

Development of Trap-Based Monitoring: A Critically Needed Tool for the Grower Community

Tracy C. Leskey, Starker E. Wright, Brent Short,
Cameron Scorza, Torri Hancock, John Cullum,
Rebecca Posa and Bryan Butler

USDA-ARS
Appalachian Fruit Research Station
Kearneysville, WV 25430 USA



What We Know

- Growers require a tool that will allow them to detect presence, abundance, and seasonal activity of BMSB in various cropping systems.
- Provide information for making management decisions.
- Reliable detection for nationwide survey/monitoring efforts.

Development of a Behaviorally Based Monitoring Tool for BMSB

- Visual Cues
- Olfactory Cues
- Capture Mechanism
- Deployment Strategy



Visual Cues

Black

Green

Yellow

White

Clear



Trunk
Mimic

Foliar
Stimulus

Foliar
Stimulus

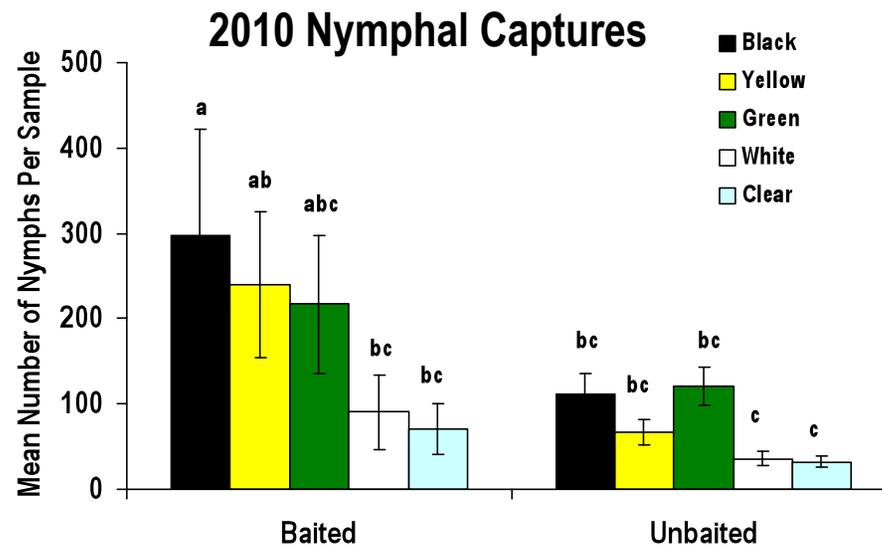
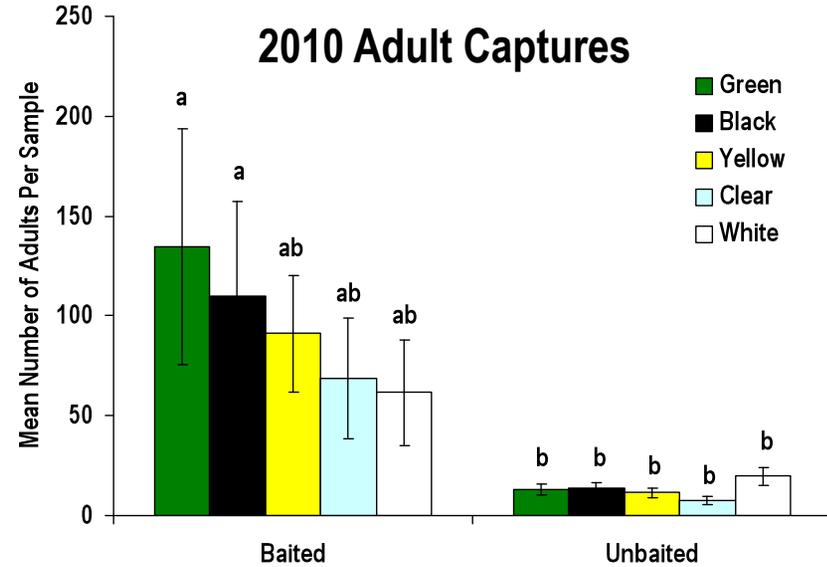
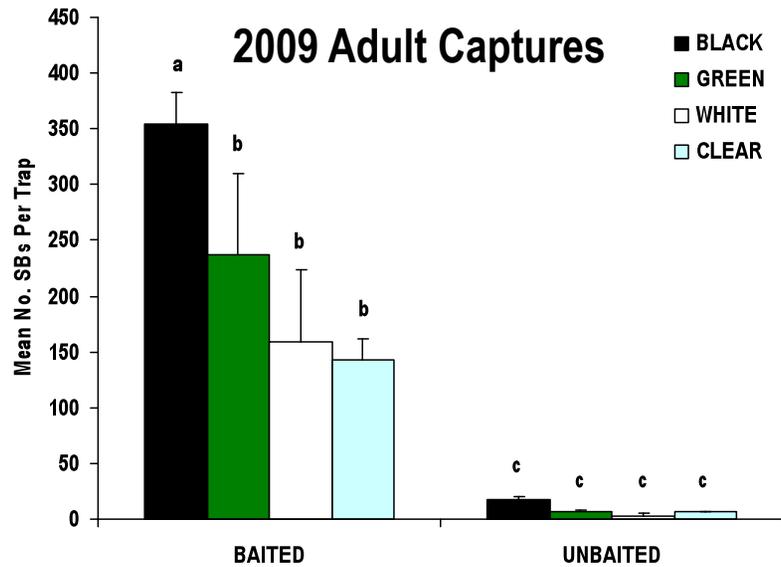
Unapparent
Stimulus

Unapparent
Stimulus

- Responses to visual stimuli associated with trap bases.
- Baited with methyl (2E, 4E, 6Z)-decatrienoate or left unbaited.
- Traps deployed at the periphery of orchards blocks
- Captures from October 7-November 17, 2009 and July 23-October 14, 2010.



Greatest Adult and Nymphal Captures in Baited Traps with Dark Visual Base

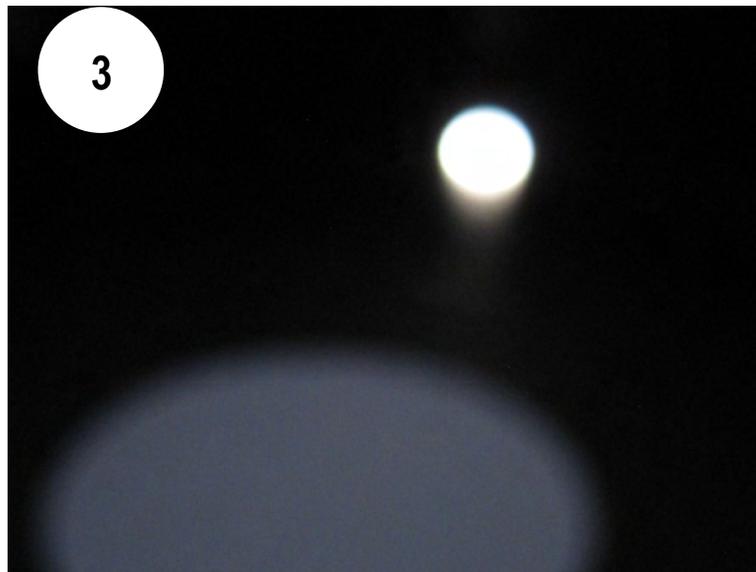
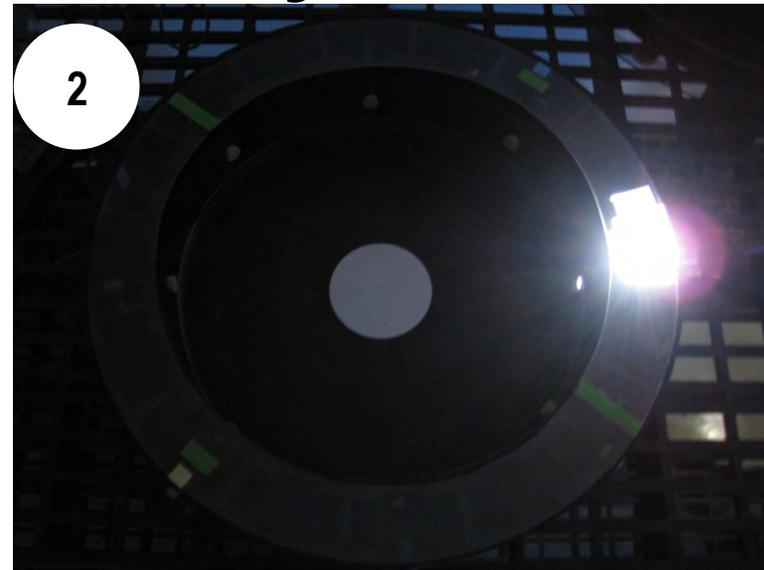
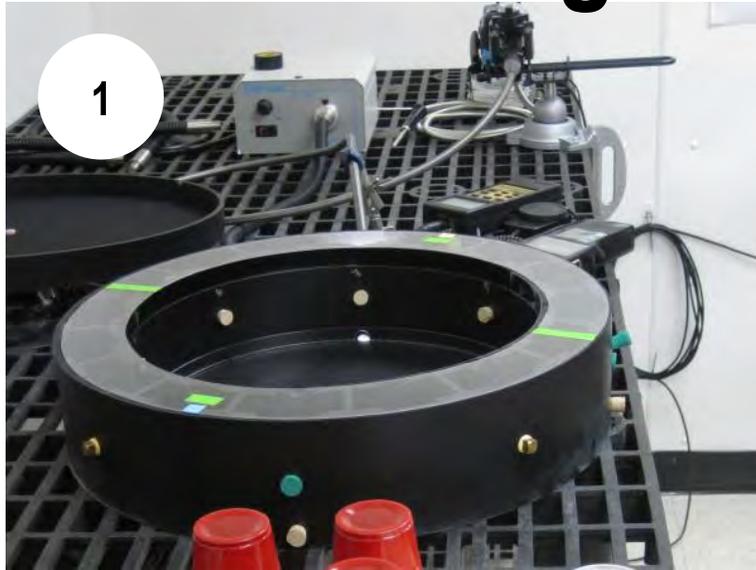


Visual Cues

Behavioral Responses to Wavelengths and Intensities of Light



Light Bioassay



Trial One - *Light Intensity*

- Release single individuals into center of arena. Simple choice experiment.
- Treatments include sex and light intensity.
- Light Intensity (Indirect Light, Fixed Full Spectrum)

- **0 Lux (Control)**

Darkness

- 100 Lux
- 200 Lux
- 400 Lux
- 800 Lux
- 1600 Lux

Fixed Full Spectrum

- Trial duration up to 15 minutes.
- Outcomes
 - Non-responder – remains in release zone.
 - Responds To Treatment – positively phototactic, but does not accept stimulus (does not enter treatment zone).
 - Accepts Treatment – positively phototactic and accepts stimulus.

Stimulus Acceptance

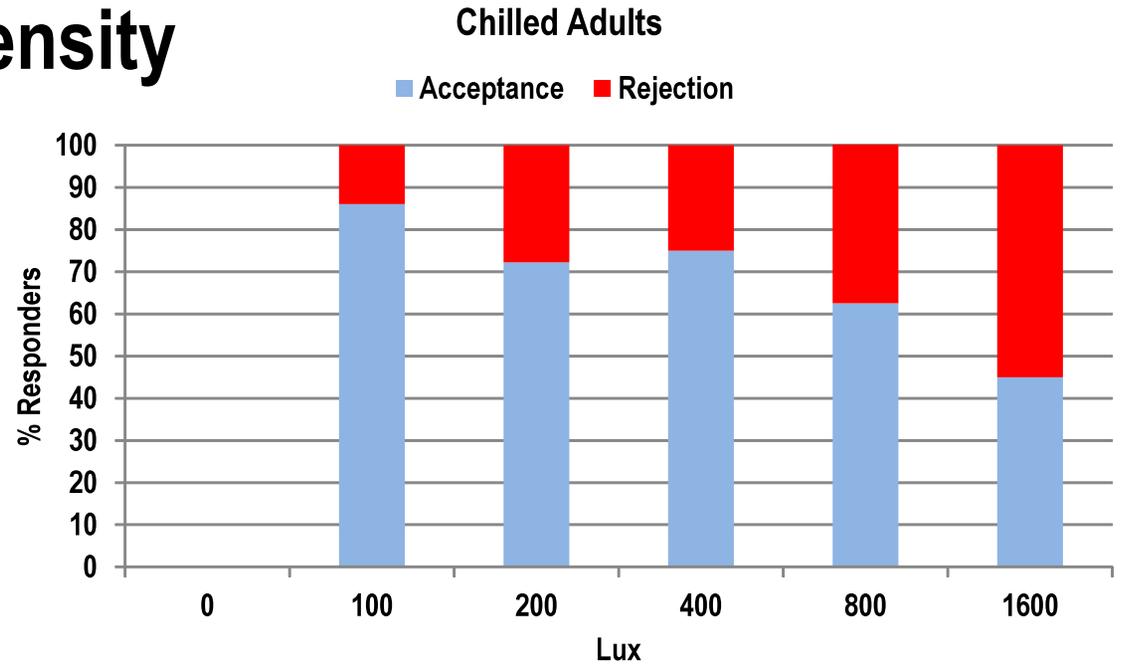


Stimulus Rejection

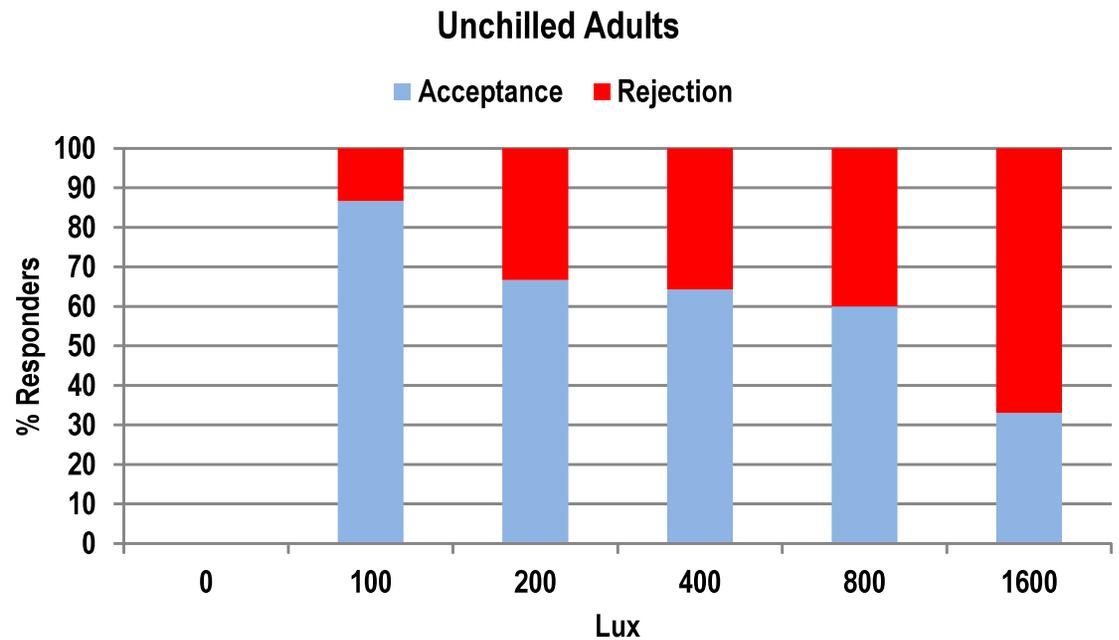


Response to Light Intensity

$\chi^2 = 34.60$
DF = 5
p < 0.001

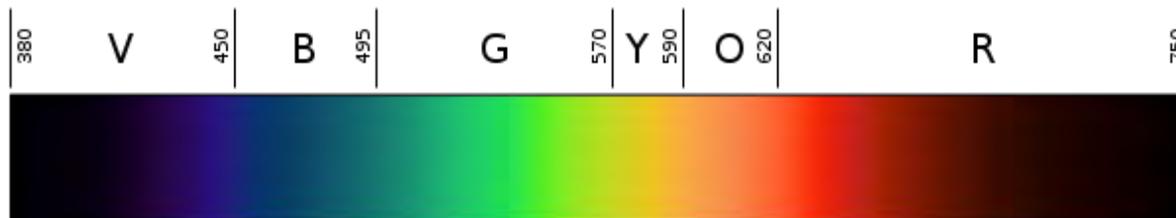


$\chi^2 = 21.35$
DF = 5
p < 0.001



Trial Two - *Wavelength*

- Release single individuals into center of arena
- Treatments – Wavelength (Indirect Light, Fixed Intensity)
 - Full Spectrum
 - 320 nm, Long Pass Filter (Ultraviolet and above)
 - 400 nm, Long Pass Filter (Visible Light, Purple and Above)
 - 495 nm, Long Pass Filter (Visible Light, Blue and Above)
 - 610 nm, Long Pass Filter (Visible Light, Yellow and Above)
 - Control



Olfactory Stimuli

- Aldrich et al. (2007) and Khrimian et al. (2008) confirmed that the aggregation pheromone of *Plautia stali* Scott, methyl (2*E*,4*E*,6*Z*)-decatrienoate (Sugie et al. 1996), is cross-attractive to BMSB, as reported in Asia (Lee et al. 2002, Tada et al. 2001 a,b).
- Adults are reliably attracted only early (Tada et al. 2001a) and late in the season (Tada et al. 2001a).

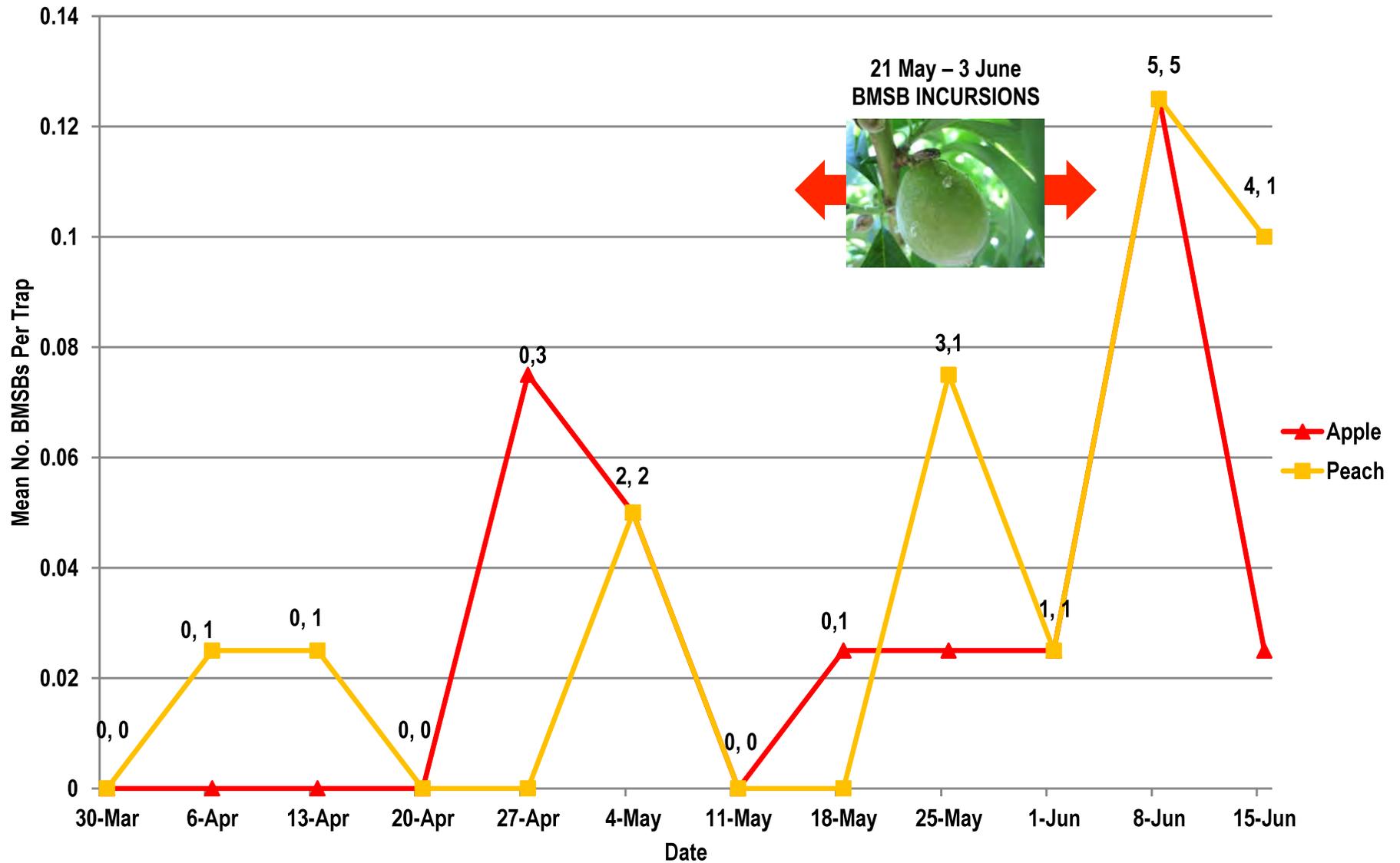
**Are BMSB attracted to methyl (2*E*,4*E*,6*Z*)-
decatrienoate early in the season?**



Commercial Orchard Studies

- 10 commercial orchards in MD and WV.
- Monitoring ~5 acre peach and apple blocks at each orchard.
- 4 black pyramid traps deployed in the border row of each block, spaced ~50 m apart, and baited with methyl (2*E*, 4*E*, 6*Z*)-decatrienoate.
- Additional sampling in two orchards; sweep netting, beat trays, and visual sampling.

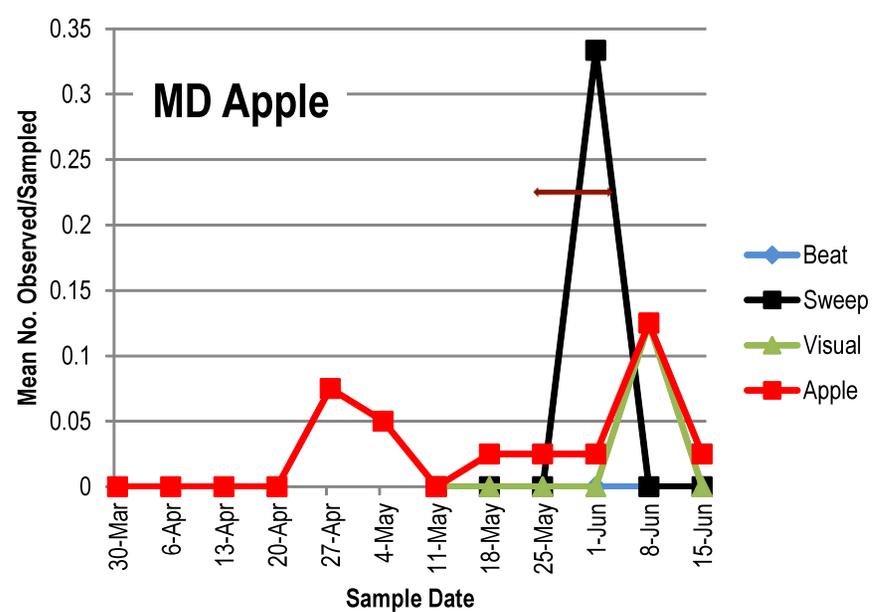
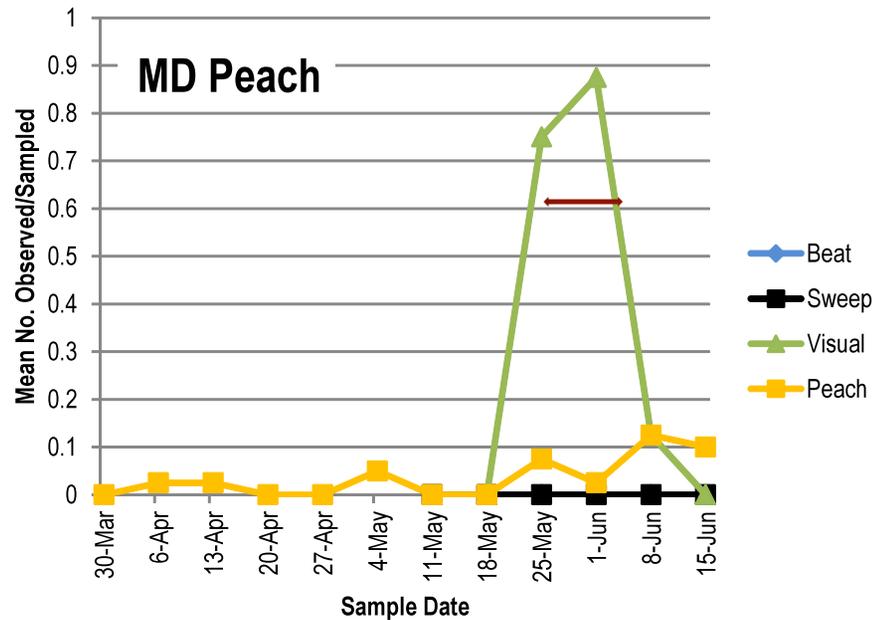
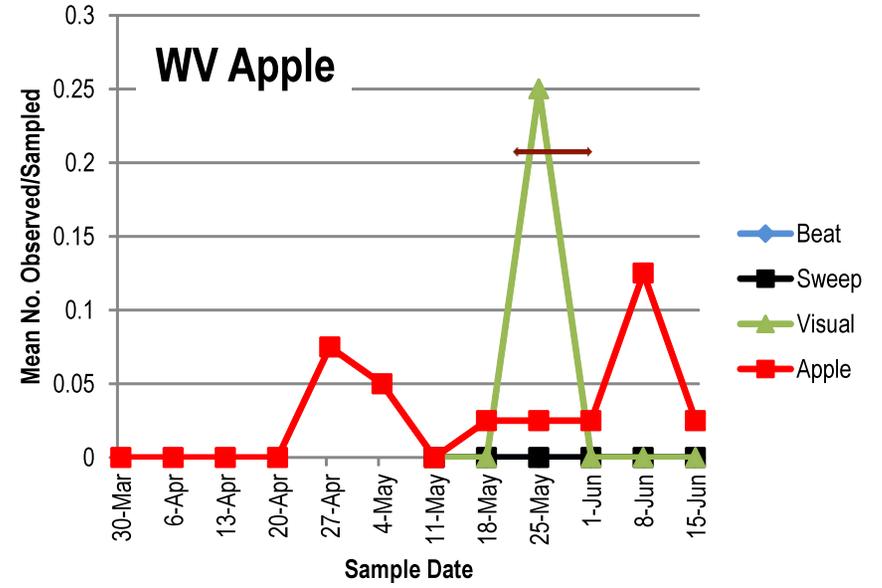
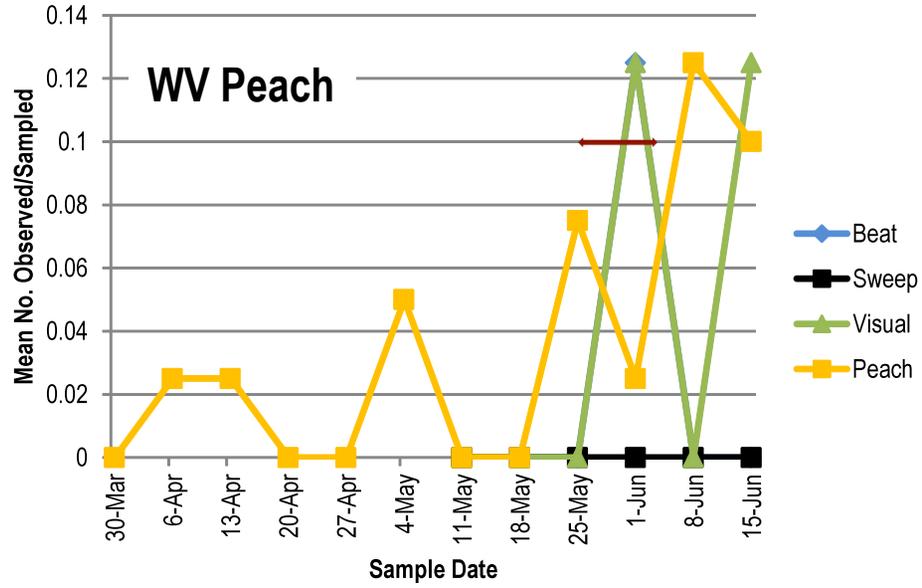
Early Season Trap Captures Do Not Reflect BMSB Activity



Additional SB Sampling Techniques

- **One commercial orchard in WV and one in MD.**
- **Monitoring ~5 acre peach and apple blocks at each orchard.**
- **Sampling began 11 May.**
- **Beat sample on 8 trees in border row and sample each side of the tree.**
- **Sweep net samples in peripheral area. Three replicates (25 sweeps per replicate) each covering 50 m.**
- **Three-minute visual sampling of 8 additional trees.**

Visual Sampling Provided Best Indication of In-Orchard Activity



Trap Type Experiment



Black Light Trap

Visual Stimulus – UV Light

Olfactory Stimulus – methyl (2E,4E,6Z)-
decatrienoate OR Unbaited

Capture Mechanism – Principally Flight

Deployment Strategy – Hanging, Perimeter of
Natural Overwintering Sites



Commercial Pyramid Trap

Visual Stimulus – Dark Upright Trunk Mimic

Olfactory Stimulus – methyl (2E,4E,6Z)-
decatrienoate OR Unbaited

Capture Mechanism – Principally Walking

Deployment Strategy – Ground-Deployed,
Perimeter of Natural Overwintering Sites



Prototype Pyramid Trap

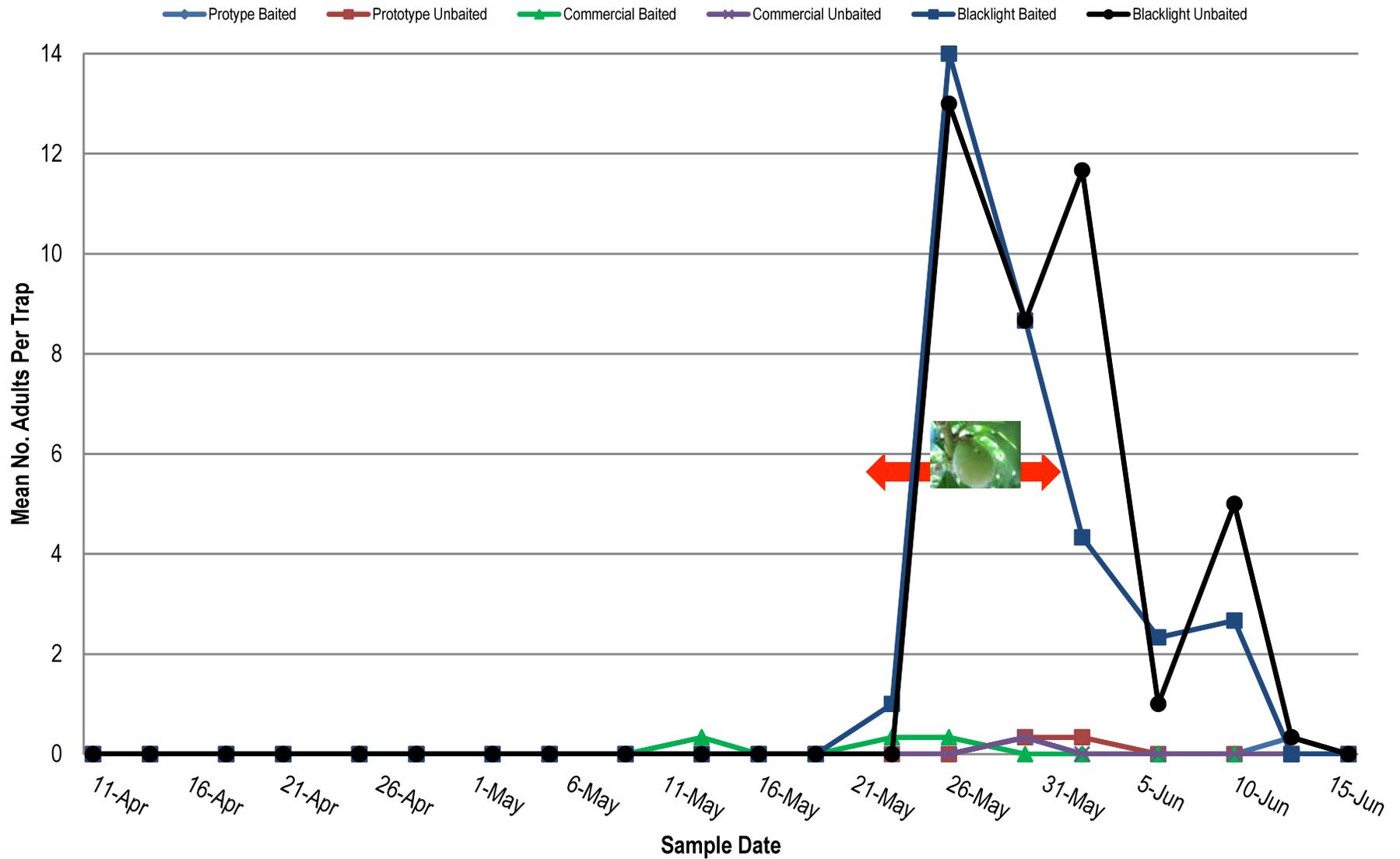
Visual Stimulus – Dark Upright Trunk Mimic

Olfactory Stimulus – methyl (2E,4E,6Z)-
decatrienoate OR Unbaited

Capture Mechanism – Principally Walking

Deployment Strategy – Ground-Deployed,
Perimeter of Natural Overwintering Sites

Results to Date



Black light captures reflected immigration period, but captures have subsequently have dropped off despite field presence and activity.

Conclusions and Questions

- **BMSB adults do not respond to methyl (2E,4E,6Z)-decatrienoate early in the season.**
- **Visual sampling provides some information, but in general, sampling techniques for others SBs are not providing accurate information reflective of in-orchard activity.**
- **BMSB respond to full spectrum light as a point-source at lower intensities and likely aggregate near high intensity sources.**
- **BMSB response to UV light may reflect movement patterns and/or be associated with a particular physiological/behavioral state.**

Next Steps

- Continue with current experiments season-long.
- Establish a behavioral foundation for responses to wavelengths and intensities of light. Physiological/behavioral state (age, mating status, etc.)
- Critical need for olfactory stimulus that is attractive earlier in the season.
- Develop a trap that incorporates attractive visual and olfactory stimuli, effective capture mechanisms, and deployment strategies.

Acknowledgements

- **USDA-ARS, NIFA Critical Issues Grant # 2010-37610-21845, and the Maryland State Horticultural Society**

