Subobjective 2.2.5. Asian Natural Enemies

Funding

USDA United States Department of Agriculture

National Institute of Food and Agriculture

Specialty Crop Research Initiative

Grant #2011-01413-30937

Collaborating Institutions

University of Delaware

ars

Penn State

The State University of New Jersey Rutgers

Northeastern IPM Center

Washington State University

Cornell University

University of Maryland

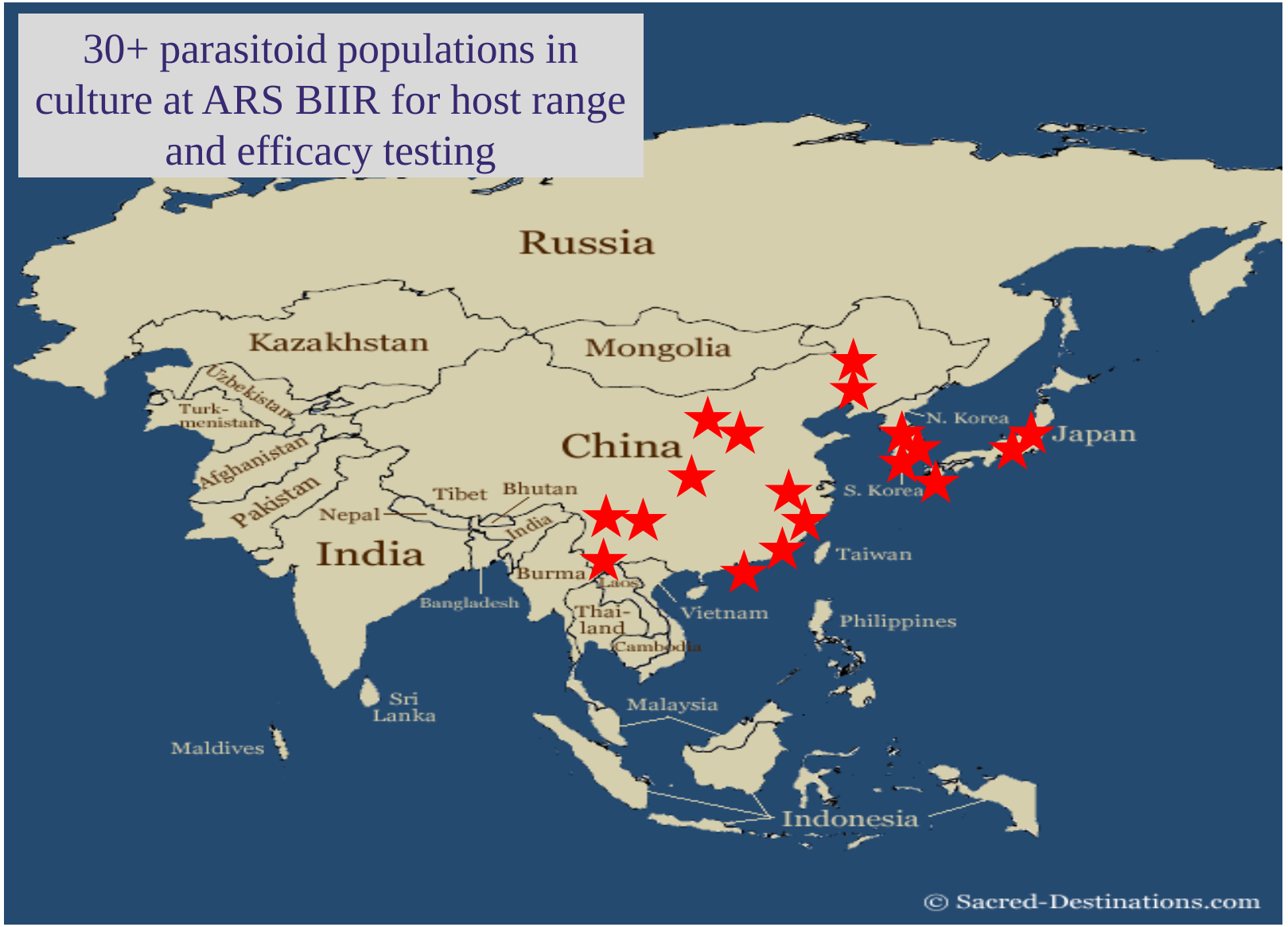
Virginia Tech

OSU Oregon State University

NC State University

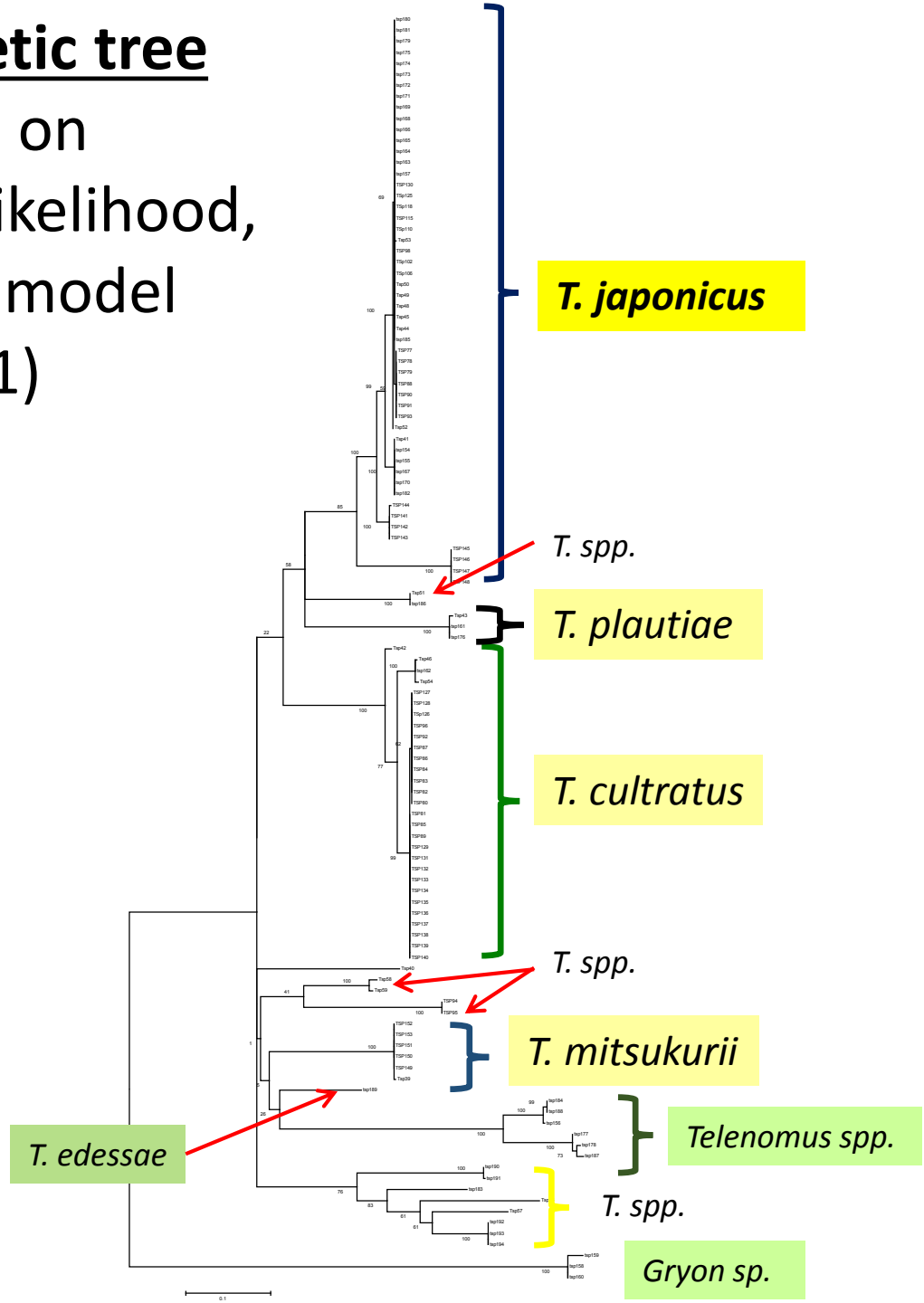
Stop BMSB.org

Foreign exploration for Asian natural enemies of BMSB (2007-2015)



Phylogenetic tree

based on
Maximum Likelihood,
GTR+G+I model
(CO1)



Scelionidae recovered from Asian Pentatomid eggs

&

Scelionidae recovered from North American Pentatomid eggs

Contributors:
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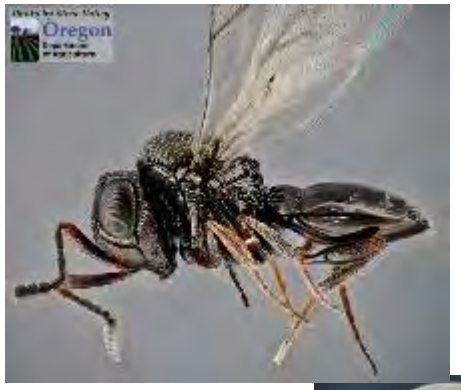
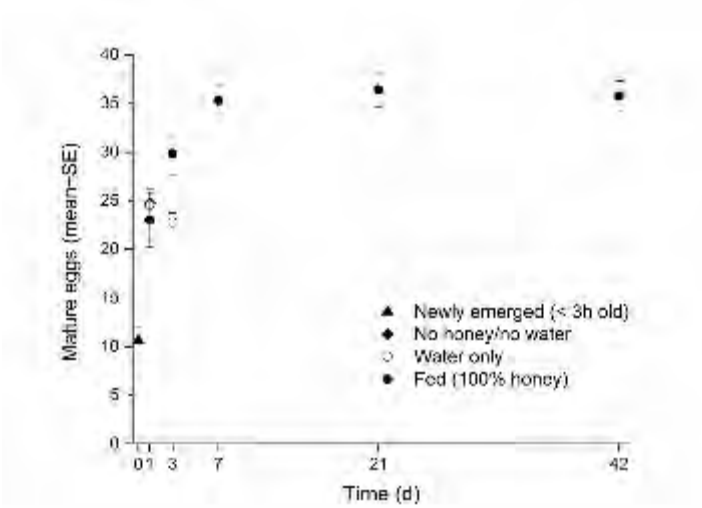
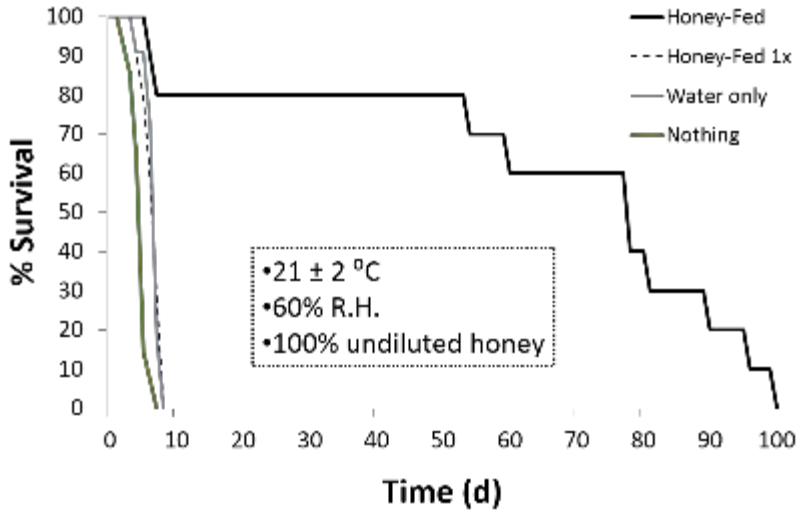
K. Hoelmer – ARS/BIIR



Trissolcus japonicus (Hymenoptera: Scelionidae)

(first described as *T. halyomorphae*)





- **solitary egg parasitoid**
- **2 - 3 weeks/generation**
- **multiple generations/season**
- **female-biased sex ratio**
- **65 to 90% parasitism on BMSB reported in Asia**

Yang et al. (2009) Annals of the Entomological Society of America . 102: 39-47

Trissolcus japonicus is oligophagous - it attacks several Asian pentatomid species

Halyomorpha halys

Glaucias subpunctatus

Plautia crossota

Dolycoris baccarum

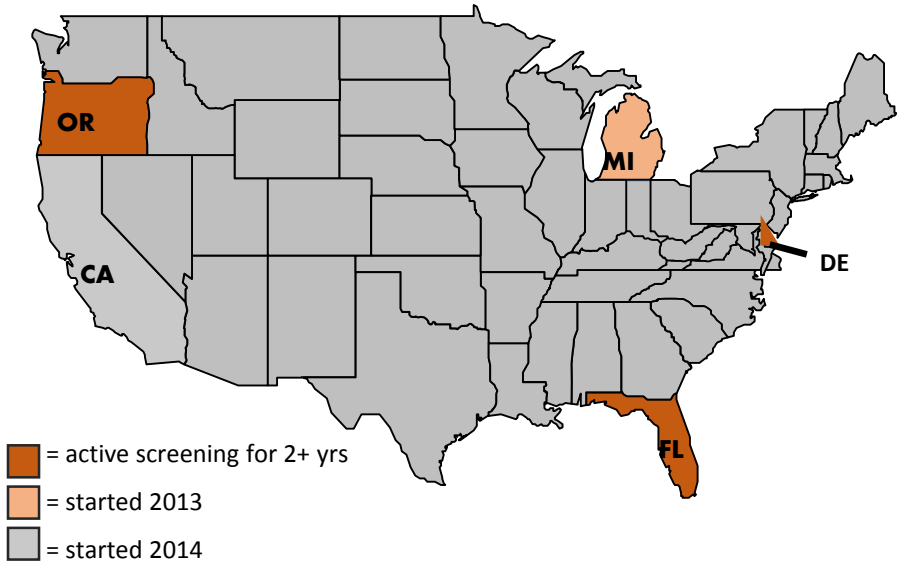
Erthesina fullo

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

Funding for Host Range Evaluations:

Farm Bill funding (APHIS PPQ)

NIFA SCRI multi-institution BMSB grant



Collaborators:

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

University of Delaware (D. Tallamy)

Florida Dept. Agriculture & Consumer Services, Division of Plant Industry

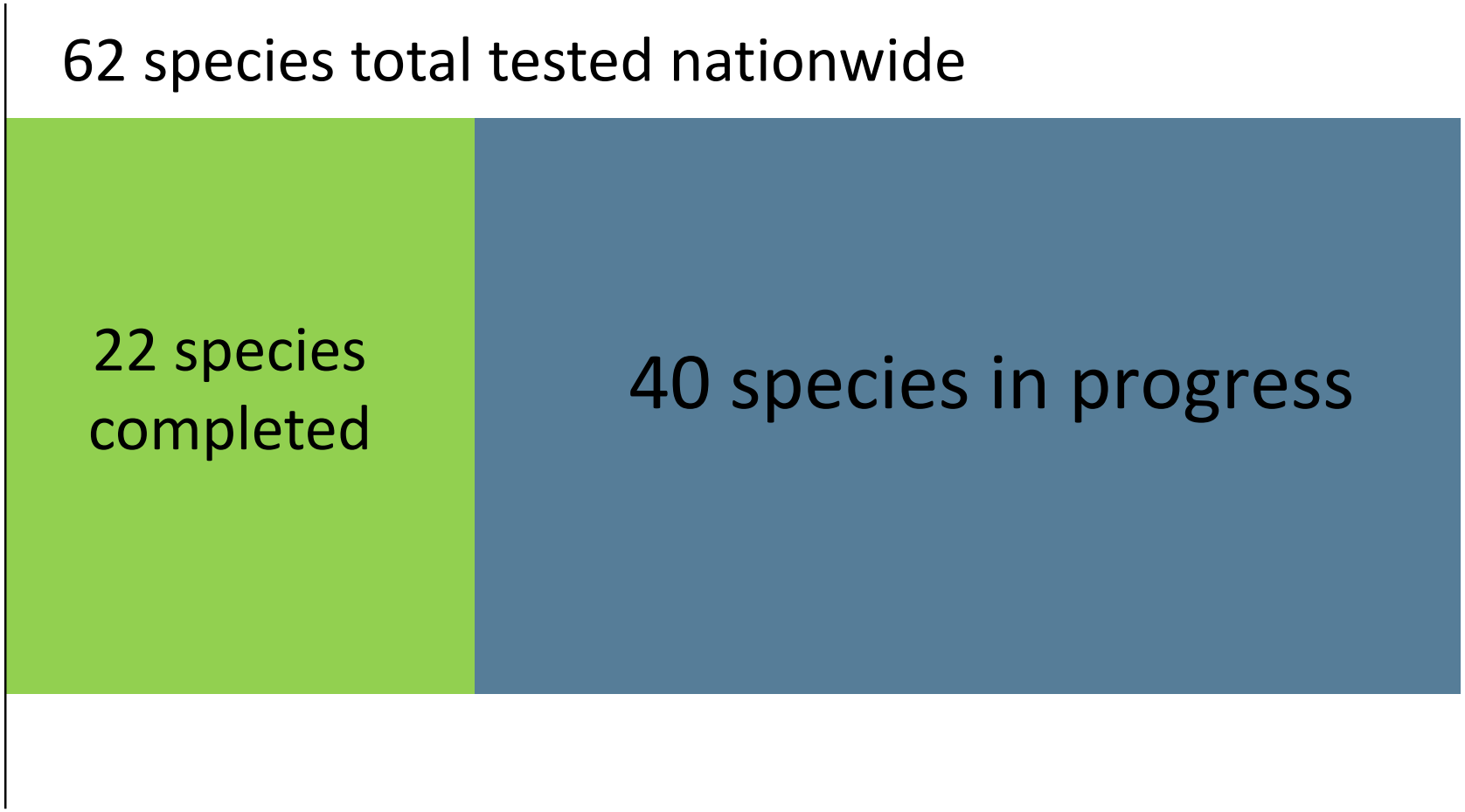
MSU – Michigan State University – Department of Entomology (E. Delfosse)

Oregon Department of Agriculture

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

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

Host Range Evaluations: Progress



Host range testing procedures

No Choice Test

Exposure to non-target species egg mass only – for 24h:

Followed by a BMSB target egg mass as control for another 24h:

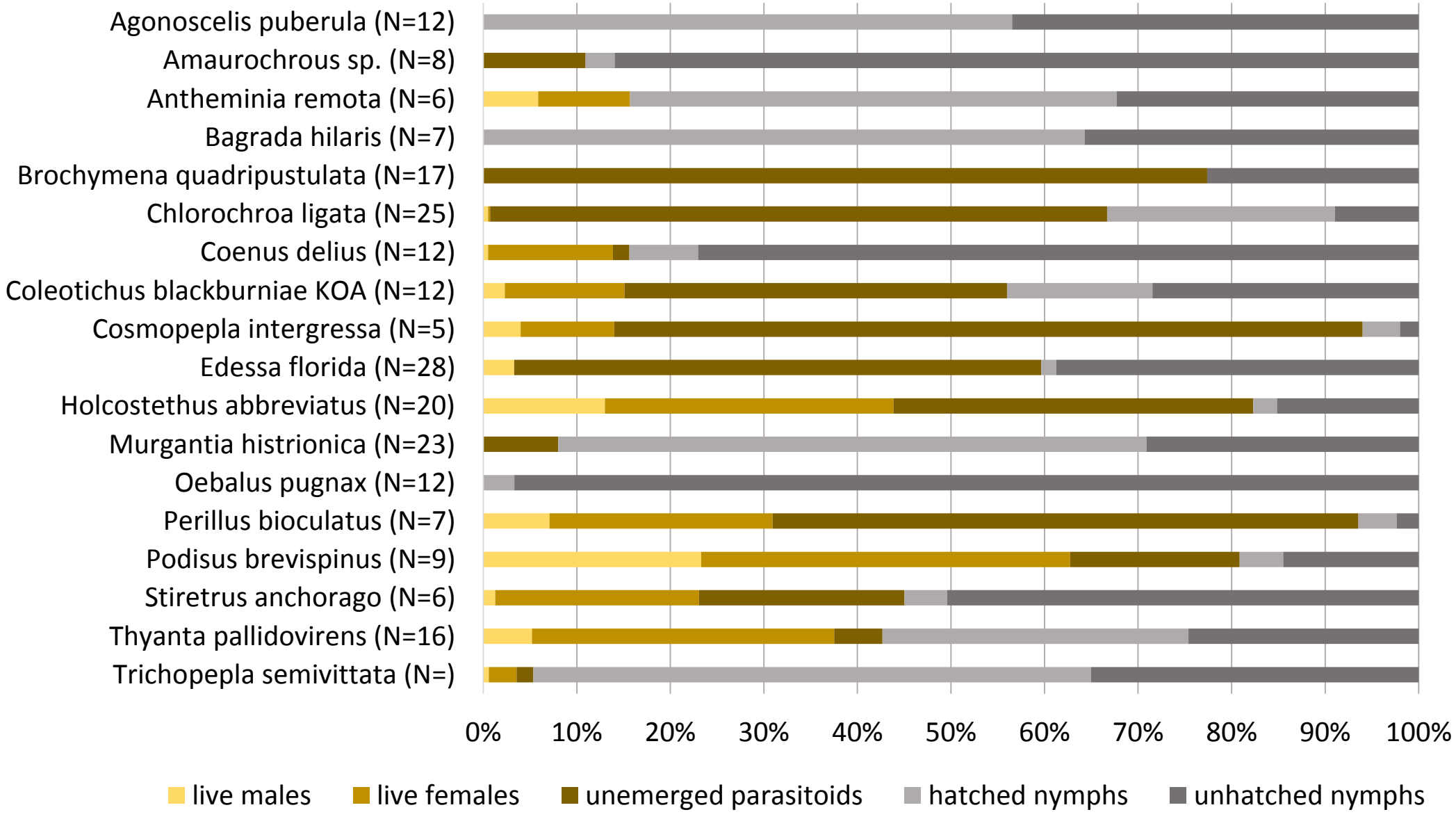
If parasitism on non-target is recorded

Choice Test

Egg masses of non-target species and BMSB presented together for 24h:

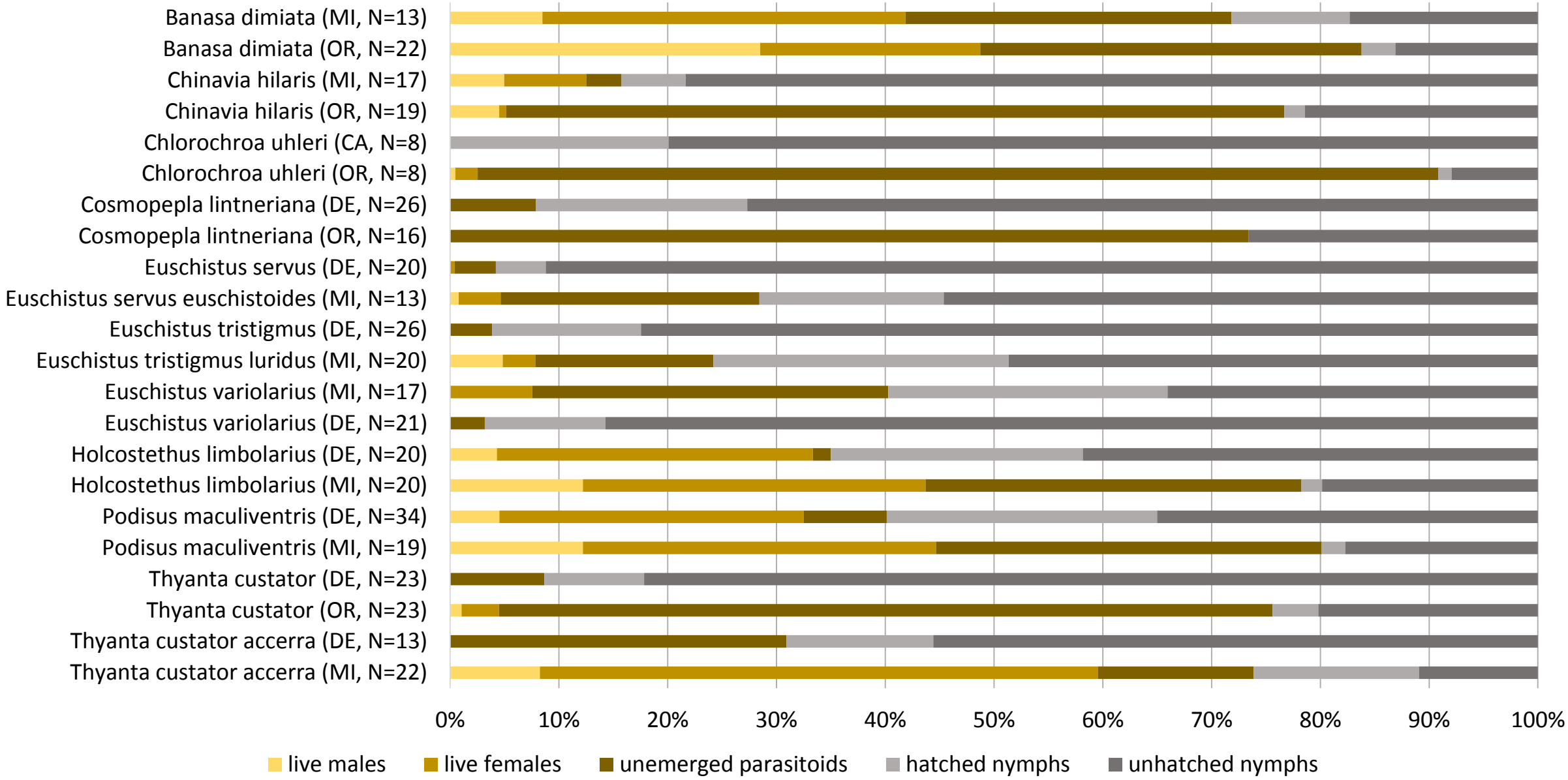
No-Choice Test Outcome - Part 1

(as of 2015)



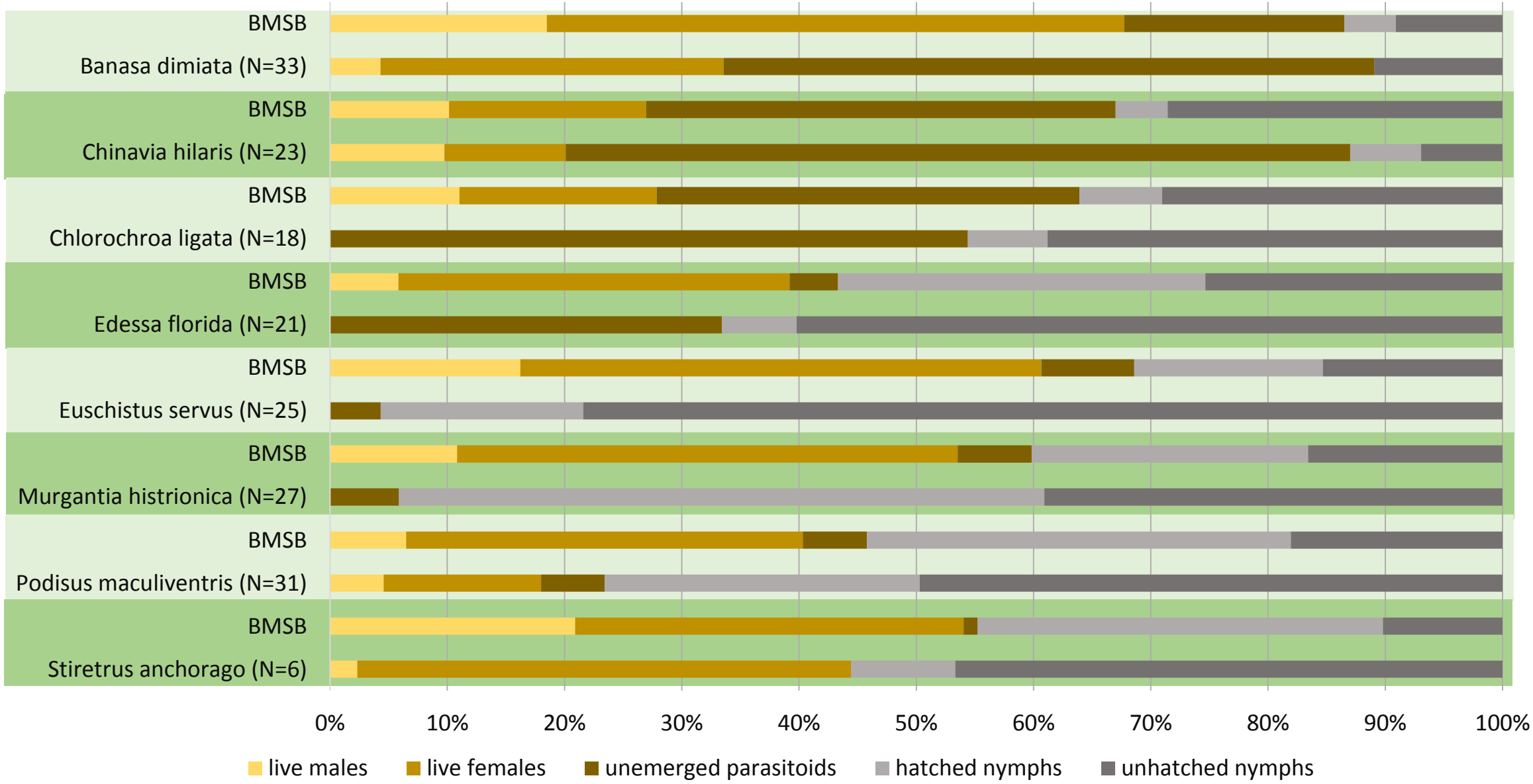
No-Choice Test Outcome - Part 2

(as of 2015)



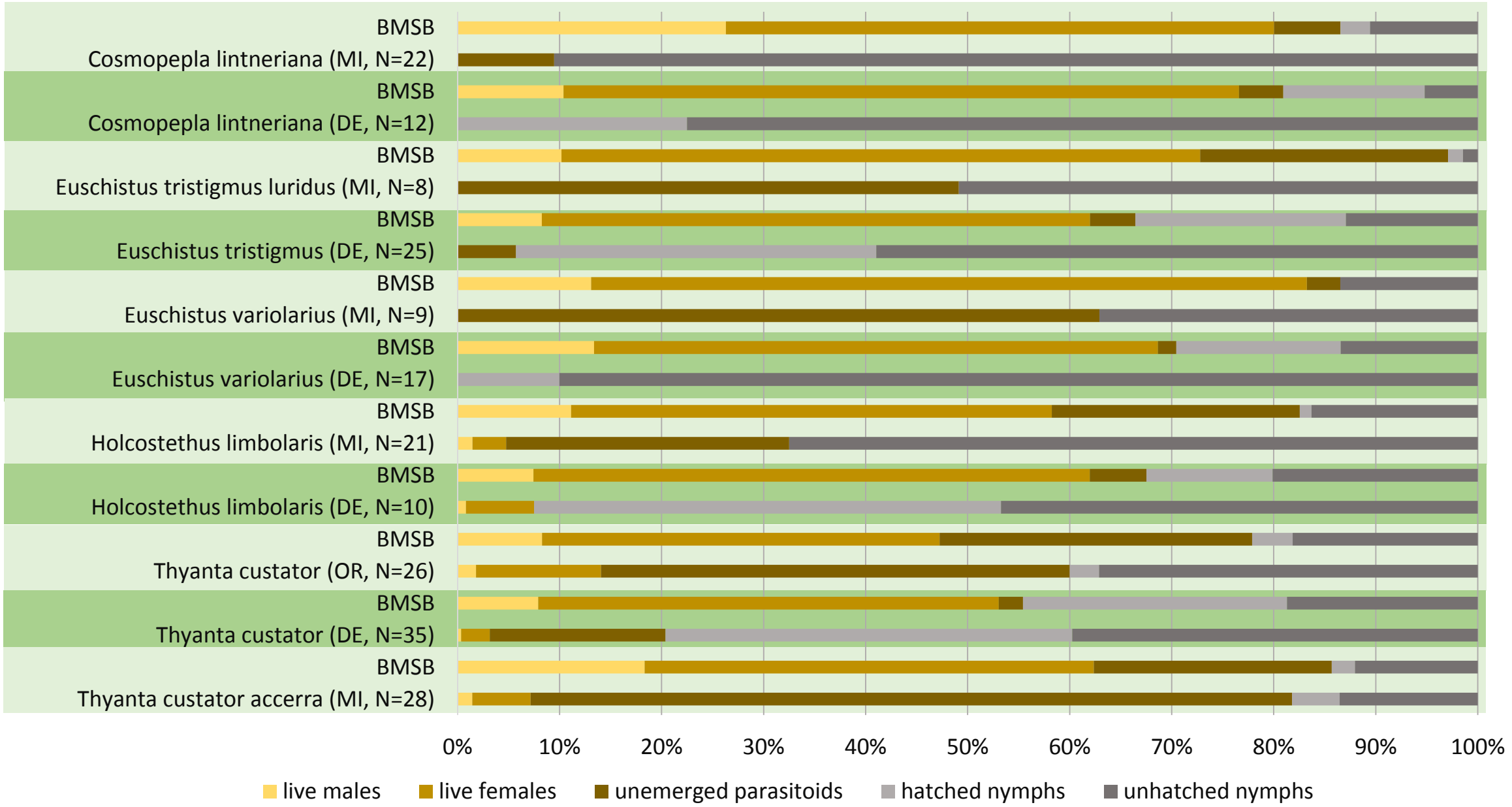
Choice Test Outcome - Part 1

(as of 2015)



Choice Test Outcome - Part 2

(as of 2015)



Logical next steps

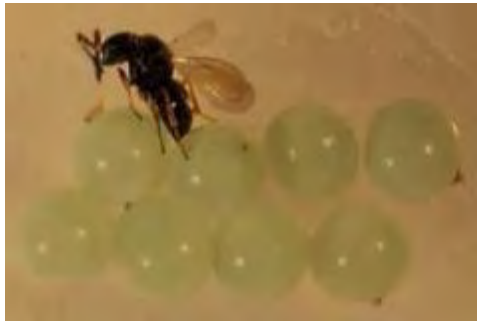
A Closer Look at Host Choice Behavior in *T. japonicus*

Influence of arena size and complexity

- **Size (Finished)**
  - 10 dram
  - 100 dram
  - 500 dram
  - 1000 dram
  - 2000 dram

- **Complexity (Started)**
  - Choice tests on plants

Role of parasitoid physiology & experience

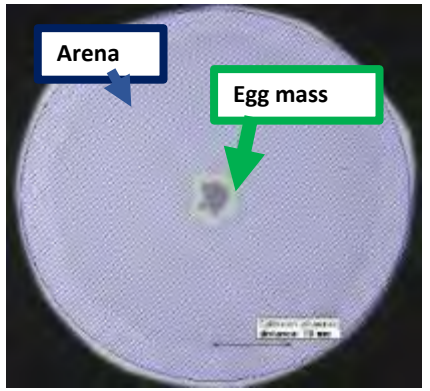


- Parental experience
- Parental physiology
- Effect of host choice on offspring physiology & behavior

Influence of time of exposure

- **Finished**
  - 1 h
  - 4 h
  - 6 h
  - 24 h

Behavioral observations

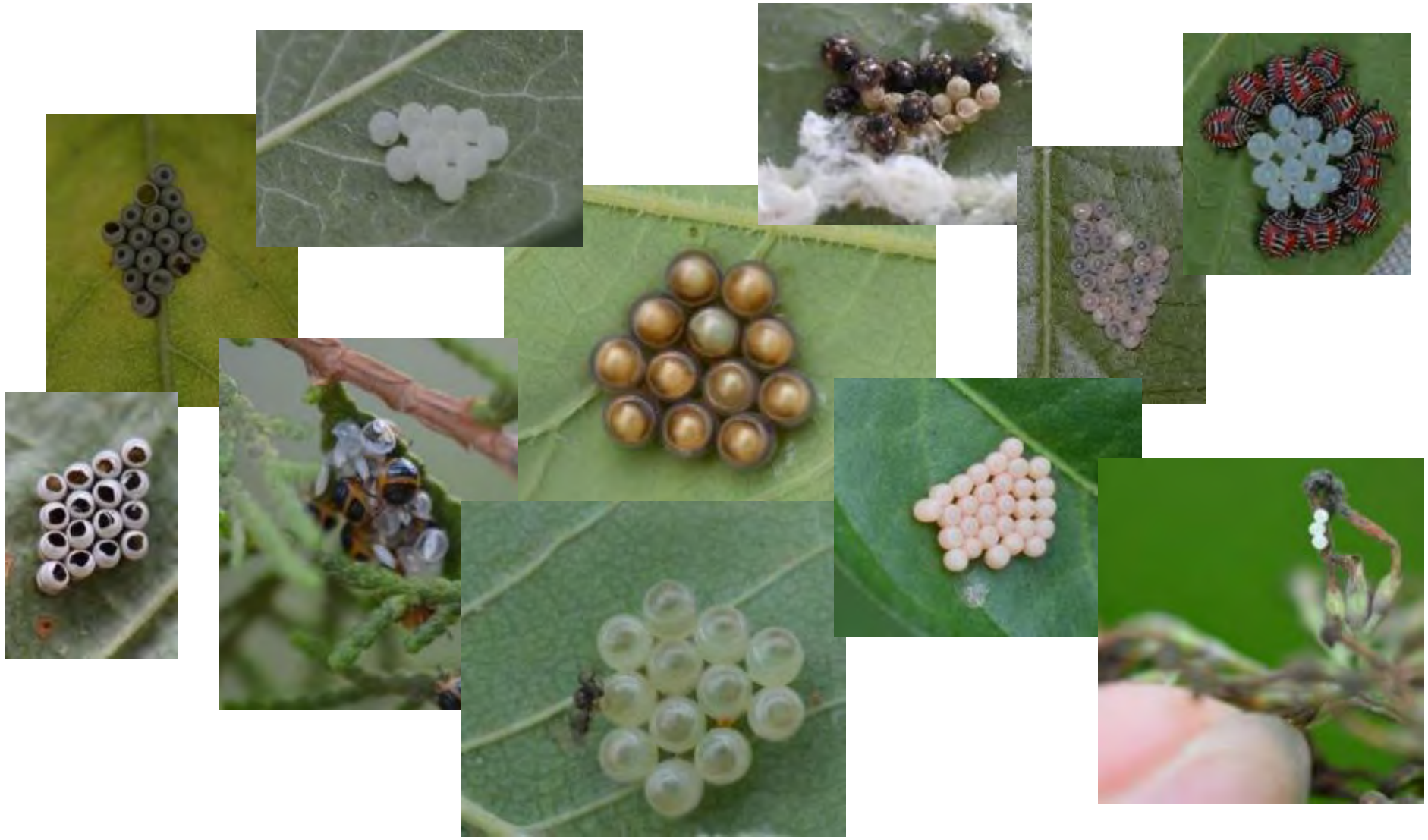


- **Ongoing**
  - Searching behavior
  - Oviposition behavior
  - Host choice
  - …

Olfactometer Studies

(FL, MI) - **ongoing**

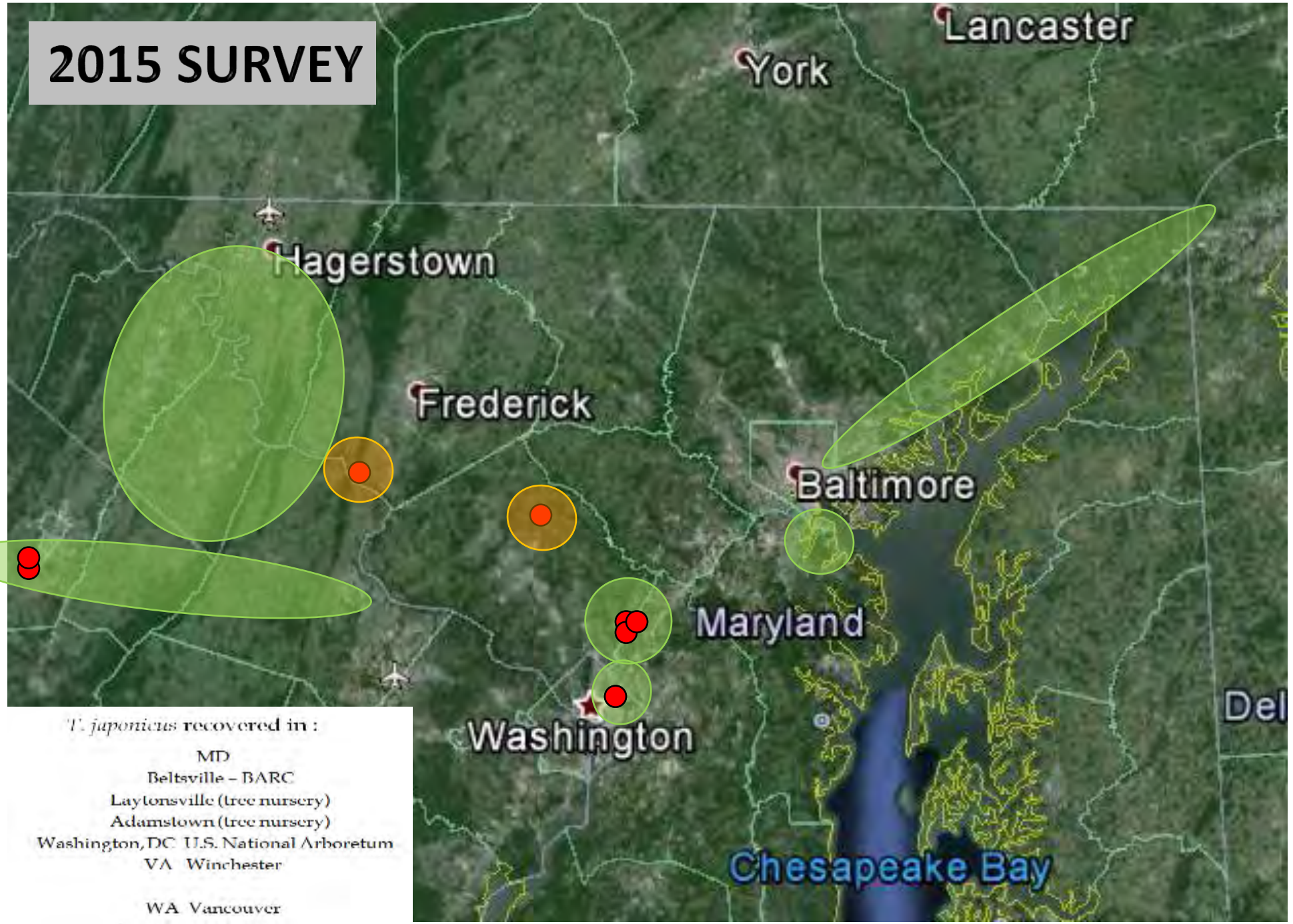
Ecological Host Range of *T. japonicus* in Asia



Recovery of *Trissolcus japonicus* in Maryland in 2014

a potential game changer?

2015 SURVEY



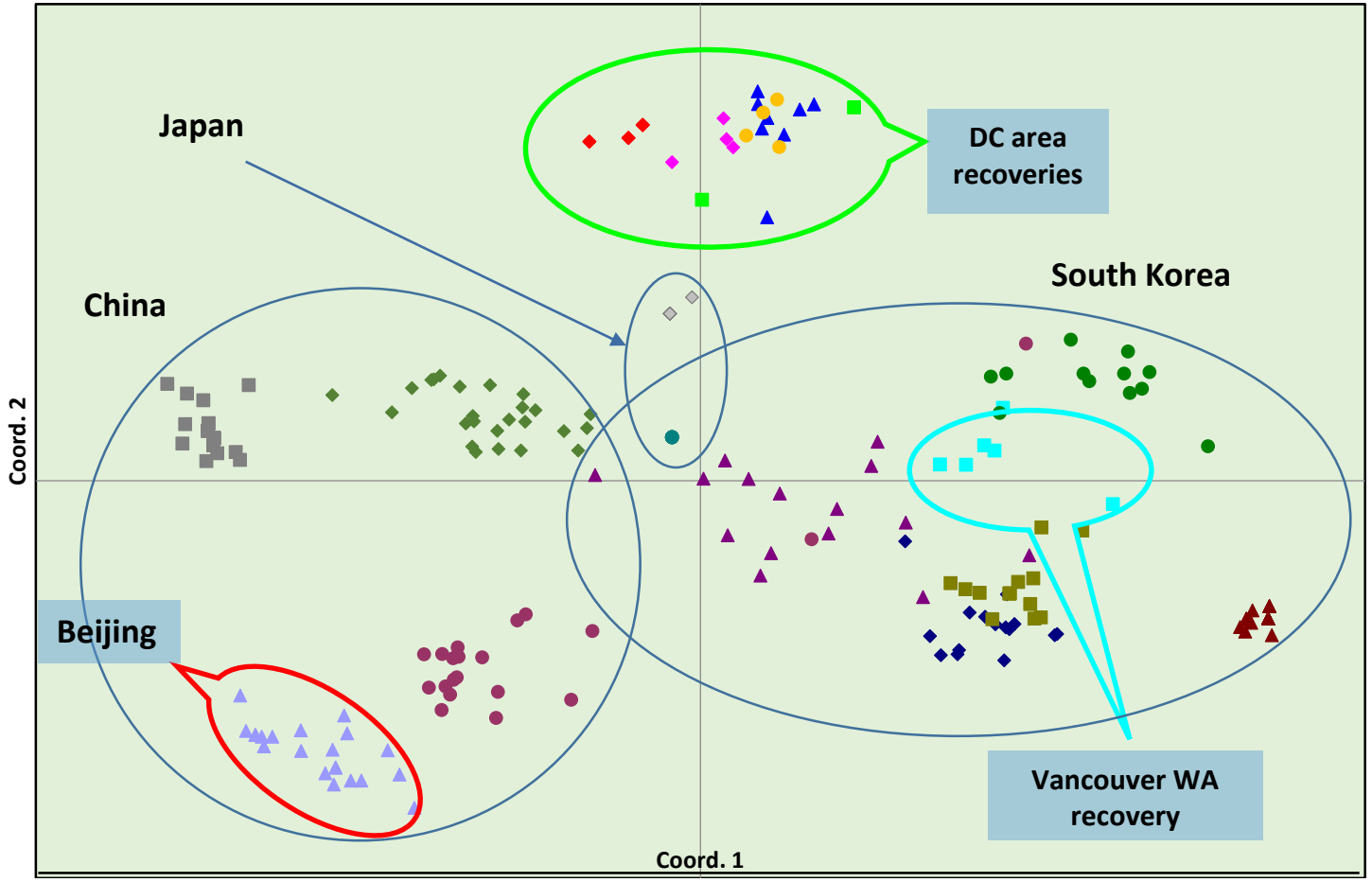
T. japonicus recovered in :

MD
Beltsville – BARC
Laytonsville (tree nursery)
Adamstown (tree nursery)
Washington, DC U.S. National Arboretum
VA Winchester

WA Vancouver

Origin of the adventive *T. japonicus* populations

Principal coordinates analysis of genetic diversity among 23 microsatellite markers in *T. japonicus*



Genetic distance between populations

Axis 1 & axis 2 explain, 22% and 20% respectively, of the distribution

Take home message:

1) These populations are adventive – they were not released nor did they escape quarantine!
2) DC area populations genetically similar to populations sampled in Japan and S. Korea
3) WA population genetically similar to populations sampled in S. Korea

Logical next steps – Asian Natural Enemies

Quarantine Host Range Evaluations:

- Continue laboratory host range research (pending evidence of establishment and dispersal of adventive populations) towards a Petition to Release (APHIS requires a Petition to Release for each state)

Adventive *Trissolcus japonicus*:

- Expand surveys initiated in 2015 to determine the extent of establishment, incl. an increased focus on wooded habitats and a widened survey area to see how quickly populations spread

- Analyze recovered parasitoid microsatellite DNA to determine heterogeneity of the adventive populations

- Increase monitoring of parasitism of BMSB & non-target pentatomid egg masses in the field