2.1 Developing Effective Monitoring Tools For Brown Marmorated Stink Bug

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StopBMSB.org

- 2.1.1. Trap-Based Monitoring
  - 2.1.1.1. Identification of pheromone and other olfactory attractants.
  - 2.1.1.2. Optimization of pheromone and kairomone dispensers for monitoring BMSB.
  - 2.1.1.3. Identification of attractive visual stimuli including color and light.
  - 2.1.1.4. Define behavioral characteristics of BMSB and active space of baited traps to develop efficient traps and deployment strategies.

- 2.1.2. Assess other types of monitoring tools

- 2.1.1. Trap-Based Monitoring
  - 2.1.1.1. Identification of pheromone and other olfactory attractants.
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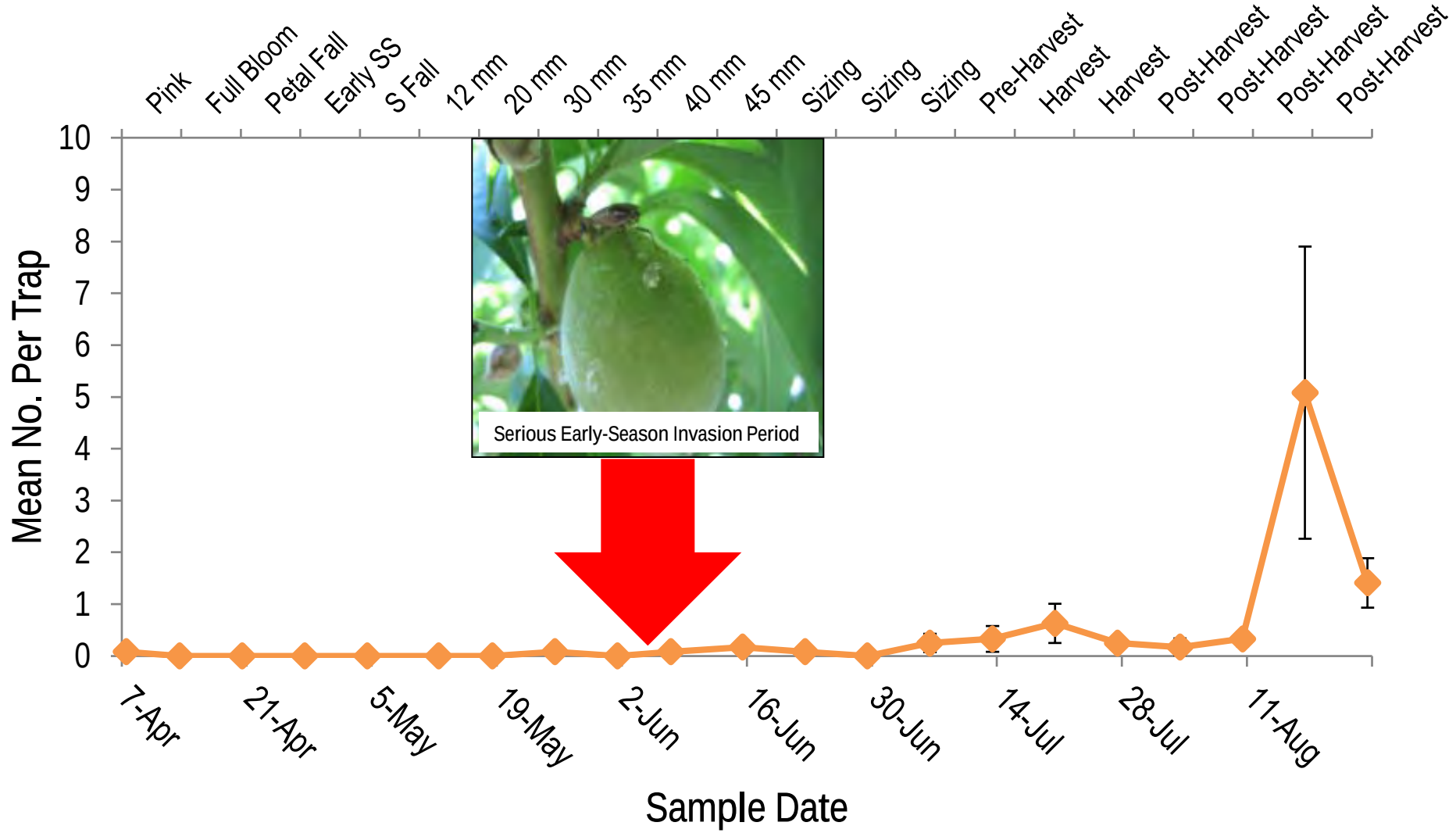
2.1.1.1. Identification of pheromone and other olfactory attractants

Pheromone of *Plautia stali*

- Methyl (*2E, 4E, 6Z*)-decatrieonate.

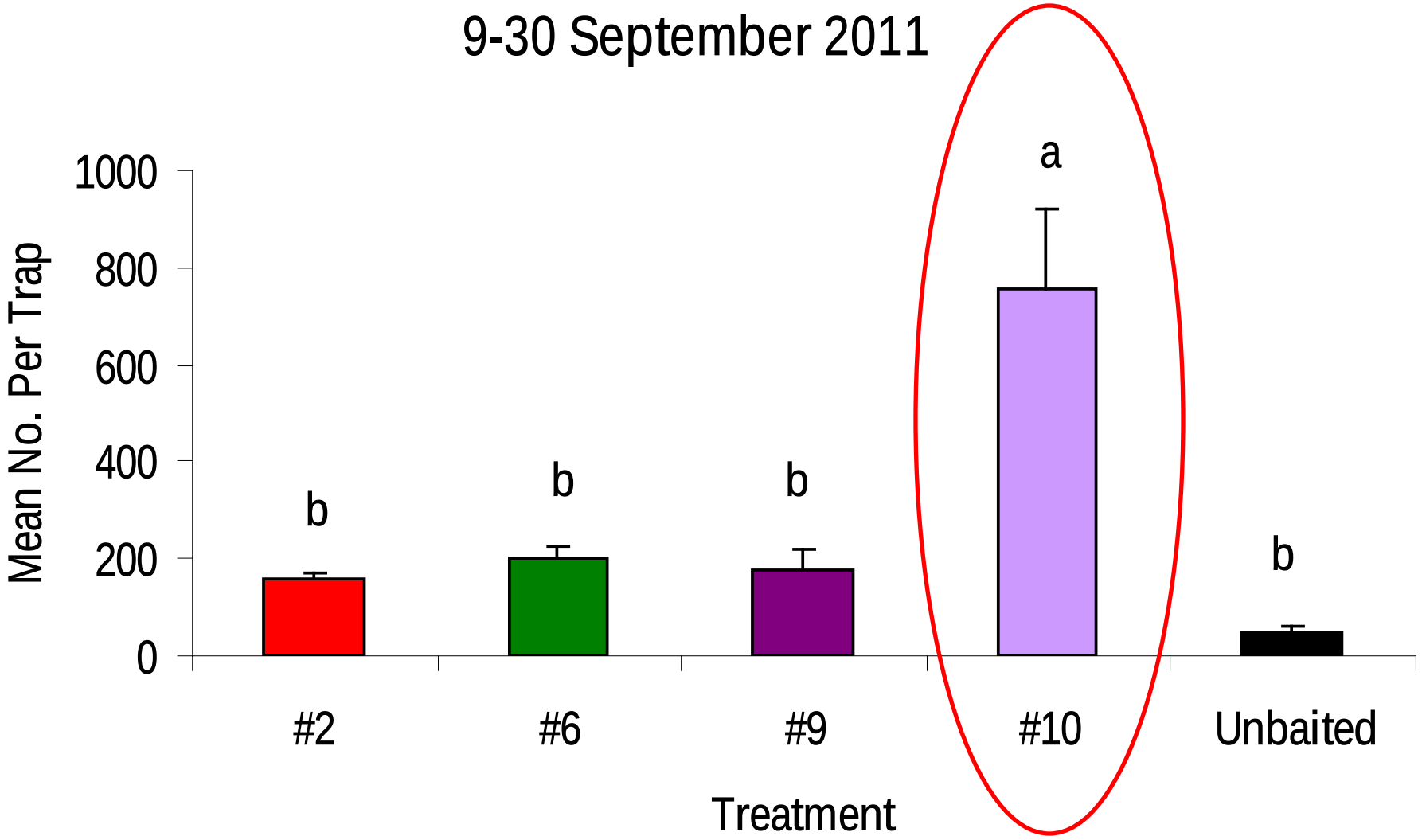
- Cross attractive to brown marmorated stink bug and other pentatomids.

Methyl (*2E,4E,6Z*)-decatrieonate (MDT) Attractive to Adults Only During the Late-Season



Identification of BMSB Pheromone

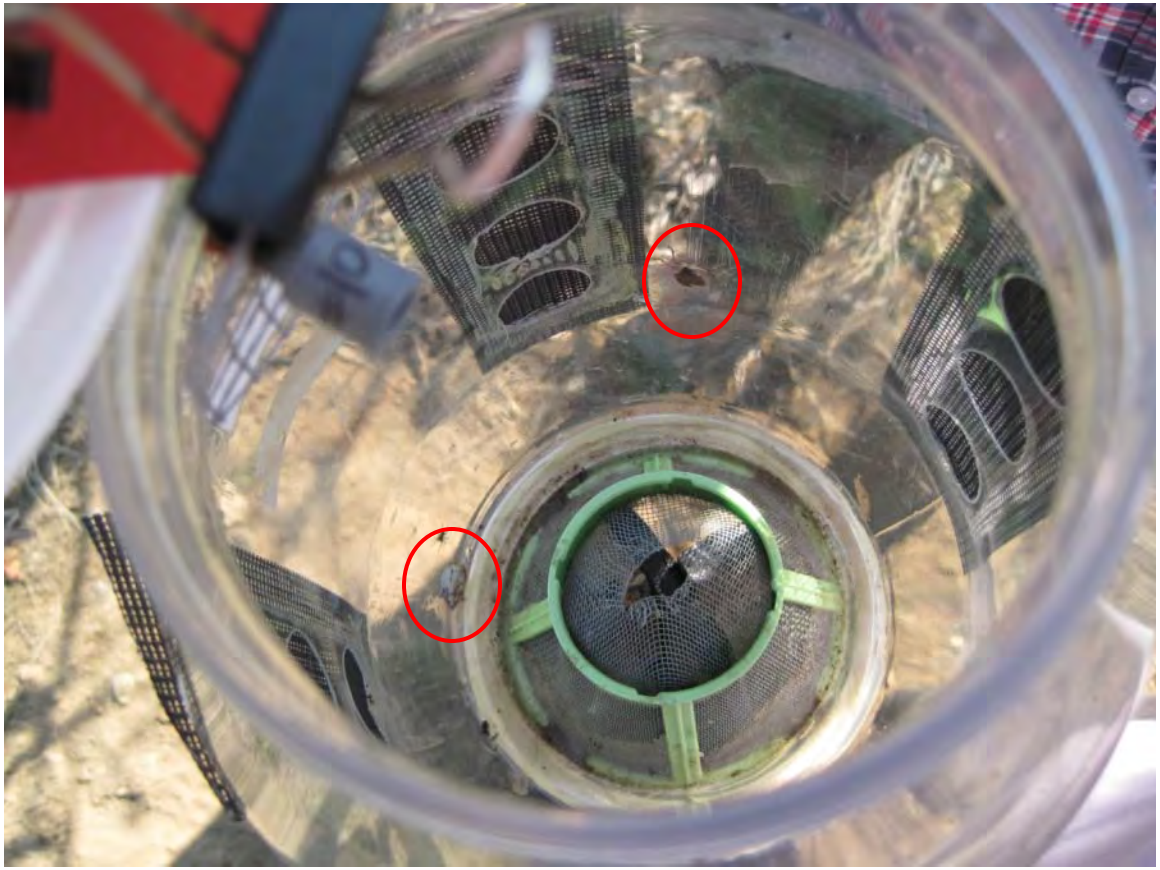
Identification of the BMSB Aggregation Pheromone



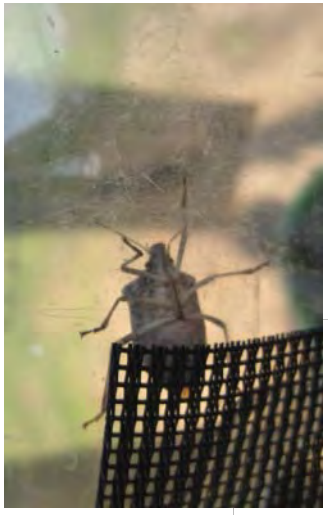
Traps baited with #10 captured ~15x more than control and ~3-4x more than other treatments.

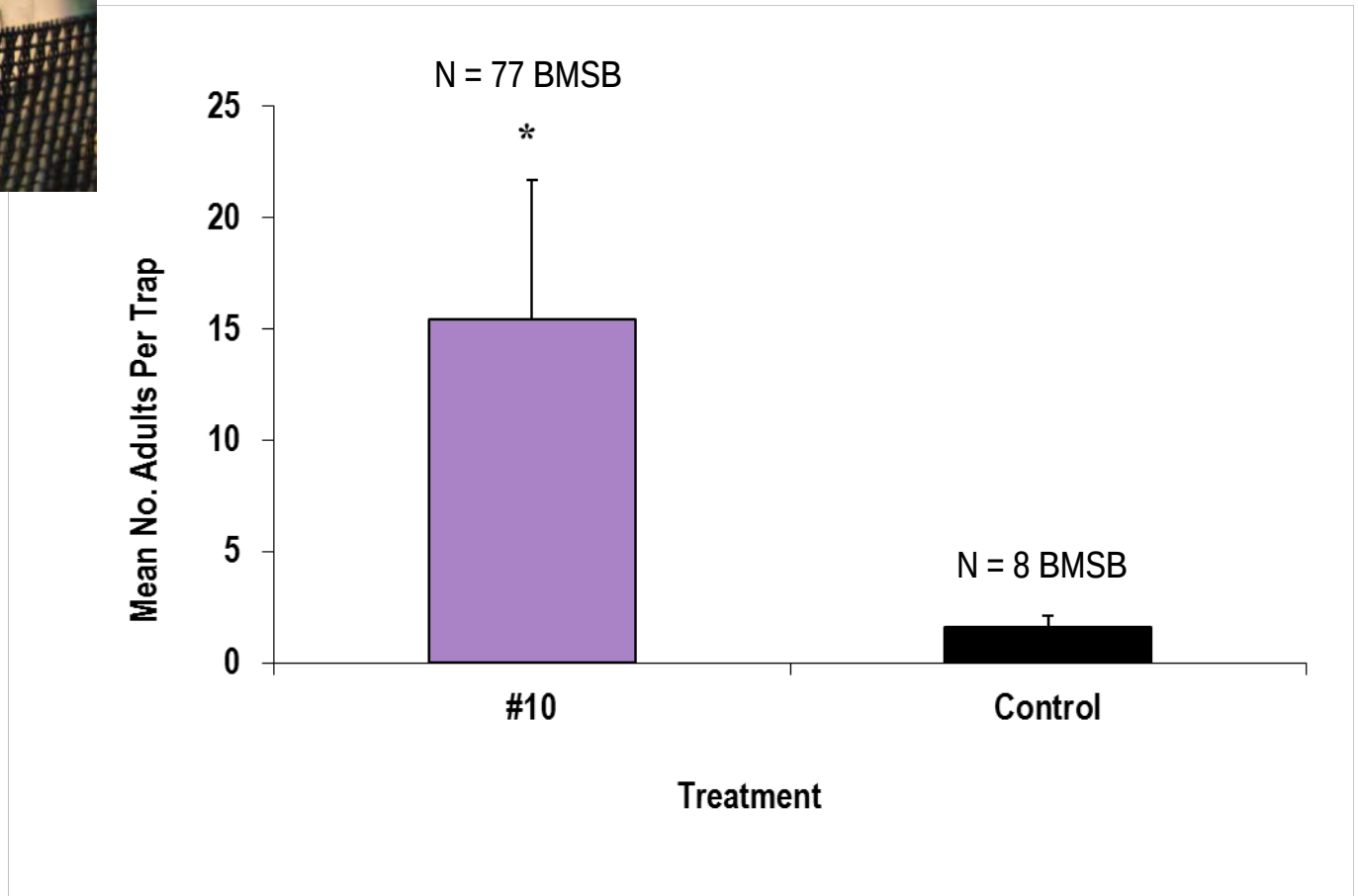
Is #10 Attractive in the Early Season?

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



Early Season Attraction Documented for BMSB March 20-April 17, 2012





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, OH, and MI

General Protocol

- Black pyramid traps
- Three odor treatments
  - 1) #10 (10 mg)
  - 2) MDT (119 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.

Total of 350 Traps
Deployed Across
12 States

<u>Leveraged and In-Kind Support</u>

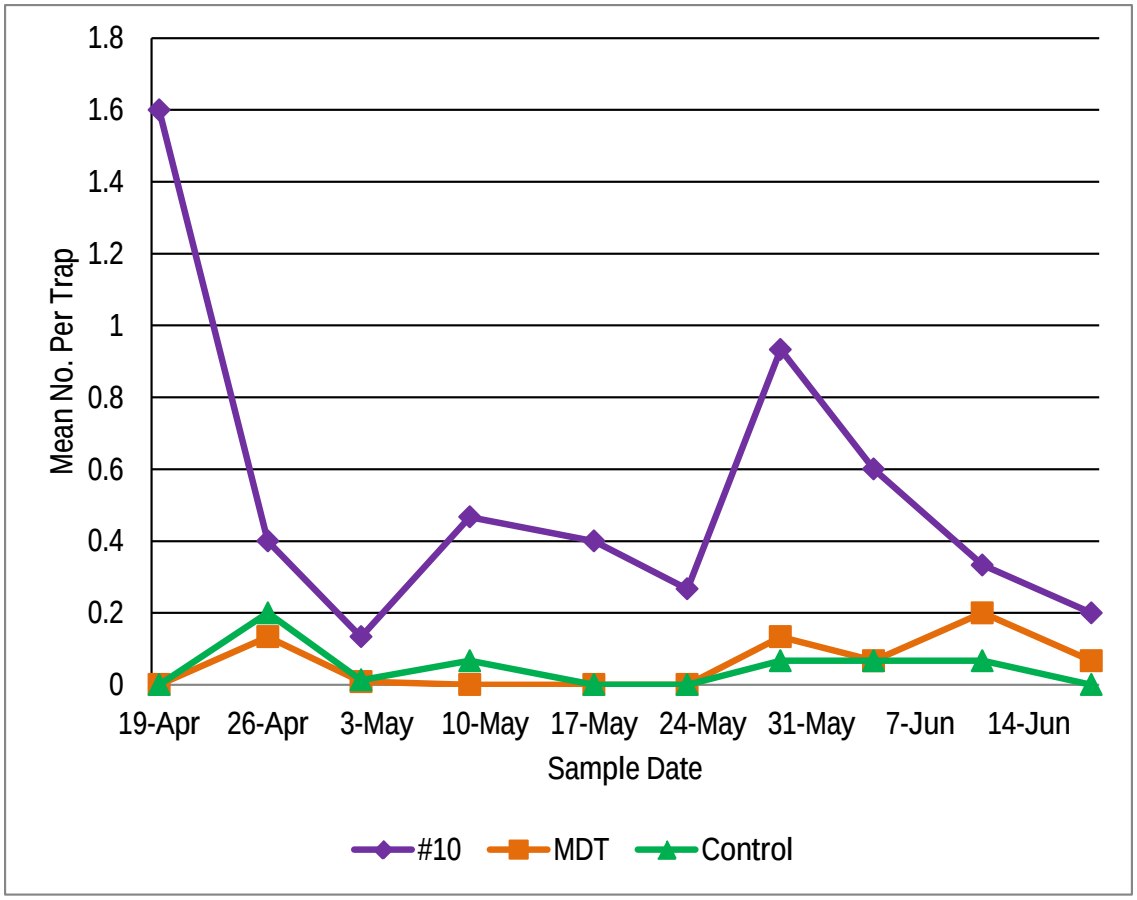
USDA-ARS

USDA-APHIS

AgBio

Sterling/Rescue

Early Season Summary
Mid-April to Mid-June 2012

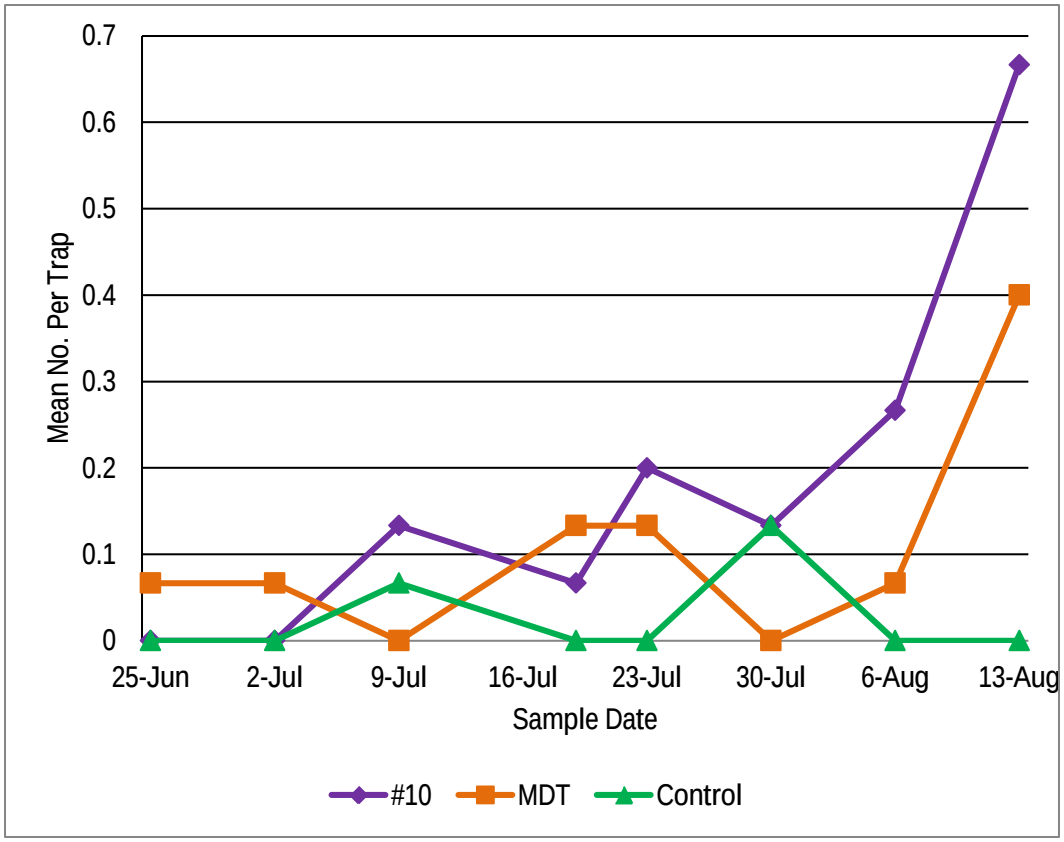


Trap Capture Ratios

#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

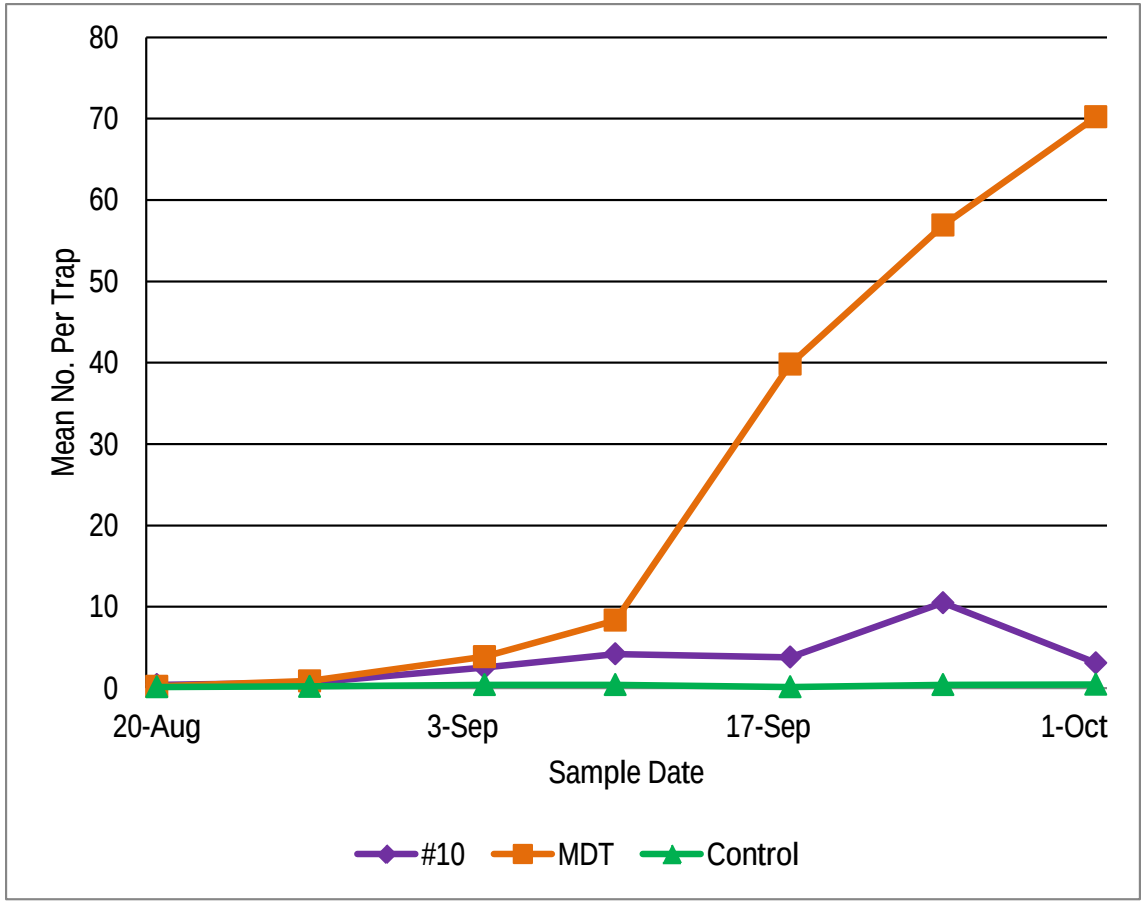


Trap Capture Ratios

#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

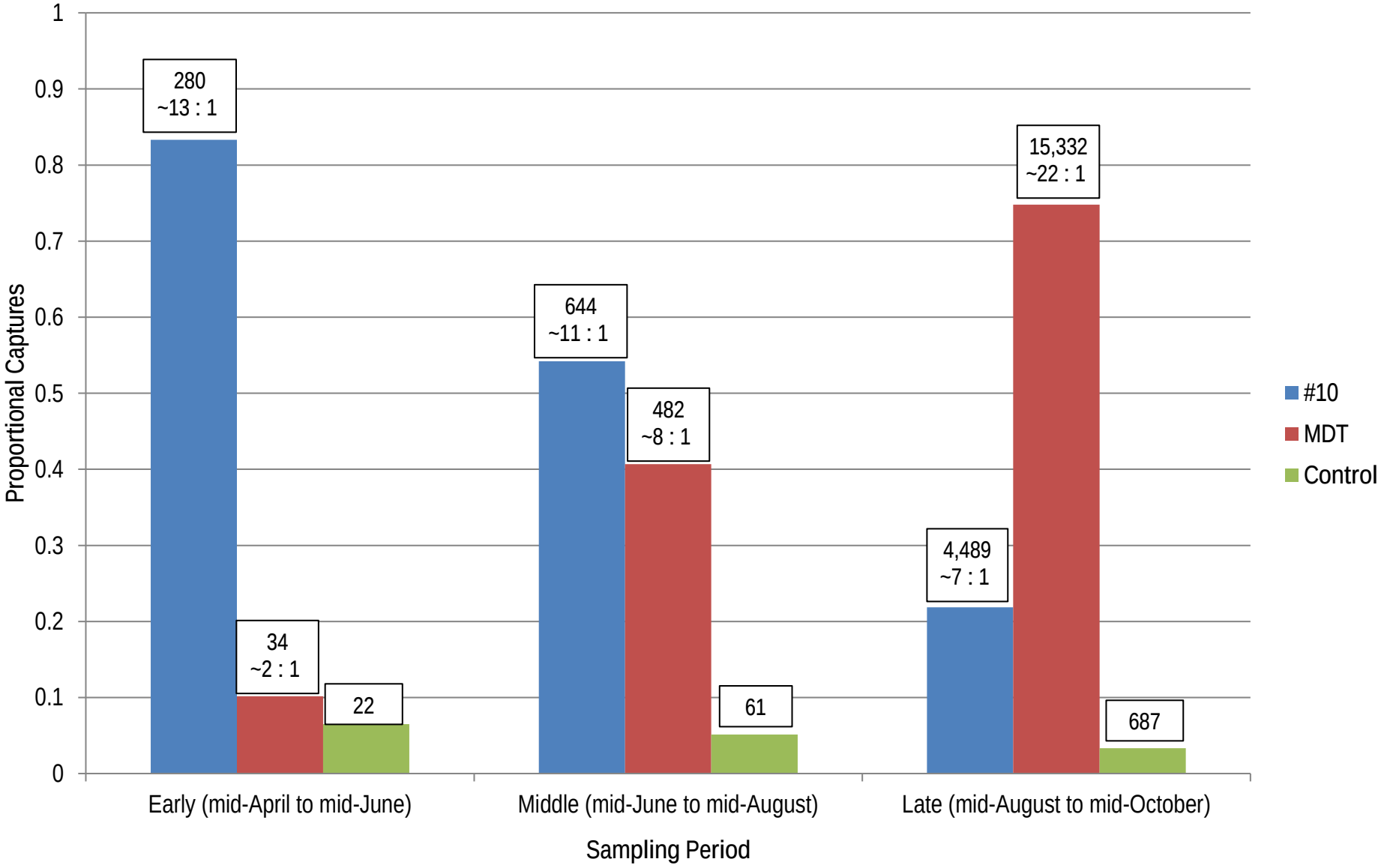


Trap Capture Ratios

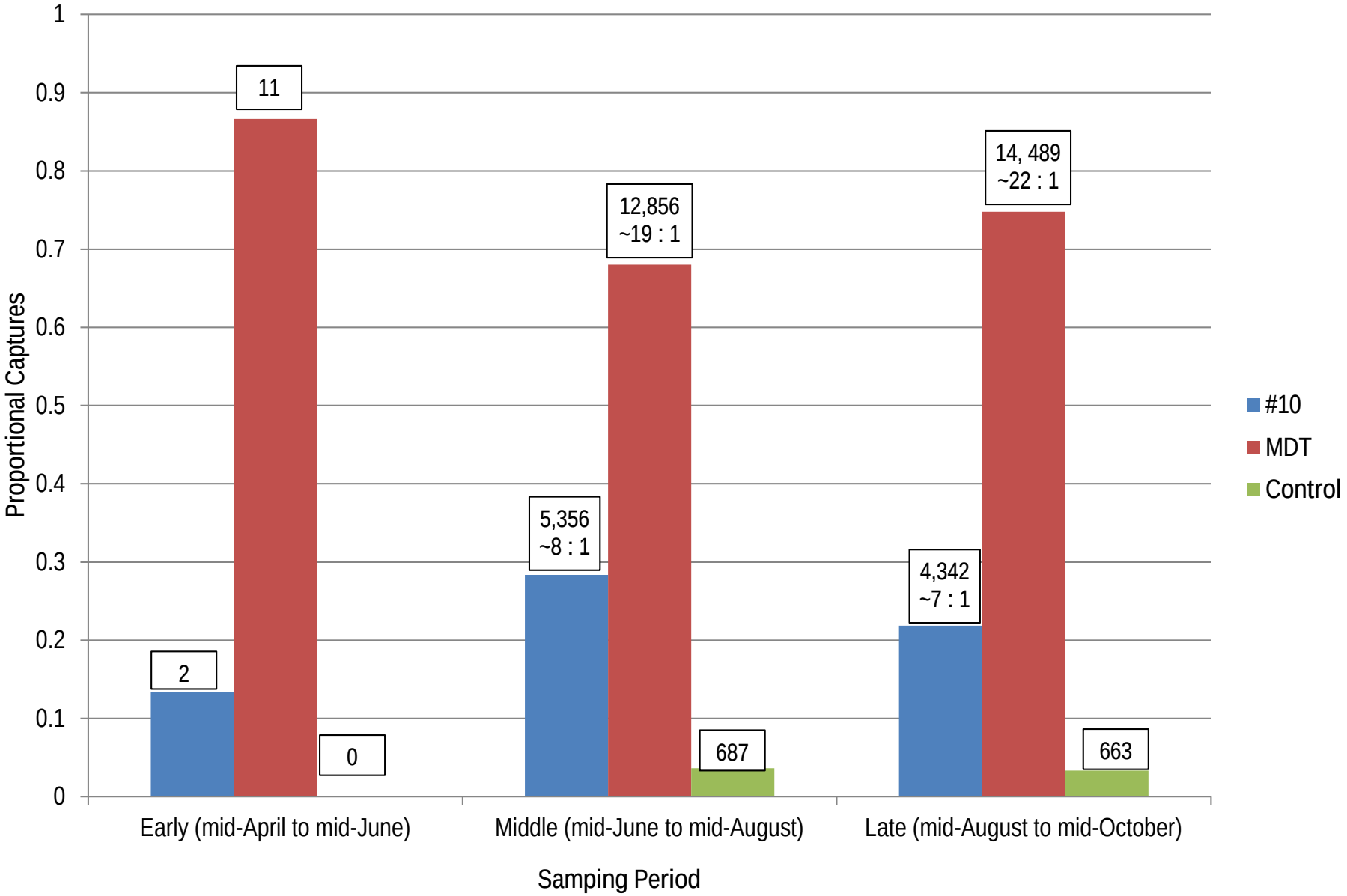
#10:Unbaited	12 : 1
MDT:Unbaited	90 : 1
MDT:#10	7 : 1

- 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



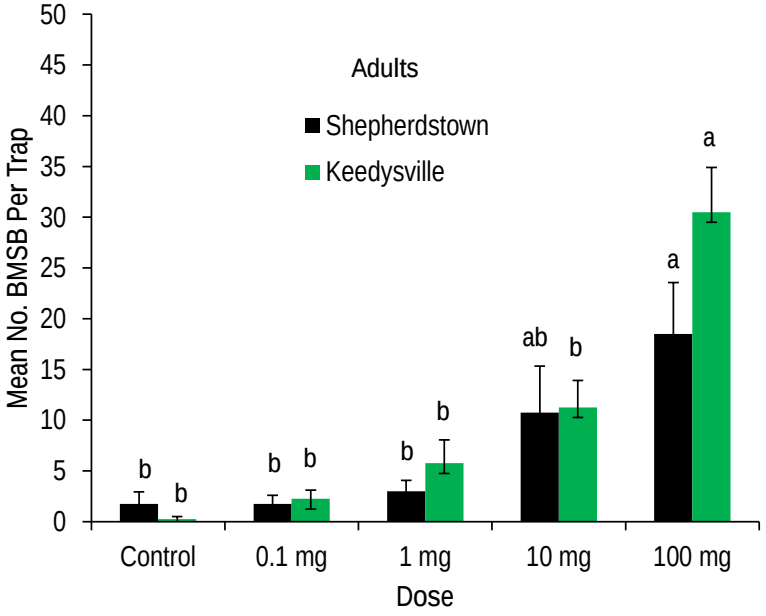
Seasonal Nymphal Captures

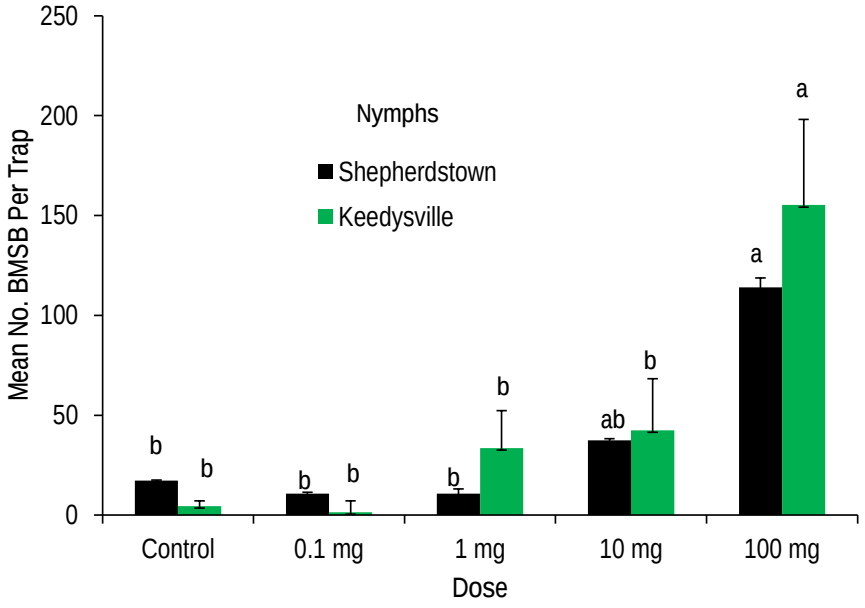


Dose Response Trial

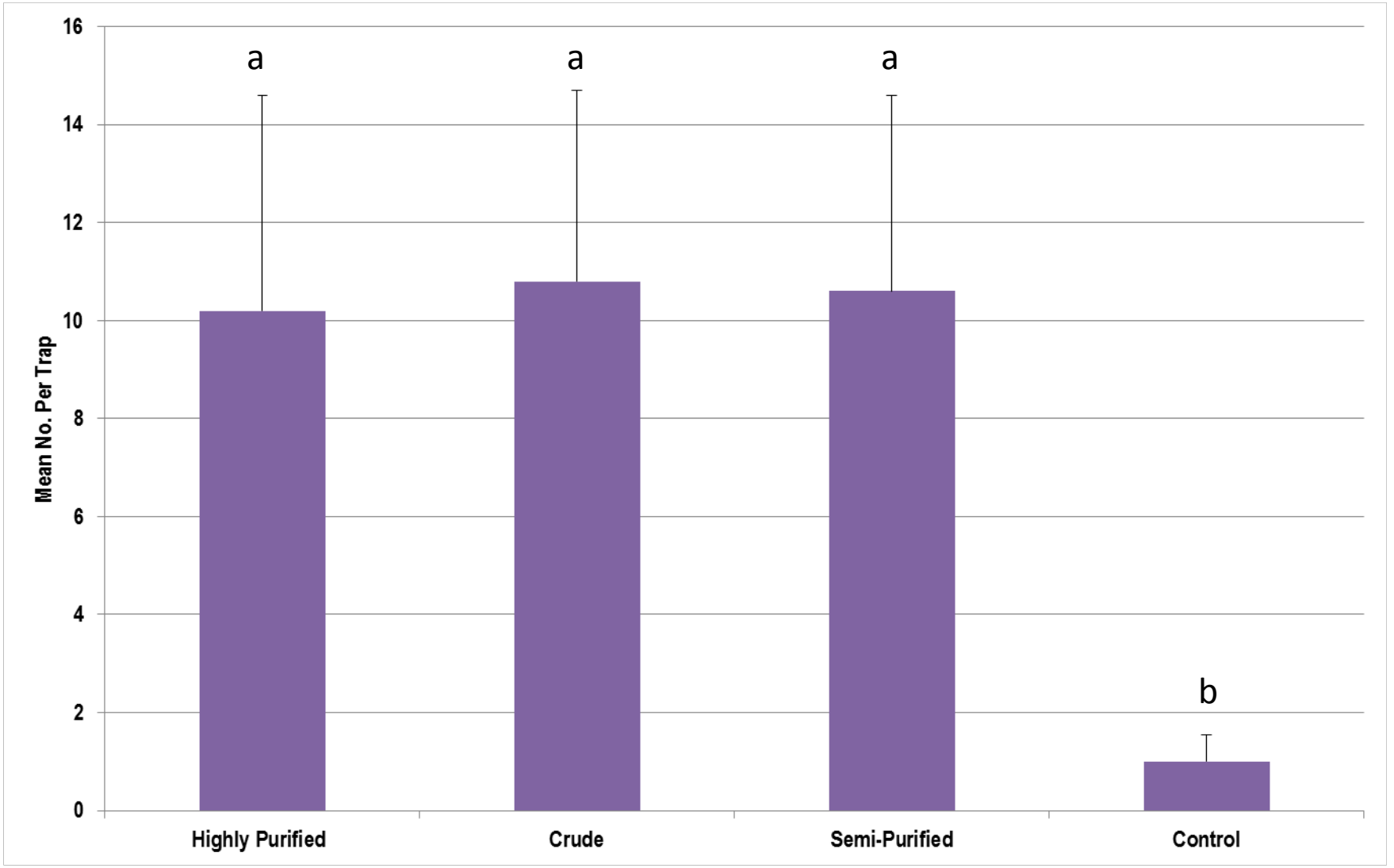
June 14-July 19, 2012

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

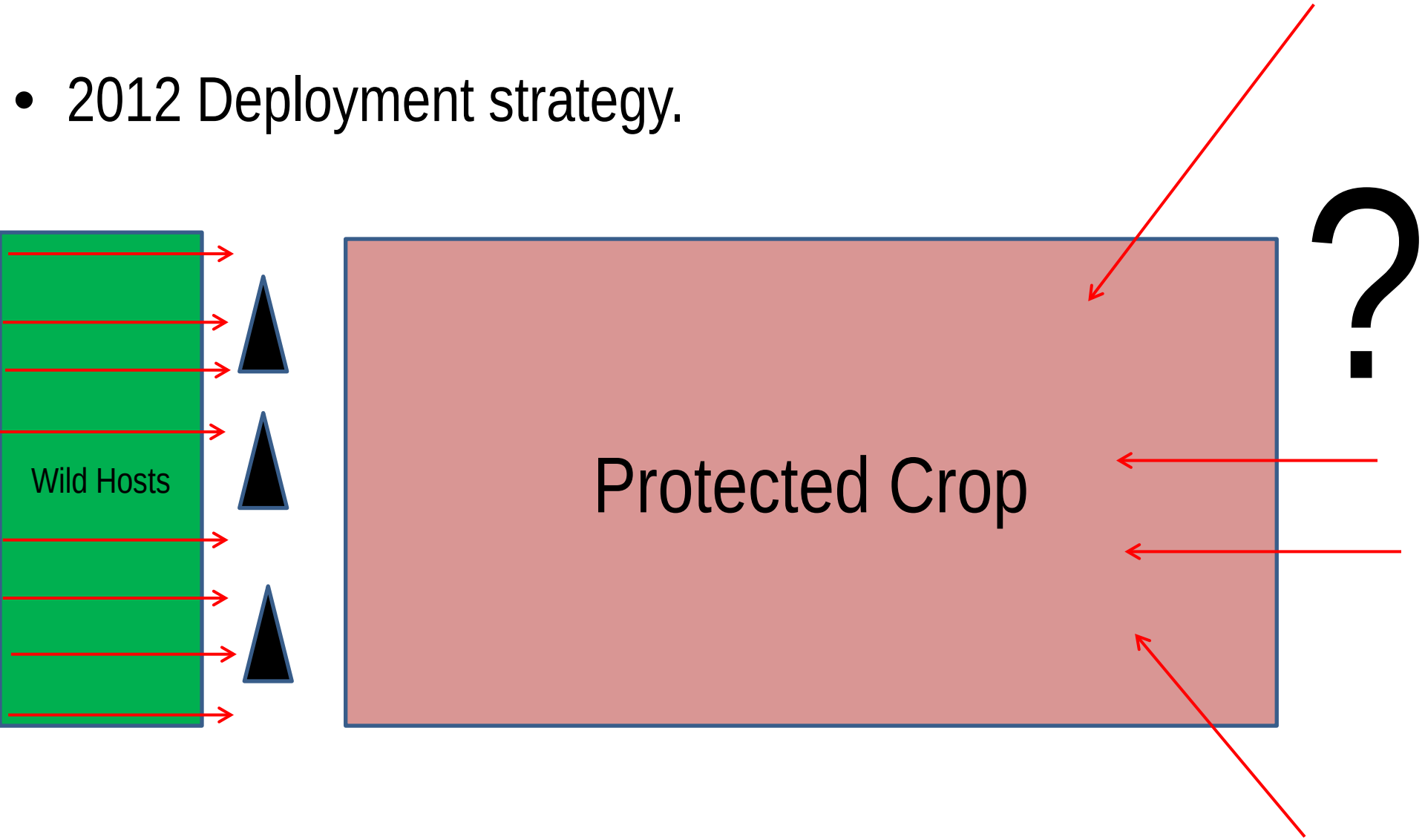


Conclusions

- Aggregation pheromone of BMSB and a synergist have been identified.
- These stimuli provides reliable, season-long detection of BMSB.
- Likely will need a higher loading of #10 if used alone. Synergist significantly increases attractiveness and sensitivity.
- Crude material can be used to formulate lures, reducing overall costs.
- MDT is very sensitive stimulus for adults in the late-season.

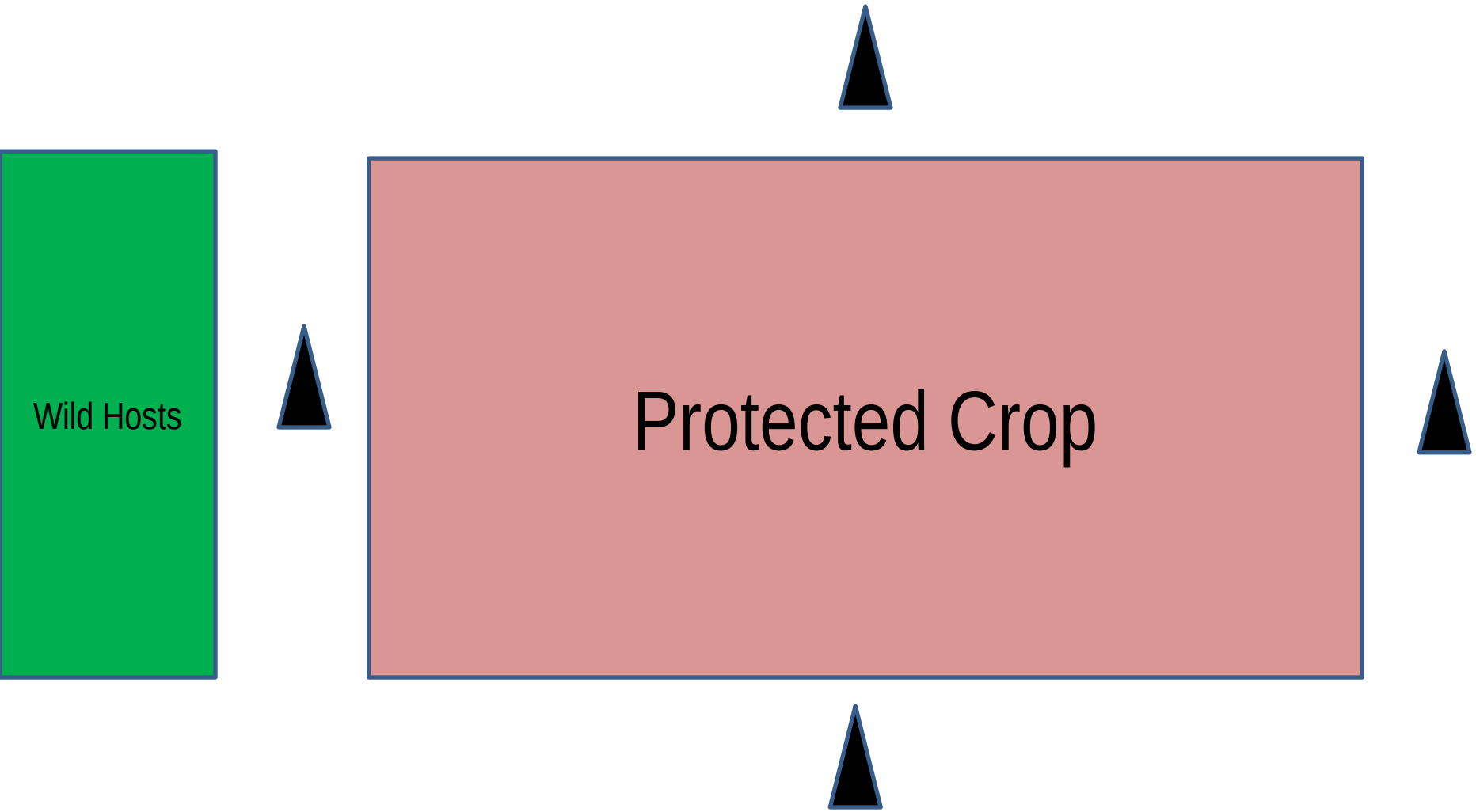
Pitfalls Encountered

- 2012 Deployment strategy.



Follow-Up Studies

- Amended deployment strategy + stimuli with increased sensitivity.



2.1.1.2. Optimization of pheromone and kairomone dispensers for monitoring BMSB

- Commercial companies developing new formulations of MDT.

- Commercial companies provided a small amount of #10 to formulate into different release devices.

- Pending release-rate studies (Brunner and others).

Commercial Lure Summaries

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

2.1.1.3. Identification of attractive visual stimuli including color and light

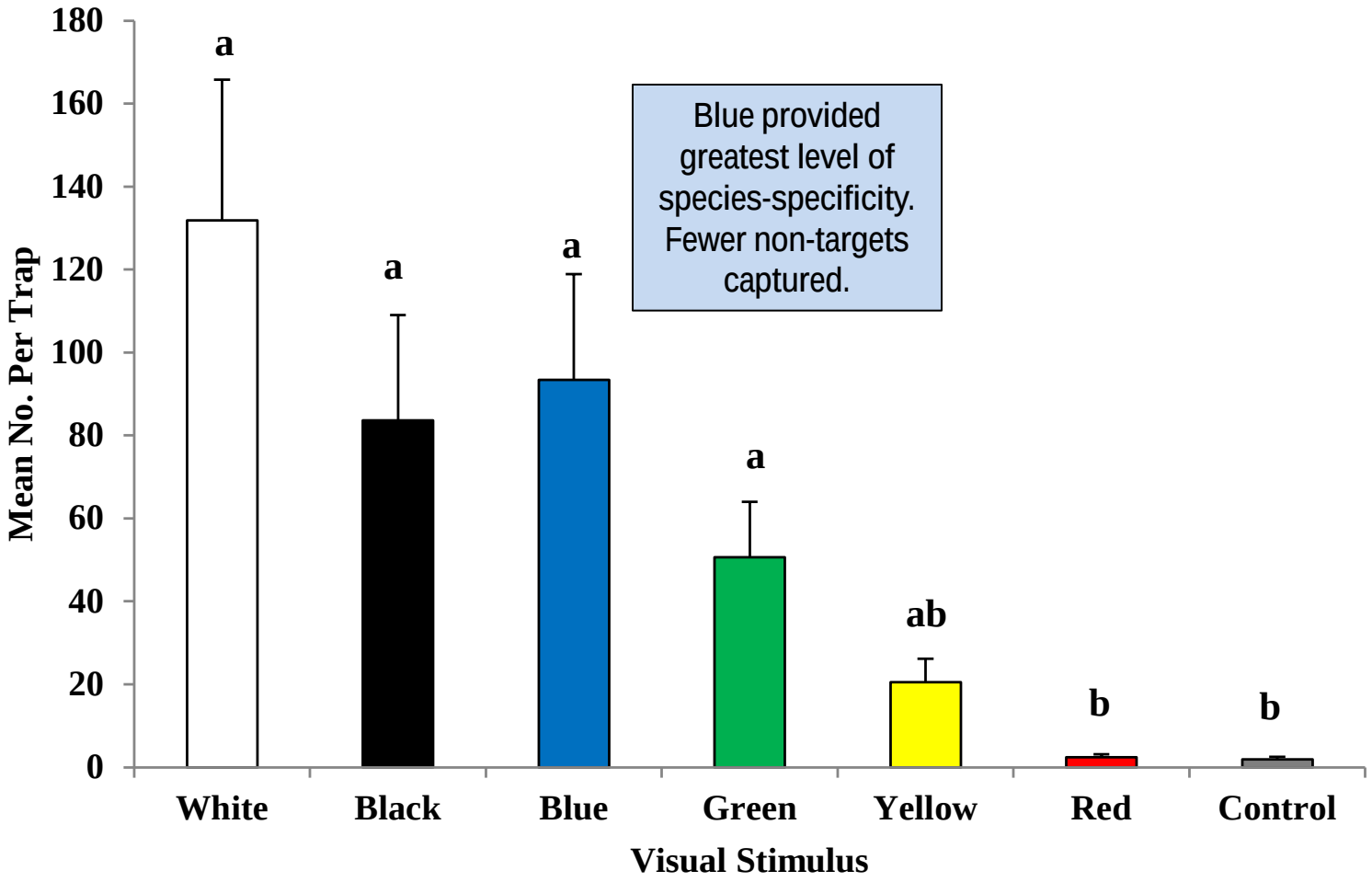
2011 Field Trial

- Are wavelength-restricted light sources more stimulating/attractive to BMSB under competitive field conditions?
- Can we augment ordinary pyramid traps with light sources and capture BMSBs reliably?
- Stimuli included white, black, blue, green, yellow, and red compact fluorescent bulbs and control.

Field Trial Set-Up

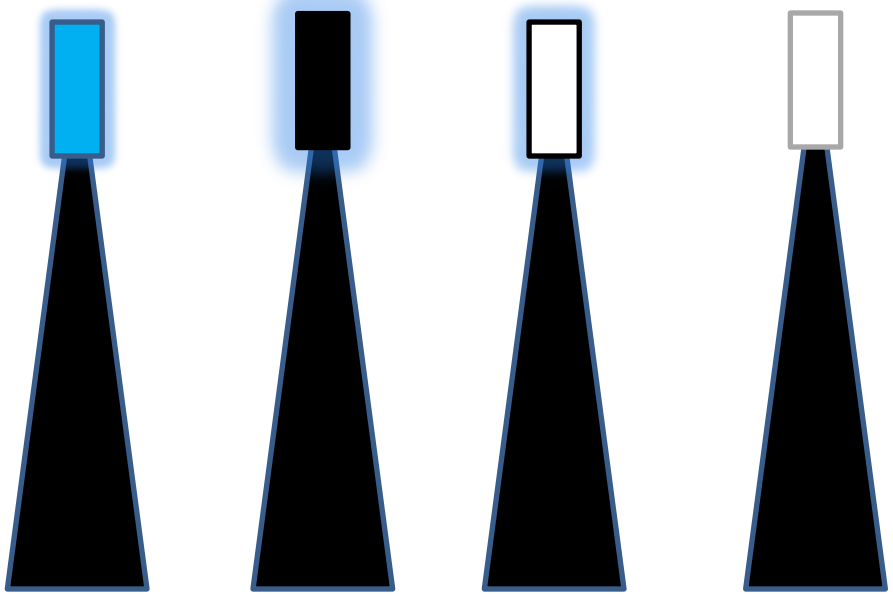
Night View

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

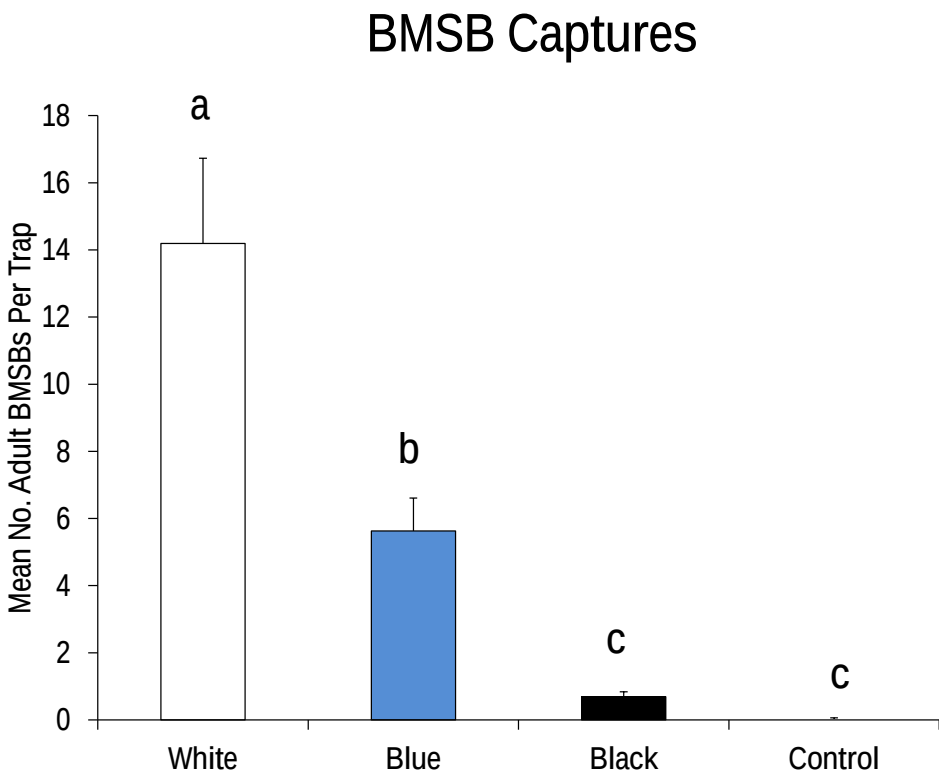


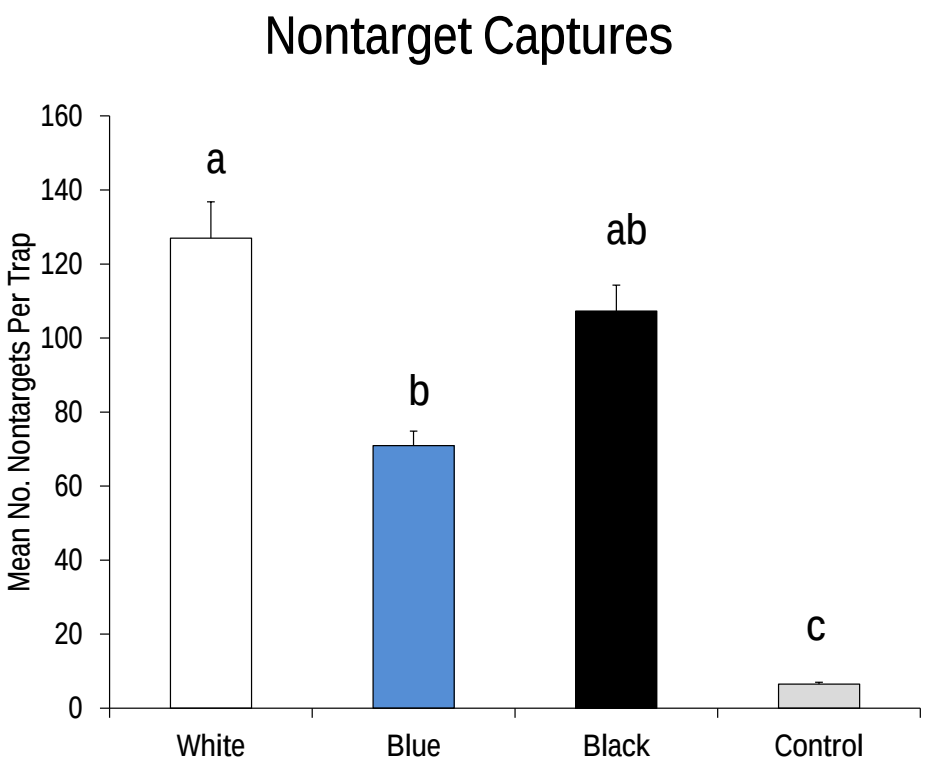
Season-Long Trial 2012

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

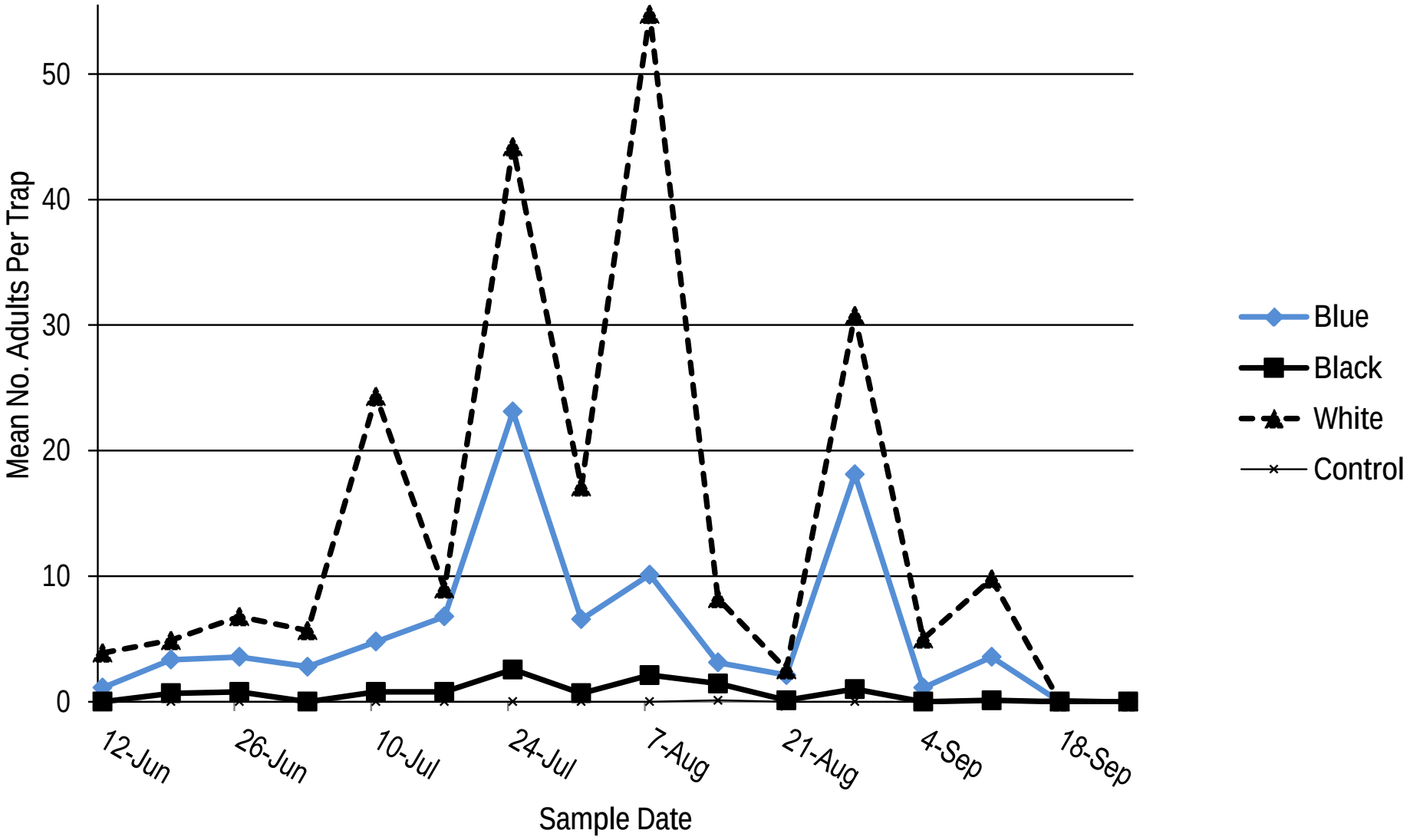


Mean Weekly Captures





Season-Long Captures of BMSB



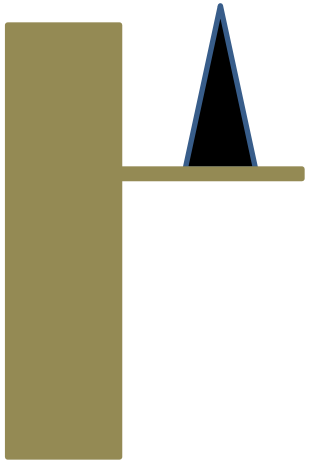
Conclusions

- 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.

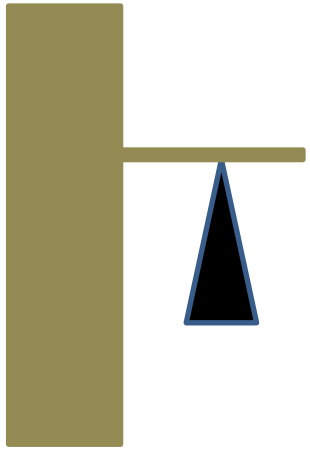
Proposed Trap Type Studies

Ground-Mounted Standard Pyramid Trap

Ground-Mounted Small Pyramid Trap



Limb-Mounted Small Pyramid Trap



Hanging Small Pyramid Trap

Field Validation of Solar Traps

Expected Outcomes

- We will identify, optimize, and integrate attractive olfactory and visual stimuli, capture mechanisms, and deployment strategies in order to develop an effective monitoring trap for BMSB