Current knowledge of the Switchgrass Gall Midge in Ontario


H. Fraser

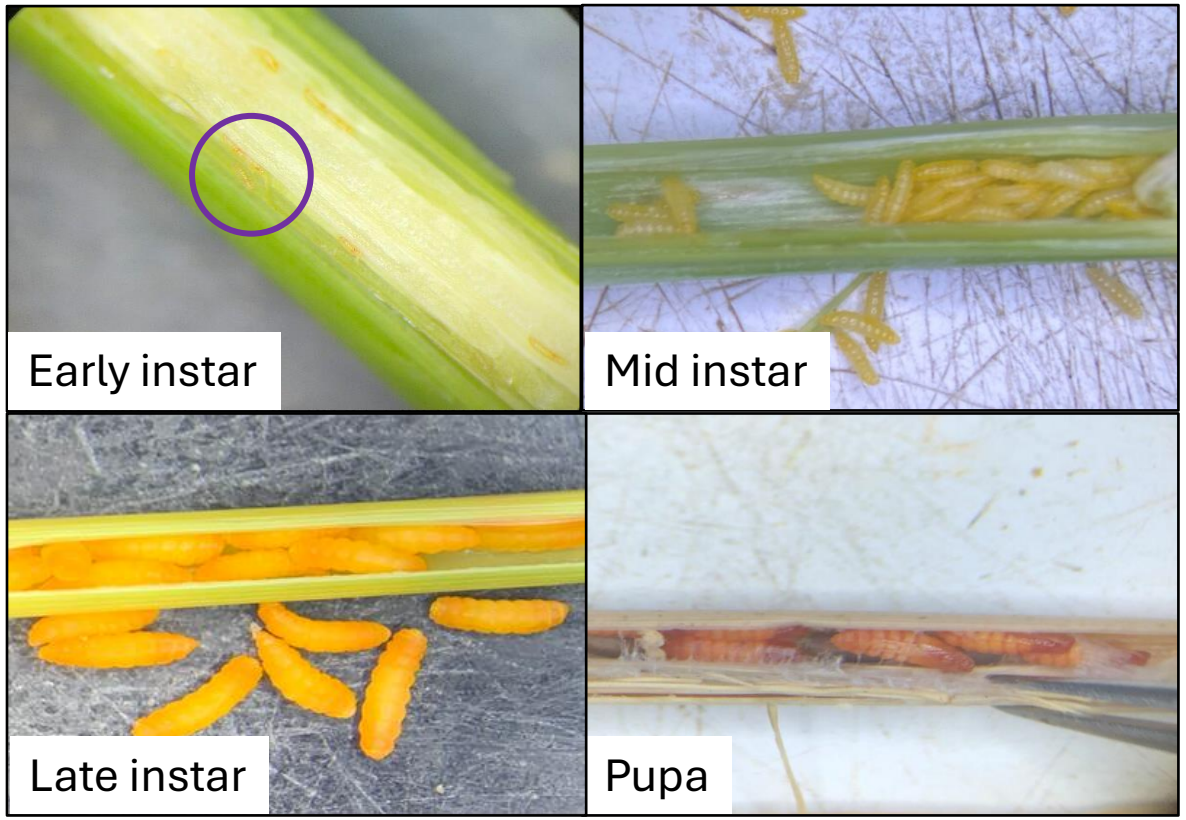
UNIVERSITY of GUELPH
ONTARIO AGRICULTURAL COLLEGE
SCHOOL OF ENVIRONMENTAL SCIENCES

Clarissa Capko, Graham Ansell, Angela E. Gradish, **Rebecca H. Hallett**
School of Environmental Sciences, University of Guelph, Guelph, ON

Mar 18 2025

Switchgrass gall midge (SGM), *Chilophaga virgati* Gagné

- Caused nearly 100% seed loss and a 35% reduction in biomass per tiller in South Dakota
- Discovered both SGM and parasitoids in southern Ontario in 2020 by OMAFA

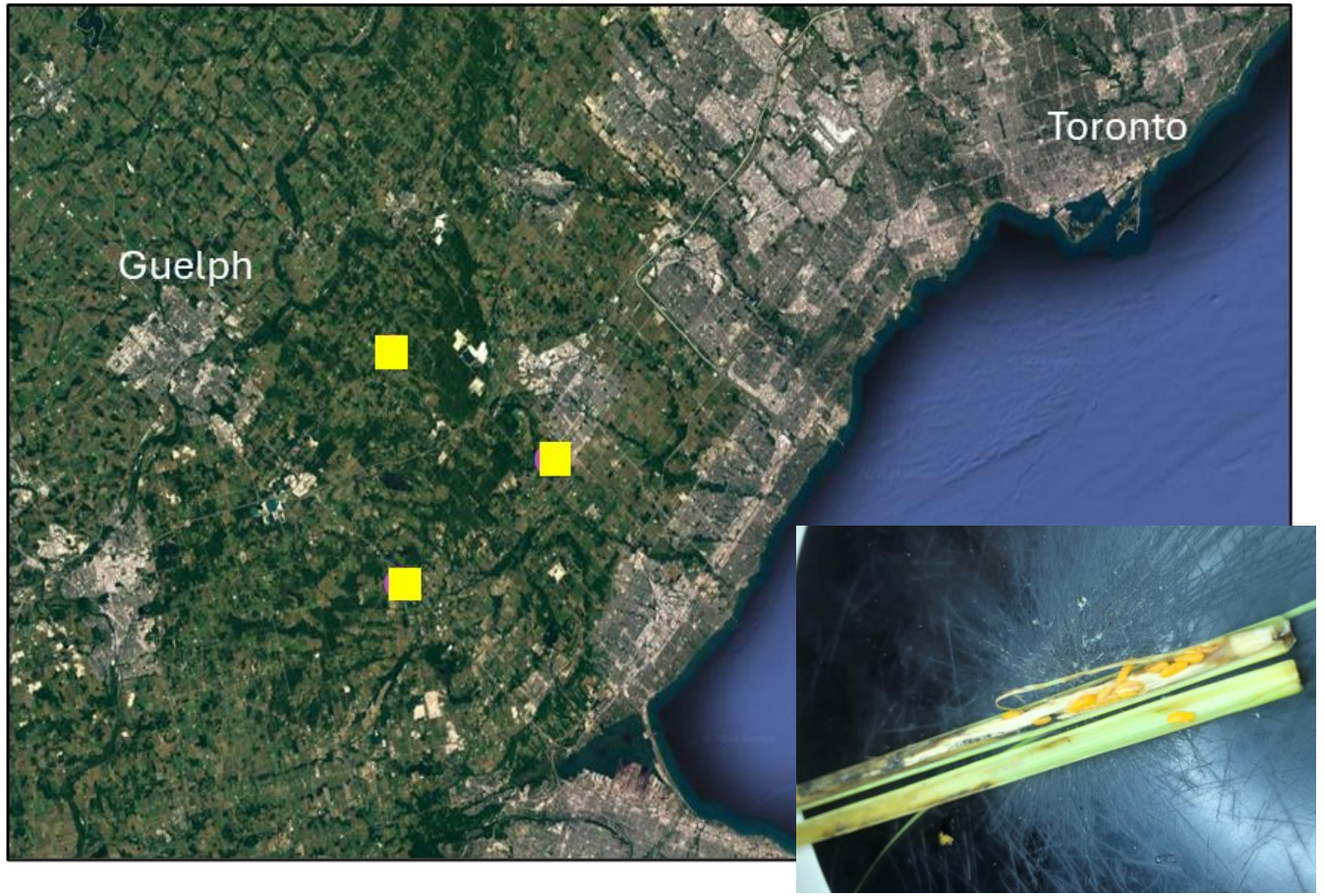


Phenology Sampling Methods 2024

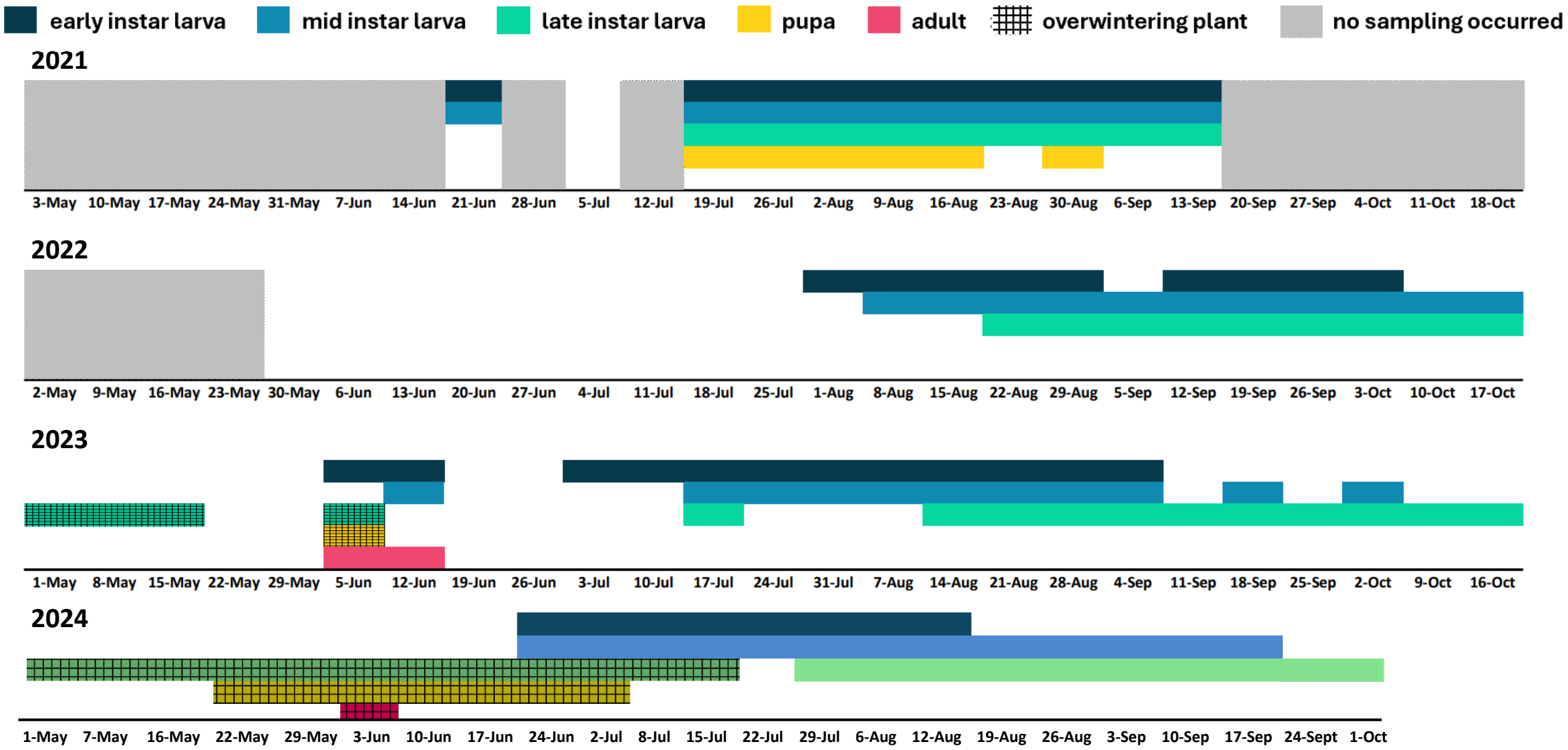
Phenology: timing of each life stage throughout the year

- Management practices rely on understanding the phenology of a pest

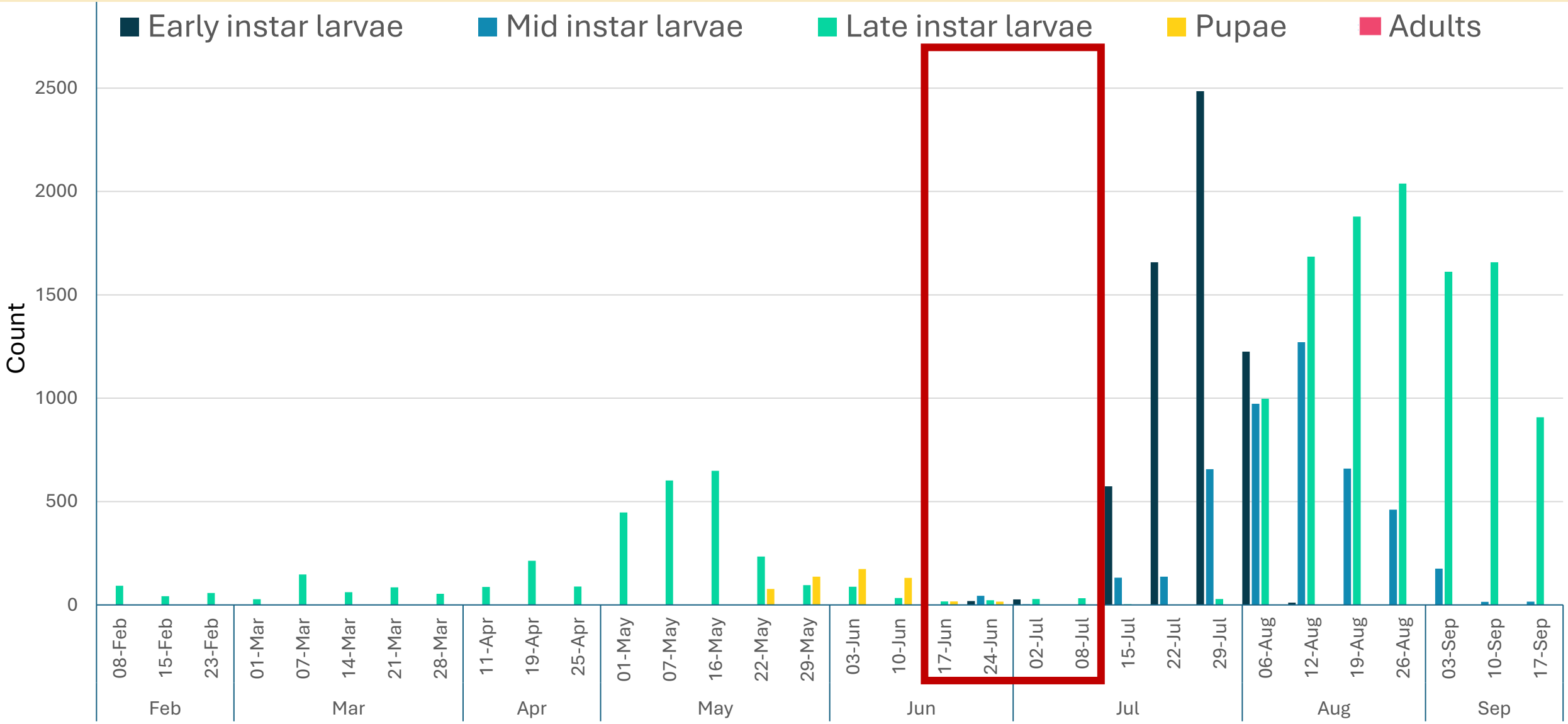
Weekly tiller collections February-October



SGM has one generation per year

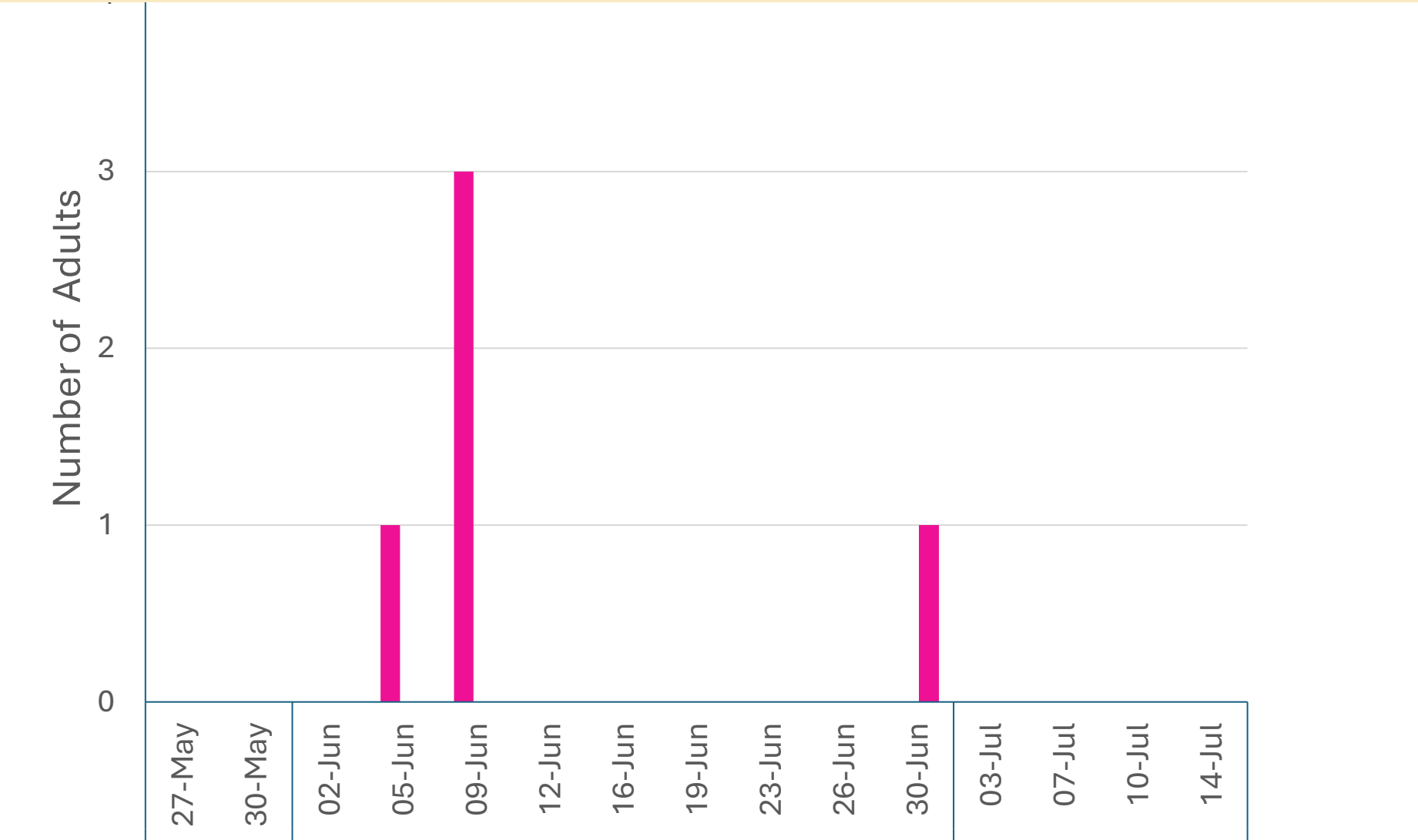


Pupae developed from mid-May to mid-June



Emergence Traps

Adults were present throughout June



First egg sighting!

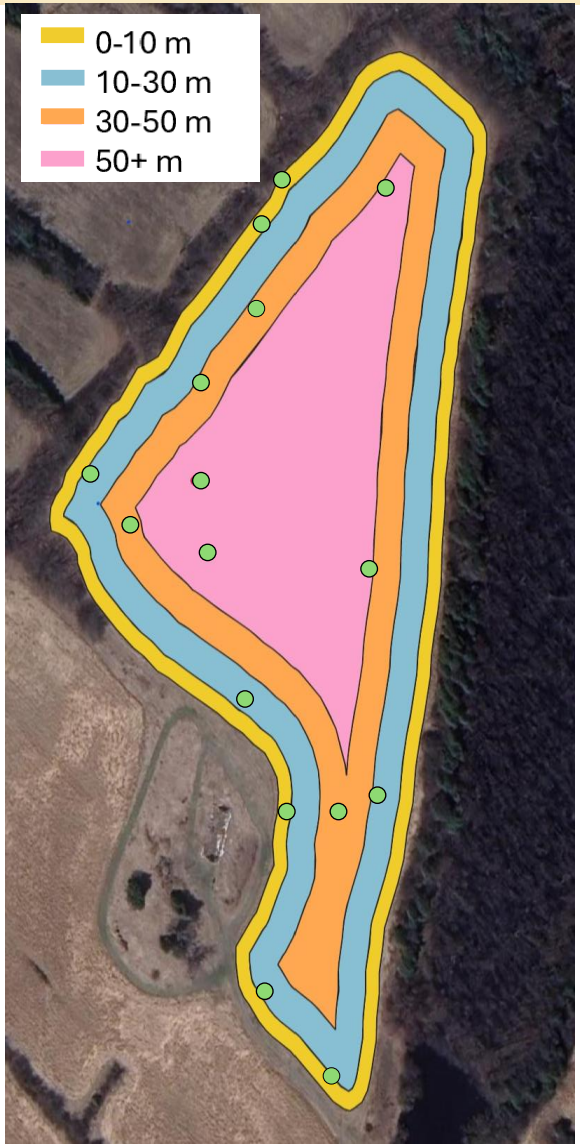
Quadrat Sampling

Site 1

Quadrat: 0.75 m^2

Infested tillers were found in 15/16 sampling locations

Mean infestation per sample was 2.1%

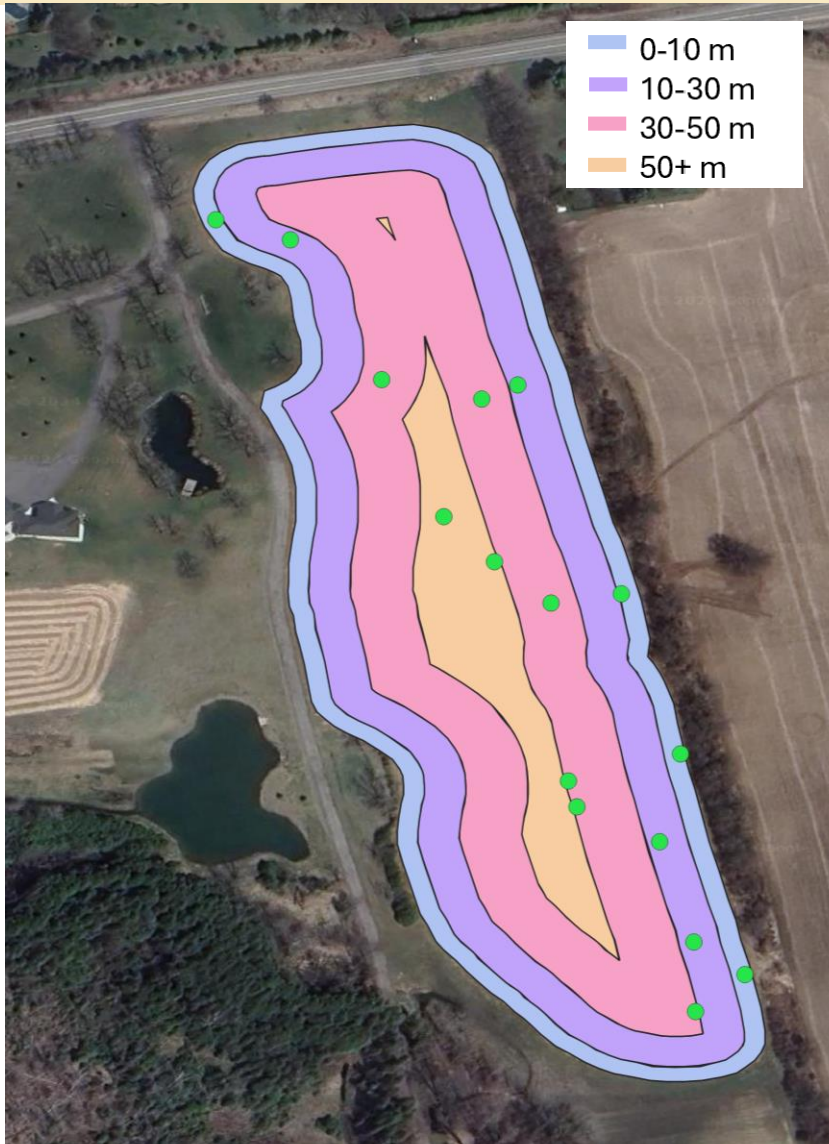


Site 2

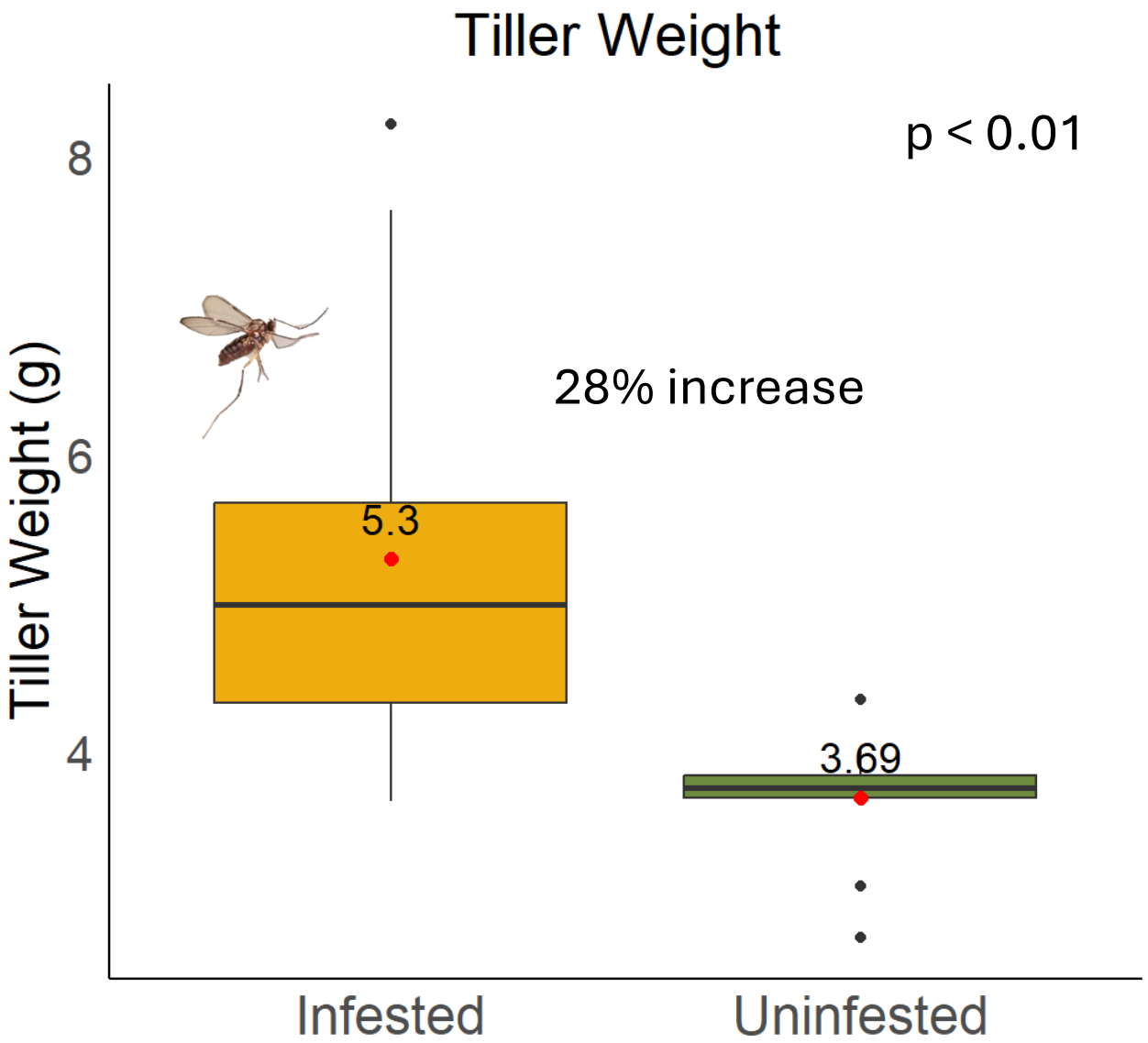
Quadrat: 0.75 m^2

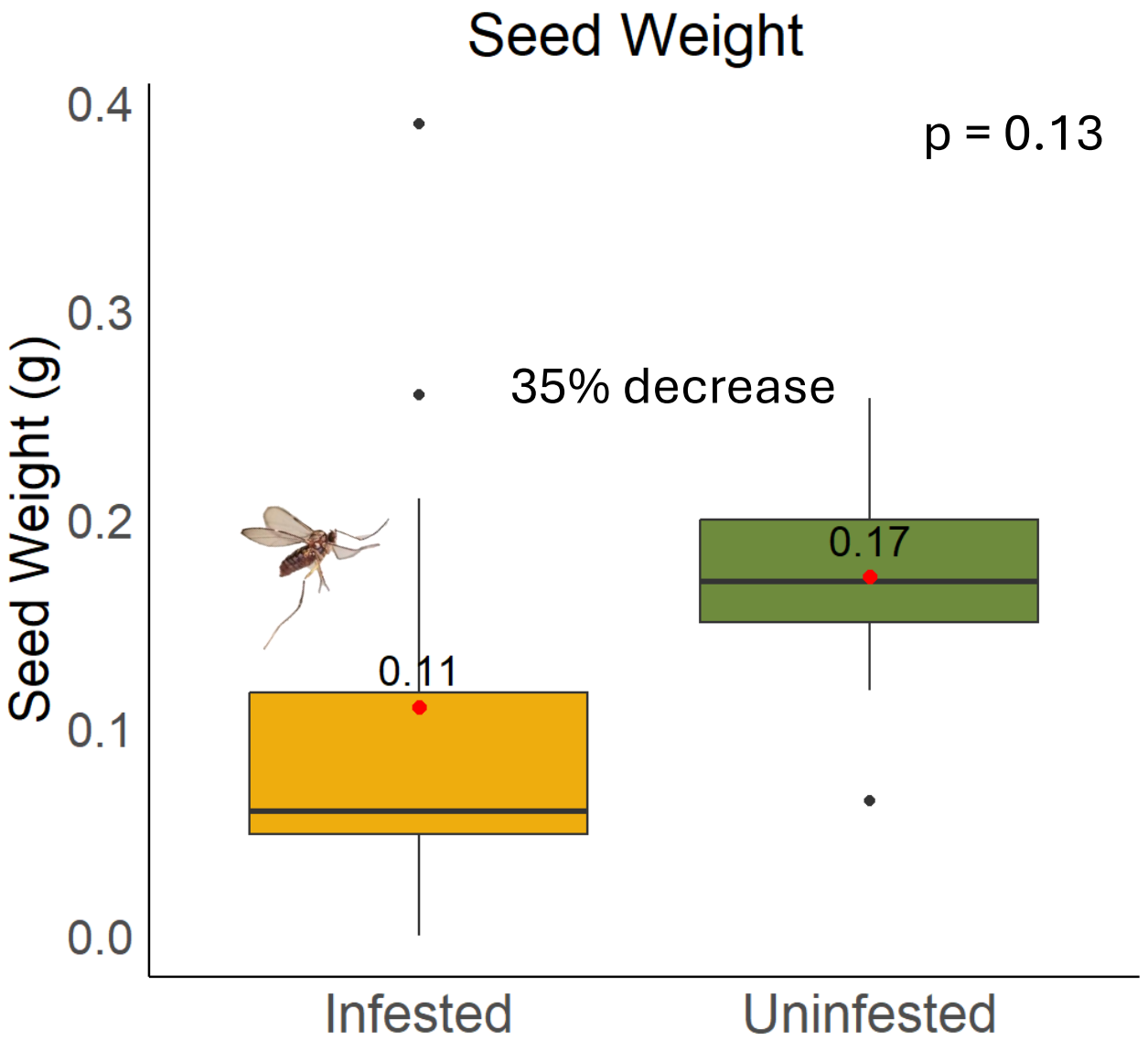
Infested tillers were found in 16/16 sampling locations

Mean infestation per sample was 8.9%

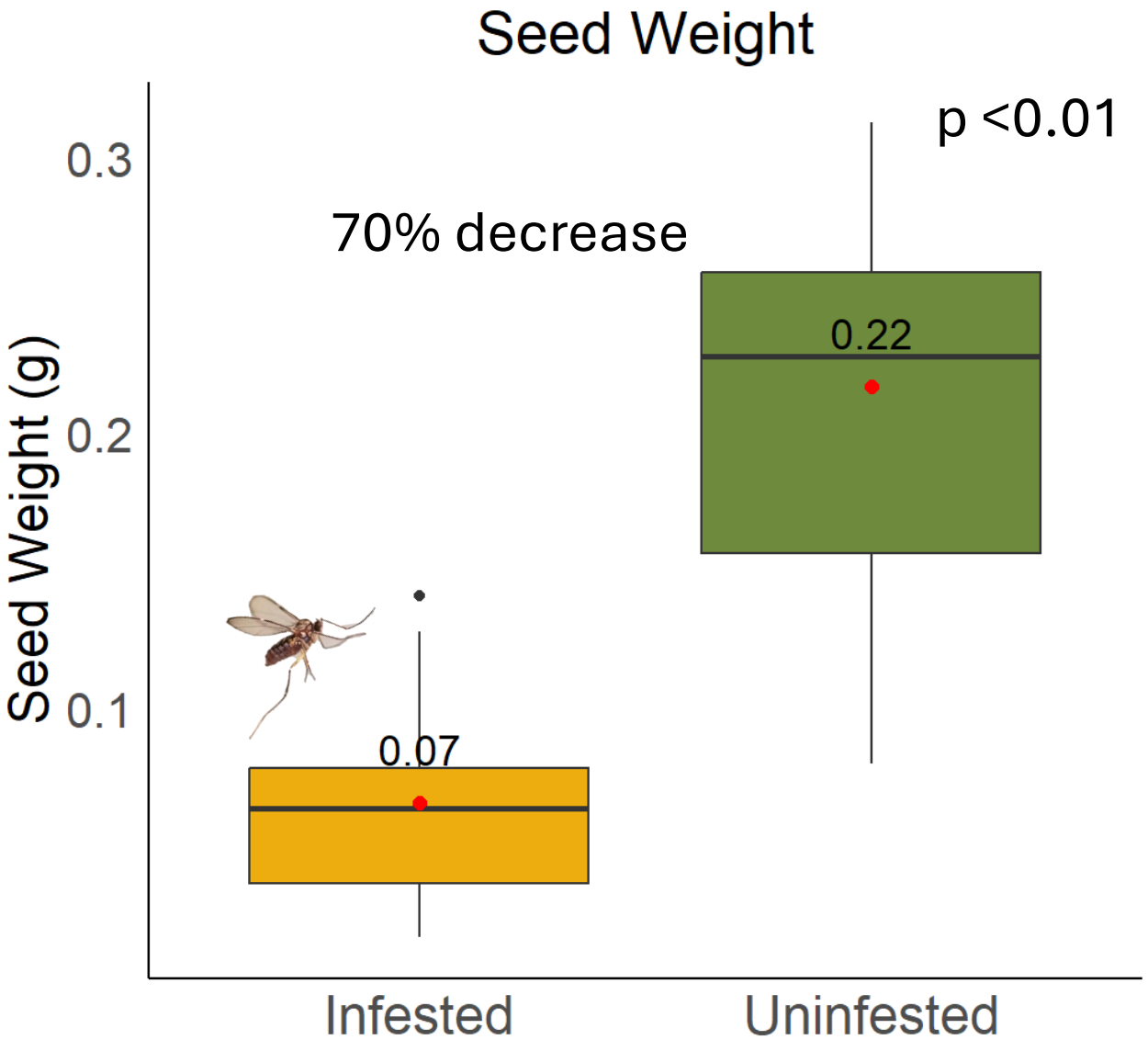


Site 1- Big Rock 1





Site 2- Big Rock 2

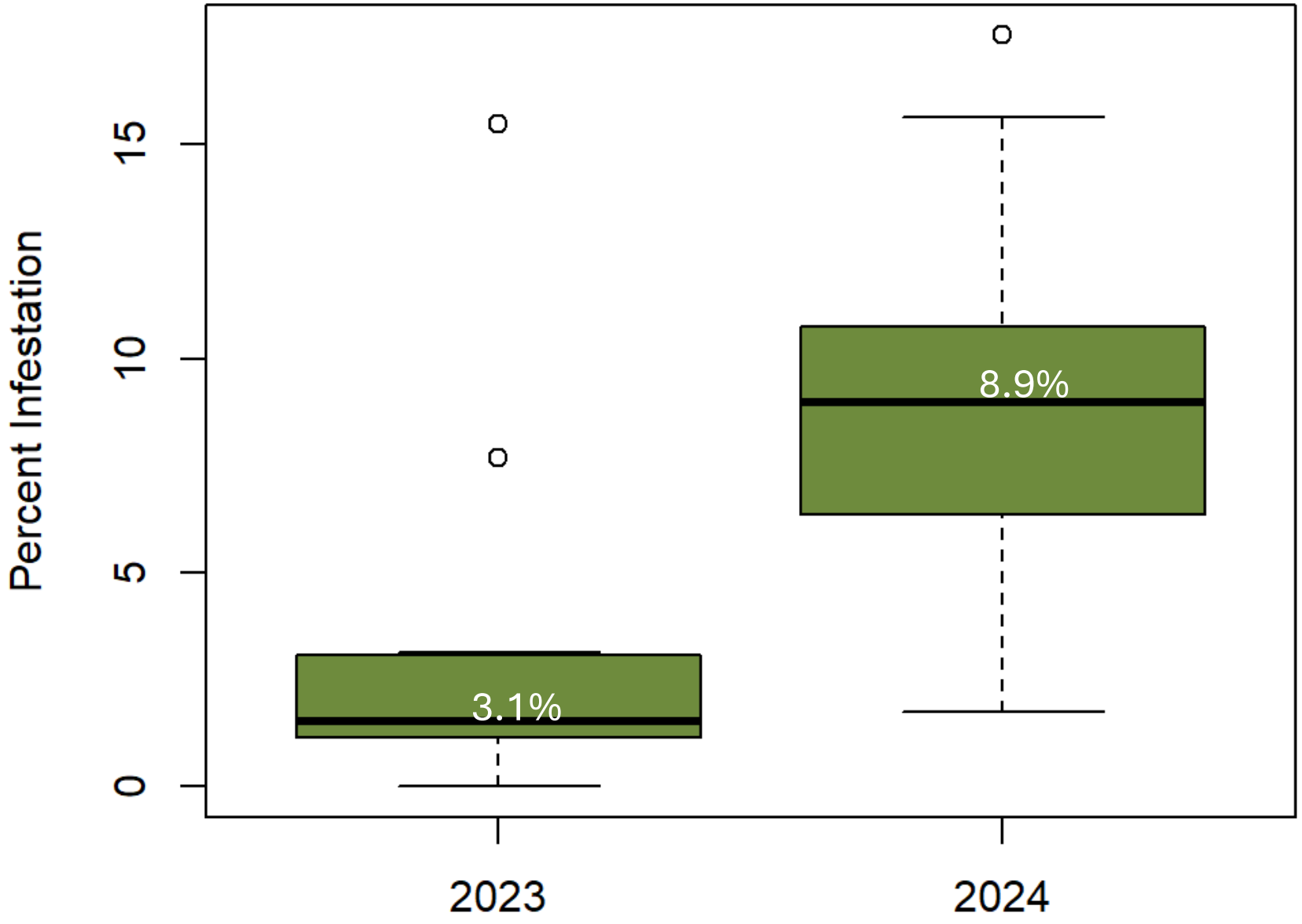


SGM impacts tiller and seed mass

With a 5.5% infestation rate per field

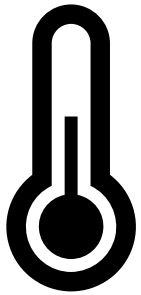
- 22% increase in tiller weight per tiller -> **1.2% increase**
- 52.5% decrease in seed weight per tiller -> **2.9% decrease**

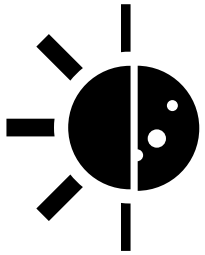
Percent infestation increased from 2023-2024 at Site 2

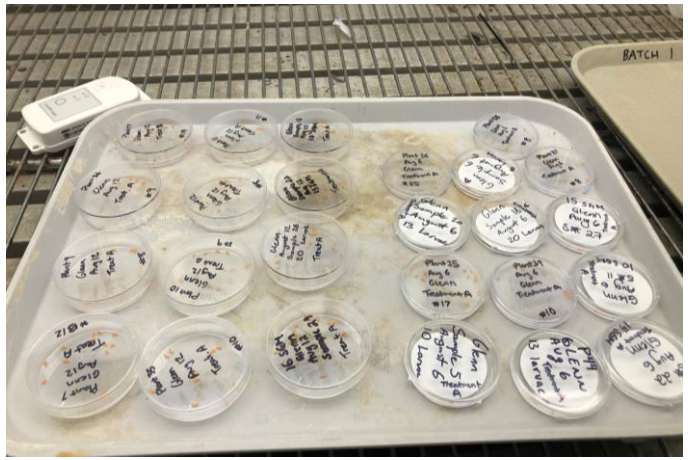


Diapause Experiments

- Diapause: a period of paused development influenced by environmental conditions
- Understanding diapause helps to predict when developments stops in the fall and when development starts in the spring
- Confirmed that diapause is facultative → a second generation may develop under the right environmental conditions in the field







Parasitoids of SGM

pupa

Platygaster chilophagae

Larva and pupa

Aprostocetus chilophagae

pupa

Trichacis rufipes

pupa

Quadristichus sp.

T. rufipes is the most abundant parasitoid

	Total	*T. rufipes*	*P. chilophagae*	*Quadrastichus* sp.
SGM larvae	400			
Parasitoids	205	192	11	2
Percent	51.3%	94%	5.4%	0.97%

Timing of SGM and parasitoids

adults

pupae

larvae

larvae

adults

pupae

larvae

January February March April May June July August September October November December

Overwintered Crop

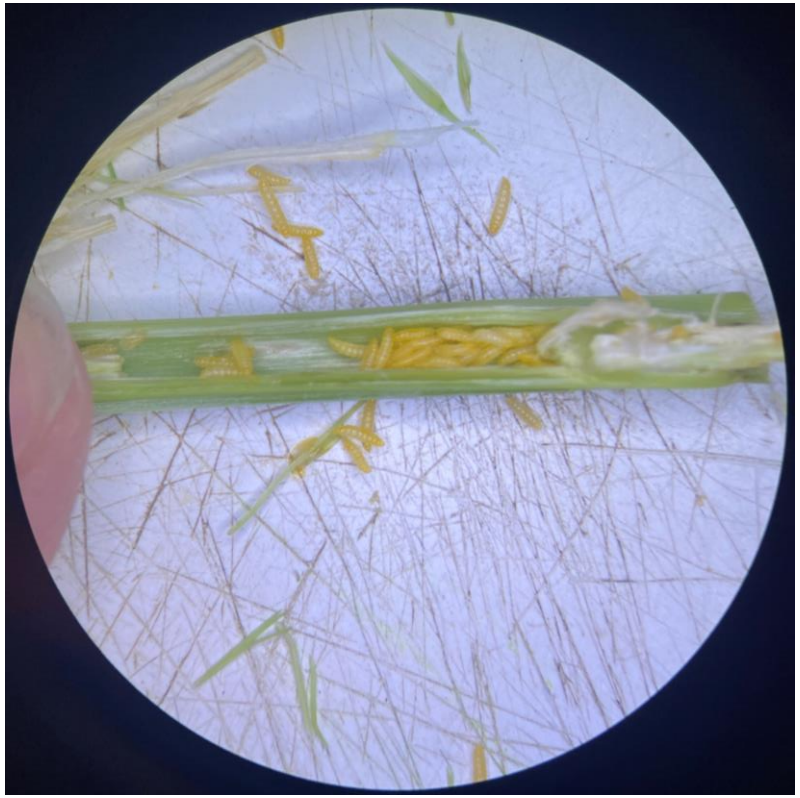
New Crop

2025 Field Season Objectives

- Evaluate sweep net sampling methods for adult monitoring
- Conduct in-field oviposition experiments to observe eggs and early larval stages
- Increase sampling frequency to determine spring activity
- Compare pupal development at different temperatures
- Sample for parasitism rates
- Assess the infestation rate in the same fields as 2024

Conclusions

- SGM has one generation per year, but diapause is not a requirement
- Percent SGM infestation in 2024 was 5.5%
  - Tiller weight in a field increases by 2.1%
  - Seed weight in a field decreases by 2.9%
- Percent infestation increased 3x from 2023-2024
- Parasitism rates are high



Identification of the Female Sex Pheromone of the Switchgrass Midge

Collaboration with
David Hall, Daniel Bray, Steven Harte

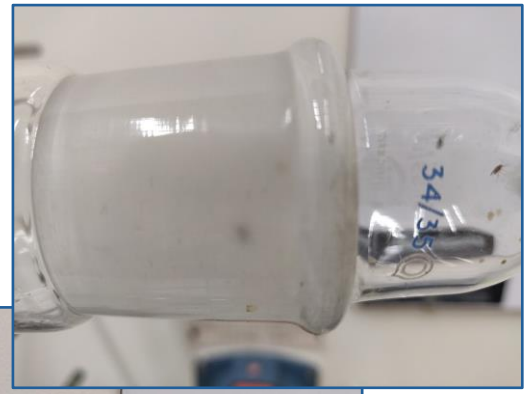
UNIVERSITY of GREENWICH

Pheromone Collection & Identification

Pheromone collection

- Pupae sent from UofG to UK
- Placed in individual tubes until emergence as adults

- Three methods of pheromone collection
  - Entrainment
  - Extraction of whole bodies
  - Solid-phase microextraction (SPME)



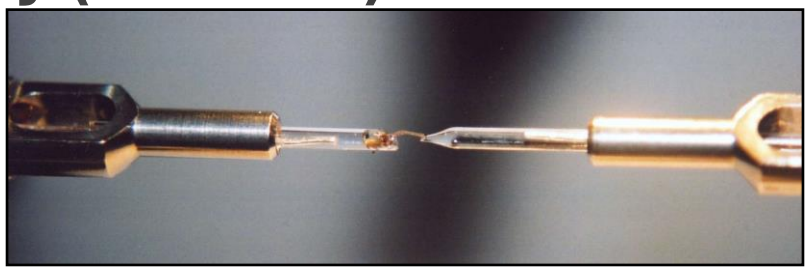
Pheromone Analysis

Gas Chromatography - Mass Spectrometry

- Look for female-specific compounds: potential pheromone components
- Scan for known midge pheromone compounds in NRI library of synthetic standards
- Scan for likely structures typical of midge pheromones

Gas Chromatography - Electroantennography (GC-EAG)

- Compounds detected by receptors on the male antenna are potential pheromone components



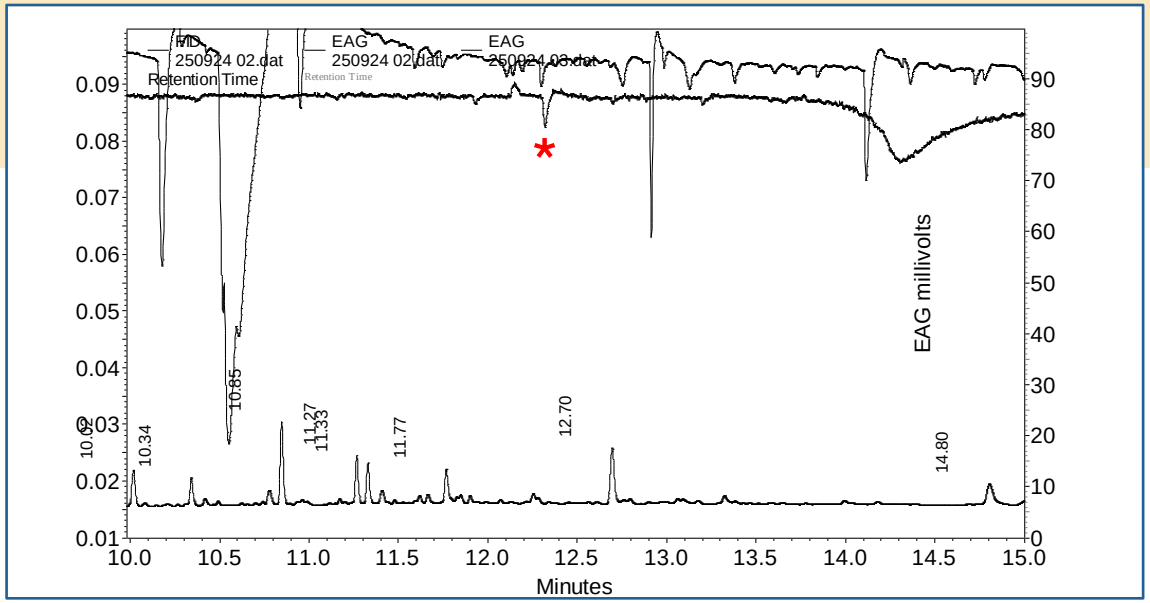
Results

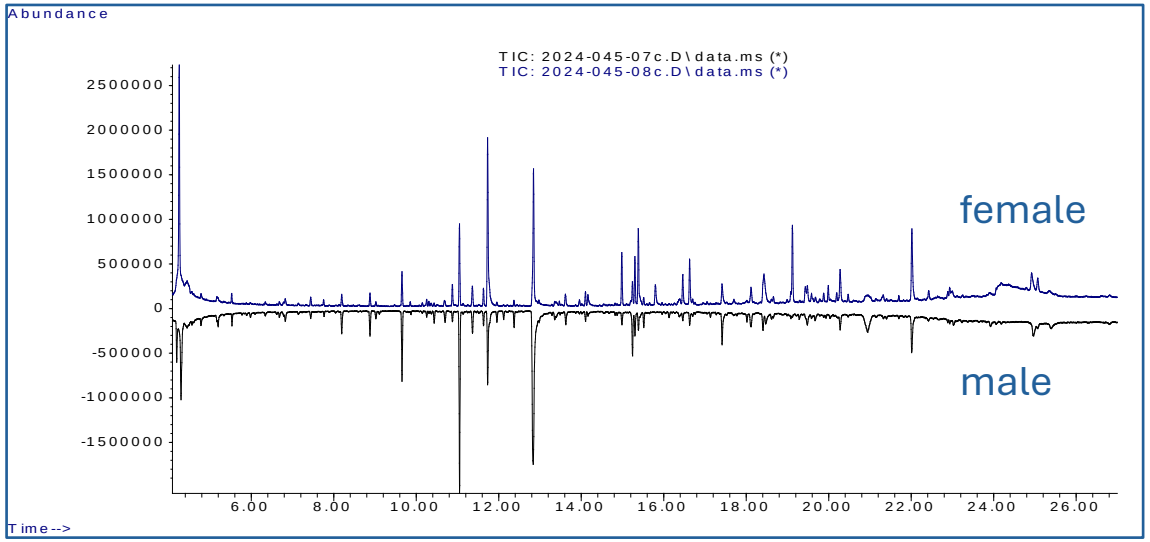
GC-EAG Analyses

- Found one EAG response (*)
  - at 12.30 min (RI 2500)

GC-MS Analyses

- No potential pheromone structure at RI 2500
- No obvious differences between collections from females and males
- Single ion scanning did not show any potential components

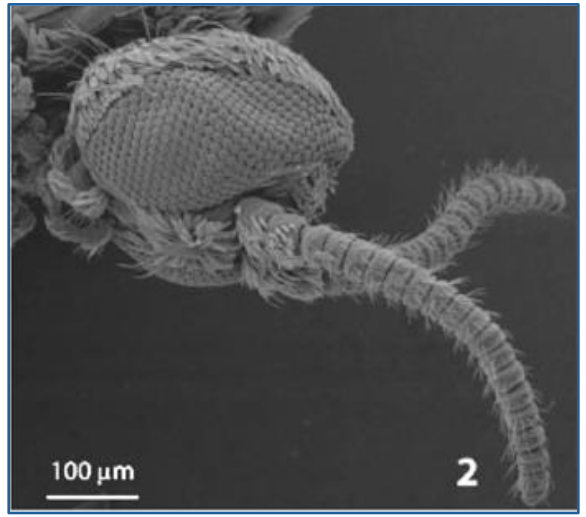




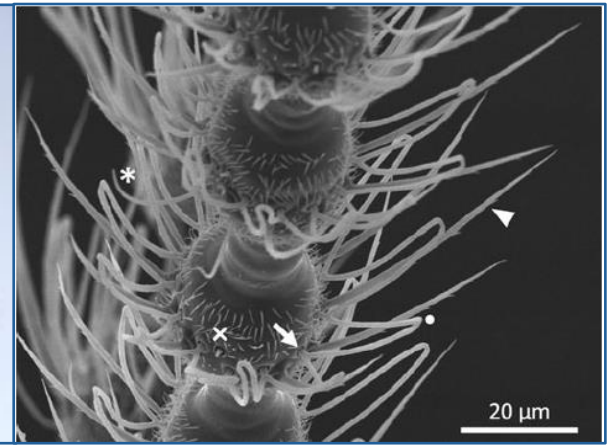
Conclusions

- No evidence of a sex pheromone in SGM
  - Female sex pheromones identified in ≥ 19 species of cecidomyiid midges
- Switchgrass gall midge belongs to subfamily Alycaulini
  - No pheromones identified so far
  - Antennae in males and females are similar
  - Antennae different from other subfamilies where pheromone present
- **Need to investigate biology further to confirm existence of pheromone**

Switchgrass gall midge



Swede midge



Ontario Agri-Food Innovation Alliance research program

Ontario Biomass Producers Co-operative Inc.

NSERC Alliance research program

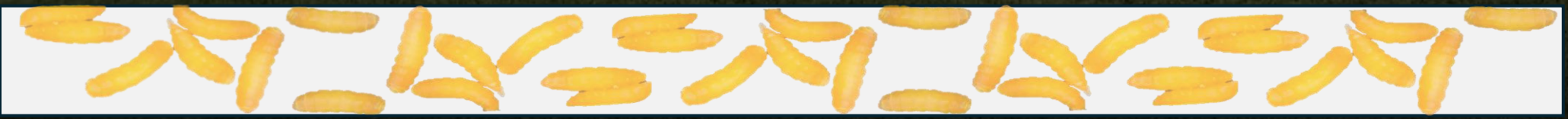
Ontario

OMAFA Partners
Hannah Fraser
Mahendra Thimmanagari

Switchgrass Growers

Student Research Assistants
Chloe El Hani
Colin Grant
Emily Stevens
Kaitlin Pengelley
Natalie Savoia
Sam Schmidtke

Thank You!



Pupae developed from mid-May to mid-June