

BMSB in Ornamental Systems

Ornamentals Commodity Team Participants and Participating Institutions:

University of Maryland – Paula Shrewsbury (*coordinator*), Pedro Barbosa, Bryon Butler, Stanton Gill, Holly Martinson, Karen Rane, Mike Raupp, Ray St. Leger

University of Delaware – Brian Kunkel

Rutgers University – George Hamilton

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Oregon State University – Peter Shearer, Nik Wiman

Many graduate students, post docs, technicians, and stakeholders



Cornell University



VirginiaTech



pp Research Initiative
3-30937

Ornamental Systems

(woody and herbaceous plants: nurseries, landscapes, greenhouses, high tunnels)



Objs. 1.2, 1.3: Damage, Phenology and Impact of BMSB in Ornamental Systems

Objs. 3.1, 3.2: Crop Specific IPM Programs in Ornamental Systems



Ornamental Nurseries



Why nurseries?

- **Economically important:**
 - #2 Ag Sector in MD 2008: ~ \$2 billion green industry gross receipts
- **High plant diversity**
- **Large blocks of trees**

BMSB

- **Potentially damaging pest**
- **Must immigrate, emigrate**
- **Feed throughout season**
- **Broad use of ornamentals**

Examine abundance, host use and selection, movement patterns, and damage in woody plant nurseries

Woody Ornamentals (MD)

- **Abundance over time**
- **Host utilization**
- **Damage by BMSB**
- **Plant phenology**

BMSB Egg Abundance Over Time



- Sampled three nurseries at regular intervals from late May through September 2012 and 2013
- Visual searches of foliage on *Acer*, *Prunus*, and *Ulmus*



Photo by Steve Black



Photo by Ruppert Nurseries

Total Number of BMSB Eggs

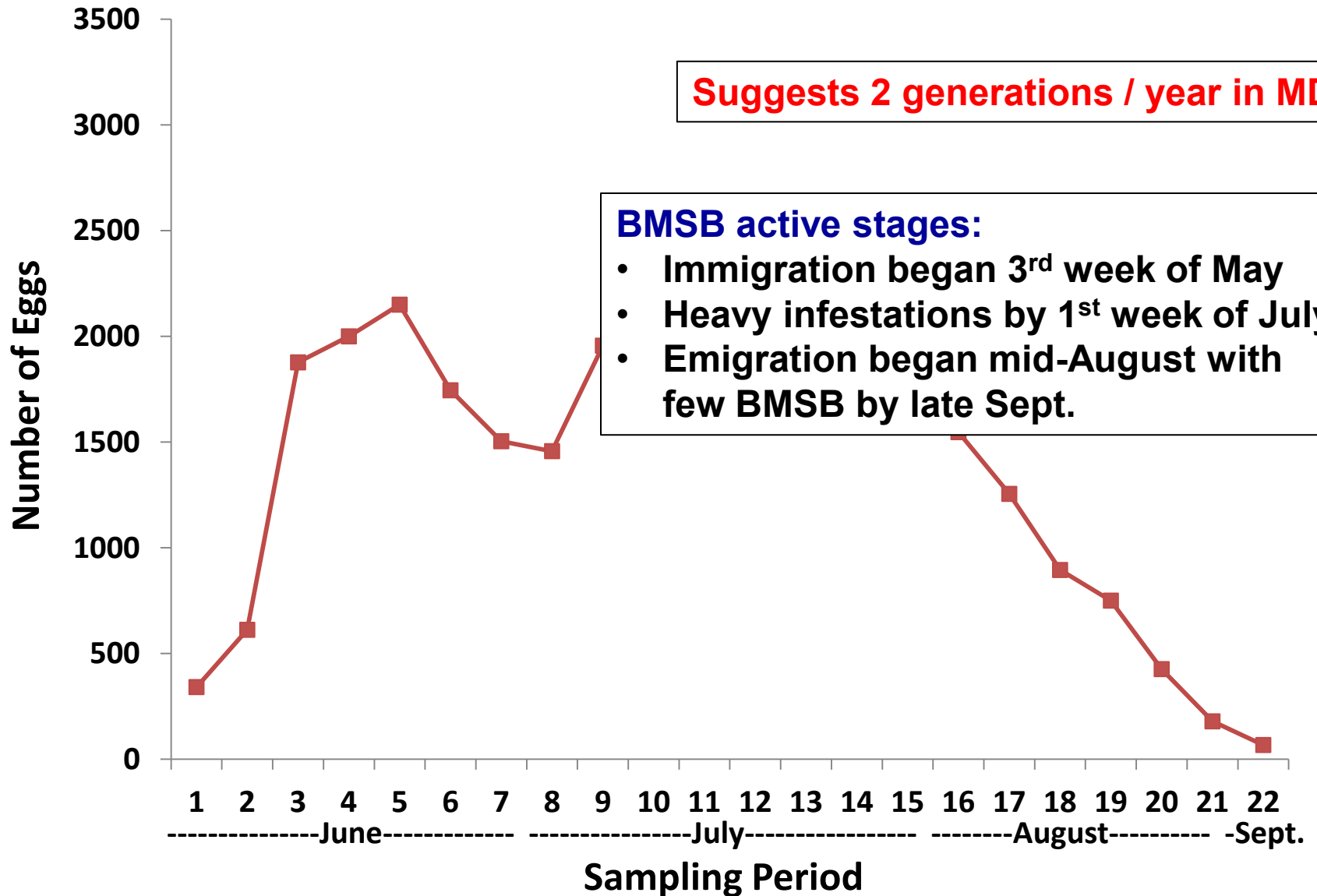


2013

Suggests 2 generations / year in MD

BMSB active stages:

- Immigration began 3rd week of May
- Heavy infestations by 1st week of July
- Emigration began mid-August with few BMSB by late Sept.



Host Utilization - Study Site



Raemelon Farm

Western MD

Wholesale Commercial Nursery

~300 Acres

BMSB pressure ~4 years



Host Utilization - Survey Methods



2011-2013

1 min visual counts:

Leaves ▪ Fruit ▪ Bark

BMSB stages:

Egg Masses

Nymphs

Adults

2nd nursery data to be analyzed

Host Utilization - Scope of Survey



E. Bergmann

2011-2013

258 cultivars

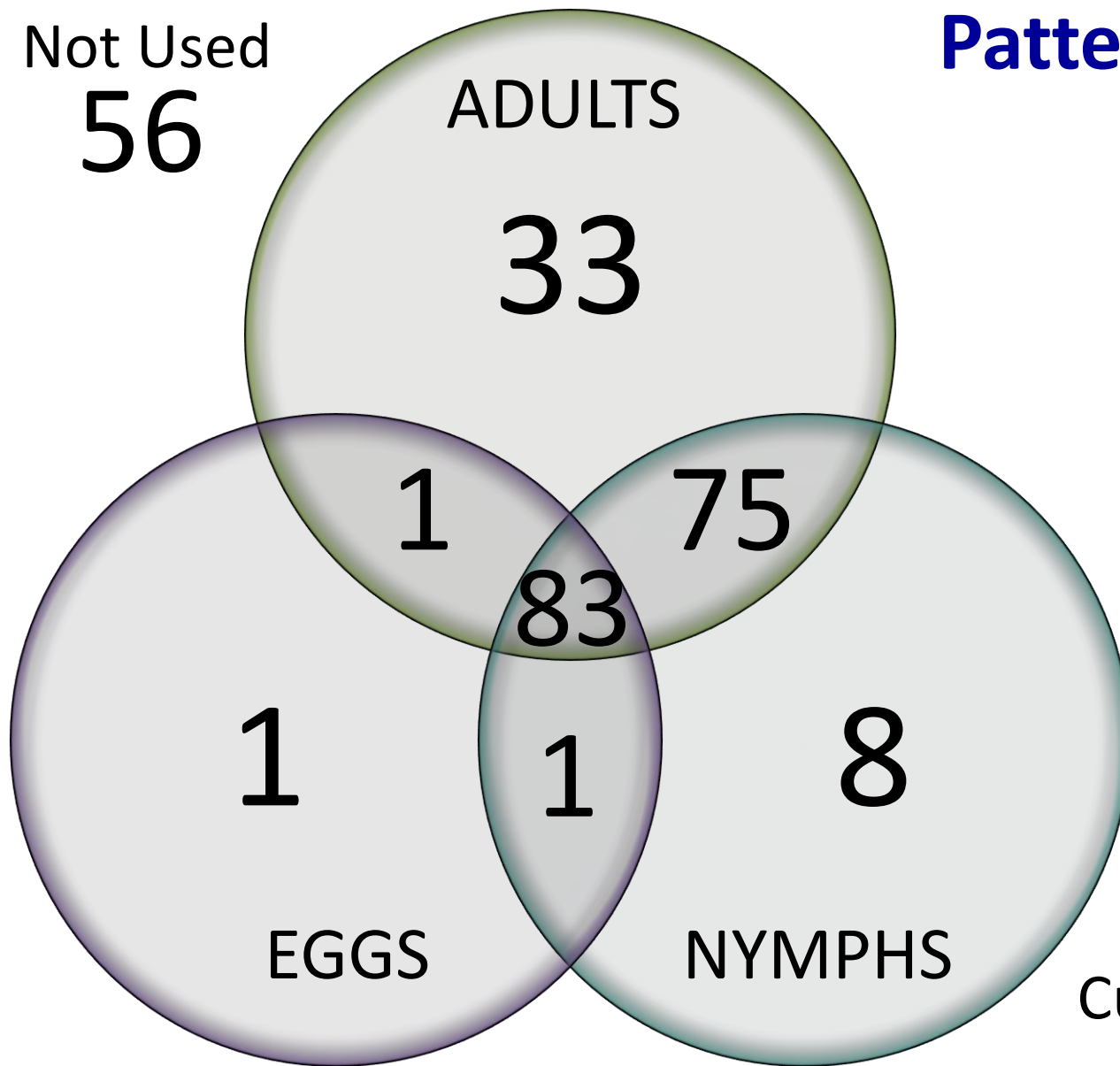
4,247 individual plants

35,767 tree visits

24,440 stink bugs and egg
masses



Patterns of Host Use



Total cultivars
sampled: 258

Total used by any
stage: 202

Cultivars used by
Eggs: 86 (34%)
Nymphs: 167 (64%)
Adults: 192 (74%)

Cultivars not used: 56

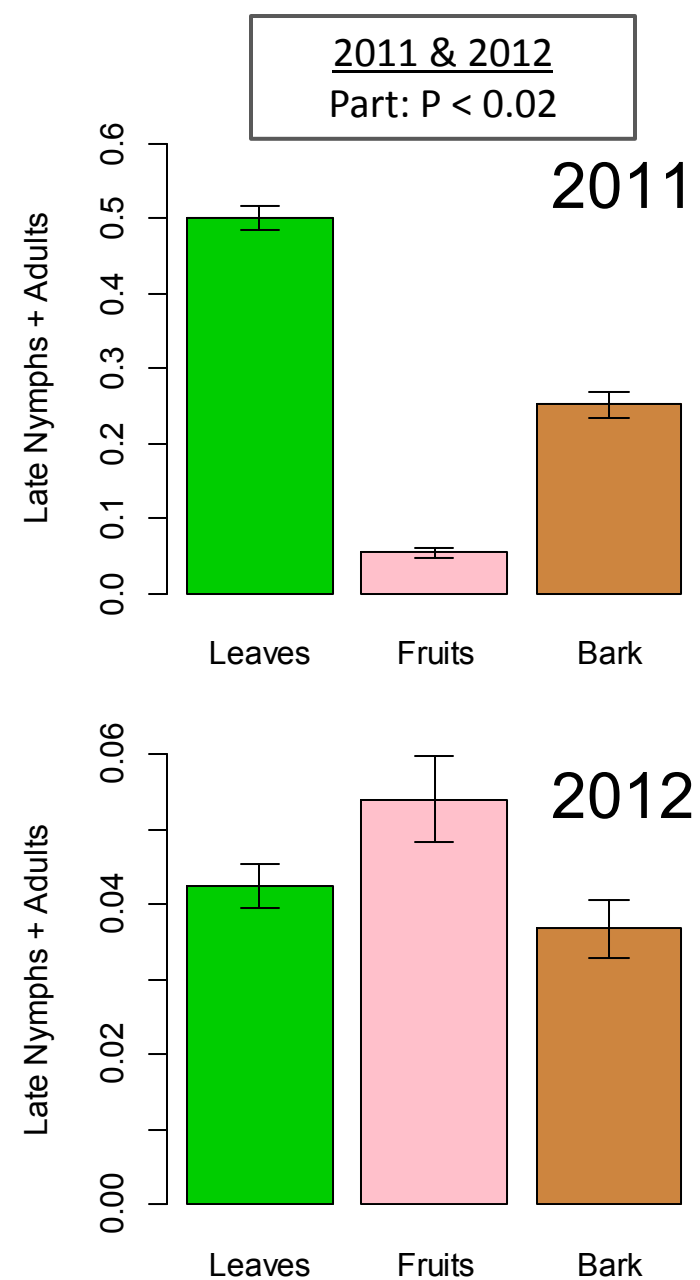
2011-2013

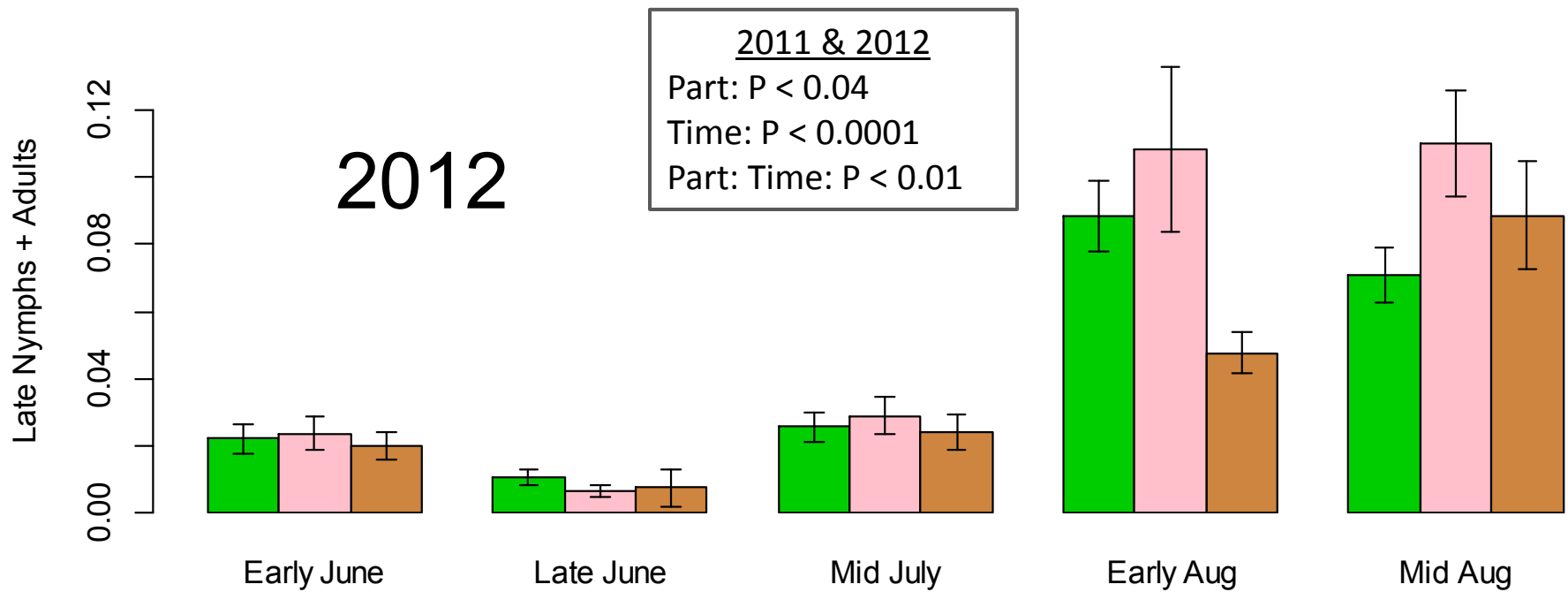
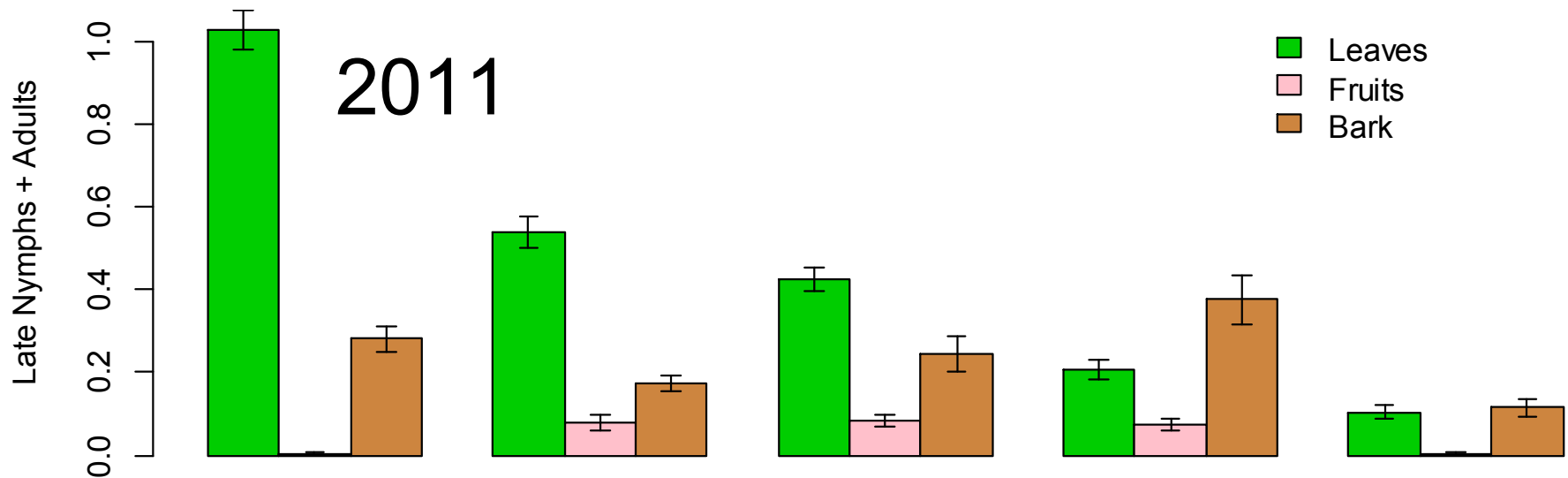
78 % of cultivars used

BMSB distribution within woody plants



Martinson, Raupp, Shrewsbury (in press)
Annals of the Entomological Society





BMSB feeding damage to woody trees

Possible damage

Direct feeding

Indirect as disease vector



Monitoring in Oregon Nurseries

	Target	Plants	BMSB
2011	14 sites in Canby and Dayton	Cherry, Crabapple, Elm, Euonymus, Hawthorne, Mixed hedge, Pear, Plum (unsprayed), Poplar, Syringa	Sep 8 (beat), Oct 7 (trap) in plum
2012	16 sites spread over 100 miles	Apple, Cherry, Conifer, Cornus, Crabapple, Euonymus, Hawthorne, Laurel, Mixed hedge, Oak, Plum (unsprayed), Rose	☹ Despite high efforts
2013	3 sites in Canby, Dayton, Portland	Mixed hedge near abandoned orchard, Plum (unsprayed), Retail mix	Aug 14 – Oct 23 (trap)

- Each site has a Pyramid trap or Rescue trap, and Beat 100 plants
- Densities low
- In 2014:
 - Minimal trapping with main stakeholder nurseries, this is not providing much information
 - Trap & beat in abandoned holly orchard



J. Lee, USDA ARS, N. Wiman,
P. Shearer, Oregon State Univ.

BMSB Nursery Survey (NJ)

Woody Plants – 2012, 2013

Methods

- **Nursery block with diversity of tree species (8+)**
- **Sampled weekly**
 - June – Oct.
 - Beat sampling (5/tree)
- **Multiple trees per species sampled**
 - Mean # nymphs and adults / tree



American ash
Green ash
Horse chestnut
Popular
Redbud
Sugar maple
Sweet gum
Weeping Cherry

G. Hamilton,
Rutgers, NJ

BMSB Nursery Survey (NJ)

Woody Plants – 2012, 2013

Results

- **2012**
 - Abundance varied by tree species and time
 - Low densities (range 0 – 2 / tree)
- **2013**
 - Abundance was very low, mostly “0”s

BMSB Activity on Herbaceous Plants and Cut Flowers (MD, DE)

- **To establish if BMSB feeds on herbaceous perennials**
- **To establish if BMSB feeds on specialty cut flowers**
- **If they feed, determine if there is detectable damage to the plants from feeding or any disease transmission to the plants**

Herbaceous Perennial and Cut Flower Nurseries monitored in 2013

- Grasshopper Nursery, Knoxville, MD (Washington County)
- Glade Nursery, Walkersville, MD (Washington County)
- North Creek Nursery, PA
- Holly Hill Nursery, Earlsville, MD
- Marshall River Bank Nursery, Salisbury, MD
- Farmhouse Flowers and Plants, MD
- Weekly or bi-weekly visual timed sampling

Trap baited with #10 USDA pheromone and standard pheromone and kill strip Vapona strip placed at each nursery and cut flower operation that was monitored to verify BMSB pressure was present.



Herbaceous Perennial Operations monitored in 2013

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- Farmhouse Flowers and Plants, MD

Cut flower - Amaranth:

Before bloom no BMSB

When in flower and seed production = high BMSB



Note damage to foliage from amaranth leaf beetle

Cut flower – Sunflower: Stink bugs like to feed on unopened sunflower buds



**Feeding on leaves and stems but
no damaged detected**



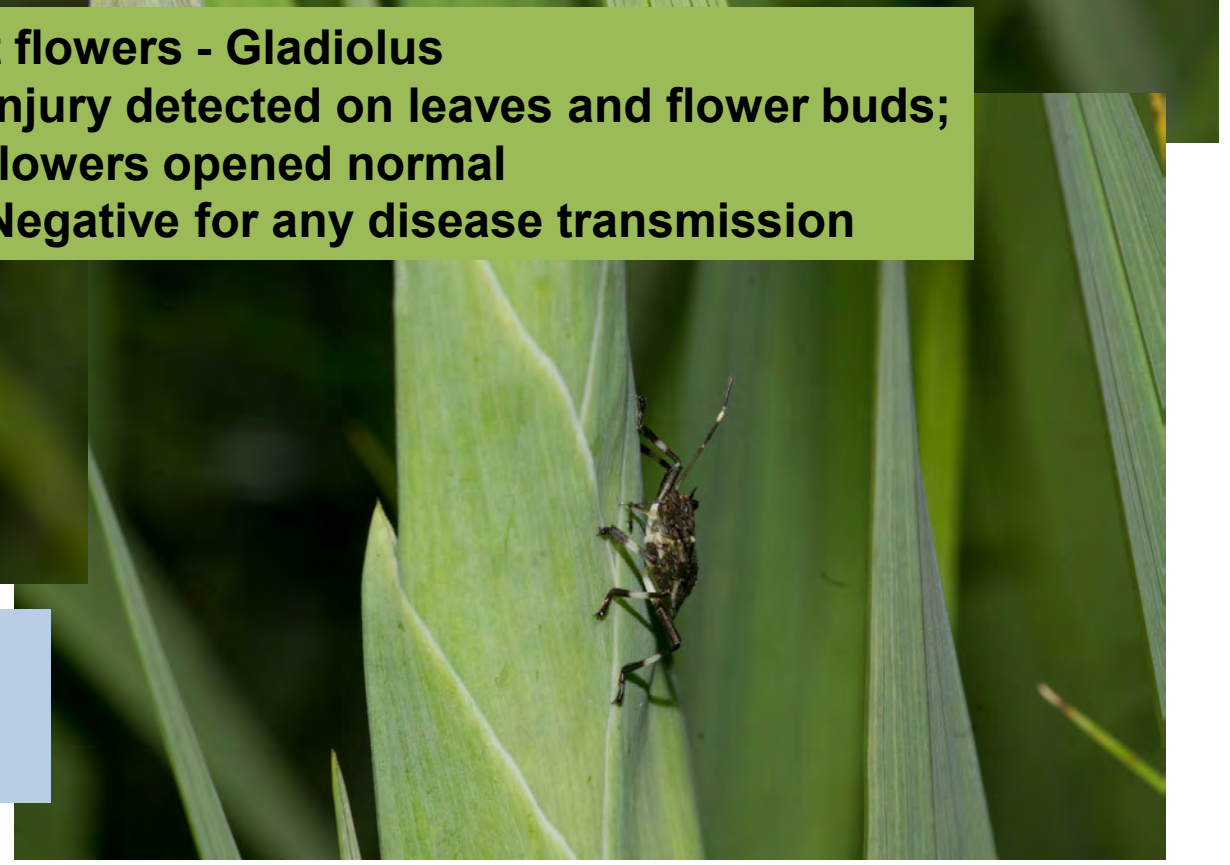
Cut flower - Zinnias:
Adults feed on flower parts, stems and
leaves; and unopened flower buds
Some egg laying on foliage





Cut flowers - Gladiolus

- Injury detected on leaves and flower buds; flowers opened normal
- Negative for any disease transmission



August 3 – 14, 2013 BMSB were all over gladiolus leaves, stems and unopened flower buds

BMSB on Perennials in Nurseries - 2013

- BMSBs preferred to feed on flowers, buds, or just under a bud (on the swollen peduncle/receptacle of a flower) and newly forming seeds or seedpods when existing on plants
- No feeding damage was found on any perennial
- The following perennial plant species/cultivars were documented with active BMSB feeding:

- **Feeding on foliage** (7 different plants, total of 31 BMSBs)
 - **Lychnis 'Maltese Cross'**
 - **Caryopteris 'Dark Knight'** (Blue mist shrub)
 - ***Polemonium viscosum* 'Blue whirl'** (Jacob's-Ladder)
 - **Veronica 'Sunny Border Blue'**
 - ***Althea lasiocarpus* (= *Hibiscus moscheutos* subsp. *lasiocarpos*, Hairy rose mallow)**
 - **Monarda 'Marshall's Delight'** (Bee balm)
 - **Phlox 'Franz Schubert'**

Conclusion: Perennials

- BMSBs were active at Grasshopper Perennial Nursery but did not cause aesthetic nor economic damage to perennials
- The top 2 preferred perennial species that were both fed upon and visited by BMSB were *Althea lasiocarpus* and *Caryopteris* 'Dark Knight', followed by *Veronica* 'Sunny Border Blue', Hollyhock 'Halo Blossom', and Baptista
- A total of 29 different perennial plant species attracted BMSBs
- No sign of disease / pathogens



Future Directions

Sampling:

Spatial Replication (2nd Nursery)

Monitoring – associate Degree Days with development, activity

Damage:

Bark feeding by BMSB (pathogens, stress, growth)

Phenology and Movement:

Does BMSB track resources through time and space

Host origin effects:

Are plants you “don’t know” at greater risk than plants you “know”

Designing sustainable landscapes:

Avoid plants used for oviposition and feeding



P. Shrewsbury, UMD

Progress Toward IPM Programs in Ornamental Systems



Research Based Information Sustaining IPM Programs

- **BMSB biology / phenology**
 - Associate significant life cycle activities (eggs, nymphs, etc.) with degree days
 - 2 generations/yr; active May – Sept.
- **BMSB patterns in ornamental host use**
 - Host utilization patterns on woody ornamental, herbaceous perennial, cut flower hosts (identify key plants)
 - Appear to track resources (ex. fruit, seed)
- **Spatial dynamics and movement**
 - Immigration / emigration; edge effects; patch dynamics
 - Landscape plants / overwintering populations in structures
- **Chemical efficacy**
 - No consistent significant damage to date
- **Biological control**
 - Native egg parasitoids / predators are suppressing BMSB (~58% egg mortality)
 - Plant species, hosts that favor native natural enemies

Designing BMSB-free Landscapes

- **Avoid use of highly utilized plants**
 - Angiosperms used more than gymnosperms (evergreens)
 - Preliminary data suggest BMSB use hosts they don't know (U.S. natives, non-Asian) more so than hosts they know (Asian)
 - Preliminary data suggest BMSB use plants with fruit and seeds
- **Incorporate use of less utilized plants**
- **Incorporate plants that favor native natural enemies**

Woody Plant Utilization by BMSB (nymphs and adults)

Cultivars most used (top 15)

- *Sophora japonica* 'Millstone'
- *Syringa pekinensis* 'Morton'
- *Syringa pekinensis* 'Zhang Zhiming'
- *Evodia daniellii*
- *Acer x freemanii* 'Jeffersred'
- *Gleditsia triacanthos* 'Shademaster'
- *Cercis canadensis* 'Alba'
- *Acer pensylvanicum*
- *Malus* 'Mary Potter'
- *Acer rubrum* 'October Glory'
- *Cornus florida* x *kousa* 'Celestial'
- *Hibiscus syriacus* 'Satin Blue'
- *Carya illinoensis* 'Choctaw'
- *Ulmus americana* 'Valley Forge'
- *Acer rubrum* 'Brandywine'

3 years of data

Woody Plant Utilization by BMSB (nymphs and adults)

Genus species not used (56 cultivars)

- *Abies nordmanniana*
- *Acer davidii*
- *Acer palmatum*
- *Aesculus spp.*
- *Cedrus atlantic*
- *Cedrus deodara*
- *Cercidiphyllum japonicum*
- *Chamaecyparis obtusa*
- *Cladrastis kentukea*
- *Cornus kousa*
- *Cryptomeria japonica*
- *Ginkgo biloba*
- *Hamamelis x intermedia*
- *Juniperus chinensis*
- *Nyssa sylvatica*
- *Physocarpus opulifolius*
- *Picea breweriana*
- *Picea koraiensis*
- *Picea meyeri*
- *Picea omorika*
- *Picea pungens*
- *Pinus cembra*
- *Pinus densiflora*
- *Pinus koraiensis*
- *Pinus nigra*
- *Pinus parviflora*
- *Pinus strobus*
- *Pinus thunbergii*
- *Prunus mume*
- *Prunus serrulata*
- *Quercus robur*
- *Sequoiadendron giganteum*
- *Taxus x media*
- *Thuja plicata*
- *Tsuga canadensis*

3 years of data

Designing BMSB-free Landscapes

- **Reduce BMSB abundance in landscapes that surround homes, structures, etc.**
- **Should reduce abundance of BMSB entering structures to overwinter**



A close-up photograph of a tree trunk with rough, greyish-brown bark. Several brown, mottled bugs, likely stink bugs, are clustered on the bark. The bugs have a shield-like shape with irregular brown and tan patterns. The text "Questions?" is overlaid in white, sans-serif font in the center of the image.

Questions?

Pitfalls, Future Plans, Expected Outcomes

Pitfalls

- Low densities of BMSB in autumn in 2011 and early season of 2012, and on herbaceous plants in general, may reduce sensitivity in resolving seasonal patterns in BMSB phenology and injury to plants
- Difficult to separate direct BMSB damage from other causes
- Difficult to document indirect damage to ornamentals (ex. vector, secondary pathogens)
- Standardizing sampling methods across structurally diverse plants / crops

Future plans

- Complete second year of nursery surveys of BMSB phenology; integrate Degree Day information, plant phenology data
- Implement manipulated studies to:
 - determine relationship between BMSB and damage to woody and herbaceous plants
 - elucidate effects of bark feeding on tree health and susceptibility to secondary pathogens

Expected outcomes

- Elucidate timing of initial immigration and oviposition, and predict seasonal changes in populations in nurseries
- Help stakeholders to:
 - Refine IPM programs (monitoring and management of BMSB)