Brown Marmorated Stink Bug
IPM Working Group Meeting

Alson H. Smith, Jr. Agricultural Research and Extension Center
Virginia Agriculture Experiment Station
595 Laurel Grove Road, Winchester, VA 22602

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Executive Summary

The brown marmorated stink bug (BMSB), *Halyomorpha halys* (Stål) continues to spread throughout the United States. BMSB has been detected in 40 states The BMSB IPM Working Group updated the BMSB map that is published on the www.stopbmsb.org web site. At present severe agricultural injury has been detected in PA, NJ, DE, MD, WV, VA and D.C. States recently reporting agriculture injury include NY, NC, TN, KY, OH, OR and WA. Nuisance problems have been reported in NH, MA, CT, RI, MI, IN and CA as well as in Hamilton, Ontario, Canada over the past year.

The eighth formal BMSB Working Group meeting was held at Alison H. Smith, Jr. Agricultural Research and Extension Center Virginia Agriculture Experiment Station on December 3, 2013. Research and extension personnel from Rutgers University, USDA-ARS, Penn State University, Cornell University, North Carolina State University, Oregon State University, Ohio State University, University of Delaware, University of Maryland, Virginia Tech, University of Tennessee and University of California as well as EPA, Northeastern IPM Center, Ontario Ministry of Agriculture, and industry representatives attended the meeting. In addition, participating through webinar were representatives from the Cornell University, industry members from DuPont, Hercon Environmental and South African Avocado Growers Association.

There were approximately eighty-nine participants in attendance. Specific discussions on hosts at risk, rearing and national coordination efforts were discussed. In addition, research and outreach updates including adult and nymphal dispersal, efficacy of organic insecticides, BMSB injury on different apple cultivars and phenological stages, updates on the BMSB pheromone and synergist, potential collaborations with the Department of Interior BISON project as well as a webinar from researchers in South Africa discussing stink bug problems in horticultural production systems.

BMSB Presentations

Presented by: Tracy Leskey & George Hamilton
USDA-ARS-AFRS & Rutgers University
Department of Entomology

Summary:

- Overview of day's schedule
- Agricultural injury in Kentucky
- Detection in Arkansas submitted to NAPISS
- Introduction to Florida in cut flowers from Columbia, South America
- Agricultural/nuisance problems for Oregon and Washington
- News reel on BMSB stating they are in many states now

Insights on Brown Marmorated Stink Bug Behavior from a Mark/Recapture Field Experiment

Presented by: Kevin Rice
Co-Authors: William Mitchell, Moshe Gish, Shelby Fleischer, and John Tooker
Department of Entomology
Penn State

Summary:

- Dispersal
    - Dispersal hazards
        - Increased predation - Failure to find host plant - Failure to find mates
    - Host plant availability
        - Induced defense - Phenological changes
    - Patchy agricultural landscape
        - 1 week they are in corn, next week in soy - No action thresholds - We are developing mark recapture technique for BMSB that allows us to work with large numbers.
- Goals
    - How much does BMSB move?
    - When does BMSB move?
    - Where does BMSB move to?
    - Mark/Recapture
        - A good way to answer these questions is with mark recapture.
        - With insects, we need to mark a lot to get a good recovery.
        - Elisa-more time and expensive
- Fluorescent Marking
    - Mark insect with powder - We have developed a technique of mark recapture of BMSB using fluorescent powders.
    - UV light
    - Visible light reflection
- Problems Marking BMSB

  - Fluorescent powders
  - Sensory interference
  - Flight interference
  - Fluorescent paints
  - Flight interference
    - Ideal marker for one insect is useless for other insects-Hagler Jackson 2001.
    - There are lots of methods available-protein markers.
- Neon Pens
  - Pen marking - UV fluorescent, Inexpensive, No cross contamination, Waterproof, Long lasting, Non-toxic - Time consuming - Potential handling damage
- Tracking BMSB Dispersal
  - 2,500 adult BMSB from soybean
  - Knockdown CO_2
  - Individually hand marked
    - Yellow released in woods/5% in 48H
    - Pink released in soy/5% in 48H
    - Bugs found for 3 weeks post-release
    - Higher dispersal rate in woods
- Recapture-UV Flashlights
  - GPS Points recorded
  - Don't bring back to lab = large scale and fast
  - Used to track adults at night
- Mass Marking Technique
  - Fluorescent powder - Diluted with water for improved marking technique for masses of bugs / Spray and rinse / Less handling
- Increased Fluorescence Coverage
  - Increased detection-see from under leaves; Clean antenna; Eye not covered
- Recapture Distance - Neon pens = 11.2 m; Powder spray = 6.5 m
- Conclusions
  - Recapture 3 weeks after marking
  - Some BMSB stay in system 3 weeks
  - Established 2 mark/recapture methods-BMSB
  - Marking doesn't appear to negatively affect most BMSB behaviors
  - Looking into use of large mounted UV spotlights to cover more area and to be able to higher in canopies of trees.
- Marking Does Not Appear to Interfere with Behavior (In Captivity)
  - Flight - Host plant finding – Feeding - Mating - Oviposition - Diapauses induction – Longevity - Predation?
- Dispersal from Overwintering Sites
  - Spring 2014 - Mark 10,000 if possible - ID wild host plants
- Improved Recapture
  - Cherry picker - Access tree canopy - Mounted UV spotlights - Field site (collaborations)

Brown Marmorated Stink Bug: An Update from Ontario

Presented by: Hannah Fraser
Co-author: Tara Gariepy, Cynthia Scott-Dupree, Tracey Baute
Ontario Ministry of Agriculture
Ontario, Canada

Summary:

- Known distribution and abundance
    - Brown marmorated stink bug (BMSB) has been detected in 40 states, posing severe agricultural problems in six states and nuisance problems in thirteen others. First detections of BMSB in Ontario were homeowner finds starting in 2010. Ontario shows up as yellow here because homeowners in Hamilton and Burlington, where we've had the most reports, are reporting high numbers, sometime in the hundreds.
- Cootes Paradise, Hamilton, on August 2012
    - In August, an established breeding population was identified at Cootes Paradise, part of the Royal Botanical Gardens in Hamilton.
- Assessment of the Distribution and Natural Enemies of the Brown Marmorated Stink Bug in Southern ON
    - Funding through the OMAF / MRA University of Guelph Partnership Agreement - Emergency Management Theme (2013-14), and financial support from the following grower organizations:
        - *Grain Farmers of Ontario*
        - *Ontario Apple Growers*
        - *Ontario Tender Fruit Producers*
        - *Niagara Peninsula Fruit & Vegetable Growers' Association*
        - *Grape Growers of Ontario*
- Research Plans for 2013-2014
    1. Assessing the distribution and abundance of, and patterns of host use by BMSB in southern Ontario;
        I. Sentinel plants – known non-crop landscape hosts*
        II. Surveys in field and hort crops
    - How?
        a) Sweeps / beat trays / nets
        b) Visual observations (including binoculars)
        c) Traps

    * Based on Nik Wiman's work, OSU
- Site Categories
    - Urban / Industrial (n=65)
        - Areas of land with potential plant hosts surrounded on at least 3 sides by urban subdivisions, industrial and / or commercial zones.
        - Parks, walking trails and conservation authority properties can be placed in this designation if they fit the above criteria.
    - Natural / Rural (n=36)

        - Areas of land with potential plant hosts that do not border directly on urban subdivisions or industrial / commercial zones. They may however, border on agricultural land on one side of the property.
        - Examples: trails, parks, conservation authority properties that fit the above described criteria.
    - Agricultural (n=136)
        - Areas of land with potential native / invasive plant (i.e., hedgerows) or cultivated crops with no urban/industrial connection at all.
        - Survey will take place either in the actual cultivated crops, or in hedgerows or pastureland bordering these areas.
    - Transportation Corridor (n=27)
        - A linear tract of land that contains lines of transportation like highways, railroads, or canals.
        - Focus will be on MTO truck inspection sites, picnic areas and truck stops along major transportation corridors in southern Ontario
        - Examples: HWY 401, QEW and county roads.

2. Identifying agricultural areas in southern Ontario at risk from BMSB impact;
    I. Landscape factors conducive to population build-up and migration, abundance of seasonal hosts, overwintering sites, track movement of BMSB
3. Inventory parasitoids and predators that are using BMSB as a resource. This will provide baseline data on the potential for augmentative biological control of BMSB in Canada.
    I. Expose newly-laid sentinel egg masses of several stink bug species (non-BMSB!) on a weekly basis
    II. Obtain parasitoids for morphological ID
    III. Determine host-parasitoid associations (if any)
    IV. Collect BMSB egg masses to determine level of parasitism / predation by native natural enemies
4. Evaluation of new pheromone trapping system
    I. Utility for early detection?

Public Outreach

5. Facilitate knowledge transfer on the status of BMSB in Ontario:
    I. Develop information for use in communications including websites (e.g., ontario.ca\stinkbug, stopBMSB.org),
    II. Newsletters, tweets / blogs, conferences, online tools for IPM (e.g., Crop IPM), outreach to traditional (i.e., grower) and
    III. Non-traditional (e.g., homeowner, botanical gardens, pest control companies and tourism) stakeholder groups.

- Exposure of Sentinel Egg Masses
    - 434 egg masses exposed June - October 2013
    - *Thyanta acerra* (n=57), *Euschistus variolarius* (n=101), *Acrosternum hilare* (n=25), *Podisus maculiventris* (n=210), and *Holcostethus limbolarius* (n=41)
    - 50.5% produced stink bug nymphs once returned to the laboratory for rearing
    - 49.5% failed to produce stink bug nymphs …
    - 15% of the egg masses showed signs of attack by predators
    - Parasitoids emerged from 3.5% of the exposed egg masses

    - 31% failed to produce nymphs or parasitoids, and showed no signs of predation
        - suspect that many of these eggs were attacked by parasitoids which failed to complete development to the adult stage
        - will be confirmed using DNA-based technology to detect parasitoid DNA within unhatched eggs
- Items to think about and future work:
    - No information regarding potential populations in Quebec
    - Believes that there are multiple reintroductions of BMSB from the U.S., which makes it difficult to tell whether it is spreading
    - BMSB may already be widespread in Southern ON
    - Establishment in agricultural crops not confirmed.
    - OW and new adults by mid July - is there potential for a partial 2nd generation of BMSB in southwestern ON???
    - Pheromone trapping systems may be useful as early detection tools.
    - Survey in 2014 needed to determine the potential impact of NEs on BMSB in newly invaded areas.
    - Additional survey work in 2014 will be required to confirm BMSB in other parts of Ontario, including those areas associated with new homeowner finds.

Virginia Field Crops and Vegetables BMSB Research Update

Presented by: Tom Kuhar
Co-author: D. Ames Herbert
Department of Entomology
Virginia Tech

Summary:

- Evaluating indoor light traps
    - Paper in review (Aigner, J.) about citizen scientists evaluating light traps for capturing BMSB in homes in VA. Turkey roasting pan with light captured most BMSB.
    - Aigner, J.D. and T.P. Kuhar. 2014. Using Citizen Scientists to Evaluate Light Traps for Catching Brown Marmorated Stink Bugs in Homes in Virginia. J. of Extension (*in review*)
- Deltamethrin-incorporated polyethylene mosquito netting
    - Can last up to 10 years, not publicly available
    - Work well for certain crops – eggplant
    - Cucumber & Flea Beetles and BMSB killed
    - Deltamethrin screen kills BMSB after exposure to elements after one year
    - 104°F/40°C = kills bugs after 4H
- BMSB threat to cotton
    - Kamminga, K., D. A. Herbert, M.D. Toews, S. Malone, and T. Kuhar. 2013. *Halyomorpha halys* (Hemiptera: Pentatomidae) feeding injury on cotton bolls. J. Cotton Sci. *in press*
    - In southwest VA, H. halys is dominant SB. However, in Eastern Shore it is found in very low numbers.

- Can BMSB take the heat?
  - In the lab, temps. >40˚C (104˚F) resulted in significant mortality to all life stages of BMSB after < 4hrs exposure.
  - BMSB development is negatively impacted at temps > 33˚C (91˚F) and no development occurs > 35˚C (Nielsen et al. 2008).
  - Nielsen, A.L., G.C. Hamilton, and D. Matadha. 2008. Developmental Rate Estimation and Life Table Analysis for *Halyomorpha halys* (Hemiptera: Pentatomidae). Environ. Entomol. 37(2): 348-355 (2008)
- Species complex of stink bug adults observed on wooded borders and agricultural crop plants* from May until Oct 2012 and 2013 in two regions of Virginia.
  - Host plants – Paulownie, Tree of Heaven, Catalpa, Peach, Mulberry, Wild Cherry, Corn -- Stopbmsb website has continually updated list of BMSB host plants
  - Host plants along border of favorable crops created hot spot on border (woods) and move slightly into crop and not much further
  - Border sprays working for control of BMSB at F5 stage on soy/20-30% acreage sprayed
  - Edge of field corn hard to control BMSB damage because dusted with plane, which doesn't cover edge well
  - BMSB infestations are usually concentrated on the perimeters of soybean and corn fields
  - Can have 10+ BMSB on developing ears
  - Insect injury is often associated with increased levels of fungal infections and mycotoxin contamination
  - FDA has established regulatory levels for aflatoxin and guidelines for fumonisin and deoxynivalenol (DON) in food and feed (no advisory guidelines for zearalenone)
  - Stink bugs move into soybean fields at the R4 (full pod) stage
  - Injury to soybeans includes undeveloped (flat) pods, punctured and deformed seed

Spread of BMSB in Northern California

Presented by: Charlie Pickett
Co-author: Chuck Ingels and Mark Hoddle
California Department of Food & Agriculture
University of CA Coop Extension

Summary:

- Est. populations in LA and Pasadena
- First Reproducing Population of BMSB in California outside LA Basin
  Downtown Sacramento, September 4, 2013 – Found in high numbers
- Future Plans: 2014 to 2016
  - Host range testing
  - Define state distribution of BMSB

  - Identify extant natural enemies, host plants
  - Release parasitoids
- Observed commonly on Chinese Pistachio trees
- Sacramento has 10-20 days of at least 100F
- Not doing any citrus or avocado surveys for BMSB

The Dispersal Capacity and Host Choice of BMSB Nymphs

Presented by: Brett Blaauw
Co-authors: Doo-Hyung Lee, Anne Nielsen, and Tracy Leskey
Rutgers University
USDA-ARS-AFRS

Summary:

- Anecdotal evidence suggests that BMBS nymphs have strong walking capacity and can easily move among host plants within a planting or among different host plants on a farm.
- This work was done to elucidate the spatial scale of their movement and host preferences of nymphs.
- Walking capacity test in the lab
  - To validate this, first we used laboratory behavioral bioassay where we tested 2nd through 5th instars and adult together to estimate the baseline walking capacity of each BMSB life stage. We included adults, so that we can also compare nymph walking capacity in the context of adults.
  - We used this petri-dish arena and video tracking system to record and measure horizontal walking capacity of BMSB. Each individual was observed for 1 hour in the trial and analyzed with EthoVision software.
- Under lab conditions 3rd instar nymphs moved the greatest distances
  - First of all, there was a significant difference in the horizontal distance moved by BMSB among the life stages tested in the Petri dish arenas. 3rd instars moved significantly greater distances compared with adults. 2nd, 4th and 5th instars exhibited intermediate walking distances with no significant difference compared with 3rds or adults in the study.
- Direct observation of nymph movement in the field
  - We have extended our trials to field conditions to first validate the laboratory results and also measure BMSB walking capacity directly from the field.
  - We used open mowed grass field between orchard plots to directly observe BMSB nymph's walking.
  - In this study, we observed 3rd and 5th instars over 30 min for each individual.
  - Observations were made throughout different times of day, so that we can have varying abiotic conditions (e.g., temperature) in the data sets.
  - We marked their positions every 5 min to measure BMSB walking paths and distances at the end of observations.

- Under field conditions 5th instar nymphs moved further at higher temperatures
    - Here is the result where each individual's walking distance is plotted across temperatures measured throughout the day.
    - First of all, 5th instars moved on average 230 cm over 30 min and this was nearly twice greater than the distance moved by 3rd. Second, there was a significant temperature effect on the walking distance. Under 25°C of ground temperature, shorter bouts of movement were dominant, whereas individuals showed longer walking distances, e.g., >3 m above 25°C. It was also observed that some individuals seemed to try to escape from direct sunlight by moving close to the ground surface under shade created by upright grass, especially when the temperature exceeded 40°C.
- Mark-release-recapture study 5m
    - Another field experiment was a mark-release-recapture study. We set up these pyramid traps as recapture stations and they were baited with #10mg + MDT as an olfactory attractant
- Mark-release-recapture study 20m
    - Then, we released color-marked 4th and 5th instars from the center of the pyramid trap circle.
    - The distances between the insect release point and traps were established at 5 m and 20 m.
    - Then, we checked the all the traps every hour for 12 hours, starting at 30 min after sunrise.
- Recapture rates
    - In this mark-release-recapture study, first of all recapture rates were quite high in both 5 m and 20 m distance settings. Therefore, this study system, where we used the baited pyramid traps, is valid and useful to study BMSB nymph dispersals in the field.
- At 5m peak recapture after 3 hours
    - Both 4th and 5th instars first arrived at the traps within two hours after release, then they picked between 3 and 4 hours.
- At 20m peak recapture after 7 hours
    - In this longer distance setting, as expected, it took longer for BMSB to get to the traps but still they were able to move to the traps within 4 or 5 hours after the release.
    - Therefore, these data sets confirm again the strong walking capacity of BMSB nymphs in the field and also their strong response to the olfactory attractant baited on the traps.
    - During the mark release and recapture study, we also caught a significant number of nymphs, 2nd through 5th, from the wild populations present in/around the experimental plot.

- In the experimental plot, the nearest distance from the traps to woodlots was about 20 m and over the course of the study, we saw many wild BMSB nymphs getting to the traps.
- This strongly supports that BMSB nymphs have strong walking capacity to actively disperse to the olfactory attractant even by leaving their current wild host plants and waking through an open grassy fields where there would be virtually no food resource available.
- These data sets strongly support that BMSB nymphs can successfully disperse between crops by walking substantial distance with strong walking capacity.

- Nymphal host choice
  - Establish the dispersal capacity of BMSB nymphal stages, and how the phenological stage of host plants affects their host selection.
- Field Set-Up
  - To assess nymphal dispersal and host choice, a mark-release-recapture experiment was used to examine movement from a center host plant to four other representative host plants at progressive phenological stages. We evaluated nymphal dispersal among four host plants; bell pepper, Swiss chard, soybean, and sweet corn. Experimental plots consisted of 3 m x 3 m plantings broken into 4 - 1 m^2 subplots planted to one of the four host plant species with a fifth host plant positioned in the center as a release point. Host plant species were arranged in a random Latin square design within each main plot with four replications for a total of 16 plots.
- Mark-release-recapture
  - Nymphs were marked with oil-based paint pens, with each plot receiving a unique color combination.
  - The marked nymphs were then placed on one of the center host plants and covered with a fine mesh bag to confine the nymphs to the plant.
  - The nymphs remained on the center plant for 2 days in order to acclimate to the conditions.
  - After 2 days, the plants with the nymphs were placed in the center of each of the 16 plots and the mesh bags were carefully removed, allowing the nymphs to either remain on the plants or disperse to the surrounding plants.
  - Plots were monitored 1, 3, and 5 days after each release with the number and stage of nymphs within each plot recorded.
  - Releases of marked nymphs were made six times over the course of the 2013 growing season.

Discussion Period – Crops at Risk

Summary:

- Northeast, Southeast, Midwest, West Coast
  - Almonds, avocados, pistachio, asparagus, Sudan grass, sorghum, citrus, sunflower, hops, endive, pomegranate, tobacco, marijuana, dates, lentils, rice, buckwheat, kumquat, tomatillo, buckhorn, currants, figs, walnuts, pearl millet, Swiss chard, popcorn, and persimmon.

Comparison of alternative trap designs for stink bugs in sweet corn & apples in Ohio

Presented by: Celeste Welty
Co-author: Jim Jasinski
Ohio State University

Summary:

- Traps for BMSB
  - Still important in 'fringe' States!
  - Lure now worked out by USDA
  - But what about trap type?
    - Black pyramid is standard in fruit (but we do not like using them!)
    - Clear standard in vegetable crops
- Field trials 2013
  - 4 weeks in August
  - Trap types not replicated - 13 traps in corn -9 traps in apples
  - Locations shifted once per week
  - Data taken 3 times per week
  - All with ARS#20 + MDT lures
  - Corn: 2 weeks in 1 early field, then 2 weeks in adjacent later field
- Conclusions
  - PVC pipe topped with Dead Inn performed well
  - Netting increases catch (100), especially with nymphs (over 800)
  - Color (black vs. yellow) not critical

BMSB on Specialty Cut Flowers and Herbaceous Perennials

Presented by: Stanton Gill
Co-author: Karen Rane, Debby Smith-Fiola, Suzanne Klick, Ginny Rosenkranz, Chuck Schuster
University of Maryland Extension
Extension Specialist, IPM and Entomology for Nurseries and Greenhouses

Summary:

- Purpose of this project
  - 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 diseases transmitted to the plants
- Herbaceous Perennial Operations monitored in 2013
  - Grasshopper Nursery, Knoxville, MD (Washington county) – hot bed of BMSB activity – Scouted by Debby Smith-Fiola
  - Glade Nursery, Walkersville, MD (Washington County) – Scouted by Debby Smith-Fiola
  - North Creek Nursery, PA – scouted by Brian Kunkel
  - Holly Hill Nursery, Earlsville, MD – Scouted by Brian Kunkel
  - Marshall River Bank Nursery, Salisbury, MD – scouted by Ginny Rosenkranz
- Size of the Herbaceous Perennial Industry
  - 326 wholesale listed growers in the Perennial Plant Growers Association
  - Perennial Industry Grosses $820,000,000 per year (2012 figure)
  - Average size operation is 10 acres for something over 3000 acres.
  - Source: Steven Stills, Ohio State University of Exe Secretary of PPA
- Specialty Cut Flower Industry
  - The Association of Specialty Cut Flower Growers (ASCFG) has 514 active growers in 36 states. Fifty six cut flower growers in Maryland
  - Field acreage
  - 48 Under half acre
  - 150 ½ t0 3 acres
  - 74 3 to 10 acres
  - 21 10 to 50 acres
  - 17 50+ acres
  - Source: Judy Lauschman, Executive Secretary ASCFG
- Farmhouse Flowers and Plants - Flowers chosen based on previous year's reports from growers of BMSB activity on cut flowers
  - Started monitoring on June 12, 2013 and continued through October of 2013
  - **Crops monitored**:
  - Zinnias (examined 3 different planting dates)

    - Amaranthus (Orange and Red flowering varieties)
    - Gladiolus
    - Sunflowers (examined 4 different planting dates)
    - Dahlias (Karma series)
    - Celosia (examined two different planting dates)
    - Hydrangea (Limelight variety)
  - 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
  - Used three people each time for timed examination of 50 plants
  - Zinnias and Amaranthus
    - Survey of cut flower growers at field days in 2011 and in 2012 revealed most frequent plants that they find BMSB feeding on is zinnias and amaranth.
    - Amaranth before bloom time was covered with Disonycha glabrata - Pigweed Flea Beetle
    - Amaranth before bloom BMSB did not feed on the stems or leaves but nymphs and adults were all over the plant when in flower and seed production.
    - Orange flower was preferred by BMSB when in flower; Red fed on by BMSB but not as preferred as orange flowers
    - No measureable damage detected in Amaranth blooms; grower brushed off insects and sold stems
  - BMSB on Smartweed – August 26, 2013
    - We found egg masses on some cut flowers, but not the number that correlated to the number of BMSB being found
  - BMSB on wheat celosia flower little activity until blooms started to form
  - Procut sunflower planting block - 4 sequenced planting blocks examined from June until October
    - Stink bugs like to feed on unopened sunflower buds
    - Feeding on leaves and stems but no damaged detected
    - Cut flower growers harvest the flowers when one or two petals separate from the disk. This prevents cucumber beetles from feeding on the petal rays.
    - They place the sunflowers in the barn or cooler and let them open.
    - Little chance of BMSB injury to flower heads with the system used by most growers
- Zinnias - Adults do feed on flower parts, stems and leaves. We had some egg-laying on foliage.
  - 2nd and 3rd instars reached a peak on zinnias on August 14, 2013
  - No damage noted on flowers or leaves
  - No diseases were found associated with the feeding sites
  - Peak adult BSMS on Sept 3, 2013 on zinnias. Again no major damage detected.

- In August, a greenhouse cut flower grower had BMSB feeding on snapdragons in his greenhouse damaging flowers
- We found egg masses laid on Zinnias, Sunflowers, Hydrangea & Smartweed
- We recorded predators in the cut flowers - Praying mantis & Assassin bugs
- Florida predacious stinkbug, ***Euthyrhynchus floridanus* - Peak activity in** – Late June to mid August 2013
- Egg masses found on hydrangea early in July
- BMSB on Dahlias peaked in July and August
- BMSB on gladiolus
    - Injury detected on leaves and flower buds. Flowers opened normal.
    - Sample taken to Karen Rane lab – negative for any disease transmission
- Grasshopper Perennial Nursery
    - Grasshopper Perennial Nursery (GPN), a small wholesale/retail operation near Sharpsburg, MD. GPN both propagates and grows perennial liner plants for use in its landscape division, as well as for direct sale. GPN grows 4,000 perennials (~300 varieties)
    - In the spring of 2013 overwintering BMSBs were found by the hundreds between pots, bags of soil mix, between stacked pavers.
    - Perennial plants were monitored weekly in 2013 from the **first week of May through mid June, and then bi-weekly until frost (mid October).**
    - Each cultivar of perennial plant was monitored for BMSB for a total of 2 – 5 minutes each. Five to ten individual plants were inspected visually for BMSBs on foliage and stems, and then the pot lifted up to inspect for egg masses and bugs on the undersides of leaves.
    - All sightings of BMSBs were recorded for each plant, including life stage, time of day, weather conditions, feeding/non-feeding, specific location on plant (leaf/stem/flowers/seed) and the percent damage. In addition, any beneficial insects noticed were also recorded.
- Trap counts form May 16 to October 15 2013
    - <u>Trap Counts</u>. The numbers of BMSBs in and around the nursery site were high the entire monitoring season - A total of 3,685 BMSBs were counted - 1,327 adults - 2,358 immatures
- Grasshopper nursery – Perennials that BMSB was found feeding on:
    - Caryopteris 'Dark Knight, Centranthus ruber (Jupiter's beard – native to med area, Cleome, Helenium 'Rotgold', Hibiscus moschetos, Hibiscus, Lobelia, Persicaria, Sedum 'Autumn Joy', Solidago 'Rigida Sun', Stokesia, Verbena tenuisecta, Veronica 'Sunny Border Blue', Monarda 'Marshall's Delight' (Bee balm)) , Phlox 'Franz Schubert
- BMSB Egg masses laid on - Persicaria (knotweed family), Stokesia, Veronica 'Sunny Border'

- <u>Egg masses</u> – only 4 egg masses were found on perennial plants (Althea, Veronica, and Persicaria) at GPN in 2013. The first egg mass was found on July 12. Low counts found on plants
- BMSB Feeding on foliage
    - **<u>Feeding on foliage</u> (7 different plant species)**
    - Lychnis 'Maltese Cross' (total 1)
    - (1 Adult; 5/30)
    - Caryopteris 'Dark Knight' (Blue mist shrub) - (total 8)
    - (1 adult; 6/14),(1- 3$^{rd\ N}$, 6/20),(1- 4th N; 7/12),(2- 2nd +3rd; 8/8),(2: 2nd N+5th N; 8/22), 1-5th feeding on foliage, 9/5)
    - *Polemonium viscosum* 'Blue whirl' (Jacob's-Ladder)(total 1)
    - (1 adult; 6/20)
    - Veronica 'Sunny Border Blue' (total 8)
    - (1- 3rd N; 7/12), (7- 1st N, hatching from EM; 7/25)
    - *Althea lasiocarpus* (= *Hibiscus moscheutos* subsp. *lasiocarpos,* Hairy rose mallow) (total 9)
    - (5 newly hatched 1st instars from EM; 7/12)(1 adult, 9/5)(3 adults, 9/20)
    - Monarda 'Marshall's Delight' (Bee balm) (total 3)
    - (2: 1-2$^{nd\ N}$ and 1-3rd N, 7/25)
    - Phlox 'Franz Schubert' – (total 1)
    - 1 adult, 9/20
- <u>BMSB FEEDING</u> –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. The following perennial plant species/cultivars were documented with active BMSB feeding:
- <u>BMSB Feeding on flowers/flower buds</u> (11 different perennials species)
    - Stokesia 'Klaus Jelitto' (Stoke's Aster) - (total 8)
    - (7 adults & 1- 2nd on flower bud about to open)
    - Eupaporium coelestinum (Mist flower) –(total 1)
    - 1-5thN; 7/25- feeding at base of flower
    - Coreopsis 'Zagreb' – (total 1)
    - (1-4th N feeding beneath flower/base 8/8)
    - Verbena tenuisecta (moss verbena)- (total 1)
    - 1 adult feeding at base of flower cluster 8/8
    - *Hibiscus macheatos* (Dwarf rose mallow)- (total 9)
    - 5: 1 A; 2- 3rd Ns, 1- 4th N, 1-5th N; 8/22) (1-2nd N; 7/25),(3 adults, 9/20)
    - *Althea lasiocarpus* (= *Hibiscus moscheutos* subsp. *Lasiocarpos,* Hairy rose mallow) (total 3)
    - 1-adult at base of flower+ 2-5th N on buds, 9/5)
    - Echinacea 'Big Sky Sundown'-(Purple Coneflower) – (total 1)

- 1 A feeding on base of flower, 9/5
- Aster novae-angliae ‘Purple Dome’ (Dwarf New England Aster) (total 1)
- 1 adult feeding on yellow center ray, 9/20
- Shasta Daisy ‘silver princess’ – (total 1)
- 1 adult on flower, 9/20
- Chrysanthemum ‘Pink Sheffield’ (total 1)

- No feeding injury found on any of the perennials
  - BMSB will lay eggs on herbaceous perennials which do not appear to be preferred host site
  - BMSB Egg masses laid on - Persicaria (knotweed family), Stokesia, Veronica ‘Sunny Border’
  - They will feed on stems, leaves, flowers and seed pods but do not do any major damage.
- Conclusion
  - BMSB feeds on sunflowers, amaranth, celosia, dahlias, hydrangea but no significant damage or economic impact to growers. There is a level of damage to snapdragons and gladiolus from BMSB feeding.
  - BMSBs were quite active at Grasshopper Perennial Nursery during the 2013 season, but did not cause aesthetic nor economic damage to perennials. The top preferred perennial species that were both fed upon and visited by BMSB at GPN were Althea lasiocarpus, Caryopteris, Veronica, and Hibiscus.

Efficacy of Organic Insecticides for Control of BMSB on Pepper

Presented by: Galen P. Dively
Co-author: Terry Patton, Peter Coffey and Jesse Ditillo
Department of Entomology
University of Maryland

Summary:

- Only effective against nymphs and relatively poor control of adults.
- <u>Most effective available insecticides (% control):</u>
  - Azera alone (74-84%)
  - Azera + M-Pede (65-90%)
  - Entrust (68-89%)
  - Entrust + M-Pede (68-92%)
  - PyGanic (58-79%)
- F-2994 product (Veratran D, sabadilla alkaloids, MGK Co.) looks promising and further refinement should increase its efficacy against nymphs and adults.
- Control will be expensive, given that two or three applications of product mixtures may be needed.
  - The best level of control still yielded 40% injury in pepper.

- Very, very short residual activity from organic materials
- Overall, some materials effective against nymphs, but all poor against adults

- Bacterial symbionts of the invasive brown marmorated stink bug, Halyomorpha halys
  - Two taxa of bacterial symbionts detected from BMSB culture by 16S rDNA:
    - Wolbachia
    - Pantoea agglomerans
  - Detected in:
    - 4th crypt-bearing region of midgut (verified by FISH)
    - Salivary glands
    - Surface of egg mass (PCR)
  - Pantoea is deposited on surface of eggs; Wolbachia through transovarial transmission
  - Pantoea agglomerans has potential to cause rot disease in plants, but many strains occur.
- We plan to:
  - Identify the strain in BMSB and compare with the strain in host plants.
  - Examine effects of high temperatures (C. Taylor).
  - Test adjuvant, competitive replacement products, and antibiotics for suppression (C. Taylor)
- Future suppression of BMSB populations or injury may be possible by manipulating the symbionts.

Overview of the South African Stink Bug Problem as Well as Possible Solutions

Presented by: Schalk Schoeman
South Africa

Summary:

- Introduction
  - First macadamias in South Africa 1935
  - Initial research on macadamia pests ± 1980 – Nezara viridula
  - Comprehensive research 1987 - 9 new species of stink bugs
  - Bathycoelia natalicola and Pseudotheraptus wayi major pests
  - First symptoms of P. wayi on avocado 1987
  - Damage quickly escalated since then mainly because of increases in production volumes of avocado
  - Avocado and macadamia direct crop losses ± US$ 5 – 6 million/annum
  - First records of P. wayi on litchis 2009
  - Magnitude of damage on litchis, guavas and mangoes currently poorly studied
- Control methods
  - Initally Aldicarb and endosulfan was registered

    - Currently we have a range of synthetic pyrethroids, Thiamethoxam & Pymetrozine + 2 diamide products
    - 4 – 6 sprays/ season for macadamias
    - No classical biological control
    - Tachinids Trichopoda pennipes & T. giacomelii were introduced no significant improvement in control
- Problem description (Macadamias)
    - Environmental concern regarding overuse of pesticides
    - Resistance of lesser important pests (Tortricid moths & Citrus thrips)
    - Monitoring very difficult to do (use Dichlorvos EC 100g/L as a knockdown) – results are erratic
    - Bugs occur at a very low densities (range 0 – 7.7 bugs/tree/week average = 1.75)
    - Most growers spray on a prophylactic basis
    - Processors have a very low tolerance for damage (typically less than 2%)
    - Macadamia are very tall & vigorous growing trees –making physical spraying rather difficult
    - We have a burgeoning amount of small holder farmers who cannot control these
- Problem description (Avocados)
    - Complex of bugs occurring on this crop is not sorted out
    - Until recently damage symptoms of coconut bug was mistaken for fruit fly damage.
    - Fruit become more susceptible towards the end of the production season – limits the use of chemicals
    - Field weathered residues of synthetic pyrethroids only control the bugs for a very short time
    - Bugs migrate into orchards unabated after residue levels had worn off.
    - Limited range of chemicals
    - Very difficult to monitor, no pheromones
    - Very wide host range – indigenous hosts largely not quantified
    - Damage heterogeneously distributed in various production regions
    - Low density feeder
- Aspects that were previously investigated on macadamias
    - Effect of tree density on stink bug damage
    - Quantification of cultivar susceptibility/tolerance
    - Quantification of compensation for early season damage
    - Advantages of monitoring based spraying vs. fixed interval spraying
    - Damage studies (characterization and seasonality)
- Aspects that were previously investigated on avocados
    - Damage characterization of P. wayi damage
    - Relative seasonal abundance of Heteroptera damage symptoms
    - Quantification of link between fruit phenology and susceptibility to P. wayi.
    - Effect of field weathered residues of synthetic pyrethroids on Heteropterans
- Aspects that are currently being investigated (Stink bugs)

- On-going population survey (± 4 years)
- Website for the Nelspruit region with weekly updates and recommendations.
- Immigration patterns (attract and kill technology early in the season or perimeter sprays to reduce chemical usage)
- Vertical distribution of heteropterous and lepidopterous pests (optimise spray operations)
- Investigate the use of refugia to optimise the biological control component
- Basic decision support for farmers regarding economics of spraying
- Pheromones & chemical communication

- Conclusion
    - No control program can function independently
    - Must integrate programme with control options for Lepidoptera and Thysanoptera complexes
    - Must also integrate macadamias with other subtropical crops (avocados, mangos and litchis)
    - Such a programme will have to be based on sound ecological principles otherwise it will not be successful

BMSB Damage to Apples at Different Growth Stages

Presented by: Amanda Bakken
Co-author: Jim Walgenbach
North Carolina State University

Summary:

- H. halys is an occasional pest of tree fruit
- Past cage experiments have demonstrated that H. halys can cause damage to developing fruit during mid and late season growth periods
- Feeding at shuck split/petal fall in peaches and apples caused fruit abscission
- Feeding damage can occur throughout the growing season
- Studies have not been conducted to illustrate how damage size progresses throughout the growing season
- Objectives
    - Determine width and depth of injury over time
    - Determine width and depth of injury occurring in different locations on the fruit
    - Determine distribution of puncture marks for each introduction period
- Materials and Methods
    - To determine stink bug damage appearance, nylon mesh exclusion cages (25'' circumference, 27'' height) were fitted around cylindrical deer fencing (19'' circumference) which contained a 6'' wooden dowel
    - Cages were placed on the terminal ends of fruit bearing branches
    - Seven different apple varieties
    - Two adult *H. halys* were placed in each treatment at three week intervals for a 48 hour period

- At harvest all apples were removed and separated into their respective introduction period bags
  - Fruit was stored in 35-40°F cooler to await processing
  - Number of intact and aborted fruit was recorded for each introduction period
  - Amount of feeding marks were recorded by feeding locations; shoulder, middle and ventral
  - Feeding damage was assessed first by a superficial examination of the fruit, then by peeling and cutting each fruit
  - Each feeding mark was measured
  - Control cages were treated identically
  - Apples were measured for both height and width, then each feeding mark was measured for width and depth of damage
  - Mid season feeding damage on a Ginger Gold; notice the brown necrotic tissue and surface depression
- Conclusions
  - Type of damage appearance did not change during the course of the growing season
  - Injury inflicted early in the season tends to be larger in both puncture width and puncture depth than later in the season
  - Damage is more prevalent and severe in the middle portion of the fruit
  - There was no significant difference between introduction periods for amount of aborted fruit

Emergence of Adult Brown Marmorated Stink Bug from Overwintering Shelters

Presented by: Chris Bergh
Co-author: Tracy Leskey
Associate Professor of Entomology
Alson H. Smith-AREC/Virginia Tech

Summary:

- A return to sustainable crop protection programs in fruit orchards vulnerable to BMSB will require applied and basic research on monitoring and management tactics
- When do BMSB emerge from overwintering sites?
  - (presence, risk to crops, intervention timing)
- Do captures in traps reflect emergence?
  - (optimize traps as decision tool)
  - Shelters placed individually in square, screened cages
  - One cage with top on, other with top removed
  - Cages placed in apple crates with metal screen insert
  - Deployed in pairs in protective domes at six woodland sites in mid-February

    - Temperature/humidity sensors placed inside one shelter and suspended beneath one plastic dome
    - Shelters encircled by 8 alternating baited and un-baited traps
- Captures in traps and number of bugs emerged from shelters in closed cages recorded weekly, then twice weekly thro' early July
- Largest number of BMSB emerged in late May/early June with an earlier smaller peak of emergence in early –mid April
- Emergence of BMSB from shelters in closed cages and captures in pyramid traps
    - 97.6% of captures (n = 290) were in baited traps
    - Pyramid traps did not capture any of the marked bugs emerging from the overwinter shelters, but did capture overwintering populations

A Comparison of Two BMSB Sampling Techniques in Peaches & Nectarines

Presented by: George Hamilton
Co-authors: John Cambridge, Noel Hahn, April Heliothis, Alex Kaufman, Thomas Pike, & Martha Wilkinson
Department of Entomology
Rutgers University

Summary:

- The BMSB Invasion -- Introduced in the mid-1990's; Now established or detected in over 40 states and the District of Columbia; Established in Canada; Detected and/or established in Europe; APHIS Florida find in flowers shipped from Columbia
- Impact of Invasion -- 2009/10 explosion in the mid-Atlantic US; Damage to field, nursery, tree fruit and vegetable crops; Increased pyrethroid use; Secondary pest outbreaks; Need for effective monitoring techniques
- Study Design -- Cream Ridge Fruit Research Station; Mixed block of peaches and nectarines; Sampled once a week during the growing season in 2011 and 2012; 1.5 minute visual samples, 5 beats per tree
- Conclusions and Next Steps -- Beat sheets worked best in early season; A significant relationship between beat samples and visual counts was found; The models developed need further refinement; Determine if the data can be combined

Identification of Aggregation Pheromone of Brown Marmorated Stink Bug

Presented by: Ashot Khrimian
Co-authors: Aijun Zhang, Donald C. Weber, Hsiao-Yung Ho, Jeffrey R. Aldrich, Karl E. Vermillion, Maxime A. Siegler, Shyam Shirali, Filadelfo Guzman, and Tracy C. Leskey
USDA-ARS
Beltsville Maryland

Summary:

- Natural occurrence of 1,10-bisaboladien-3-ols and 10,11-epoxy-1-bisabolen-3-ols
    - Representative 1,10-bisaboladien-3-ol (a.k.a. zingiberenol) was isolated from ginger, *Zingiber officinale*
    - 1,10-Bisaboladien-3-ols were identified as rice stalk sting bug, *Tibaca limbativebtris*, pheromone
    - 10,11-Epoxy-1-bisabolen-3-ol (called murgantiol) was identified as aggregation pheromone of harlequin bug, *Murgantia histrionica*
    - Male brown marmorated stink bug, *Halyomorpha halys*, produce 10,11-epoxy-1-bisabolenols
    - In all four studies, *absolute configurations* and *field attractiveness of pheromones have not been demonstrated*
- Two stereoisomers from one reaction
- X-Ray (Cu *K*α) structure determination of intermediate triol
    - Displacement ellipsoid plot of crystalline RSRS triol
- Synthesis of individual stereoisomers of 10,11-epoxy-1-bisabolen-3-ol
- (3*S*,6*S*,7*R*,10*S*)-10,11-epoxy-1-bisabolen-3-ol, main component of brown marmorated stink bug aggregation pheromone
- Synthetic work: Summary
    - We synthesized and streochemically characterized <u>previously unknown</u>:
        - All 8 possible stereoisomers of 1,10-bisaboladien-3-ol
        - All 16 possible 1-bisabolen-3,10,11-triols
        - All 16 possible 10,11-epoxy-1-bisabolen-3-ols
- BMSB main pheromone component (A) identified!
- BMSB minor pheromone component (B) identified!
- Brown Marmorated Stink Bug Pheromone Identification: Summary
    - Main component of BMSB aggregation pheromone (A) has been identified as (3*S*,6*S*,7*R*,10*S*)-10,11-epoxy-1-bisabolen-3-ol
    - Minor component of BMSB aggregation pheromone (B) has been identified as (3*R*,6*S*,7*R*,10*S*)-10,11-epoxy-1-bisabolen-3-ol
    - Availability of all 16 stereoisomers and combination of two chiral columns streamlined the assignments and bioassay confirmed the identification.
- H. halys captures in pyramid traps with pheromone components

- Trapping H. halys with mixed-isomer lures

Synergy of Aggregation Pheromone with MDT in Trapping of Brown Marmorated Stink Bug

Presented by: Don Weber
Co-authors: Ashot Khrimian, Tracy C. Leskey and Guillermo Cabrera Walsh
USDA-ARS
Beltsville Maryland

Summary:

- Plautia stali Brown-winged green stink bug
    - Aggregation pheromone is methyl (*E*, *E*, *Z*) -2, 4, 6-decatrienoate (MDT); produced by male and attractive to both males and females MDT attracts other insects which do not produce it! Halyomorpha halys Glaucias subpunctatus Chinavia hilare + several tachinid species
- MDT attracts other pentatomids which do not produce it. This cross-attraction is not uncommon and includes other stink bug species; *why?*
    - food signal for polyphagous species
    - overwintering site signal
    - promotes aggregation which passively protects them from natural enemies
- Asian native responsive to MDT
    - but in most years, almost exclusively late in the season
    - or, during outbreak years (axis is 60 vs. 10 to 30 in subsequent years)
    - and occasionally in the early season
    - <u>but</u> usually only after harvest of apple crop, in late season
- Trapped BMSB with BMSB pheromone + MDT synergist and showed significantly higher captures than with either pheromone alone. Showed synergistic effect rather than just additive.
- Found no difference in attraction by instar or by sex of adults in response to combined lure.
- Harlequin bug also attracted to BMSB pheromone but not to MDT
- Need to fine tune the ratio of the components and adjust doses for maximizing capture
- Challenges to understanding and application of pentatomid semiochemicals – big picture
    - Knowledge of biology << knowledge of chemistry
    - Pheromone may have multiple functions depending on...
    - Other senses involved: visual and especially short-range substrate-borne vibrational
    - Species are polyphagous and highly mobile; need to consider wild hosts and entire [agro]ecosystems
    - Additional attractants: other species' semiochemicals and also various phytochemicals
    - Natural enemies respond to pheromones

    - Making pest suppression work: general challenges with managing trap-cropping or mass trapping
- Next steps with BMSB pheromone research
    - Individual isomers: determine optimal ratios (how much increased dose compensates for off-ratios)
    - Combined lures: determine optimal doses and ratio of MDT to pheromone
    - Trap design, including toxin-free models
    - Making pest suppression work: implement trap-cropping and/or mass trapping, while protecting natural enemies and other non-targets

Discussion Period – Factors Affecting Population Dynamics

Summary:

- Should look at historical data for relationship with rain/storms at the end of the season impacting numbers of overwintering
- Impact of late season cool versus warm weather affecting numbers going to overwintering
- Mild winter may permit overwintered adults to maintain higher metabolism and run out of stored resources
- Impact of very hot days on survivorship of gut symbionts and ability to pick up gut symbionts
- Impact of predators and look at phenology of predators in conjunction with BMSB
- Start evaluating reasons why BMSB is not present in areas in which it could be
- Is it cyclical?
- Generate life table. Start with single colony of BMSB and distribute across country and to different areas and follow development and all future survivorship.

Targeting BMSB via Organic Tactics: Trap Cropping and Compost Tea

Presented by: Clarissa Mathews[1,2]
Co-authors: M.H. Hallack[2]
[1]Institute of Environmental and Physical Sciences
Shepherd University, Shepherdstown, WV
[2]Redbud Farm, LLC, Inwood, WV

Summary:

- Evaluate ability of sunflower and BMSB pheromone/MDT in Rescue trap to act as a combo trap crop to pull bugs from protected crops. Compared with sunflower crop with no bait

- Colonization of cash crop occurred two weeks later in plots with baited traps and sunflower border than those without baited traps
- Low levels of injury even in controls in 2013.
- Eggs treated with compost tea within 24h of oviposition had a lower hatch rate than untreated. No difference in 2-3 day old eggs

Fate of BMSB Sentinel Eggs in NC Agroecosystems

Presented by: Jim Walgenbach
Co-author: Rachel Suits, and Amanda Bakken
Department of Entomology
NC State University
Mtn Hort Crops Res & Ext Ctr
Mills River, NC

Summary:

- Evaluated predation and parasitism on fresh, frozen sentinel egg masses and natural egg masses
- Sources of Variation -- Type of egg mass; Sentinel Fresh; Sentinel Frozen; Natural
    - Habitats -- Organic and conventional vegetables, Organic and conventional apples, Woodlands (native eggs)
- Sentinel egg masses (frozen or healthy) had comparable levels of predation and parasitism as naturally laid eggs.
- Impact of parasites in agricultural settings may be underestimated due to low rates of parasite development in BMSB eggs.
- Predation was generally higher in organic vs. conventional agriculture, but overall rates were low in both systems ($\leq$10%).
- *Telenomus podisi* was the most common parasite of BMSB encountered in agriculture settings, but *Anastatus reduvii* may be more effective against BMSB.
- No observed difference in field weed border between sentinels and natural for predation
- No difference in fresh and frozen sentinel egg masses in crops
- Majority of eggs that were prey upon were from chewing predators. Very few parasitoids observed. Organic systems had a greater level of chewing predation than in conventional systems.
- Level of predation increased over time with peaks from mid-August to mid September
- Had higher percentage of parasitism in wooded habitats than in crops

Brown Marmorated Stink Bug Development and Survival on Single and Mixed Diets of Selected Fruit Trees and Wild Hosts

Presented by: Angelita Acebes-Doria
Co-author: Tracy C. Leskey and J. Christopher Bergh
Virginia Tech
USDA-ARS-AFRS

Summary:

- Mixed diets proved to be optimal for nymphal survivorship and development
- Combining 2 sub-optimal single diets (apple & ToH) resulted in increased survivorship
- Nymphs reared on mixed diets and ToH resulted into bigger and larger adults
- Peach appeared to be the most suitable single host for BMSB development among the host plants tested
- Apple and catalpa were found to be least suitable as single diets
- Tree of heaven showed higher suitability toward the latter part of the growing season
- Evaluated impact of single and mixed diets on adult emergence, survivorship, body size, development of BMSB
- Peach alone and the mixed diets yielded high percent adult emergence
- High survivorship on single diets of tree of heaven, peach and mixed diets
- Mixed diets yielded higher weights and larger pronotal widths

Bugs and BISON: How Can the Biodiversity Information Serving Our Nation Project Help BMSB-NEIPM?

Presented by: Annie Simpson
U.S. Geological Survey, Core Science Analytics and Synthesis (CSAS) Program
Core Science Systems (CSS) Mission Area

Summary:

- Developed by the U.S. Geological Survey
  - Core Science Analytics and Synthesis (CSAS) Program (Core Science Systems Mission Area)
  - A species occurrence data aggregator providing 110+M species occurrence records for the U.S. and Territories including:
    - Various taxonomic groups (animals, plants, fungi)
    - Terrestrial and aquatic species
    - Various data types: observation-based data, natural history collections (specimen-based) data, and literature-based data
    - Federal and non-federal data
- BISON Goals
  - Increase Data Access, Exposure,
  - Discoverability, and Quality

    - Data Mobilization through integration and application of standards, open data technologies, machine readable access
- BISON is an information system that allows users to access, explore and download U.S. species occurrence data
- How can BISON help members of the BMSB-NEIPM working group?
    - "Submit-a-dataset"
    - Search for host species occurrences
    - Post BISON API search results on your Web pages
    - Use BISON data or visualizations in your publications
- Site allows users to submit data for storage and analysis, search for species occurrences, post results from BISON on web pages or in publications
- Currently has a list of over 300,000 taxonomic

What We Learned in 2013 and Revised Grower Survey

Presented by: Carrie Koplinka-Loehr
Northeastern IPM Center

Summary:

- Provided survey to group about how to present information to growers and how to present BMSB for identification
- Details about website activities and general traffic of visitors
- More training and investment in providing information to grower consultants, master gardeners, and extension professionals as they have more regular access to growers

BMSB Outreach 2013

Presented by: Chris Gonzales
Northeastern IPM Center

Summary:

- Tracking the Brown Marmorated Stink Bug Video Series
    - Ten-part video series:
        - www.StopBMSB.org/video
            - 15,100 views since April 2013
        - One-Minute Trailer on YouTube
- StopBMSB.org
    - We've been making lots of updates to the website.
    - 37 links to media reports in last year
    - 2 feature stories, 5 other articles
    - Over 26,000 unique visitors in year ending September 30
    - Website traffic - (Sep. 1, 2012 – Nov. 21, 2013) 44,461 unique visitors
- Host Plants Publication
    - We published a list of host plants of BMSB.

  - BMSB eats and uses for reproduction 170 species
  - View them at www.stopbmsb.org/where-is-bmsb/host-plants/

Group Discussion Period – National Coordination Efforts

Summary:

- Western BMSB Working Group needed?
- Collaboration with other IPM centers for funding to bring west coast folks to meetings.