

Title

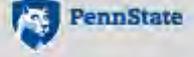
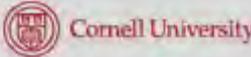
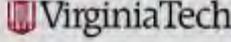
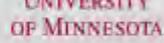
Deborah G. Grantham
Northeastern IPM Center



Funding

 **USDA** United States Department of Agriculture National Institute of Food and Agriculture
Specialty Crop Research Initiative

Collaborating Institutions

This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, Specialty Crop Research Initiative under award number 2016-51181-25409.

Northeastern
IPM
Center

BMSB SCRI NEIPM Center Update
February 2019



United States
Department of
Agriculture

National Institute
of Food and
Agriculture

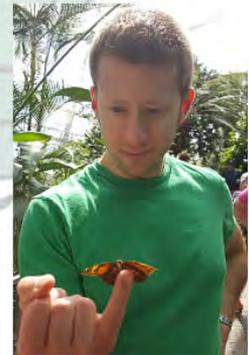
Fully staffed as of September 2018

* **New:**

- * Deborah G. Grantham, Director
- * Mike Webb, Communication Specialist
- * David Lane, Evaluation Specialist

* **Continuing:**

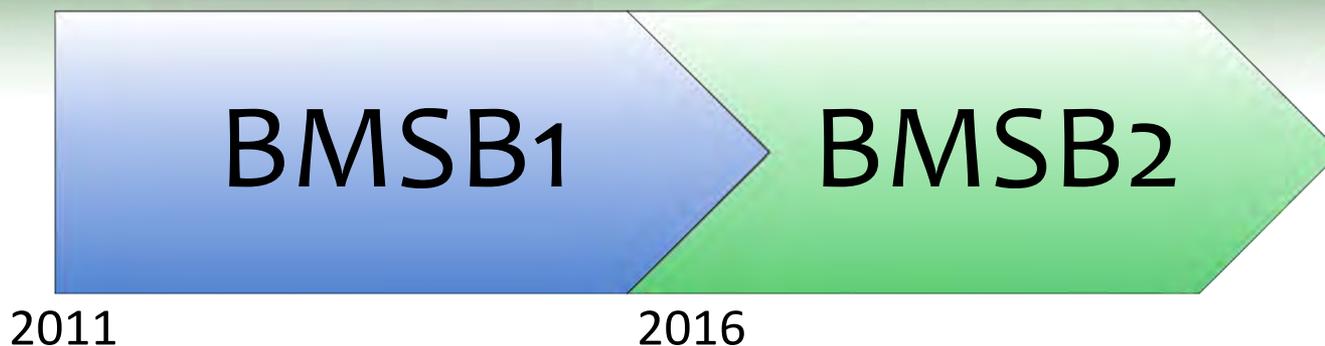
- * Nancy Cusumano, Program/Extension Aide
- * Susannah Reese, Program Coordinator, StopPests in Housing
- * Kevin Judd, Web Administrator
- * Jana Hexter, Grants/Partnerships Coordinator



Funding

- * Core funding for NEIPM Center is USDA-NIFA
- * Renewed as of September 1, 2018 for 4 years
- * Provides basis for participating in other projects such as the BMSB SCRI work

Outreach for USDA SCRI Projects



- Launched StopBMSB.org website in 2012
- Established awareness, shared biological and ecological information (host range, monitoring, pheromones, natural enemies)

- Building upon existing resources, adding new ones over time
- Added more partners from Midwest, Southeast, West
- Landscape ecology, biological control, BMPs, economics, outreach

StopBMSB.org

- Widely used and cited interactive map
- Basic biology & identification
- Host plants info
- Management info
- Biological control (*Trissolcus japonicus* info)
- Repository for videos, management documents, list of publications
- News & updates
- Spanish resources

Stop BMSB Management of brown marmorated stink bug in US specialty crops

Search

ABOUT US
Project, people, research, reports, publications...

STINK BUG BASICS
Origins, life stages, photos, look-alike insects...

WHERE IS BMSB?
Maps, crops, host plants, damage gallery...

MANAGEMENT
Monitor, manage by crop, behavior and landscape...

BIOLOGICAL CONTROL
Native natural enemies, samurai wasp...

MORE RESOURCES
News, videos, espanol, resource links...

Overview

The brown marmorated stink bug, *Halyomorpha halys* (Stål), is a voracious eater that damages fruit, vegetable, and nut crops in North America. With funding from USDA's Specialty Crop Research Initiative, our team of more than 50 researchers is uncovering the pest's secrets to find management solutions that will protect our food, our environment, and our farms.

Updates

Survey BMSB Management Survey for Commercial Producers Participate in a nationwide survey to gather information from farmers and growers on the economic impact of the brown marmorated stink bug (BMSB) on agriculture.

Watch These Stink Bugs Hatch in Unison When stink bug eggs hatch, they do so virtually in unison with all the other stink bug eggs clumped around it. How? What signals an egg on one side of the brood to hatch so soon after an egg on the other side? Source: *New York Times*, Jan. 16, 2019.

Why Taxonomic Preparedness Is Critical for Invasive Species Response In the latest issue of *American Entomologist*, a team of scientists tells their story about how they sprang into action to investigate natural enemies of the brown marmorated stink bug. Source: *Entomology Today*, Dec. 17, 2018.

Parasitoids of the Brown Marmorated Stink Bug Workshop A specialized training workshop covering parasitoids of the BMSB will be offered January 31 and February 1, 2019, at the University of Florida.

A Local Researcher Is Breeding an Army of Wasps to Devour Invasive Stink Bugs The brown marmorated stink bug—already the scourge of the Northeast—is also in Washington. And it might move in with you this winter. A WSU researcher is breeding tiny samurai wasps in an effort to fight the pests. Source: *The Seattle Times*, Aug. 23, 2018.

Scientists Spent Years on a Plan to Import This Wasp to Kill Stink Bugs. Then It Showed Up on Its Own. The samurai wasp (*Trissolcus japonicus*) arrived by accident in the United States before scientists were ready to release it. Source: *Science*, Aug. 9, 2018.

Scientists Deploy Attract-and-Kill Trees against Stink Bugs Rob Morrison, a research entomologist with the USDA-ARS Center for Grain and Animal Health Research, describes a method for baiting select border-row trees with an aggregation pheromone of the brown marmorated stink bug.

Scientists Pick Up the Genetic Scent of Stink Bug Invaders A new method that tests for insect DNA on farm produce could "revolutionize" agricultural pest surveillance. Source: *Scientific American*, July 12, 2018.

Scientific Publications New articles published by our team of scientists and extension specialists in 2018.

[More news items >](#)

Funding

USDA United States Department of Agriculture National Institute of Food and Agriculture Specialty Crop Research Initiative

Collaborators

OSU Oregon State University NC STATE UNIVERSITY UNIVERSITY OF MARYLAND WASHINGTON STATE UNIVERSITY Washington State University Cornell University Rutgers University The Ohio State University University of Minnesota MICHIGAN STATE UNIVERSITY University of Georgia University of Kentucky UC Davis Berkeley UC RIVERSIDE

This material is based upon work that is supported by the National Institute of Food and Agriculture, U.S. Department of Agriculture, Specialty Crop Research Initiative under award numbers 2016-51161-25409 and 2011-51161-30937. Any opinions, findings, conclusions, or recommendations expressed in this publication are those of the author(s) and do not necessarily reflect the view of the U.S. Department of Agriculture. Website maintained by the Northeastern IPM Center.

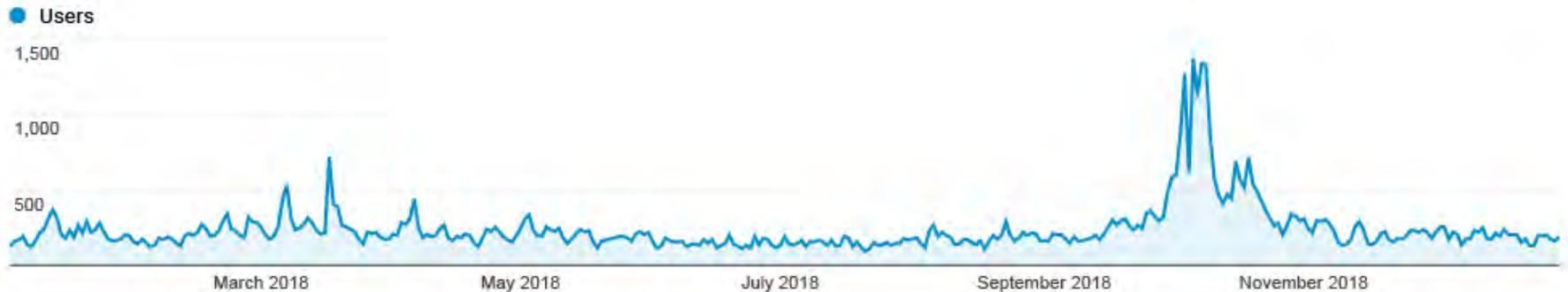
StopBMSB.org – Unique Visitors



Compared to five years ago, yearly traffic has doubled

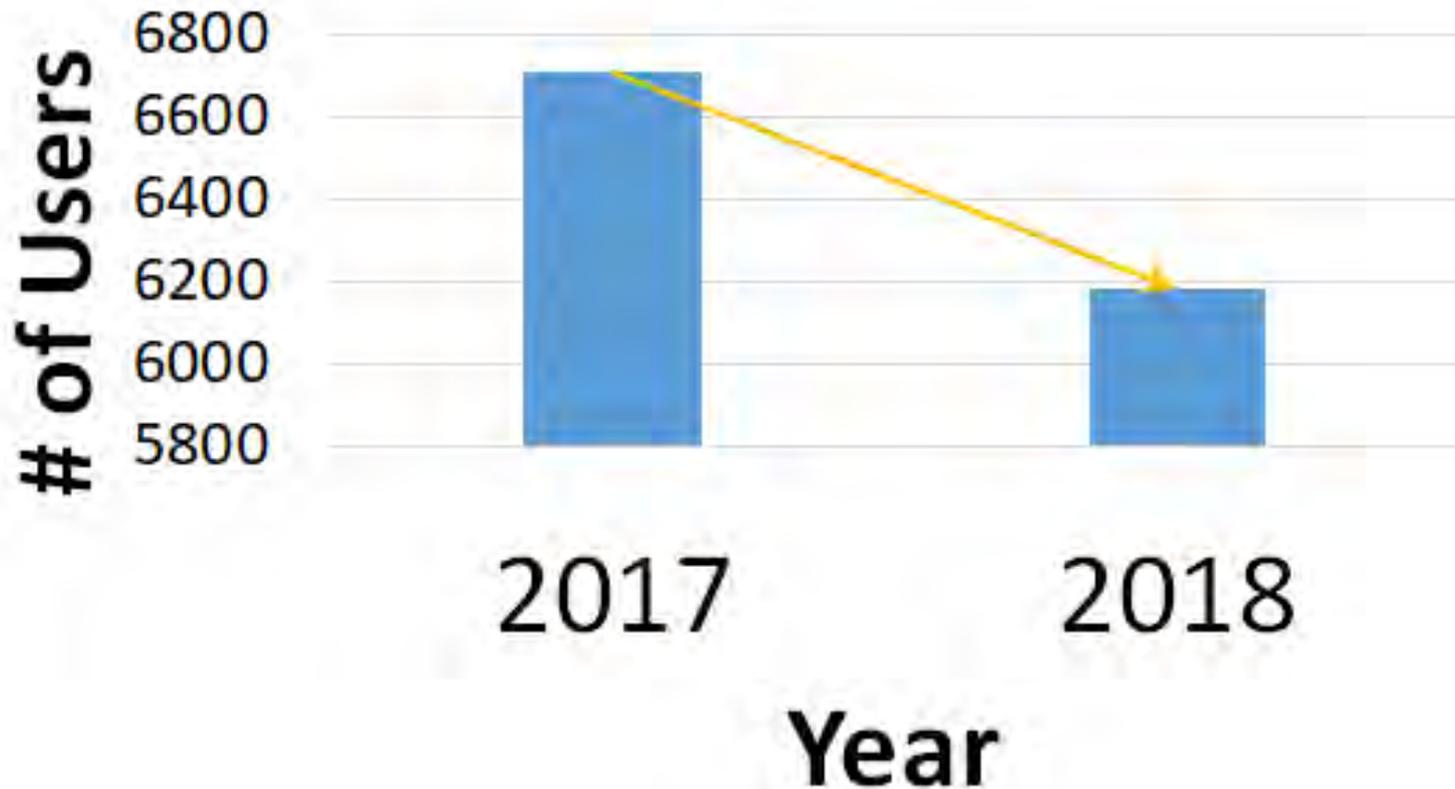
StopBMSB.org – Unique Visitors

80,663 unique visitors in 2018



As in previous years, we saw a bump in traffic starting around October 1 when stink bugs enter homes and there is more media coverage of the topic.

Users of www.stopbmsb.org in New York



Management Documents

Four sets of management documents completed August 2016.

Total downloads: 2,390

Download Totals

	English	Spanish
Orchard Crops	767	22
Vegetables	761	27
Grapes	414	19
Small Fruit	363	17

Integrated Pest Management for Brown Marmorated Stink Bug in Orchard Crops

A synopsis of what researchers have learned so far and management recommendations using an integrated approach

Authored by the BMSB SCRI CAP Orchard Crop Commodity Team:

Chris Bergh and Angel Acebes-Doria (Virginia Tech), Tracy Leskey, Rob Morrison and Brent Short (USDA ARS Kearneysville, WV), Greg Krawczyk (Pennsylvania State University), Jim Walgenbach (North Carolina State University), Arthur Agnello and Peter Jensch (Cornell University), George Hamilton, Anne Nielsen and Brett Blaauw (Rutgers University), Vaughn Walton, Nik Wiman, Chris Hedstrom and Peter Shearer (Oregon State University), and Betsy Beers (Washington State University)

Basic Biology and Life Cycle of BMSB

- References herein to specific points in the growing season are based on information from the mid-Atlantic region, where the seasonal biology of BMSB is currently understood best, and may vary in other regions.
- BMSB is a serious agricultural pest of numerous crops during the late spring and summer.
- After emerging from overwintering sites in May and June, BMSB adults begin mating and laying eggs on various host plants (Fig. 1).
- In most of its range in North America, BMSB completes one to two generations per year, progressing from the egg stage through five nymphal stages (instars) before molting into a winged adult (Fig. 2).

Orchard Crops at Risk / Crops Not at Risk

- BMSB may move frequently among different wild and cultivated host plant species, feeding alternately among them.
- BMSB nymphs and adults feed by inserting their piercing-sucking mouthparts into fruit, nuts, seed pods, buds, leaves, and stems and appear to prefer plants bearing reproductive structures. Their mouthparts can penetrate very hard and thick tissue, such as the hazelnut hull.
- Older nymphs and adults cause more injury to apples and peaches than young nymphs.
- Peach is considered a preferred and highly vulnerable host. The survival of BMSB nymphs has been studied on only a few hosts, but peach was the only host on which they completed development without feeding on another plant.
- Nectarines show BMSB injury and may be as vulnerable as peach, but the relative susceptibility of apricots is less well known.
- Apples and European and Asian pears are also very susceptible to BMSB feeding injury.
- Economic injury from BMSB to hazelnuts has been documented in Oregon, but other nut crops have been less well studied at present.
- Cherries can sustain BMSB feeding injury, but the effects at harvest are usually small.
- Plums and plum hybrids are not considered as vulnerable to BMSB as some other tree fruits.

Orchard Crop Injury Diagnostics

- BMSB feeding through the skin of tree fruits can cause injury to the fruit surface and flesh. These injuries are not immediately apparent, but develop gradually after feeding has occurred.
- Feeding on young peaches, nectarines, and apricots causes gummosis at the feeding site (Fig. 3), deformations on the fruit surface (Fig. 4), and brownish-red internal necrosis (Fig. 5).
- Feeding on more mature peaches and nectarines may or may not result in apparent surface injury at harvest but can cause areas of whitish necrosis in the flesh (Fig. 6), which has been an important marketing issue.
- The mouthpart insertion point on apples and pears leaves a tiny hole in the skin (Fig. 7) and a "stylet sheath" that runs into the flesh (Fig. 8), both of which are best

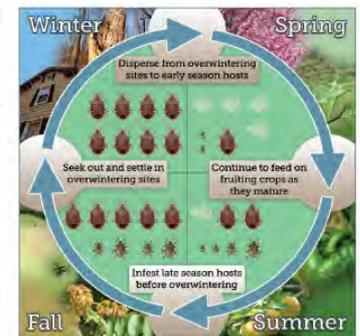


Fig. 1. Typical seasonal biology of brown marmorated stink bug.

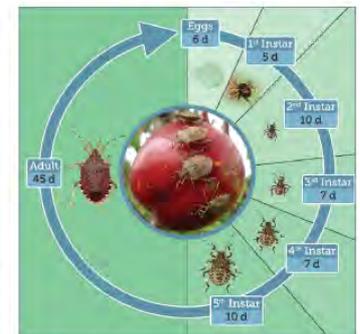


Fig. 2. Life cycle of brown marmorated stink bug.

Videos

“Tracking the Brown
 Marmorated Stink Bug”

10-part video series, plus
 4 Research Update videos



Lifetime Views	
Total (all videos combined)	70,602
Pt. 1: History and Identification	29,143
Pt. 10: Biological Control	10,398
Pt. 6: Host Plants & Damage in Vegetables	7,209
Pt. 2: Overwintering and Spread	4,470
Pt. 3: Monitoring and Mapping	4,366
Pt. 9: Management	2,813
Pt. 4: Host Plants & Damage in Orchard Crops	1,788
...	

Stink Bug Kits

Includes: stink bug guide, specimen in bottle, video postcard, article, factsheet, “Crops at Risk” flier



Kits distributed in 2018:

279 kits sent to 9 states,

1 Canadian province & 5 countries

2018 Website Updates

New and updated articles on the website:

- Scientists Deploy Attract-and-Kill Trees against Stink Bugs
- Samurai Wasp (*Trissolcus japonicus*) – field recoveries map
- Behavioral- and Landscape-Based Management: IPM Crop Perimeter Restructuring

Samurai Wasp (*Trissolcus japonicus*)

During the 1990s, the brown marmorated stink bug (BMSB) invaded the United States. In the years since, scientists have learned that many native enemies of other stink bugs in the United States will also attack BMSB. Unfortunately, those native enemies are not well adapted to BMSB and, as a result, they are not effective in keeping BMSB from damaging crops. To fill in this gap, ARS scientists in Newark, Delaware, began a worldwide search for a solution. Those explorations turned up a key natural BMSB enemy—the egg parasitoid *Trissolcus japonicus*. Also known as the “samurai wasp,” these stingless warriors search for and destroy 60–90% of BMSB eggs in Asia.

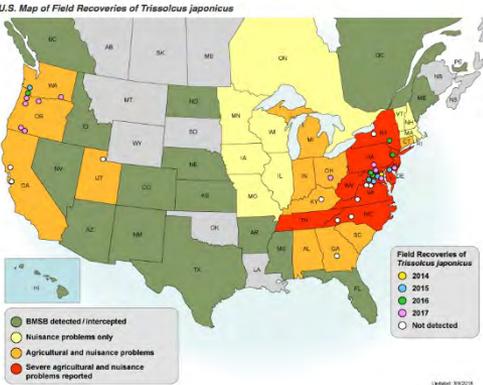
Research underway at quarantine laboratories in Newark and elsewhere is determining how suitable the wasp is for release in the United States. Those studies show that the wasp specializes in attacking only certain kinds of stink bugs, like BMSB. Before regulatory permission could be obtained for their release in the United States, surveys conducted during 2014–2015 detected the wasp’s presence in several U.S. locations. Genetic matching studies showed that these wasps were different from the ones under ARS quarantine. Although we don’t know how it arrived, the “samurai wasp” made its way to the United States naturally and has continued to spread to new locations. As of 2017, the wasp was found in ten U.S. states and Washington, DC. Plans are underway in some of these states to rear large numbers of these warrior wasps in laboratories in order to release them and protect key U.S. agricultural crops from BMSB damage.

—Text from USDA ARS factsheet “Samurai wasp (*Trissolcus japonicus*)”, April 2017.



The samurai wasp (*Trissolcus japonicus*) is a natural enemy of the brown marmorated stink bug. Photo by G. Tolman.

U.S. Map of Field Recoveries of *Trissolcus japonicus*



Field Recoveries of *Trissolcus japonicus*

- 2014
- 2015
- 2016
- 2017
- Not detected

Legend:

- BMSB detected/intercepted
- Nuisance problems only
- Agricultural and nuisance problems
- Severe agricultural and nuisance problems reported

USDA ARS factsheet about the samurai wasp (*Trissolcus japonicus*), a natural enemy of the brown marmorated stink bug. [Download](#)

Brochure about *Trissolcus* wasps and their use as biological control agents of the brown marmorated stink bug. [Download](#)

Scientists Deploy Attract-and-Kill Trees against Stink Bugs

It’s a kind of trap. The theory behind attract-and-kill is to lure pests such as insects to a precise location and kill them there. The point is not to have to spray an entire field or orchard, thus significantly reducing the amount of insecticide used, and therefore saving money and reducing risks of environmental side-effects.



Attract-and-kill traps on a tree. Photo: Rob Morrison.

Rob Morrison, a research entomologist with the USDA-ARS Center for Grain and Animal Health Research, describes a method for baiting select border-row trees with an aggregation pheromone of the brown marmorated stink bug (BMSB). The aggregation pheromone is the stink bug’s invitation to party. But then, firehair style, an insecticide kills them. The article was published recently in *Pest Management Science*.

While scientists having been working on applying this idea to BMSB for several years, the theory behind it goes back decades.



Damage to apple from brown marmorated stink bug. Photo: Rob Morrison.

For attract-and-kill to work, you need to attract bugs to a tree en masse and keep them there for long enough that they drink the party’s Kool-Aid.

Scientists used a pheromone, in a low dose, that attracted bugs to an area of about the same size as the area they attracted bugs to when using a high dose. This is important, because it means that bugs only gather in a small party zone—small enough to ensure that their roachiness doesn’t spill over and cause damage on fruit in nearby trees.

ECONOMICS COULD BE BETTER

Morrison and his team have shown that attract-and-kill is effective at managing low to moderate *H. halys* populations, but must be optimized to increase economic viability for commercial growers.

There was less damage in attract-and-kill plots, but not enough to offset the additional cost of lures for the strategy.

The authors expect that the lure prices will come down in the future as manufacturing costs come down through greater production efficiency, and through optimizing the technique. The technique could be improved by having fewer attract-and-kill sites per orchard, less pheromone at each attract-and-kill site, or by having a sprayable pheromone that could dissipate as the effectiveness from the insecticide wears off instead of discrete dispensers.



Dead stink bugs on an attract-and-kill tree. Photo: Rob Morrison.

“This study provides a proof-of-concept that attract-and-kill effectively works to manage an invasive and highly mobile pest,” Morrison said. “Once this tactic is optimized, I think attract-and-kill has the potential to significantly help rebuild the advanced IPM programs that were severely disrupted when BMSB became a problem for growers.”

NEW TECHNOLOGY: NETS AND RADAR

Using long-lasting insecticide netting in trees instead of sprays is showing promise. Basically, scientists bait trees with lure and set up traps made of insecticide-laced netting. If a threshold is reached in the traps, growers spray the orchard “alternate row middle,” basically spraying every other row, on one side.



A tagged BMSB. Photo: Rob Morrison.

As part of this study, Morrison tagged BMSB and reliably tracked them with harmonic radar. The tags look like a tiny antenna, glued to the back of the bug. It doesn’t interfere with the bug’s movement or behavior. Using this technology, investigators found, for example, that BMSB remain in a fruiting apple tree on average six times longer than on mowed grass.

The attract-and-kill method killed stink bug adults 180-fold more compared with controls.

Curiously, the aggregation pheromone seems to draw BMSB from a wider area than typical sex pheromones do moths.

The authors conclude that BMSB can be aggregated to spatially precise locations in orchards and removed through regular insecticide applications.

This provides an opportunity to revamp IPM programs, use precision agriculture by localizing management to specific sites, and preserving the natural enemies that can provide biological control services.

IMAGE GALLERY – PHOTOS BY ROB MORRISON

Click on thumbnail image for a larger version.



Evaluating the “party zone” | Dead bugs on an attract-and-kill tree | Damage to apple from BMSB | Tagged BMSB on a leaf | Tagged BMSB | Harmonic radar being performed | Attract-and-kill tree

Search engines

- * Searching on BMSB brings up StopBMSB.org
- * Searching on stinkbug or brown marmorated stinkbug does NOT bring up StopBMSB.org
 - * Wikipedia article, using one of our images without attribution
 - * Kevin added attribution
- * We are thinking about keywords and making sure that brown marmorated stinkbug or stinkbug shows up in as many articles, publications, etc., as possible
- * More people searching on various terms and choosing StopBMSB.org will help

Going Forward – 2019

- Microsporidia article (Carrie Preston, Ann Hajek)
- Researcher bios: template/sample has been developed and is being circulated as a model
- Working with extension committee to determine areas where updates or additional content are needed
- More emphasis on visual information instead of text-heavy pages
- Mobile friendliness
- Tracking location of visitors by state



Questions?

- * Contacts:

- * StopBMSB.org

- * Northeastipm.org

- * Deb Grantham: dgg3@cornell.edu

- * Nancy Cusumano: nec2@cornell.edu

- * Mike Webb: mrw11@cornell.edu

- * David Lane: del97@cornell.edu

- * Kevin Judd: kaj57@cornell.edu