

BROWN MARMORATED STINK BUG

Integrated Pest Management for Landscape Professionals and Home Gardeners

The brown marmorated stink bug (*Halyomorpha halys*) or BMSB is native to Eastern Asia, mainly China, Korea, Japan, and Taiwan. The first report of this species in the United States occurred in Pennsylvania in 2001, although it is likely to have established as early as 1996. It has been found in at least 40 states, either as reproducing populations or single sightings; and the list of states with official sightings has grown each year. The brown marmorated stink bug was first found in Oregon in 2004 and has spread through many parts of that state and into Washington. In California a reproducing population was first found in Pasadena and San Marino (Los Angeles County) in 2006, and it has since been detected in many other parts of California. In 2013, large reproducing populations were discovered in Sacramento and Yuba City. As BMSB expands its range on the West Coast, it will likely continue to be found first in urban areas.

IDENTIFICATION

The adult BMSB is a typically-shaped stink bug, about 5/8 inch long, and marbled brown. It can be distinguished from other stink bugs of comparable size and color by the following characteristics: the antennae have two white bands; the forward edge of the head is blunt; the margin of the shoulder (thorax) is smooth; the legs are marbled brown with faint white bands; the membranous parts of the forewings have dark bands at the tip; and a banded abdominal edge is visible to the side of the wings (Figure 1). BMSB is commonly mistaken for other stink bugs, especially the rough stink bug, *Brochymena sulcata*, due to its similar size and brownish color. The rough stink bug has a rough shoulder margin, the forward edge of the head is extended with two points, and there are no white

bands on the antennae, although there are tiny light-colored striations where the antennae segments join (Figure 2). The consperse stink bug, *Euschistus conspersus*, has banded abdomen edges like BMSB but no bands on its antennae, and the legs have distinct dark spots rather than marbled markings and white bands; it is also a little smaller with a length of about 1/2 inch (Figure 3).

Eggs are barrel shaped, white to pale green, and laid in clusters on leaves (Figure 4). Nymphs shed their outer skin (molt) as they progress through five stages or



Figure 1. Adult (left) and late-stage nymph (right) of BMSB. (S. Ausmus, USDA)

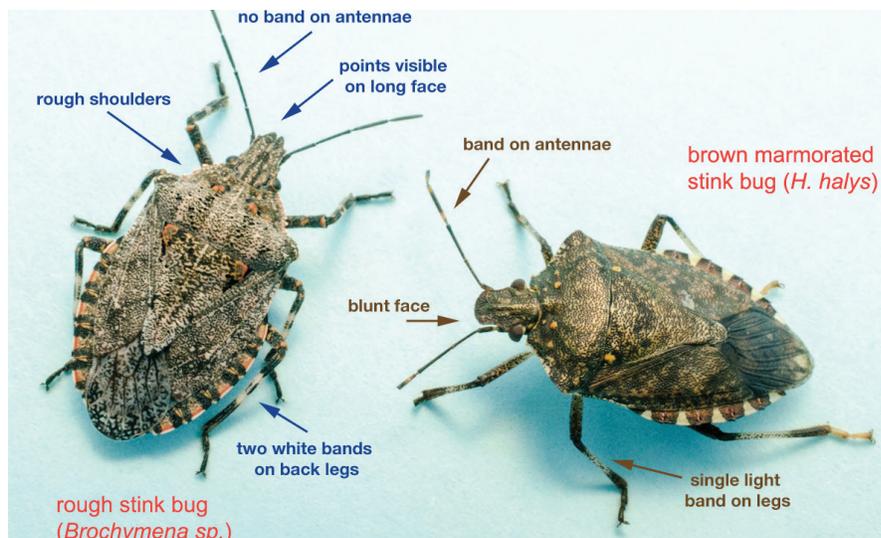


Figure 2. The rough stink bug (left) can be confused with the brown marmorated stink bug (right) but the top edge of its thorax (or "shoulder") is toothed and its antennae are not banded. (C. Hedstrom, Oregon State Univ.)



Figure 3. The consperse stink bug, has bands on its abdomen, no banding on its antennae or legs, and is slightly smaller than BMSB. (J.K. Clark, UCIPM)



Figure 4. Egg mass (hatched) laid on the underside of a Chinese pistache leaf. (C. Ingels, UCCE, Sacramento)

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nymphal instars before becoming adults. Nymphs range in size from 2.4 mm (first instar) to 12 mm (fifth instar). The newly hatched nymph has an orange abdomen with dark brown plates and brown head and thorax (Figure 5). First instars remain clustered around the egg cases feeding from the egg before dispersing, sometimes remaining until they molt to the second instar. The newly-molted second instar has an almost black appearance; subsequent instars (third through fifth) have marbled brown head and thorax and reddish brown, black, and white abdomen markings (Figure 1, insect on right). They have distinct white bands on the antennae and legs and spines in front of red eyes and on shoulder edges. Fourth and fifth instars have visible wing pads.

LIFE CYCLE

In the fall BMSB adults aggregate in large numbers on the sides of buildings or on trees (Figure 6). They then move to protected places and overwinter as adults in a state of facultative diapause (resting stage). Adults become active in the spring; and after feeding for about 2 weeks, they mate. The female begins to lay eggs in clusters of 20 to 28 with a range of 212 to 486 per lifetime. In mid-Atlantic states, there are one or two generations per year. The number of generations in various areas of California is unknown; however, more generations generally occur in warmer regions than in cooler areas.

DAMAGE

Brown marmorated stink bugs primarily damage fruit and are a serious pest of many fruit and fruiting vegetable crops. In Asia, BMSB are reported to feed on over 100 host plants, including tree fruit, vegetables, shade trees, and leguminous crops. In the mid-Atlantic, the crops most affected are apple, pear, peach, nectarine, lima bean, snap pea, pepper, sweet corn, tomato, field corn, and soybean. Other identified crop hosts include raspberry, blueberry, grape, hazelnut, pecan, cucumber, and pole and bush bean.

The stink bugs also feed on fruit or seed pods of ornamental tree and shrub species, especially tree-of-heaven (*Ailanthus altissima*), princess tree (*Paulownia tomentosa*), Catalpa (*Catalpa* spp.), English holly (*Ilex aquifolium*), Southern magnolia (*Magnolia grandiflora*), redbud (*Cercis* spp.), and Chinese pistache (*Pistacia chinensis*). The feeding effect on tree health, particularly young trees, is still being evaluated. A list of over 170 host species, including those that attract the highest densities, can be found at StopBMSB.org. The list of host plants will likely increase as the pest spreads to new regions.

BMSB may reach very high numbers, and since one bug can feed on many fruit sources, losses can be severe. Adults and nymphs inject tissue-destroying enzymes and suck juices from fruit and seeds, creating pockmarks and distortions that make fruit and vegetables unmarketable. Damaged flesh under the skin turns hard and pithy (Figure 7). They can also feed on buds, flowering structures, leaves, and stems, including feeding through the bark of the branches and trunks of young trees.

Nuisance Pest

In many home landscape situations the greatest concern may be the movement of brown marmorated stink bugs into buildings as they congregate in late summer and early fall and seek safe overwintering sites. Once inside buildings they can become a nuisance and emit an offensive odor if disturbed or crushed. During the winter months, the adults do not reproduce and feeding, if any, is minimal. They seek out narrow spaces to hide indoors, including cracks under or behind baseboards, around window and door trim, and around exhaust fans or lights in ceilings; and they prefer high and cool locations. In the spring, adults move from overwintering sites to host plants.

Brown marmorated stink bugs are not harmful to people, houses, or pets. They do not bite, sting, suck blood, or spread mammalian diseases; and they do not eat or bore into wood structures. Residents may become alarmed when



Figure 5. Newly hatched nymphs and egg mass. (D.R. Lance, USDA APHIS PPQ, Bugwood.org)



Figure 6. Adults aggregating on a Chinese pistache limb. (B. Villegas, sactorose.org)



Figure 7. Stink bug damage on tomato, peach, and pear (from top left clockwise). (J.K. Clark, UCIPM)

the bugs enter their homes and noisily fly about when lights are on. However, the stink bug will not reproduce or cause damage inside structures.

MANAGEMENT

Interior and Exterior Control for Homes

In the wild, brown marmorated stink bug adults spend the winter months

in cracks or under the peeling bark of older or dead trees. This characteristic of seeking protection in narrow spaces has helped them to adapt well to homes and other buildings, where they seek shelter in late summer and fall.

Non-Toxic Methods. The best way to keep stink bugs from entering homes and other buildings is to exclude them. Locate openings where the insects can gain access, such as cracks around windows, doors, screens, utility pipes, window air conditioners, vents, siding, and underneath fascia boards. These entry points should be sealed with good quality silicone, silicone-latex caulk, or foam sealant. Damaged screens on doors and windows should be repaired or replaced. Install weather stripping around the edges of doorframes. Adjust or install tight-fitting sweeps or thresholds at the bottom of exterior doors. Fill gaps on the edges of window air conditioner units and cover with screen material if necessary. Prevent entry into attics by putting window screening inside gable vents.

Stink bugs are naturally attracted to lights. They will often fly around light posts in large numbers at night; therefore, turn off unnecessary lights. When entering or exiting a home, avoid inviting the bugs in by keeping exterior lights on away from the entrance and keeping interior lights off near the entrance. Consider turning off or relocating exterior lights around open (screened) windows to prevent the very distracting noises when they fly around the lights.

To trap stink bugs that have come indoors, the most effective and inexpensive method is to place a foil roasting pan filled with some water and a few drops of dish soap, point a light into the pan, and place it in a dark room. Bugs will be attracted to the light and will fall into the water and drown. Empty the pan and repeat as necessary. See this short video from researchers at Virginia Tech: <http://vimeo.com/92354801>.

An efficient way to collect stink bugs indoors is by sucking them up with

a dry or wet vacuum. The bugs will cause the collection canister or bag and other parts of the vacuum to give off an unpleasant stink bug odor, so some people dedicate a vacuum cleaner to stink bug capture only. Alternatively, a nylon stocking can be stuffed inside the tube and securing the end over the outside of the vacuum tube with a rubber band; this way, bugs are collected in the stocking and not the vacuum cleaner bag. Individual stink bugs can be brushed off into a cut-off plastic bottle containing an inch of soapy water, where they will drown in a short period of time. If needed, the container can be fastened to a pole or broom handle to reach high locations. Stink bugs caught live also can be placed inside a plastic sealable bag and then into a freezer for 2 days to kill them. To conserve water, avoid flushing them down the toilet and avoid placing live stink bugs in the garbage so they do not become established around landfills.

Outside the home, sweeping stink bugs into containers can be effective when the bugs are easy to access and have congregated in large numbers; wait until it is cool so they don't fly. Spraying the bugs with a stream of water will dislodge them but they will likely return.

Insecticides. Although application of insecticides outside structures and around potential entry points may temporarily deter stink bugs from entering homes, the sprays break down rapidly, often within days. Sealing structures is a much more effective and environmentally sound strategy. Indoor sprays are not recommended as they are generally ineffective.

Control in Gardens

The amount of damage brown marmorated stink bugs may cause to garden plants has yet to be determined and may depend on each region's climate and nearby host plants. In the mid-Atlantic, many backyard gardeners have lost all their susceptible crops to BMSB. Keep in mind that a small amount of damage is tolerable; a spot or pithy area in fruits or vegetables can be cut out and does not affect eating quality. For

large populations, a variety of methods will likely be needed to manage this pest, which may include the use of row covers, hand picking, pheromone traps, trap crops, and natural enemies.

Covering vegetables with a row cover material can prevent feeding by stink bugs. A row cover is a light, permeable material, usually made of polypropylene or polyester that is used for extending the harvest season past the first few frosts and preventing damage by a wide range of pests (Figure 8). However, row covers also prevent pollinators from reaching flowers, which may be a key time for preventing stink bug feeding. Large fruit trees are very difficult to cover, winds can tear the material and in hot climates heat can build up inside. Espalier-trained fruit trees can be easier to cover.

Because stink bugs are large, they can be easily handpicked and crushed or brushed off plants into soapy water. However, they can be hidden inside dense foliage layers or fruit clusters, and they tend to hide or drop when startled. The use of a hand-held vacuum dedicated to catching stink bugs can be effective at reducing numbers if used regularly. Be sure to also destroy the



Figure 8. Row cover to protect vegetables against damage by stink bugs and other pests. Row cover fitted over PVC structure, used to protect a 10-foot-tall cherry tree. (top - J.K. Clark, UCIPM; bottom - C. Ingels, UCCE, Sacramento).

egg masses found on the underside of leaves.

Commercially available stink bug traps with aggregation pheromone lures can be useful for monitoring to determine if the bugs are present, when they emerge in spring and when populations are high. They can remove large numbers of stink bugs but probably have little value in preventing damage to crops. Several studies have shown that traps are sometimes ineffective in catching stink bugs, unless populations are high. A 2013 study in Maryland home gardens showed that single pheromone traps placed a meter from garden rows resulted in more stink bugs and damage on the plants near the traps. This may be due to a “spill-over” effect in which some bugs simply gather around traps. It may be useful to move traps well away from gardens, but the best distance is not known; and many backyards are too small to accommodate much distance.

Natural enemies have been documented feeding on various BMSB life stages, including assassin bugs, earwigs, and green lacewing larvae. In some situations, researchers have observed egg mortality as high as 50 to 60%. Birds may feed on adults and nymphs. Tiny parasitic wasps, reported to parasitize up to 80% of BMSB eggs in Asia, have been imported and are under study in quarantine facilities; but it is unknown, at this time, if they will be approved for release in the United States. Although native natural enemies may not be able to effectively control BMSB, they are important to preserve because they control other pests.

Most garden insecticides are not very effective against stink bugs, especially adults. Even if some are killed, additional stinkbugs are likely to move in to reinfest the crops. Insecticides, including broad spectrum, persistent materials such as pyrethroids, lower toxicity products such as oils, and botanicals such as pyrethrin or azadiractin, may provide some suppression of young nymphs. Additional research is required to provide firm recommendations for BMSB management with insecticides.

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Pesticides are poisonous. Always read and carefully follow all precautions and safety recommendations given on the container label. Store all chemicals in the original, labeled containers in a locked cabinet or shed, away from food or feeds, and out of the reach of children, unauthorized persons, pets, and livestock.

Pesticides applied in your home and landscape can move and contaminate creeks, rivers, and oceans. Confine chemicals to the property being treated. Avoid drift onto neighboring properties, especially gardens containing fruits or vegetables ready to be picked.

Do not place containers containing pesticide in the trash or pour pesticides down the sink or toilet. Either use the pesticide according to the label, or take unwanted pesticides to a Household Hazardous Waste Collection site. Contact your county agricultural commissioner for additional information on safe container disposal and for the location of the Household Hazardous Waste Collection site nearest you. Dispose of empty containers by following label directions. Never reuse or burn the containers or dispose of them in such a manner that they may contaminate water supplies or natural waterways.

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