

# Biology & management of new pests of soybean

Robert Koch  
Associate Professor &  
Extension Entomologist



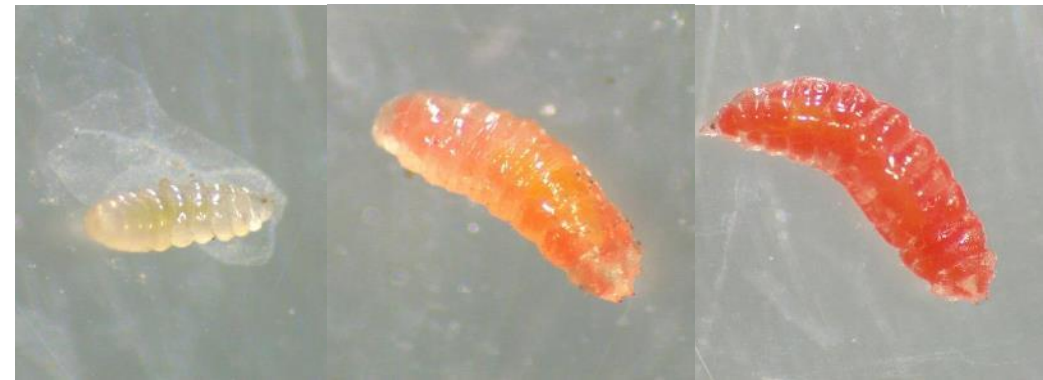
# SGM adults

- Tiny delicate flies with slender bodies
- Mottled wings
- Long legs banded with an alternating light and dark color pattern
- Unlikely to find adults

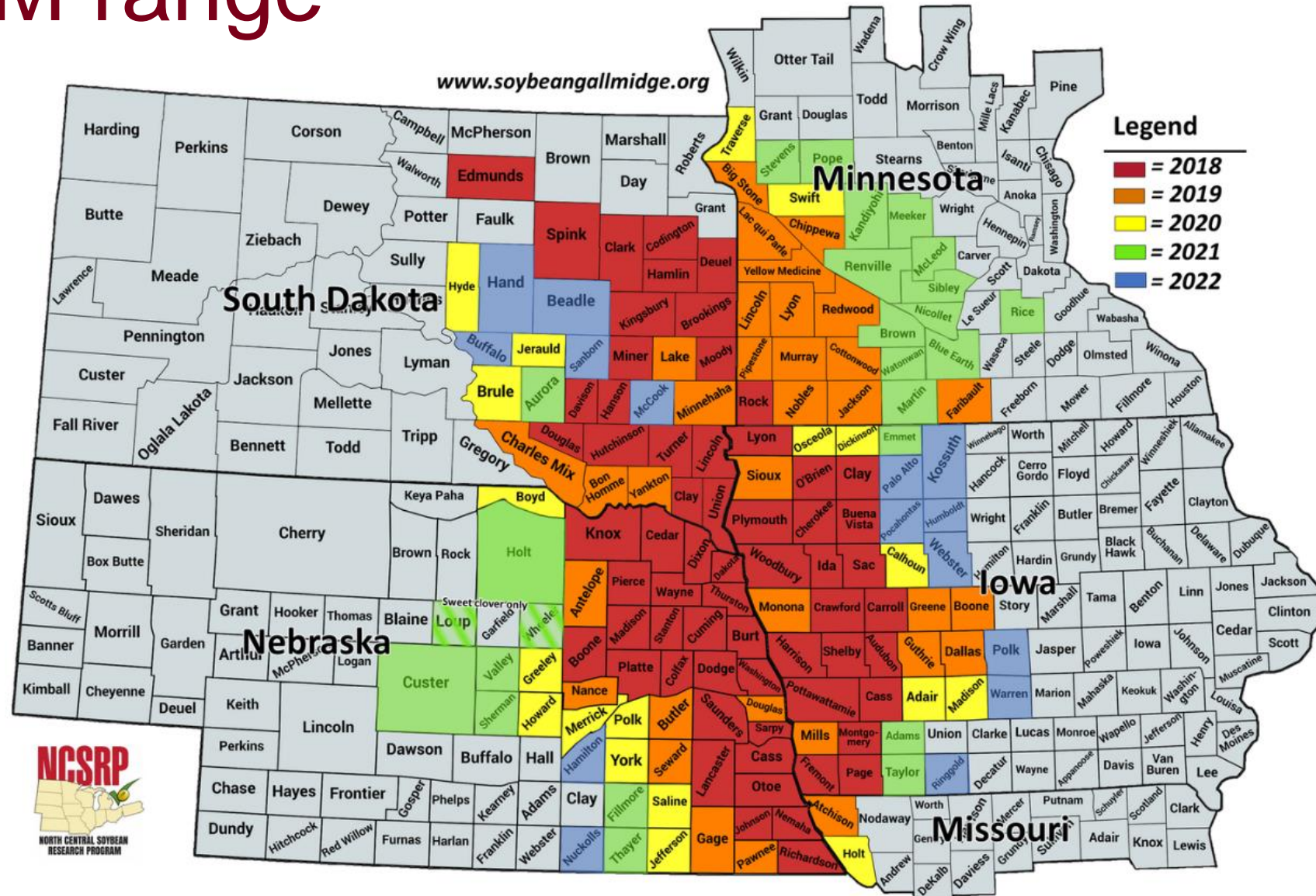


# SGM larvae

- Small legless, maggot-like larvae
- Clear to white-colored when young turning bright orange as they mature
- Up to 1/8 inch long

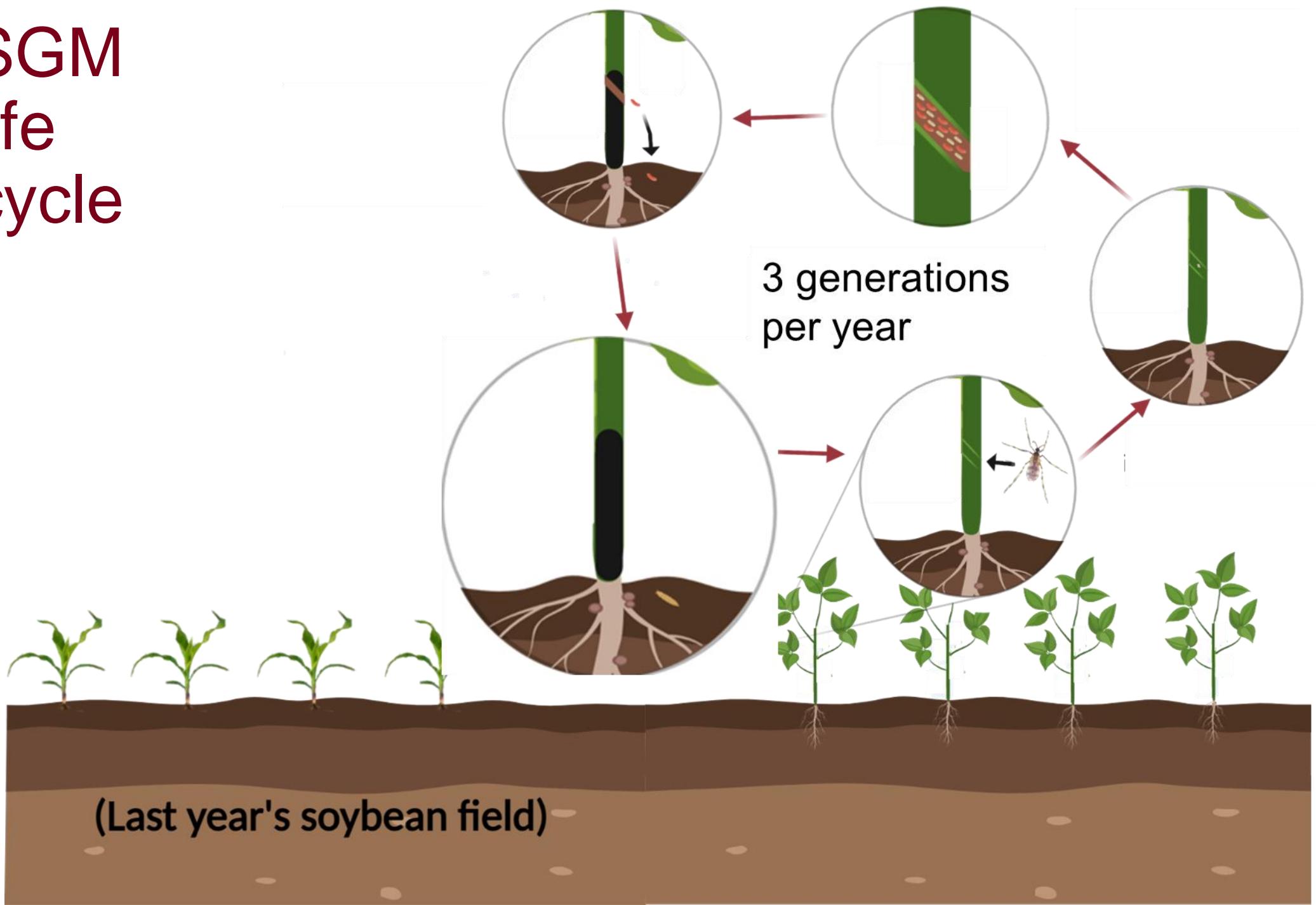


# SGM range

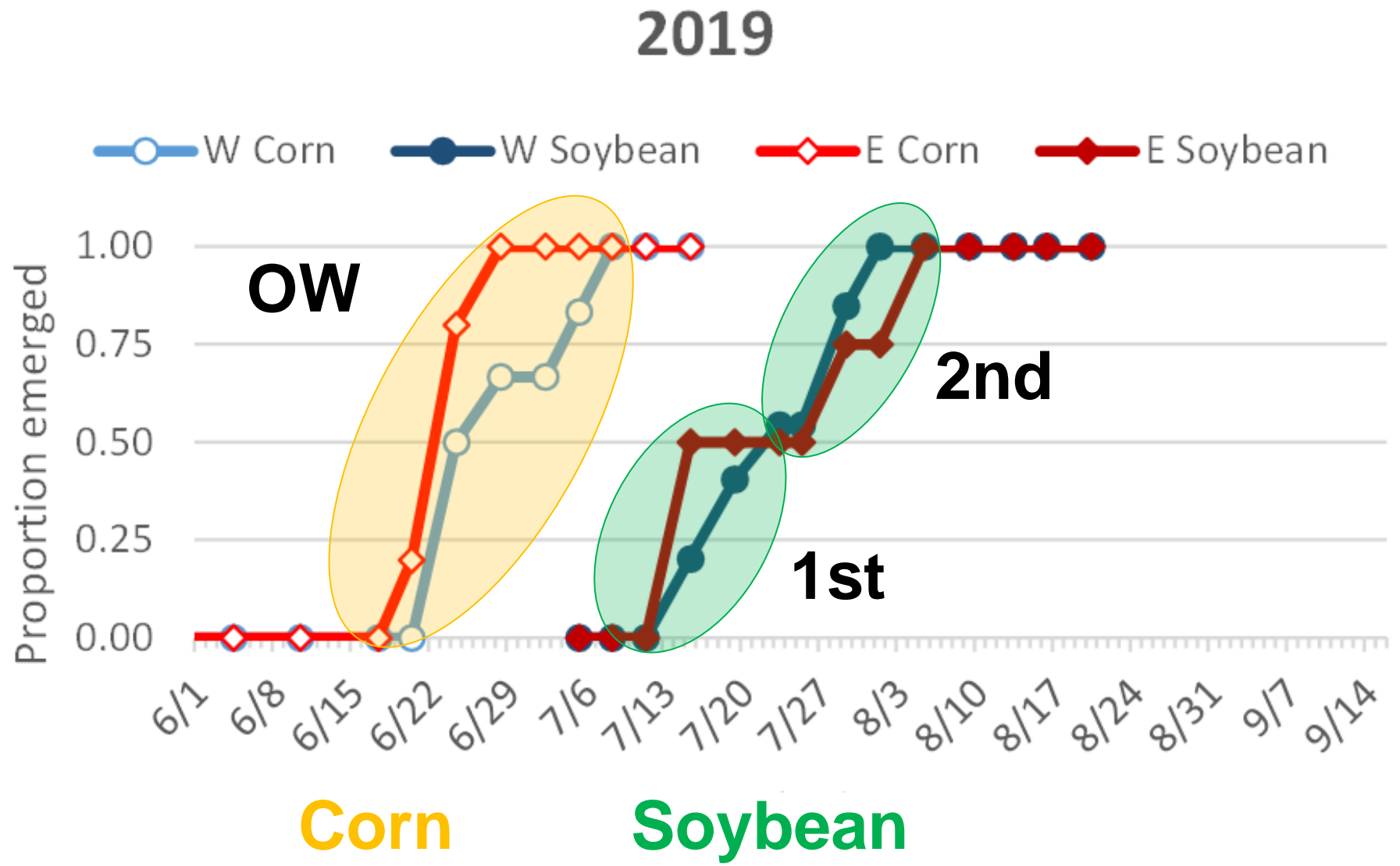


Unconfirmed report from Sargent Co., ND in 2022

# SGM life cycle



# Adult emergence in Luverne, MN



# Injury

- Infestations begin around V2-V3
- Occur under epidermis of stem at base of plant
- Darkened lesions on stem



E. Evan, UMN

# Injury

- Plant wilting, stem breakage & plant death
- Most severe on field edges
- Yield loss
  - Edges: up to 100%
  - Interior: 17-31%





# SGM host range

## Soybean



## Sweet clover



## Alfalfa

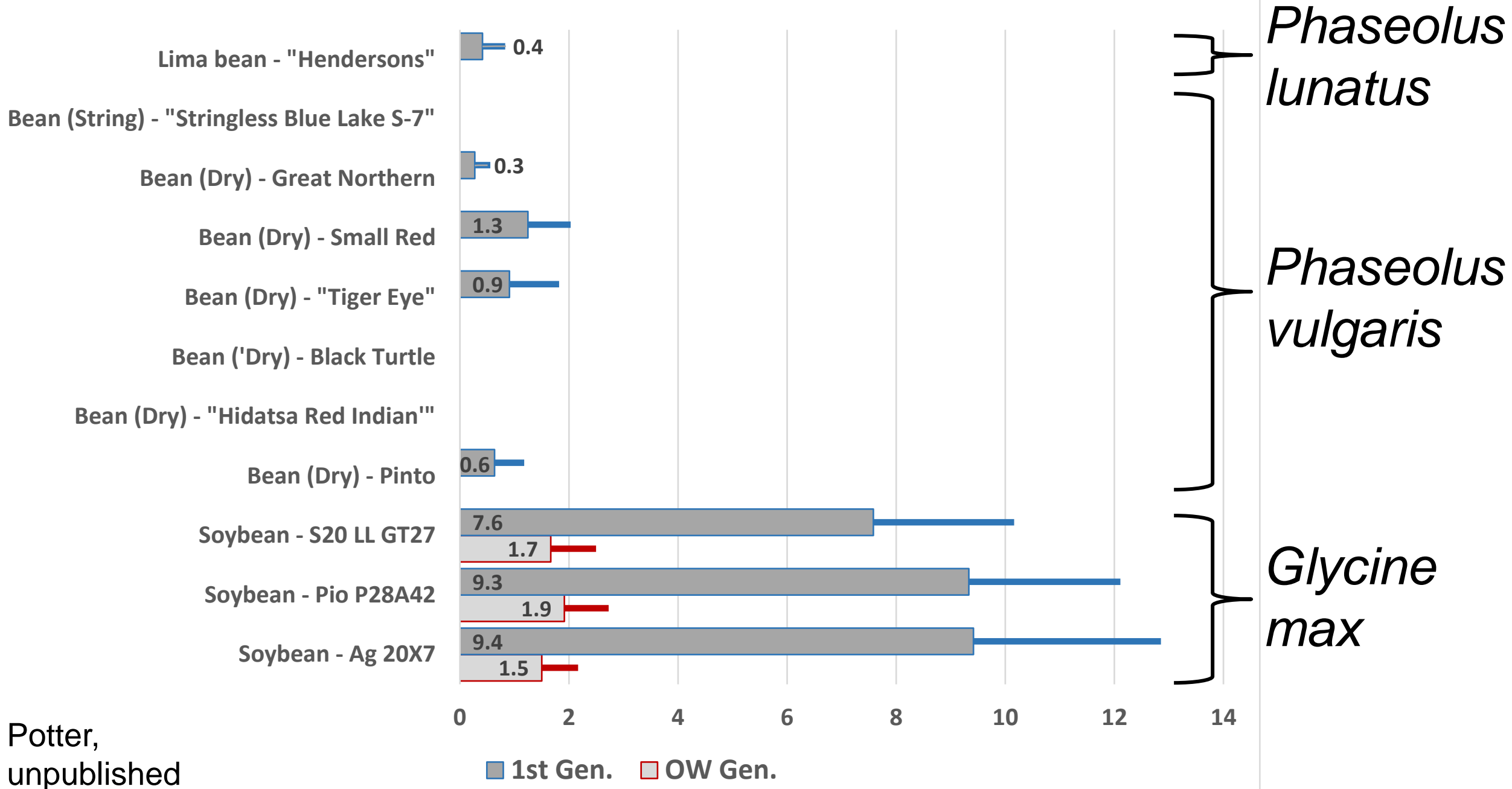


# Evaluating host range: Sentinel plants

- Potted legumes placed in field for 1 week
  - Overwintering adults
  - 1<sup>st</sup> generation adults
- Return plants to greenhouse for 1 week & dissect stems



# SGM Larvae/Plant (Luverne, MN 2022)



Potter,  
unpublished

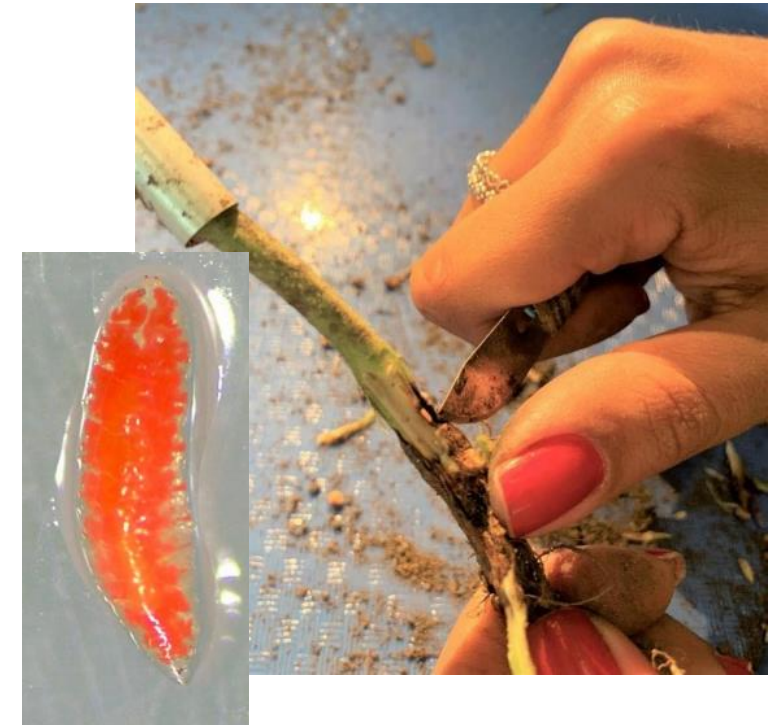
# Evaluating host range: Field survey

- SGM found in 2 dry bean (navy) fields in Lac Qui Parle County
- Infestation in navy bean lower than in adjacent soybean
  - Navy bean: 0-5% infested
  - Soybean: 15-40% infested



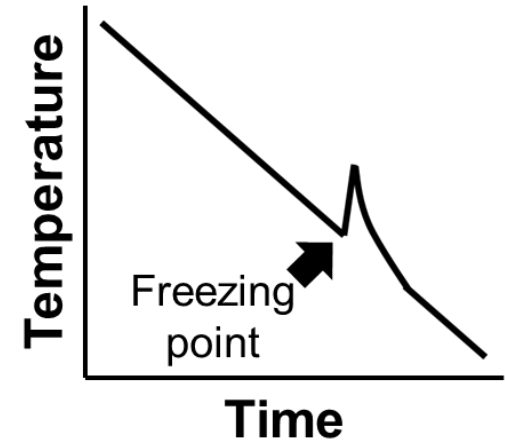
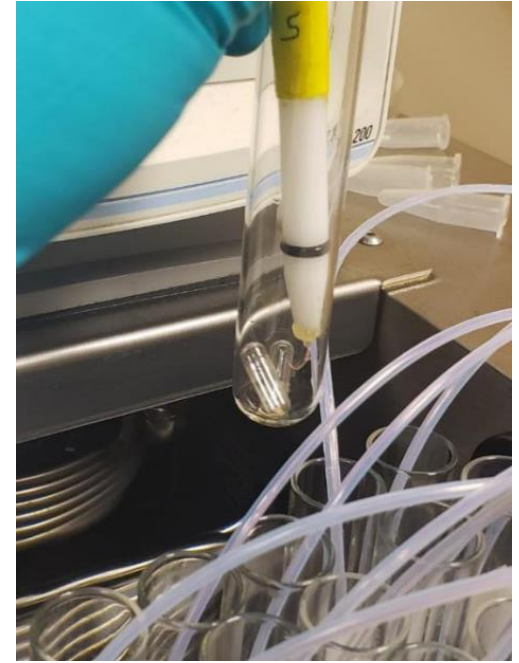
# Assessing cold tolerance

- Larvae collected from field (Sept. 2022)
- Placed in conditions to produce overwintering stage
- Placed at “fall/winter” conditions
  - 37°F with short day (10 h light)
  - 55°F with short day (10 h light)
- Maintained for 1 and 2 months

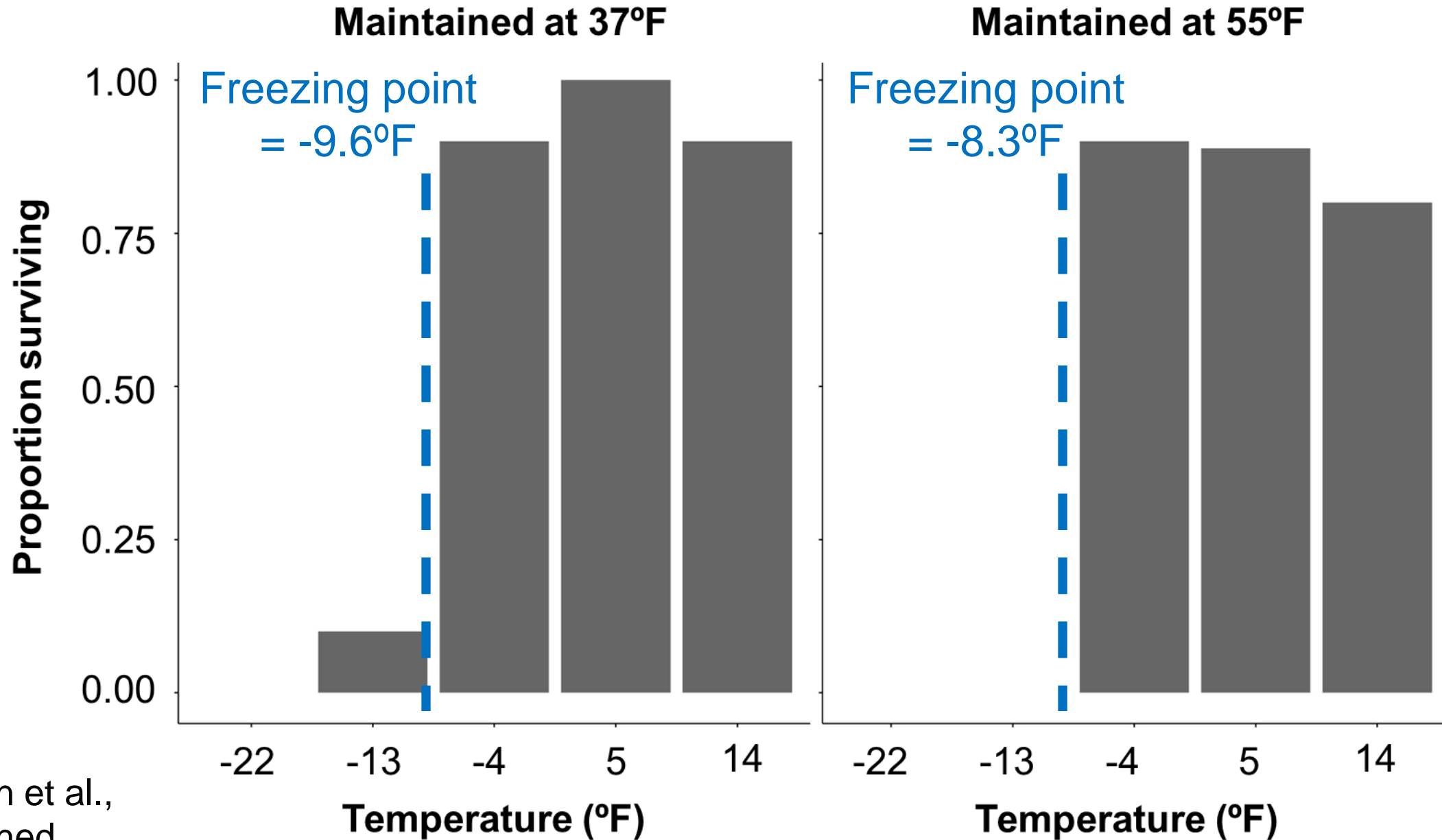


# Assessing cold tolerance

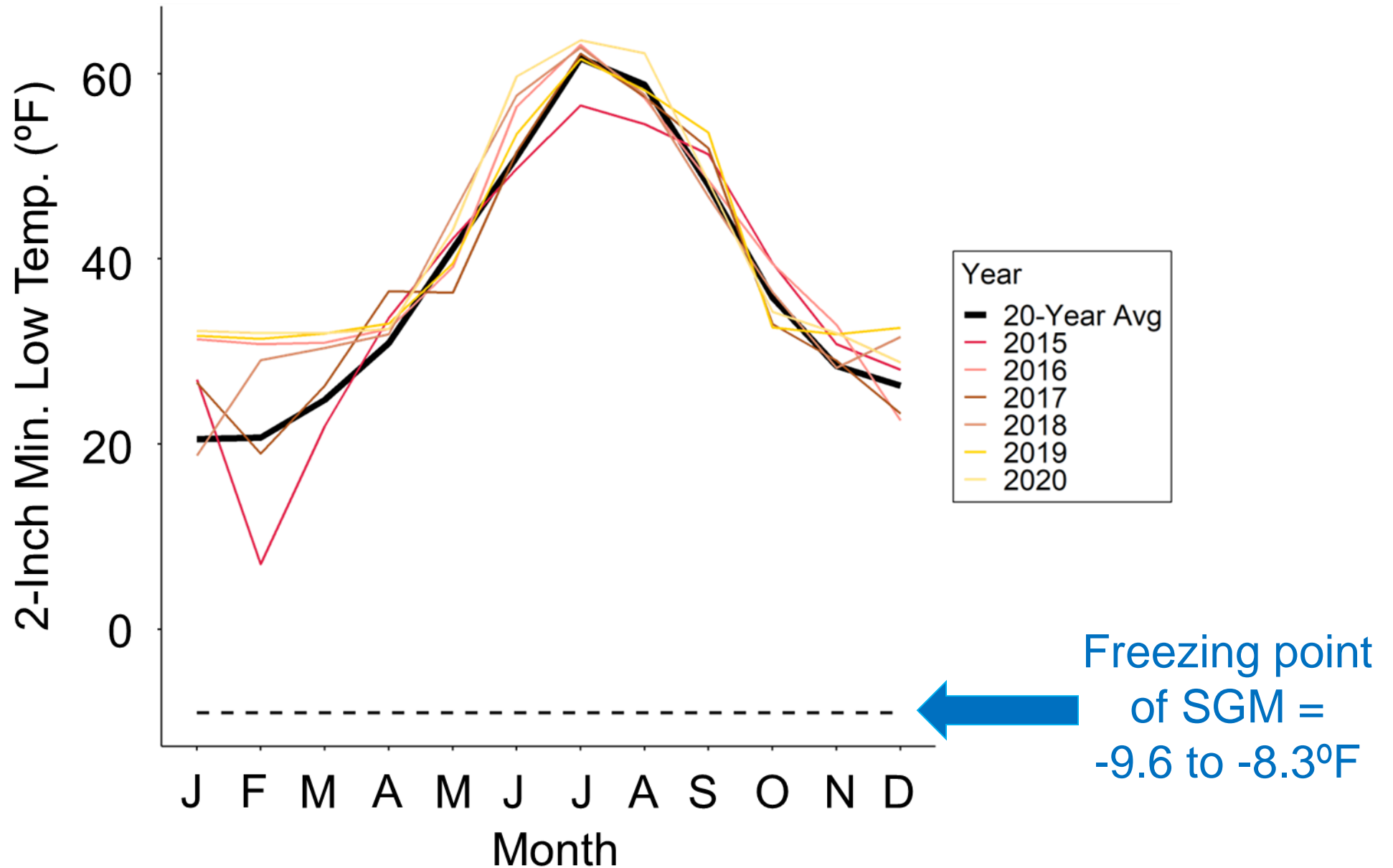
- Measures of cold tolerance
  - Lower lethal temperature
  - Supercooling point
    - Determining the freezing point



# Assessing cold tolerance



# Soil temperatures – Lamberton, MN





# Management

- Chemical control



shutterstock.com · 70623667



UNIVERSITY OF MINNESOTA  
**Driven to Discover**<sup>SM</sup>

# Foliar applications: Minnesota, 2020

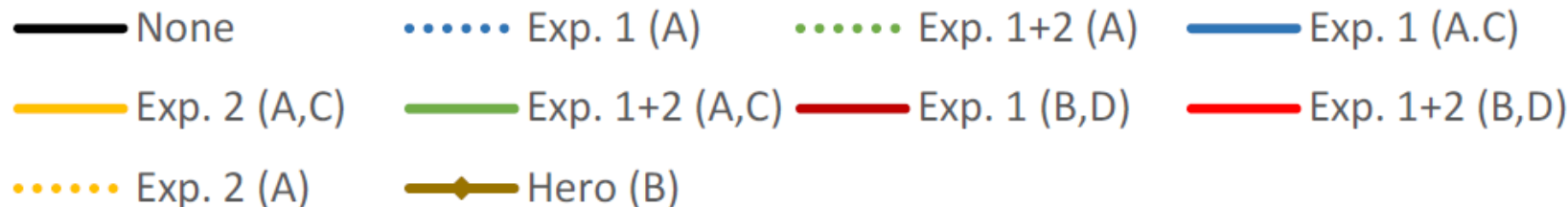
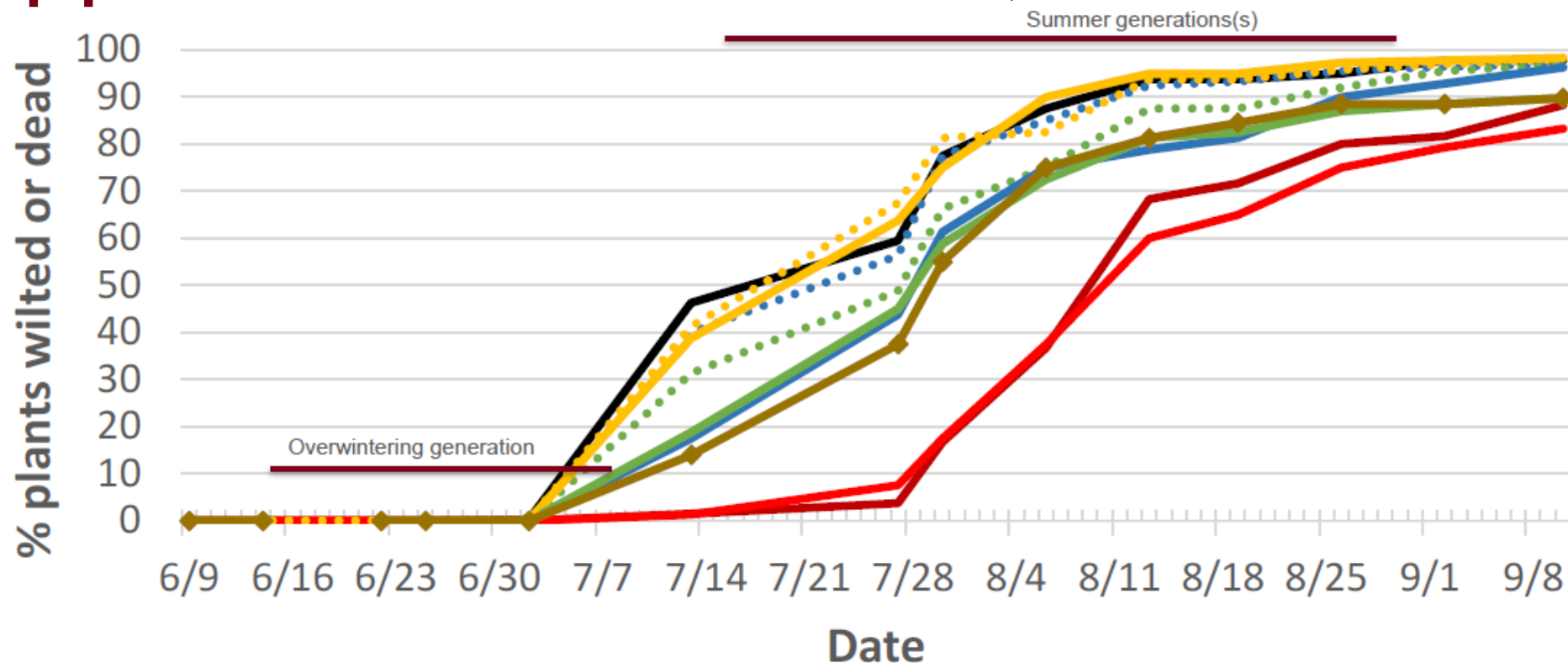
Application dates:

A=9 June,

B=19 June,

C=22 June,

D=2 July



# Management

- Chemical control
- Biological control



shutterstock.com · 70623667



UNIVERSITY OF MINNESOTA  
**Driven to Discover**<sup>SM</sup>

# Assessment of biological control

- Rock County, MN
  - 2021
  - 2022 (analysis underway)
- Two fields
- 8 locations per field
- June - August



# Parasitic wasps

- *Synopeas* sp. (Platygastridae)
  - >350 species worldwide
- No genetic match
- No morphological match
- **New species!**

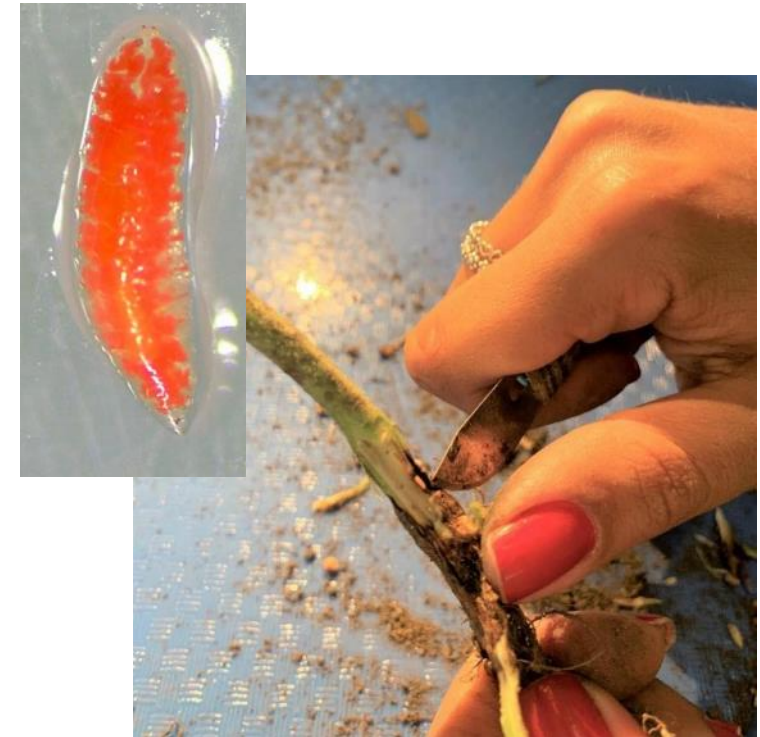


# Parasitic wasps

Rearing insects from field-collected stems

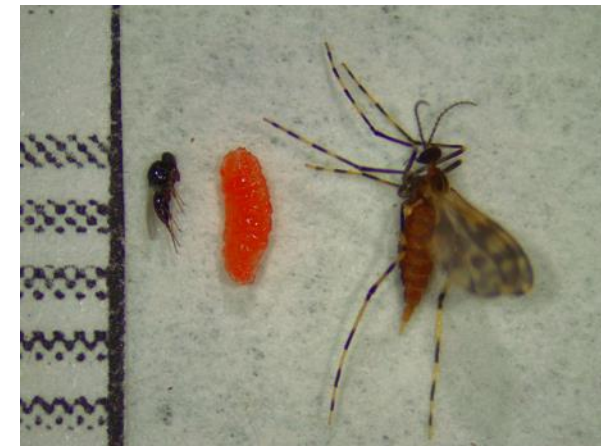
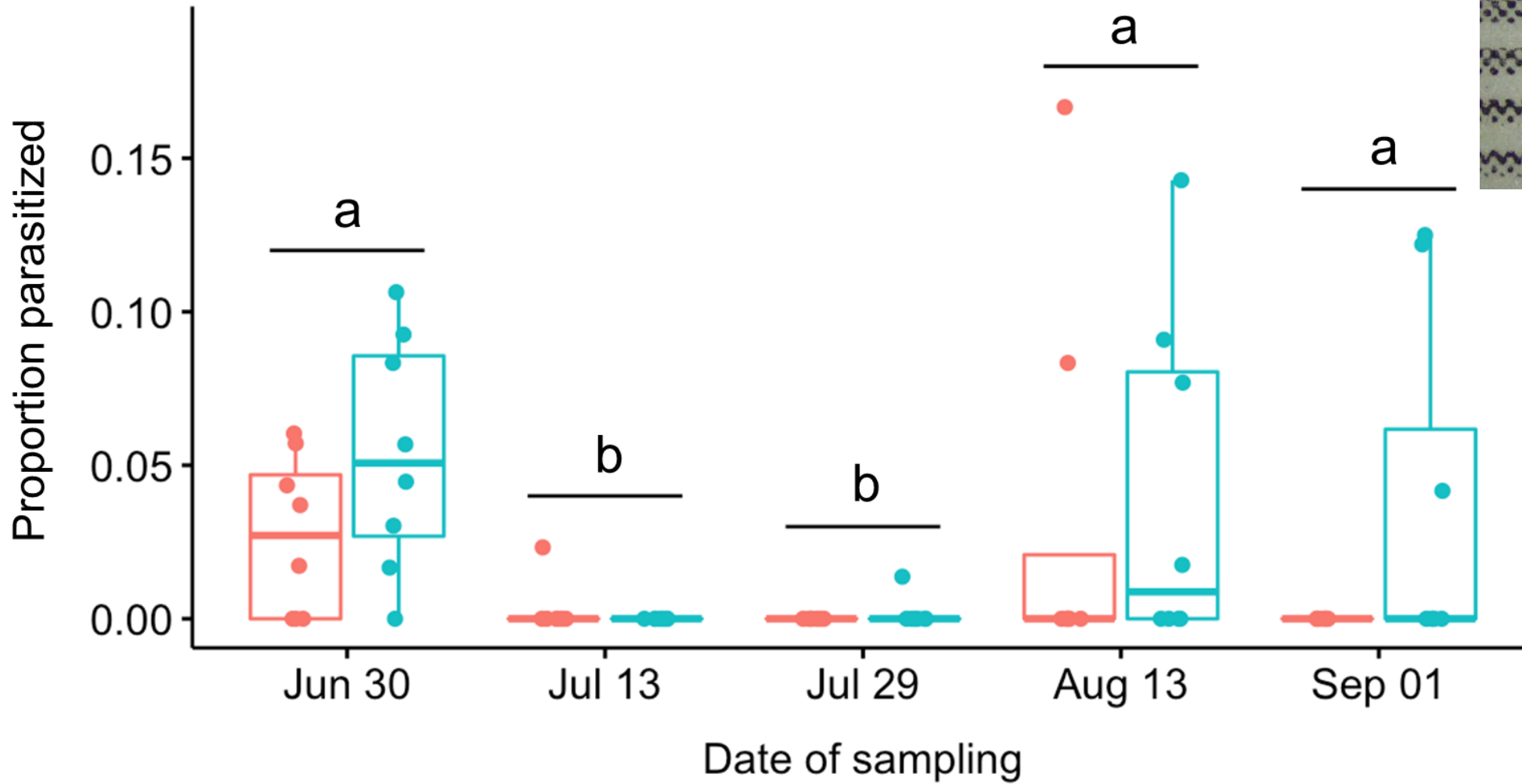


Molecular assessment of parasitism



# 2021

Emergence cage Molecular

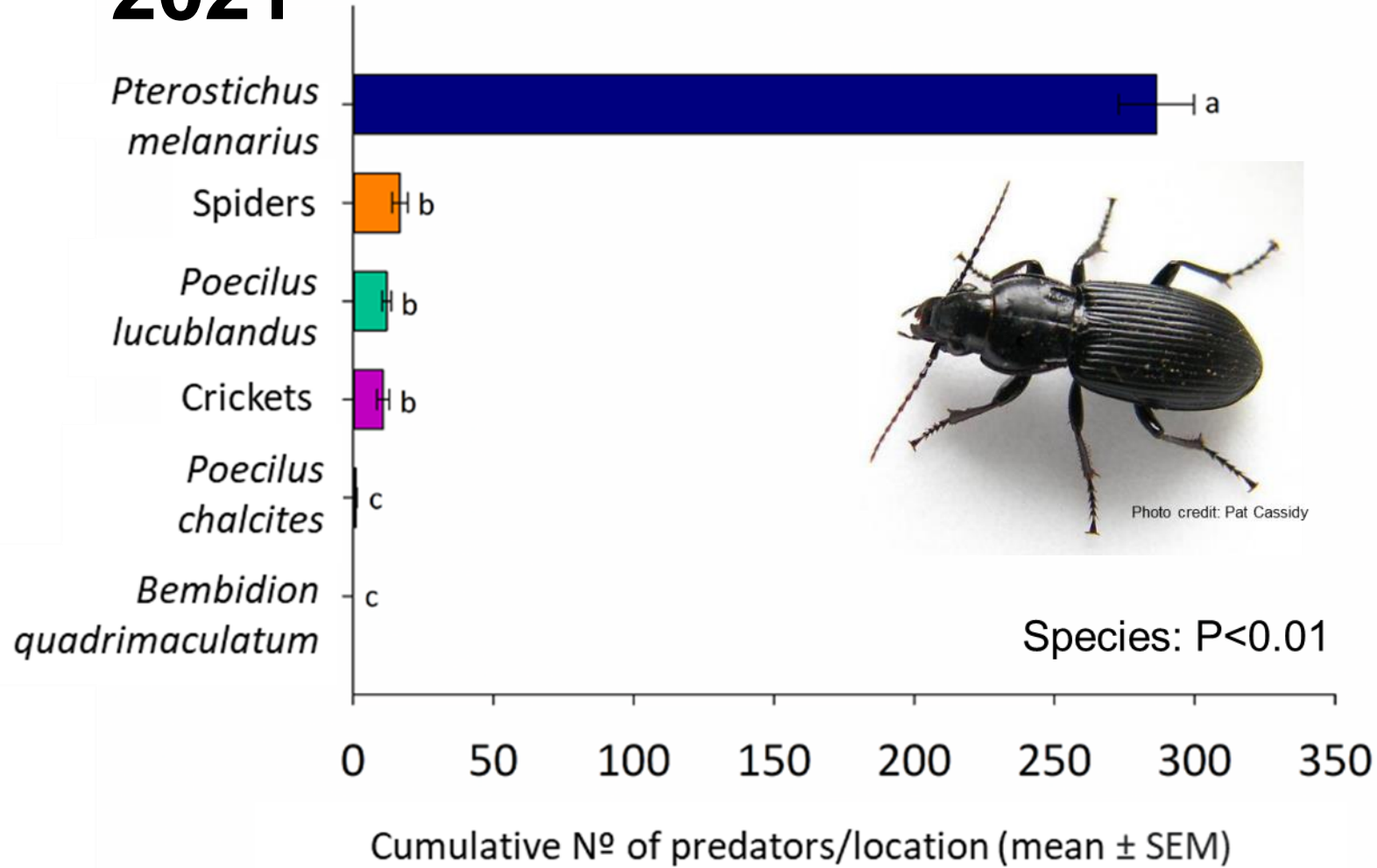


Method:  $P=0.002$   
Date:  $P<0.001$



# Ground-dwelling predators

## 2021





# Predation assay

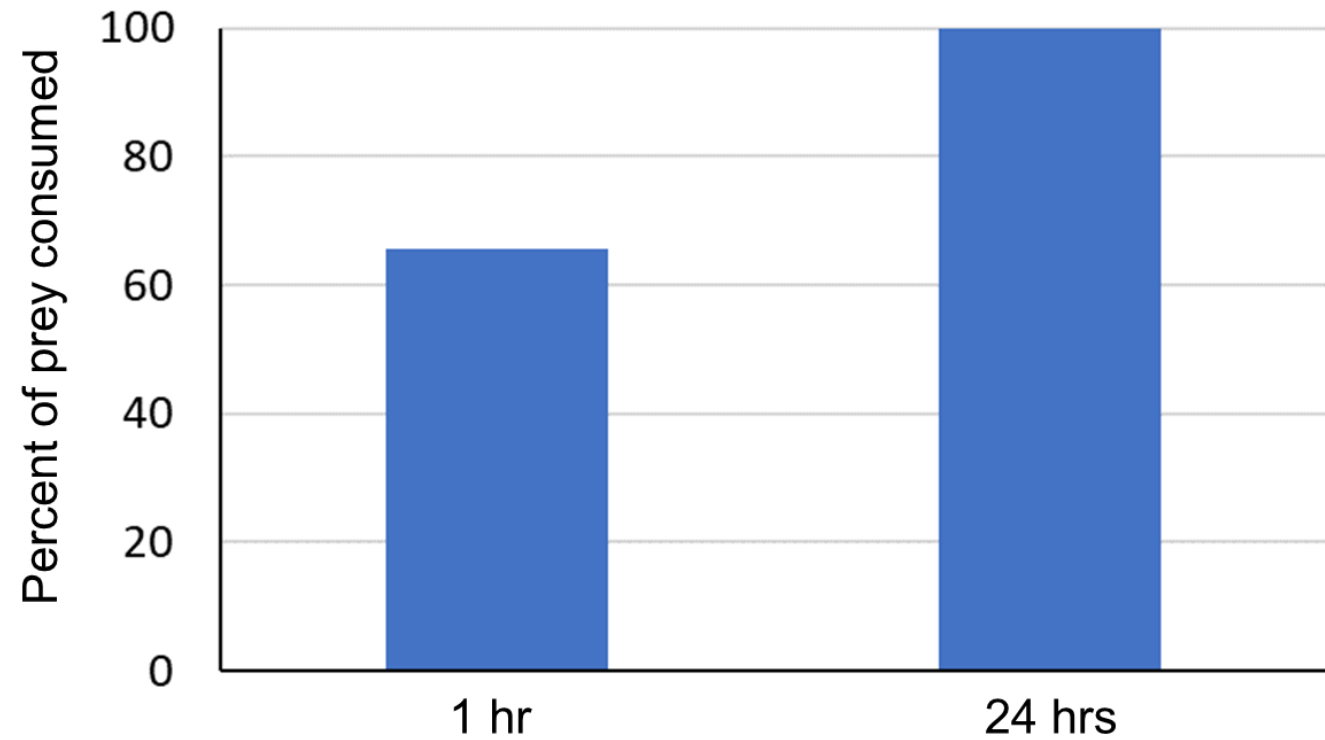
- 1 predator +  
7 SGM larvae per dish
- 9 replications
- 24 hours

*Pterostichus melanarius*



UNIVERSITY OF MINNESOTA  
Driven to Discover<sup>SM</sup>

# Predation assay



# Summary - SGM

- SGM is a new threat to MN soybean, but limited geography
- Infestations most severe on field edges near previous year's soybean
- Look for:
  - lesions at base of plants
  - orange larvae
  - wilting, lodged & dead plants



# Summary - SGM

- SGM appear very cold hardy
- Chemical control inconsistent & generally low effectiveness
- Biological control promising with several predators & a new parasitic wasp



# Soybean tentiform leafminer

- *Macrosaccus morrisella*
- Québec, Canada
  - 2016, 2019 & 2021
- Minnesota, USA
  - 2021: Saint Paul & Rosemount



Québec

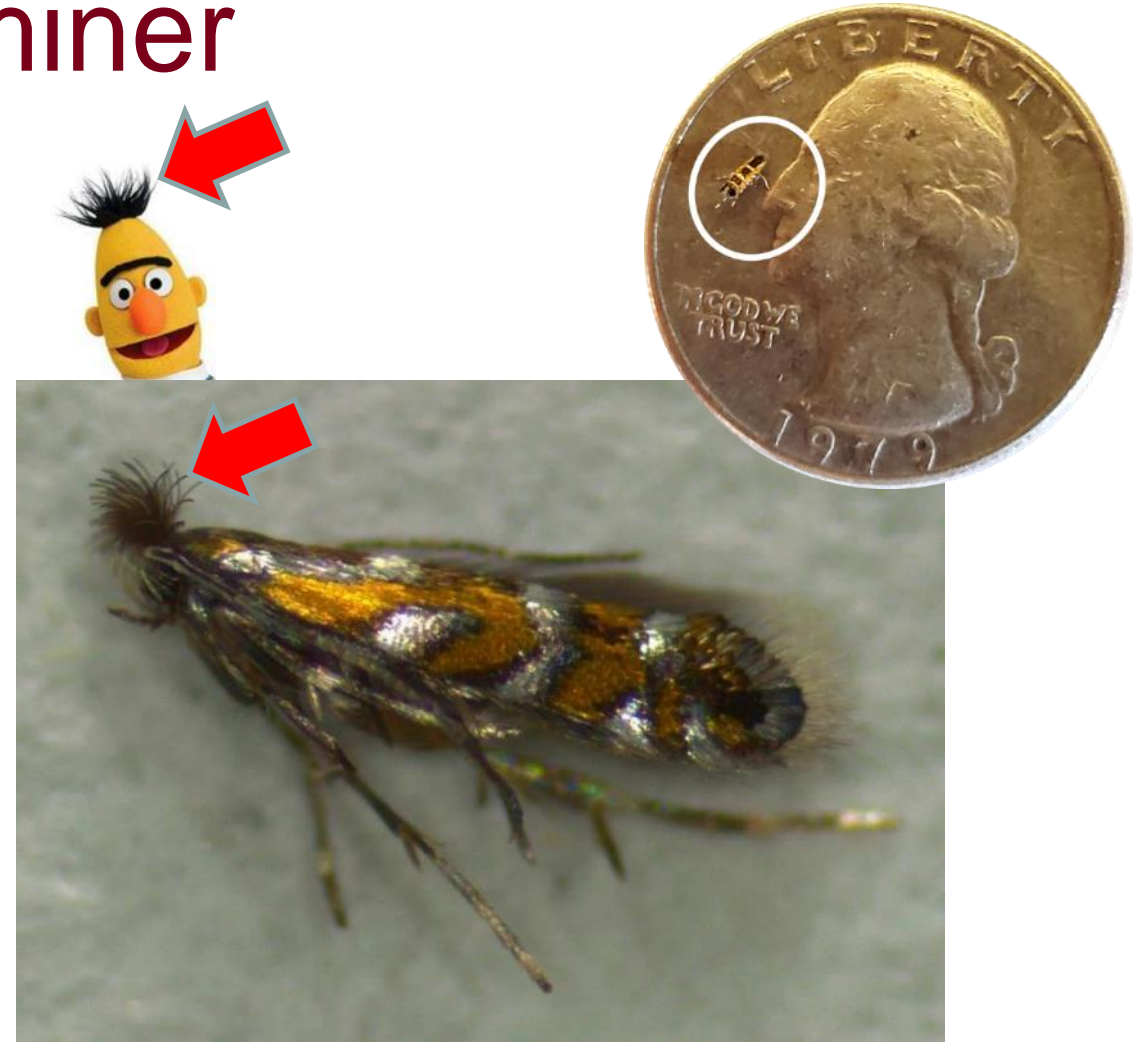


Minnesota



# Soybean tentiform leafminer

- Tiny (~6 mm)
- Front wings with orange, white & gray-black markings
- Well-developed occipital tuft



# Leafminers in U.S. soybean

- Rare pest
  - *Odontota horni*, soybean leafminer
- Even less common
  - *Odontota dorsalis*, locust leafminer
  - *Sumitrosis rosea*

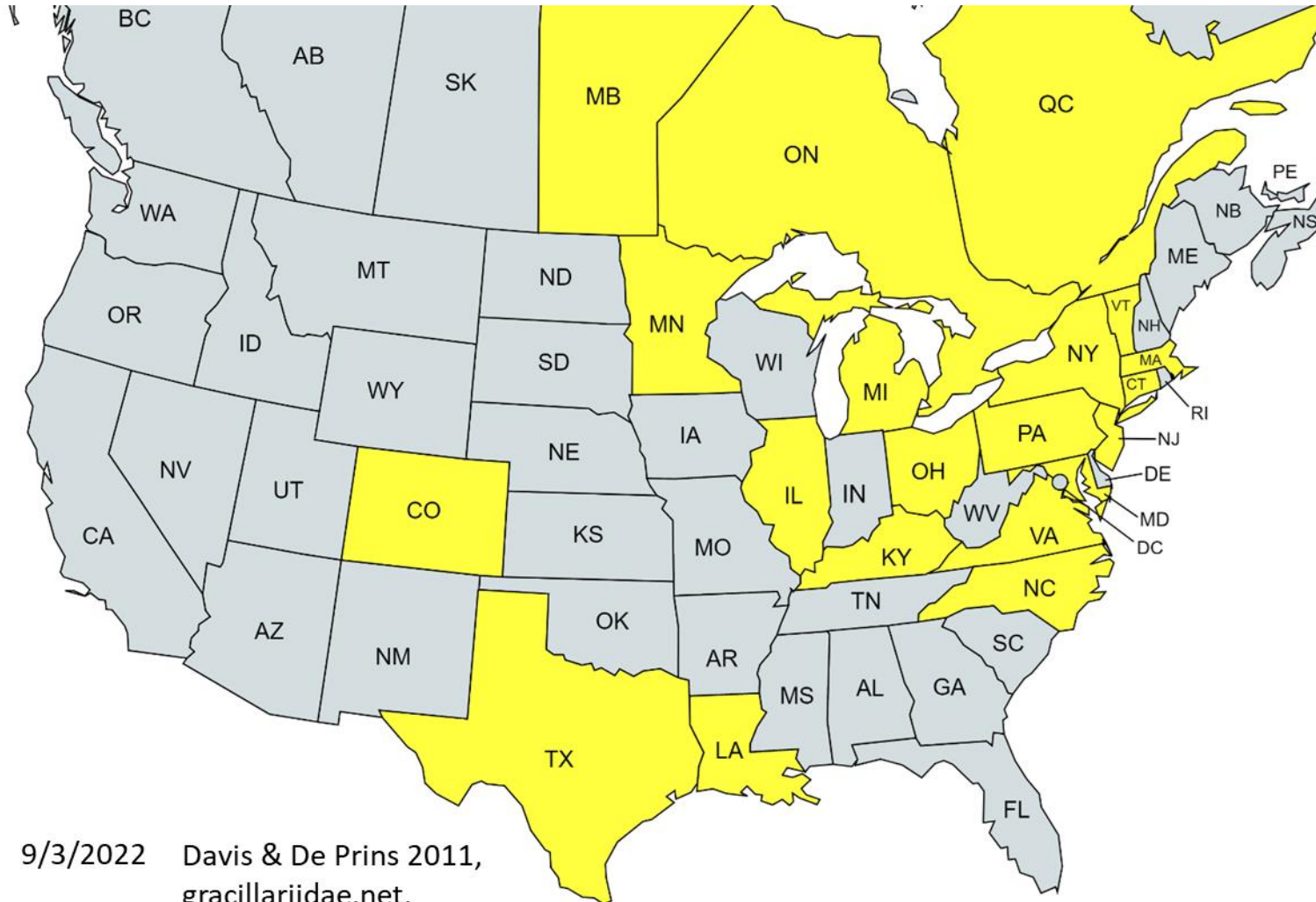


# Known host plants



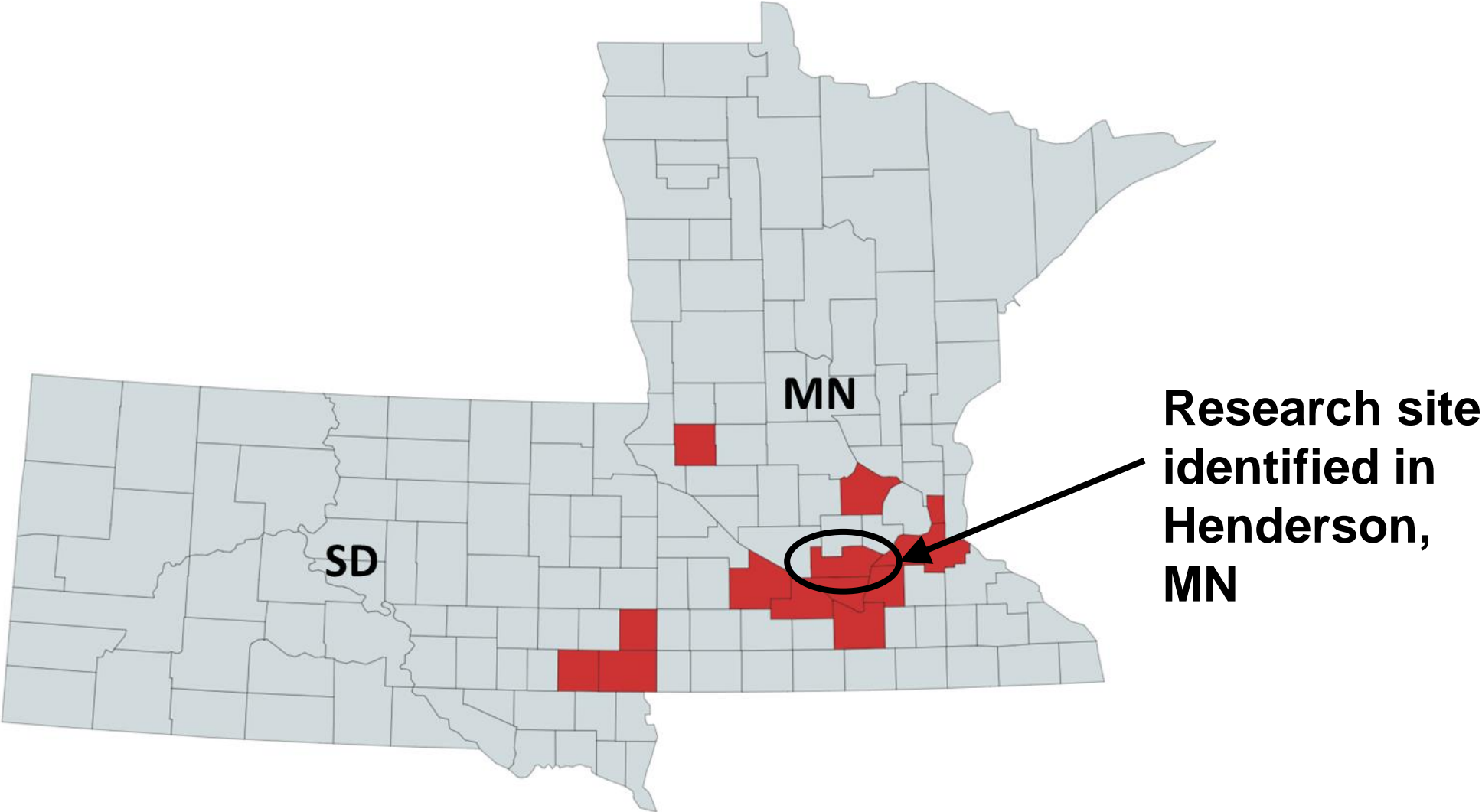


# Distribution (literature & databases)

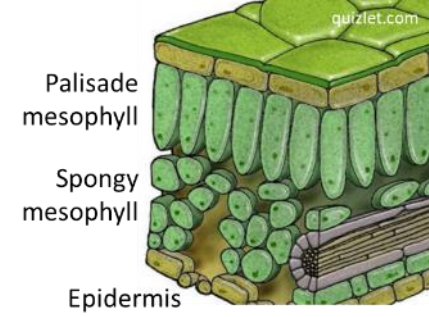


9/3/2022 Davis & De Prins 2011,  
gracillariidae.net,  
iNaturalist,  
butterfliesandmoths.org

# Reported infestations in soybean - 2022



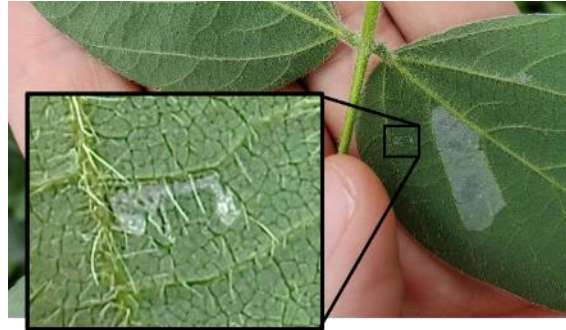
# Life cycle



Egg



1<sup>st</sup>-2<sup>nd</sup> instars



3<sup>rd</sup> instar



Adult



Pupa



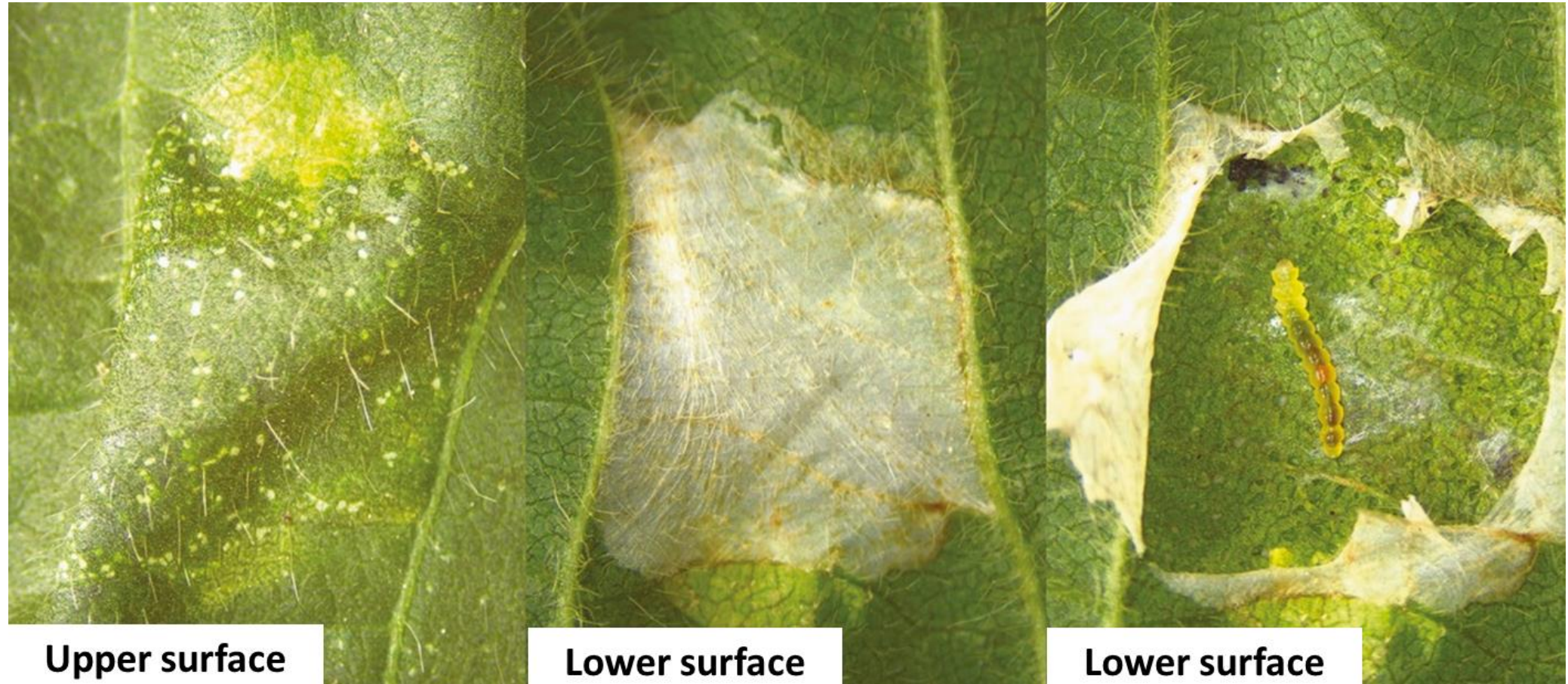
4<sup>th</sup>-5<sup>th</sup> instars



Likely 2-3 generations / yr



# Injury



Upper surface

Lower surface

Lower surface



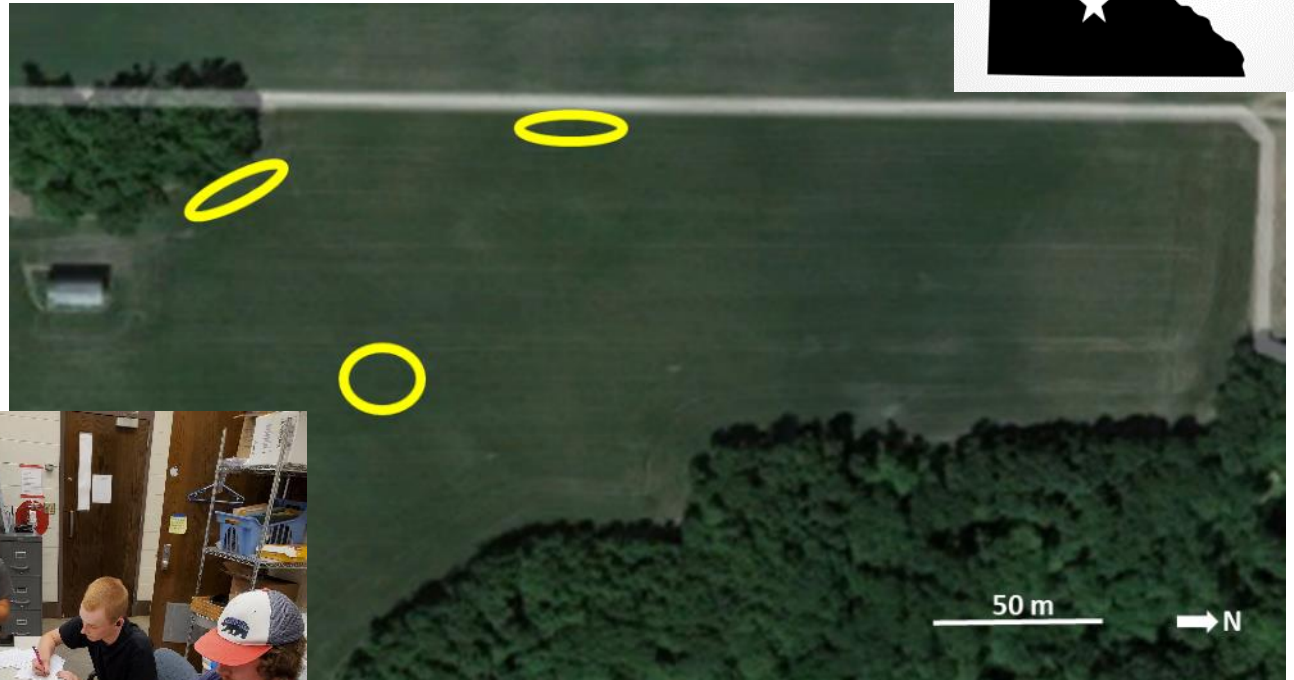
# Injury



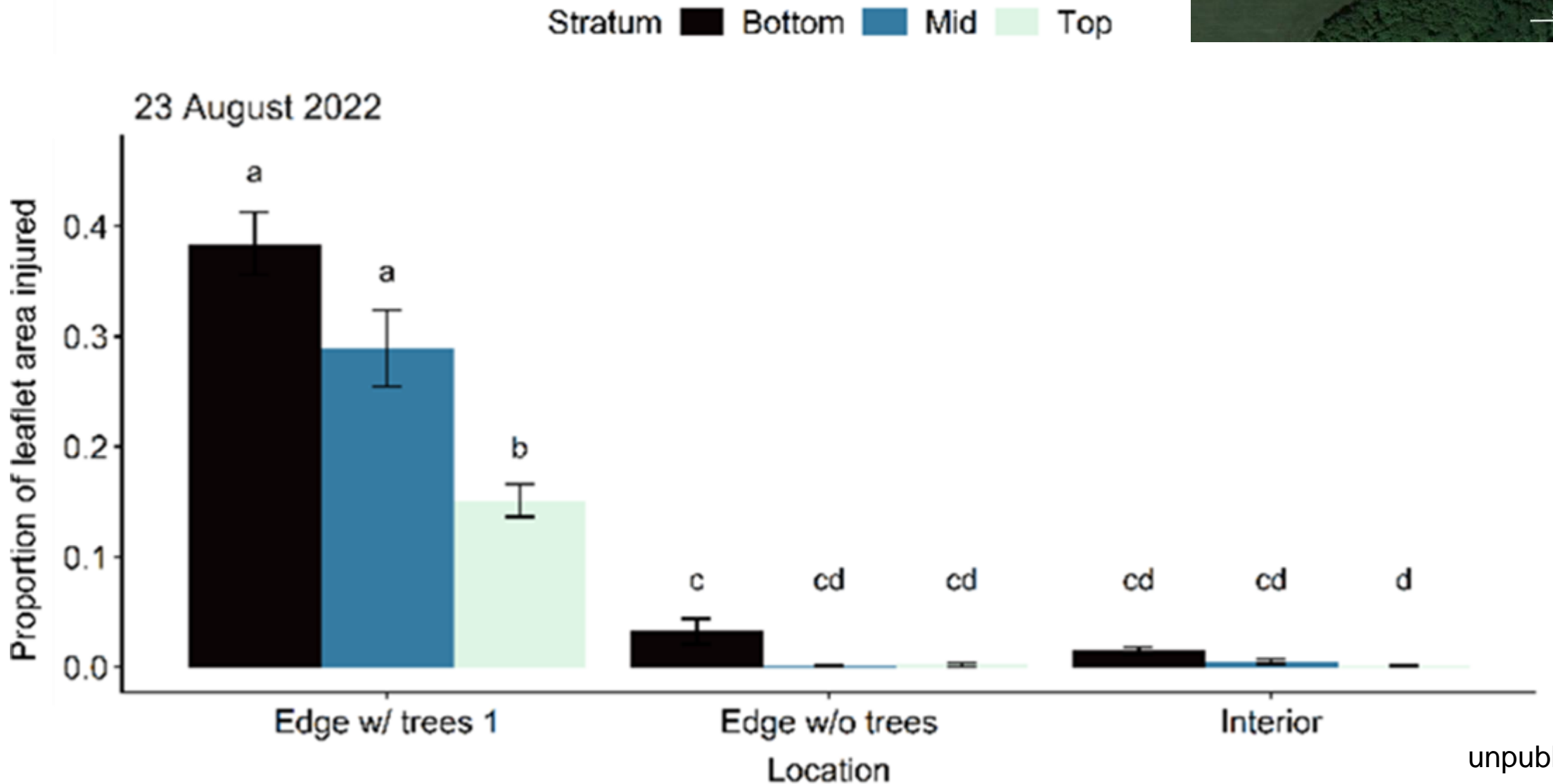
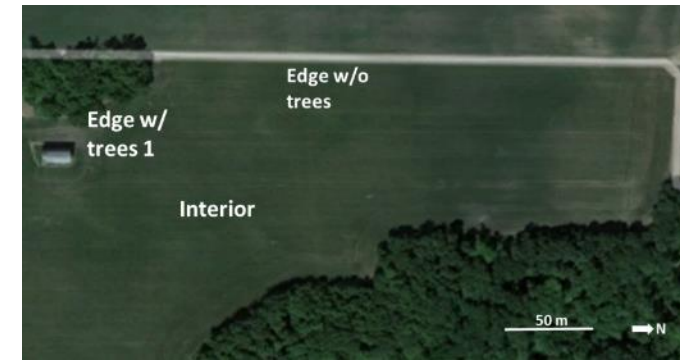
UNIVERSITY OF MINNESOTA  
Driven to Discover<sup>SM</sup>

# Spatial distribution

- Henderson, MN - 2022
- 3 locations
- 20 plants per location
- Proportion leaf area injured (mined)
  - iPad with LeafByte



# Spatial distribution (preliminary data)



# Chemical control

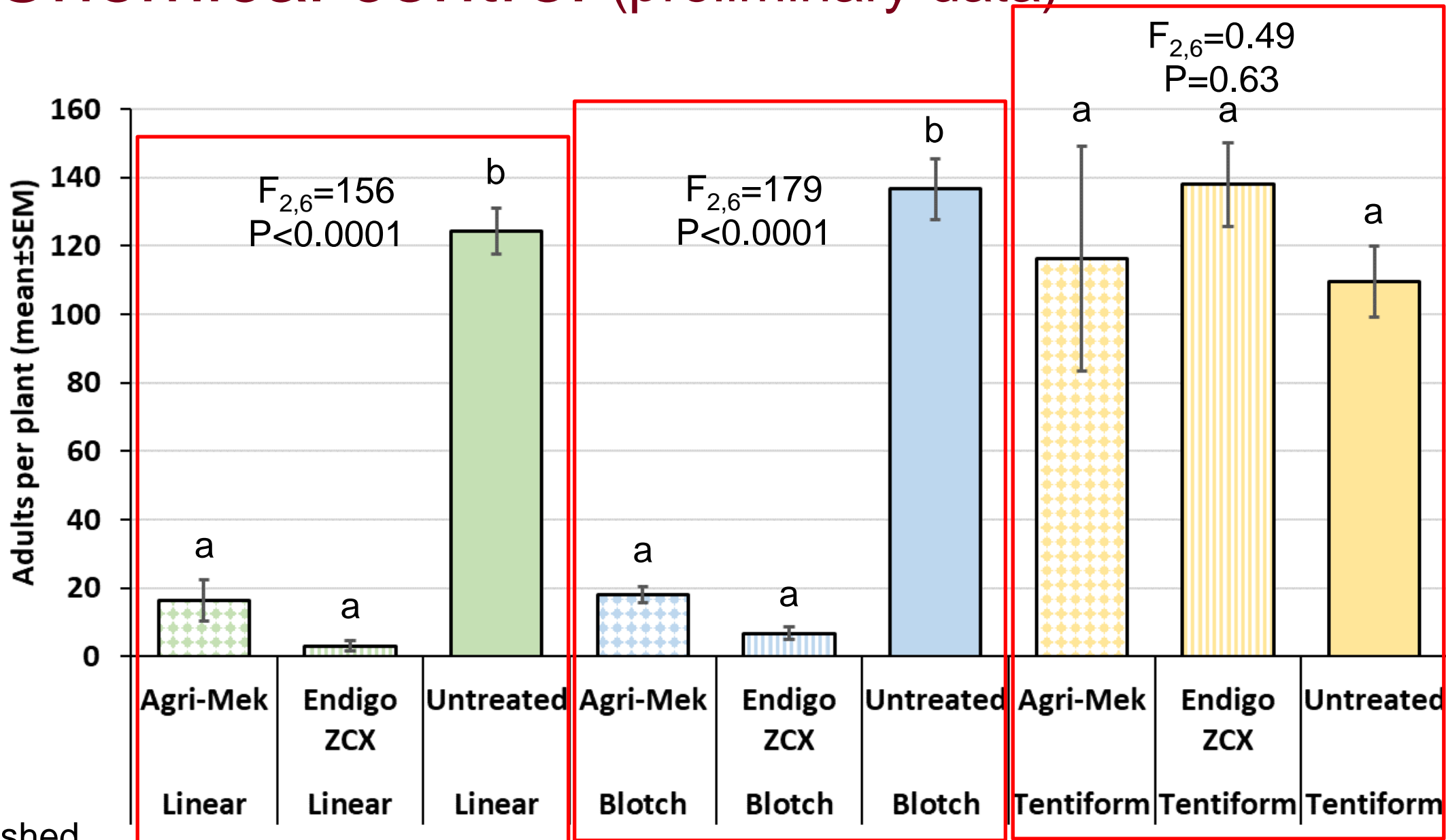
- Life stages
  - Linear mines: 1<sup>st</sup>-2<sup>nd</sup> instars
  - Blotch mines: 3<sup>rd</sup> instar
  - Tentiform mines: 4<sup>th</sup>-5<sup>th</sup> instars
- Insecticide treatments
  - Agri-Mek
  - Endigo ZXC
  - Untreated control

} Translaminar activity;  
Labeled for soybean





# Chemical control (preliminary data)



# Biological control

300+ individuals from soybean & hogpeanut



*Pediobius albipes* & *Sympiesis marylandensis*

(Peck 1985, Maier 1988)



UNIVERSITY OF MINNESOTA

Driven to Discover<sup>SM</sup>

# Summary - Soybean tentiform leafminer

- Widespread in southern MN soybean
- Highest risk for infestation
  - Bottom of plants
  - Edges of fields
- Biological control: Several parasitoids
- Chemical control: Target early instars with translaminar insecticides



# Thank you

- Funding (SGM)
  - MN Rapid Agricultural Response Fund
  - MN Department of Agriculture
  - MN Soybean Research & Promotion Council
  - North Central Soybean Research Program
- Sharing & collecting data/info
  - Koch lab students/staff
  - Bruce Potter - UMN
  - Dr. Amelia Lindsey - UMN
  - Joseph Moisan-De Serres – MAPAQ
  - Dr. Aaron Lorenz – UMN
  - Agonomists & Consultants
  - Extension staff

**Koch's email: [koch0125@umn.edu](mailto:koch0125@umn.edu)**



UNIVERSITY OF MINNESOTA  
**Driven to Discover<sup>SM</sup>**