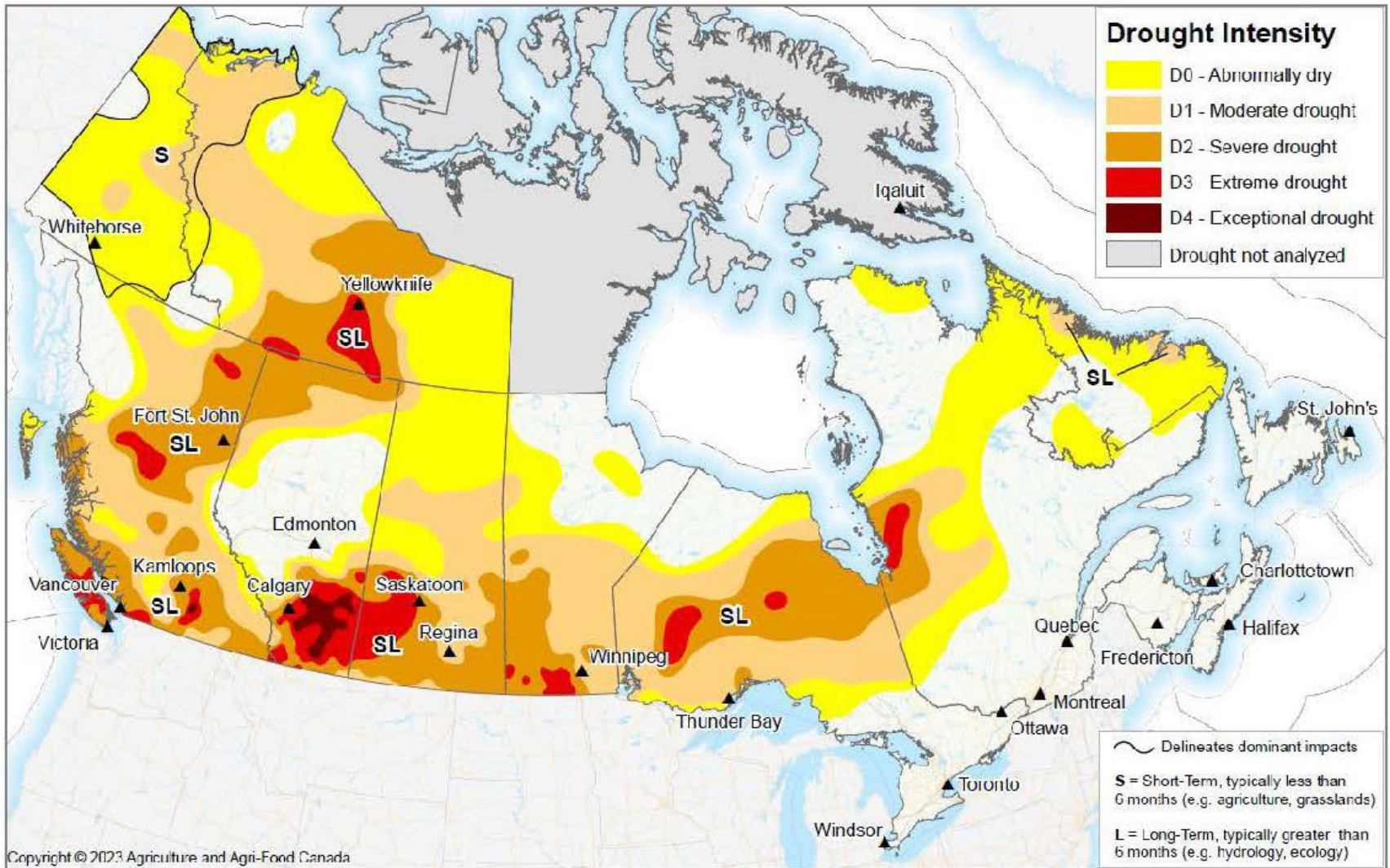
- Dry and very warm conditions in many regions
  - Agricultural emergencies declared in 20 Saskatchewan RMs, 15 Alberta communities
  - Drought and grasshoppers
  - Very warm conditions in May
    - Early emergence of nymphs

# Warm



# Canadian Drought Monitor

Conditions as of August 31, 2023

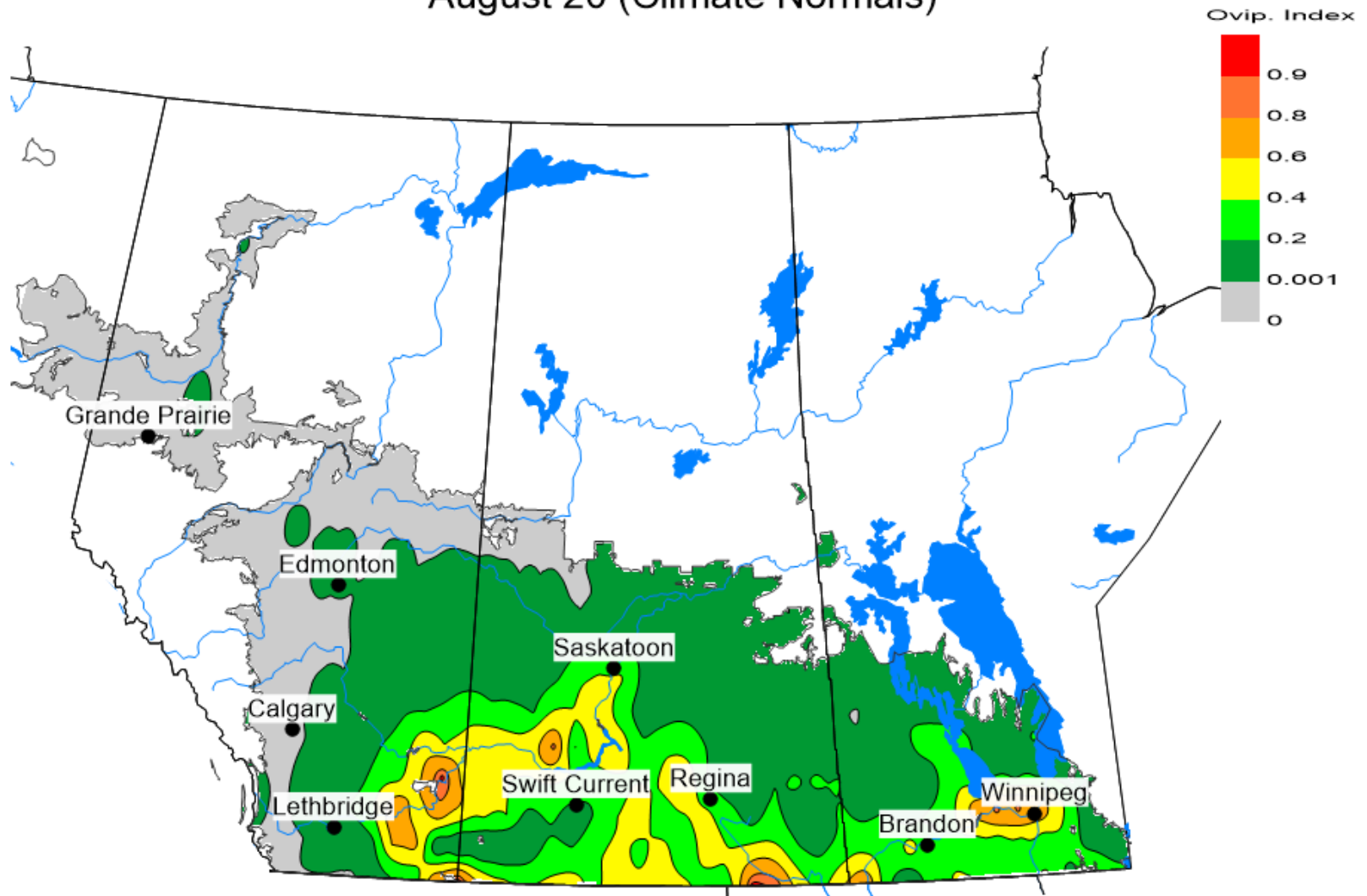


# Grasshopper populations and the weather

- Migratory GH
  - Olfert and Weiss 2006 and refs therein
  - Warm spring
    - Earlier hatch
    - Increased nymphal survival and increased fecundity
    - More rapid development of eggs, nymphs, and adults
  - Warm late summer, fall
    - Oviposition related to adult densities, timing of adult emergence and weather conditions
    - Warm dry conditions promote embryonic development

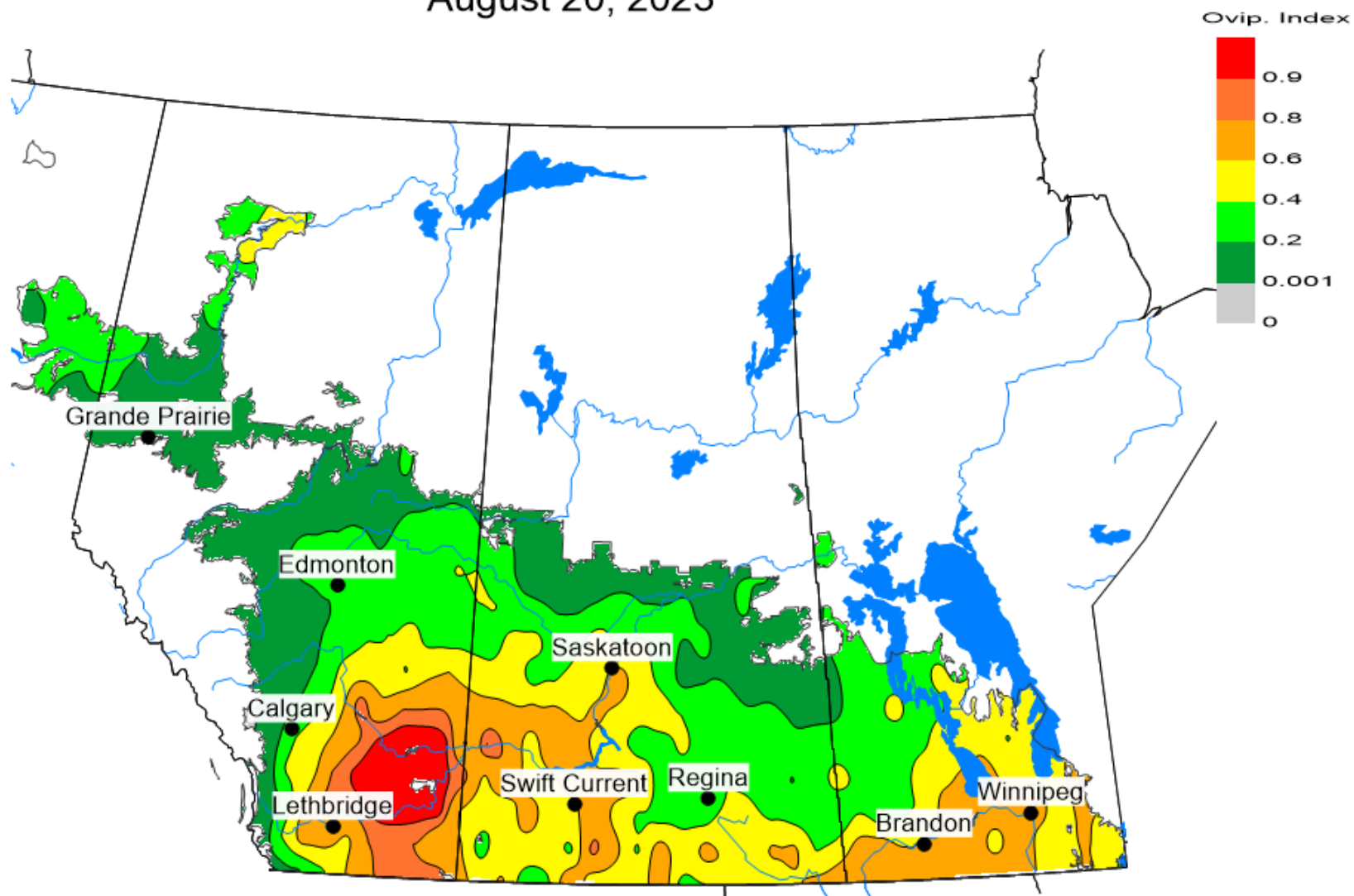


# Grasshopper oviposition index August 20 (Climate Normals)





# Grasshopper oviposition index August 20, 2023



# Grasshopper Development



- **Temperature**

- High late summer, fall temps speed embryonic development
- Diapause required before some can complete development
  - At 30°C, migratory and two-striped GHs reach diapause-ready stage in 15d (80% development)
  - Clearwing GH diapause earlier in embryonic development. Ready in 7d but only 50% developed
- Warm spring conditions break diapause – complete embryonic development
- Hatch



# Grasshopper Development and water

- **Moisture**

- Migratory GH

- Eggs must absorb water
    - Min soil moisture 13.5% necessary for complete development
    - Development halts if <13.5% until moisture increases

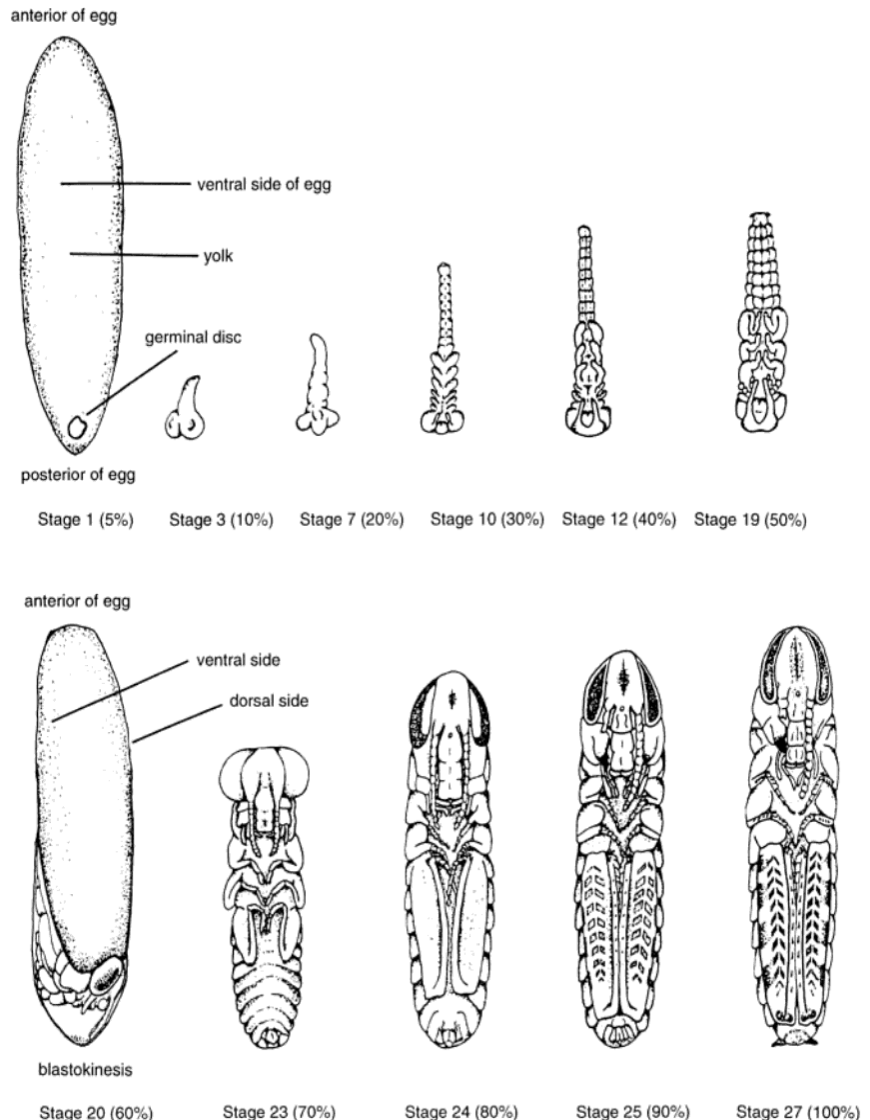
- Two striped GH

- Embryo death if 2/3 moisture loss

- Clearwing GH

- Moist soils help cold hardiness

Figure: Pfadt, Robert E. Field guide to common western grasshoppers. Vol. 912. Wyoming Agricultural Experiment Station, 1994.



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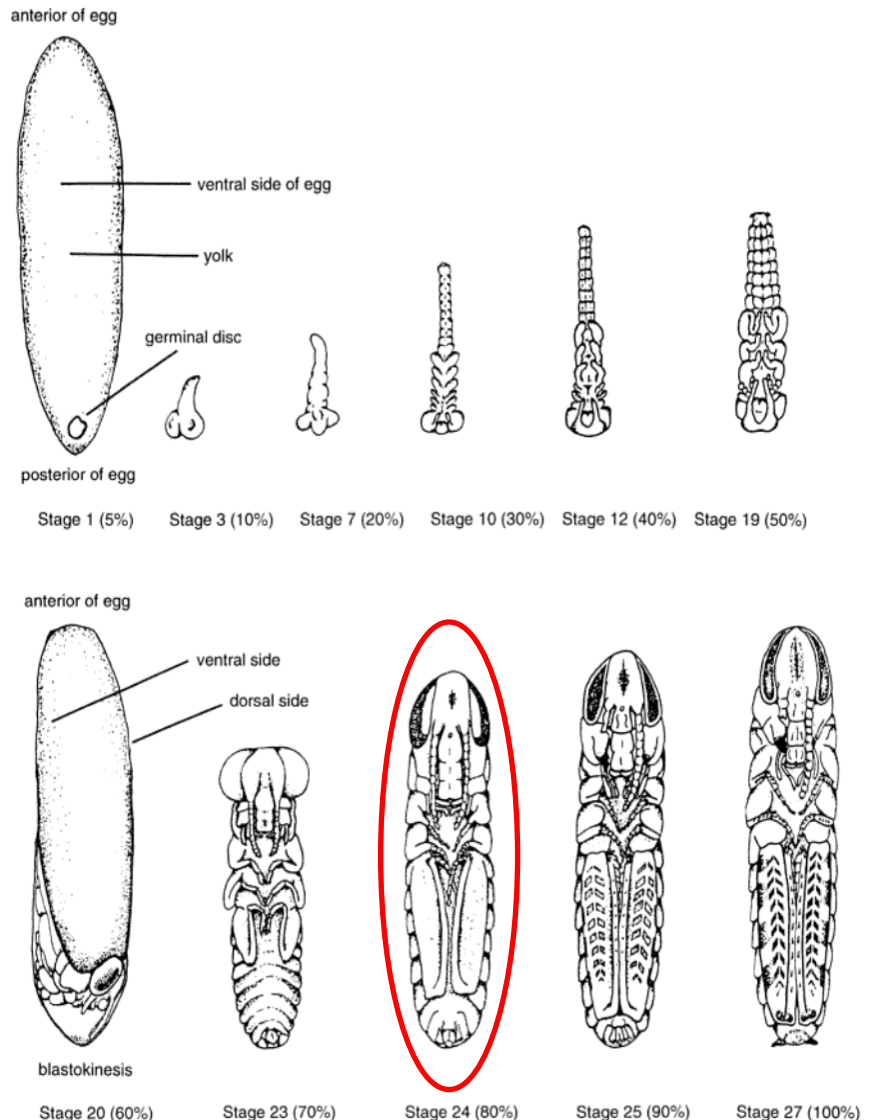
- **Two striped GH**

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Figure: Pfadt, Robert E. Field guide to common western grasshoppers. Vol. 912. Wyoming Agricultural Experiment Station, 1994.



# Grasshopper Development and water

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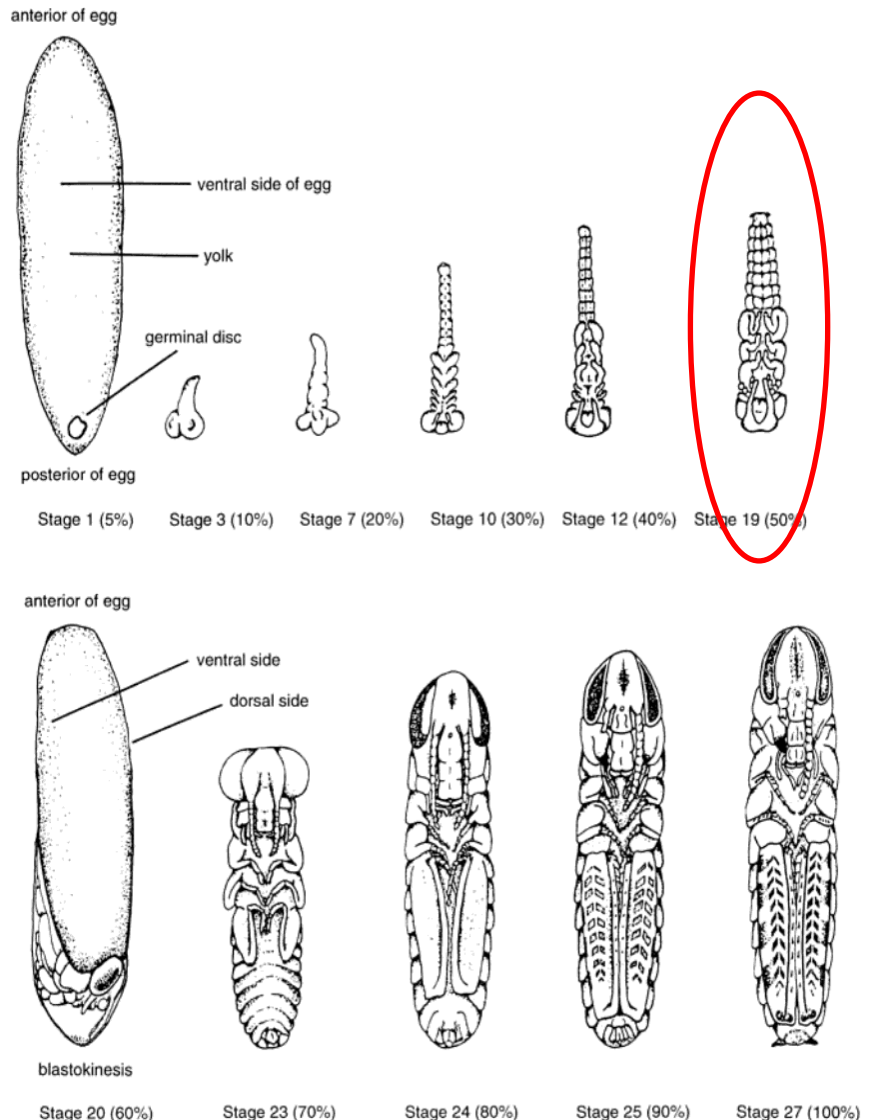
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Figure: Pfadt, Robert E. Field guide to common western grasshoppers. Vol. 912. Wyoming Agricultural Experiment Station, 1994.



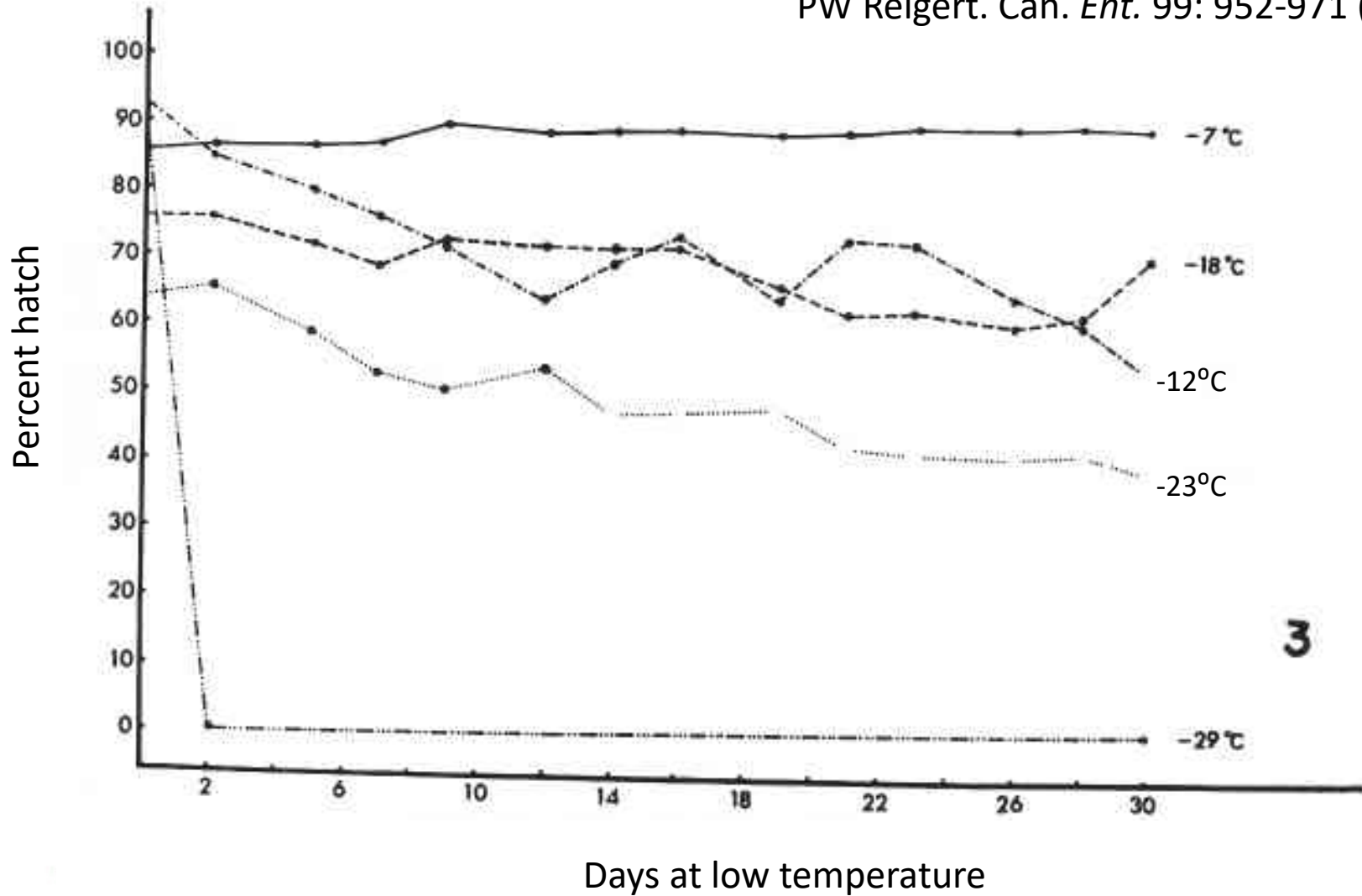
# Cold hardiness

- Migratory
  - Sig egg mortality at  $-15^{\circ}\text{C}$  (Mukerji & Braun, 1988)
  - Snow cover protects
    - Snow-free site  $-15.9^{\circ}\text{C}$  soil temp, below 20 cm of snow  $-5.2^{\circ}\text{C}$  (Mukerji (1987))
  - More advanced development, more hardy



# Cold hardiness - Clearwing

PW Reigert. *Can. Ent.* 99: 952-971 (1967)



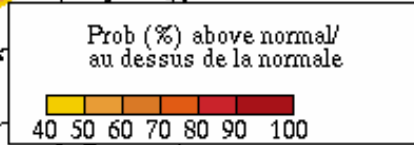
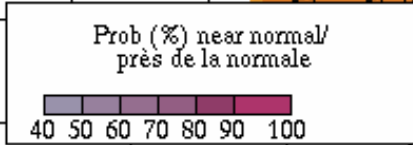
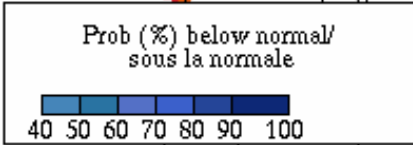
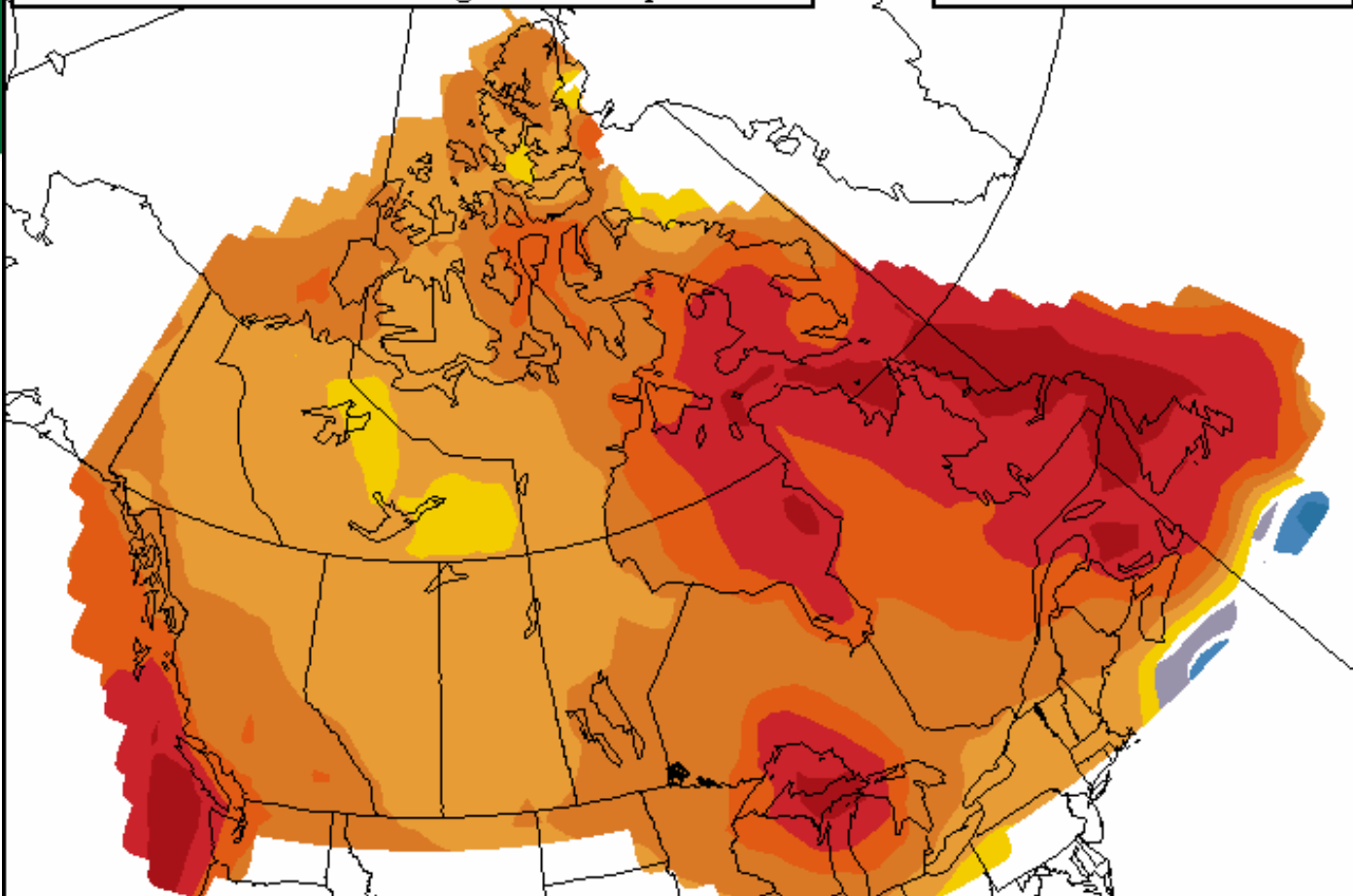
3



# Nymphs and high temperatures

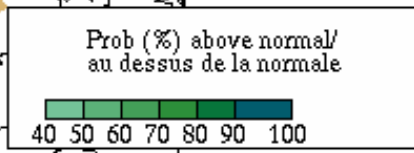
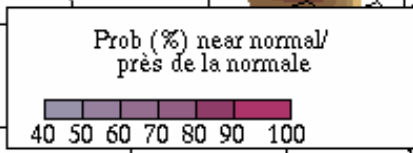
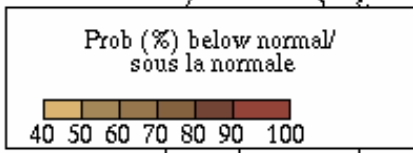
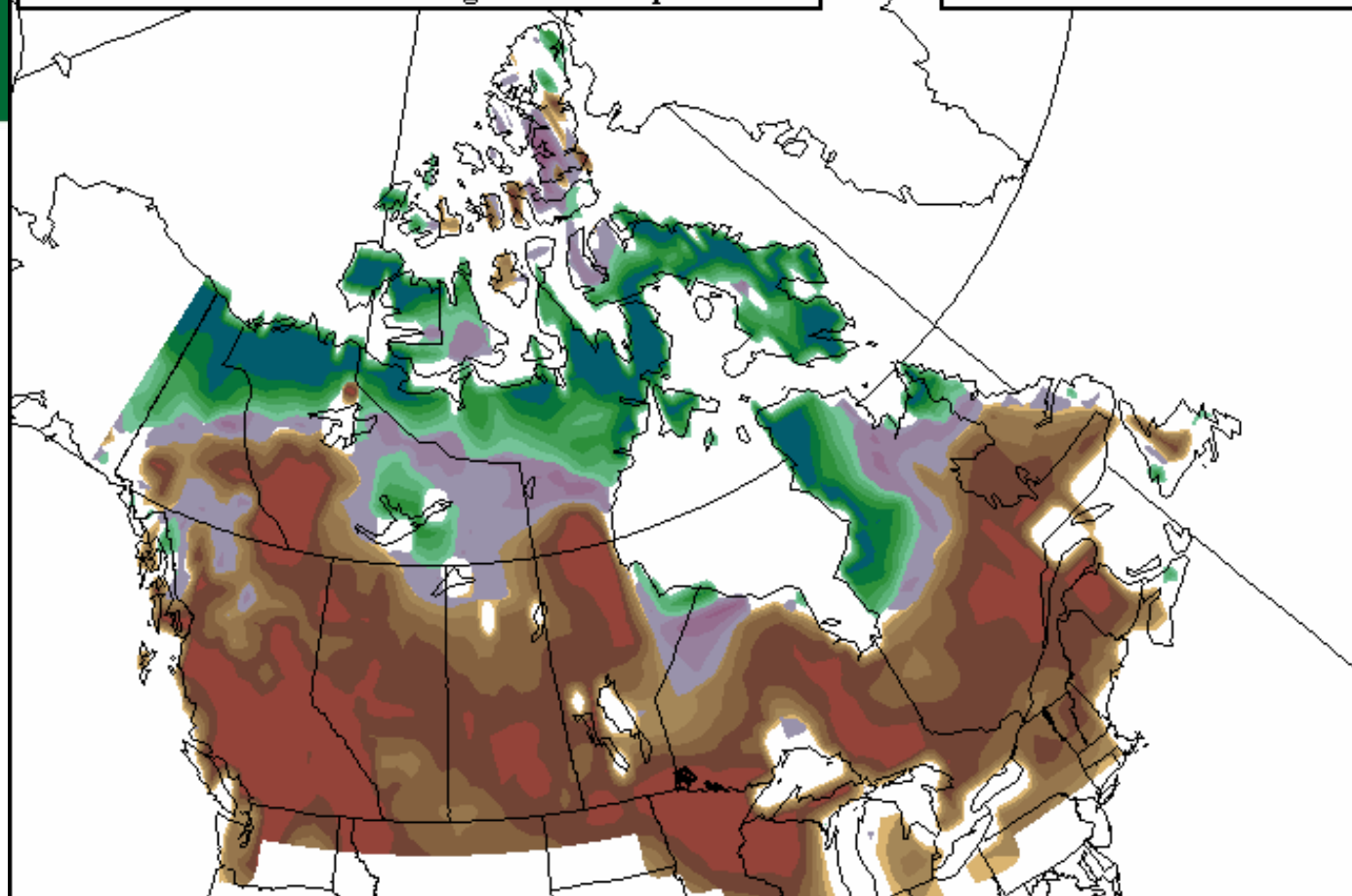
- Clearwing
  - Very warm soil surface temperatures cause difficulty in moulting, contribute to nymph mortality. Riegert, 1958
- Migratory
  - 50% nymph mortality with two consecutive days of +35°C (Pickford 1966)
  - Upper limit for nymphs +37°C. Parker, 1930
  - Adults can survive several weeks at +38°C. Parker, 1930





**Forecast probability of Temperature  
above, below and near normal (calibrated)**  
**Period: January-February-March 2024**  
 Based on 3 equiprobable categories  
 from 1991-2020 climatology

**Probabilités prévues de températures  
au-dessus, sous et près de la normale (calibrées)**  
**Période: janvier-février-mars 2024**  
 Basé sur 3 catégories équiprobables  
 de la climatologie 1991-2020



Forecast probability of snow water equivalent  
above, below and near normal (calibrated)  
**Period: January-February-March 2024**  
Based on 3 equiprobable categories  
from 1991-2020 climatology

Probabilités prévues de contenu en eau liquide  
au-dessus, sous et près de la normale (calibrées)  
**Période: janvier-février-mars 2024**  
Basé sur 3 catégories équiprobables  
de la climatologie 1991-2020



# Moisture, Temperature and Disease

- Fungal pathogens
  - *Beauveria bassiana*
  - Mortality increases with elevated RH
    - Marcandier and Khachatourians 1987. The Canadian Entomologist 119.10 901-907)
  - Basking increases internal temp to 38-42°C, reduces infection by half
    - Inglis, Johnson, and Goettel 1996 – Biological Control 7, 131-139)



A *Melanoplus* grasshopper killed by the *Beauveria bassiana* fungus.

# Moisture, Temperature and Disease

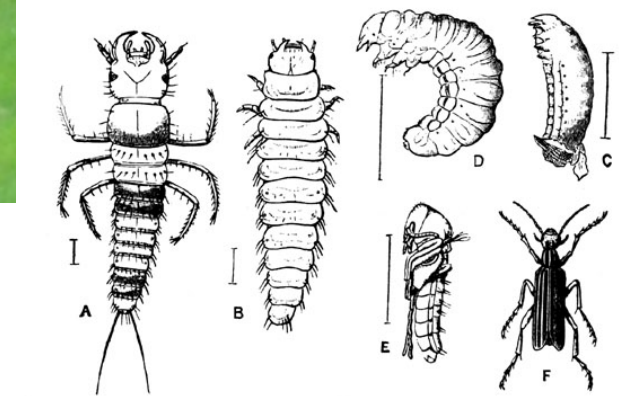
- Fungal pathogens
  - *Entomophthora gryllii*
  - Grasshopper outbreaks 1930's, late 1940's and early 1960's terminated by cool, wet weather and outbreaks of *E. gryllii*



# Natural Enemies



Blister beetle



Field cricket with nematomorph



*Mermis nigrescens*

# Natural Enemies

Photo: Bugguide.net



Tangleveined fly, *Neorhynchocephalus sackenii*  
Wind-distributed larvae attack mature nymphs

[saskatchewan.ca](http://saskatchewan.ca)

Servies, Tarn



Jessica Joachim  
PHOTOGRAPHER

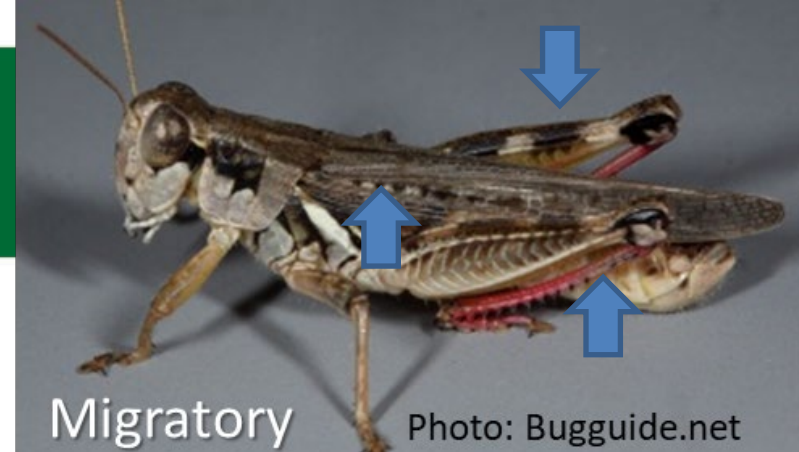
*Scelio* sp. Egg parasitoid

Photo: Kim Taylor



*Formica sanguinia*: Slave-making ants of *fusca* and *neogagates* species groups

# Migratory behaviour



- Migratory grasshopper

- Flight

- Some are short-distance, some long-distance flyers
    - Interpopulation differences in proportions
      - Heritable response to regional semi-arid conditions and patchy distribution of resources
    - Sustained flights longer than 10 hours documented\*
      - Flight speeds 16-20 km/hr
      - No known upper limit for flight duration
      - Reach heights where transport by wind currents occurs
    - Capable of flight at night but typically roost

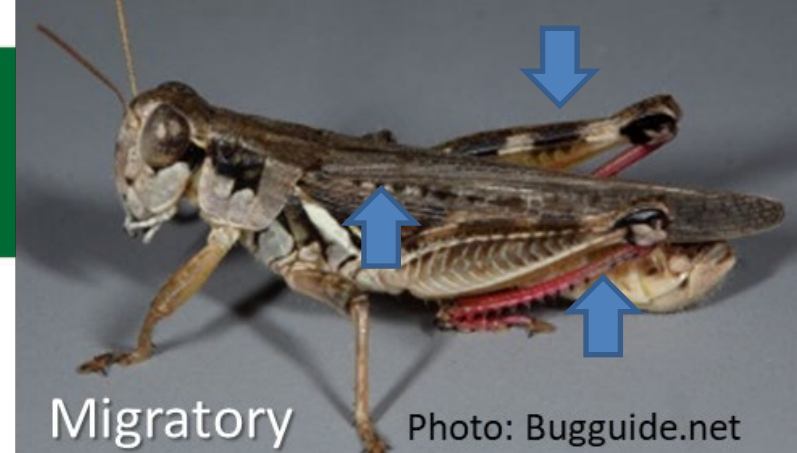
- Mass migration

- Common in *M. sanguinipes*, even in non-outbreak populations
    - Generally, 25-50 km/day

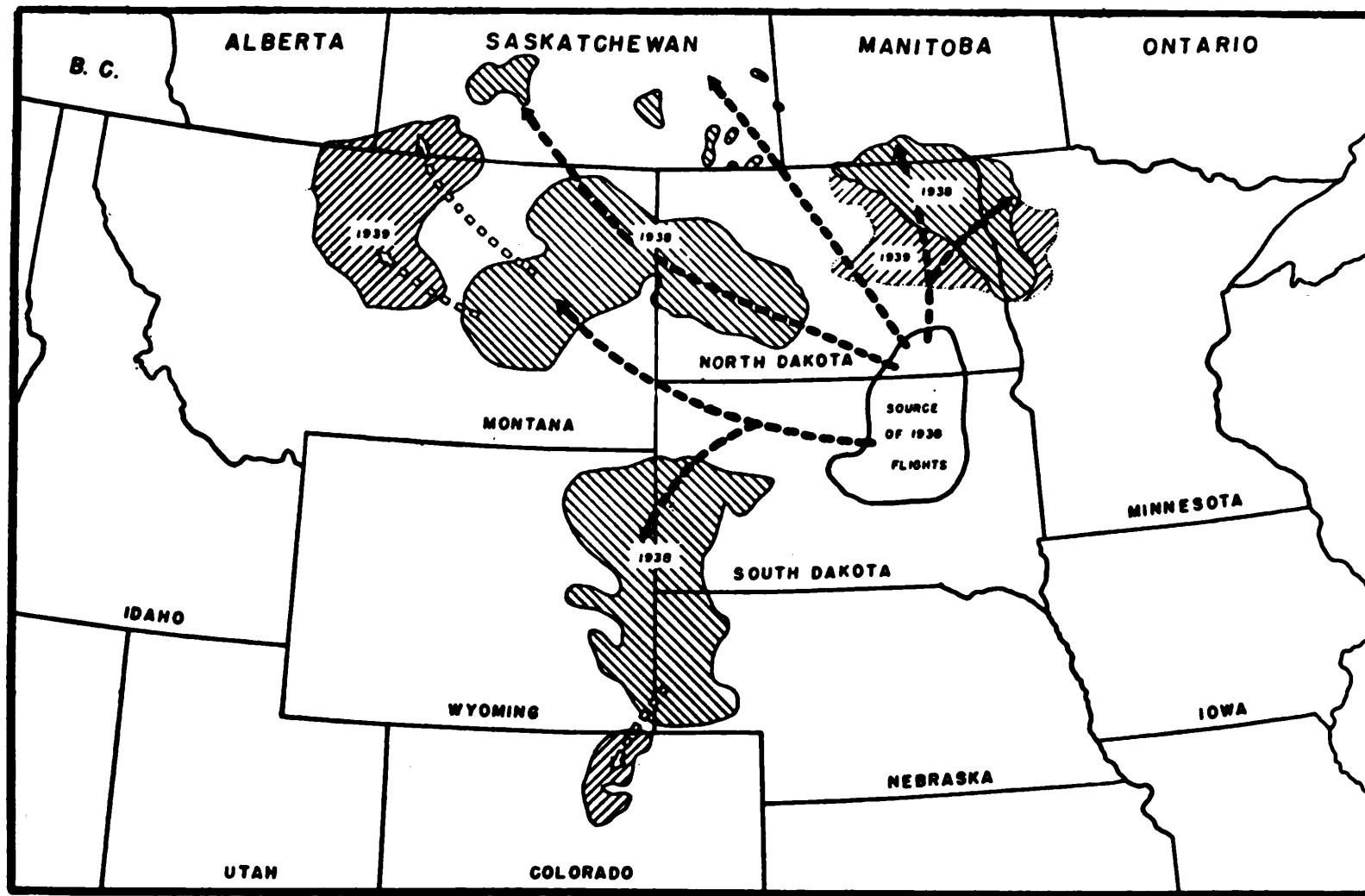
\*McAnelly, M. L., & Rankin, M. A. (1986). *The Biological Bulletin*, 170(3), 368-377.  
Riegert, P. W. (1962). *Nature*, 194(4835), 1298-1299.

# Migratory behaviour

- Migratory grasshopper
  - Mass migration
  - Common in *M. sanguinipes*, even in non-outbreak populations
    - Movement of large numbers from 260-925 km documented
  - Spectacular mass flights 1938, 1939, and 1940
    - Average of 106 km/day
    - Also, mass ground dispersal of nymphs







**AREAS OF HEAVIEST EGG LAYING**

1938 

1939 

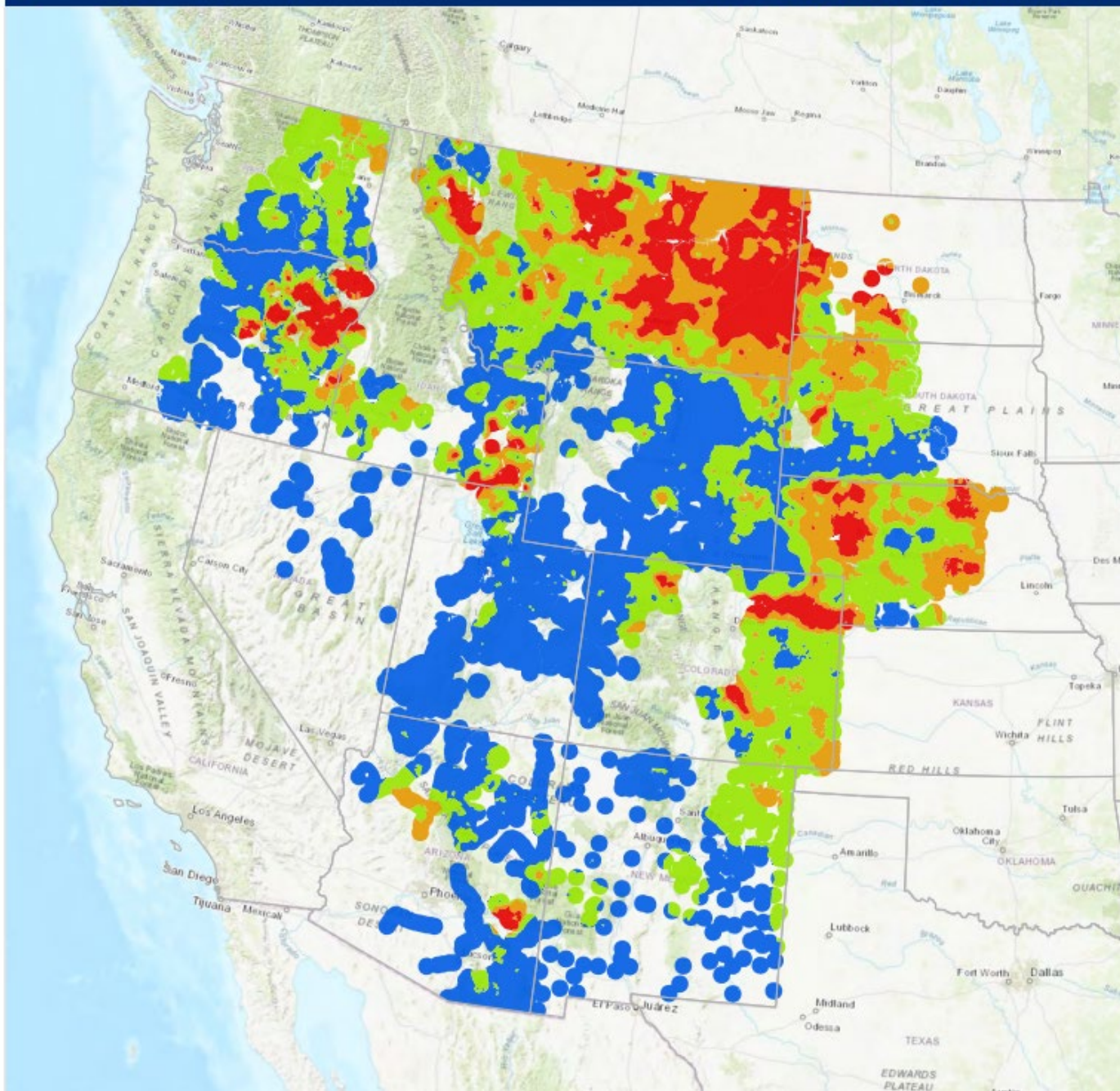
**GENERAL DIRECTION OF FLIGHTS**

1938 

1939 

**FIGURE 1.**—Main migration routes and areas of heaviest egg laying by *mexicanus* in 1938 and 1939.

Parker, J. R., Newton, R. C., & Shotwell, R. L. (1955). *Observations on mass flights and other activities of the migratory grasshopper* (No. 1109). US Department of Agriculture.



# Control products (consult product labels)

- Adults and mature nymphs
  - Coragen/Coragen MaX – chlorantraniliprole
  - Cygon 480-Ag, Lagon 480E, Diamante 4 – dimethoate
  - Eco Bran – carbaryl
  - Malathion 85E
  - Nolo Bait\* - spores of *Nosema (Paranosema) locustae*
  - Sevil XLR - carbaryl
- Nymphs
  - UP-Cyde 2.5 EC, Ship 250 EC – Cypermethrin
  - Decis 100 EC, Poleci 2.5 EC, Advantage Deltamethrin 5 EC – Deltamethrin
  - Silencer 120 EC, Zivata, Labamba, Matador – lambda-cyhalothrin\*

# Thresholds

- Always look for damage

Crop	Grasshopper stage	Threshold in field	Threshold in ditch
Cereals/Most crops	Nymphs	30-45/m <sup>2</sup>	50-75/m <sup>2</sup>
	5 <sup>th</sup> instar and adult	10-12/m <sup>2</sup>	21-40/m <sup>2</sup>
Canola/Soybean	Nymphs	30-45/m <sup>2</sup>	50-75/m <sup>2</sup>
	5 <sup>th</sup> instar and adult	12-14/m <sup>2</sup>	24-50/m <sup>2</sup>
Lentil in flower/Flax in boll	Nymphs	6-9/m <sup>2</sup>	unknown
	5 <sup>th</sup> instar and adult	2/m <sup>2</sup>	unknown
Range/pasture	Nymphs	45-60m <sup>2</sup>	unknown
	5 <sup>th</sup> instar and adult	15-20/m <sup>2</sup>	unknown

# Acknowledgments

- Association of Alberta Ag Fieldmen
- SCIC Adjusters and Summer Students
- Dr. Meghan Vankosky (AAFC)
- Shelley Barkley (AB Agriculture and Forestry)

# Questions?

