Seasonal distributions of economic pests occurring in alfalfa seed production on the Canadian prairies

Boyd Mori[1,2], Jennifer Otani[3] and Héctor Cárcamo[4]

[1]University of Alberta, [2]AAFC Saskatoon, [3]AAFC Beaverlodge, [4]AAFC Lethbridge

UNIVERSITY OF ALBERTA
FACULTY OF AGRICULTURAL, LIFE & ENVIRONMENTAL SCIENCES

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Photo: sticktoplantsee.com

AgriScience Program: Project

Enhancing turf and forage seed production in Western Canada: Subactivity 3

ALFALFA SEED COMMISSION ALBERTA

Peace Region Forage Seed Association

Saskatchewan Alfalfa Seed Producers Development Commission

Objectives

1. Monitor alfalfa seed production fields to determine the presence and abundance of important economic pests and their natural enemies

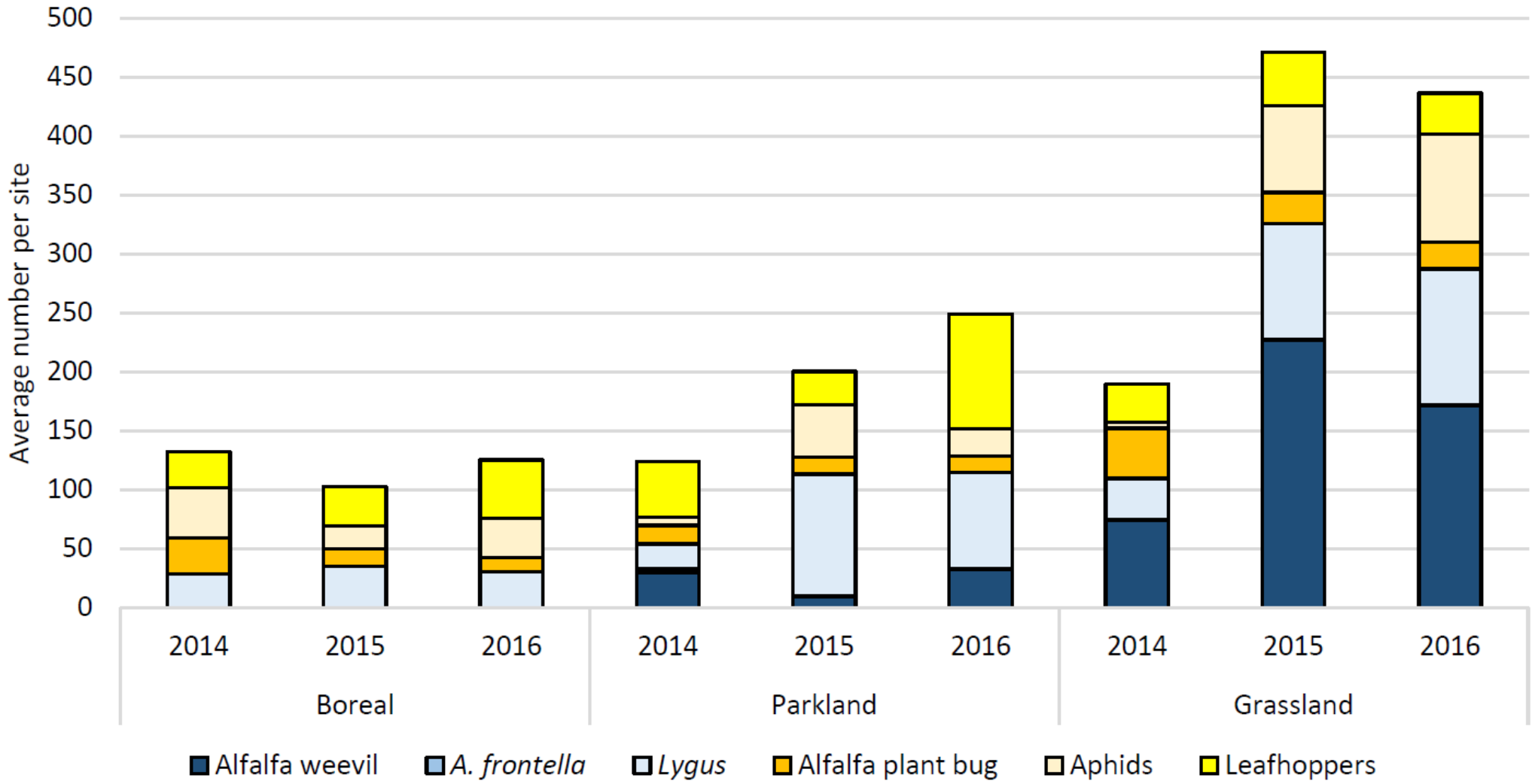


Figure 6. The average abundance of main pest insects per year of the alfalfa survey (2014-2016) in all 3 agro-ecoregions of Alberta.

Sim and Meers 2017

Objectives

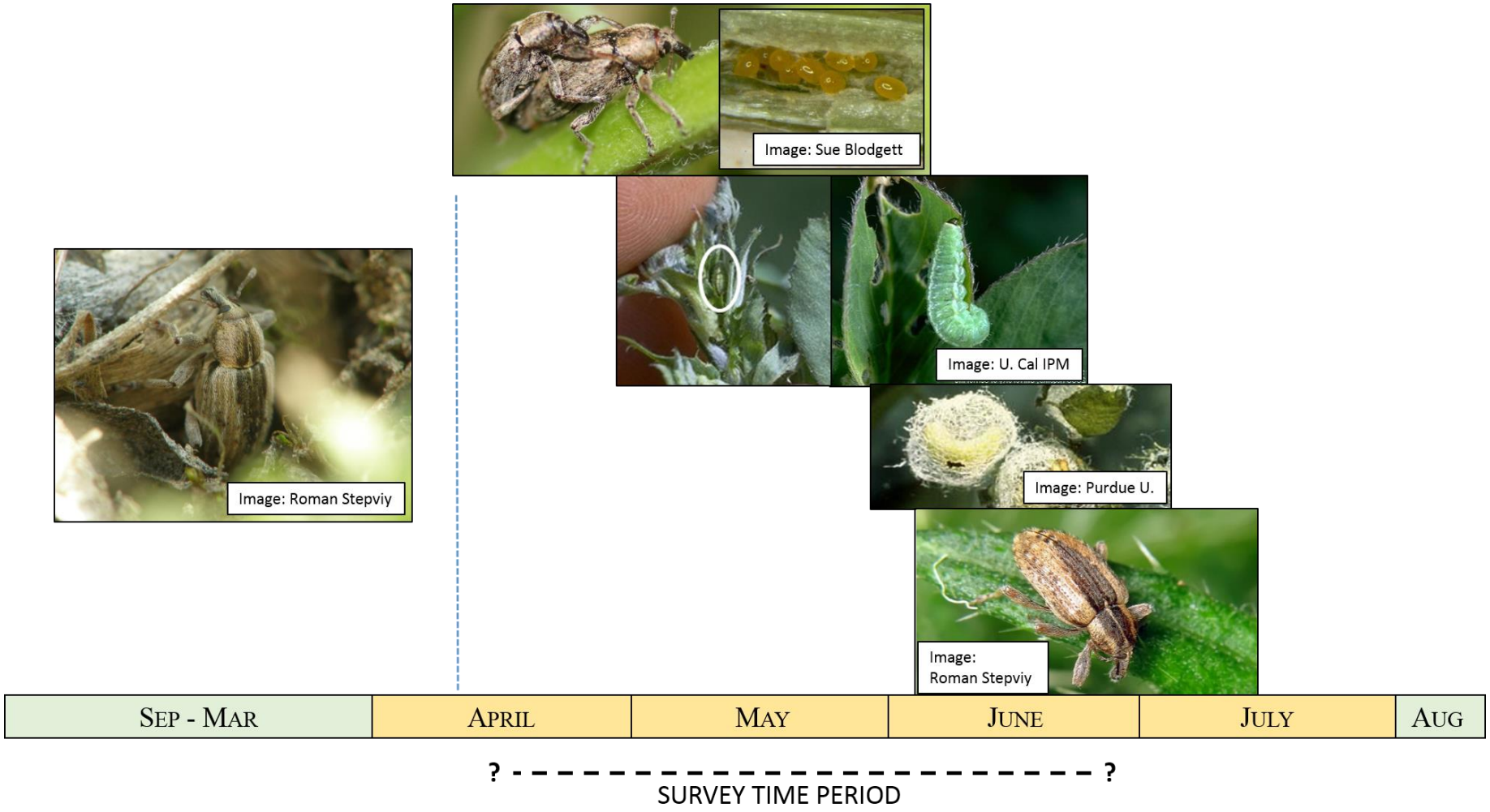
1. Monitor alfalfa seed production fields to determine the presence and abundance of important economic pests and their natural enemies

2. Characterize insecticide resistance in southern Alberta populations of alfalfa weevil

Alfalfa weevil, *Hypera postica*

Photo: Agriculturewire.com

Alfalfa weevil lifecycle



Lifecycle courtesy of Montana State University

Alfalfa weevil damage

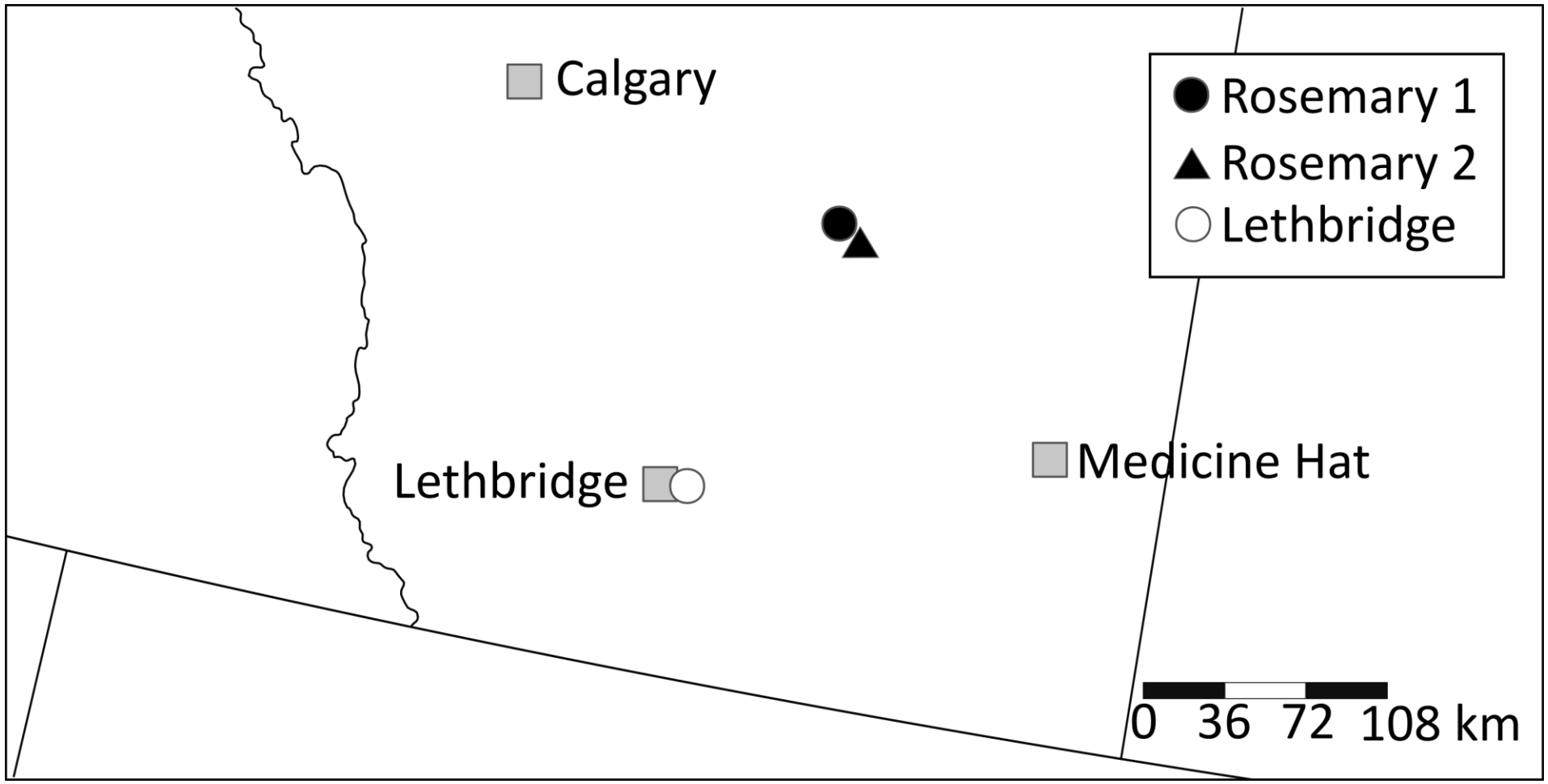
Photo: Whitney Cranshaw, Colorado State University

Background: Insecticide resistance

- Alfalfa weevil insecticide resistance in USA (1960s) (Adler and Blickenstaff 1964)
- Resistance to pyrethorids in California (2010s) (Orloff et al. 2016)
- Putative resistance to pyrethroids in southern Alberta (2015) (Meers 2015)

Photo: Larry Grenkow, AAFC

Alfalfa weevil adult collections: 2018



Black = putative resistance White = putative naïve

Adult resistance testing: methods

Insecticide Resistance Action Committee
Method #027

Insecticide: **Commercial Grade**: Deltamethrin

Treatment rates:

1. Control (0 g AI/ha)
2. Quarter (3.125 g AI/ha = 62.5 ml/ha)
3. Half (6.25 g AI/ha = 125 ml/ha)
4. Full* (12.5 g AI/ha = 250 ml/ha)

10 adult weevils added per vial

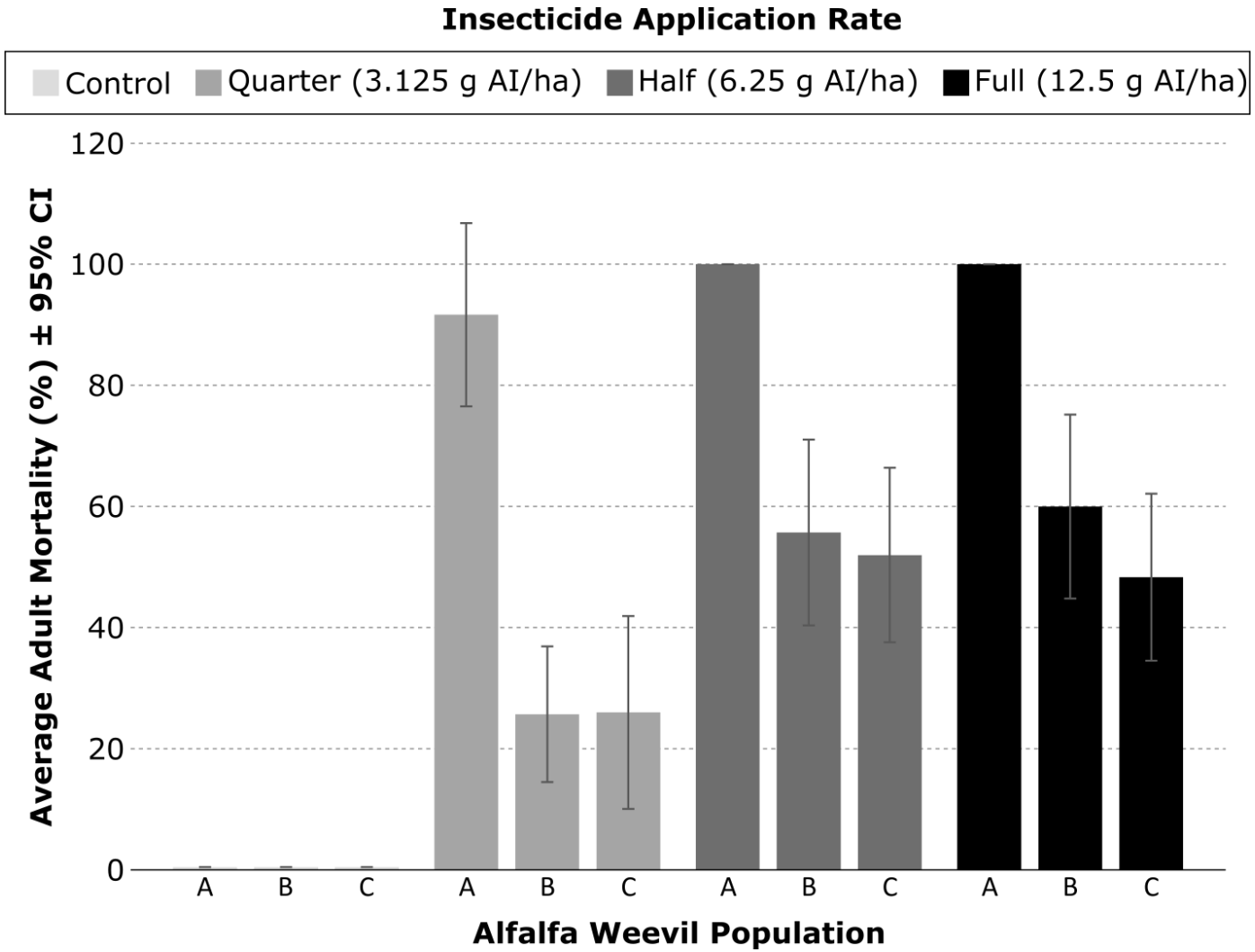
Replicates, n = 6-7 per treatment

* Recommended high rate in the Saskatchewan Crop Protection Guide

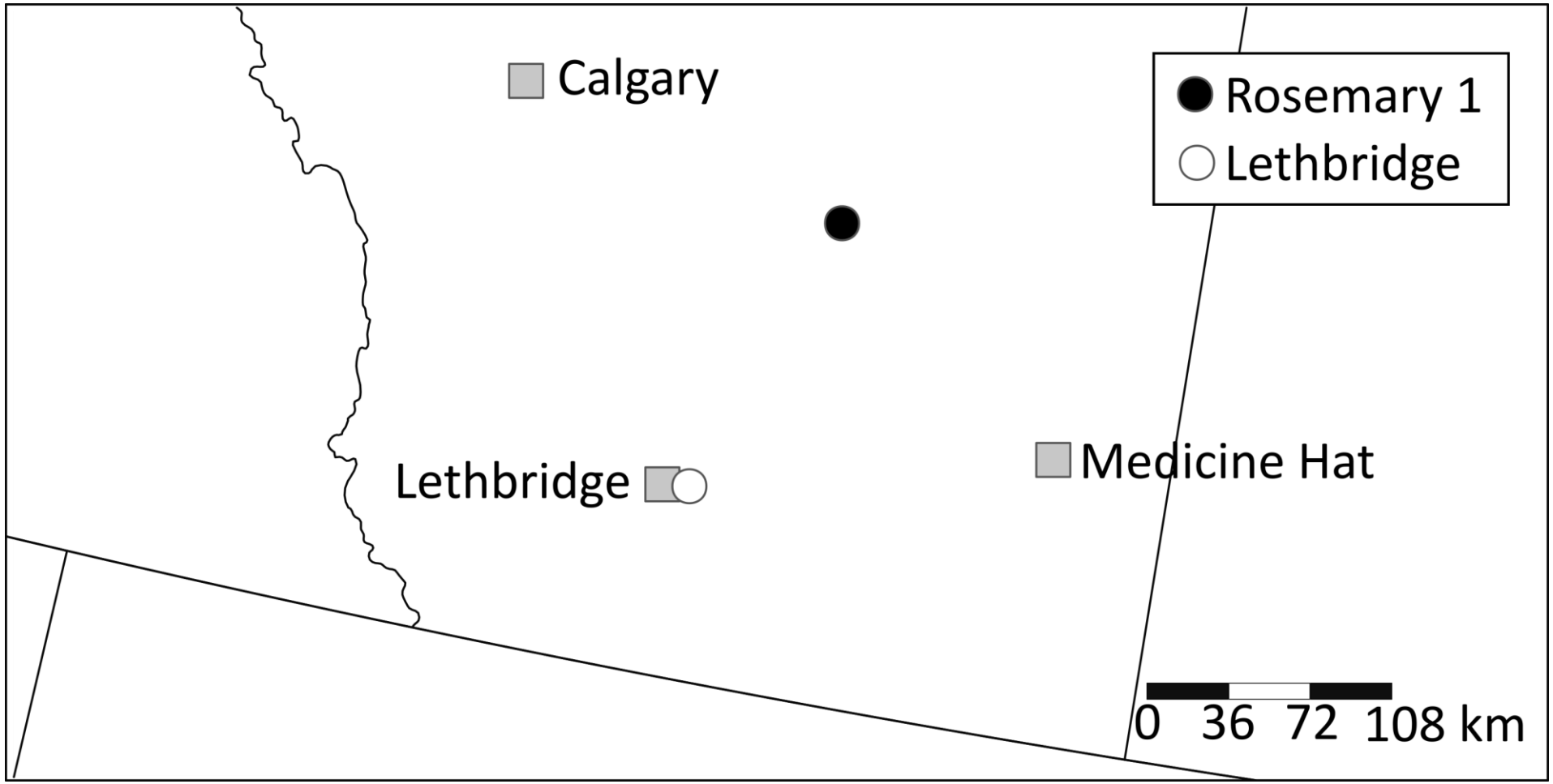
Adult resistance testing: results

Alfalfa weevil population

A = Lethbridge
B = Rosemary 1
C = Rosemary 2



Alfalfa weevil adult collections: 2019



Black = Resistant (2018) White = Naïve (2018)

Adult resistance testing: methods

Insecticide Resistance Action Committee
Method #027

Insecticide: **Technical Grade**: Deltamethrin

Treatment rates:

1.	Control	(0 g AI/ha)
2.	0.1 X	(1.25 g AI/ha)
3.	1 X *	(12.5 g AI/ha)
4.	10 X	(125 g AI/ha)
5.	100 X	(1250 g AI/ha)

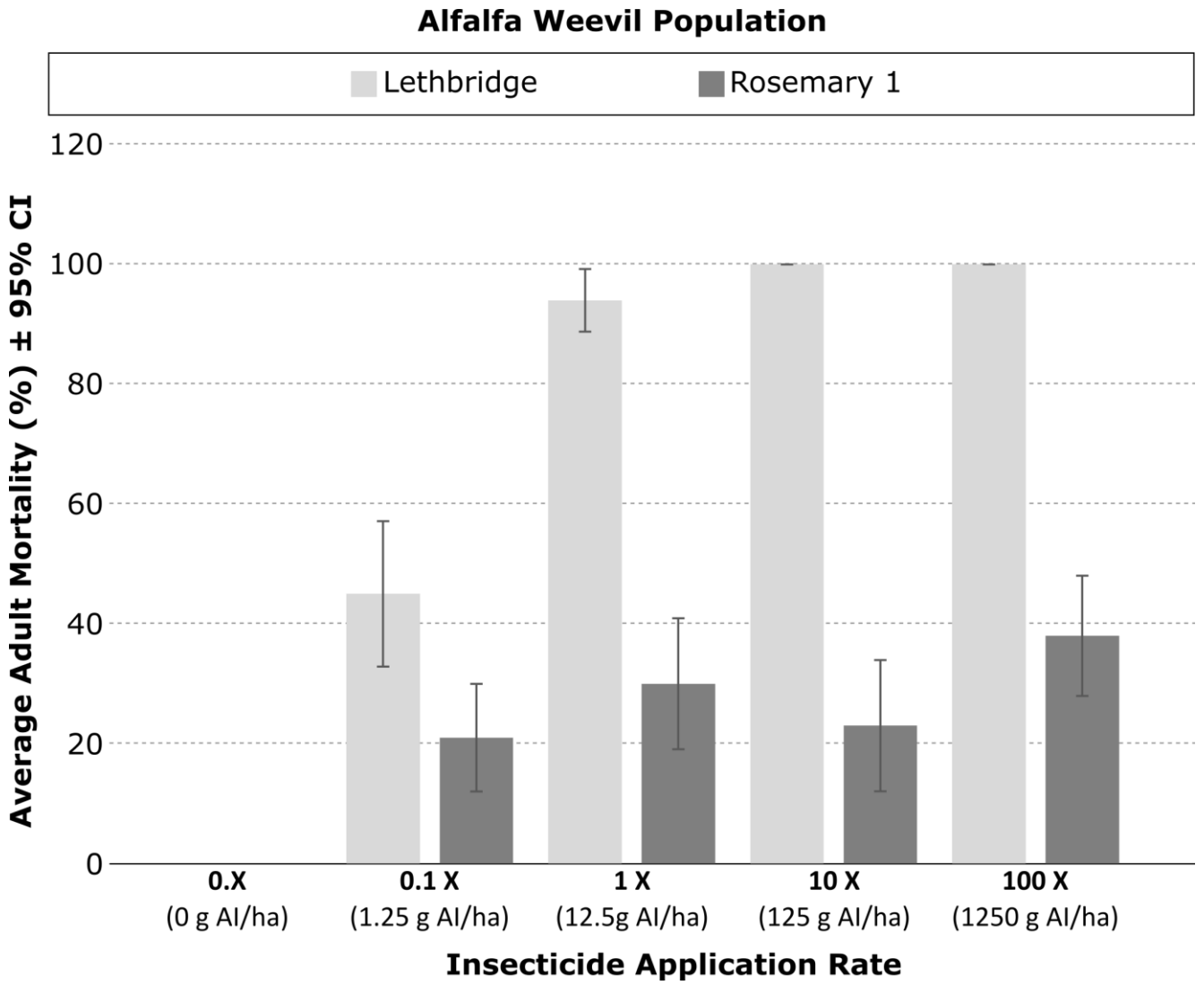
10 adult weevils added per vial

Replicates, n = 10 per treatment

* Recommended high rate in the Saskatchewan Crop Protection Guide

Adult resistance testing: results

* Technical grade: Deltamethrin



Interim conclusions: Insecticide resistance

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- Resistance is well established in Rosemary area
- Pyrethroid insecticides should be avoided in this region
- Preliminary work indicates organophosphates still effective
- Future work will explore the extent of resistance in Western Canada

Michelle Reid, MSc Student

Objectives

1. Monitor alfalfa seed production fields to determine the presence and abundance of important economic pests and their natural enemies

2. Characterize and determine the mechanisms of insecticide resistance in southern Alberta populations of alfalfa weevil

3. Determine alfalfa weevil parasitism levels through the development of a single-step multiplex PCR diagnostic assay

Alfalfa weevil biological control

Photo: David Ostermann, MB Agriculture

Alfalfa weevil parasitoids

Bathyplectes curculionis

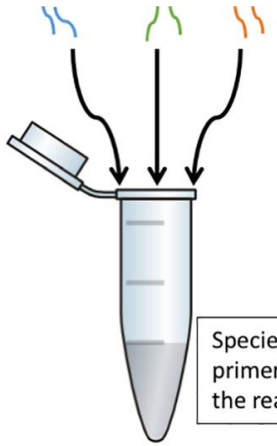
Oomyzus incertus

Photo: David Ostermann, MB Agriculture

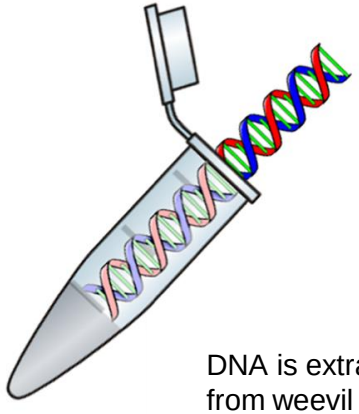
How can you identify parasitized larvae?

Photo: David Ostermann, MB Agriculture

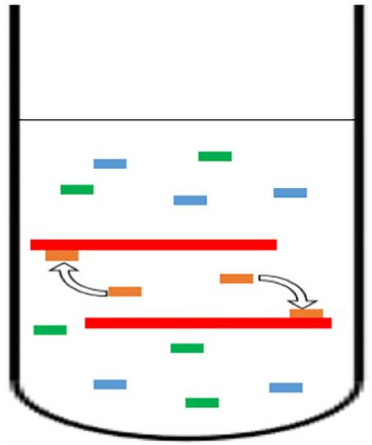
Identifying parasitized larvae



Species specific primers are added to the reaction mixture.

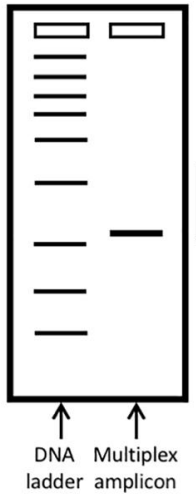


DNA is extracted from weevil larvae



One set of species specific primers will anneal to the DNA

Amplicon visualized on gel



DNA ladder

Multiplex amplicon

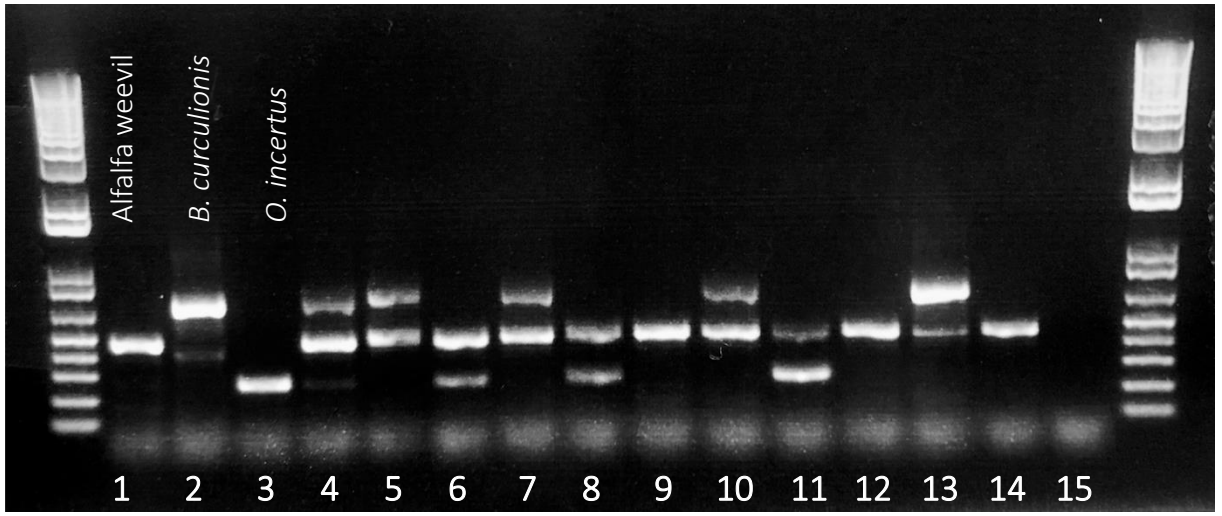
A 2% agarose gel is used to visualize the length of the resultant amplicon.

Any where from 1 to 3 bands will be present on the gel depending on parasitism

Modified from Ewart et al. 2018 – PLoS One doi.org/10.1371/journal.pone.0198565

Identifying parasitized larvae

Alfalfa weevil multiplex PCR



Lanes 1 to 3 – Voucher specimens
Lanes 4 to 14 – Alfalfa weevil larvae collected from Alberta 2019
Lane 15 – Negative control, no DNA

Mori et al. - unpublished

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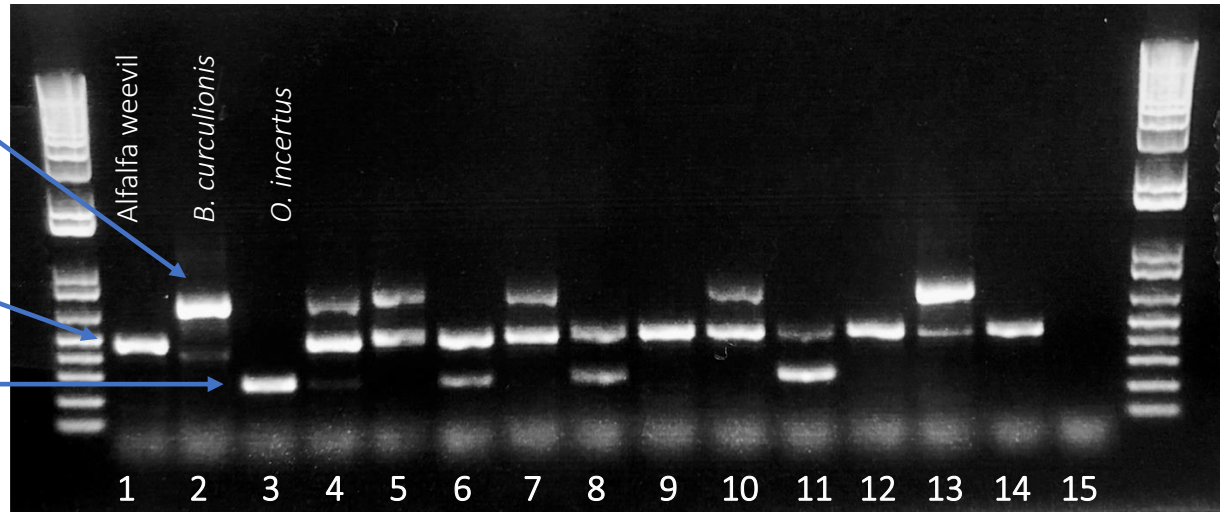

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- Multiplex PCR assay developed to test parasitism rates
- Future work will determine parasitism rates across sites in Western Canada
- One day a field-based assay?

Alfalfa weevil LAMP Assay?

Acknowledgements

Alberta Agriculture: Scott Meers, Shelley Barkley

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Questions?

Boyd Mori, PhD

Assistant Professor, Agricultural & Ecological Entomology

Department of Agricultural, Food and Nutritional Science

bmori@ualberta.ca

@boydmori

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