Northeastern IPM Center

Brown Marmorated Stink Bug Project Communications Review December 2015

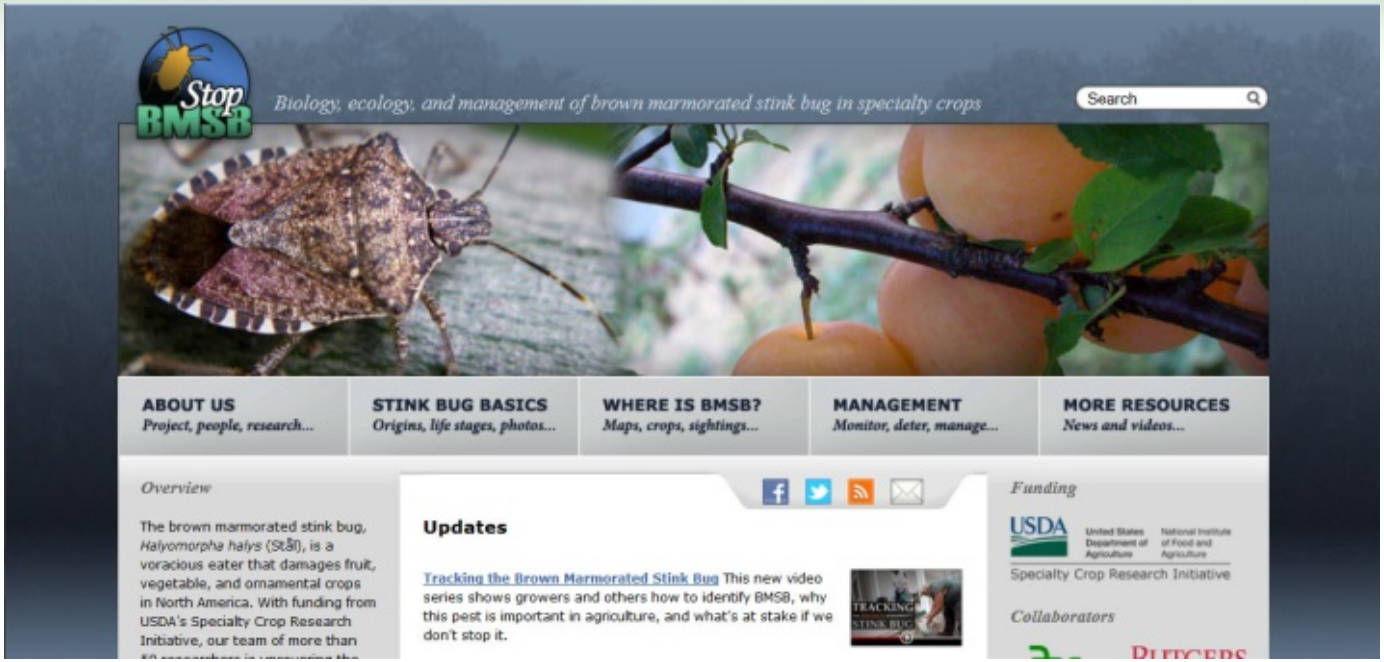
USDA United States Department of Agriculture National Institute of Food and Agriculture

Communications Overview

* Topics:
  1. Efforts of the Northeastern IPM Center
  2. Control in Homes and Businesses
  3. Damage in Vegetables
  4. National and Regional Outreach
  5. Chemical Control
  6. Integrated Pest Management for BMSB

1. Efforts of the Northeastern IPM Center

Website

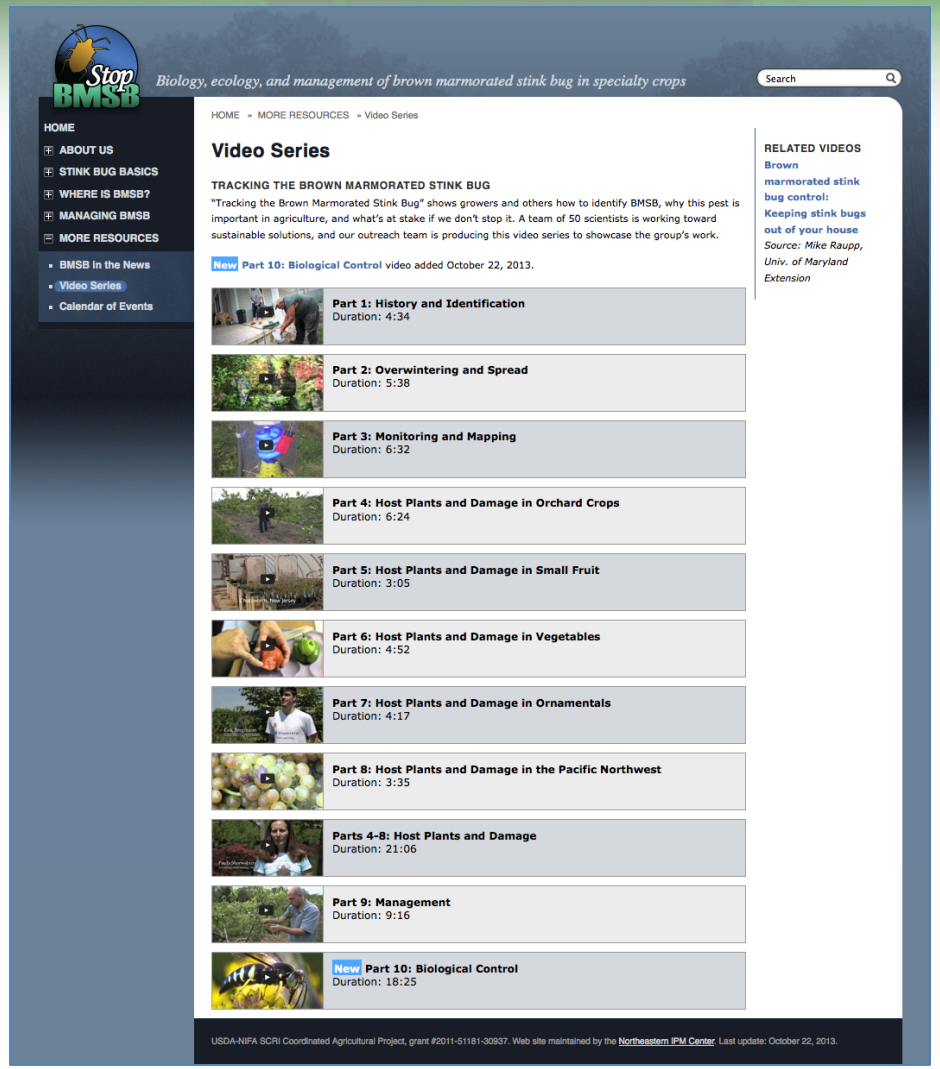


StopBMSB.org

Network

* 3,500 stakeholders on Center e-mail list
* 375 recipients on BMSB e-mail lists
* 4,600 regional addresses receive print
* Facebook: **267** likes
* Twitter: **1,911** followers / **225** retweets (past year)
* YouTube (over **27,000** views in past year, **52** subscribers)
* Flipboard (**81** viewers)

Tracking the Brown Marmorated Stink Bug Video Series



Ten-part video series:

www.StopBMSB.org/video

Our YouTube channel saw 13,855 views in past year

One-Minute Trailer on YouTube

Stink Bug in a Bottle

Cross Promotion

The IPM Practitioner
Monitoring the Field of Pest Management

IPM for the Brown Marmorated Stink Bug

By William Quarles

The brown marmorated stink bug (BMSB), *Halyomorpha halys*, is an invasive species native to China, Japan, and Korea. It was first noticed in Pennsylvania in the late 1990s and was established in Pennsylvania by 2001. Genetic analysis shows the initial U.S. introduction likely came from Beijing, China, possibly from shipping containers. Populations are growing exponentially, and it spreads by hitchhiking on shipping containers and vehicles. Adults can fly, which aids local dispersal (Hoebeke and Carter 2003; Nielsen et al. 2013; Lee et al. 2013; Xu et al. 2014).

From the original introduction, the pest has now spread in 13 years to 41 states and Canada (Lee et al. 2013; StopBMSB.org 2014). It appeared in Oregon in 2004, and has been in California since 2005. Large breeding populations have established near Los Angeles and Sacramento (Hoddle 2013; StopBMSB.org 2014; Ingels and Varela 2014).

H. halys will eat almost anything. It attacks more than 170 different plant species, and prefers to eat many of the same foods as humans, especially beans, garden vegetables, and tree fruit. It is a threat to commercial agriculture, landscape ornamentals, and backyard gardens. It is also a structural pest, as large populations invade houses, trying to overwinter (StopBMSB.org 2014; Lee et al. 2013; Inkley 2012).

More than $37 million damage was done to apples in the mid-Atlantic states in 2010. Growers reacted by a four fold increase in pesticide applications. Pesticides disrupted IPM programs and led to secondary outbreaks of mites, aphids, and scales in orchards (Leskey et al. 2012a).

The black pyramid trap, shown here, can be used to monitor brown marmorated stink bug populations. Bugs are attracted by aggregation pheromones at the top of the pyramid. *Photo courtesy B. Butler, Northeastern IPM Center, StopBMSB.org*

Most pyrethroids had limited effectiveness, as about one-third of the bugs recovered after knockdown. As a result, growers turned to endosulfan, methomyl, and neonicotinoids. Though more effective, these pesticides have environmental problems, including toxicity to bees (Leskey et al. 2012b; Funayama 2012; Quarles 2014a).

This article outlines an IPM program that will help control the brown marmorated stink bug (BMSB), while sparing beneficial insects and bees.

Why More Successful than Native Stink Bugs

We have many species of native stink bugs in the U.S. These have always been rather low level pests. The invasive *H. halys* is more successful due to lack of specific natural enemies, reproduction in large numbers, wide host range, resistance to cold weather, effective overwintering strategies, and increased survival due to global warming (Lee et al. 2013). At crop sites throughout the mid-Atlantic states, *H. halys* is now the predominant stink bug pest (Nielsen and Hamilton 2009*ab*).

Though there is some predation, our native parasitoids have not yet adapted to the pest. Reproduction is prolific, as one female can lay an average of 240 eggs per generation. *H. halys* overwinters as adults, emerging in spring to start feeding when temperatures exceed 17°C (63°F). Long daylight hours, warm temperatures, and food lead to sexual maturation

Watanabe, M., R. Arakawa, Y. Shinagawa et al. 1994. Anti-invading methods against the brown marmorated stink bug, *Halyomorpha mista*, in houses. *Japanese J. Sanit. Zool.* 45(4):311–317.
Weber, D.C., T.C. Leskey, G. Cabrera-Walsh and A. Khrimian. 2014. Synergy of aggregation pheromone with methyl (*E,E,Z*)-2,4,6-decatrienoate in attraction of *Halyomorpha halys*. *J. Econ. Entomol.* 107(3):1061–1068.
Xu, J.W., D.M. Fonseca, G.C. Hamilton et al. 2014. Tracing the origin of US brown marmorated stink bugs, *Halyomorpha halys*. *Biol. Invasions* 16(1):153–166.
Yang, Z.-Q., Y.-X. Yao, L.-F. Qiu et al. 2009. A new species of Trissolcus (Hymenoptera: Scelionidae) parasitizing eggs of *Halyomorpha halys* in China with comments on its biology. *Ann. Entomol. Soc. Am.* 102(1):39–47.
Zhang, Q.-H., R.G. Schneidmiller, D.R. Hoover et al. 2013. Essential oils as spatial repellents for the brown marmorated stink bug. *J. Appl. Entomol.* 4 Dec 2013. Online
Zhang, Q.-H., R.G. Schneidmiller, G. Zhou and D.R. Hoover. 2014a. Murgantiol as an indoor stink bug attractant. U.S. Patent No. 8,663,619, March 4, 2014.
Zhang, Q.-H., R.G. Schneidmiller, G. Zhou and D.R. Hoover. 2014b. Murgantiol as a synergistic attractant for use outdoors. U.S. Patent No. 8,663,620, March 4, 2014.

This reprint was produced in partnership between the Bio-Integral Resource Center and the Northeastern IPM Center, December 2014. USDA-NIFA SCRI Coordinated Agricultural Project, grant #2011-51181-30637.

Resources

Beauveria (Botanigard®)—Laverlam International, 117 South Parkmont, PO Box 4169, Butte, MT 59702; 406/782-2386. Fax 406/782-9912; www.laverlamint.com. BioWorks Inc., 100 Rawson Road, Suite 205, Victor, NY 14564; 800/877-9443, 585/924-4362, Fax 800/903-2377; www.bioworksinc.com

Chromobacterium (Grandevo®)—Marrone Bio Innovations, 2121 Second St., Suite B-107, Davis, CA 95618; 877/664-4476, 530/750-2800; www.marronebioinnovations.com

Indoor Light Trap—Sterling International, Inc., 3808 N. Sullivan Rd., Bldg 16, Spokane, WA 99216; 800/688-6766, 509/926-6766, Fax 509/928-7313; www.rescue.com

Metarhizium (MET52®)—Novozymes Biologicals, 77 Perry Chapel Church Rd., Franklinton, NC 27525; 919/494-3000, Fax 919/494-3450; www.novozymes.com

Neem plus pyrethrins (Azera®)—MGK Company, 8810 10th Avenue North, Minneapolis, MN 55427; 800/645-6466, 763/544-0341, Fax 763/544-6437; www.mgk.com

Pheromone Baited Black Pyramid Trap (Dead Inn™)—AgBio Inc., 9915 Raleigh St., Westminster, CO 80031; 877/268-2020, 303/469-9221, Fax 303/469-9598; agbio-inc.com

Pheromone Lures—Trécé Inc., PO Box 129, Adair, OK 74330; 866/785-1313, 918/785-3061, Fax 918/785-3063; www.trece.com

Pheromone Trap—Sterling, see above

Sweep Nets, Beat Sheets, Black Lights—BioQuip Products, 2321 Gladwick Street, Rancho Dominguez, CA 90220; 310/667-8800, Fax 310/667-8808; www.bioquip.com

Sticky Barriers (Tanglefoot®)—Contech Enterprises, 7572 Progress Way, Delta, BC, Canada V4G 1E4; 604/940-9944, Fax 604/940-9433; www.contech-inc.com

Stink Bug ID Kit

Video postcard, ID specimen, Stink Bug guide, article, factsheet, crops at risk flyer

End of section 1

2. Control in Homes and Businesses

Control in Homes and Businesses

NortheastIPM uploaded a video 2 years ago

Tracking the Brown Marmorated Stink Bug: Part 1 History and Identification

by NortheastIPM

2 years ago • 17,223 views

"Tracking the Brown Marmorated Stink Bug" shows growers and others how to identify BMSB, why this pest is important in agriculture, and what's at stake if we don't stop it. A team of 50 ...

Impact on Homes and Businesses

* For homeowners, BMSB is mainly a nuisance.
* The bug causes a lot of aggravation.
* People's tolerance of the pest is low.
* For commercial settings, such as hotels and restaurants, the bugs' presence can have economic consequences.

Prevent Bugs from Getting Inside

* Sealing and caulking
* BMSB congregate on southern and western sides of buildings

Prevent Bugs from Getting Inside

* Often the size of the building may prevent access points that are high off the ground from being treated, so screening and caulking from the interior will still be necessary.
* Timing: not too early, or chemicals degrade. Not too late, or they'll already be inside.

Control after They Get Inside

* Skip insecticide
* Head straight for vacuum
* Stocking over nozzle catches them before they enter machine

* Source: Day, E. 2014. Brown Marmorated Stink Bug. Virginia Cooperative Extension publication number 2902-1100 http://pubs.ext.vt.edu/2902/2902-1100/2902-1100.html

Control after They Get Inside

* The aluminum foil water pan trap was the most effective device for trapping BMSB in homes during the winter and spring.

* Source: Aigner, J.D., T.P. Kuhar. 2014. Using Citizen Scientists to Evaluate Light Traps for Catching Brown Marmorated Stink Bugs in Homes in Virginia. Research In Brief. J. Extension. August 2014, Volume 52, Number 4, Article # 4RIB5. Online open-access journal publication. www.joe.org.

End of section 2

3. Damage in Vegetables

Damage in Vegetables

* Peppers and tomatoes: white or yellow scars
* Sunken areas in fruit with tissue collapsing below
* In corn, aborted, collapsed, or discolored kernels
* Beans: scarred, faded, or sunken areas; deformed pods
* Okra: deformed pods

End of section 3

4. National and Regional Outreach

* Cornell University, New York
* Delaware State University, Delaware
* Oregon State University, Oregon
* Rutgers University, New Jersey
* Virginia Tech University, Virginia

Outputs by the Numbers

* Over 650 peer-reviewed publications, presentations, and workshops.

Cornell University

* BMSB present in the lower and mid-Hudson Valley in low to moderate populations, but this can change quickly and some fields may be hot spots.
* Late summer/harvest is a critical time to check fields for BMSB
* Pay close attention to field edges that are bordered by trees and/or brush/weeds.
* Highest populations are 90 feet in from field edges bordered by Tree of Heaven, Black Walnut, Catalpa, Maple, and Ash.

Cornell University

* Damage typically begins along field edges.
* Scout along edges in cool, early morning.
* Inspect fruit for damage, inspect undersides of leaves for eggs and nymphs.
* Thresholds are not established

* Source: The 'Jentsch Lab' web site (http://blogs.cornell.edu/jentsch/) produced 21 Extension and Outreach Publications

Delaware State University

* “We looked at feeding that occurs prior to and during pollination, before the kernels even begin to develop, and we found that brown marmorated stink bug **feeding injury can result in aborted kernels**. The reason we think that’s the case is because they’re actually interrupting pollination by **damaging some of the silk channels**,” said Bill Cissel of the University of Delaware Cooperative Extension.

Delaware State University

* The stink bugs are capable of causing substantial economic losses due to quality reductions at densities **as low as one bug per ear of corn.**
* "We did see some pretty high levels of kernel injury at all the growth stages that would likely result in quality reductions for sweet corn growers."

* Source: http://www.udel.edu/udaily/2016/aug/corn-stink-bugs-082515.html

Oregon State University

* BMSB found in areas of the north Willamette valley on commercial farms.
* Wine quality can be compromised due to taint.
* Two publications on identification available, including one in Spanish.
* List of products that control stink bugs, including BMSB

Source:
https://catalog.extension.oregonstate.edu/sites/catalog.extension.oregonstate.edu/files/project/pdf/em8413_0.pdf

Oregon State University

* BMSB findings have been increasing in **commercial hazelnut growing** regions in the northern Willamette Valley.
* BMSB may pose a significant **risk to nut quality**, causing corking during the latter portion of the season.
* Monitor for BMSB using commercially available **pheromone traps placed close to surrounding vegetation**.
* Alternate hosts include English holly, broadleaf maple, tree of heaven, and empress tree.
* **BMSB populations tend to build up during the latter portion of the season** and move from surrounding vegetation into orchards.

Source:
https://catalog.extension.oregonstate.edu/sites/catalog.extension.oregonstate.edu/files/project/pdf/em8413_0.pdf

Oregon State University

* Current insecticide programs in the eastern USA are based upon pyrethroid, carbamate, organophosphorus and nicotinoid insecticides. All of these insecticides are disruptive to various natural enemies and have the potential to cause secondary pest outbreaks.
* Gardeners and growers with small plots may be able to exclude BMSB with fine netting, but this is not feasible for larger farms.

Source: http://insect.pnwhandbooks.org/pnw-insect-management-handbook/emerging-pest-brown-marmorated-stink-bug

Rutgers University

* Nielsen Lab: The influence of photoperiod was investigated and based on preliminary results strongly suggests that **a long-day photoperiod cue is required for BMSB to leave overwintering sites**. Validation of the voltinism model and tests at 8 geographic locations were run. The models suggest that **photoperiod restricts populations size at certain locations**.

Rutgers University

* Hamilton Lab: Results from the diel visual sampling study suggest that **time of day does significantly impact the numbers found on trees** during sampling. Time of day also significantly impacted the movement of nymphs within and between trees.

[Rutgers University]

* Barriers to Success: The most significant barrier to success has been the **low population size of BMSB** emerging from overwintering sites. The second barrier has been the **availability of the pheromone lures** in the early season. The third barrier has been the **inability to continuously rear BMSB**.

End of section 4

5. Chemical Control

IPM for Stink Bugs

* IPM combines biological control from predators with selective chemical application for maintaining pest populations below economic threshold levels.
* Inadequate monitoring or implementation of IPM practices will lead to unsatisfactory results.

* Source: Pfeiffer, D. G. (Bulletin Coordinator since 1988), J. C. Bergh, D. L. Frank, C. R. R. Hooks, G.M. Peck, C. S. Walsh, K. S. Yoder, A. R. Biggs, J. B. Kotcon, J. F. Derr, R. S. Chandran, M. J. Weaver, A. Brown and J. Parkhurst. 2014. 2014 Spray Bulletin for Commercial Tree Fruit Growers. Va. Coop. Ext. Serv. Publ. 456-419. A regional manual for VA, WV and MD.
* https://pubs.ext.vt.edu/456/456-419/456-419-PDF.pdf

Caution with some materials

* Some materials don't effectively kill BMSB, and some should be delayed if spotted wing drosophila will be a target later, in order to comply with the seasonal maximum number of applications.
* After application of some materials, wait at least five days before placing beehives in treated fields. If flowering plants are present in the ground cover, mow before applying.

* Source: Pfeiffer, D. G., C. Johnson, K. S. Yoder and C. Bergh. 2014. Commercial Small Fruits: Disease and Insects. p. 2-1 – 2-16. In: 2014 Pest Management Guide for Horticultural and Forest Crops. Va. Coop. Ext. Pub. 456-017.

Section 18 Exemption

* While having utility against plum curculio, possibly the native stink bugs and a few others, the highest rate labeled for both products may not provide adequate protection from brown marmorated stink bug. For this reason, both products have received **a Section 18 Emergency Exemption for use in pome and stone fruit each year since 2011.**
* The Section 18 label permits their use at rates higher than those described above, specifically to manage injury from brown marmorated stink bug, but must be renewed before each growing season. Contact your Extension Specialist **to confirm whether a Section 18 label has been granted for the upcoming season** before using these products in pome fruit or before using them in peaches and nectarines at the higher rates. REI = 12 hours; PHI = 3 days.

* Source: Pfeiffer, D. G. (Bulletin Coordinator since 1988), J. C. Bergh, D. L. Frank, C. R. R. Hooks, G.M. Peck, C. S. Walsh, K. S. Yoder, A. R. Biggs, J. B. Kotcon, J. F. Derr, R. S. Chandran, M. J. Weaver, A. Brown and J. Parkhurst. 2014. 2014 Spray Bulletin for Commercial Tree Fruit Growers. Va. Coop. Ext. Serv. Publ. 456-419. A regional manual for VA, WV and MD.
* https://pubs.ext.vt.edu/456/456-419/456-419-PDF.pdf

Endosulfan (Thionex) Discontinuation

* ENDOSULFAN (THIONEX) is an organochlorine insecticide formulated as a 50W and 3EC and registered for use in apple for controlling aphids, leafhoppers, plant bugs and stink bugs.
* Due to concerns about worker health and safety and environmental effects of endosulfan use a phase-out of the product will end all uses in apple on July 31, 2015.
* Uses of Thionex primarily target brown marmorated stink bug (2 lb or 1.33 qt per acre). Do not use more than two applications during the fruiting period in apples. Seasonal maximum use per acre is 4 lb or 2.66 qt.
* Endosulfan is highly poisonous and must be used with caution. REI = 7 days, PHI = 21 days (EC), 20 days (WP), PHI = 7 days.

PHOSMET (IMIDAN) and BMSB

* PHOSMET (IMIDAN) is a broad-spectrum organophosphate insecticide formulated as a 70W powder. It is registered for use on a number of fruit pests, including codling moth, plum curculio, redbanded leafroller, oriental fruit moth, apple maggot, and others. Imidan may not be used on sweet cherries.
* While phosmet is rated as good against native stink bugs, it is **ineffective against brown marmorated sting bug**.
* REI = 96 hours, PHI = 7 days (apple, pear, tart cherry, and plum), and 14 days (peach and nectarine).

* Source: Pfeiffer, D. G. (Bulletin Coordinator since 1988), J. C. Bergh, D. L. Frank, C. R. R. Hooks, G.M. Peck, C. S. Walsh, K. S. Yoder, A. R. Biggs, J. B. Kotcon, J. F. Derr, R. S. Chandran, M. J. Weaver, A. Brown and J. Parkhurst. 2014. 2014 Spray Bulletin for Commercial Tree Fruit Growers. Va. Coop. Ext. Serv. Publ. 456-419. A regional manual for VA, WV and MD.
* https://pubs.ext.vt.edu/456/456-419/456-419-PDF.pdf

Effective products

* Since it has been a long-standing policy of tree fruit Extension Specialists to not recommend the use of pyrethroids in the post-bloom period, due to their disruptive effects on natural enemies of secondary pests, we have not included them or products containing them in most cover sprays. However, the most **effective products against BMSB** continue to include Belay (neonicotinoid), Baythroid, Danitol, Warrior II and products containing permethrin (pyrethroids), Lannate (carbamate), and the premixtures, Engido ZC and Leverage 360.
* As in recent years, **Section 18 Emergency Exemptions** were issued for the pyrethroid, bifenthrin (Bifenture and Brigade) and the neonicotinoid, dinotefuran (Venom and Scorpion). Residual effectiveness of products for BMSB may vary considerably, particularly following rain, and may not extend beyond about 3 days.
* Source: Pfeiffer, D. G. (Bulletin Coordinator since 1988), J. C. Bergh, D. L. Frank, C. R. R. Hooks, G.M. Peck, C. S. Walsh, K. S. Yoder, A. R. Biggs, J. B. Kotcon, J. F. Derr, R. S. Chandran, M. J. Weaver, A. Brown and J. Parkhurst. 2014. 2014 Spray Bulletin for Commercial Tree Fruit Growers. Va. Coop. Ext. Serv. Publ. 456-419. A regional manual for VA, WV and MD.
* https://pubs.ext.vt.edu/456/456-419/456-419-PDF.pdf

Alternate-row-middle spray applications

* As in recent years, **Section 18 Emergency Exemptions** were issued for the pyrethroid, bifenthrin (Bifenture and Brigade) and the neonicotinoid, dinotefuran (Venom and Scorpion). Residual effectiveness of products for BMSB may vary considerably, particularly following rain, and may not extend beyond about 3 days.
* For this reason, we continue to recommend the use of **alternate-row-middle spray applications** at about 7-day intervals during much of the growing season in pome and stone fruit. Peaches and nectarines are vulnerable to injury from BMSB from fruit-set onward while injury to apples is detectable from about mid-June onward. Section 18 Exemptions for use of bifenthrin and dinotefuran will again be submitted in advance of the 2015 season. Do not use bifenthrin in apples or stone fruit until notified of the Section 18 approval. Although Venom and Scorpion are registered for use in stone fruit, the highest labelled rate may not provide adequate BMSB control. The Section 18 label for these products enables their use at higher rates against BMSB in both crop groups, but these rates must not be used until notified of the Section 18 approval. BMSB researchers are actively evaluating promising tactics to manage BMSB effectively and reduce or eliminate the disruptive effects of current programs.
* Source: Pfeiffer, D. G. (Bulletin Coordinator since 1988), J. C. Bergh, D. L. Frank, C. R. R. Hooks, G.M. Peck, C. S. Walsh, K. S. Yoder, A. R. Biggs, J. B. Kotcon, J. F. Derr, R. S. Chandran, M. J. Weaver, A. Brown and J. Parkhurst. 2014. 2014 Spray Bulletin for Commercial Tree Fruit Growers. Va. Coop. Ext. Serv. Publ. 456-419. A regional manual for VA, WV and MD.
* https://pubs.ext.vt.edu/456/456-419/456-419-PDF.pdf

Sweet Corn and BMSB

* Brown marmorated stink bug pest pressure is typically highest on the edges of fields
* Insecticide sprays should be initiated at tasseling if bugs are present and repeated as needed until harvest
* list of insecticides registered for use on sweet corn that have demonstrated efficacy against brown marmorated stink bug in research trials.

* Source: Kuhar, T., J. Whalen, G. Dively, J. Walgenbach, and S. Fleischer. 2014. Chemical Control Guidelines for Brown Marmorated Stink Bug in Sweet Corn. Technical bulletin publication of the Brown Marmorated Stink Bug IPM Working Group in conjunction with the Northeastern IPM Center posted Online http://www.StopBMSB.org , March 10, 2014.
* http://www.stopbmsb.org/resource-links/chemical-control-guidelines-for-brown-marmorated-stink-bug-in-sweet-corn/

End of section 5

6. Integrated Pest Management for BMSB

Integrated Pest Management Update for BMSB: Key Points

* Use **alternate-row-middle spray applications**: The idea of spraying on the outside, then inside, edge of alternate rows.
* Bergh has observed and read about **outbreaks of secondary pests** in apple orchards: wooly apple aphid, San Jose scale, and spider mites.
* Alternate-row-middle spray applications allow you to **reduce insecticide inputs** and reduce potential negative effects of insecticides.
* BMSB is a **landscape-scale pest**. It's widely distributed, and can't be controlled on a landscape scale by insecticides, traps, or other human tactics.
* **Biological control** is going to represent the ultimate solution to bring pest damage down to economically acceptable levels.

* Source: Chris Bergh, Virginia Tech University

Populations may remain at low levels before outbreaks occur

* Brown marmorated stink bug (BMSB):
* The **2014 season** began with a rather low BMSB population, which to some extent may have been due to the effects of the cold winter. As in 2013, favorable environmental conditions during the growing season resulted in lush growth of wild hosts through August, which may favor the growth of BMSB populations during the summer. However, despite BMSB captures in pheromone traps that again were highest in August and September and instances of some buildings and homes being heavily invaded between late September and early October, the general consensus was that BMSB populations were lower throughout the entire season than in 2013.
* In general, **acceptable levels** of BMSB management in commercial orchards were reported.

End of section 6

Northeastern IPM Center

Thank You

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Title