

# Obj. 3 Habitat management and enhancing biocontrol

Jana Lee

USDA ARS Horticultural Crops  
Research Unit, Corvallis, OR

Cerruti Hooks, Univ Maryland

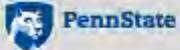
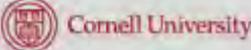
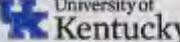
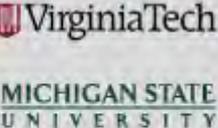
Anne Nielsen, Rutgers Univ



*Funding*

 United States Department of Agriculture National Institute of Food and Agriculture  
Specialty Crop Research Initiative

*Collaborating Institutions*

    
    
Northeastern     
    
    
  

This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, Specialty Crop Research Initiative under award number 2016-51181-25409.

- Predators and parasitoids have impact
- How to make them more effective?
  - **Flowers**
    - Field trial
    - Lab trial with *T. japonicus*
  - **Boost parasitoids**
    - Augmentative release
    - Banker system
  - 2019 plans

# Flowers – field trial

**Objective:** Determine how French marigold used as an insectary plant impact stink bug egg mortality in edamame (vegetable soybean)

**Treatments:** Edamame monoculture and edamame bordered by French marigold, *Tagetes patula*

**Location:** UMD Upper Marlboro Research & Education Facility, Upper Marlboro, MD

**PIs:** Cerruti R<sup>2</sup> Hooks and Alan W. Leslie



*Oebalus pugnax*



*Euschistus servus*



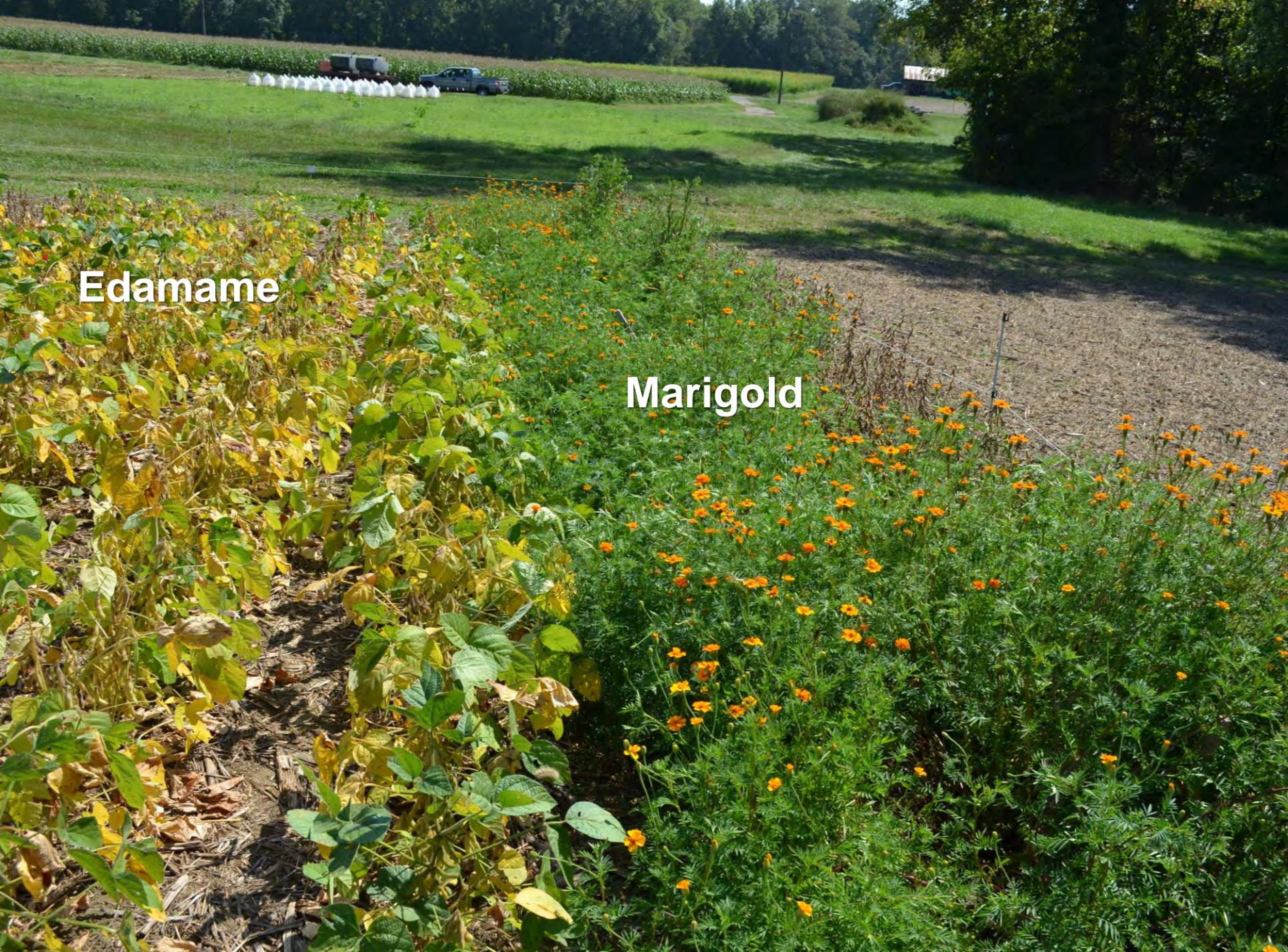
*Halyomorpha halys*



*Thyanta custator*

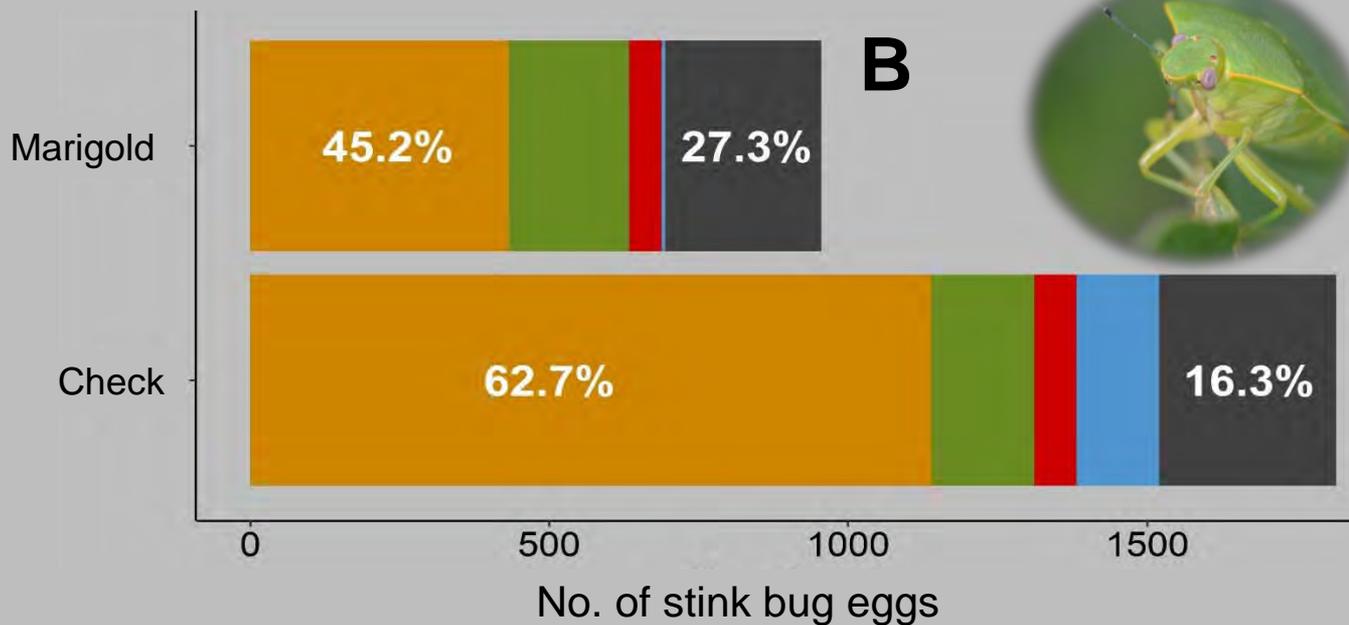
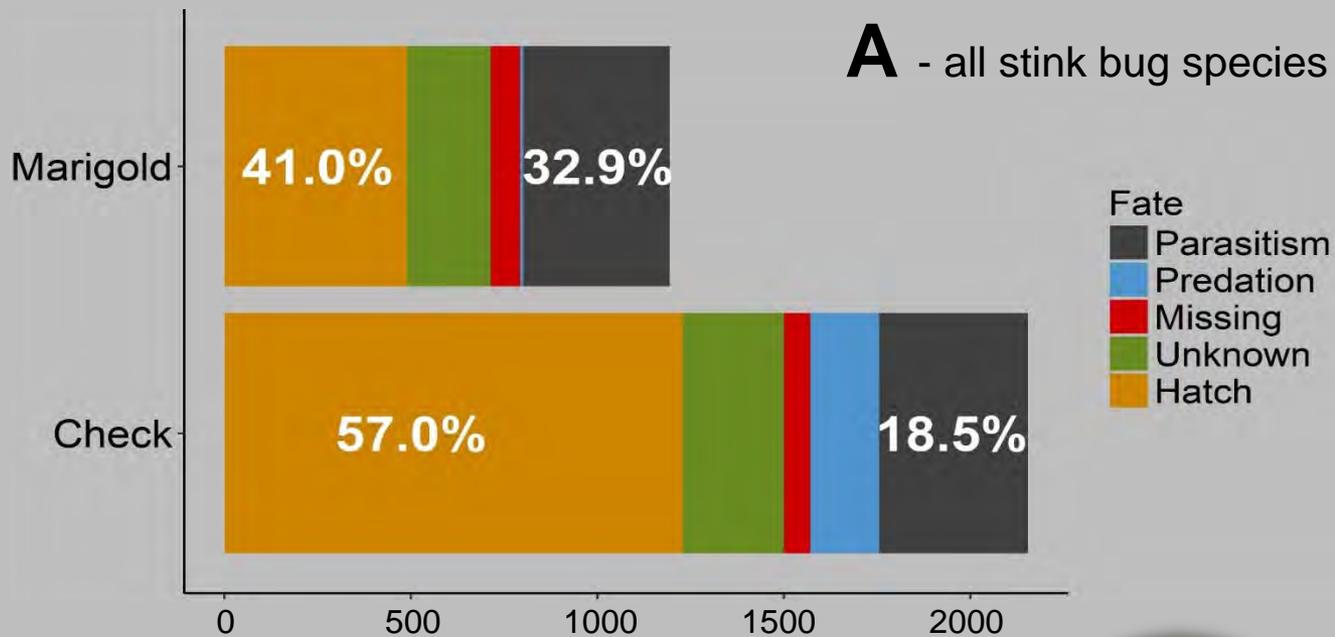


Green stink bug (*Chinavia hilaris*) *Acrosternum hilare*

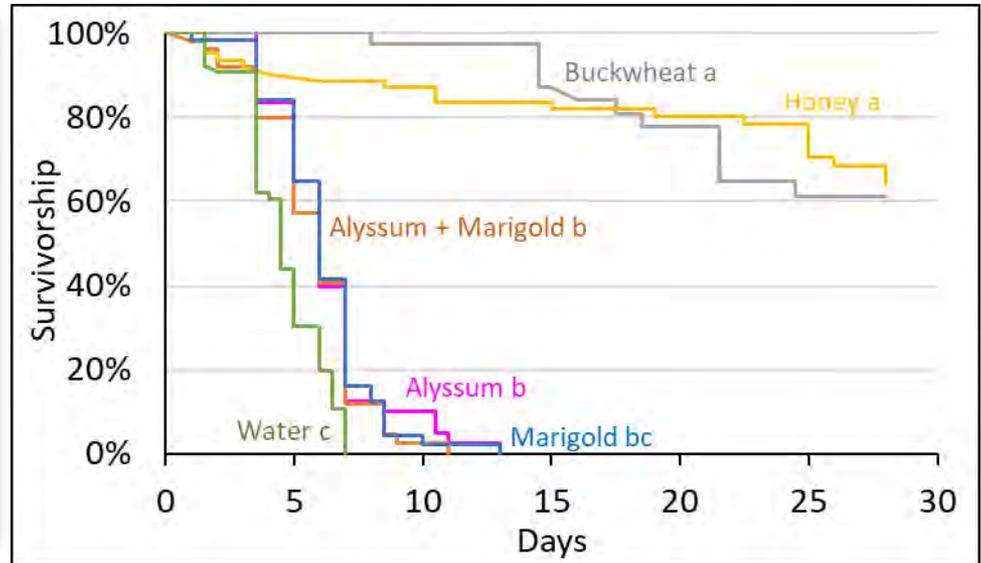
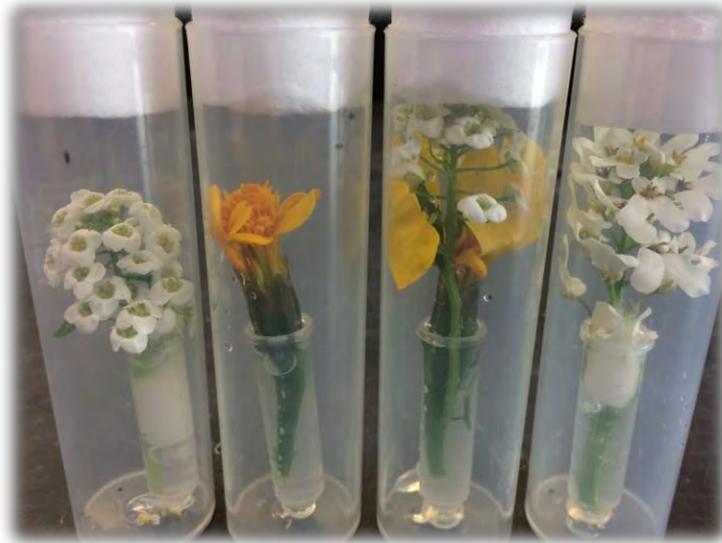


**Edamame**

**Marigold**



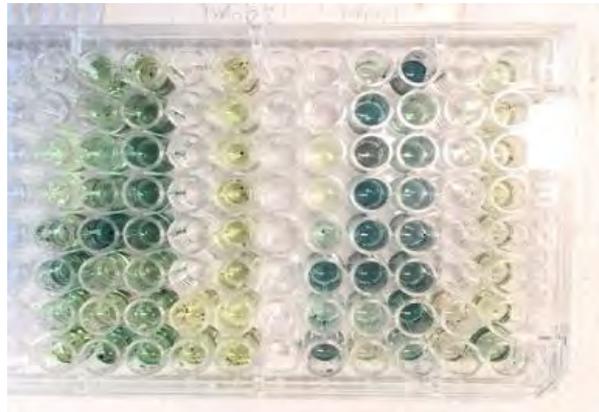
# What flowers help *T. japonicus*?



- Sweet alyssum and buckwheat commonly used, marigold tested in field
- Buckwheat good, alyssum modest increase
- More species... in 2019

# Study feeding in-depth

- Quick-crush method with anthrone reagent to verify feeding in *T. japonicus*, no instrumentation



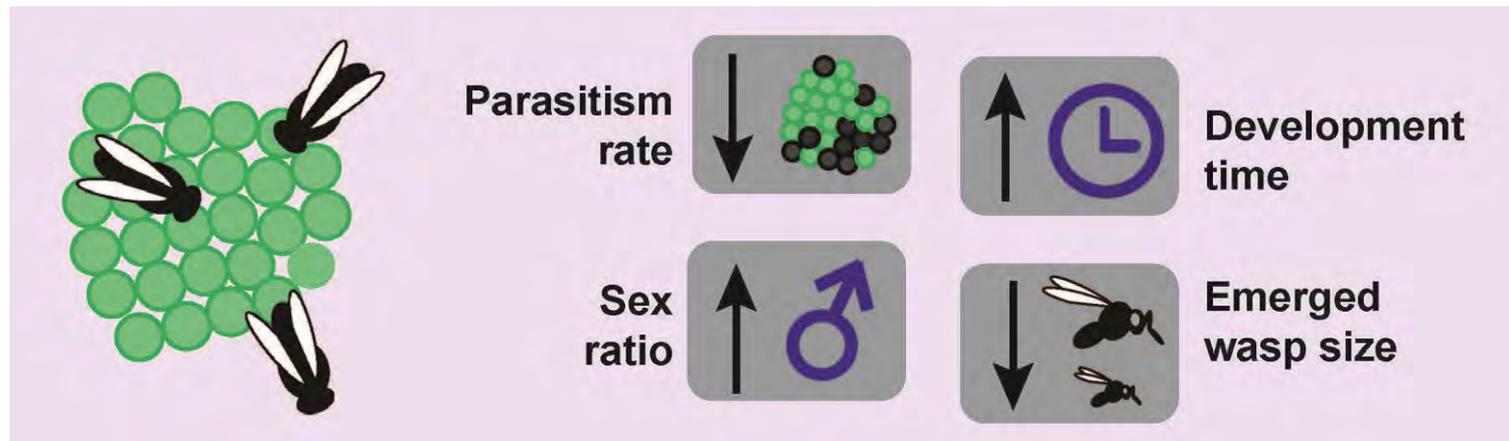
Yellow = starved  
Green = fed

*Methodology in Lee 2019 Ann Ent Soc Am*

- Specific *T. j.* protocols for measuring lipid, glycogen and sugar
- Buckwheat elevates *T. j.* carbohydrate reserves

- How to make them more effective?
  - Flowers
  - **Boost parasitoids**
    - **Augmentative release**
    - Banker system

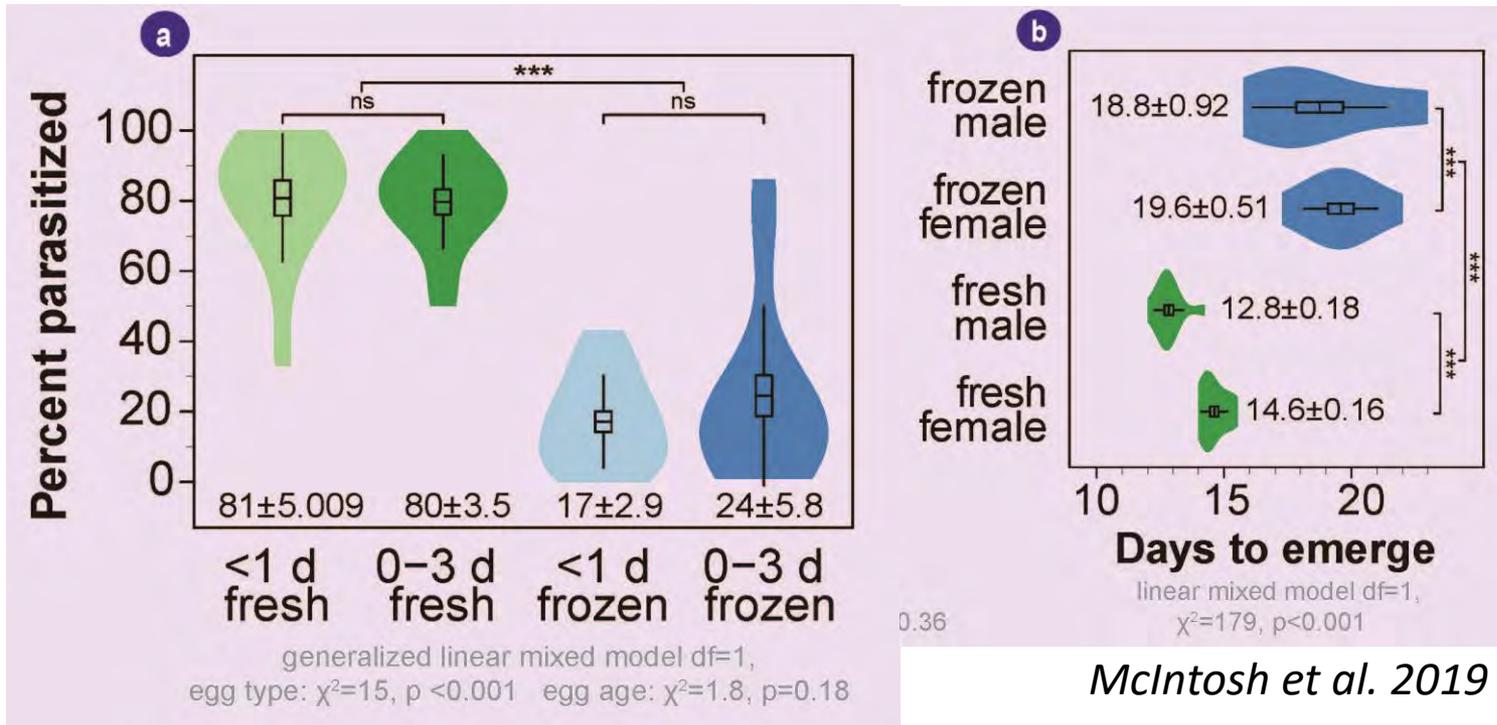
Requires mass-rearing & many BMSB eggs  
Which BMSB eggs are best for rearing?



Drawn by McIntosh

# Rearing *T. japonicus*

- Compared fresh vs frozen eggs
- Monday 0-3 d old vs Tue-Fri eggs <1 d old



- Fresh better than frozen – higher parasitism, faster development ~5 d
- Fresh  $\approx$  frozen for sex ratio or weight, short-term use of frozen eggs ok
- <1 d & 0-3 d eggs similar in parasitism (Qiu et al. 2007 & Yang et al. 2019 found similar *T.j.* parasitism with eggs collected w/in 2.5-3 d, less parasitism in 5 d old eggs)

# Frozen eggs

- Use more recent ones for studies, older leftovers accumulate
- How long are they good for?

## c Assessment of longer-stored frozen eggs (high parasitism pressure)

Cups with 10 female and 4 male wasps were exposed to 3 frozen egg masses stored 77-1352 d for 4 d, and parasitized eggs were reared in a growth chamber

 Storing frozen egg masses reduced parasitism by  $1.2 \pm 0.35$  % (mean  $\pm$  se) per month stored

generalized linear model  $df=1$ ,  $\chi^2=4.3$ ,  $p=0.038$ ; linear regression  $R^2=0.23$



There was no significant difference in sex ratio as storage duration increased in both studies

generalized linear model  $df=1$ ,  $\chi^2=0.26$ ,  $p=0.61$

## d Assessment of longer-stored frozen eggs (low parasitism pressure)

Frozen egg masses stored 3-490 d were exposed to one mated female for 3-5 d, and parasitized eggs were reared in a growth chamber

 Storing frozen egg masses reduced parasitism by  $1.2 \pm 0.35$  % (mean  $\pm$  se) per month stored

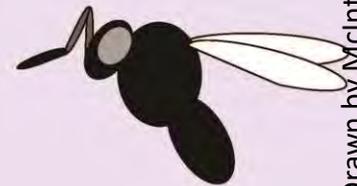
generalized linear model  $df=1$ ,  $\chi^2=4.04$ ,  $p=0.044$ ; linear regression  $R^2=0.12$

generalized linear model  $df=1$ ,  $\chi^2=0.39$ ,  $p=0.53$



Emerged wasp weight was not impacted by storage duration

generalized linear model  $df=1$ ,  $\chi^2=1.5$ ,  $p=0.22$



Drawn by McIntosh



# After *T.j.* release, how to keep them going?



## Banker system? Proof-of-concept



Both treatments have

- BMSB host plants
- Buckwheat
- 40 ♀, 10 ♂ wasps
- Sentinel eggs placed each week



- Persistence of *T.j.* with banker, but need more reps
- Practical banker? a very infested site, frozen eggs that won't add to BMSB pressure
- 2019 plans – adjust protocol, find cooperators

# 2019 plans

- Floral species screening
  - Longevity in vial arenas
  - Nutrient, Olfaction
- Lures to improve *T.j.* monitoring
- Banker proof-of-concept in large cages?
- Field release of *T.j.* and examine persistence with flowers or banker?



## Habitat Manipulation in NJ



- Conducted a mark-release-recapture study with *T. japonicus* to investigate foraging in peach and wooded habitats
  - Identified equal dispersal between peach and woods
  - Some foraging in peaches occurred
- MS student (Nick Avila) will be investigating insectary plants to boost dispersal into peach and/or soybean habitats
  1. 2019: Influence of extra floral nectaries on *T. japonicus* survivorship and fitness (fecundity) in the greenhouse
  2. 2019: Field study on insectary plants using a Latin square design with 4 or 5 potential insectary plants
    1. *Look at bloom time and length*
    2. *Release *T. japonicus* and measure attractiveness of each plant*