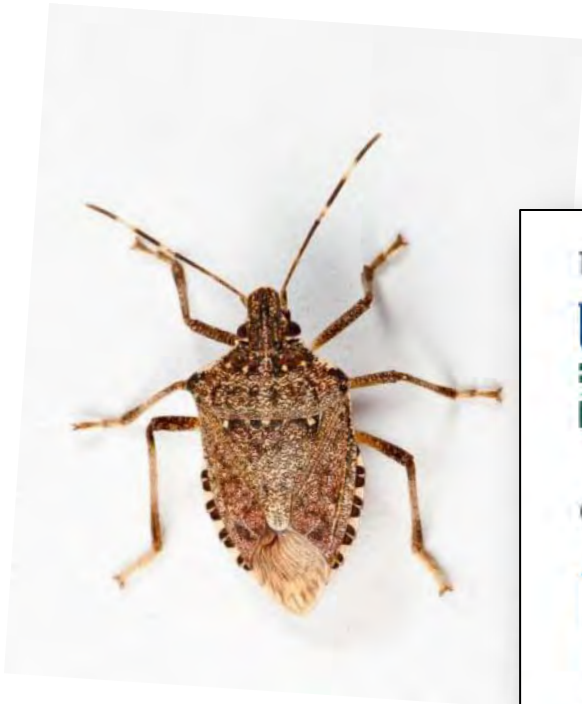


2.1.1 and 2.1.2 Monitoring Tools

2.2.3. Attract and Kill and 2.2.8 Entomopathogens



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Collaborating Institutions

 **Cornell University**   **UNIVERSITY OF MARYLAND**

 **Virginia Tech** 

2.1.1 and 2.1.2 Monitoring Tools

- Pheromone-based monitoring
 - Identification of the pheromone and synergist
 - Season-long performance of olfactory stimuli
 - Trap-type studies
- Light trapping
 - Landscape level monitoring with blacklights
 - Farmscape level with modified pyramid traps
- Nymphal dispersal traps

2011-2012 Pheromone-Based Trapping Studies

- Black pyramid traps deployed between agricultural production and wild host habitats.
- Deployed mid-April and left in place season-long.
- Two Olfactory Attractants

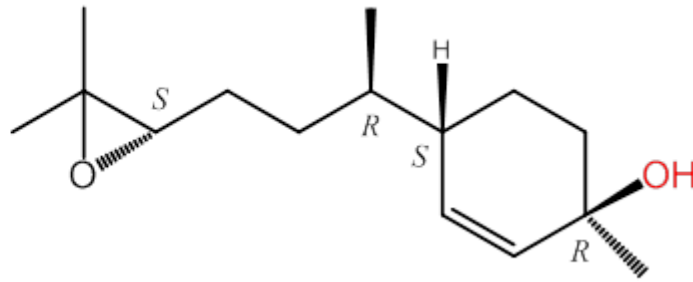
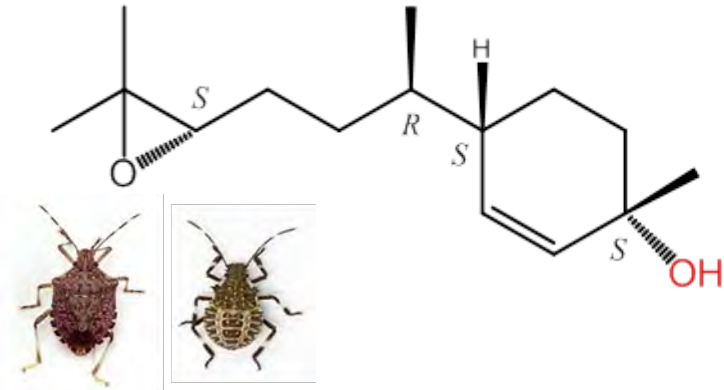


	<u>Adults</u>	<u>Nymphs</u>
# 10	Season-Long	Season-Long
MDT	Late-Season	Season-Long

BMSB Attractants

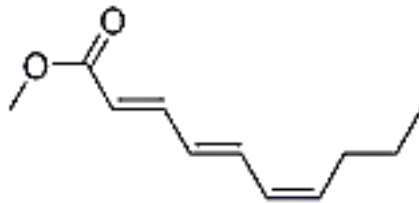
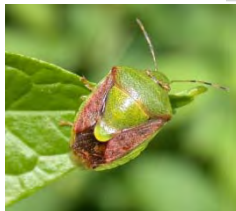
Main component of BMSB aggregation pheromone
(3*S*,6*S*,7*R*,10*S*)-10,11-epoxy-1-bisabolen-3-ol

Minor component of BMSB aggregation pheromone
(3*R*,6*S*,7*R*,10*S*)-10,11-epoxy-1-bisabolen-3-ol



+

Methyl (*E,E,Z*)-2,4,6-decatrienoate (MDT) acts as a synergist for BMSB pheromone



=

Synergism

2013 Multi-State Trial

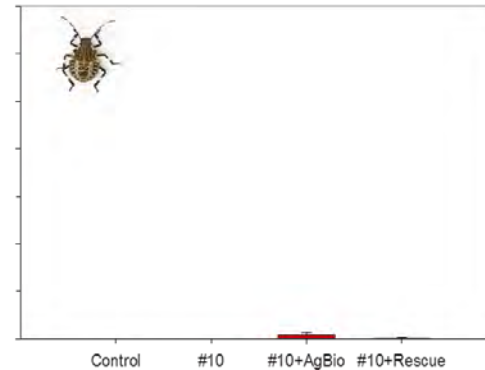
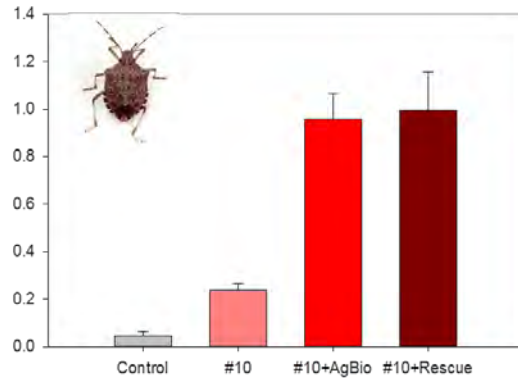
- Document season-long patterns of activity.
- #10
- #10+ AgBio MDT (66 mg)
- #10 + Rescue MDT (120 mg)
- Control

- ME, NH, CT, MA, PA, NJ, VA, WV, MD, DE, NC, FL, AL, MI, OH, IA, MO, UT, CA, OR, WA

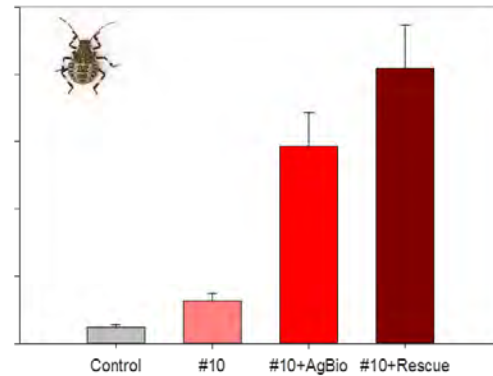
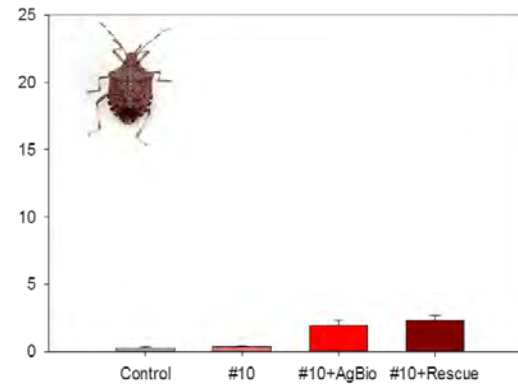


2013 Summary Results

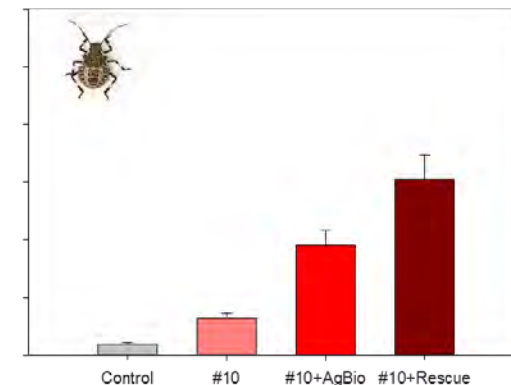
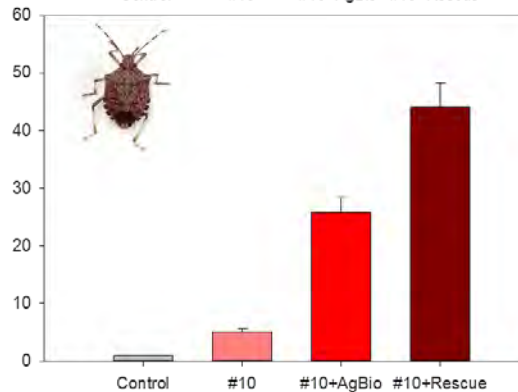
Mean number of BMSB / trap / week



Early Season

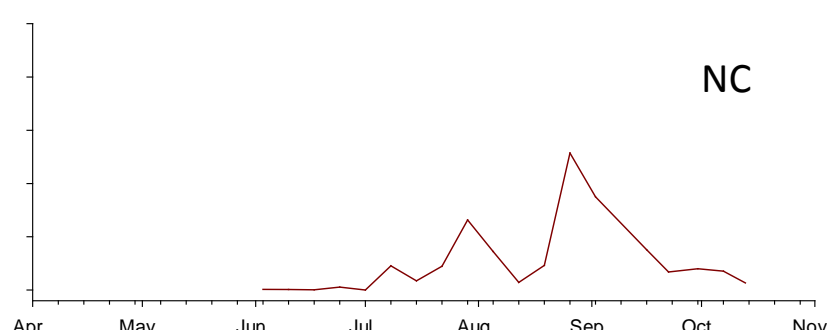
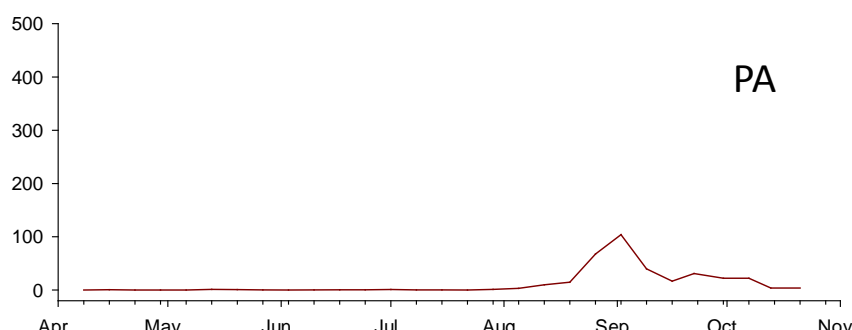
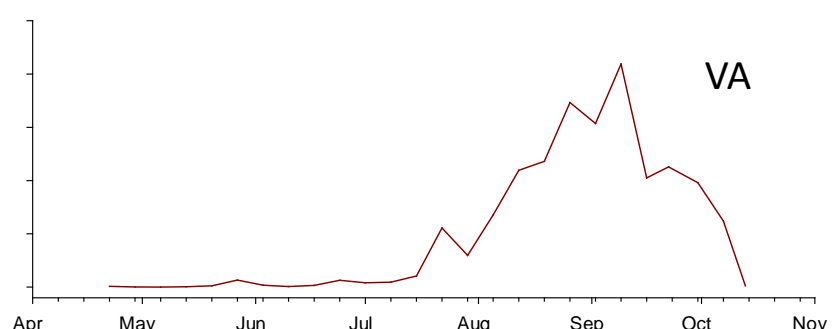
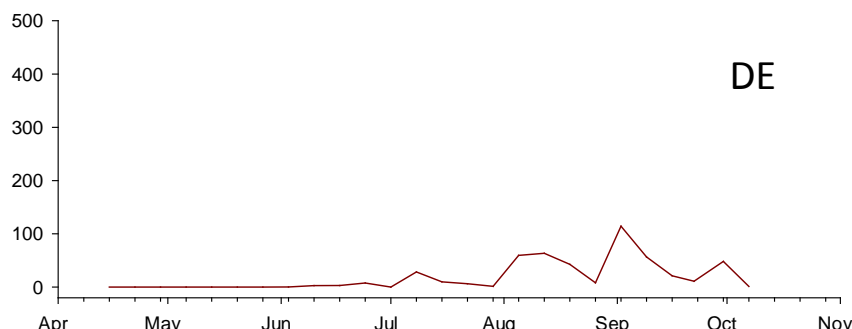
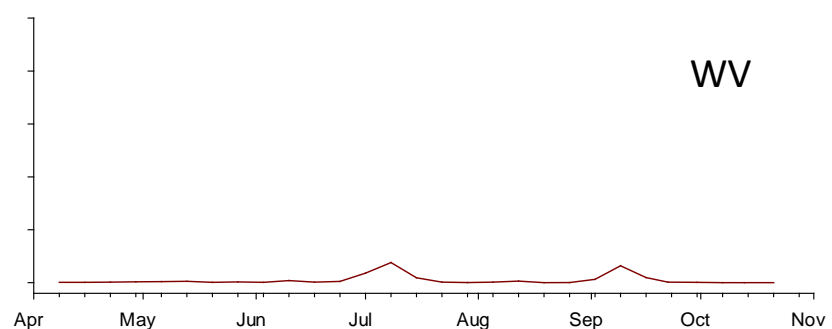
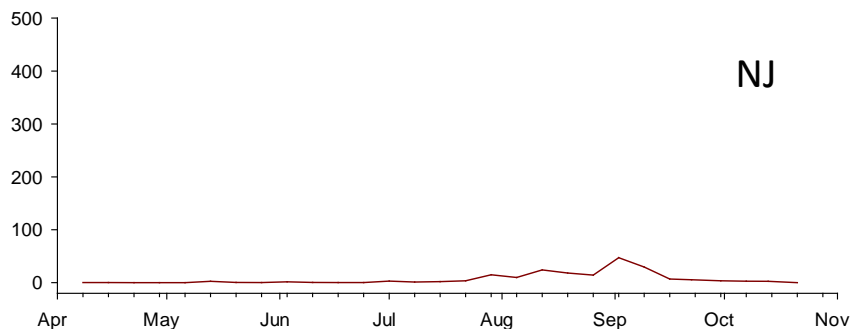
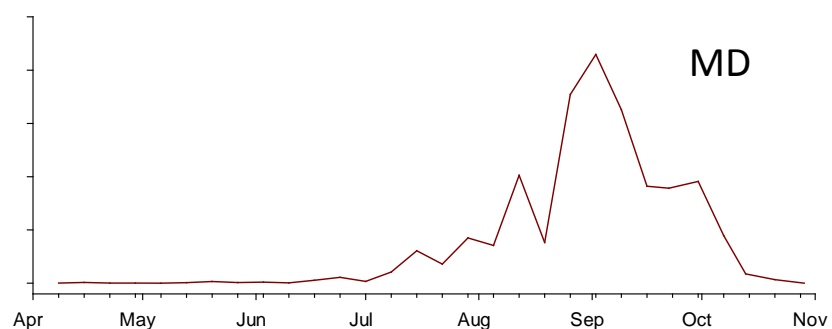
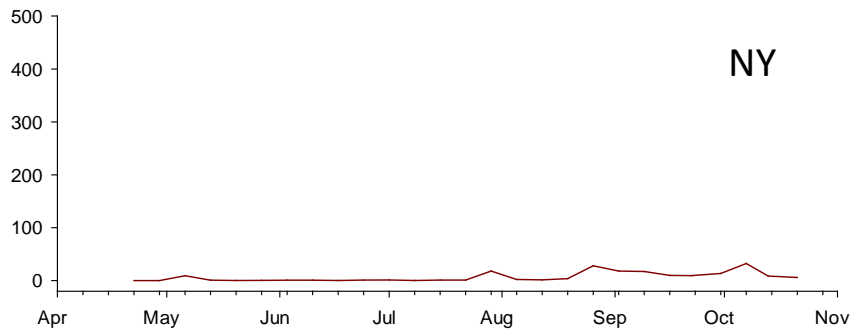


Mid Season

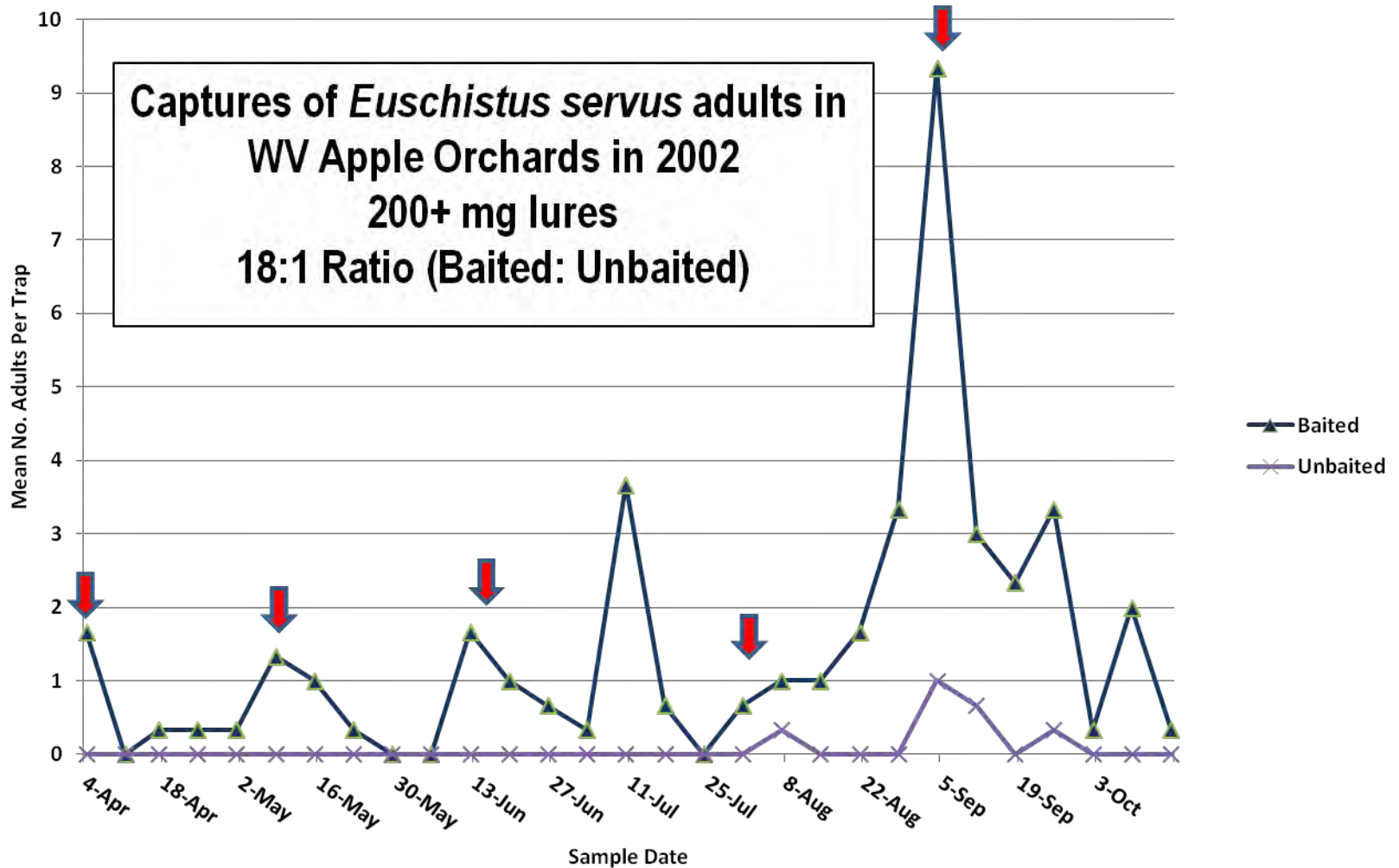


Late Season

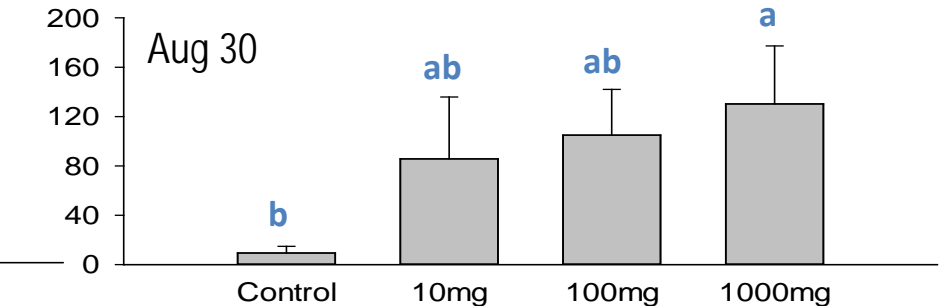
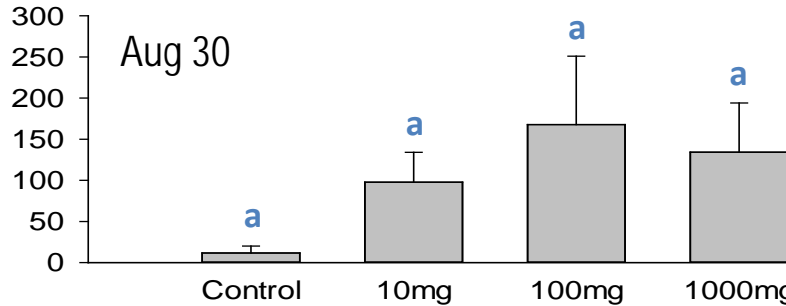
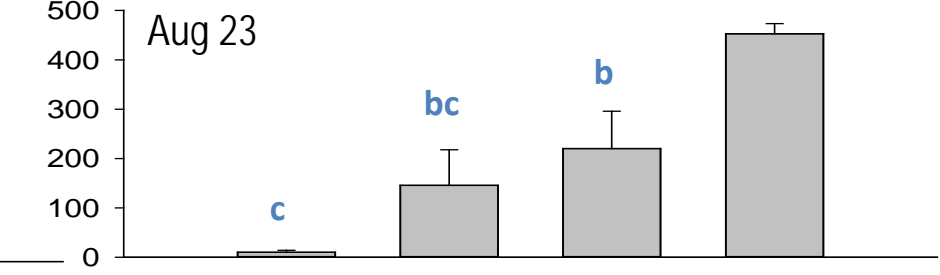
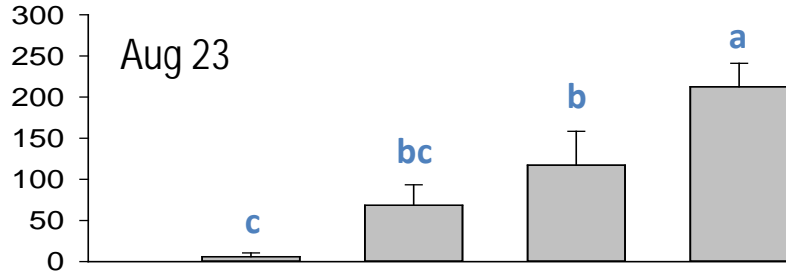
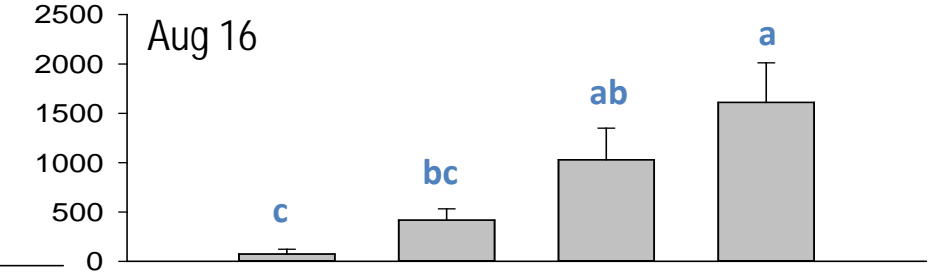
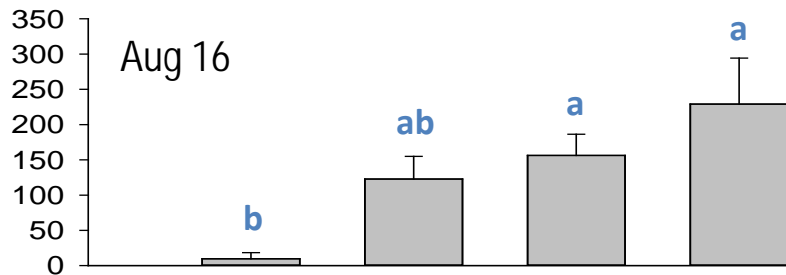
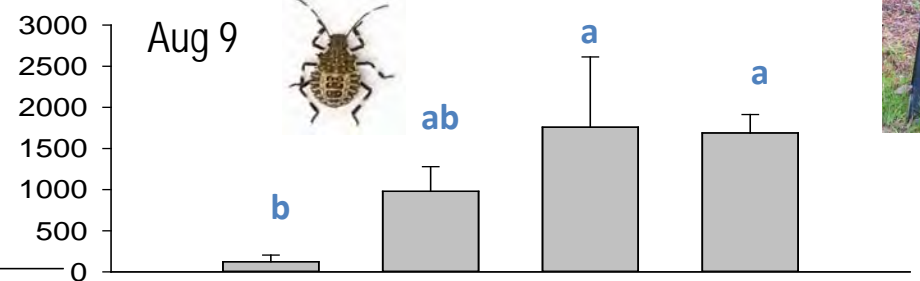
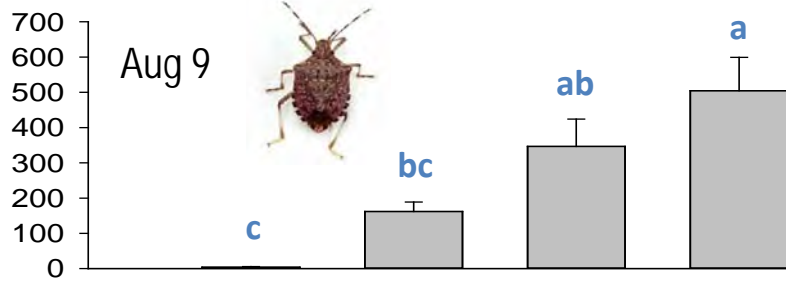
Mean number of BMSB / trap / week



What should we expect?



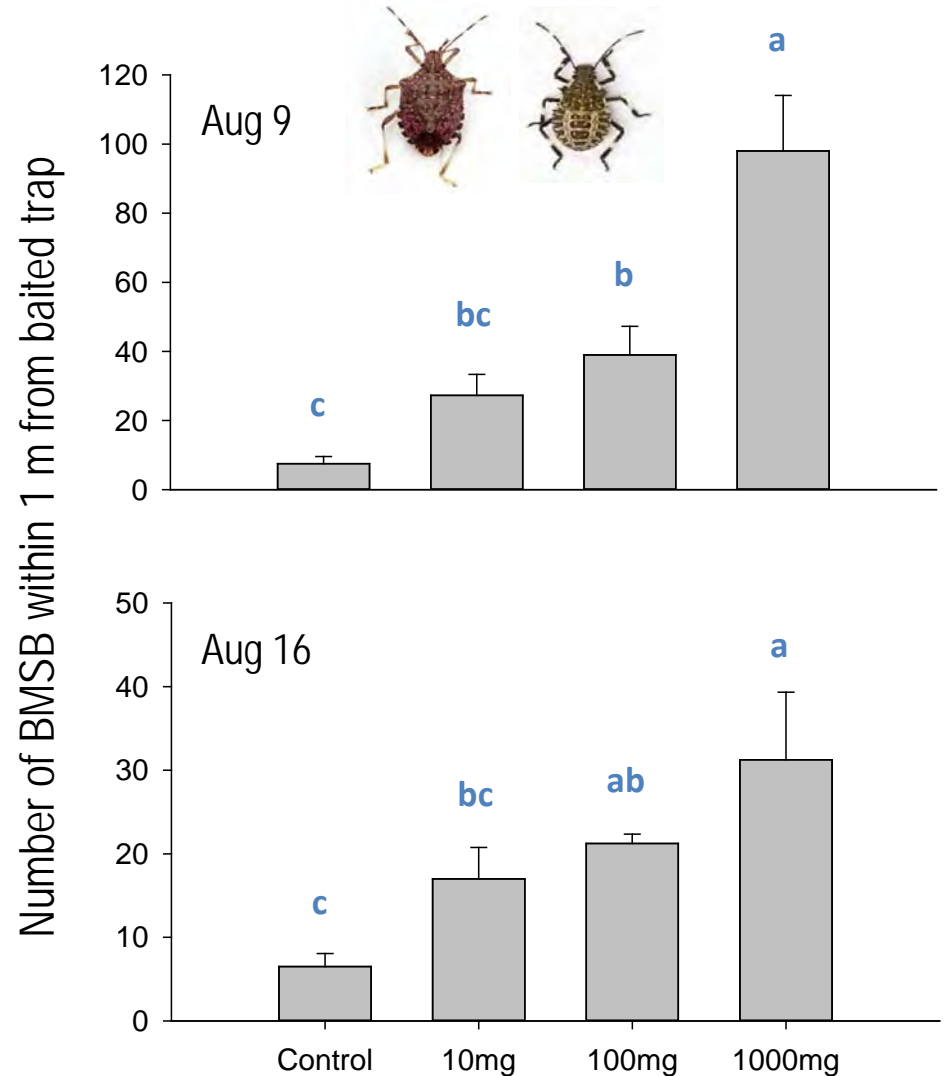
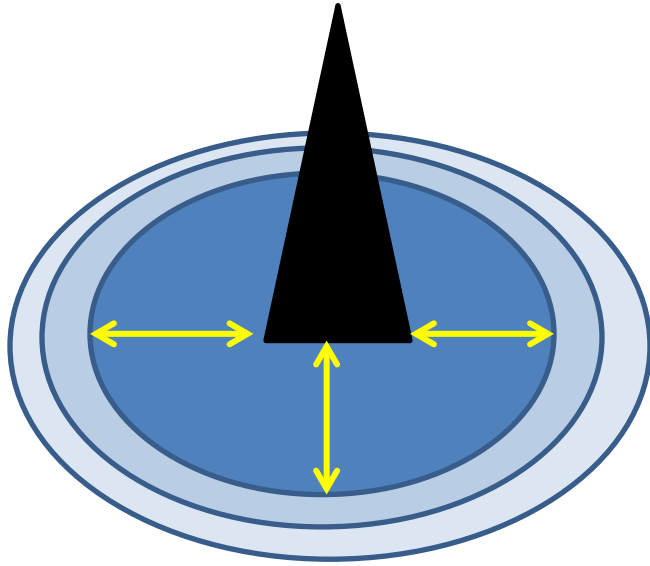
Dose-Response Studies



Number of BMSB adults / Trap / Week

What about BMSB Aggregating Around Traps?

2-minute Timed Count of Adults and Nymphs within 1 m from Trap



Year 1: Season-Long Trap Type Studies

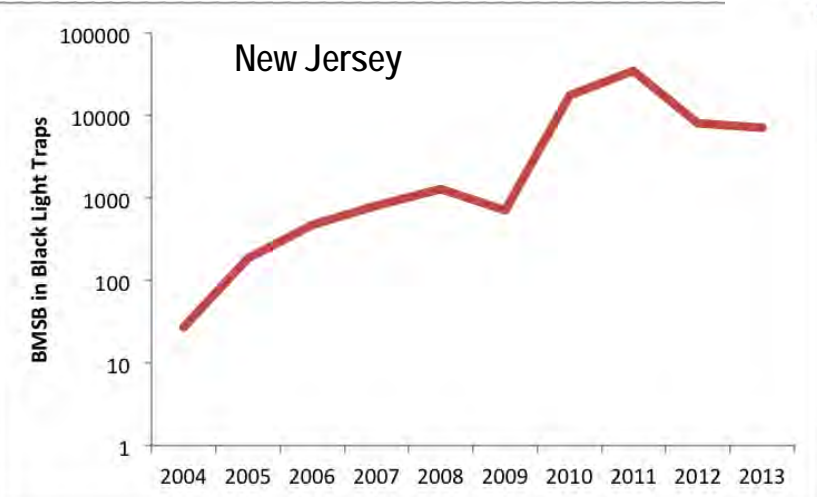
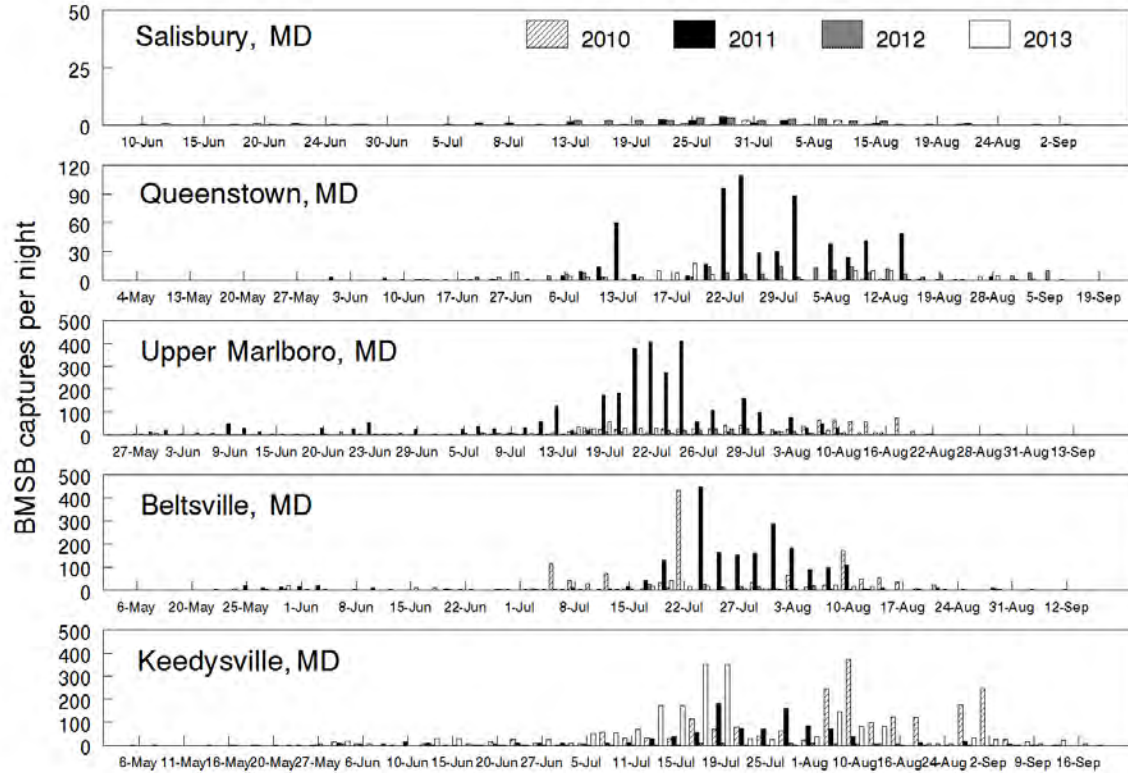
Orchard 1



Orchard 2



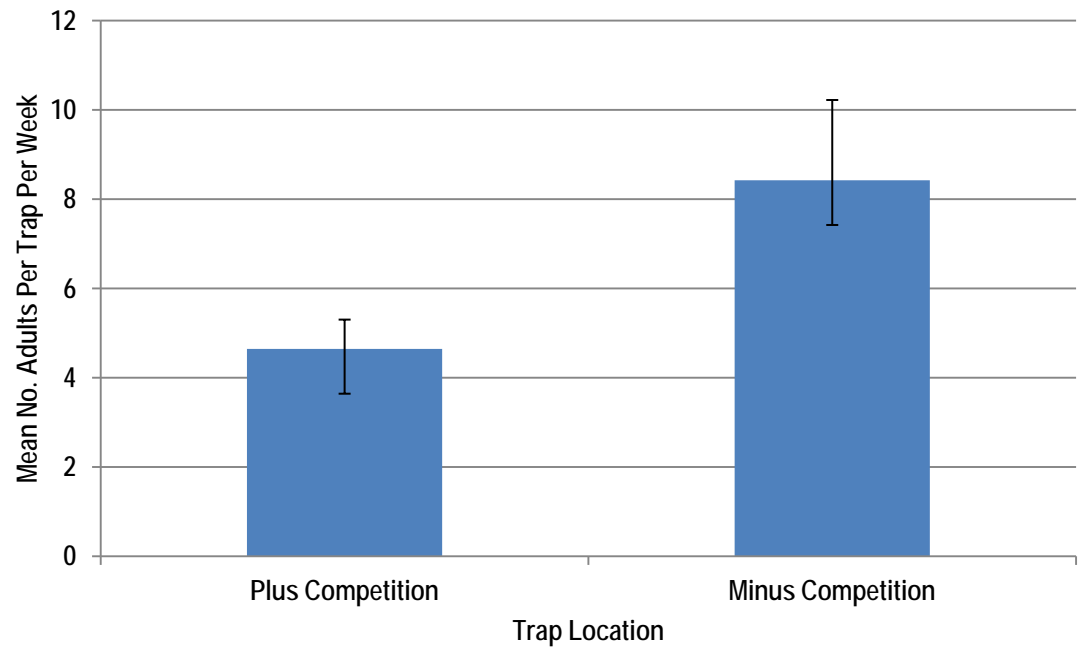
Landscape-Level Monitoring With Blacklight Traps



Seasonal and annual trends in populations

Farmscape-Level Monitoring With Lighted Pyramid Traps

What is the impact of competing light stimuli? Does trap location matter?



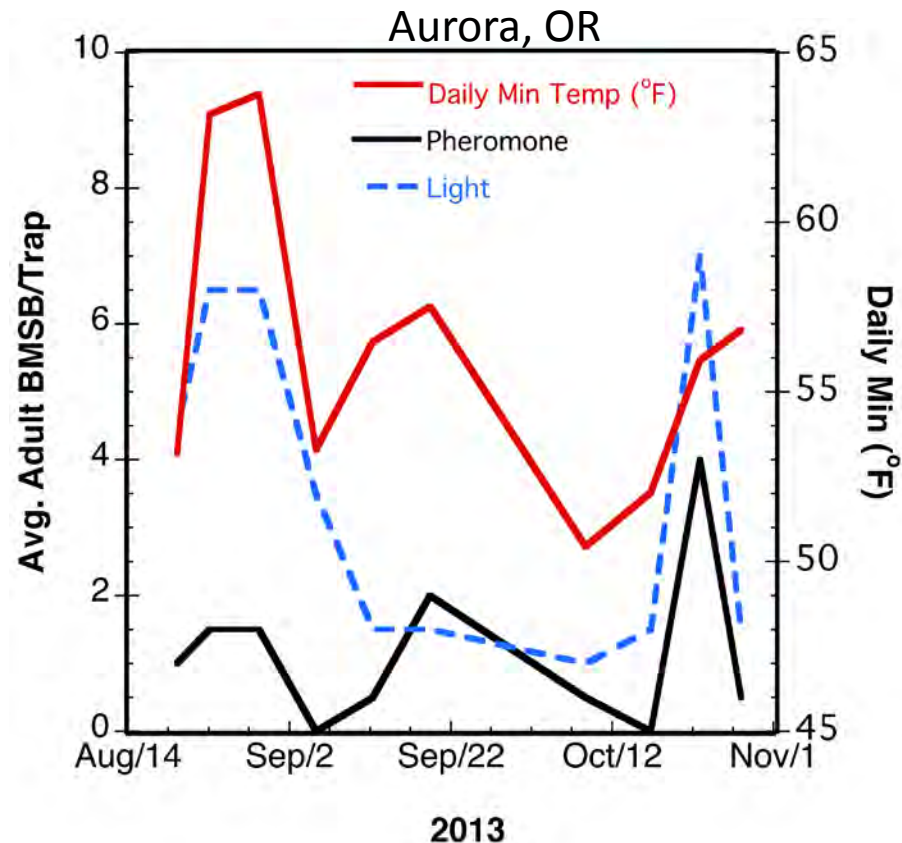
Trap location influences overall sensitivity. Do not deploy near competing stimuli.

Pheromone and Light Trap Comparisons in PNW

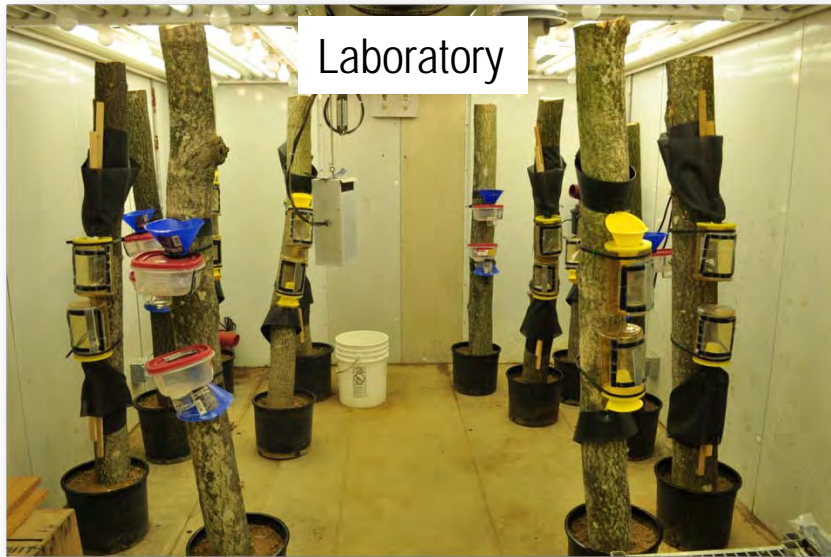


Light vs pheromone trap results: PNW 2013

- BMSB captured in light traps: 1 of 10 sites.
- BMSB captured in pheromone traps: 3 of 10 sites.
- Cooler nights limit capture.
- It is possible light traps bring BMSB into an area, which then get captured in pheromone traps.



Monitoring Nymphal Dispersal



DOWN



DOWN

Understanding nymphal dispersal among hosts

Monitoring Summary

- Season-long attraction to pheromone+synergist combination. Largest populations are in the late-season.
- Two companies have committed to commercializing lures for monitoring in 2014. AgBio/ChemTica and Trece.
- Populations also can be monitored at landscape and farmscale levels with light traps.
- Nymphal dispersal to and from host plants can be monitored.
- Next steps – distance of response to stimuli, trap-based threshold development, trap type studies, aiding in commercialization of products and multi-species monitoring stations.



2.2.3. Attract and Kill and 2.2.8 Entomopathogens

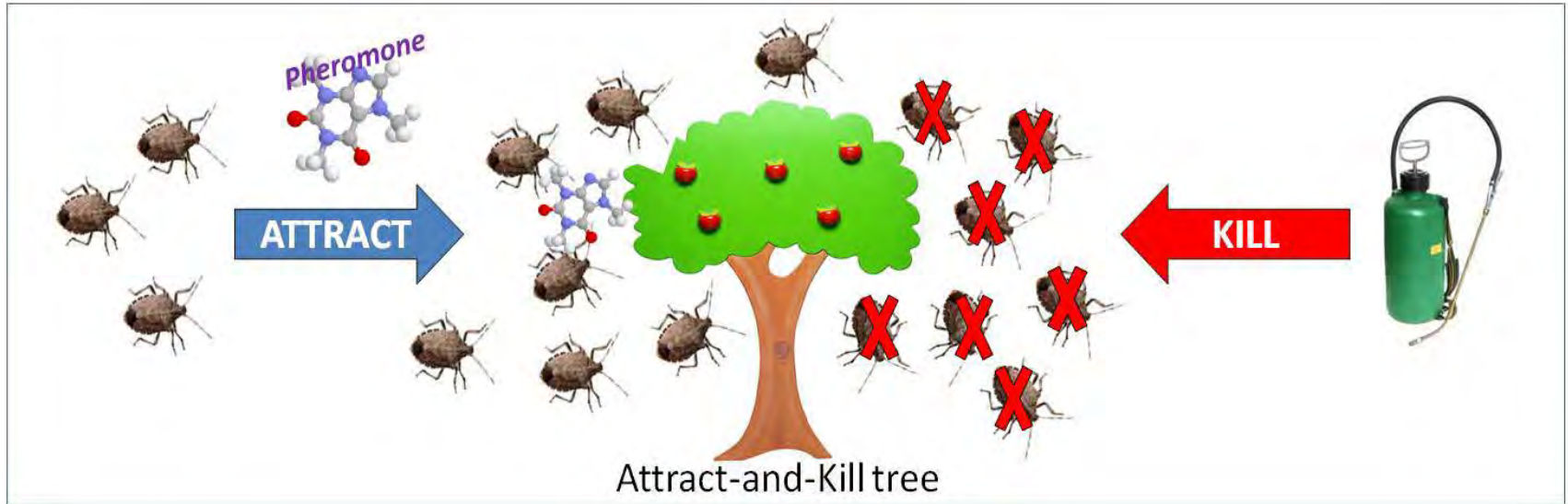
- Mass Trapping
 - Traps baited with MDT
- Attract and Kill and Entomopathogens
 - Attract and Kill Trees
 - Attract and Kill Nets + Entomopathogens

Small-Scale Mass Trapping



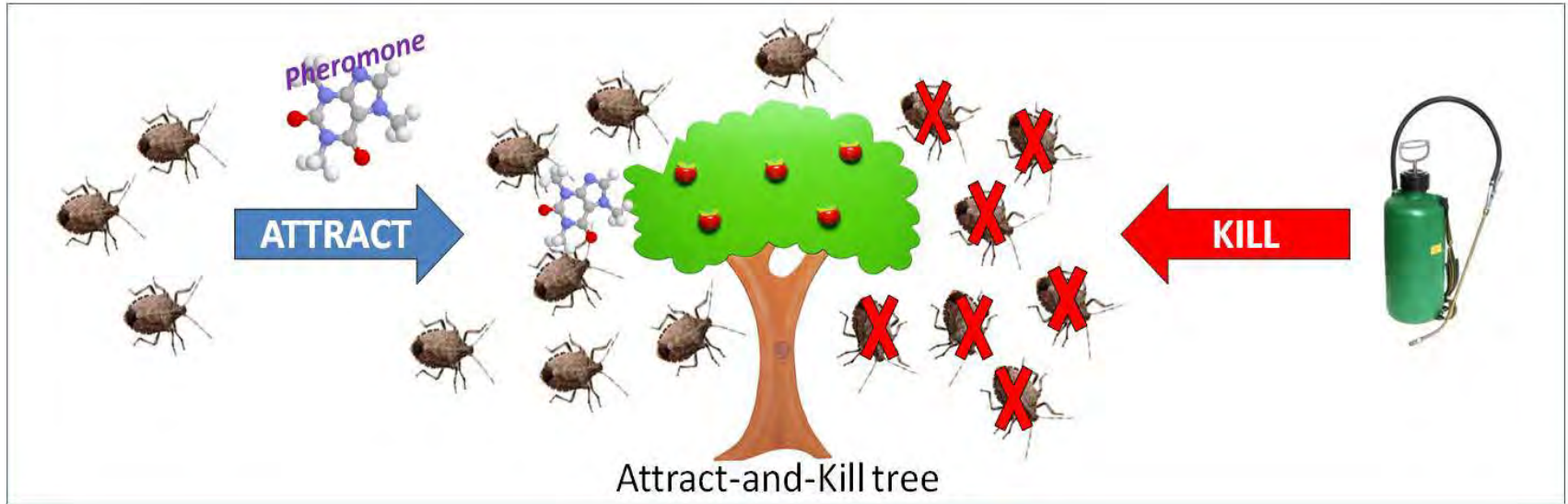
- Master gardeners provisioned gardens with stink bug traps baited with MDT (or unbaited).
- Gardeners with traps were no more or less likely to have BMSB on tomato plants than those without traps, but the abundance of BMSB on tomato fruits was marginally greater in gardens with traps.
- Tomatoes in gardens with traps sustained significantly more injury than without.
- We found no evidence that stink bug traps protected tomatoes from BMSB, and it appears that the addition of traps to gardens may increase injury to tomato fruits.

Can we create spatially-precise attract-and-kill sites?

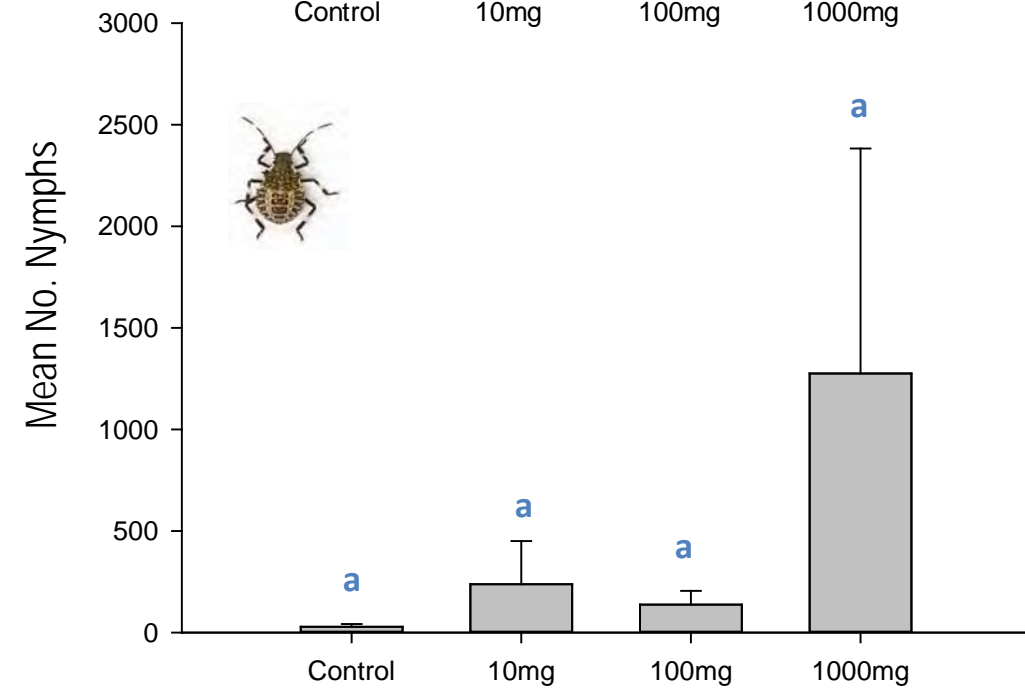
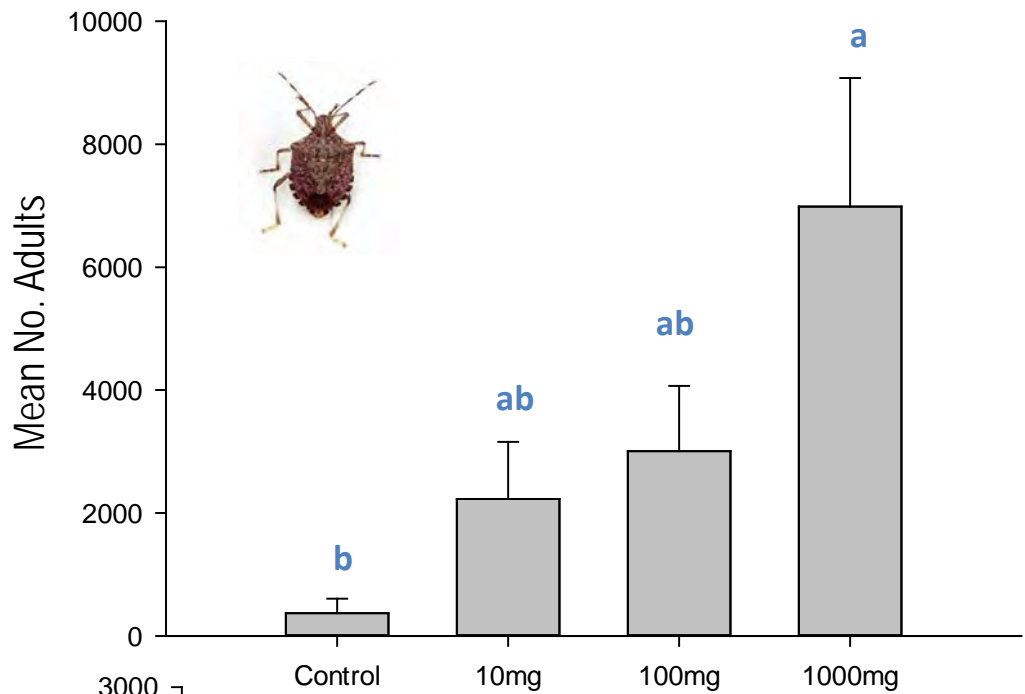


- BMSB are attracted in greater numbers to increasing dose of olfactory stimuli.
- Area of aggregation around stimulus < 5m.
- BMSB will forage longer on host vs. non-host structures.

Can we create spatially-precise attract-and-kill sites?



- Baited apples trees with 10, 100 or 1000 mg pheromone + synergist along with unbaited control.
- Treated trees with bifenthrin 48h later.
- Counted number of bugs 6h and 6d after treatment.

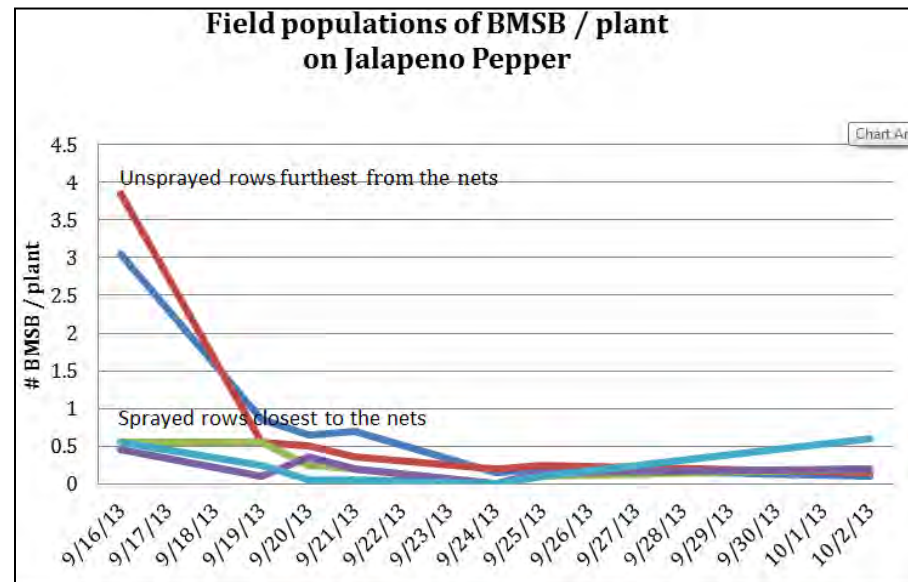


Attract and Kill: Baited Nets + *Beauveria*



Attract and Kill: Baited Nets + *Beauveria*

Date	South Net Trap (#10 + MDT only)	North Net Trap (#10 + MDT+100W Halogen Lights)	Totals
9-Sep	0	0	0
10-Sep	613	943	1556
11-Sep	299	249	2104
12-Sep	788	1656	4548
17-Sep	1130	2805	8483
19-Sep	426	282	9191
20-Sep	563	527	10281
21-Sep	722	670	11673
25-Sep	284	101	12058
Totals	4825	7233	12058



Attract and Kill Summary

- Mass trapping at backyard garden scale not very promising.
- Attract and kill using pheromonal and light-based stimuli hold promise.
- Include most effective entomopathogenic fungi strains.
- Next steps – Move from proof of concept to studies in commercial crops, questions of attraction vs. retention, distance of response, use of entomopathogens (when, where, how often).

