



BMSB CLASSICAL BIOLOGICAL CONTROL: STATUS REPORT

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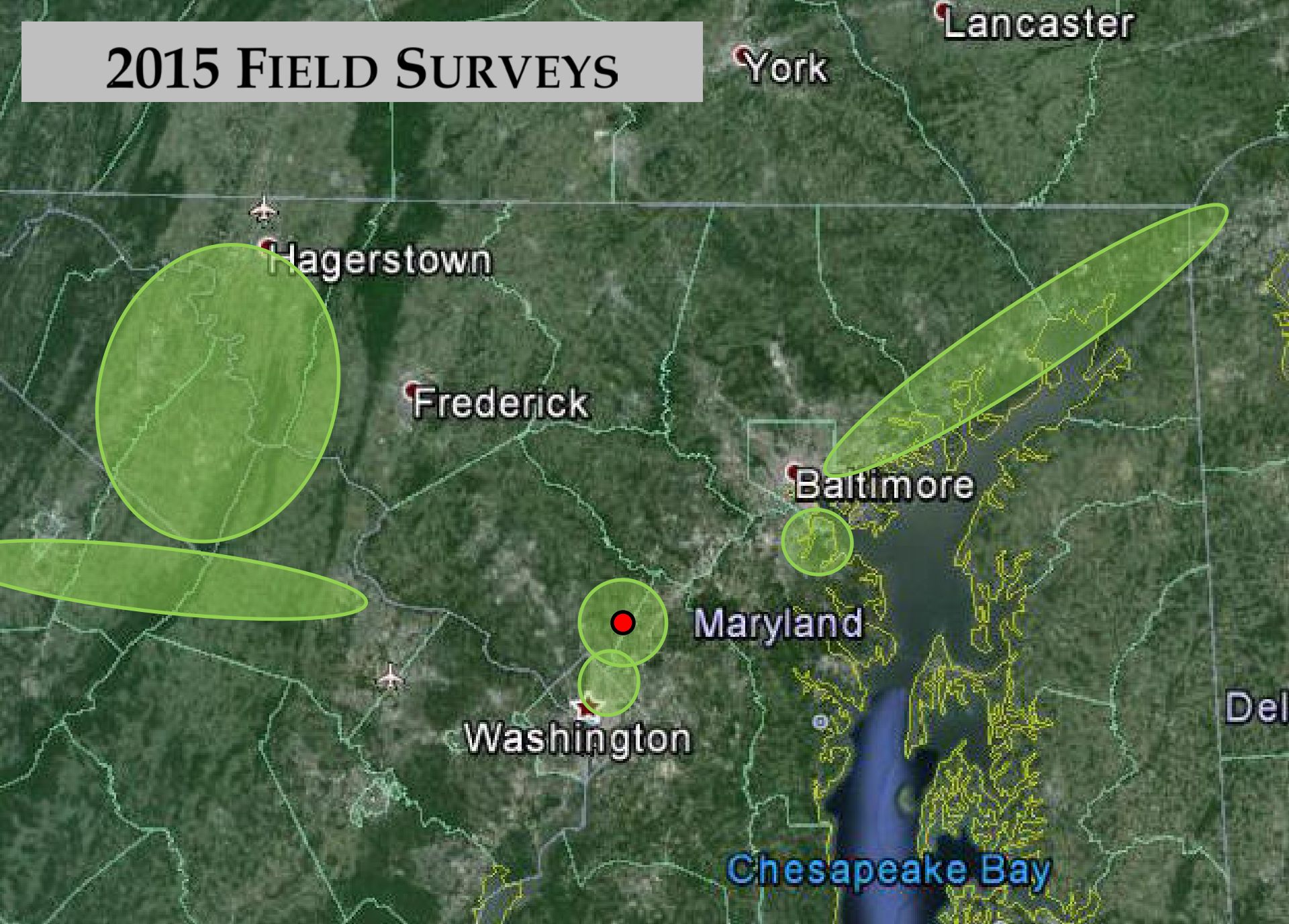
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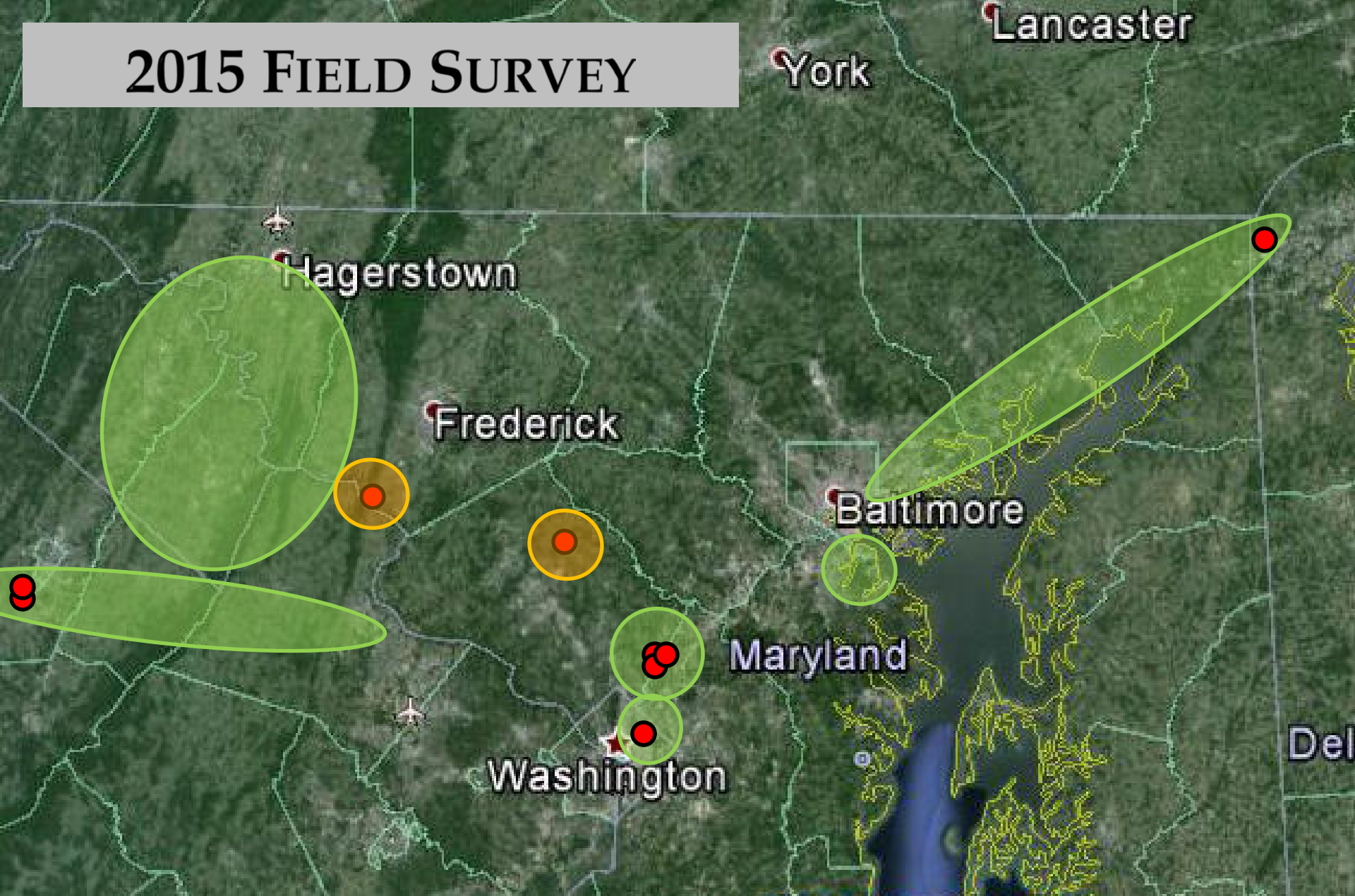
Status of adventive *Trissolcus japonicus* in the U.S. - 2015



2015 FIELD SURVEYS



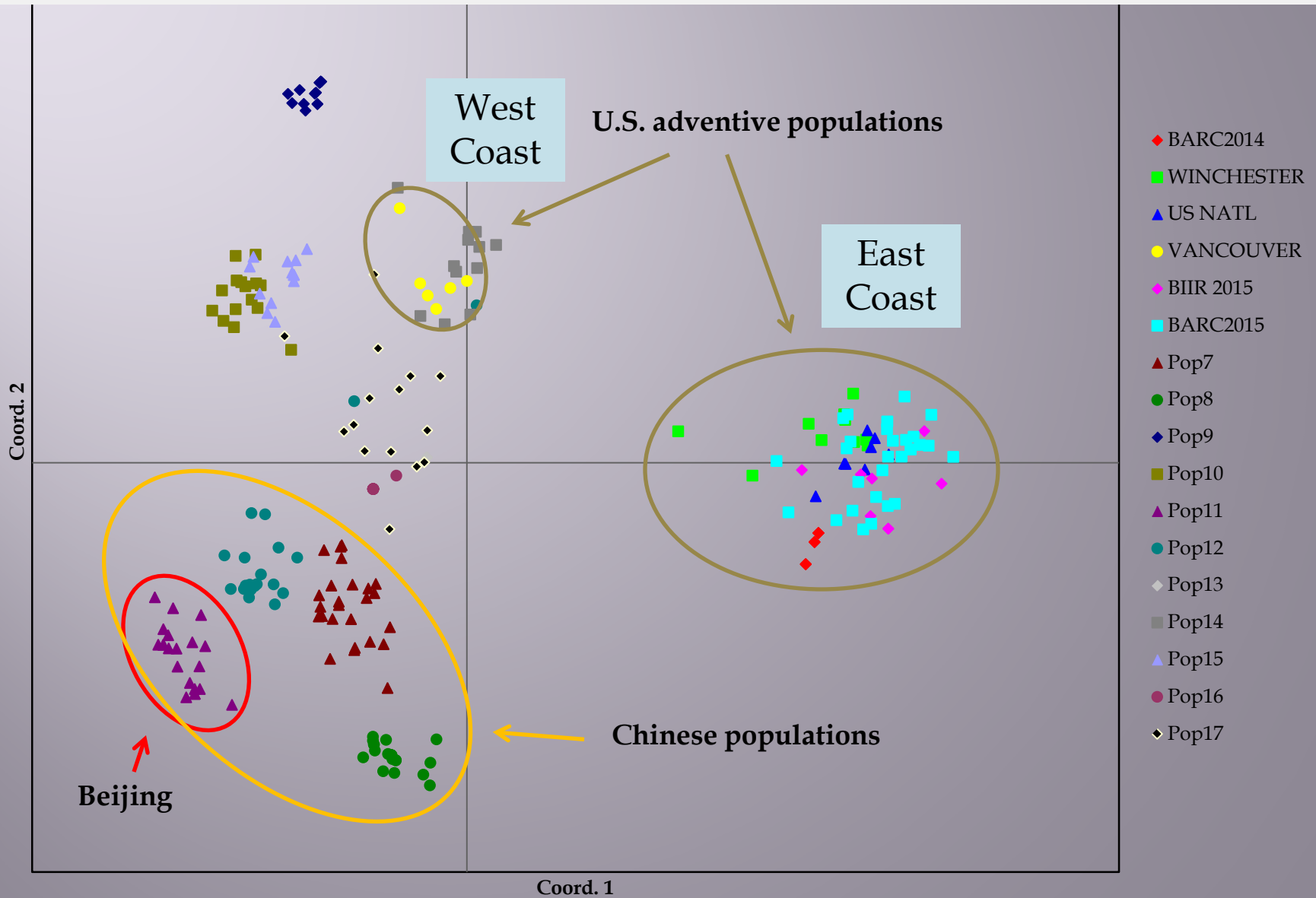
2015 FIELD SURVEY



T. japonicus now found in: MD, D.C., VA, DE (east coast) and WA (west coast)
Recoveries were made from BMSB (sentinel & wild), *Podisus* and *Thyanta*



Principal coordinate analysis (PCoA) of genetic diversity among 23 microsatellite markers in *T. japonicus*





Implications of adventive populations

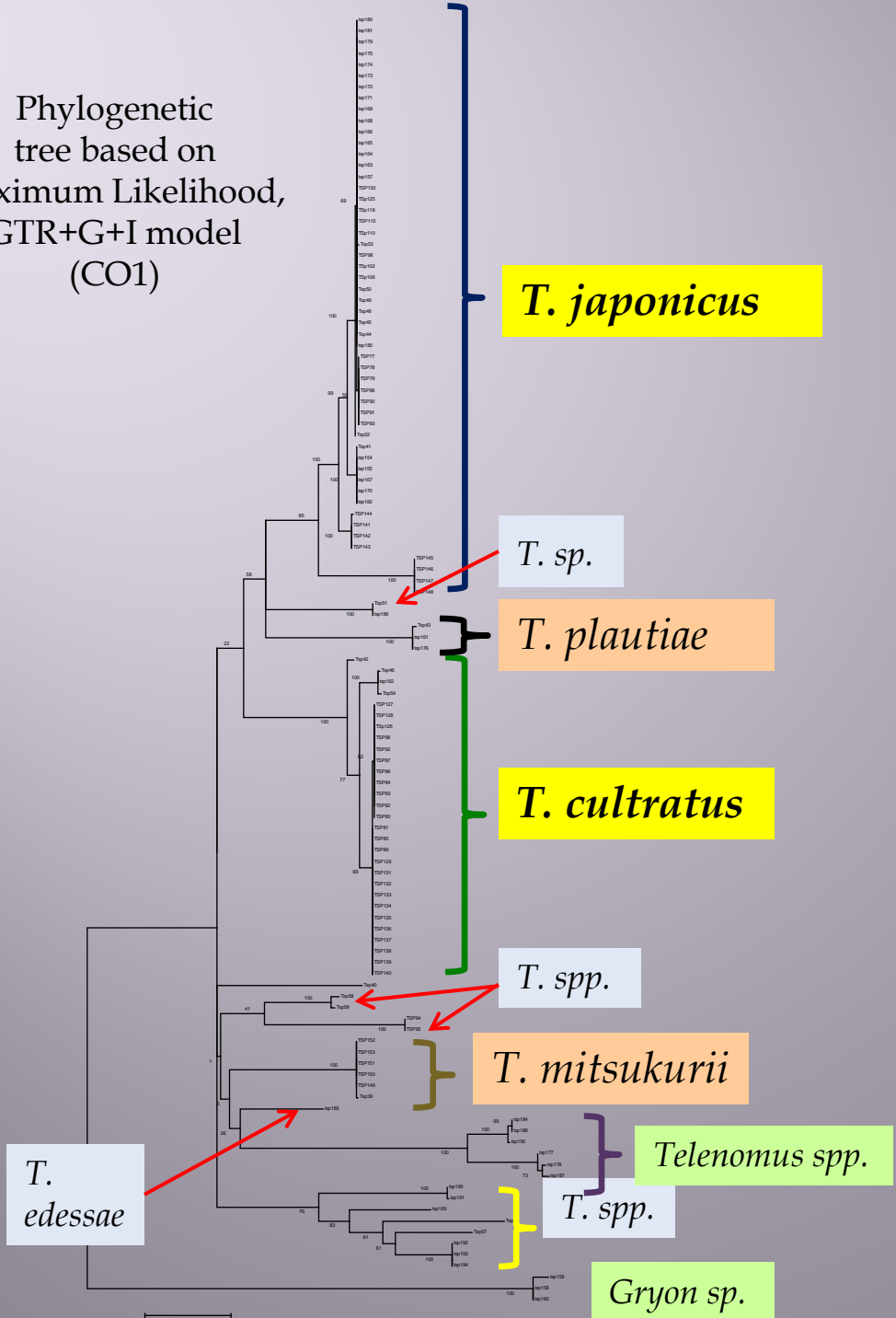
- ❑ Wider regional surveys needed to monitor their spread
- ❑ Determine their impact on BMSB & non-targets in the field
- ❑ Continue work on a Petition to release **Beijing** *T. japonicus*
- ❑ APHIS requires a Petition for each state
- ❑ Field recovery/impact data may help to fast-track a Petition to Release in other regions (if it is still needed) or redistribute the adventive populations

Status of Biological Control In North America:

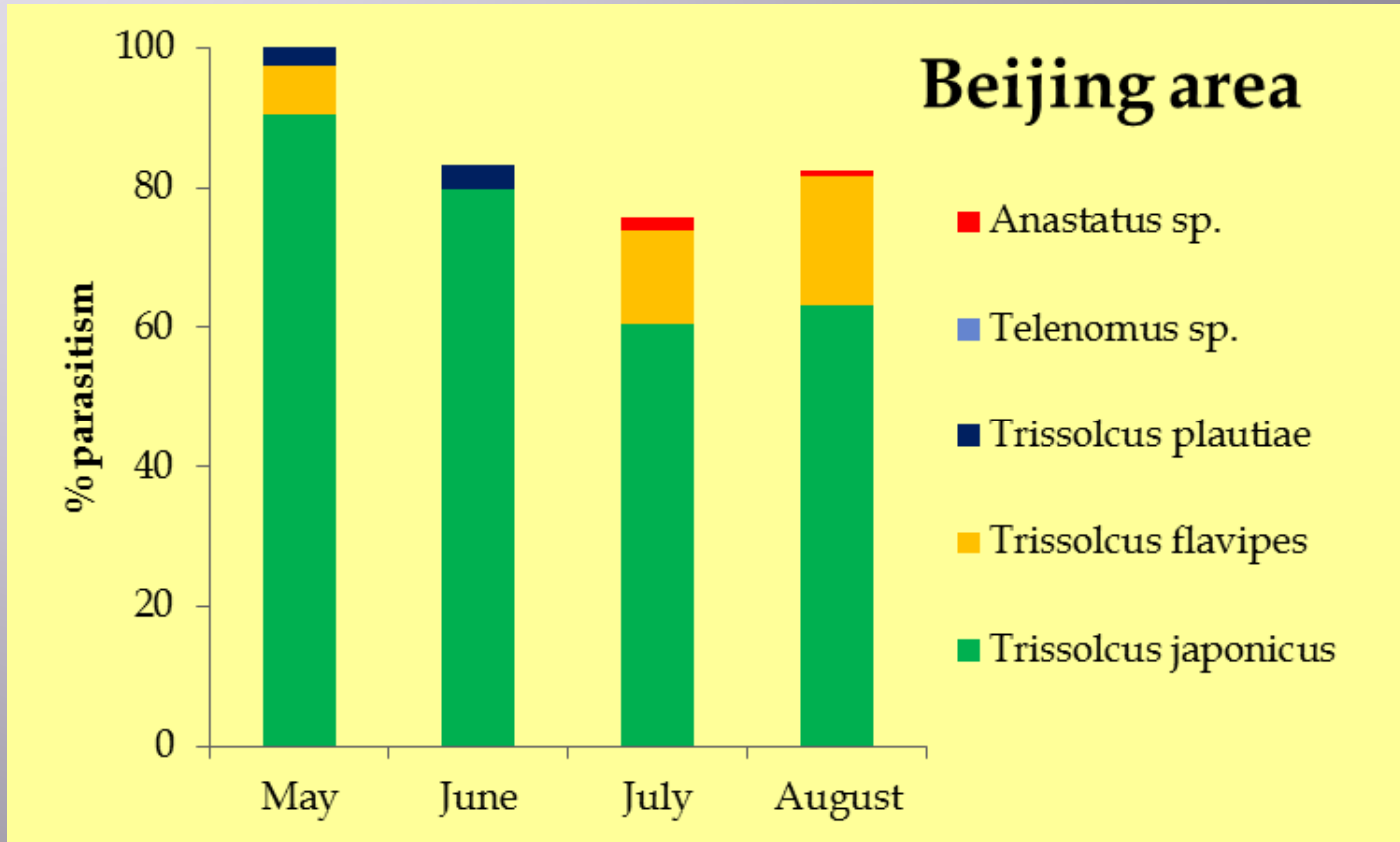
- **Regional surveys (ongoing) to document the occurrence & impact of natural enemies:**
 - Overall low levels of parasitism
 - Impact varies according to habitat
 - Predation is often more important than parasitism
- **Studies in conservation biological control to increase impact of native predators and parasitoids**
 - Border plantings, trap crops, insectary plants
- **Will native natural enemies adapt to BMSB over time?**
 - Why are native parasitoids poorly adapted to BMSB?
 - Can adaptation be enhanced via laboratory selection?

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

Scelionidae from eggs of Asian Pentatomidae



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 K. Hoelmer - ARS/BIIR



Data from Tim Haye, CABI Bioscience

Continued field research to determine natural ecological host range of *T. japonicus* in Asia



Trissolcus japonicus is **oligophagous**
- it attacks several (but not all) Asian pentatomid species



Halyomorpha halys



Glaucias subpunctatus



Plautia crossota



Dolycoris baccarum



Erthesino fullo

Summary – In Asia:

- *T. japonicus* is the dominant species throughout the season on different host plants
- Other species (e.g., *Anastatus*, *Telenomus*, tachinid flies) are of minor importance in controlling BMSB
- Ecological host range of *T. japonicus* contains other species in these habitats, e.g. *Plautia* and *Dolycoris*
- *T. japonicus* is an oligophagous species, thus non-target attacks likely of some other stink bugs, risk-benefit analysis needed
- Ongoing studies: impact on non-target species, including the predatory species *Arma chinensis*

Introducing Asian Parasitoids: Status

NAPPO Guidelines for Petitions for First Release of Arthropod Pest Biological Control Agents

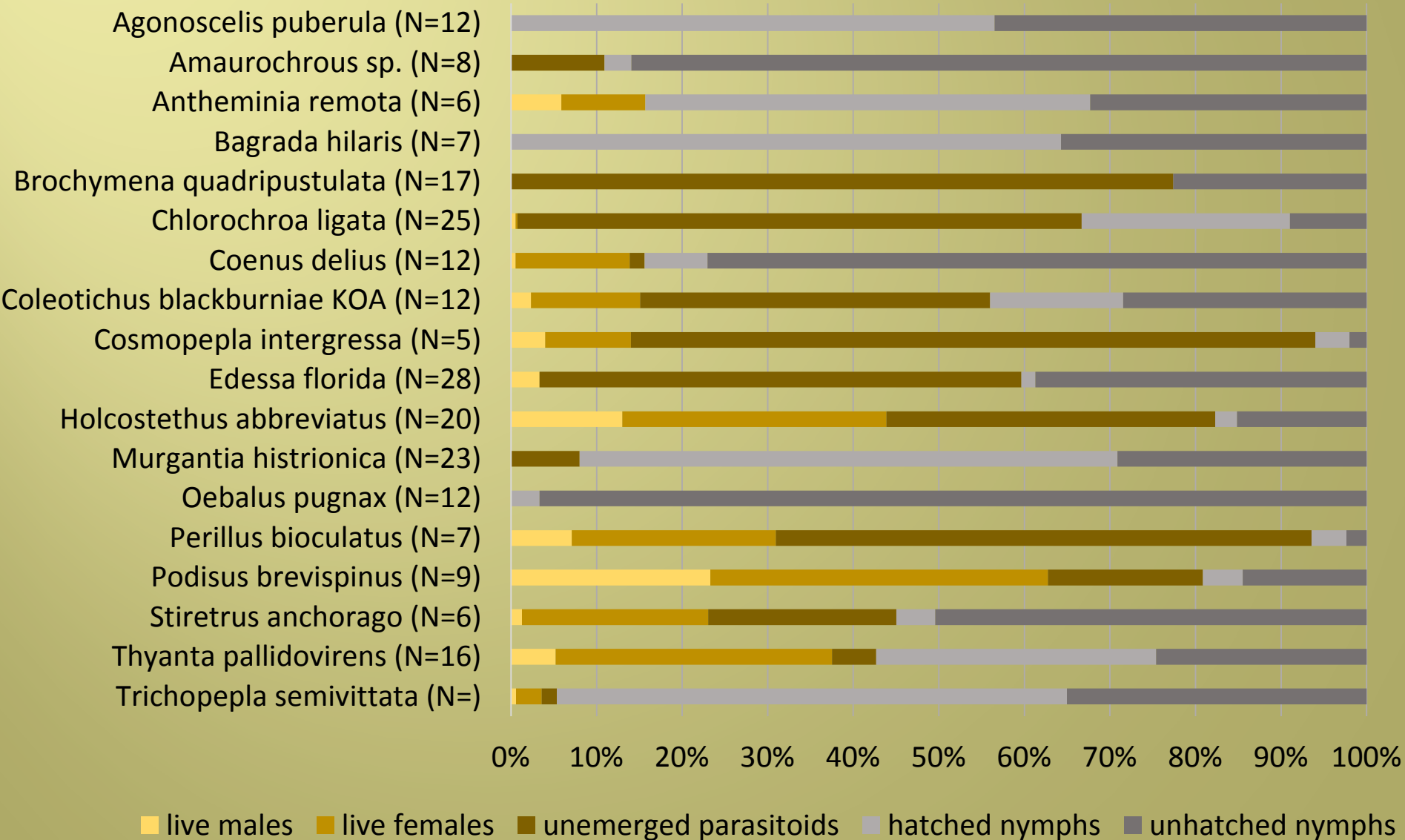
General Requirements

1. Proposed Action
2. Target Pest Information
3. Biological Control Agent
Information

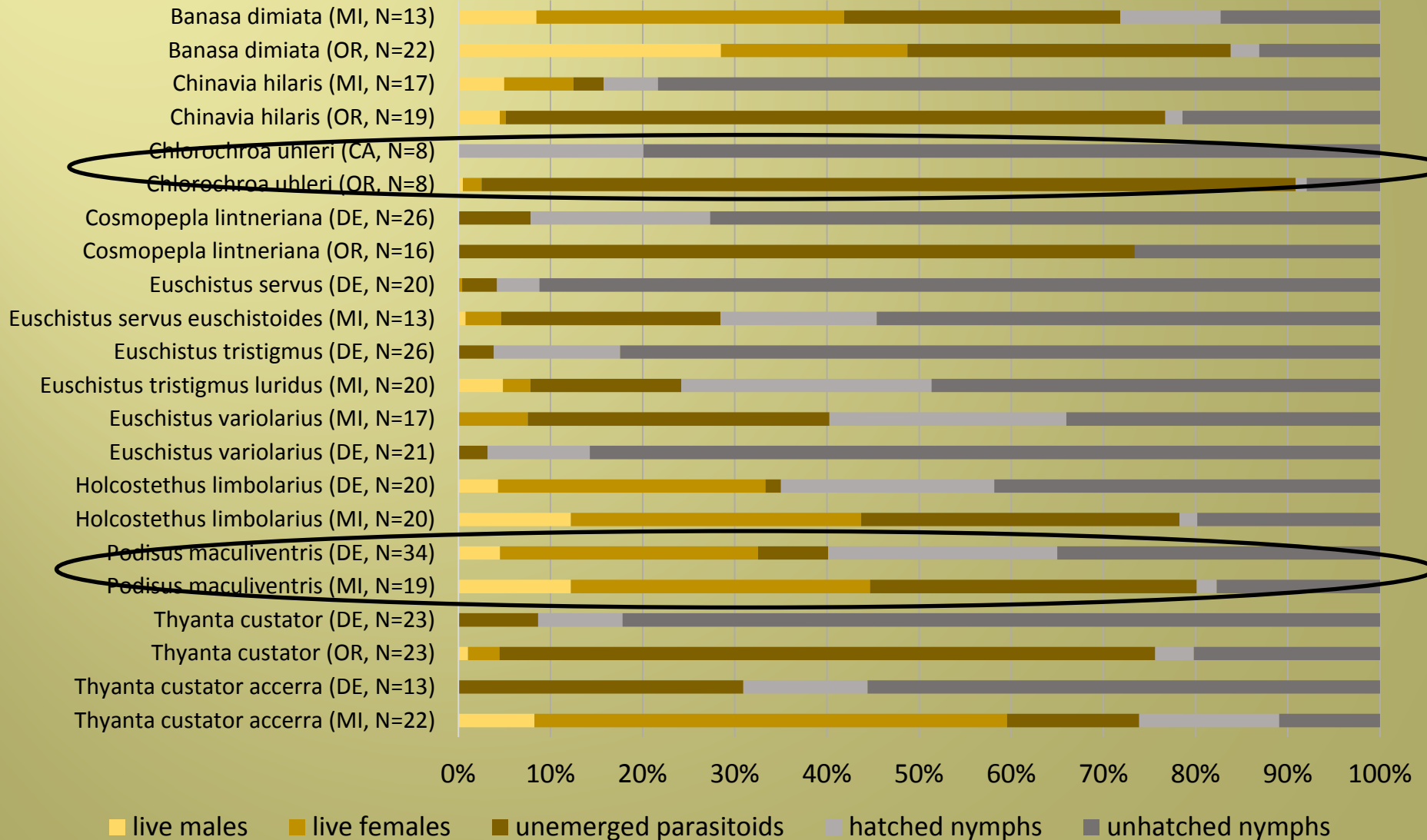
4. Host-Specificity Testing
5. Environmental and Economic
Impacts of Proposed Release

6. Post-Release Monitoring

No-Choice Test Outcome (1)



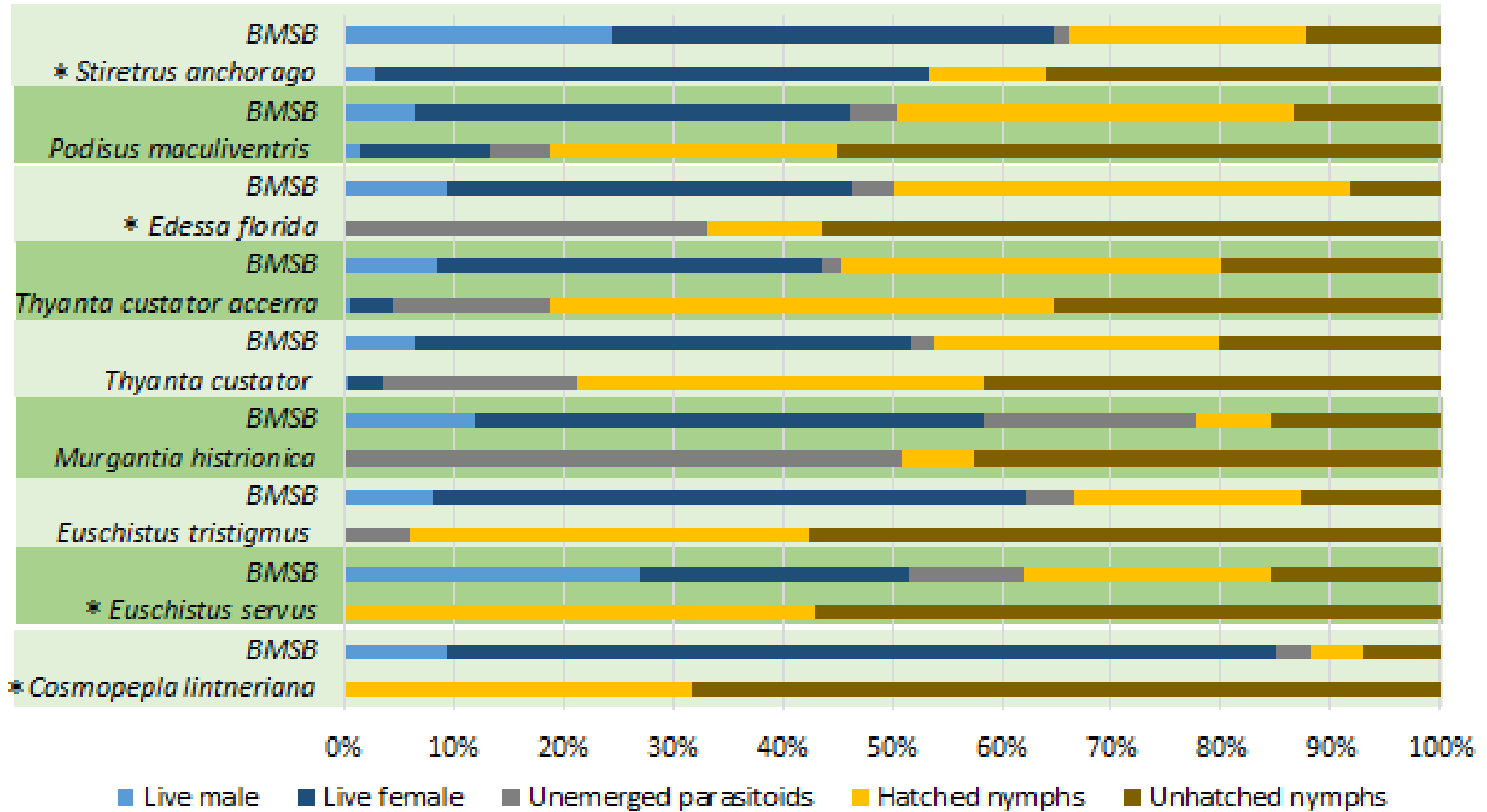
No-Choice Test Outcome (population variability)



Choice Test Outcome

(as of 2015, Newark BIIR)

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



Caveat: Laboratory vs. Field Results

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

non-target attack

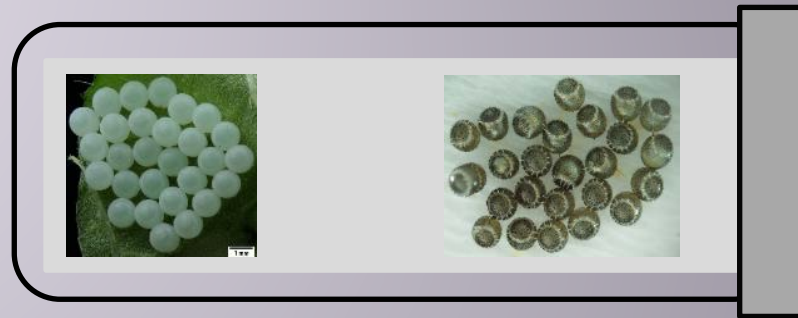


1. No-choice test
(Petri dish)

2. Choice test
(Petri dish)
(cage)

3. Choice test
(field)

Influence of Exposure Time on Host Choice



BMSB

*P.
maculiventris*

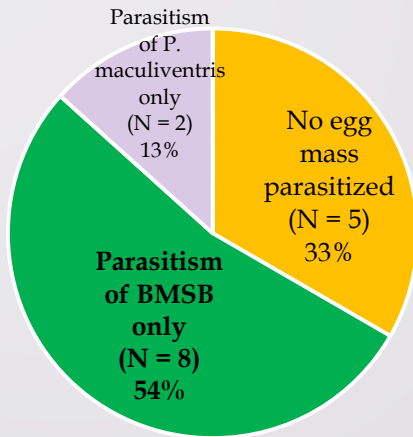
Naïve, 24h-old female
T. japonicus exposed to
egg masses

- 1 hour
- 4 hours
- 6 hours
- 24 hours

Observation of
parasitoid behavior for
1 hour

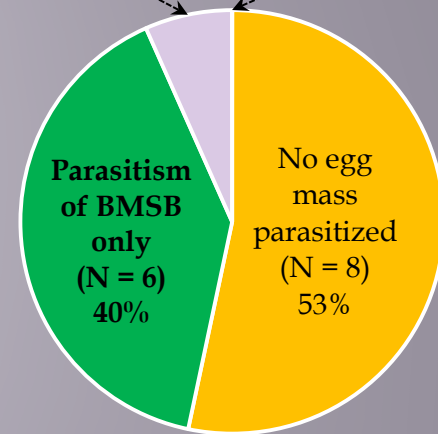


1 hour



Parasitism of both egg masses (N = 0) 0%

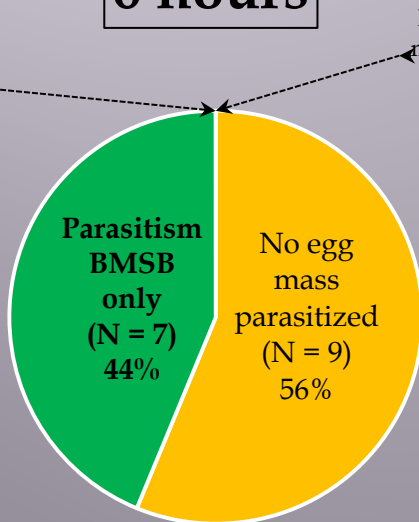
4 hours



Parasitism P. maculiventris only (N = 1) 7%

Parasitism of both egg masses (N = 0) 0%

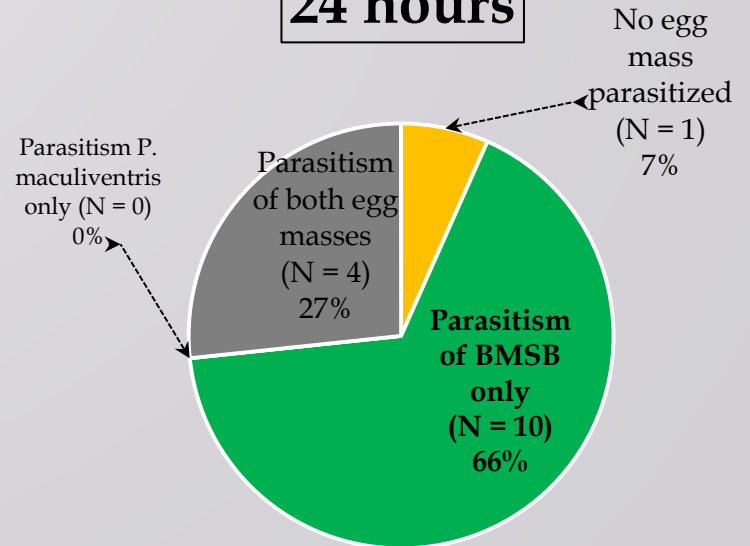
6 hours



Parasitism of both egg masses (N = 0) 0%

Parasitism P. maculiventris only (N = 0) 0%

24 hours



Parasitism P. maculiventris only (N = 0) 0%

No egg mass parasitized (N = 1) 7%

Summary

- Native parasitoids have low impact in landscape reservoirs but may be important in certain crops/situations (e.g., *Anastatus*, *Telenomus*)
- *T. japonicus* is established and spreading in the U.S. in arboreal landscape habitats (important as population reservoirs)
- Physiological host range of *T. japonicus* includes other stink bug species in the U.S. (in laboratory tests)
- Ongoing studies: ecological impact on non-target pentatomids, including *Podisus maculiventris*
- Impact of both native & introduced natural enemies should increase over time

Thanks for your attention!

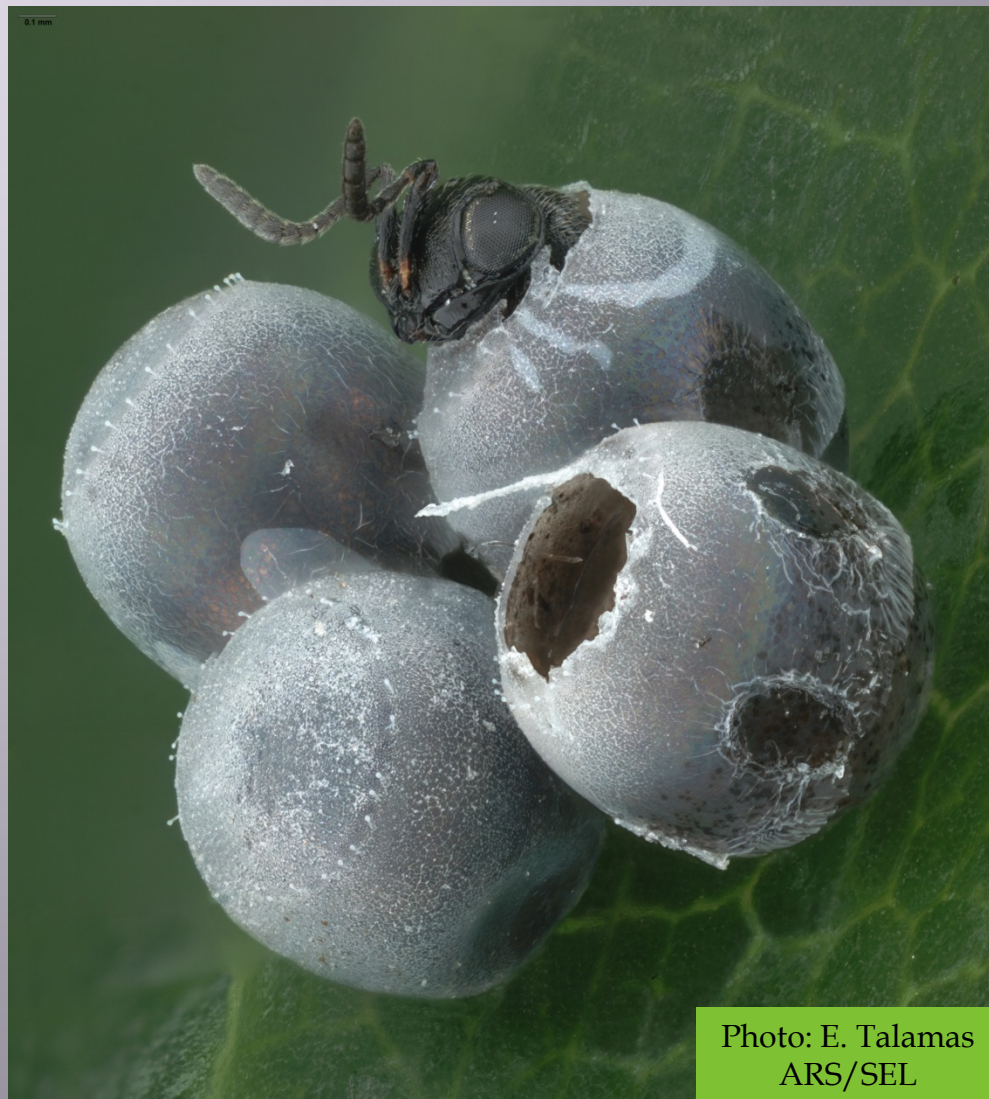
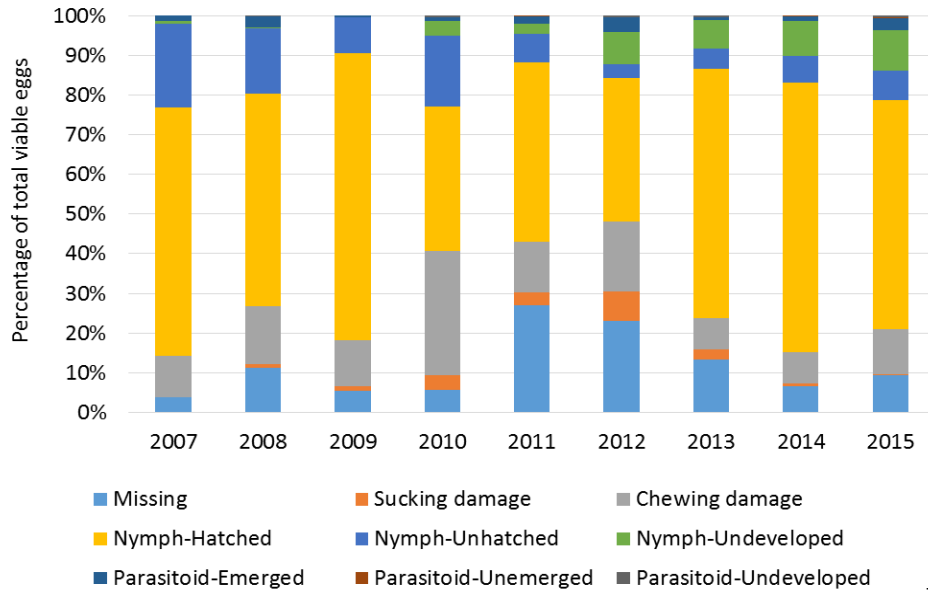


Photo: E. Talamas
ARS/SEL

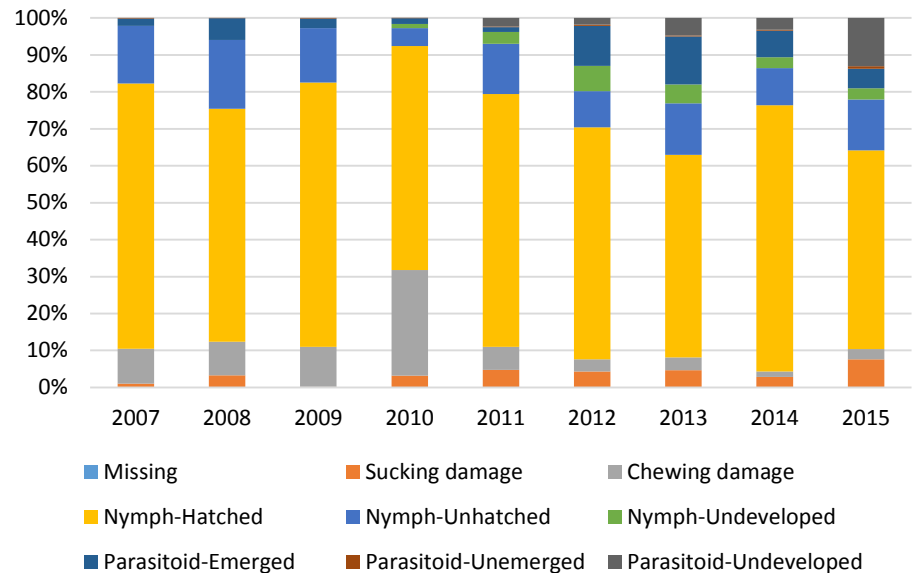
Sentinel Egg Masses



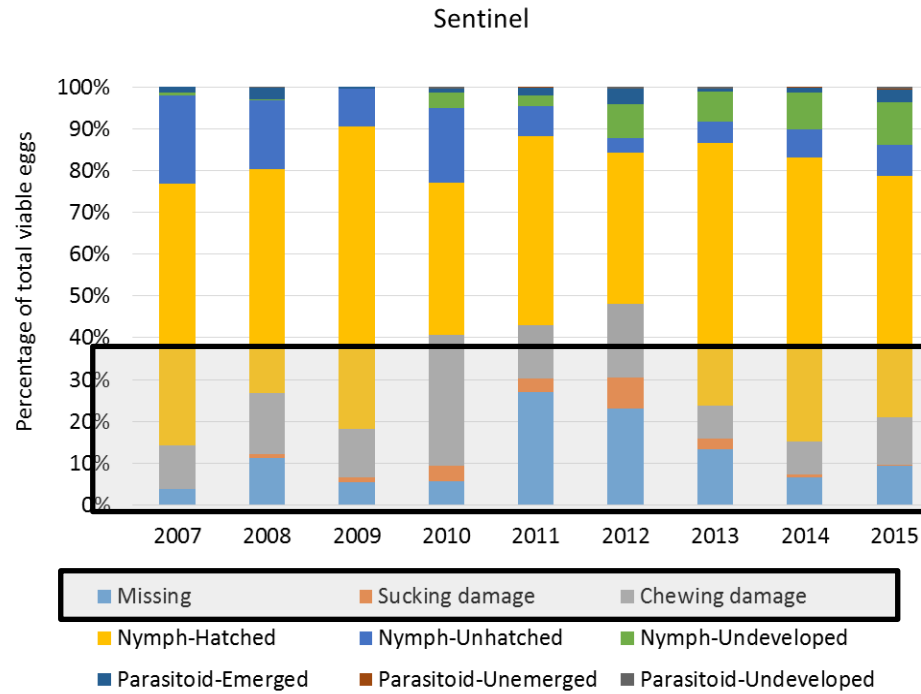
Fate of BMSB eggs
in DE surveys
2007 to 2015

Sentinels vs.
naturally laid
(wild)

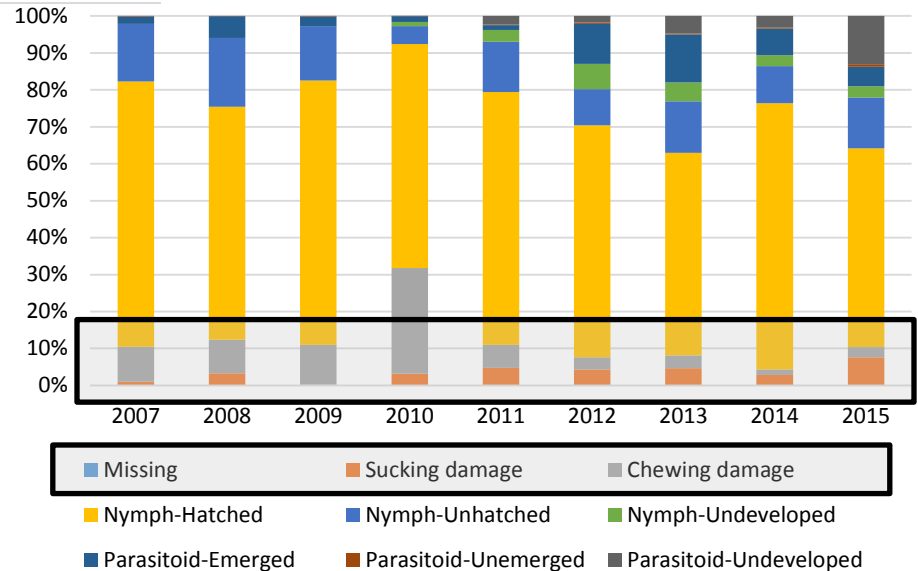
Naturally Laid Egg Masses



Fate of BMSB eggs in DE surveys 2007 to 2015

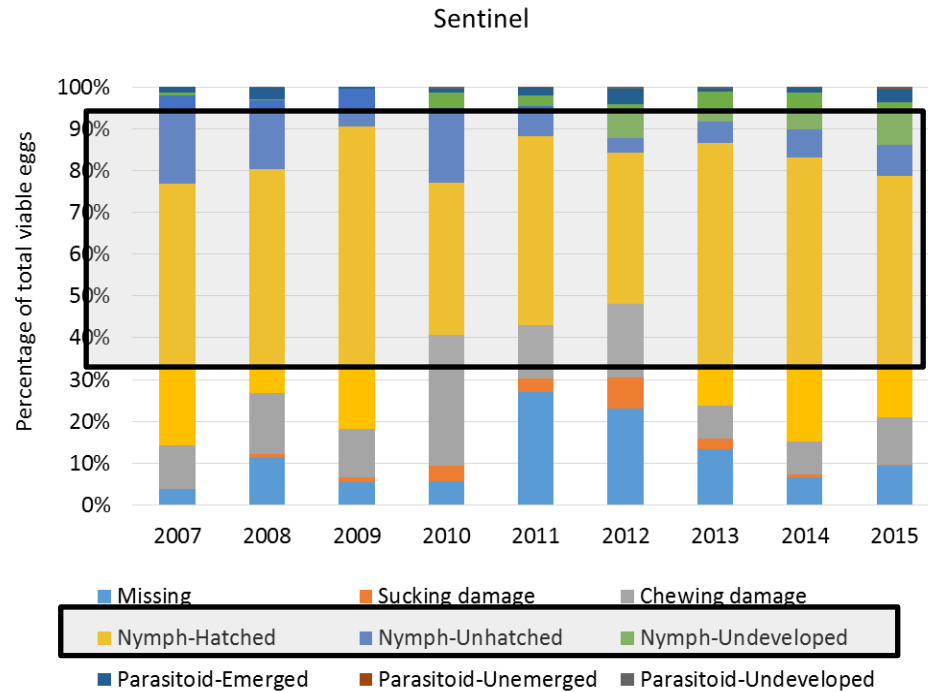


Naturally Laid Egg Masses

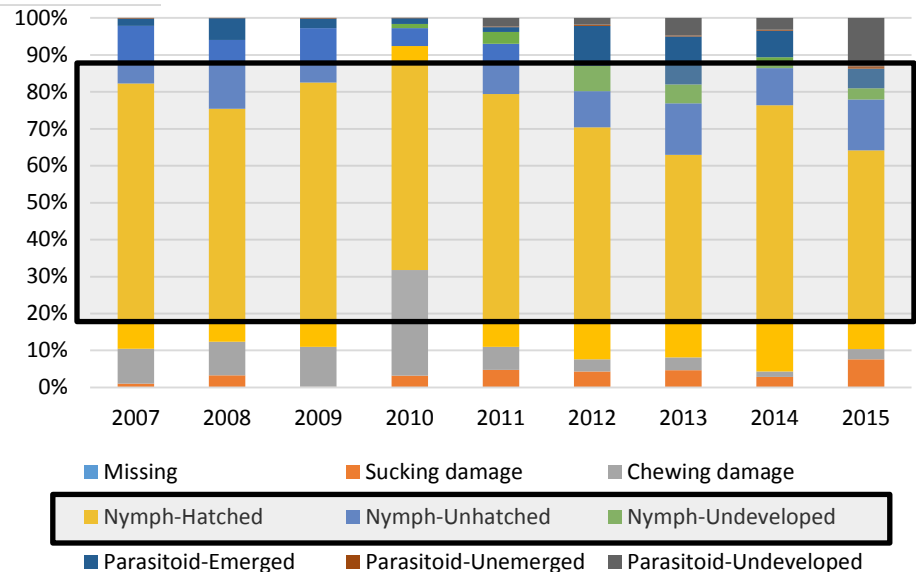


Missing or
apparent
predation

Fate of BMSB eggs in DE surveys 2007 to 2015

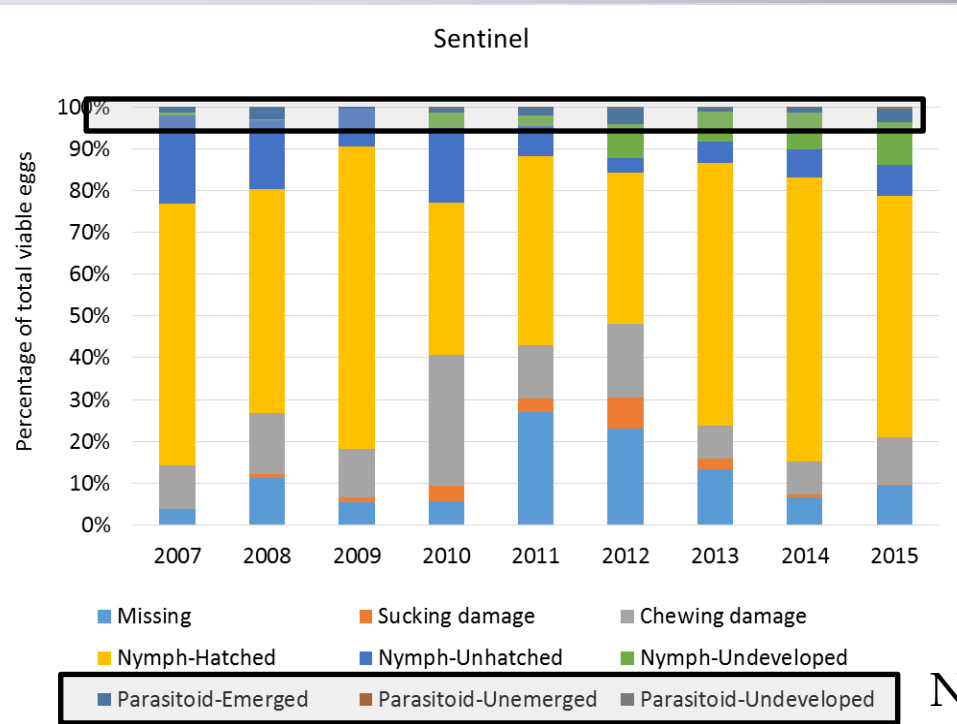


Naturally Laid Egg Masses

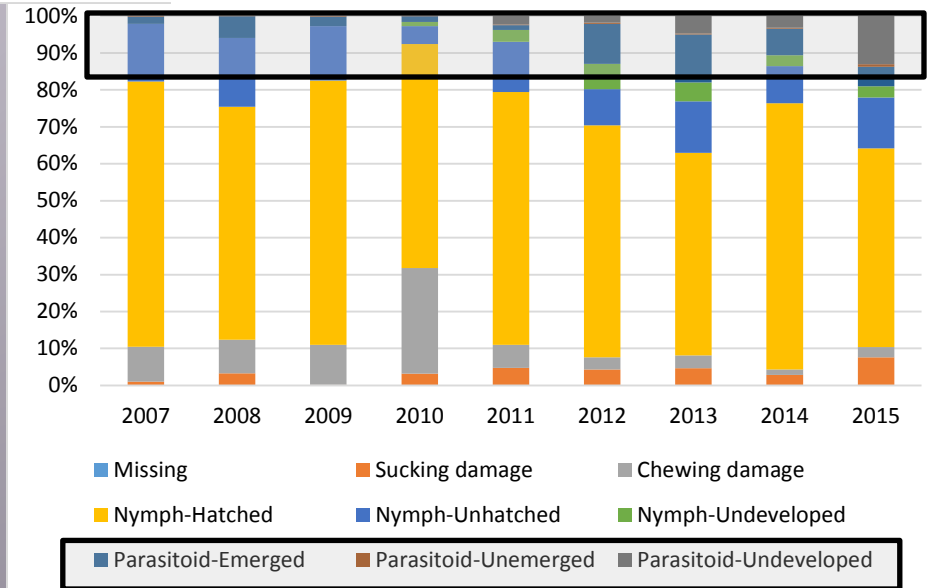


BMSB nymphs
(hatched &
unhatched)

Fate of BMSB eggs in DE surveys 2007 to 2015



Naturally Laid Egg Masses

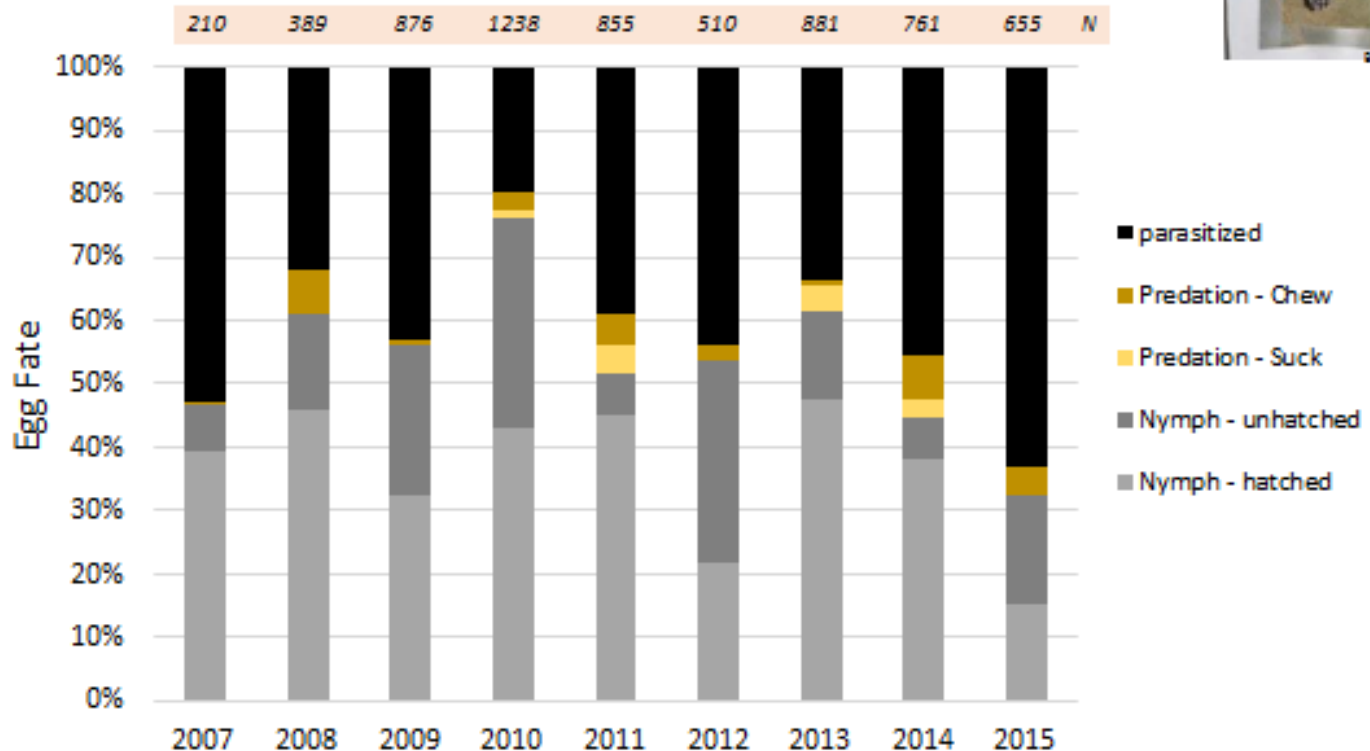
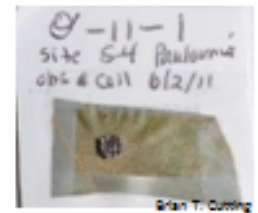


Parasitism
(emerged &
unemerged)

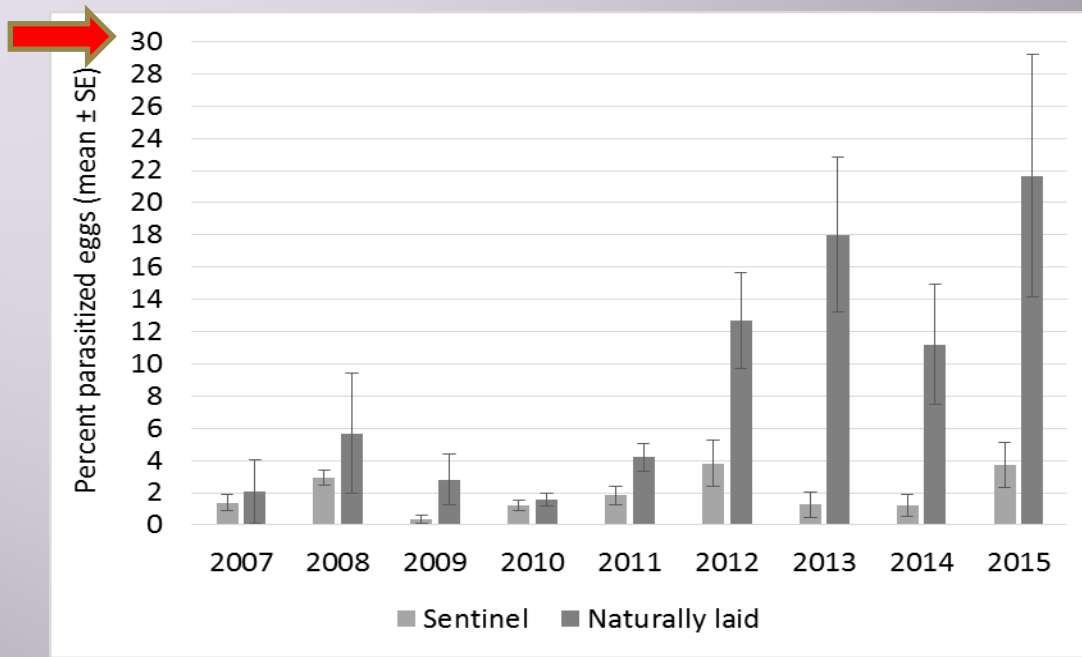
Compare with parasitism rates on native US pentatomids:

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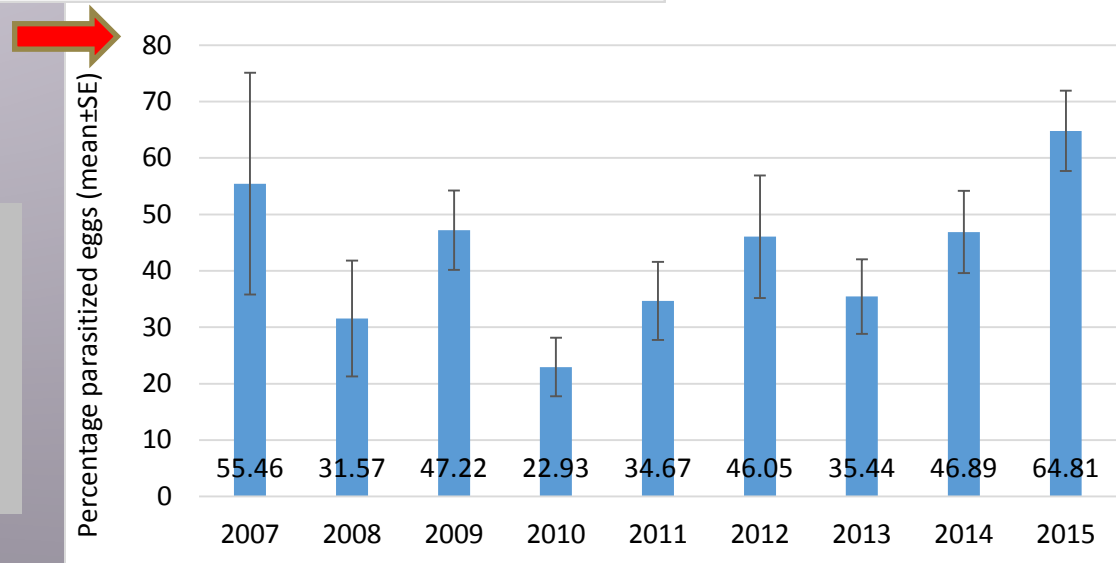
Fate of naturally laid non-BMSB eggs



Note differences in Y-axis scale

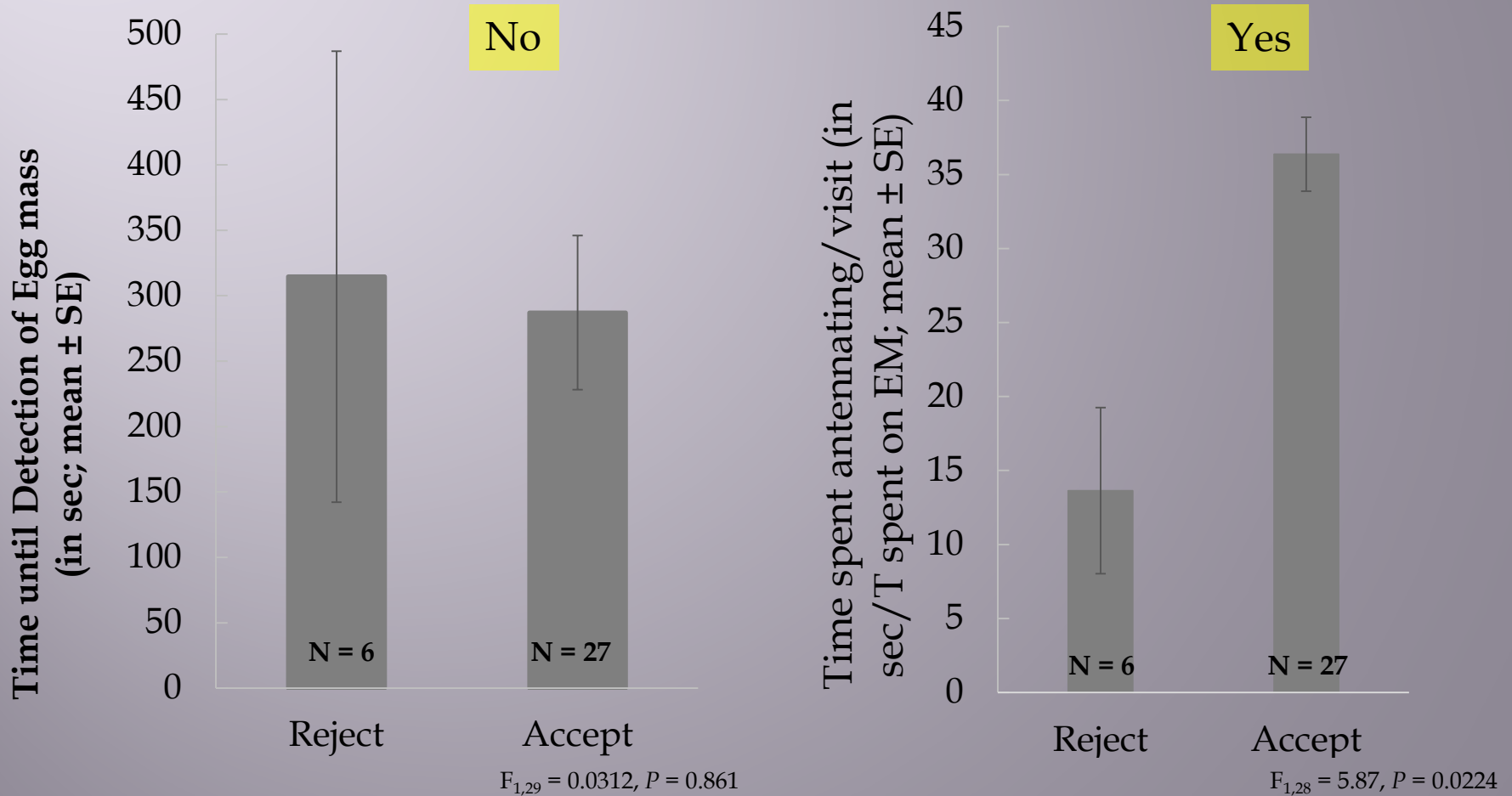


Sentinel BMSB eggs (light grey) & naturally laid BMSB eggs (dark grey):
 % eggs parasitized in each egg mass (\pm SE)



Naturally laid eggs of *other species* (blue):
 % parasitized per egg mass (\pm SE)

Correlation of Female Behavior with Acceptance?



Oviposition (mean \pm SE): 168.65 ± 11.5 s
Marking (mean \pm SE): 22.65 ± 2.32 s