

The brown marmorated
stink bug, *Halyomorpha halys*
(Hemiptera: Pentatomidae)



Introduction

- Native to East Asia
- Detected in continental United States in 2001 in Allentown, Pennsylvania
- Highly polyphagous plant feeder



Image citation:
Susan Ellis, Bugwood.org, #5369381



The brown marmorated stink bug, *Halyomorpha halys* (Stal) (Hemiptera: Pentatomidae), is native to China, Japan, Korea, Myanmar, Taiwan, and Vietnam. In 2001, this species was first detected in the United States in Allentown, Pennsylvania and identified by Karen M. Bernhard, an extension entomologist with the Lehigh County Cooperative Extension office. Although the means of introduction is not certain, it is thought to have been accidentally introduced into the United States via imported cargo from Asia. Mitochondrial analysis reveals that the population that has established in parts of the U.S. appear to have come from populations of brown marmorated stink bug in and around Beijing, China.

It appears that the current U.S. population of brown marmorated stink bug occurred through a single introduction event of a small population of this pest.

The brown marmorated stink bug is a highly polyphagous plant feeder with a wide range of host plants. The nymphs will typically feed on the leaves and stems of host plants, while the adults will feed on the leaves and stems as well as the fruit and seeds.

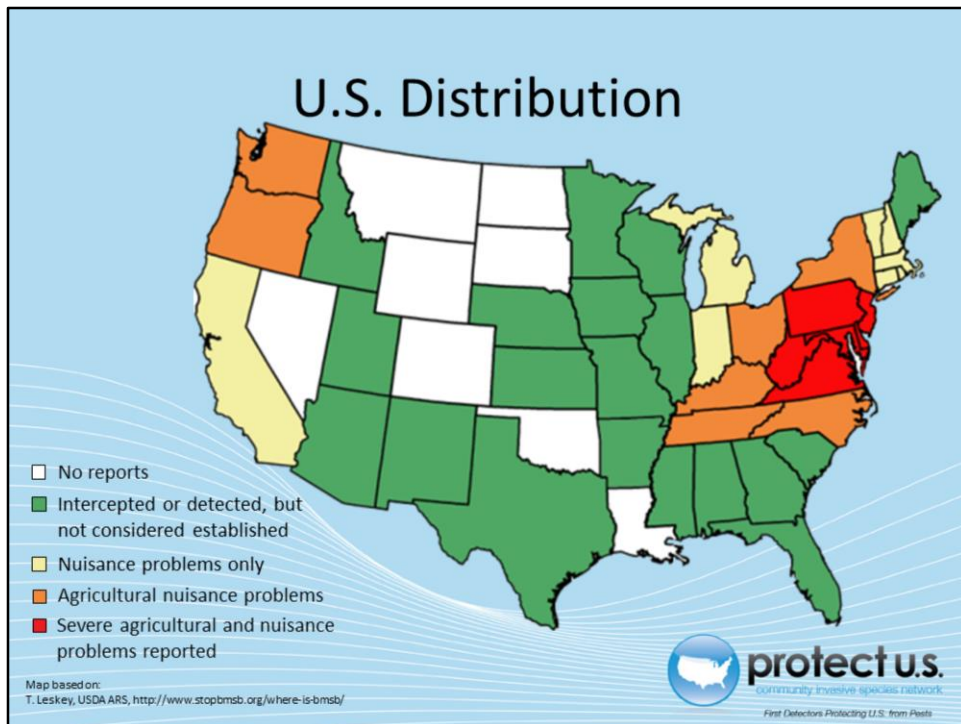
The name brown marmorated stink bug is commonly abbreviated as BMSB.

References:

Xu, J., D.M. Fonseca, G.C. Hamilton, K.A. Hoelmer, and A.L. Nielsen. 2014. Tracing the origin of US brown marmorated stink bugs, *Halyomorpha halys*. *Biological Invasions*, 16, 153-166. DOI 10.1007/s10530-013-0510-3.

Yang, Z.-Q., Y.-X. Yao, L.-F. Qiu, and Z.-X. Li. 2009. A new species of *Trissolcus* (Hymenoptera: Scelionidae) parasitizing eggs of *Halyomorpha halys* (Heteroptera: Pentatomidae) in China with comments on its biology. *Annals of the Entomological Society of America*, 102(1), 39-47.

Yu, G. and J. Zhang. 2007. The brown-marmorated stink bug, *Halyomorpha halys* (Heteroptera: Pentatomidae) in P.R. China. *International Workshop on Biological Control of Invasive Species of Forests*, 1, 70-74.



Distribution current as of June 2014.

The states shown in green are where BMSB has been detected, and is not known to be established. Many of these detections have occurred as interceptions at state interdiction stations. These states include Maine, South Carolina, Georgia, Florida, Alabama, Mississippi, Minnesota, Wisconsin, Illinois, Iowa, Missouri, Arkansas, Nebraska, Kansas, Texas, New Mexico, Arizona, Utah, Idaho, and Hawaii.

The states shown in yellow are where BMSB is primarily a nuisance problem only. These states include New Hampshire, Vermont, Massachusetts, Connecticut, Rhode Island, Michigan, Indiana, and California.

The states shown in orange are where BMSB is established as an agricultural and nuisance pest. These states include New York, Kentucky, North Carolina, Ohio, Oregon, Tennessee, and Washington.

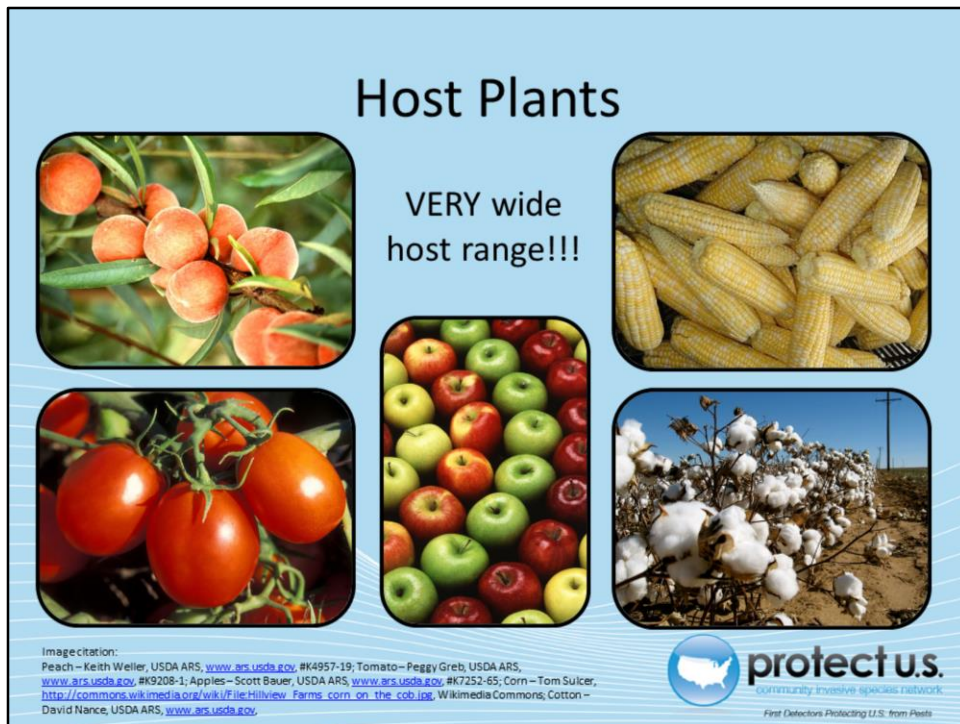
The states shown in red are where BMSB has become a severe agricultural and nuisance pest. These states include Pennsylvania, New Jersey, Delaware, Maryland, Virginia and West Virginia.

Other parts of the world in which this pest has been detected include Switzerland, Canada, and New Zealand.

Information source:

T. Leskey, USDA ARS, <http://www.stopbmsb.org/where-is-bmsb/>

Xu, J., D.M. Fonseca, G.C. Hamilton, K.A. Hoelmer, and A.L. Nielsen. 2014. Tracing the origin of US brown marmorated stink bugs, *Halyomorpha halys*. *Biological Invasions*, 16, 153-166. DOI 10.1007/s10530-013-0510-3.



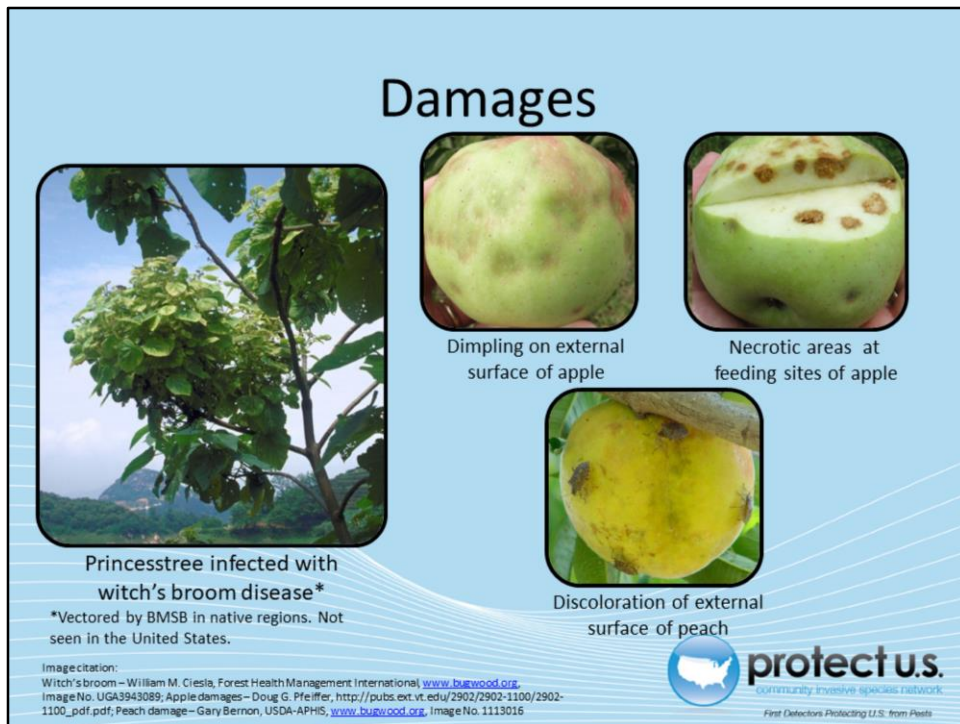
Crop hosts include apple (*Malus* spp.), apricot (*Prunus armeniaca*), asparagus (*Asparagus* spp.), bean (*Phaseolus* spp.), cherry (*Prunus avium*), corn (*Zea mays*), cotton (*Gossypium hirsutum*), fig (*Ficus carica*), grape (*Vitis vinifera*), mulberry (*Morus* spp.), orange (*Citrus* spp.), peach (*Prunus persica*), pear (*Pyrus* spp.), persimmon (*Diospyros kaki*), plum (*Prunus domestica*), pomegranate (*Punica granatum*), raspberry (*Rubus idaeus*), soybean (*Glycine max*), spinach (*Basella rubra*), tomato (*Solanum lycopersicum*), walnut (*Juglans* spp.), and wheat (*Triticum aestivum*).

Other hosts include argyi wormwood (*Artemisia argyi*), basswood (*Tilia* spp.), beet (*Beta vulgaris*), black locust (*Robinia pseudoacacia*), black nightshade (*Solanum nigrum*), blue bean shrub (*Decaisnea fargesii*), bushkiller (*Cayratia japonica*), butterfly-bush (*Buddleia* spp.), camphor tree (*Cinnamomum camphora*), catalpa (*Catalpa* spp.), Celosia (*Celosia argentea*), chaste tree (*Vitex negundo*), Chinese parasol tree (*Firmiana platyfolia*), Chinese white poplar (*Populus tomentosa*), Chinese wisteria (*Wisteria sinensis*), Chinese wolfberry (*Lycium barbarum*), Eastern redbud (*Cercis canadensis*), elm (*Ulmus* spp.), hawthorne (*Crataegus pinnatifida*), hibiscus (*Hibiscus rosa-sinensis*), hollyhock (*Althaea rosea*), honey locust (*Gleditsia triacanthos*), honeysuckle (*Lonicera* spp.), Japanese Angelica-tree (*Aralia elata*), Japanese hop (*Humulus scandens*), Japanese rose (*Rosa rugosa*), Japanese spindle tree (*Euonymus japonicus*), Japanese Stewartia (*Stewartia pseudocamellia*), Japanese tobacco (*Nicotiana glauca*), jujube (*Ziziphus jujuba*), lilac (*Syringa* spp.), maple (*Acer* spp.), mum (*Chrysanthemum morifolium*), nasturtium (*Tropaeolum majus*), oak (*Quercus* spp.), orchid (*Brassia* spp.), paulownia tree (*Paulownia* spp.), oriental arborvitae (*Platycladus orientalis*), serviceberry (*Amenlanche* spp.), spider flower (*Cleome* spp.), staghorn sumac (*Rhus typhina*), sunflower (*Helianthus annuus*), sycamore (*Platanus* spp.), tea plant (*Camellia sinensis*), tea-oil camellia (*Camellia oleifera*), tulip tree (*Liriodendron tulipifera*), weeping scholar tree (*Sophora japonica*), yellowwood (*Cladrastis kentukea*), and zelkova (*Zelkova serrata*).

In its native habitat, it is an occasional agricultural pest of tree fruits and soybeans.

References:

- Hoebeker, E. R. and M. E. Carter. 2003. *Halyomorpha halys* (Stål) (Heteroptera: Pentatomidae): a polyphagous plant pest from Asia newly detected in North America. *Proceedings of the Entomological Society of Washington*, 105(1), 225-237.
- Nielsen, A. L., G. C. Hamilton, and D. Matadha. 2008b. Developmental rate estimation and life table analysis for *Halyomorpha halys* (Hemiptera: Pentatomidae). *Environmental Entomology*, 37(2), 348-355.
- Sargent, C., G. Dively, C. Hooks, M. Raupp, S. Sardaneli, P. Shrewsbury, D. Clement, and M. Malinoski. 2010. Brown Marmorated Stink Bug, *Halyomorpha halys* Stål (Hemiptera: Pentatomidae). University of Maryland Fact Sheet.
- Wermelinger, B., D. Wyniger, and B. Forster. 2008. First records of an invasive bug in Europe: *Halyomorpha halys* Stal (Heteroptera: Pentatomidae), a new pest on woody ornamentals and fruit trees? *Bulletin de la Société Entomologique Suisse*, 81: 1-8.
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- Yu, G. and J. Zhang. 2007. The brown-marmorated stink bug, *Halyomorpha halys* (Heteroptera: Pentatomidae) in P.R. China. *International Workshop on Biological Control of Invasive Species of Forests*, 1, 70-74.



The brown marmorated stink bug has become a major pest of fruit trees and various vegetable crops in the Northeastern and Mid-Atlantic U.S. An economic damage of 25 to 80% to apples and pears by the brown marmorated stink bug has been recorded in Pennsylvania and New Jersey. As the distribution of *H. halys* has expanded and numbers increased, it has become a pest of economic concern in the United States.

The nymphs and adults may feed on the leaves, stem, fruit, seeds, and pods of the host plant. Punctures can be found at the feeding sight from the piercing-sucking mouthparts. The host may have necrotic areas, dimpling, discoloration, wilting, and catfacing (concave surfaces) due to feeding damage on these insects. In the early season, the brown marmorated stink bug may cause catfacing, dimpling, or concave surface damages to the fruit. If the brown marmorated stink bug feeds on the fruit in mid to late season, necrotic areas or injuries are seen where the rostrum was inserted.

In native regions, the princess tree (*Paulownia tomentosa*) is a primary host of the brown marmorated stink bug. The brown marmorated stink bug has been known to vector a phytoplasma that causes witch's broom disease in princess trees, where the natural structure of the plant is deformed and a dense mass of shoots grow from a single point. However, populations of the brown marmorated stink bugs in the United States have not been known to vector this disease.

References:

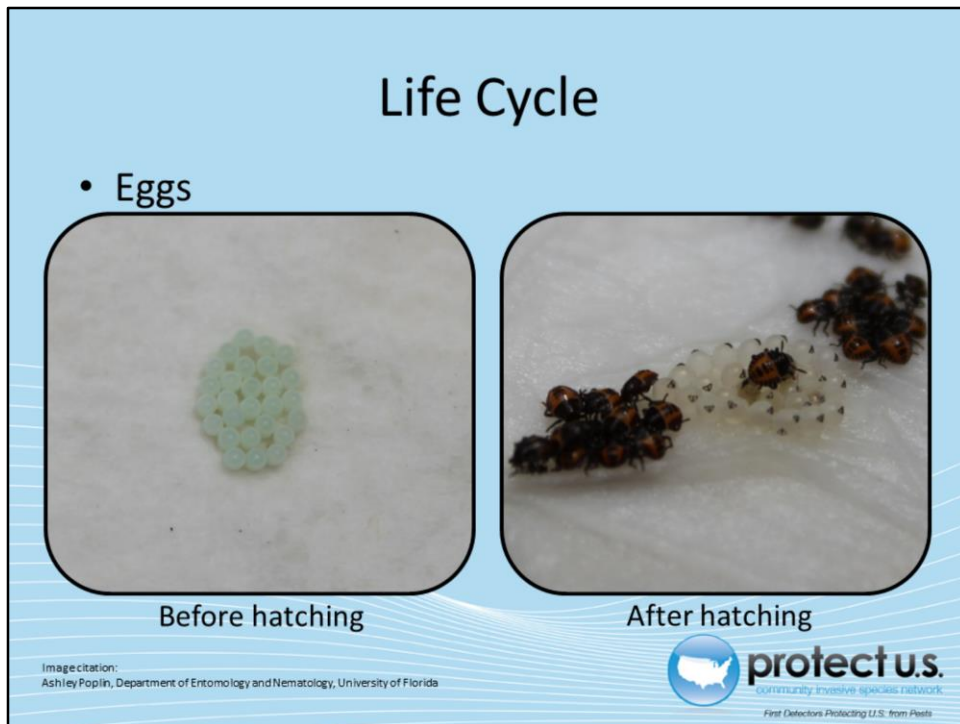
Leskey T. and G.C. Hamilton. 2010. Brown Marmorated Stink Bug Working Group Meeting. Accessed 6/8/2014-

<http://projects.ipmcenters.org/Northeastern/FundedProjects/ReportFiles/Pship2010/Pship2010-Leskey-ProgressReport-237195.pdf>

Leskey, T. C., G.C. Hamilton, A.L. Nielsen, D.F. Polk, C. Rodriguez-Saona, J.C. Bergh, D.A. Herbert, T.P. Kuhar, D. Pfeiffer, G.P. Dively, C.R.R. Hooks, M.J. Raupp, P.M. Shrewsbury, G. Krawczyk, P.W. Shearer, J. Whalen, C. Koplanka-Loehr, E. Myers, D. Inkley, K.A. Hoelmer, D. Lee, and S.E. Wright. 2012a. Pest status of the brown marmorated stink bug, *Halyomorpha halys* in the USA. *Outlooks on Pest Management*, 23(5), 218-226.

Leskey, T. C., B.D. Short, B. R. Butler, and S.E. Wright. 2012b. Impact of the invasive brown marmorated stink bug, *Halyomorpha halys* (Stål), in mid-Atlantic tree fruit orchards in the United States: case studies of commercial management. *Psyche: A Journal of Entomology*, 2012, Article ID 535062.

Weintraub, P. G. and L. Beanland. 2006. Insect vectors of phytoplasmas. *Annual Review of Entomology*, 51, 91-111.

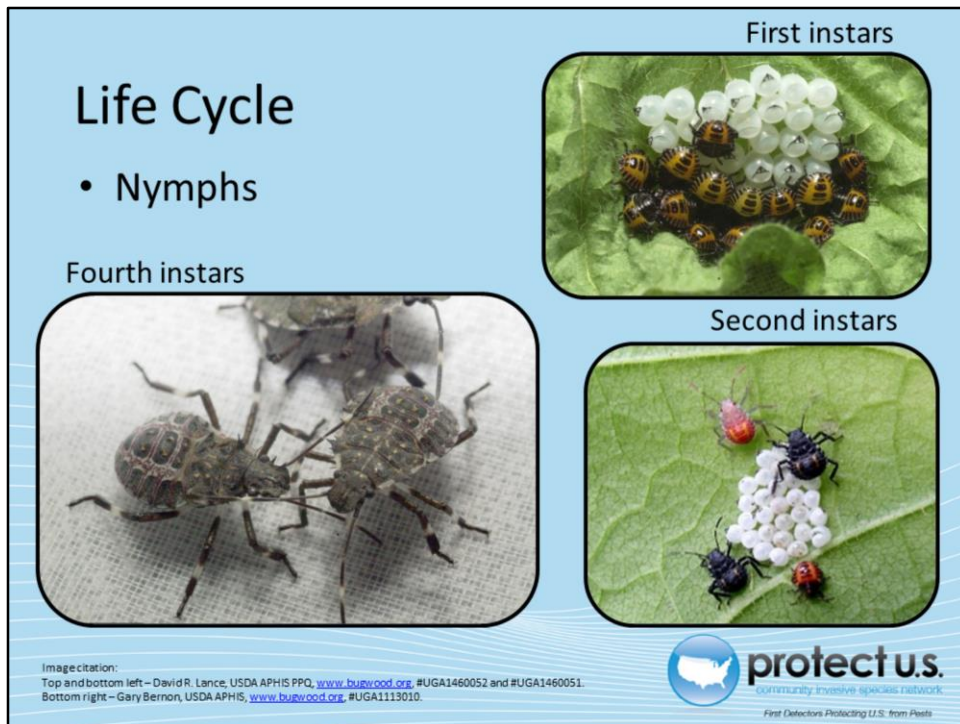


Adult females oviposit eggs between June and September, although temperature and photoperiod may prolong or shorten the ovipositing period. Egg masses are deposited in triangular clusters of 20 – 30 eggs on the underside of leaves. The eggs are small (about 1mm diameter), pale green to white in color, and spherically shaped. After the nymphs emerge, the eggs are opaque and white in color. The top of the eggs have a circular operculum and a black-framed triangle at the top used by the nymphs to burst out of the egg.

References:

Gyeltshen, J., G. Bernon, A. Hodges, S. Stocks, and J. Brambila. 2011. Brown marmorated stink bug, *Halyomorpha halys* (Stål). Featured Creatures. Retrieved August 23, 2011
http://entnemdept.ufl.edu/creatures/veg/bean/brown_marmorated_stink_bug.htm.

Nielsen, A. L. and G. C. Hamilton. 2009a. Life history of the invasive species *Halyomorpha halys* (Hemiptera: Pentatomidae) in northeastern United States. *Annals of the Entomological Society of America*, 102(4), 608-616.



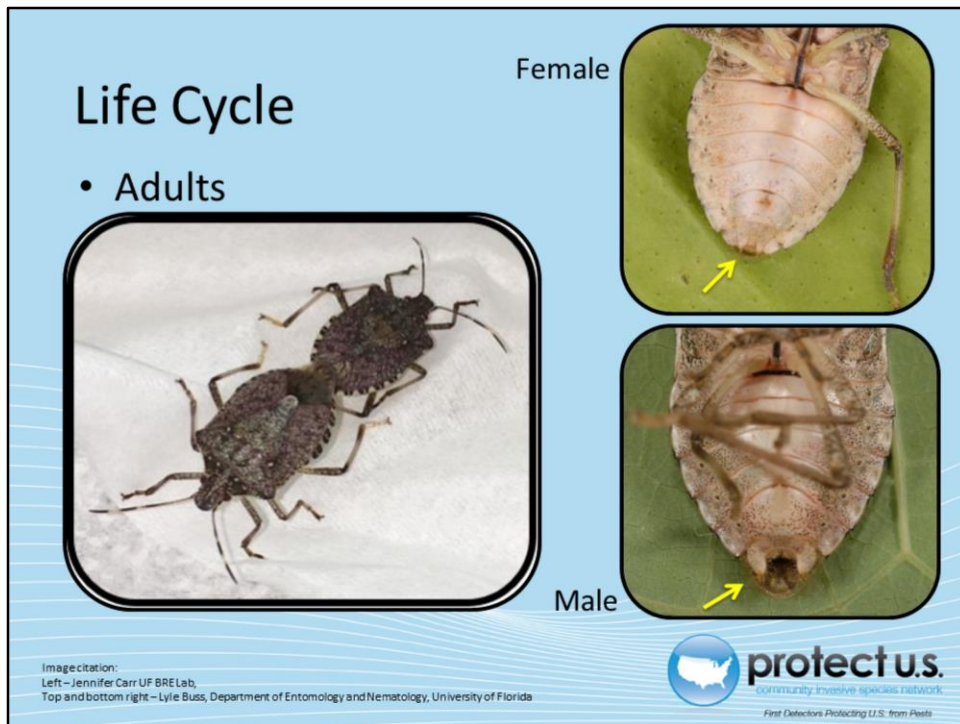
Like many stink bug species, the brown marmorated stink bug completes five nymphal instars (immature stages) which last five to ten days each. Nymphs tend to feed on the leaves, stems, and occasionally the fruit of the host plant.

First instar nymphs hatch four or five days after the eggs are deposited. First instar nymphs are typically black with orange abdomens and aggregate around the egg mass until molting into second instars. Second instar nymphs are almost entirely black and may resemble a tick due to the small size and lack of wings. Third, fourth, and fifth instars are dark colored and larger in size with visible wing pads on the thorax.

References:

Gyeltshen, J., G. Bernon, A. Hodges, S. Stocks, and J. Brambila. 2011. Brown marmorated stink bug, *Halyomorpha halys* (Stål). Featured Creatures. Retrieved August 23, 2011 http://entnemdept.ufl.edu/creatures/veg/bean/brown_marmorated_stink_bug.htm.

Nielsen, A. L. and G. C. Hamilton. 2009a. Life history of the invasive species *Halyomorpha halys* (Hemiptera: Pentatomidae) in northeastern United States. *Annals of the Entomological Society of America*, 102(4), 608-616.



The average adult brown marmorated stink bug is 12 to 17mm long and 7 to 10mm wide, although size may vary. Males and females can be distinguished by their genitalia, found at the ventral tip of the abdomen. Females have a rounded ventral surface at the tip of the abdomen. Males have two prongs on either side of the abdominal tip.

In northeastern states, adults emerge mid-March to April and remain active until October. Before copulation can occur, females must complete reproductive maturation. The brown marmorated stink bug has been known to produce one or two generations per year, both in northern China and mid-Atlantic regions of the United. However, the brown marmorated stink bug has produced up to six generations per year in southern regions of China and a similar trend may occur in southern United States.

References:

Hoffman, W. E. 1931. A pentatomid pest of growing beans in South China. Peking Natural History Bulletin, 5(1), 25-26.

Nielsen, A. L., G. C. Hamilton, and D. Matadha. 2008b. Developmental rate estimation and life table analysis for *Halyomorpha halys* (Hemiptera: Pentatomidae). Environmental Entomology, 37(2), 348-355.

Nielsen, A. L. and G. C. Hamilton. 2009a. Life history of the invasive species *Halyomorpha halys* (Hemiptera: Pentatomidae) in northeastern United States. Annals of the Entomological Society of America, 102(4), 608-616.

Yu, G. and J. Zhang. 2007. The brown-marmorated stink bug, *Halyomorpha halys* (Heteroptera: Pentatomidae) in P.R. China. International Workshop on Biological Control of Invasive Species of Forests, 1, 70-74.

Diapause

- Adults undergo reproductive diapause and exhibit overwintering behavior
 - In northeastern U.S., overwintering occurs from September to March
 - Males release pheromones for aggregation purposes
 - Large numbers of aggregated adults retreat to nearby buildings and structures



Adults reach a reproductive diapause, or a period of suspended development and reproductive activity. In its current U.S. distribution, the brown marmorated stink bug undergoes reproductive diapause triggered by environmental factors (i.e. photoperiod) and exhibits overwintering behaviors from mid-September to early spring. Males release pheromones for aggregation purposes and large numbers of aggregated adults (male and female) will retreat to nearby buildings and structures. In contrast, other native stink bugs (i.e. *Euschistus* spp., *Brochymena* spp. and *Parabrochymena* spp.) diapause in leaf litter of wooded areas.

References:

Nielsen, A. L., G. C. Hamilton, and D. Matadha. 2008b. Developmental rate estimation and life table analysis for *Halyomorpha halys* (Hemiptera: Pentatomidae). *Environmental Entomology*, 37(2), 348-355.

Nielsen, A. L. and G. C. Hamilton. 2009a. Life history of the invasive species *Halyomorpha halys* (Hemiptera: Pentatomidae) in northeastern United States. *Annals of the Entomological Society of America*, 102(4), 608-616.

Dispersal

- Dispersed by human interaction
 - Imported agricultural commodities from infested states
 - Tourist vehicles or luggage travelling from infested states



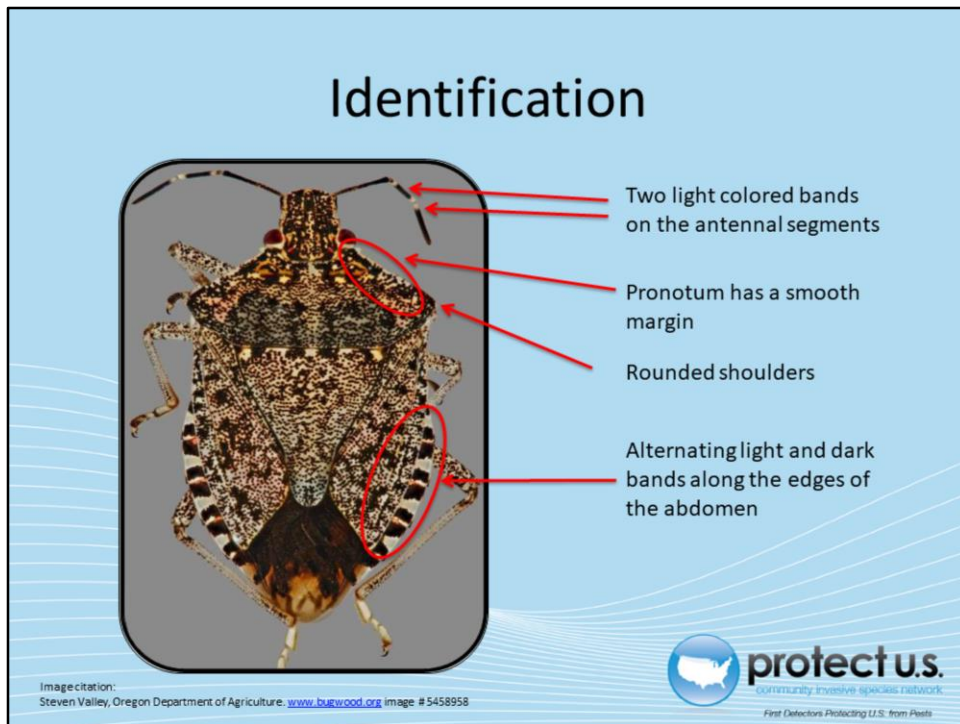
Image citation:
Top-KOMUnews, http://commons.wikimedia.org/wiki/File:Cars_in_I-70_KOMUnews.jpg, Wikimedia Commons



The brown marmorated stink bug is thought to have been accidentally brought into the United States through imported cargo from China, Japan, or Korea although the means of introduction are not certain. Since its introduction, the brown marmorated stink bug has dispersed from Pennsylvania to many other states on the east and west coast. Travel across great distances by this species is achieved by shipment of infested agricultural commodities from one area to another. This species has also hitch-hiked on tourist vehicles and/or luggage travelling from infested states.

References:

Leskey, T. C., G.C. Hamilton, A.L. Nielsen, D.F. Polk, C. Rodriguez-Saona, J.C. Bergh, D.A. Herbert, T.P. Kuhar, D. Pfeiffer, G.P. Dively, C.R.R. Hooks, M.J. Raupp, P.M. Shrewsbury, G. Krawczyk, P.W. Shearer, J. Whalen, C. Koplinka-Loehr, E. Myers, D. Inkley, K.A. Hoelmer, D. Lee, and S.E. Wright. 2012a. Pest status of the brown marmorated stink bug, *Halyomorpha halys* in the USA. *Outlooks on Pest Management*, 23(5), 218-226.



Adult stink bugs and other hemipterans can be characterized by their modified forewings called hemelytra. The proximal ends of the hemelytra are thickened and the distal ends are membranous. At rest, the wings overlap across the abdomen.

Adults have a dark marbled brown color on the dorsal side, a pale color on the ventral side, and are typically 12 to 17 mm long and 7 to 10 mm wide. Alternating light and dark bands occur along the lateral edges of the abdomen. The sides of the pronotum, often referred to as the “shoulders”, are rounded and smooth. The lateral margin of the pronotum is entire (smooth) and not dentate.

The most distinguishing feature is the two light colored bands on the fourth and fifth segments of the antennae. The same banding is often present on the legs as well.

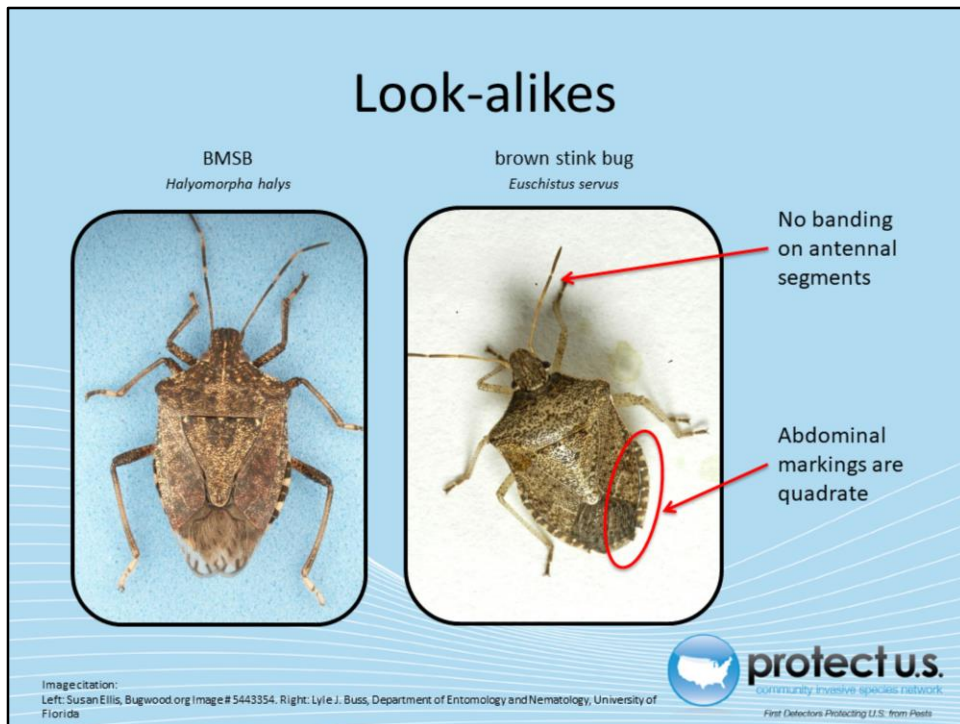
Species in the United States often confused for the brown marmorated stink bug include the brown stink bug (*Euschistus servus servus* (Say)), bark stink bugs (*Parabrochymena* spp.), rough stink bugs (*Brochymena* spp.), spined soldier bug (*Podisus maculiventris* Say), *Holcstethus* spp., and late instar nymphs of leaf footed bugs (*Leptoglossus phyllopus* (L.)).

References:

Halbert, S. and G. S. Hodges. 2011. The brown marmorated stink bug, *Halyomorpha halys* (Stål). Retrieved March 26, 2012
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Hoebeke, E. R. and M. E. Carter. 2003. *Halyomorpha halys* (Stål) (Heteroptera: Pentatomidae): a polyphagous plant pest from Asia newly detected in North America. *Proceedings of the Entomological Society of Washington*, 105(1), 225-237.

Sargent, C., G. Dively, C. Hooks, M. Raupp, S. Sardanelli, P. Shrewsbury, D. Clement, and M. Malinoski. 2010. Brown Marmorated Stink Bug, *Halyomorpha halys* Stål (Hemiptera: Pentatomidae). University of Maryland Fact Sheet.

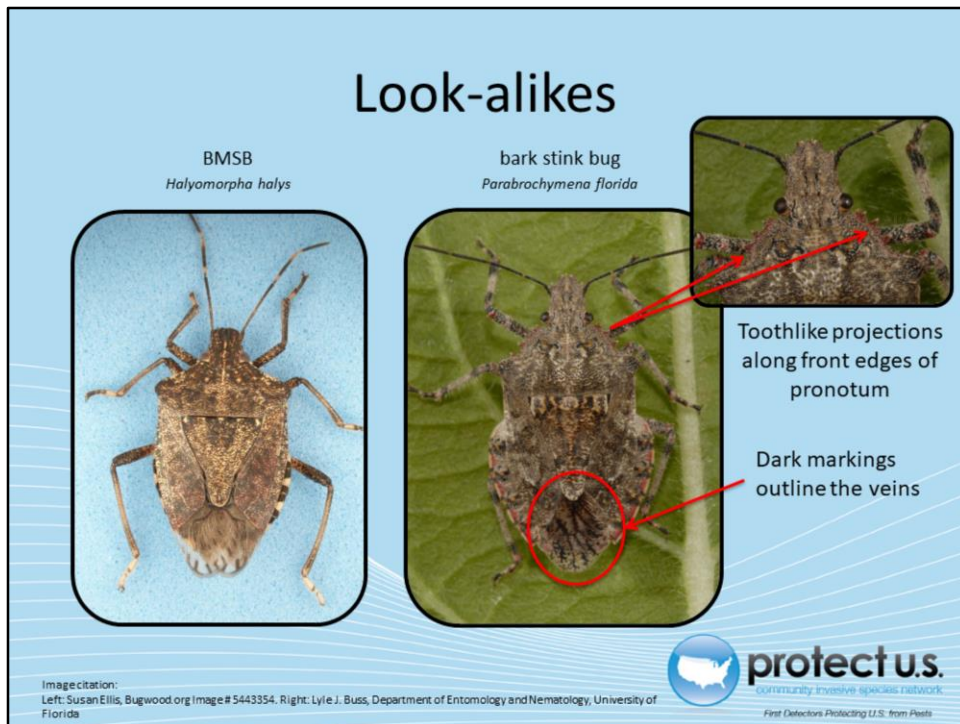


The brown stink bug (*E. servus*) may be confused with BMSB because it has similar coloring, rounded to slightly spined shoulders, and alternating light and dark bands along the edges of the abdomen. The two species may be distinguished by the pale marks on the edge of the abdomen – BMSB has triangular markings and the markings on the brown stink bug are more quadrate (roughly square or rectangular). The brown stink bug also lacks the two light colored bands on the fourth and fifth segments of the antennae as seen on BMSB. Instead, the antennae coloring gradually fades from light to dark brown.

If you are unsure about the identity of a specimen, contact your local extension agent for assistance. Visit <http://www.csrees.usda.gov/Extension/> to find your local county extension office.

References:

Rolston, L. H. and R.L. Kendrick. 1961. Biology of the brown stink bug, *Euschistus servus* Say. Journal of the Kansas Entomological Society, 34(3), 151-157.

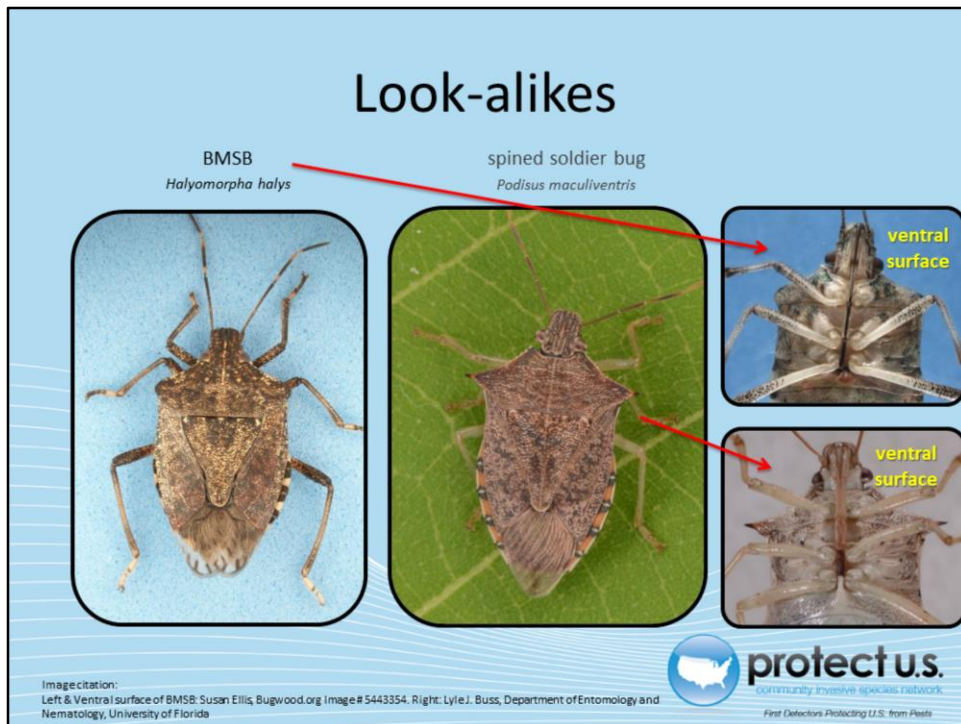


Bark stink bugs (*Parabrochymena* spp.) may also be confused with BMSB because it has similar coloring and banding on the edges of the abdomen. Bark stink bugs, as well as rough stink bugs (*Brochymena* spp.), have toothlike projections along the front edges of the pronotum whereas the front margins on BMSB are smooth. In addition, the membranous portion of the hemelytra on bark stink bugs have dark markings outlining the veins and the veins on BMSB are pale with a few darker spots.

If you are unsure about the identity of a specimen, contact your local extension agent for assistance. Visit <http://www.csrees.usda.gov/Extension/> to find your local county extension office.

References:

Larivière, M. C. 1992. Description of *Parabrochymena*, new genus, and redefinition and review of *Brochymena* Amyot and Audinet-Serville (Hemiptera: Pentatomidae), with considerations on natural history, chorological affinities, and evolutionary relationships. *Memoirs of the Entomological Society of Canada*, 124(S163), 3-75.



The spined soldier bug (*Podisus maculiventris*) is one of the most common predatory stink bugs in North America. This species is a generalist predator and has a broad host range that includes economically important pests such as the Colorado potato beetle, corn earworm, fall armyworm, and Mexican bean beetle. In fact, the spined soldier bug has been used in classical biological control programs through North America, Eastern Europe, and Russia.

The spined soldier bug may be confused with BMSB due to its marbled brown color and alternating light and dark colored banding along the edges of the abdomen. The two species may be distinguished by the shoulders, mouthparts, and ventral surface. BMSB has rounded shoulders and a long, slender rostrum (mouthparts). As the name suggests, the spined soldier bug has spined shoulders pointed in an outward direction. The spined soldier bug also has a short, robust rostrum (common for predatory pentatomids) and a pointed abdominal spine found on the ventral surface between the third pair of legs.

If you are unsure about the identity of a specimen, contact your local extension agent for assistance. Visit <http://www.csrees.usda.gov/Extension/> to find your local county extension office.

References:

Warren, L. O. and G. Wallis. 1971. Biology of the spined soldier bug, *Podisus maculiventris* (Hemiptera: Pentatomidae). Georgia Entomological Society Journal, 2, 109-116.

Monitoring

- Baited pyramid traps
 - Color: Black
 - Lure: Methyl(2E, 4E, 6Z)-decatrienolate
 - Only effective in late season
- Fluorescent light traps
 - Color: Blue or black



Implementing pest monitoring as a part of IPM programs may allow for the early detection of exotic species and improved overall pest management and/or eradication efforts. Various methods have been used to monitor populations of the brown marmorated stink bug including visual pyramid traps, pheromone-baited pyramid traps, beat sheet sampling, sweep net sampling, and light traps. Applying multiple detection methods would be a highly effective approach for monitoring brown marmorated stink bug populations.

Visual pyramid traps have commonly been used to monitor for several stink bug species, such as *Chinavia hilare* (Say), *Euschistus* spp., *Nezara viridula* (Linnaeus), and *Oebalus pugnax* (Fabricius). Generally, a yellow base pyramid trap design is used to trap stink bugs with or without a pheromone bait due to its attractiveness across species. However, significantly greater numbers of brown marmorated stink bug nymphs and adults were captured with black pyramid traps than any other colored traps with visual stimuli of green, yellow, clear, or white. The most effective results were obtained when the traps were baited with 450 mg of methyl-(2E, 4E, 6Z)-decatrienolate, an aggregation pheromone of a different stink bug species (*Plautia stali* Scott). This lure attracts both male and female adults as well as nymphs, and the number of individuals captured is dependent on increasing amounts of methyl-(2E, 4E, 6Z)-decatrienolate. However, this lure is only reliable during late-season population peaks from July to the first frost. Although it is currently being investigated, the identification of the true aggregation pheromone for the brown marmorated stink bug is unknown.

Active sampling techniques to monitor for the brown marmorated stink bug include beat sheet sampling and sweep net sampling. Beat sheet sampling has been used to collect adults and nymphs from fruit trees and woody shrubs, while sweep net sampling is more commonly used for field crops such as soybean. These methods were less effective than pyramid traps in the early crop season. Higher capture rates of nymphs and adults were obtained with these methods late in the growing season.

Black light traps are commonly used in the field to monitor the distribution and abundance of BMSB, primarily because these traps are effective, easily positioned in the field, and fairly inexpensive. Like many other pentatomid species, BMSB is more active at dusk and in the evening. Although these traps are non-specific, they are a highly reliable and effective monitoring tool for early season and low density populations of BMSB unlike pheromone or pyramid traps.

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- Kamminga, K. L., A.L. Koppel, D.A. Herbert, and T.P. Kuhar. 2012. Biology and management of the green stink bug. *Journal of Integrated Pest Management*, 3(3), C1-C8.
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- Nielsen, A. L. and G.C. Hamilton. 2009b. Seasonal occurrence and impact of *Halyomorpha halys* (Hemiptera: Pentatomidae) in tree fruit. *Journal of Economic Entomology*, 102(3), 1133-1140.
- Nielsen, A. L., K. Holmstrom, G.C. Hamilton, J. Cambridge, and J. Ingerson-Mahar. 2013. Use of black light traps to monitor the abundance, spread, and flight behavior of *Halyomorpha halys* (Hemiptera: Pentatomidae). *Journal of Economic Entomology*, 106(3), 1495-1502.

Chemical Management

- Check with local extension office
- Read and follow the label
- Most effective (in laboratory):
 - Pyrethroids
 - Bifenthrin, λ -cyhalothrin
 - Neonicotinoids
 - Dinotefurn, thiomethoxam
- May provide minor, short-term relief



It is very important to check first with your local extension office before choosing chemical management of BMSB. It is also imperative to follow the instructions on the pesticide label, not only because it provides critical information about how to safely handle and use pesticide products, but also because the user can be held legally accountable if the instructions on the label are not followed. Remember that the label is the law.

The toxicity of nine insecticides have been tested on the brown marmorated stink bug in the laboratory: one organophosphate (phosmet); three neonicotinoids (dinotefuran, acetamiprid, and thiomethoxam); and five pyrethroids (β -cyfluthrin, cyfluthrin, fenpropathrin, bifenthrin, and λ -cyhalothrin). Pyrethroids, particularly bifenthrin and λ -cyhalothrin, and neonicotinoids, dinotefuran and thiomethoxam, were the most effective insecticides against the brown marmorated stink bugs. However, the insecticides were only tested in a laboratory setting and field results have not yet been reported.

In and around homes, insecticides may provide minor relief although they have not been successful at controlling populations of the brown marmorated stink bug for long-term pest management.

For general information about pesticide labels visit: <http://www.epa.gov/opp00001/regulating/labels/product-labels.htm>, and for news regarding specific pesticides for BMSB visit: <http://www.stopbmsb.org/managing-bmsb/chemical-controls/>.

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Biological Management

- No effective natural enemies in U.S. effective
- Egg parasitoid wasp is being tested for biological control agent of BMSB
 - Up to 70% parasitism in native region
 - View [this video](#) for more information



Image citation:
Steven Valley, Oregon Department of Agriculture



Naturally occurring enemies (i.e. parasites, parasitoids, or pathogens) can be used for more effective and longer lasting of pest organisms. Currently there are no known natural enemies in the United States that sufficiently control the brown marmorated stink bug. Although there are several predators (i.e. birds, assassin bugs, etc.) that will prey on the brown marmorated stink bug, these natural enemies are typically generalist predators and not specialists of the brown marmorated stink bug.

In China, *Trissolcus halyomorphae* (Hymenoptera: Scelionidae) is a native parasitoid wasp that specializes in eggs of the brown marmorated stink bug. Females deposit one egg in a single stink bug egg. These parasitoid wasps complete their metamorphosis inside the stink bug eggs and emerge as adults, ultimately killing the host. This species has a high egg parasitism rate of 20 to 70%. It is unknown whether this wasp species would be an effective biological control agent or negatively impact native stink bugs in the United States.

The Agricultural Research Service (ARS) program of the United States Department of Agriculture (USDA) is collaborating with several states in a research project to determine the suitability of *T. halyomorphae* as a biological control agent of *H. halys*. *Trissolcus halyomorphae* testing is currently taking place in Delaware, Michigan, Mississippi, Oregon, and Florida. In Florida, the Bureau of Methods Development and Biological Control at the Florida Department of Agriculture and Consumer Services Division of Plant Industry (FDACS DPI) is currently researching the host preference of *T. halyomorphae* by exposing the parasitoid to native and established stink bugs of Florida. If the results of the research are favorable, *T. halyomorphae* may be considered for release in the United States to control the brown marmorated stink bug.

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Prevention In the Home

- Seal windows, doors, baseboards, and cracks with caulk
- Repair damaged wind/door screens and weather stripping/door sweeps
- Rake away debris and vegetation from foundation of home



Image citation:
Senior Airman Brian Ferguson, US Air Force, http://commons.wikimedia.org/wiki/File:Caulking_USAF.jpg, Wikimedia Commons



It is much easier to prevent stink bugs from getting into your house than addressing the problem after they have invaded.

To prevent stink bugs from entering your home, be sure to:

1. Properly seal all windows, doors, baseboards, and small cracks with caulk.
2. Replace or repair damaged window/door screens.
3. Close off all other areas (such as vents) with wire mesh or screening.
4. Rake away debris and vegetation from the foundation of home to eliminate possible reservoirs for insects to hide.

Insecticides may be used to prevent or control stink bugs, but this is only a temporary solution.

References:

Watanabe, M., R. Arakawa, Y. Shinagawa, and T. Okazawa. 1994. Anti-invading methods against the brown marmorated stink bug, *Halyomorpha mista*, in houses. Japanese Journal of Sanitary Zoology, 45(4), 311-317.

Management Inside the Home



- Remove individuals by hand or vacuum
- Once inside, it is not advised to use insecticidal treatments or pyrethrum foggers

Image citation:
Galen Dively, University of Maryland



During overwintering periods, large numbers of aggregated adults seek shelter in houses, buildings, and other structures to keep warm. Adults undergo a reproductive diapause at this time, meaning females are not reproductively mature to lay eggs.

Some websites suggest vacuuming or sweeping the insects off the walls once they have aggregated on structures. However, be forewarned that this will cause the stink bugs to emit a foul odor and possibly stain the surface where the aggregation occurred. Although the foul odor or stains are unfavorable, the brown marmorated stink bug does not vector diseases to humans and is not a threat to public health.

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Management for Growers

- StopBMSB.org
 - USDA's Specialty Crop Research Initiative
- Objectives
 - Improve current knowledge
 - Develop monitoring tools
 - Management programs
 - Integrate grower input and research findings



Image citation:
www.stopbmsb.org, homepage screenshot.



A very important national movement called Stop BMSB has been initiated to help in the regional management of BMSB, especially for specialty crop growers.

Funding from the USDA's Specialty Crop Research Initiative has helped mobilize a team of researchers from universities across the United States to work together and mobilize to form a defense against this invasive pest. The efforts of over 50 researchers at 10 institutions nationwide are in cooperation through StopBMSB. Updates about the BMSB are posted on the homepage of StopBMSB.org to provide the most current information available.

The objectives of the projects involved are to:

- 1) Establish biology and phenology of BMSB in specialty crops. This will help our understanding of behavior related to breeding and overwintering. It will also help characterize crop damage, identify risks to landscape and adjacent ecosystems, and conduct genetic studies of BMSB.
- 2) Develop monitoring and management tools for BMSB. This will involve assessment of effectiveness of baits and attractants, monitoring tools, conventional, organic, and alternative management tools, and investigate natural enemies of BMSB.
- 3) Establish effective management programs for BMSB in specialty crops. Both short-term and comprehensive long-term, region-wide strategies for mitigating damage to specialty crops will be developed to help control BMSB.
- 4) Integrate stakeholder input and research findings to form and deliver practical outcomes. The research will measure the biological, economic, and sociological impact of BMSB on the specialty crop community and deliver practical information to stakeholders on a timely basis. Outreach and education efforts will help give growers and others the information needed to identify and manage risks of BMSB.

References:

www.stopbmsb.org

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Published June 2014



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- Citation:
Poplin, A. V., E. G. LeVeen, and A. C. Hodges. 2014. The brown marmorated stink bug. Accessed (insert date)
<http://www.protectingusnow.org/>



Our Partners

- United States Department of Agriculture, National Institute of Food and Agriculture (USDA NIFA)
- United States Department of Agriculture, Animal and Plant Health Inspection Service, Plant Protection and Quarantine (USDA APHIS PPQ)
- Cooperative Agriculture Pest Survey (CAPS) Program
- National Plant Board (NPB)
- States Department of Agriculture
- Extension Disaster Education Network (EDEN)
- Center for Invasive Species and Ecosystem Health (Bugwood)
- National Plant Diagnostic Network (NPDN)
- U.S. Department of Homeland Security (DHS)
- U.S. Forest Service (USFS)



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