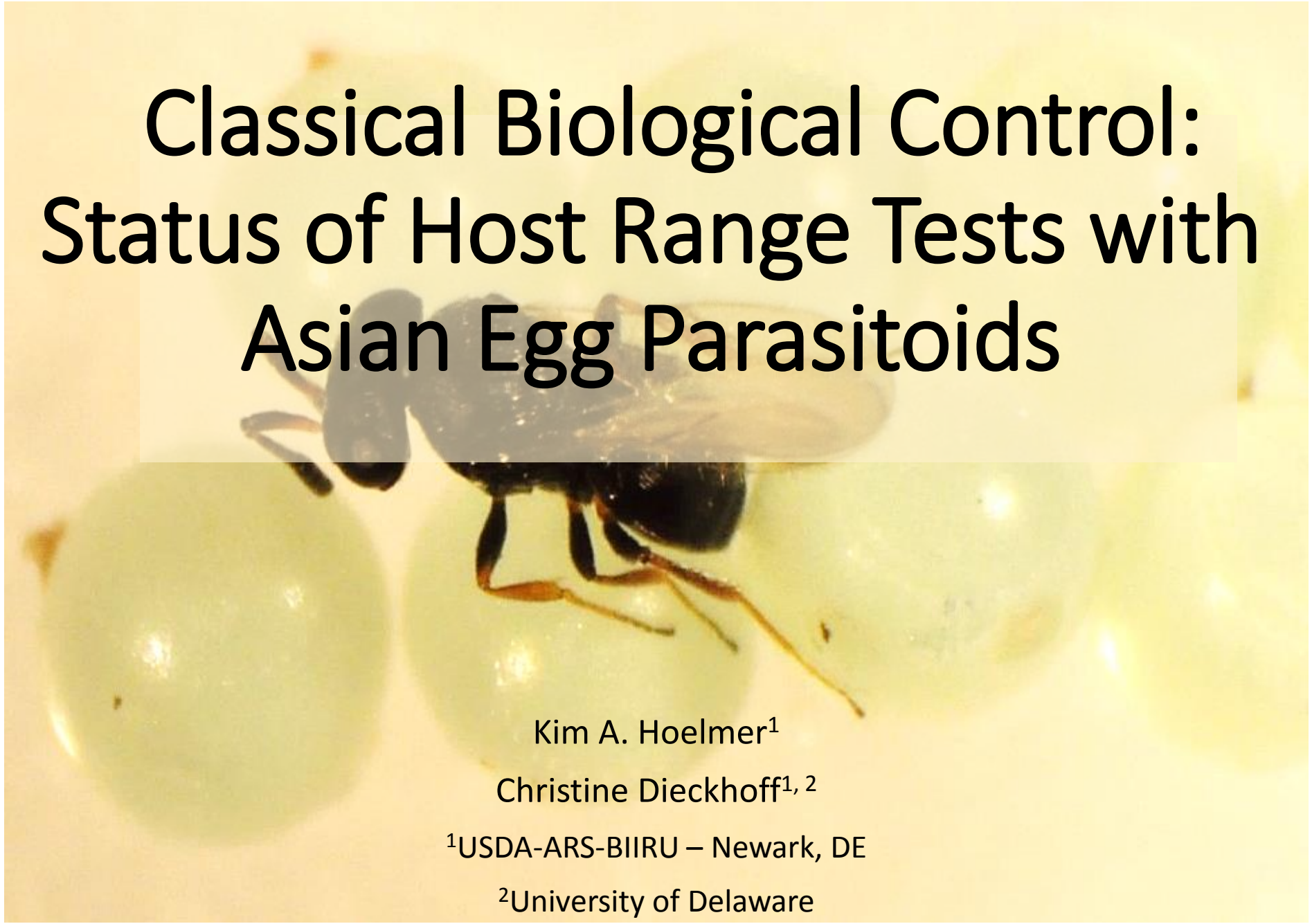
Classical Biological Control: Status of Host Range Tests with Asian Egg Parasitoids



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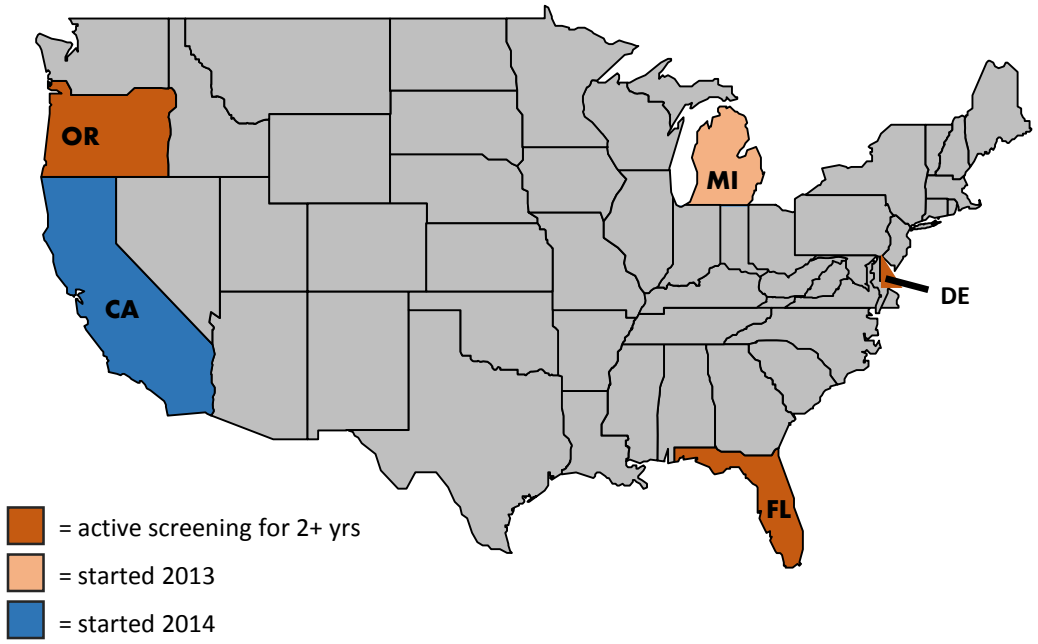
Host Range Evaluations– A team effort to fast-track the evaluation process

<u>Funding for Host Range Evaluations</u>:

Farm Bill funding (APHIS PPQ)

NIFA SCRI multi-institution BMSB grant



<u>Collaborators</u>:

USDA-ARS (Newark, DE & EBCL, France)

University of Delaware (D. Tallamy)

Florida Dept. Agriculture & Consumer Services, Division of Plant Industry (T. Smith)

MSU – Michigan State University – Department of Entomology (E. Delfosse)

Oregon Department of Agriculture (H. Rogg)

Oregon State University – Department of Horticulture (V. Walton, P. Shearer)

University of California, Riverside & CDFA (M. Hoddle, C. Pickett)

Asian *Trissolcus spp.*

30+ parasitoid populations at USDA-ARS BIIR
maintained for host range and efficacy testing

China: ***Trissolcus japonicus* (*halyomorphae*)**
(Beijing 2007, Beijing 2009, Nanjing 2009)

Japan: ***Trissolcus mitsukurii*** (Tsukuba 2007)
Trissolcus japonicus (*plautiae*) (Tsukuba 2007, 2012)
Trissolcus cultratus *(near flavipes)* (Tsukuba 2007, 2012)
Trissolcus itoi (Tsukuba 2012)

S. Korea: ***Trissolcus japonicus*** (*plautiae*) (Seoul 2009, 2010)

The potential biological control agent - *Trissolcus japonicus*

<u>Quarantine population tested</u>: Originally recovered from the Beijing area from *Halyomorpha halys* egg masses

- **Solitary egg parasitoid** of Pentatomidae
- **Short development time**
- **~ 10 generations/year**
- **Female-biased sex ratio**
- **High parasitism rates in *Trissolcus japonicus*** compared to other *Trissolcus spp.* reported in Asia

Yang et al., AnnEntomolSoc, 2009, Talamas et al., JHR, 2013

Disclaimer: The Data Presented in this slide are Preliminary Data !

Host Range Evaluations: Progress

62 non-target host species have been tested nationwide so far

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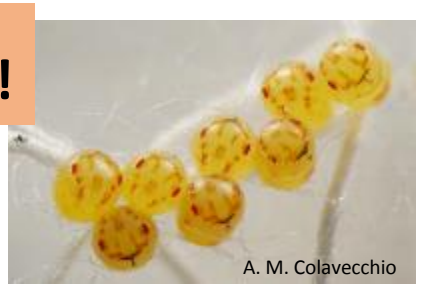

No-choice Screening

Single egg mass of non-target species:

Followed by a BMSB control for an additional 24 hours:

no attack of non-target

no further testing required

Pentatomidae

Genus	Species
Alcaeorhynchus	*grandis*
Brochymena	*quadripustulata*
Coenus	*delius*
Cosmopepla	*lintneriana*
Edessa	*bifida*
Euschistus	*ictericus*
Euschistus	*quadrator*
Homaemus	*proteus*
Loxa	*viridis*
Mormidea	*lugens*
Mormidea	*pama*
Nezara	*viridula*
Oebalus	*pugnax*
Perillus	*strigipes*
Piezodorus	*guildinii*
Proxys	*punctulatus*

Non-Pentatomidae

Genus	Species	Family
Corimelaena	*lateralis*	*Thyreocoridae*
Corimelaena	*pulicaria*	*Thyreocoridae*
Eurygaster	*alternata*	*Scutelleridae*
Homaemus	*proteus*	*Scutelleridae*
Megacopta	*cribraria*	*Plataspidae*
Sehirus	*cinctus*	*Cydnidae*

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Choice Screening

When attack of non-target hosts observed

One egg mass each of target and non-target species together

Pentatomidae

Genus	Species
Amaurochrous	*cinctipes*
Banasa	*euchlora*
Banasa	*dimiata*
Chinavia	*hilaris*
Chinavia	*marginata*
Chlorochroa	*ligata*
Chlorochroa	*uhleri*
Edessa	*florida*
Euschistus	*conspersus*
Euschistus	*servus*
Euschistus	*tristigmus*
Euschistus	*variolarius*
Euthyrhynchus	*floridanus*
Holcostethus	*abbreviatus*
Holcostethus	*limbolarius*
Loxa	*flavicollis*
Murgantia	*histrionica*
Neottiglossa	*undata*
Perillus	*bioculatus*
Podisus	*maculiventris*
Stiretrus	*anchorago*
Thyanta	*custator*

Non-Pentatomidae

Genus	Species	Family
Orsilochides	*guttata*	*Scutelleridae*

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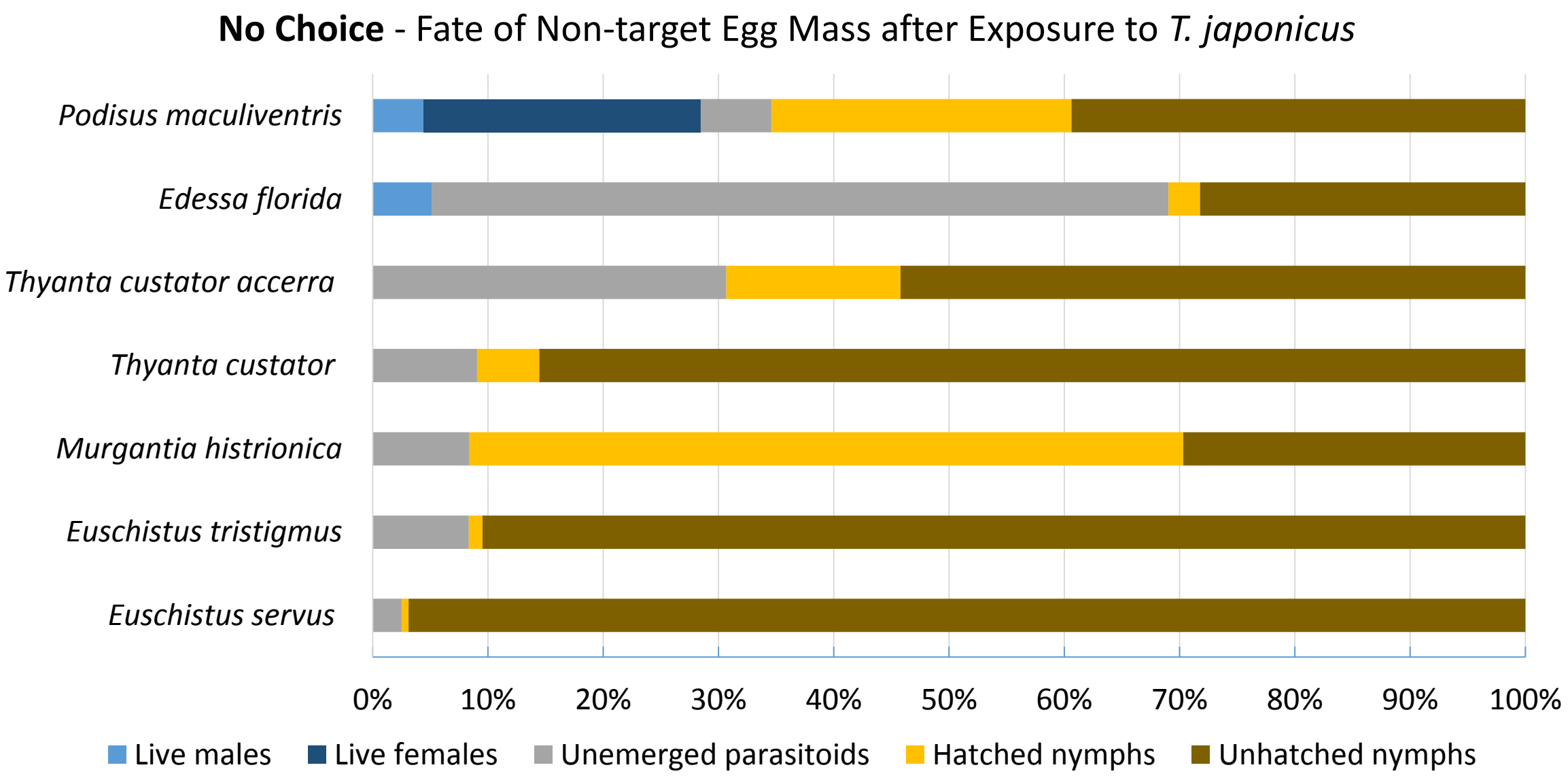

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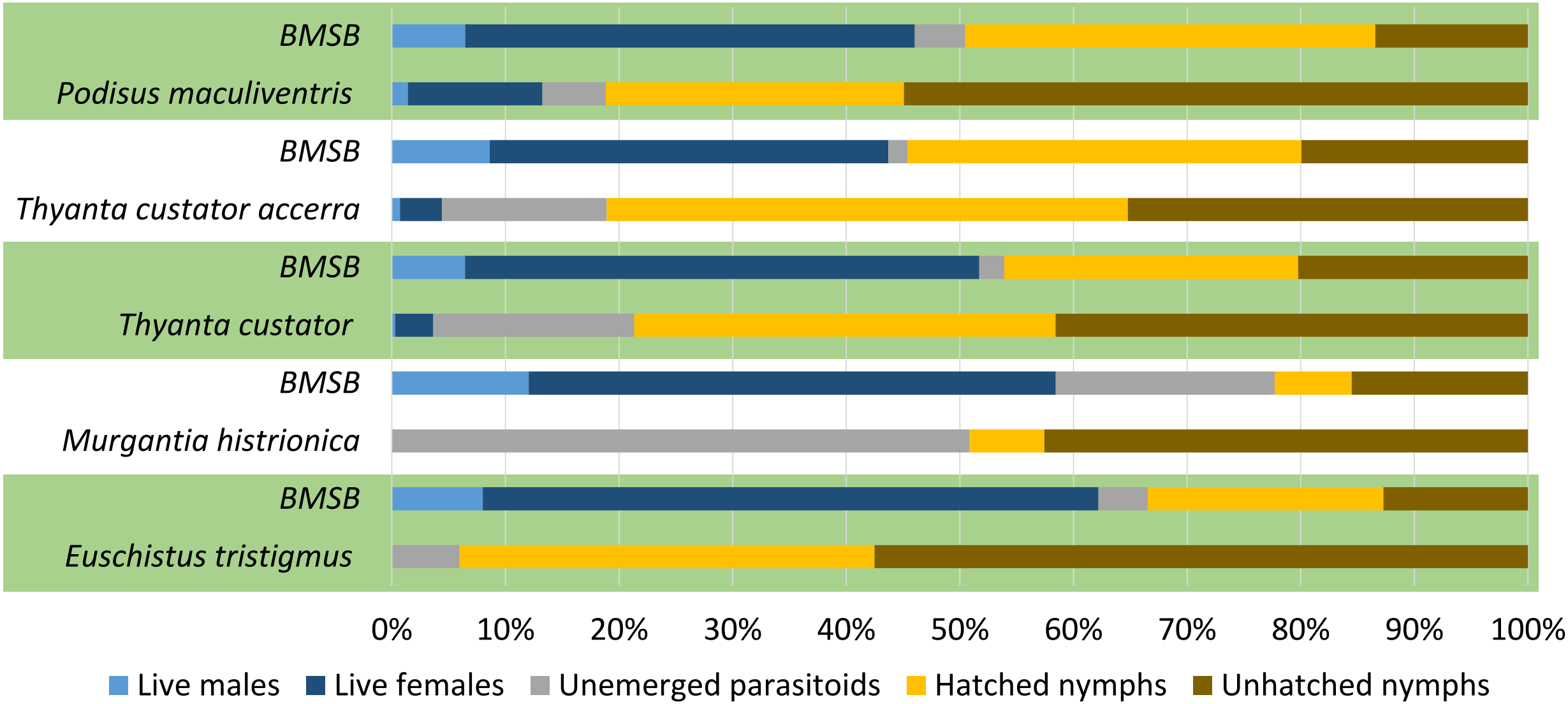
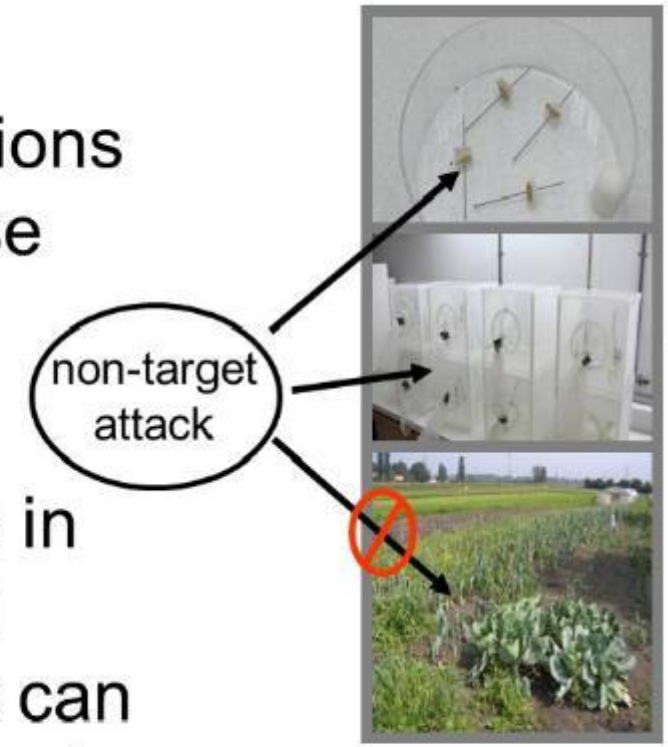
Choice Test - Fate of Target and Non-target Egg mass after Exposure to *T. japonicus*



Test Caveat

- Laboratory conditions are artificial & false positives likely
- Field experiments in area of origin and behaviour studies can provide the context for interpretation



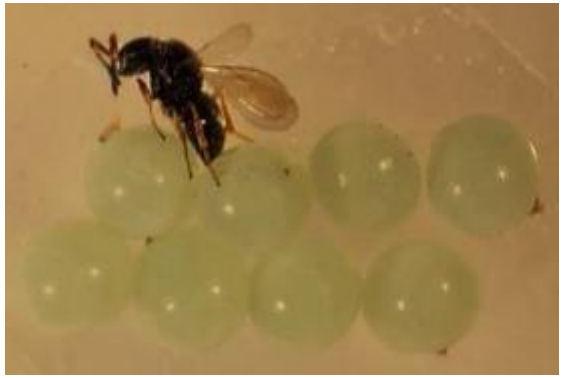
Slide: Courtesy of P. Mason

A Closer Look at Host Choice Behavior in *T. japonicus*

Influence of arena

- **Size**
  - 10 dram
  - 100 dram
  - 500 dram
  - 1000 dram
  - 2000 dram
- **Complexity**
  - Choice tests on plants

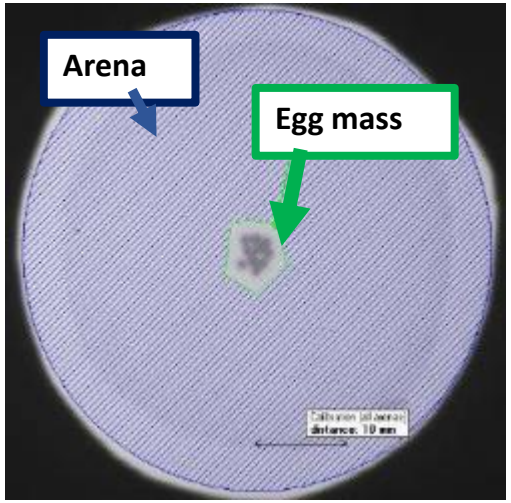
Role of parasitoid physiology & experience



- Parental experience
- Parental physiology
- Effect of host choice on offspring physiology & behavior

Olfactometer Studies (FL, MI)

Behavioral observations



- Searching behavior
- Oviposition behavior
- Host choice
- …

Influence of time of exposure

- 1 h
- 4 h
- 6 h
- 24 h

Ecological Host Range of *T. japonicus* in Asia – K.A. Hoelmer

Study the ecological host range of *Trissolcus japonicus* in Asia – Tim Haye (CABI)

Summary

- Classic host range tests:
  - with *T. japonicus* are almost completed
  - tests with additional populations and/or species have begun (DE – 13 populations/species; FL – *T. cultratus*)
  - results show that *T. japonicus* is oligophagous under laboratory conditions AND non-target species are often less-preferred and/or less-suitable than BMSB
- Additional choice test experiments designed to resemble more natural conditions have been initiated (most regional collaborators)
- Field studies in Asia will be continued to determine *Trissolcus*' realized (ecological) host range