

Season-Long Patterns of Attraction of Brown Marmorated Stink Bug to Pheromone Lures and Light Traps in Orchard Agroecosystems



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Development of Effective Detection and Monitoring Tools



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- Tools that provide accurate measurements of presence, abundance, and seasonal activity of BMSB.
- Growers can make informed management decisions.

Key Components: Earlier Studies



- Visual Stimulus
 - Large black pyramid
- Olfactory Stimulus
 - methyl (2*E*,4*E*,6*Z*)-decatrienoate
- Capture Mechanism
 - Tapered pyramid to inverted funnel jar with DDVP toxicant strip
- Deployment Strategy
 - Traps placed in peripheral row of orchard

Pheromone of *Plautia stali*

- Methyl (2*E*, 4*E*, 6*Z*)-decatrioneate.
- Cross attractive to brown marmorated stink bug and other pentatomids.
- Reports from Asia and U.S.



Will BMSB Respond to Methyl (2E, 4E, 6Z)-Decatrienoate in the early-season?



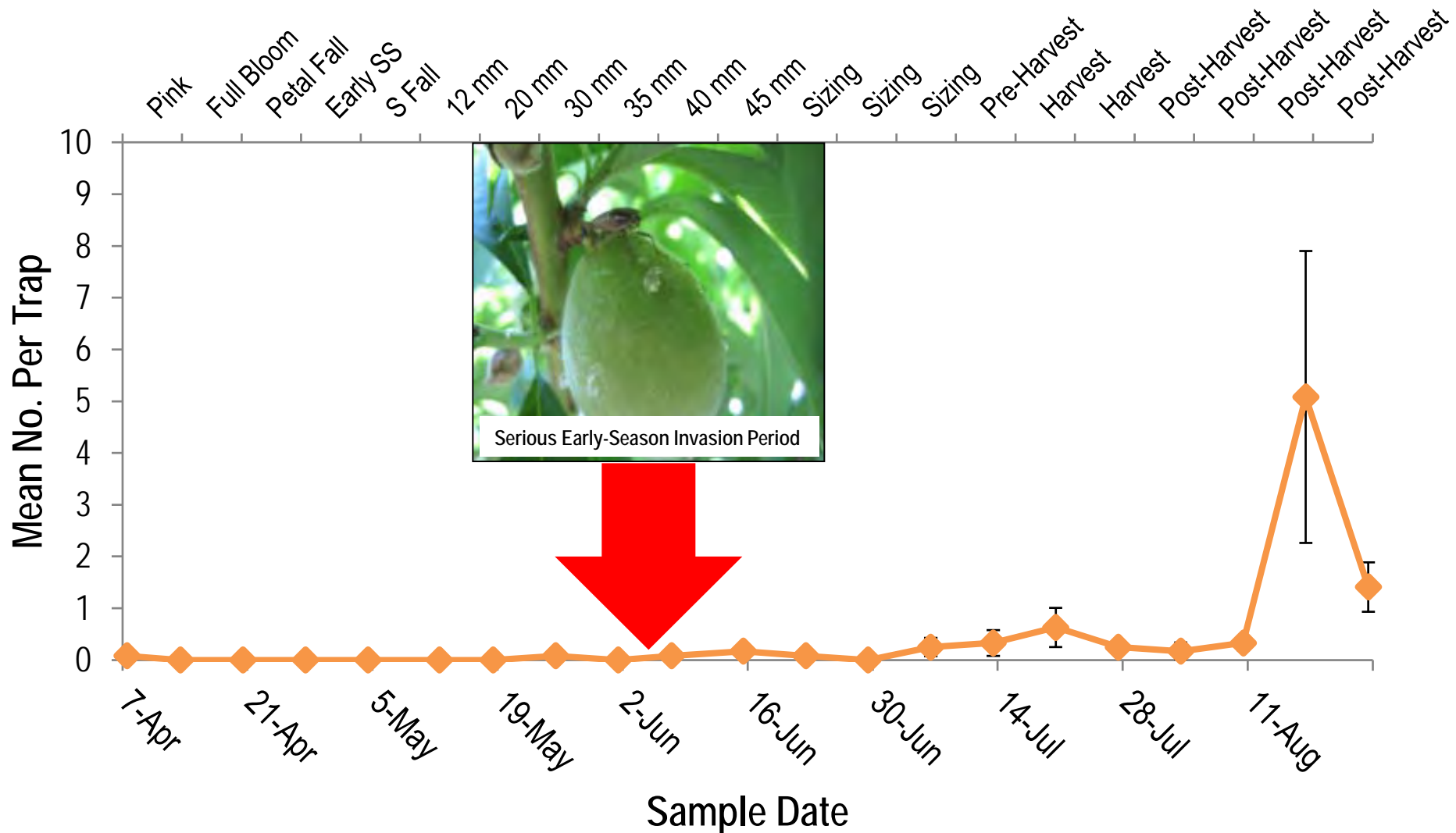
- Reports of early-season attraction in Asia.
- Previous trials had relied on low doses (<5 mg).
- Evaluated 66 mg lures.

Despite Reports in the Asian Literature, Our Only Attractant Fails During the Early- and Mid-Season



Methyl (2*E*,4*E*,6*Z*)-decatricionate (MDT) attractive to adults only during the late-season. Confirmed in MD, WV, NJ, PA, VA and other states in 2011. Not attractive to adults in early- and mid-season.

Almost No Captures in Traps Baited with MDT, Despite Very Large Immigrating Populations

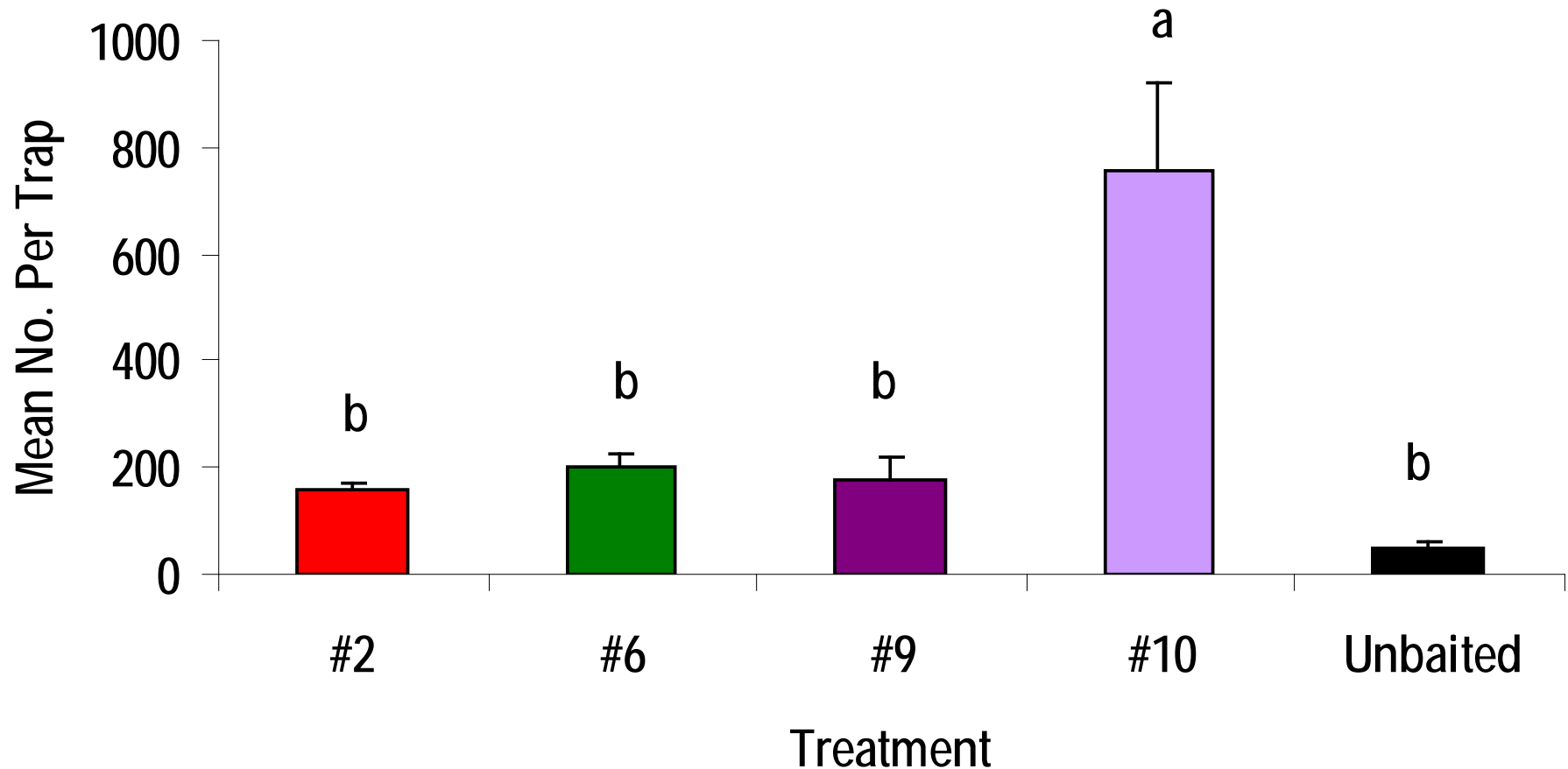


Identification of BMSB Aggregation Pheromone



Identification of the BMSB Aggregation Pheromone

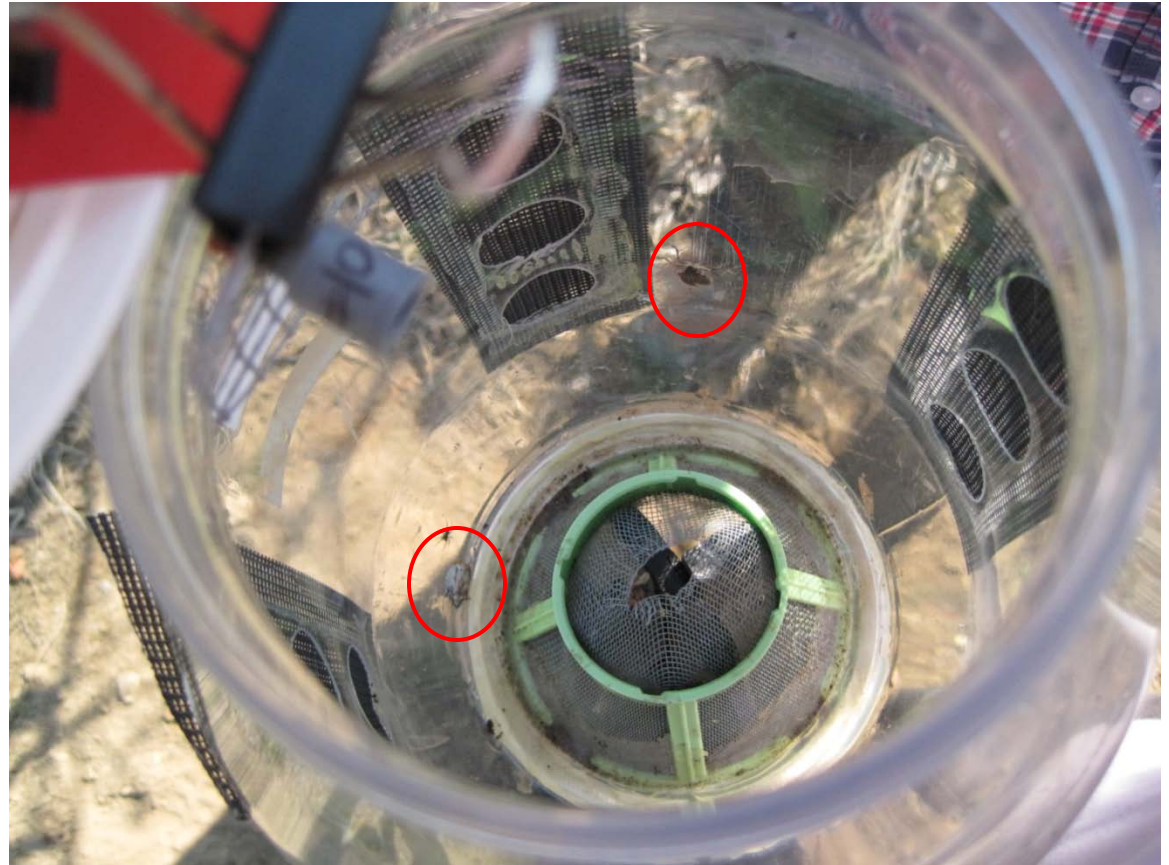
9-30 September 2011



Traps baited with #10 captured ~15x more than control and ~3-4x more than other treatments.

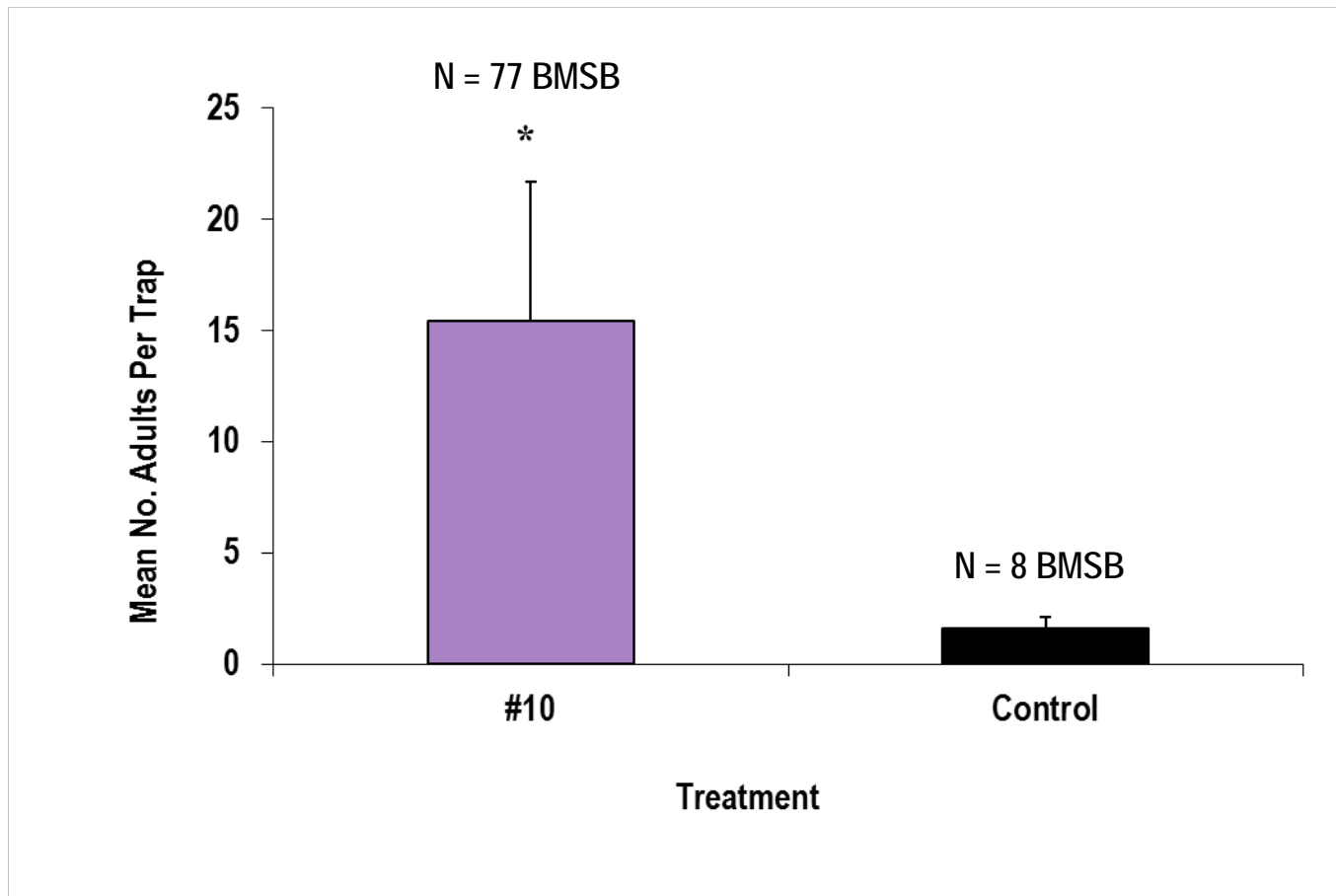
Is #10 Attractive in the Early Season?

Pre-Trial (March 20-April 17, 2012)



Early Season Attraction Documented for BMSB

March 20-April 17, 2012



Biology, Ecology, and Management of Brown Marmorated Stink Bug in Orchard Crops, Small Fruit, Grapes, Vegetables, and Ornamentals

USDA-NIFA SCRI Project

- USDA-ARS
 - Appalachian Fruit Research Station, Kearneysville, WV
 - Beneficial Insects Introduction Research Unit, Newark, DE
 - Invasive Insect Biocontrol and Behavior Laboratory, Beltsville, MD
 - Horticultural Crops Research Unit, Corvallis, OR
- The Pennsylvania State University
- Washington State University
- North Carolina State University
- Virginia Polytechnic Institute and State University
- Rutgers University
- Northeastern IPM Center
- Oregon State University
- University of Maryland
- University of Delaware
- Cornell University



Broad Validation in Multi-State Trial

- Is BMSB attracted to #10 in the early season?
- Is BMSB attracted to #10 season-long?
- How attractive is this stimulus relative to MDT and unbaited traps?
- WV, MD, VA, PA, NJ, NY, DE, NC, OR, WA, and OH





Total of 350 Traps
Deployed Across
12 States

Leveraged and In-Kind Support

USDA-ARS

USDA-APHIS

AgBio

Sterling/Rescue

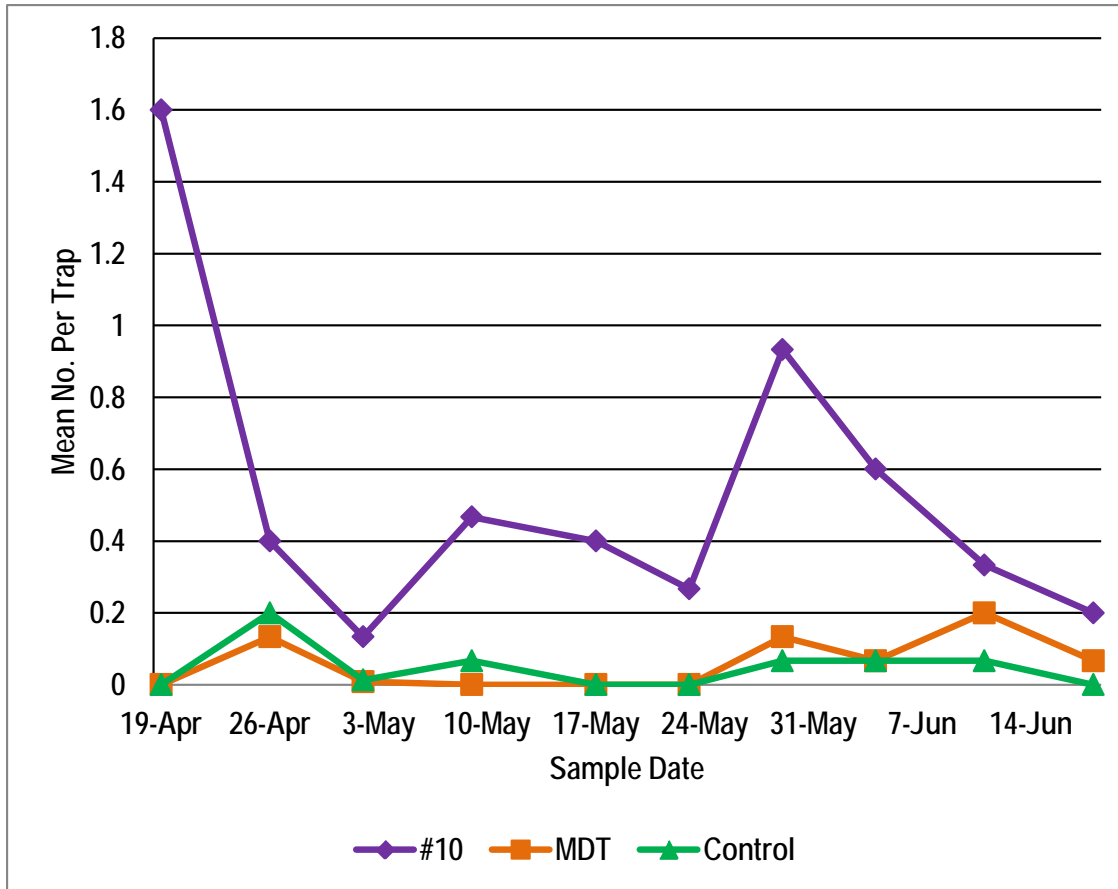
General Protocol

- Black pyramid traps
- Three odor treatments
 - 1) #10 (10 mg)
 - 2) MDT (> 100 mg)
 - 3) unbaited control
- Traps are deployed between wild host habitat and agricultural production area.
- Traps were deployed in mid-April and left in place season-long.



Early Season Summary

Mid-April to Mid-June 2012



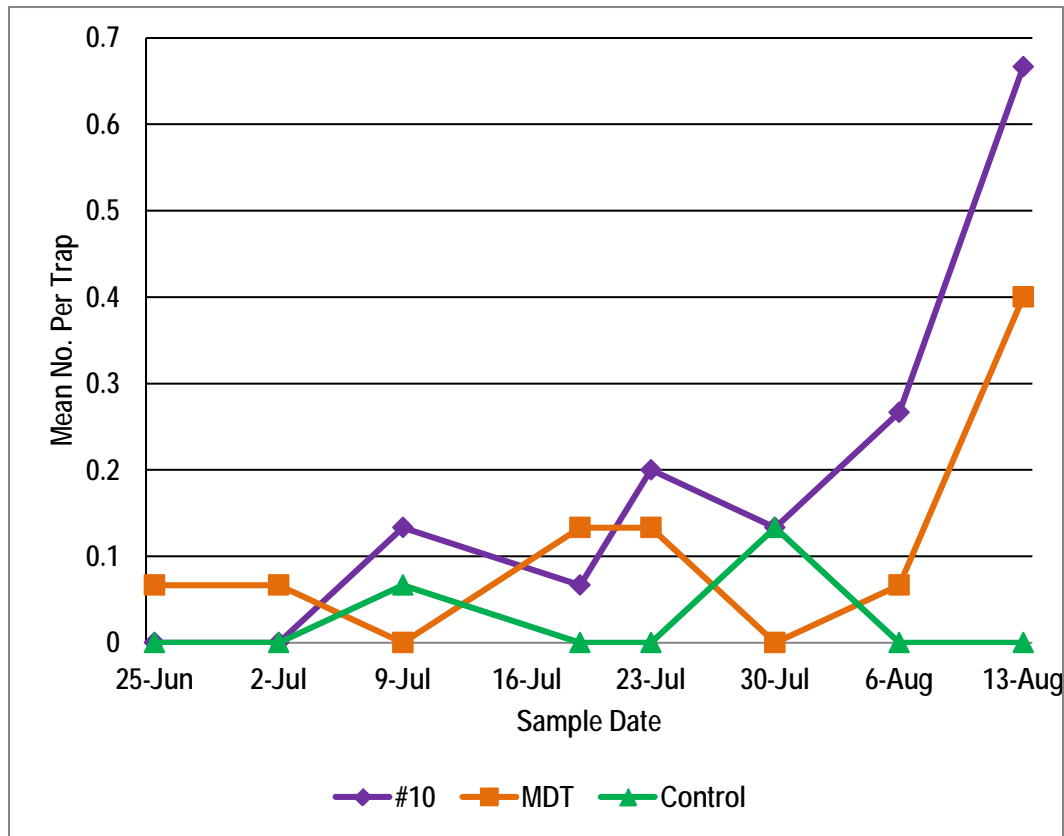
Trap Capture Ratios

#10:Unbaited	11 : 1
MDT:Unbaited	1 : 1
#10:MDT	9 : 1

- BMSB reliably captured by traps baited with #10.
- These captures represents invading overwintering adults during early season.

Mid-Season Summary

Mid-June to Mid-August



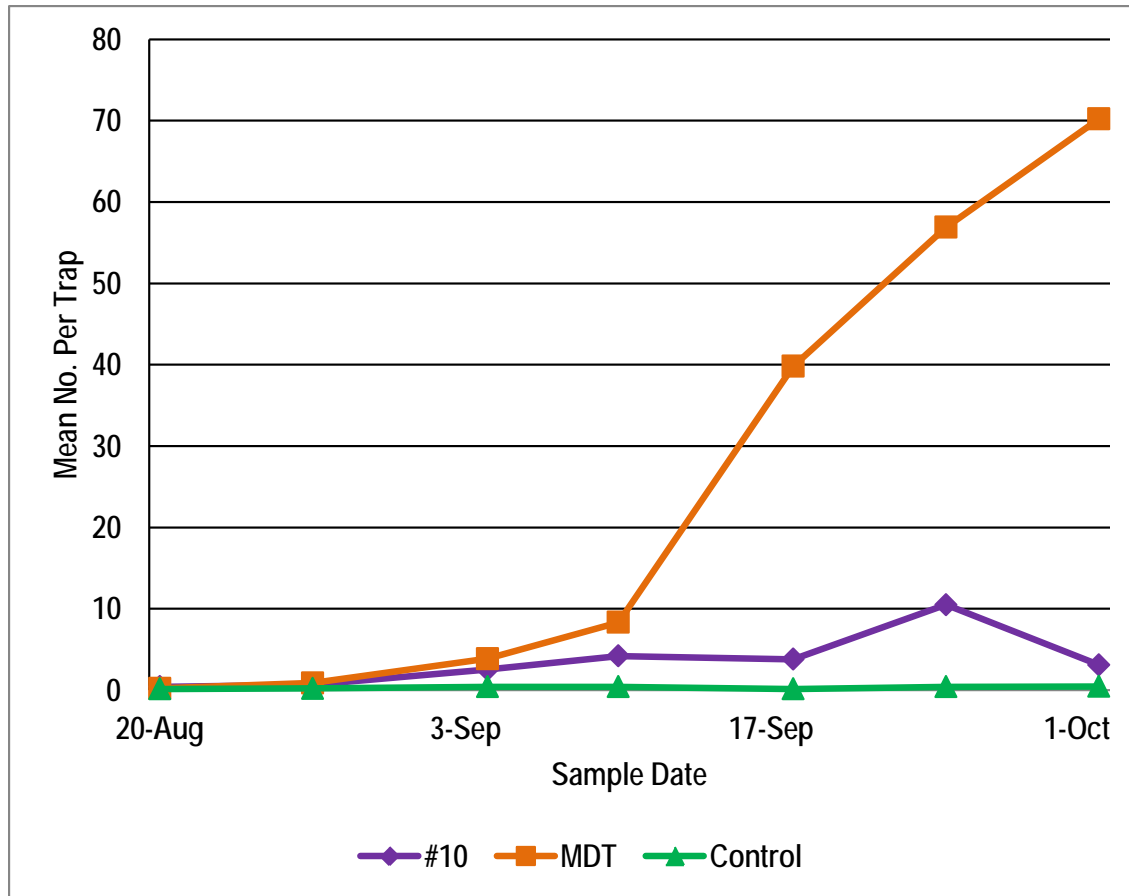
Trap Capture Ratios

#10:Unbaited	7 : 1
MDT:Unbaited	4 : 1
#10:MDT	2 : 1

- Low numbers during much of mid-season.
- Increasing populations beginning in mid-July.

Late-Season Summary

Mid-August to Mid-October

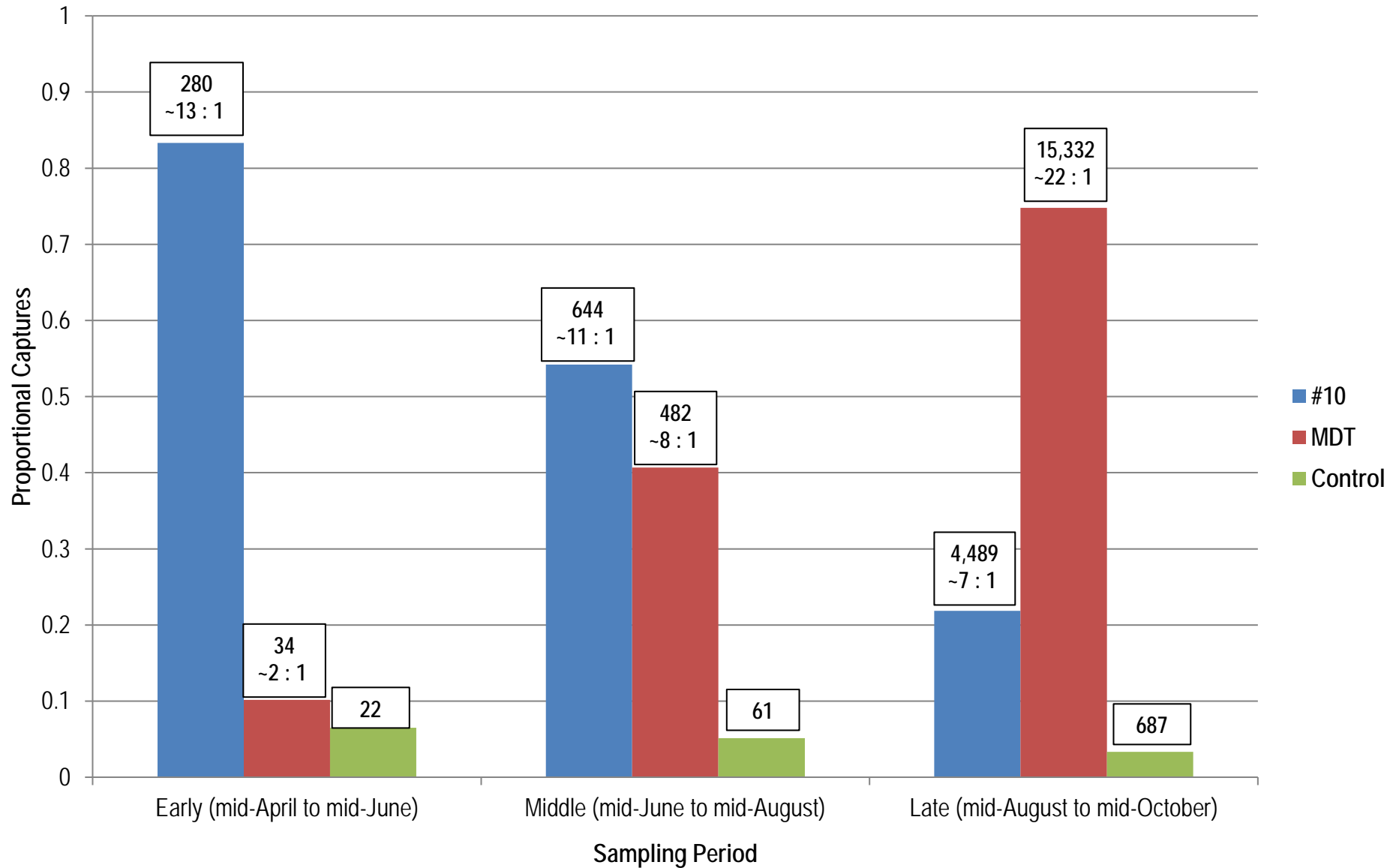


Trap Capture Ratios

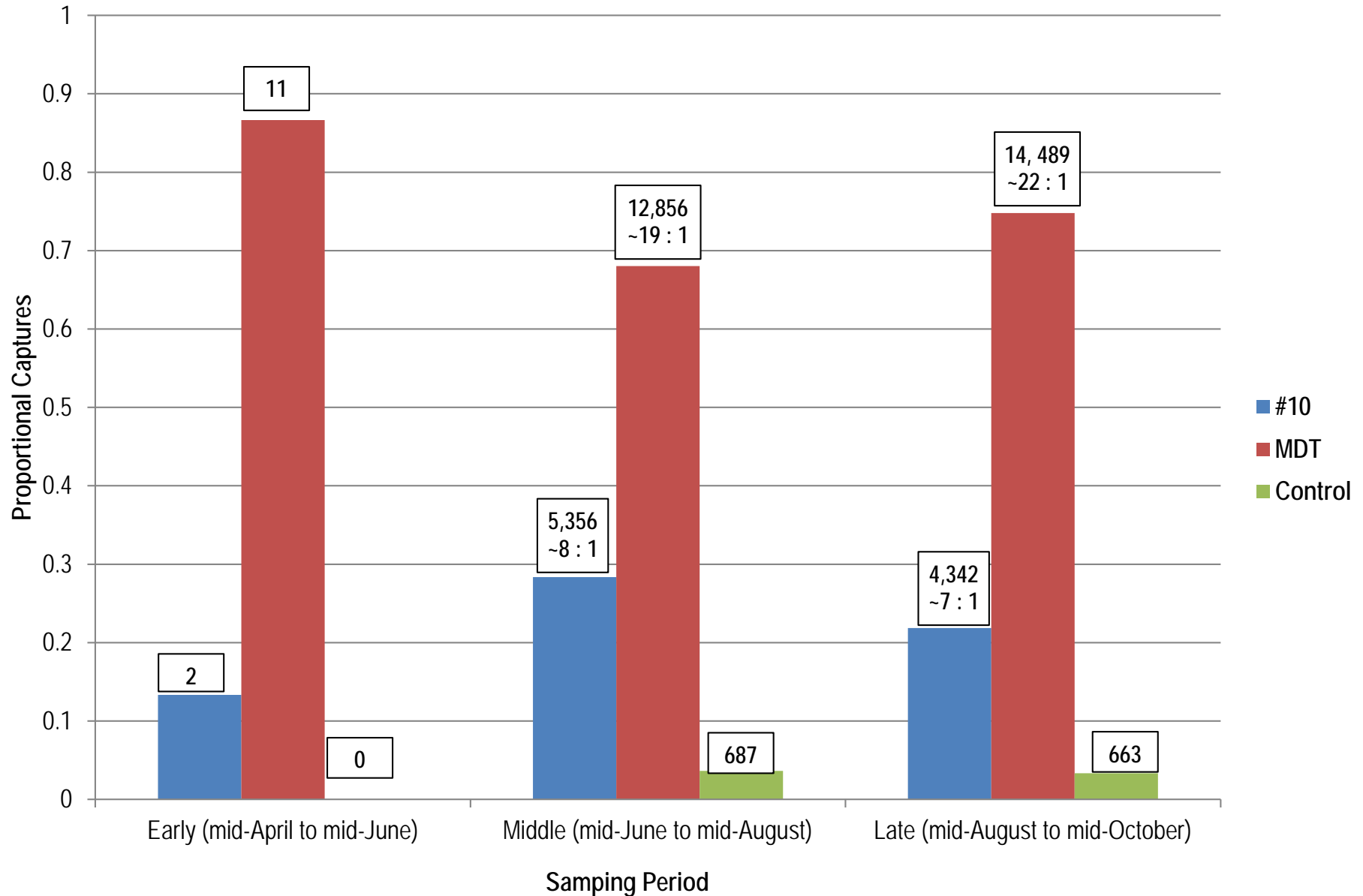
#10:Unbaited	12 : 1
MDT:Unbaited	90 : 1
MDT:#10	7 : 1

- MDT very attractive and #10 attractive in late season.
- MDT outcompetes #10 in late season at tested release rates.
- Large numbers in the field.

Seasonal Adult Captures



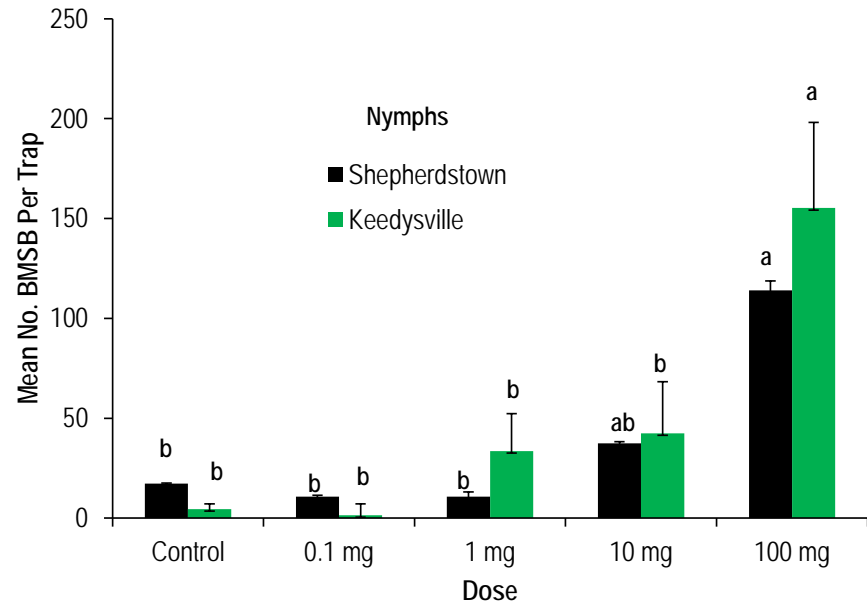
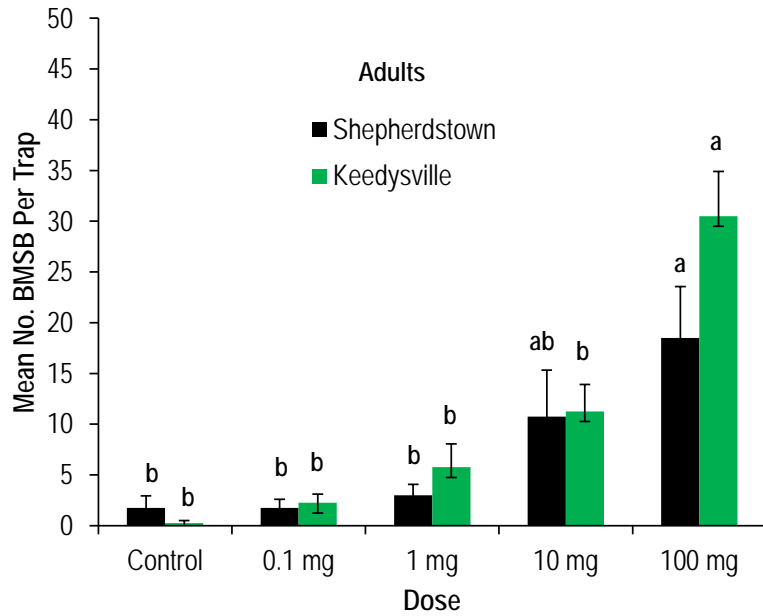
Seasonal Nymphal Captures



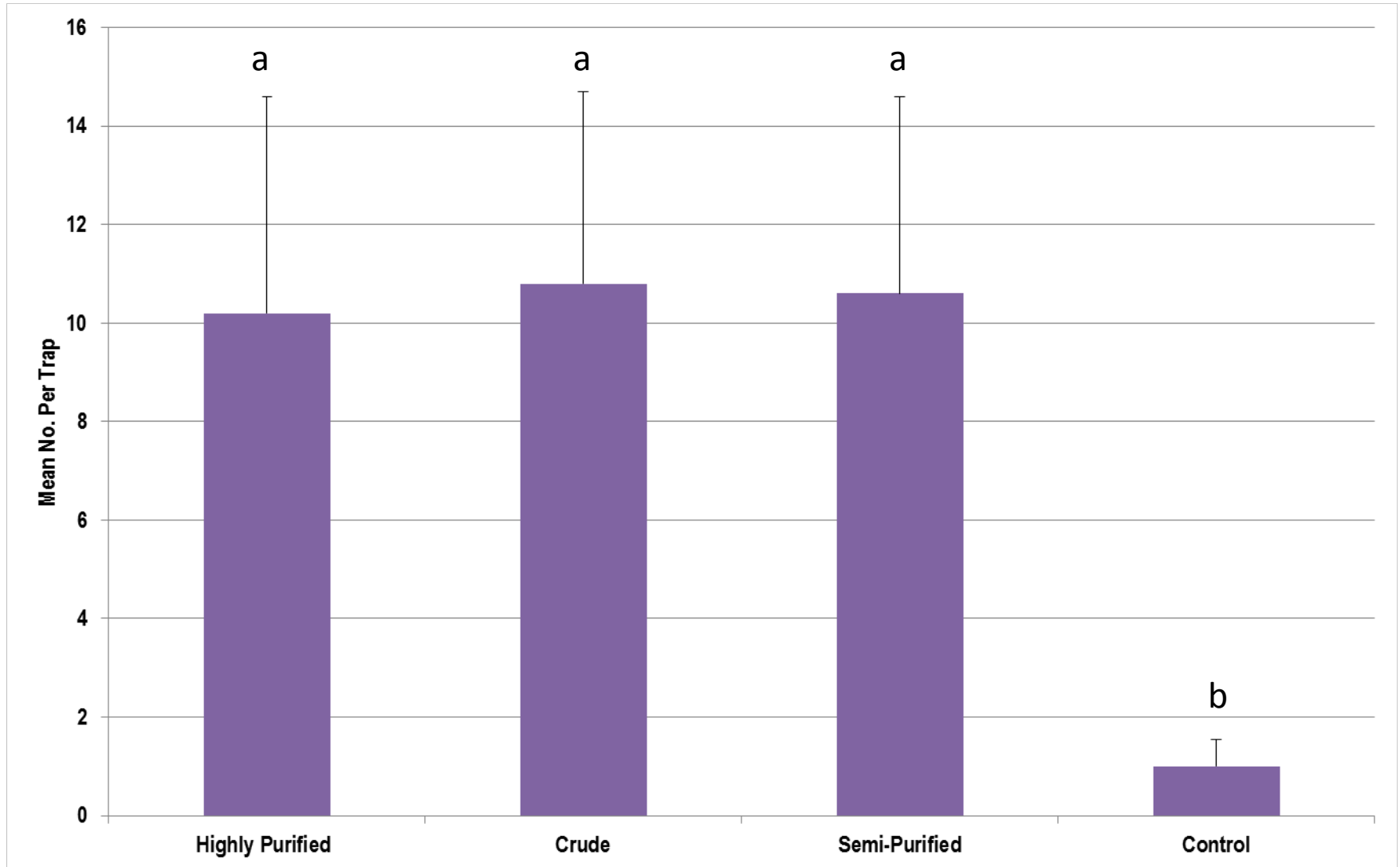
Dose Response Trial

June 14-July 19, 2012

11:1 Ratio (Baited: Unbaited) for 10 mg lure
~25:1 Ratio (Baited: Unbaited) for 100 mg lure



Lure Affordability: Encouraging Results from Purity Trial



Commercial Lure Trials

Company	Participants	Formulation #1	Formulation #2	#10	Control
ISCA	USDA, WVU, OSU, Cornell, UMD, Rutgers	15 (splat)	53 (septa)	105	26
Scentry	USDA, Rutgers	5	N/A	23	3
Alpha Scents	USDA, PSU	111 (membrane)	83 (septa)	256	33
Hercon	USDA, WVU, OSU	23	N/A	76	13
Sterling	USDA, PSU, Rutgers	76	N/A	121	43
Trece	USDA, OSU, Cornell	68	N/A	93	43

Conclusions

- Aggregation pheromone of BMSB has been identified.
- This stimulus provides reliable, season-long detection of BMSB.
- Likely will need a higher loading of material.
- Crude material can be used to formulate lures, reducing overall costs.
- MDT is very sensitive stimulus in the late-season.



Visual Cues

Identifying Optimal Wavelengths and Intensities of Light



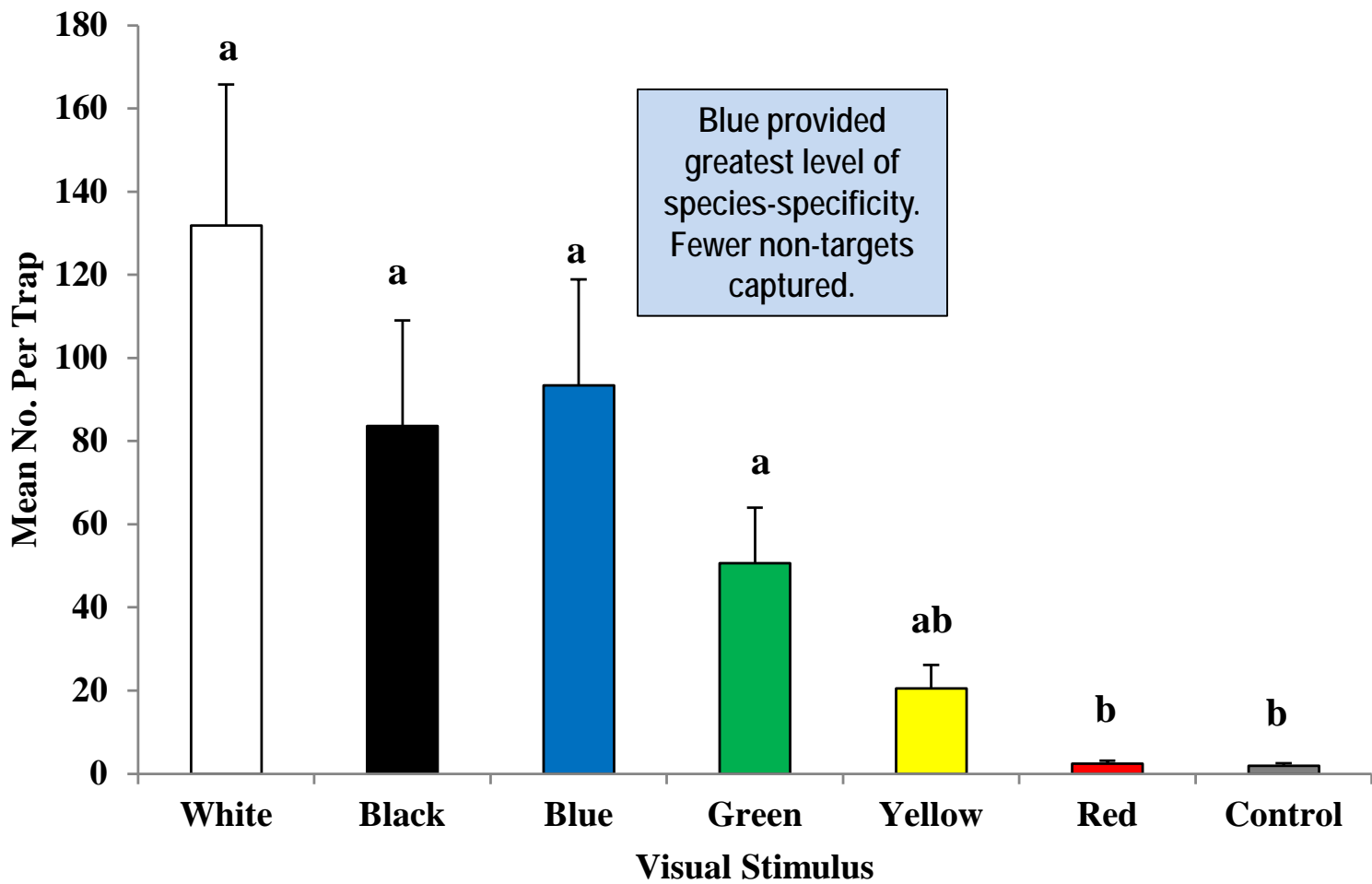
Experimental Light Traps



Night View



A Total of 21 Traps Baited With Light-Based Stimuli Captured 13,457 Adult BMSB in ~6 Weeks During Late Summer

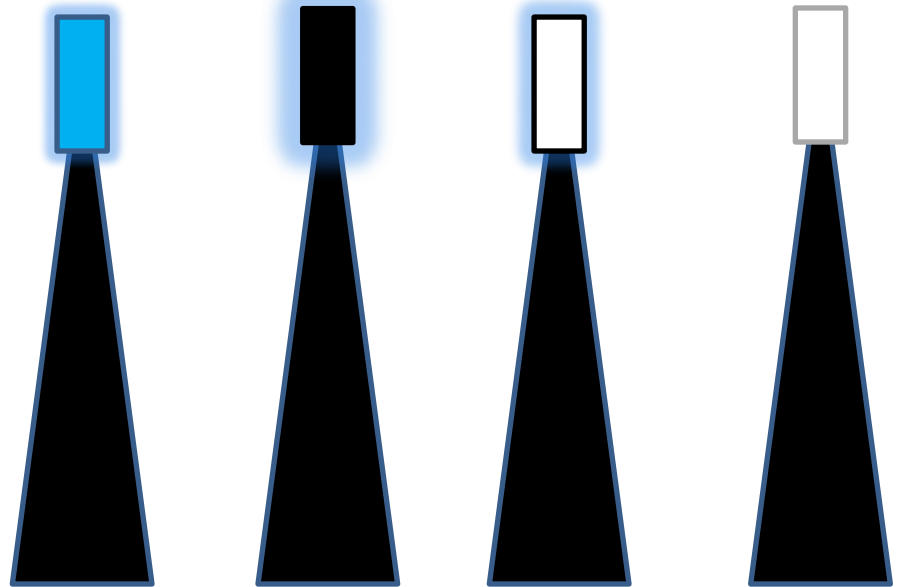


Traps Provisioned With Blue 25W Compact Fluorescent Bulbs Attractive and Species-Specific



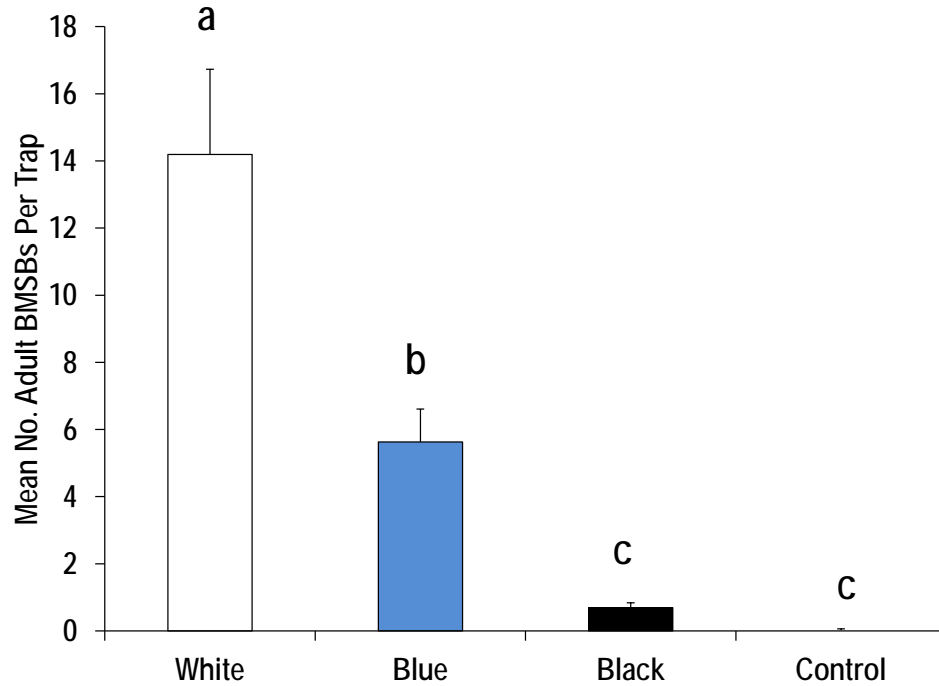
Season-Long Trial 2012

- Do we capture BMSB reliably with the most attractive stimuli?
- Species-specificity of most attractive visual stimuli?

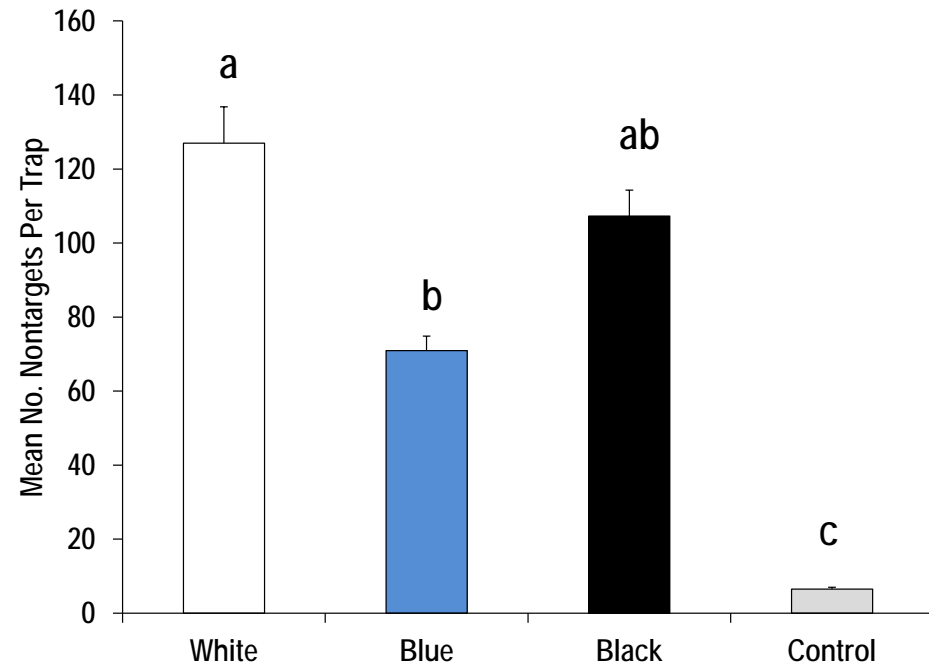


Mean Weekly Captures

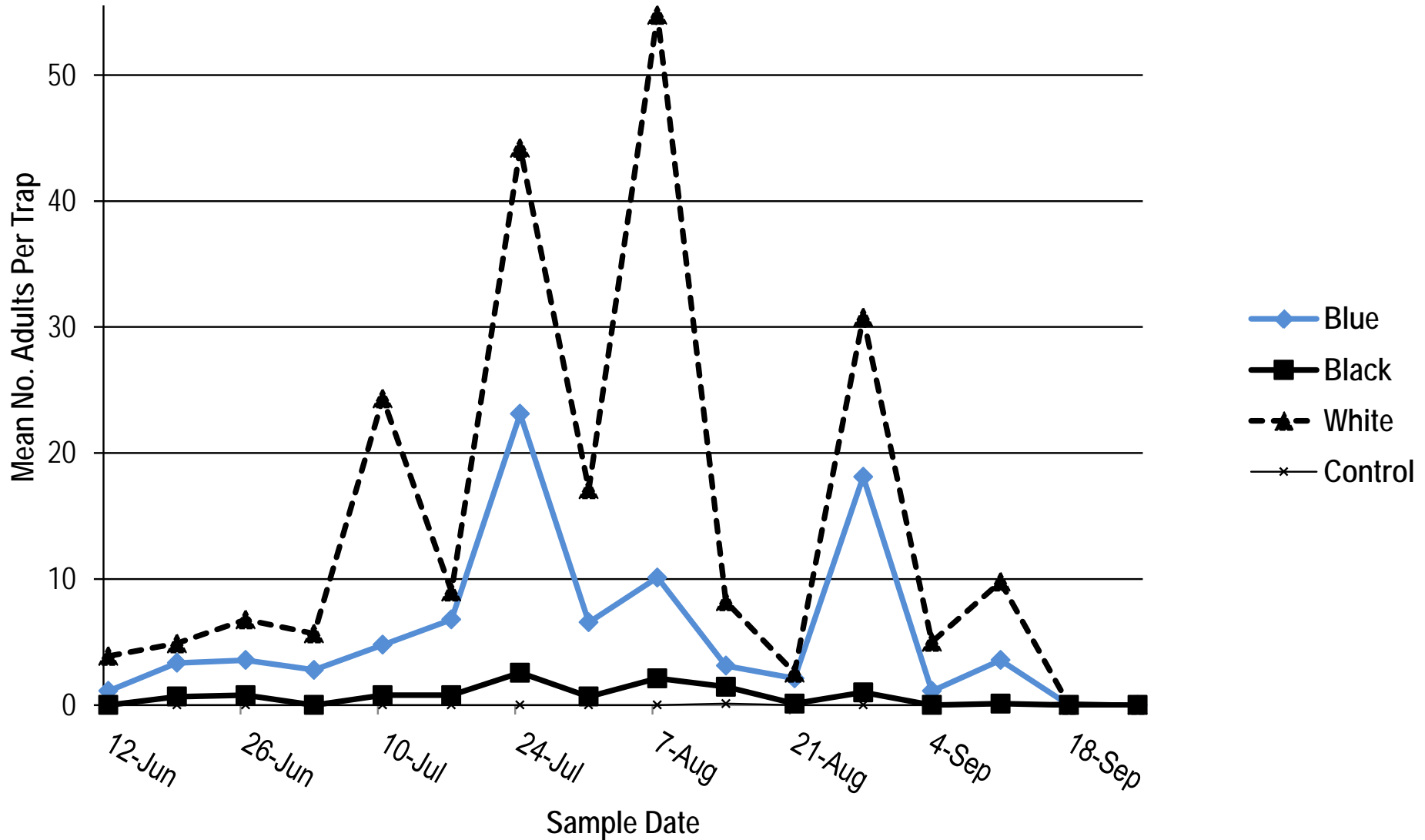
BMSB Captures



Nontarget Captures



Season-Long Captures of BMSB



Conclusions

- Traps provisioned with a white light source captured significantly more BMSBs and significantly more non-targets.
- Traps provisioned with blue light sources captured fewer BMSBs, but also fewer nontargets.
- Although captures of BMSB were lower in traps provisioned with black light sources, patterns of capture are significantly correlated among all light-based stimuli.
- Capture patterns essentially identical among white, blue and black light sources.

Next Steps

- Establish physiological and behavioral state of responders to different stimuli.
- Combining attractive visual and olfactory stimuli.
 - Improve monitoring tools.
 - Develop attract and kill strategies.



Acknowledgements

To learn more about this project and find links to BMSB information, visit



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