

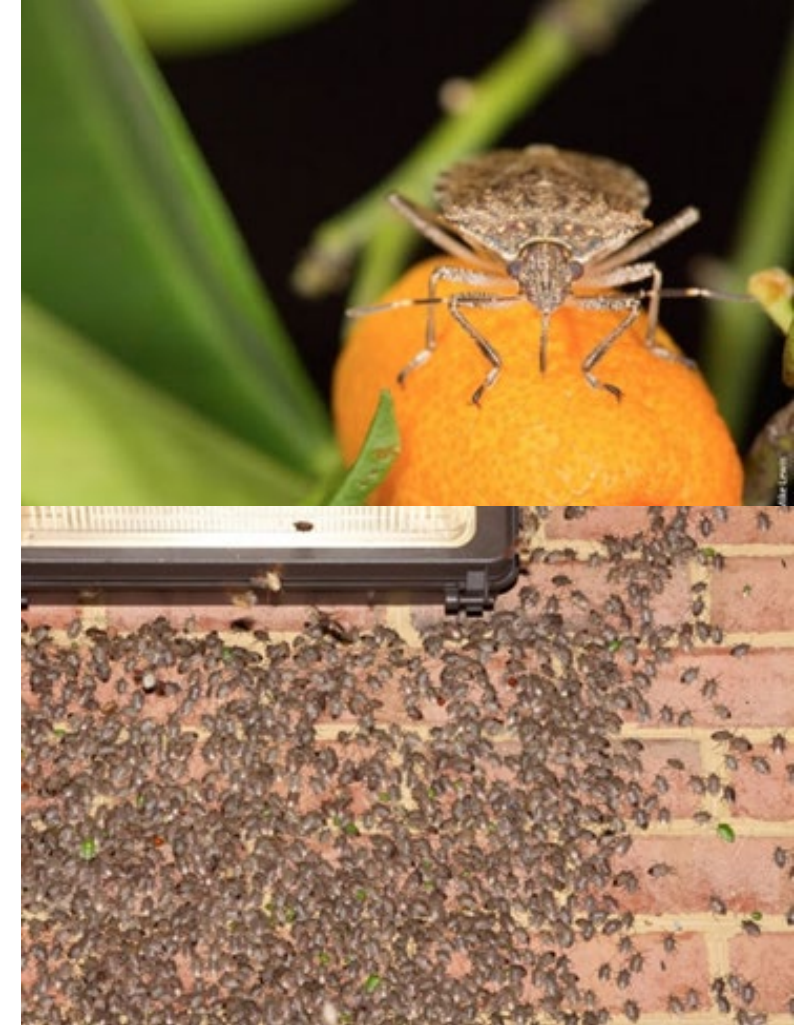
BIOLOGICAL CONTROL OF BMSB BY SAMURAI WASP (*TRISSOLCUS JAPONICUS*)

First Detector Workshop
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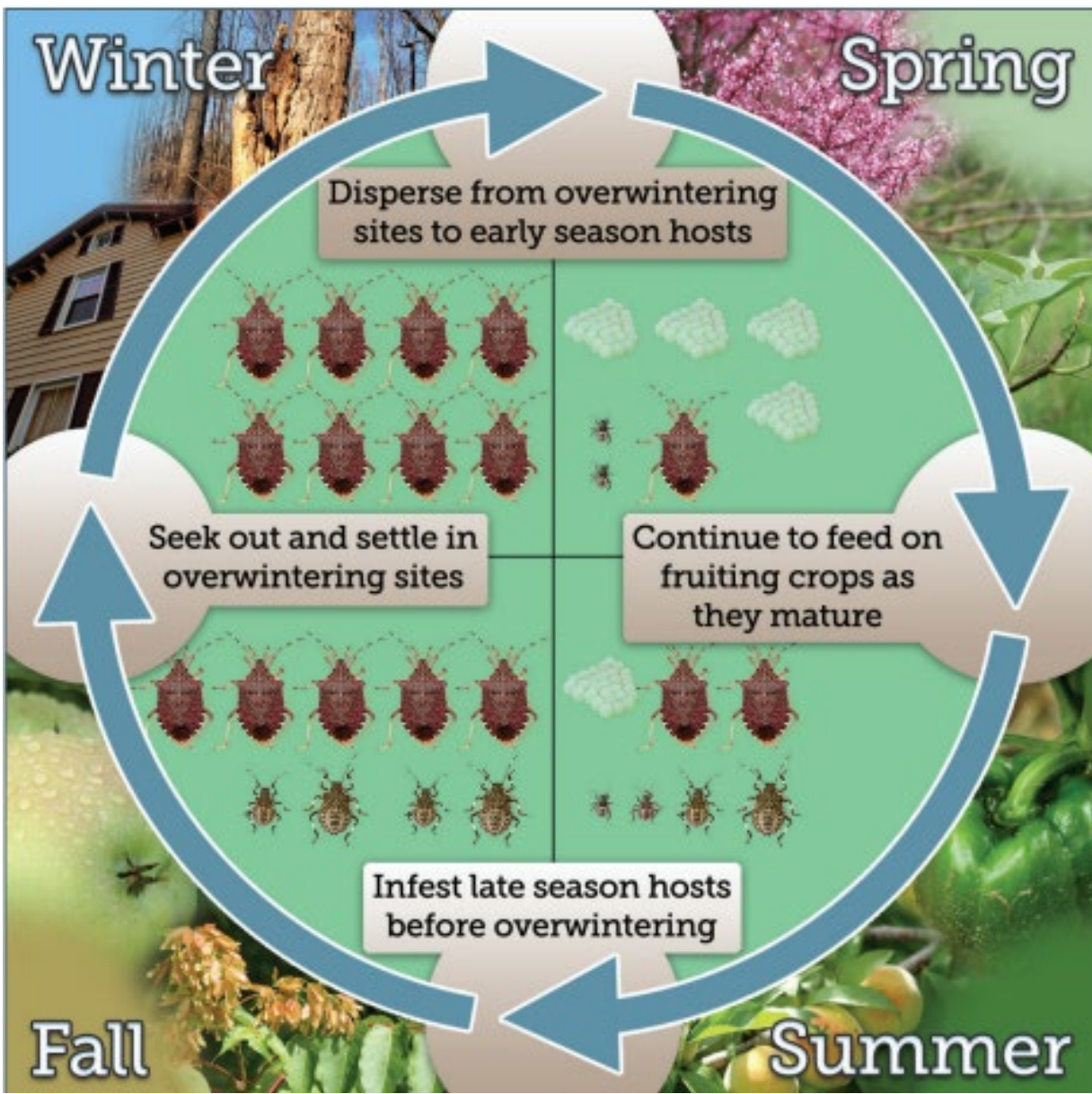
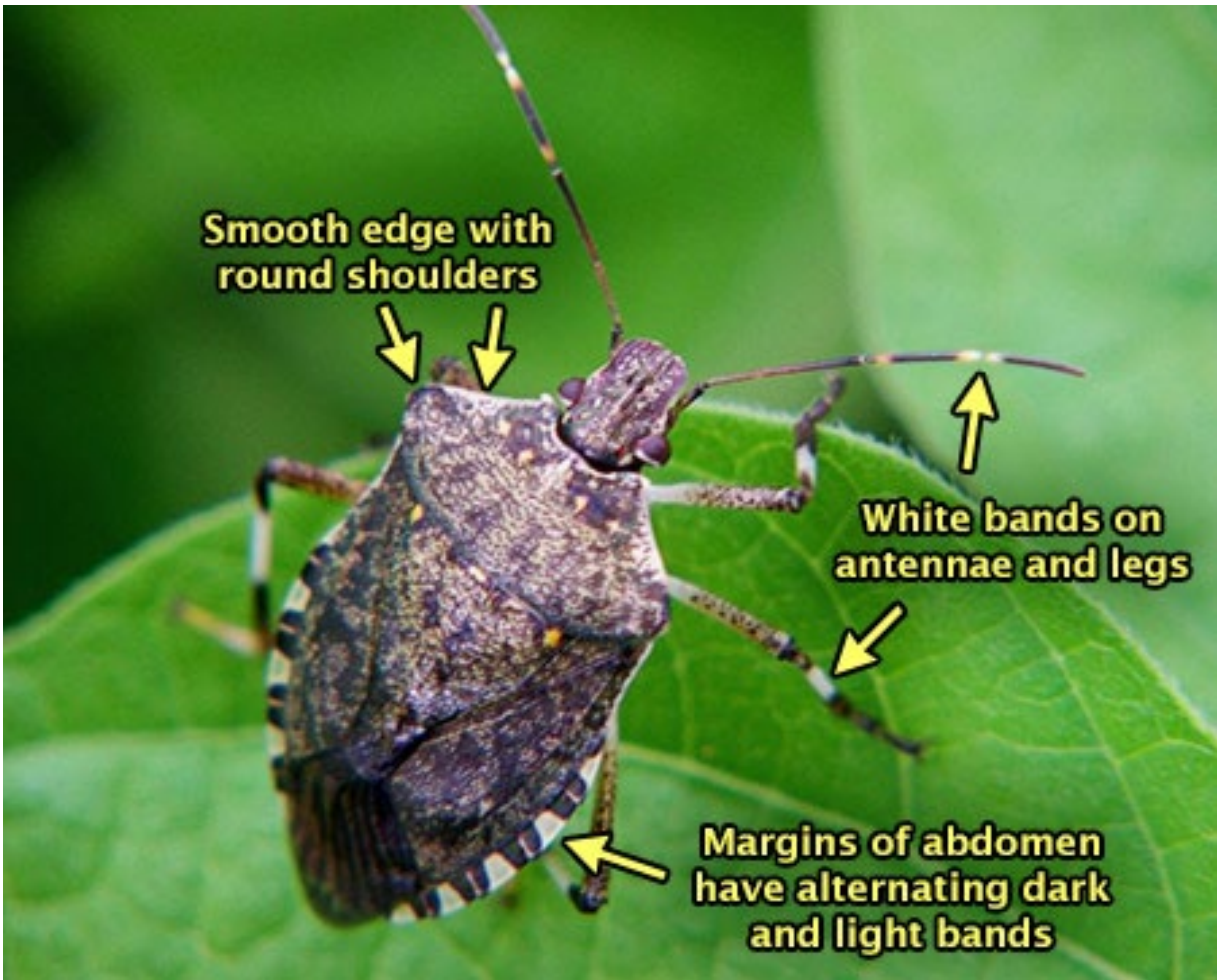


Brown Marmorated Stink Bug (BMSB) Invasion

- Invasive from Asia
- Severe agricultural pest and urban nuisance
- Advantageous traits
 - *Polyphagous*
 - *Long distance dispersal*
 - *Overwinters in human structures*

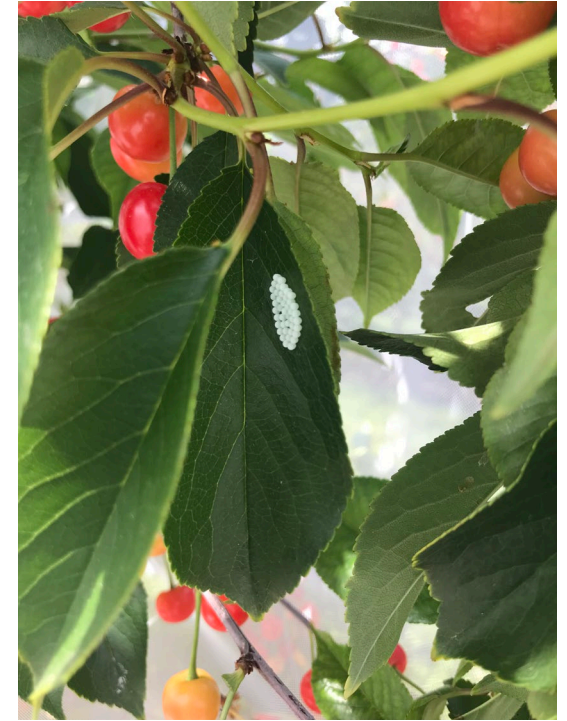


BMSB ID



BMSB in Utah

- 2012- First detection
- 2016- Establishment & nuisance problems
- 2017- First crop damage



TART CHERRY

Established:

- *Box Elder*
- *Cache*
- *Davis*
- *Salt Lake*
- *Utah*
- *Weber*

Detected:

- *Carbon*
- *Kane*



PEACH

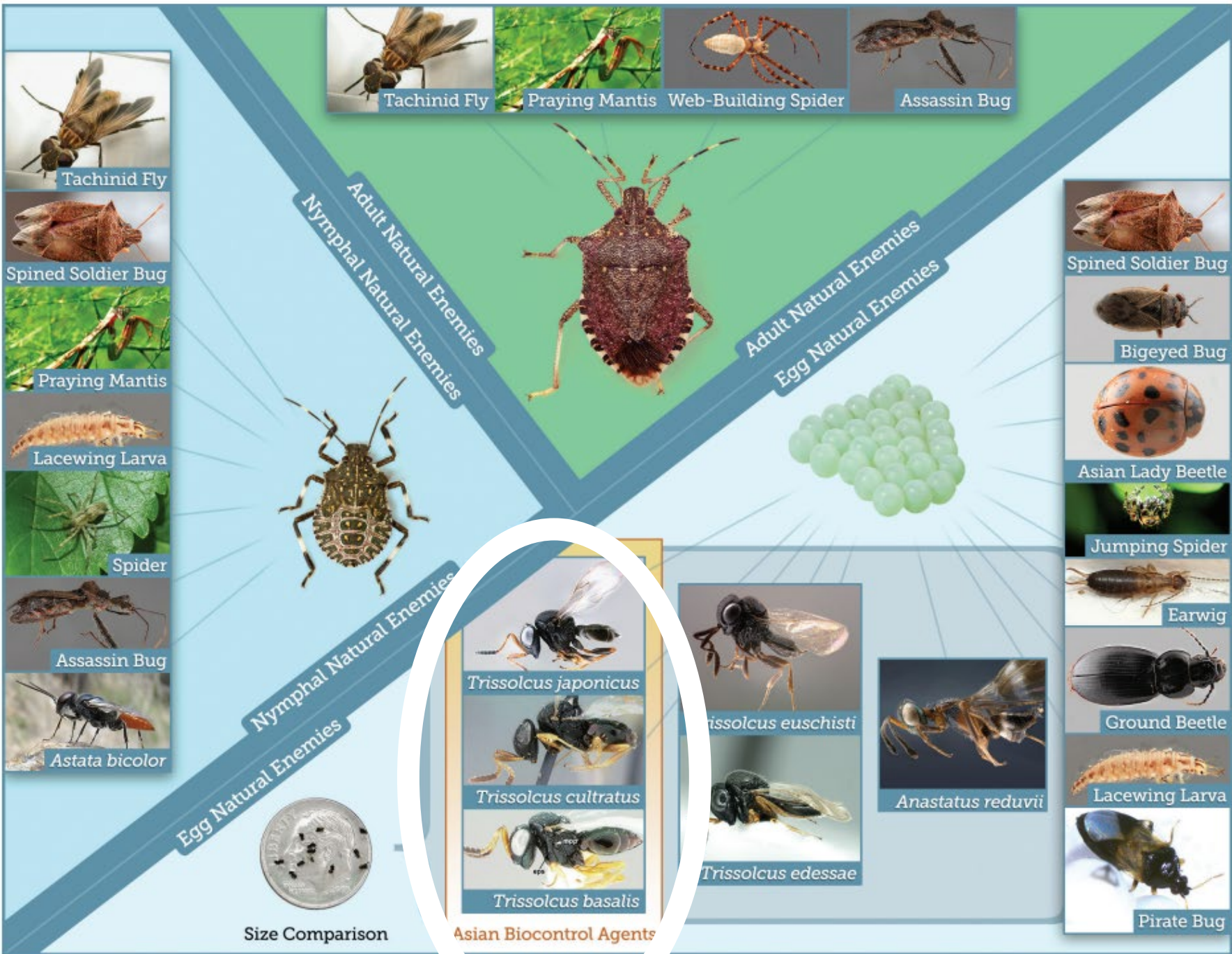


APPLE

Trying to Control BMSB

- Broad Spectrum insecticides
 - *Low effectiveness-adults*
 - *Costly*
 - *Disrupt IPM*
 - Kill beneficials & natural enemies
 - Insecticide resistance
 - Secondary pest outbreaks





Tachinid Fly



Praying Mantis



Web-Building Spider



Assassin Bug



Tachinid Fly



Spined Soldier Bug



Praying Mantis



Lacewing Larva



Spider



Assassin Bug



Astatia bicolor

Adult Natural Enemies
Nymphal Natural Enemies

Adult Natural Enemies
Egg Natural Enemies

Nymphal Natural Enemies
Egg Natural Enemies



Spined Soldier Bug



Bigeyed Bug



Asian Lady Beetle



Jumping Spider



Earwig



Ground Beetle



Lacewing Larva



Pirate Bug



Size Comparison

Trissolcus japonicus

Trissolcus cultratus

Trissolcus basalis

Asian Biocontrol Agents



Trissolcus euschisti



Trissolcus edessae



Anastatus reduvii

Biological Control Shows Promise

- Egg Parasitoids
- Classic & Conservation Biocontrol



Utah Native Parasitoid Contenders



■ *Anastatus* sp.

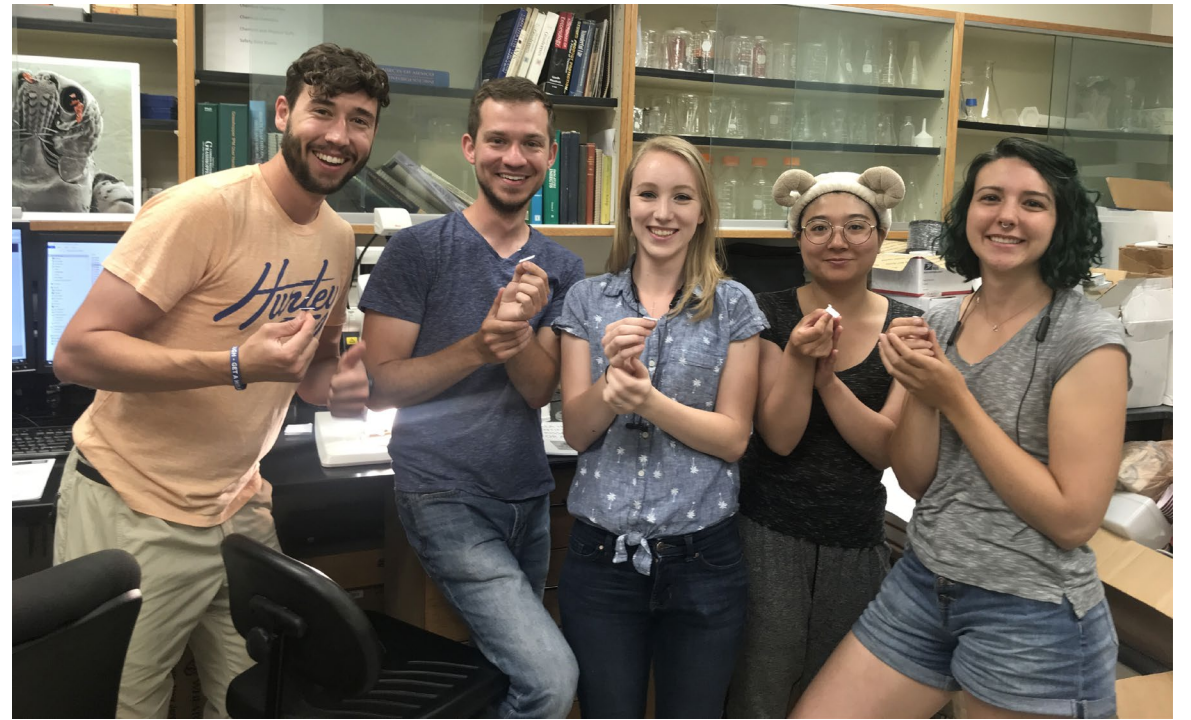


■ *Telenomus* sp.



■ *Trissolcus* sp.

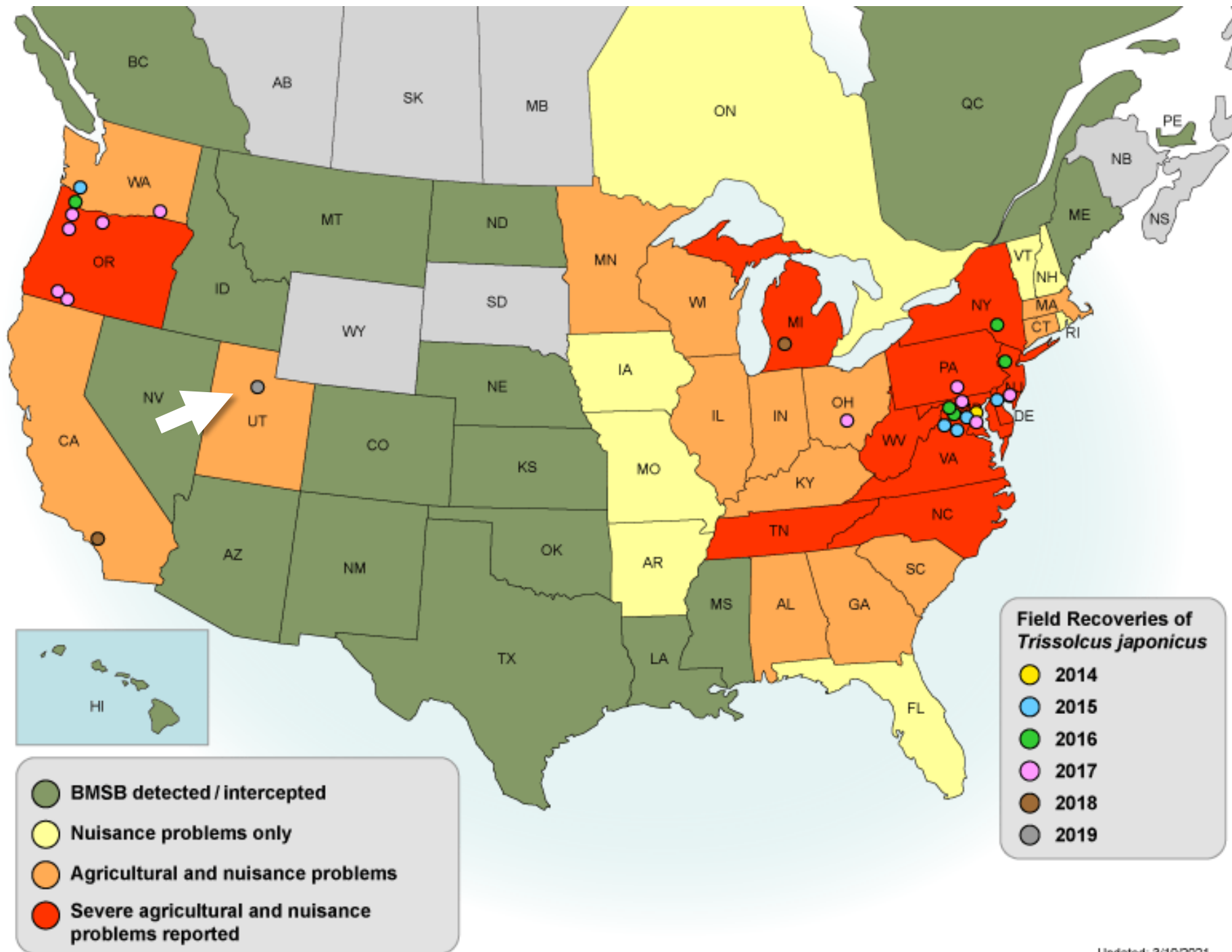
Low parasitism: 0.5-3.7% (Holthouse et al. 2020)



Samurai Wasp Discovered in Utah

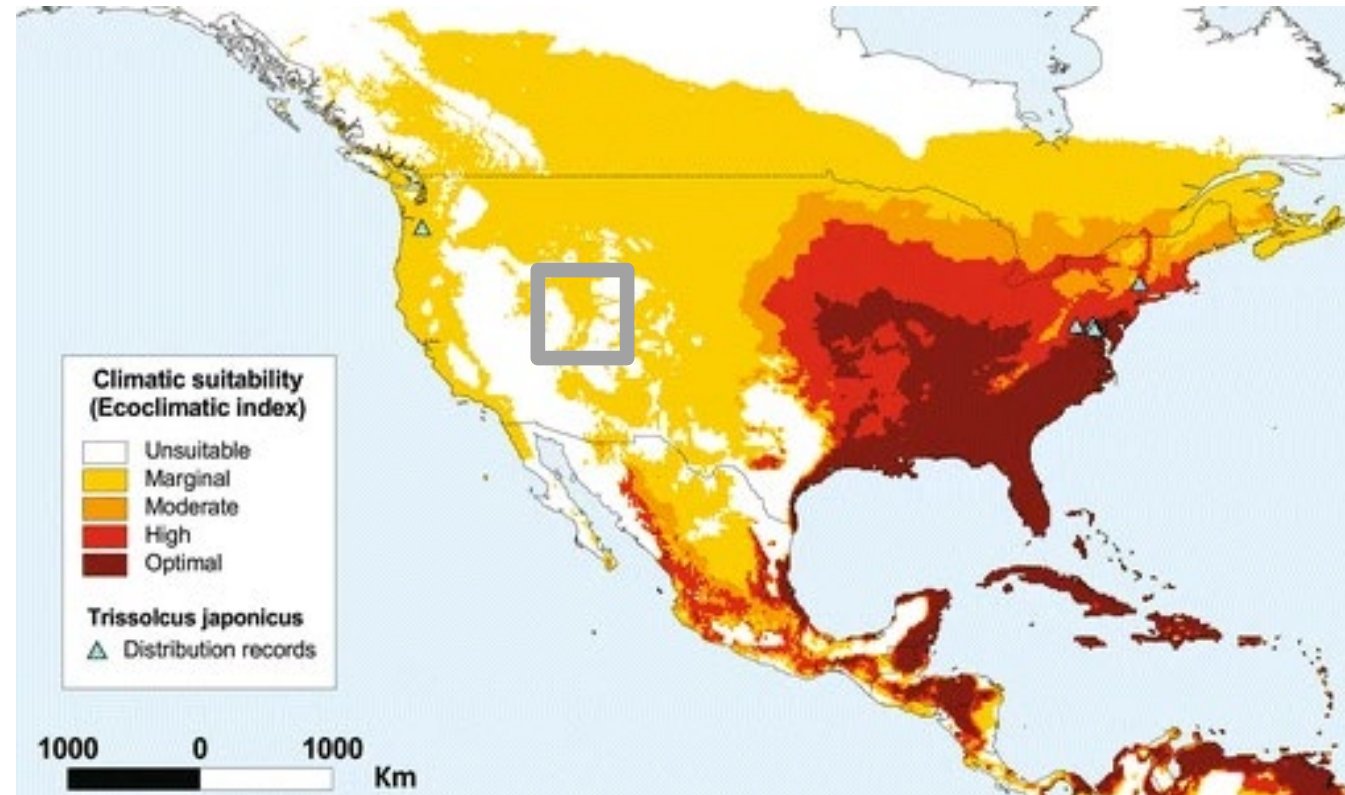
- *Trissolcus japonicus*
- Salt Lake City, Utah, June 2019
- Mean parasitism rate 78.5%
(Holthouse et al. 2020)





Environmental Challenges

- Novel landscape
- High elevation (>1200 m)
 - *Heavy snowfall*
- Arid, hot summers
- “Marginal” & “Unsuitable”



(Avila & Charles 2018)

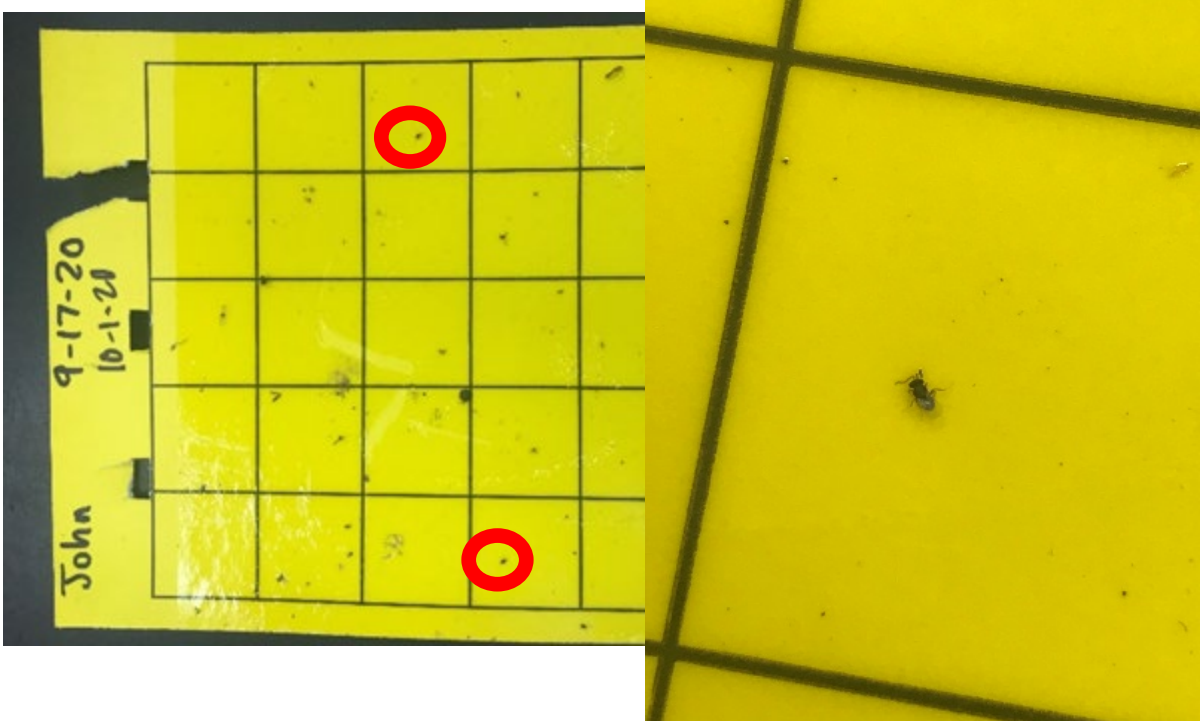
A close-up photograph of a green leaf with a small black insect on it. The leaf's veins are clearly visible, and the insect is positioned on the right side of the leaf. A dark grey rectangular box is overlaid on the left side of the image, containing the text.

RESEARCH OBJECTIVES

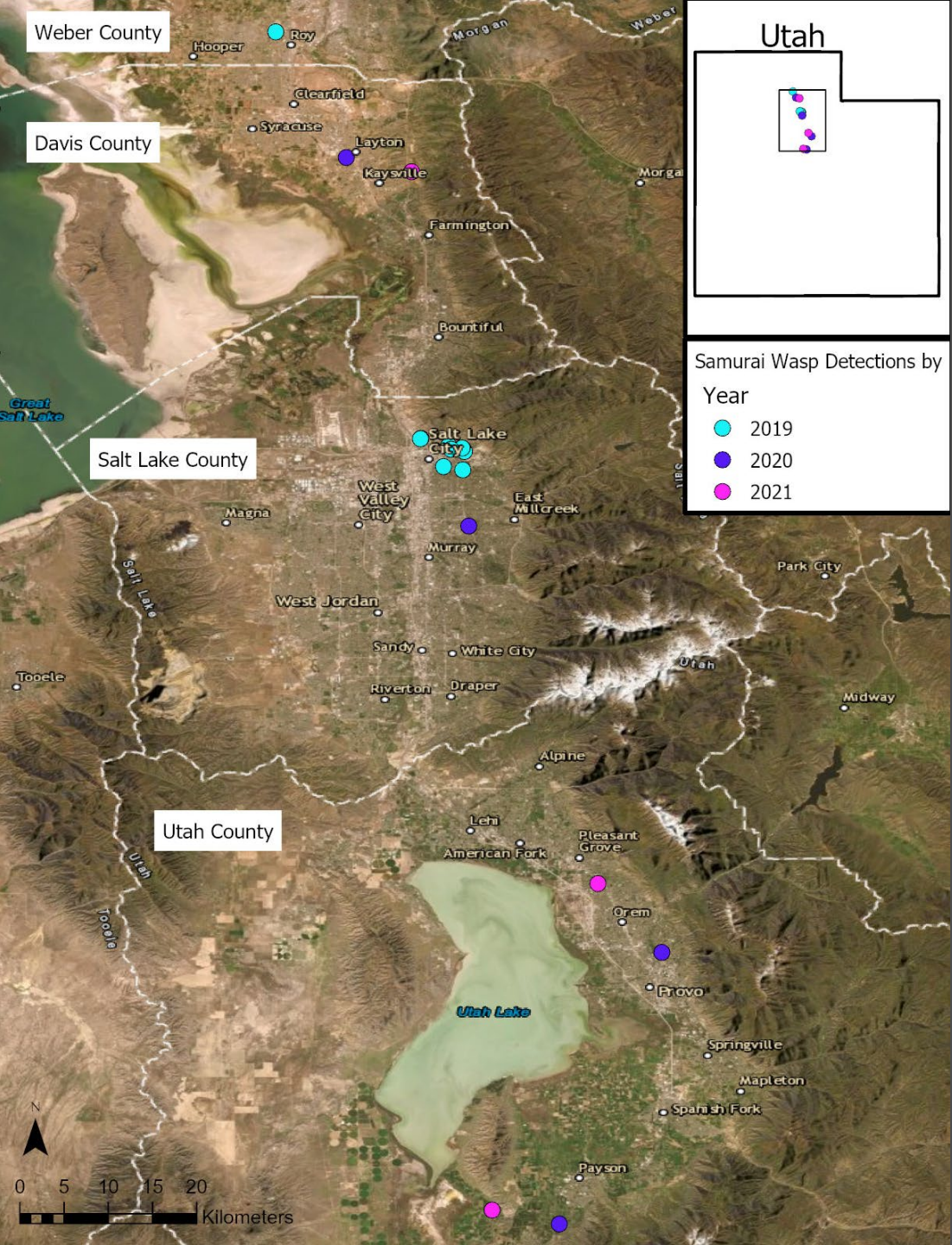
1. Survey native & exotic parasitoids
 - *Impacts of groundcover diversity*
2. Compare cover crop floral resource candidates
3. Assess viability of kairomones for increasing field egg parasitism rates

Where is samurai wasp?

- Surveys using yellow sticky cards



- Urban areas
 - *More detection sites*
 - *Higher densities*



Enhancement via Floral Resources

- Floral diversity
 - *Ornamentals*
 - *Strip/border cropping*
- Benefits for samurai wasp:
 - *Food*
 - *Habitat*
 - *Extended lifespan (Rahat et al. 2005; McIntosh et al. 2020)*





Objective 1



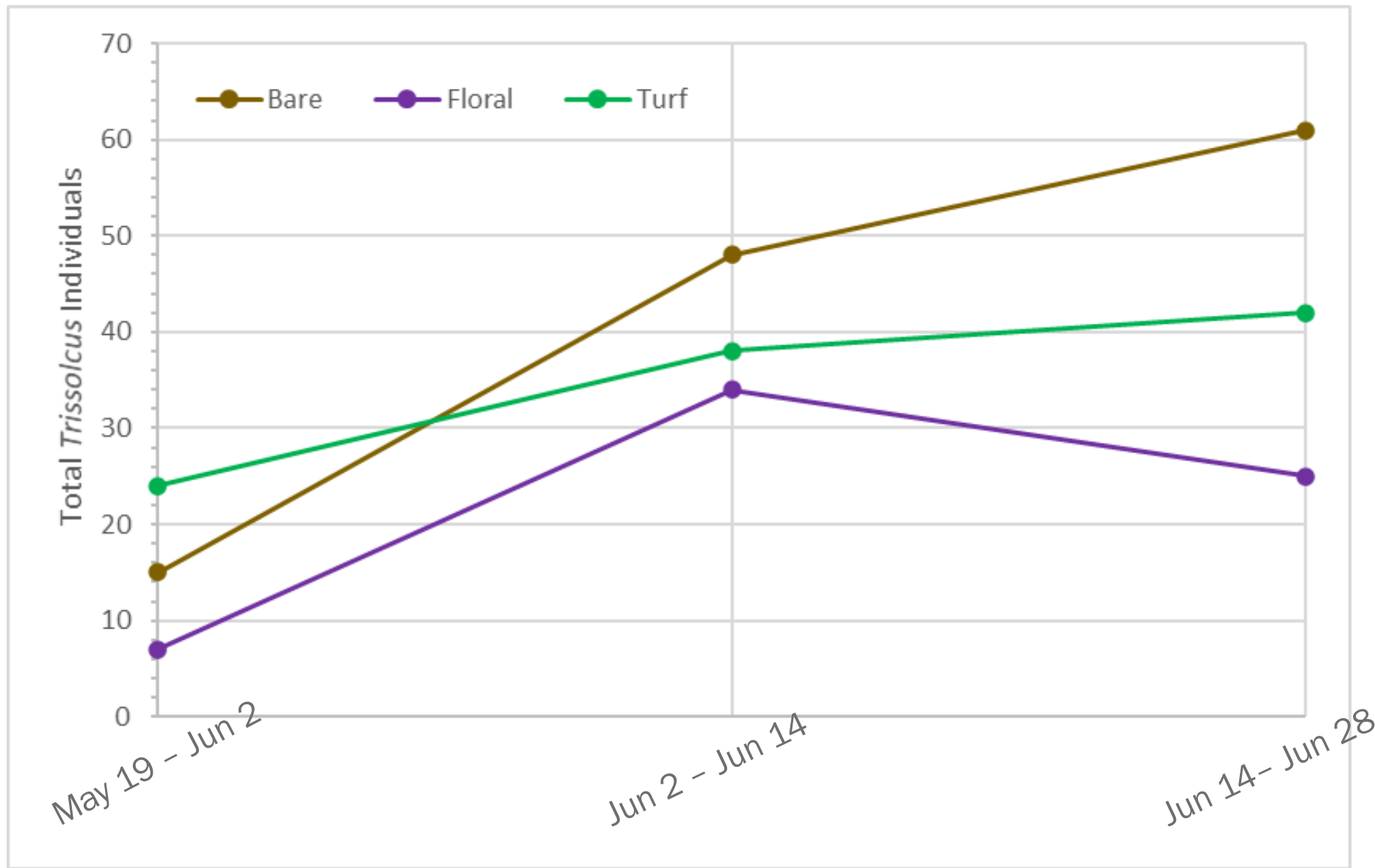
FLORAL

TURF

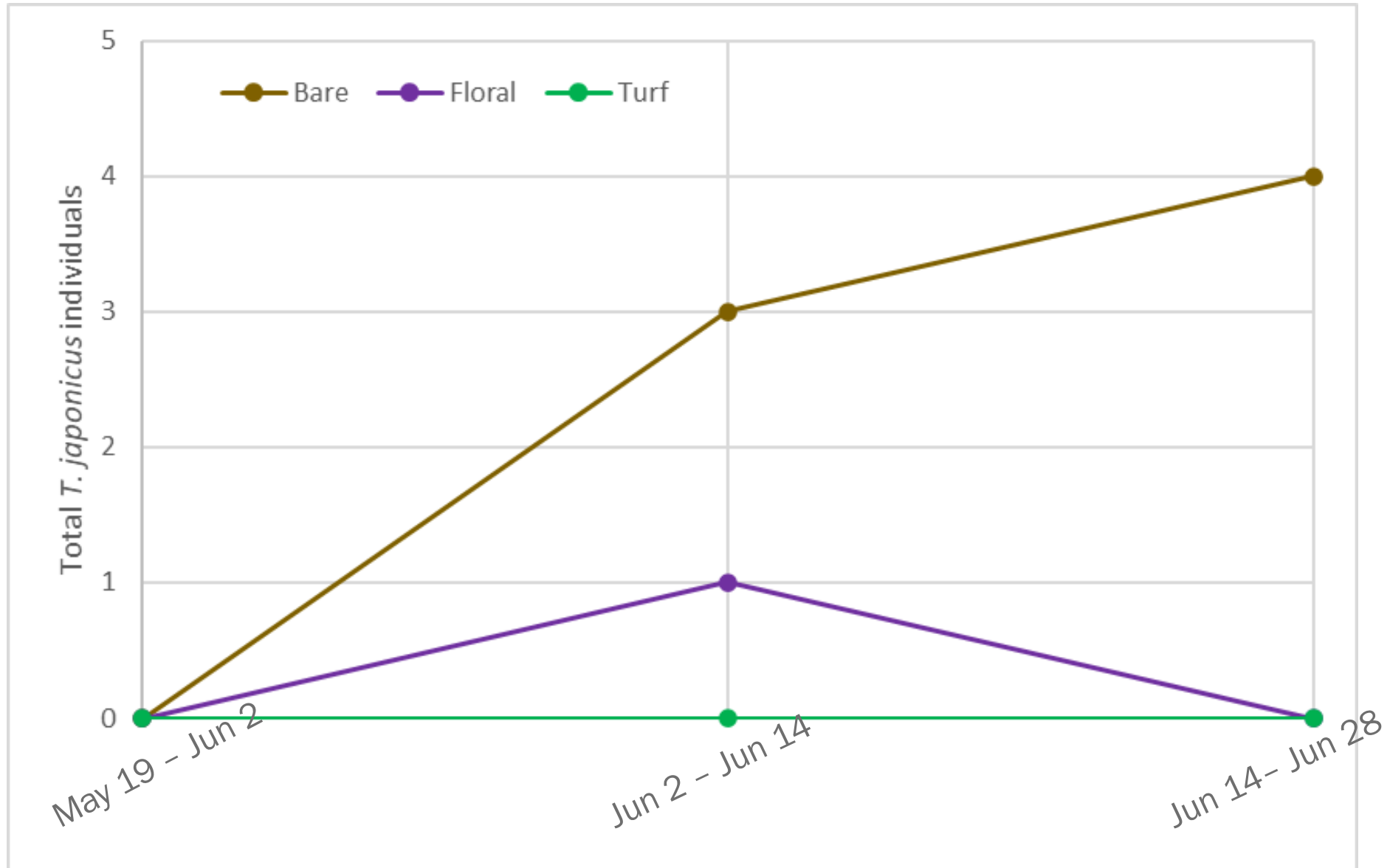
BARE



Bare orchards detect the most *Trissolcus* wasps

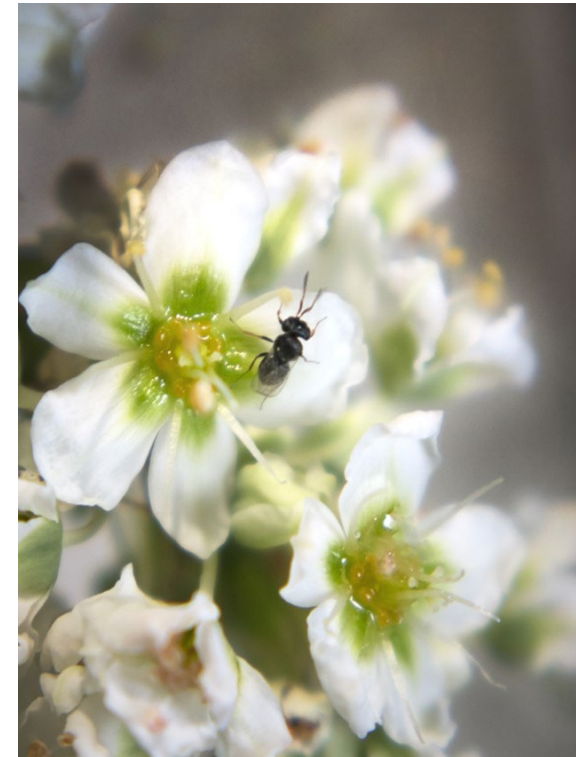


Bare orchards detect the most *Samurai Wasp*

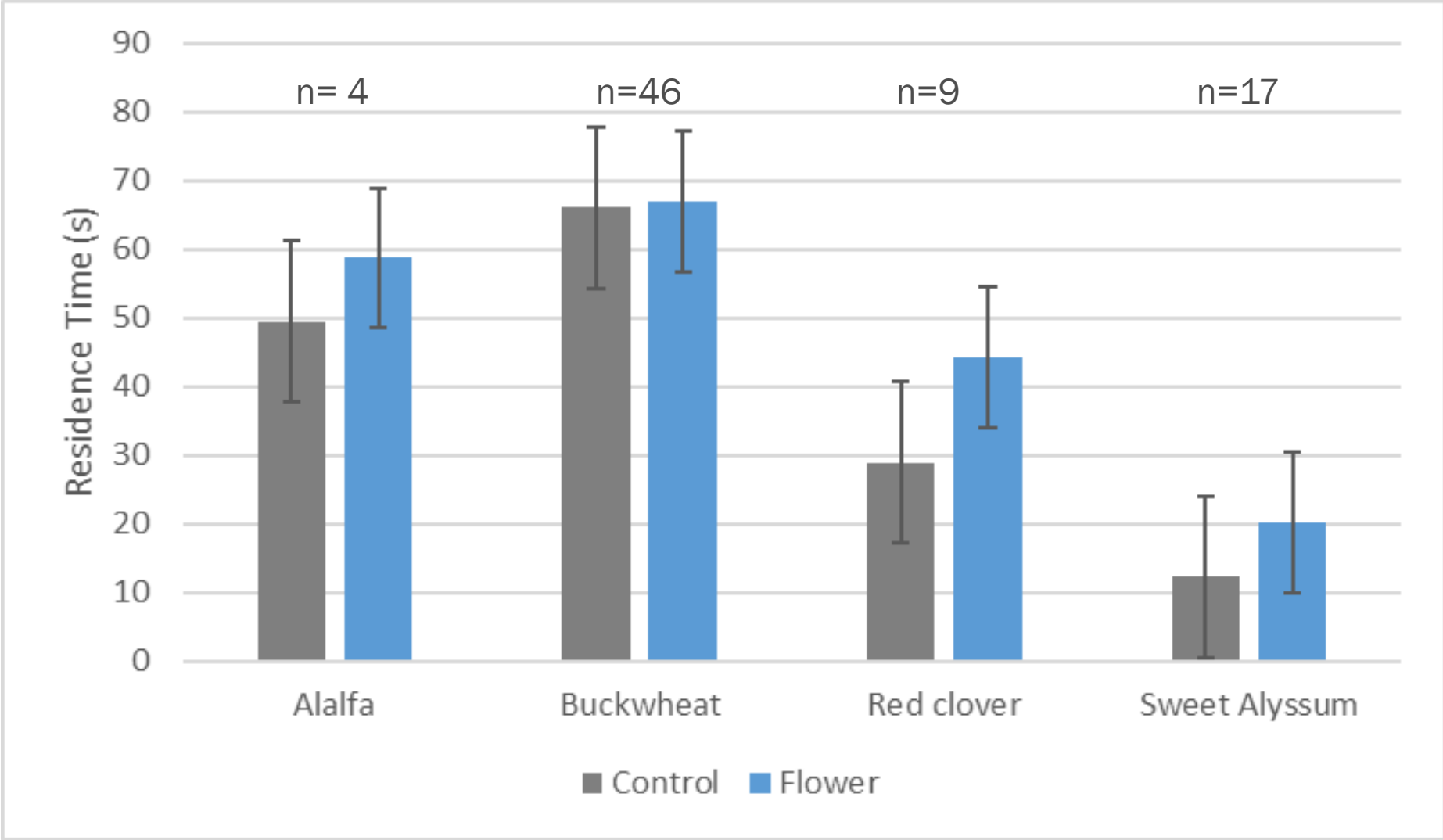


Comparing Attraction via Olfactometer

- Controlled lab conditions
- 4 cover crop species
 - *Alfalfa*
 - *Buckwheat*
 - *Red Clover*
 - *Sweet Alyssum*



Samurai wasp did not show preference



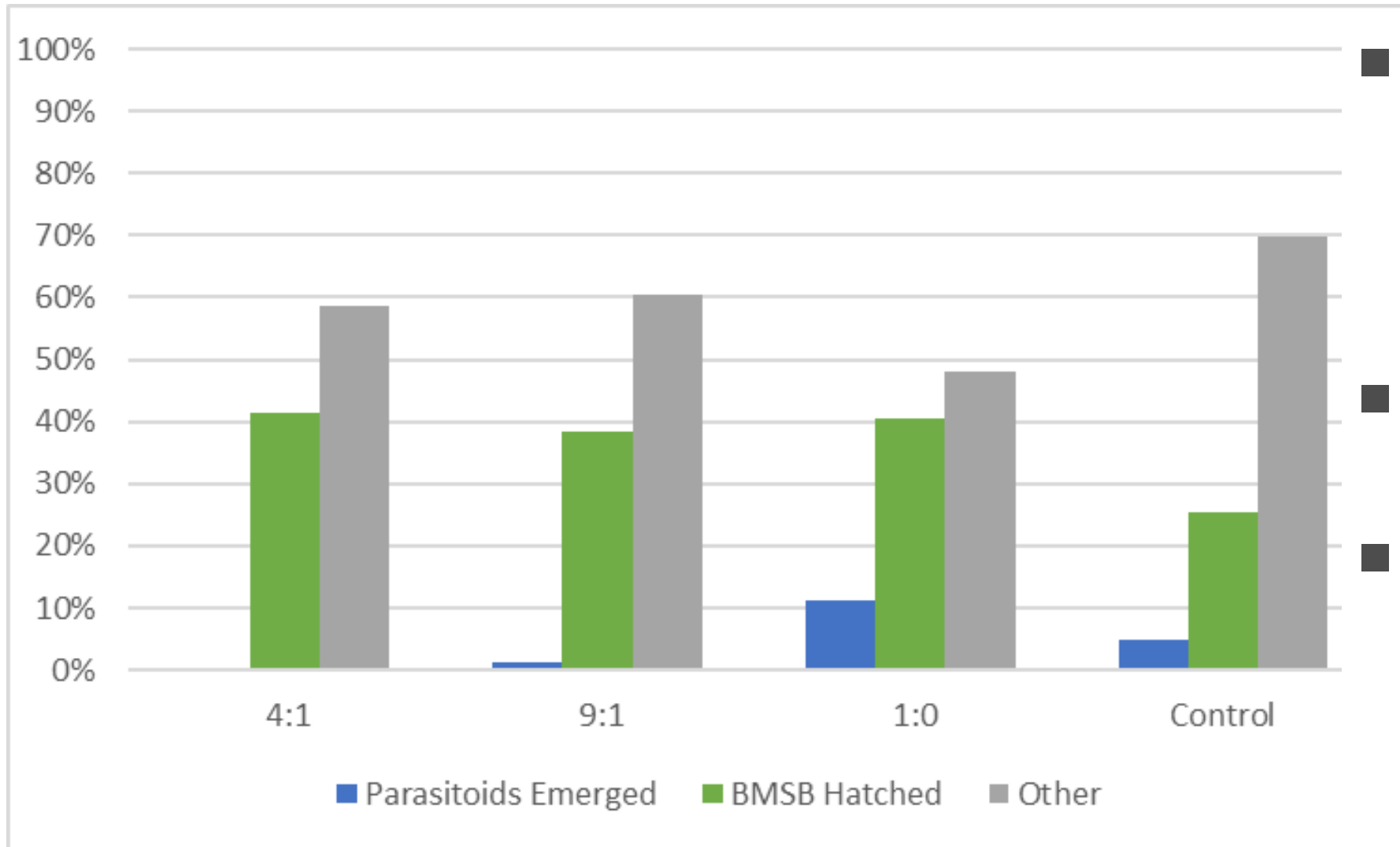
Residence time in the treatment vs. control arm of the Y-tube olfactometer out of 5 minutes

Using Kairomones to Increase Parasitism

- Stink bug chemical cues
 - *N-Tridecane* is attractant
 - *E-2-decenal* is repellent
- Novel Lures
 - 4:1 *n-Tridecane* to *e-2-decanal*
 - 9:1 *n-Tridecane* to *e-2-decanal*
 - 1:0 *n-Tridecane* to *e-2-decanal*
 - Control



Average Fate of Egg Masses by Lure Type



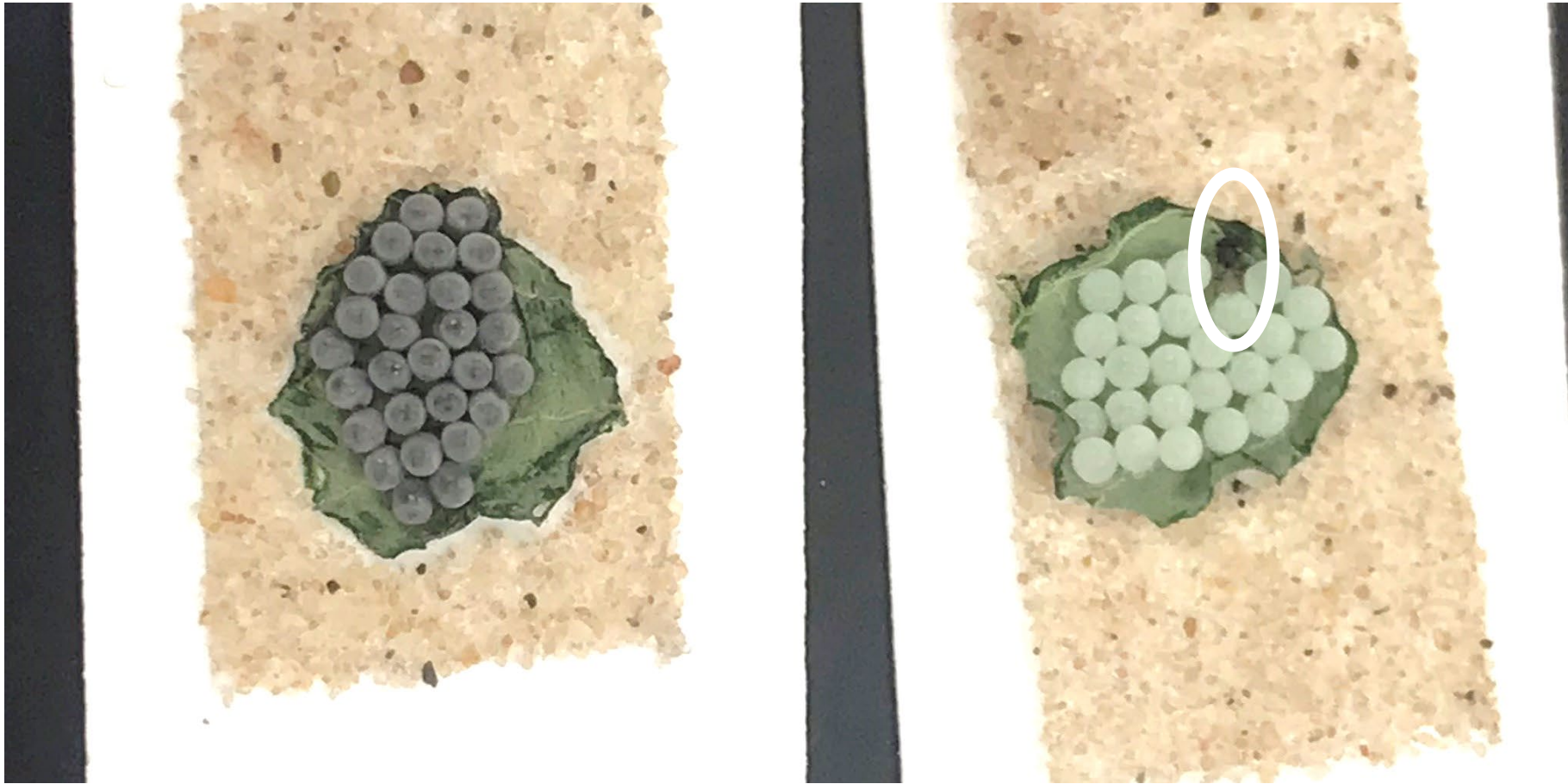
- 103 Total eggs showed parasitoid emergence
 - 6 egg masses
- 100- *T. japonicus*
 - 5 egg masses
- 3- *T. euschisti*
 - 1 egg mass

Encouraging Samurai Wasp Establishment

- Use less insecticides
 - *Spinosad*
 - *Sulfoxafor*
- Increase Floral diversity
 - *Wildflowers*
 - *Ornamental flowers*
 - *Strip/border cropping*



If you see a parasitoid wasp:



LEAVE IT ALONE!

Acknowledgements



Fellow Grad Students

Cody Holthouse & Liz Rideout

Field and Lab Technicians:

Stephanie Hall Taylor Hague
Anna Fabiszak Loren Linford
Zachary Ross Keegan Cunningham

Special thanks to Zach Schumm



United States Department of Agriculture
National Institute of Food and Agriculture

Funding



Collaborating Institutions



A close-up photograph of a green leaf with a small black insect on the stem. The leaf is vibrant green with visible veins. The stem is also green and has fine hairs. A small black insect is perched on the stem. A white L-shaped graphic element is positioned to the left of the text box.

QUESTIONS?



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