Integrated Pest Management for Brown Marmorated Stink Bug in Vegetables

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

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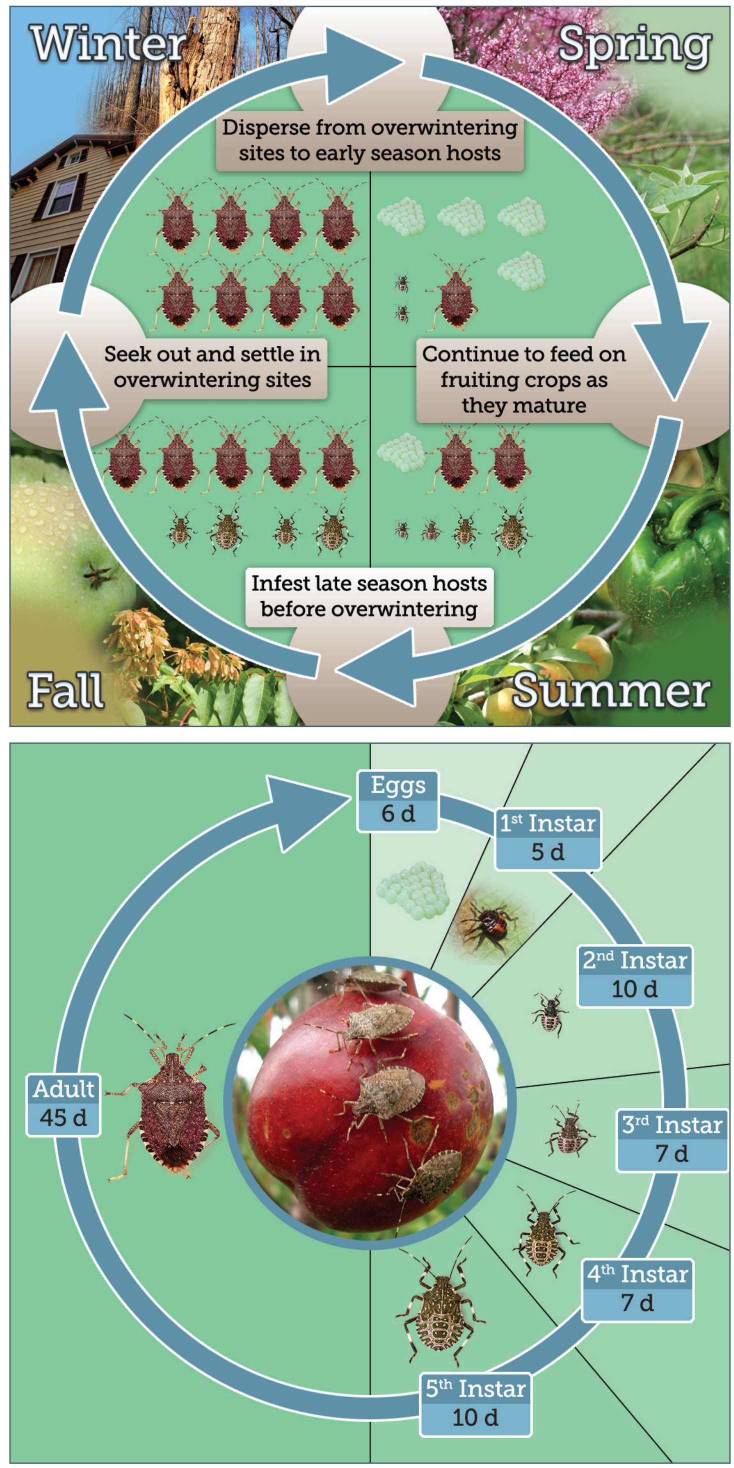
Basic Biology and Life Cycle of BMSB

- In addition to being a conspicuous household nuisance pest in the winter and spring, BMSB is a serious agricultural pest of numerous crops during the summer months.
- After emerging from shelters in late spring, BMSB adults begin mating and laying eggs on various trees and host plants in late May and June (Fig. 1).
- In most of its range in North America, BMSB completes one to two generations per year, progressing through an egg stage and 5 nymphal instars before molting into a fully-winged adult (Fig. 2).

Vegetable Crops at Risk / Crops Not at Risk

- BMSB is a landscape-level threat that frequently switches between host plants and can come from wooded habitats or among agricultural/settled land.
- BMSB will attack most vegetables that bear reproductive structures, which they prefer to feed upon.
- Among the vegetables, sweet corn (Fig. 3) and edible soybean (edamame) can incur extremely high densities of bugs during the kernel (or seed) development periods.
- Okra and bell pepper (Fig. 4) are preferred host plants for the majority of the growing season and for reproduction because their indeterminate growth patterns typically provide fruiting structures from mid-July through September.
- Green bean, tomato (Fig. 5), and eggplant also appear to support reproductive development of BMSB.
- Sweet corn, green bean, bell pepper and tomato are very susceptible to feeding injury and typically experience higher injury rates from BMSB than eggplant or okra.
- Asparagus and Swiss chard may be regularly attacked by BMSB.
- BMSB appear to be only minor feeders on cucurbits such as squash and cucumber and brassica vegetables such as broccoli, and collards.
- Leafy vegetables, root and tuber vegetables such as potatoes, and onions are not at risk to this pest.



Figs. 1 & 2. Typical seasonal biology and life cycle of BMSB.

Vegetable Injury Diagnostics

- BMSB nymphs and adults injure vegetables by inserting their piercing-sucking feeding stylets into fruit, pods, buds, leaves, and stems.
- In corn, BMSB stylets are inserted through the husk and pierce kernels, which may cause them to become sunken, collapsed, or discolored (Fig. 6). Damaged kernels appear dark brown after the corn ear is boiled.
- Injury to fleshy fruit, like tomatoes and peppers, will produce white (on peppers; Fig. 7) or yellow (ripe tomato; Fig. 8) feeding marks on the skin and spongy tissue damage internally where the feeding occurred (Fig. 9).
- Feeding on early fruiting stages can cause fruit abortion.
- Bean pods (Fig. 10) and okra seed pods (Fig. 11) may be deformed or misshapen from BMSB feeding.
- BMSB feeding can also open the path for secondary pathogens, further reducing the marketable yield.

Period of Risk/Susceptibility

- In the mid-Atlantic U.S., the highest pest pressure to vegetables occurs in July and August.
- Vegetable crops directly bordering woodlots are at the highest risk of attack as a large portion of the BMSB population disperses from wild tree hosts in the summer (Fig. 13).
- Late plantings of vegetables that mature in September or later tend to have less BMSB pest pressure often because of BMSB moving to more attractive plants such as soybeans or various trees.

Provisional Monitoring Recommendations

- Pyramid traps baited with commercial lures containing BMSB aggregation pheromone and methyl decatrianoate have been shown to be effective at catching BMSB even at low densities. These traps can be excellent monitoring tools for detecting BMSB activity on farms (Fig. 12).
- Action thresholds have not yet been developed.

Biological Control

- For most stink bugs, egg parasitoids are key natural enemies that keep pest populations in check. However, the native stink bug egg parasitoids found in North America do not develop well on BMSB and egg parasitism levels have been low in the mid-Atlantic U.S.
- A number of generalist predators have been observed feeding on BMSB eggs and nymphs and play an important role in reducing pest densities (Fig. 14).

Fig. 3. BMSB nymphs on corn.

Fig. 4. BMSB nymphs on pepper.

Fig. 5. BMSB nymphs on tomato.

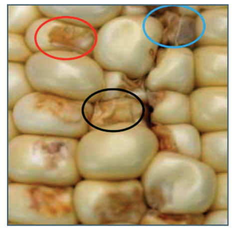


Fig. 6. Sweet corn kernel injury.

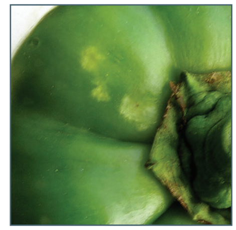


Fig. 7. Feeding injury on pepper.

Fig. 8. Feeding injury on tomato.

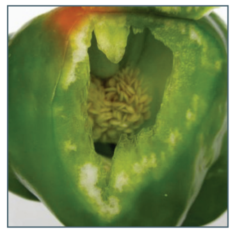


Fig. 9. Internal feeding injury.

Fig. 10. Feeding injury on bean.

Fig. 11. Feeding injury on okra.

Fig. 12. Commercial stink bug pheromone trap.

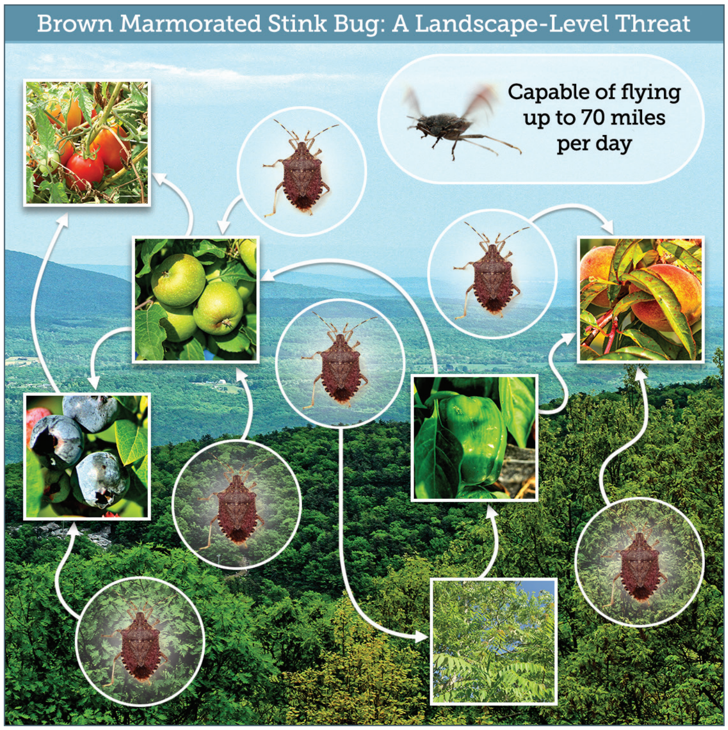


Fig. 13. Typical seasonal biology and life cycle of BMSB.

Provisional Management Strategies

- BMSB pest pressure is typically highest on the edges of fields, particularly edges bordering trees. Border sprays may be a practical option, especially on large fields. This strategy has been shown to be extremely successful in controlling BMSB in soybean cropping systems.
- As virtually all of the insecticides that are effective for stink bugs (see Table) also kill natural enemies, they should only be used when absolutely necessary.
- For corn, insecticide sprays should be initiated at tasseling if bugs are present.
- For most vegetables, control measures should be initiated if bugs are present in fields and the crop has initiated fruit development.
- Frequently, insecticide sprays should be repeated as needed until final harvest.
- Insecticides should be rotated according active ingredient.
- ALWAYS read the label before applying any pesticide.

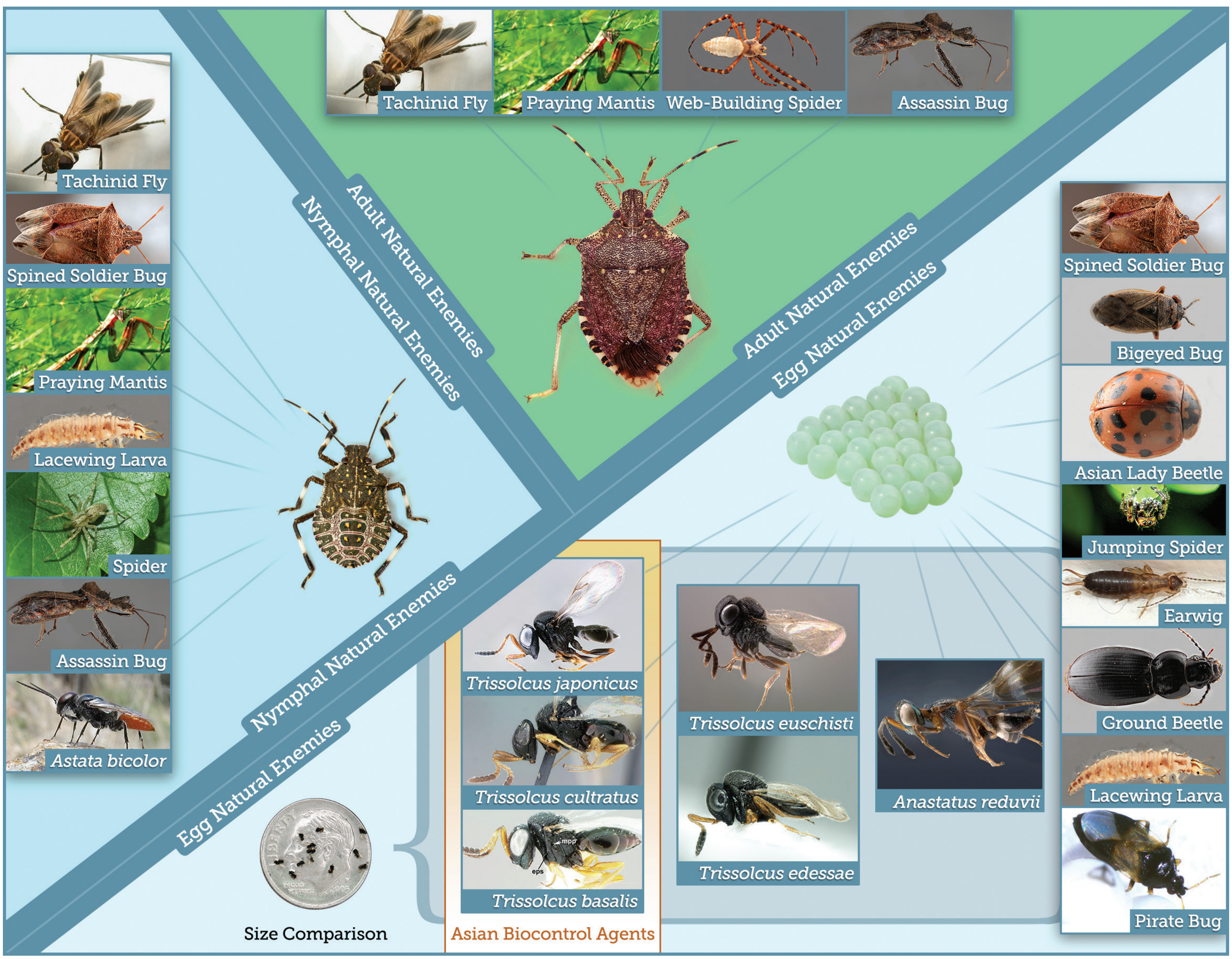


Fig. 14. Arthropod natural enemies of BMSB.

Effective Insecticides for Controlling BMSB on Vegetables

The following is a list of insecticides registered for use on vegetables in the U.S. that have demonstrated efficacy against BMSB as part of an integrated pest management (IPM) plan. Before using any pesticide, make sure the product is registered for use on the crop in your state. This list is not a substitute for pesticide labeling. Always read, understand, and follow the label directions before using any pesticide. For certain states, also make sure that the product selected is labeled for use against stink bugs.

		Crops listed on pesticide label with pre-harvest interval (days). "NL" indicates not labeled on that crop.					
Active Ingredient (IRAC class*)	**Product Name(s)**	**Sweet Corn**	**Bean**	**Pepper**	**Tomato**	**Okra**	**Swiss Chard**
acephate (1B)	Acephate 97, Orthene	NL	NL	7	NL	NL	NL
alpha-cypermethrin (3A)	Fastac EC	3	1	1	1	1	NL
beta-cyfluthrin (3A)	Baythroid XL	0	NL	7	0	NL	0
beta-cyfluthrin (3A) + imidacloprid (4A)	Leverage 360	NL	7	7	0	NL	NL
bifenthrin (3A)	Bifenture, Brigade, Sniper, others	1	3	7	7	7	7
clothianidin (4A)	Belay	NL	NL	21	21	NL	NL
cyfluthrin (3A)	Tombstone	0	NL	7	0	NL	0
dinotefuran (4A)	Venom, Scorpion	NL	NL	21	21	NL	7
imidacloprid (4A)	Admire Pro, 2F form.	NL	7	0	0	0	NL
lambda-cyhalothrin (3A)	Warrior II, Karate, Lambda-Cy, Lambda T, Silencer, others	1	7	5	5	NL	NL
lambda-cyhalothrin (3A) + imidacloprid (4A)	Brigadier	NL	7	7	1	7	NL
lambda-cyhalothrin (3A) + chlorantraniliprole (28)	Besiege	1	7	NL	NL	NL	NL
methomyl (1A)	Lannate LV	0	3	3	1	NL	NL
permethrin (3A)	Permethrin 3.2EC, Perm-UP, others	1	NL	3	0	NL	NL
thiamethoxam (4A)	Actara 25WDG	NL	NL	0	0	NL	7
thiamethoxam (4A) + lambda-cyhalothrin (3A)	Endigo	NL	NL	5	5	NL	NL
zeta-cypermethrin (3A)	Mustang Maxx	3	1	1	1	1	1
zeta-cypermethrin + bifenthrin (3A)	Hero EC	3	3	7	1	7	NL

* IRAC (Insecticide Resistance Action Committee) class: 1A = carbamates, 1B = organophosphates, 3A = pyrethroids, 4A = neonicotinoids, 28 = diamides.
Product names mentioned are for convenience only. No endorsement of products is intended, nor is criticism of unnamed products implied.

Potential Problems Arising from Multiple Applications of Pyrethroid Insecticides

- Destruction of natural enemies such as arthropod predators and parasitoids that control other pests.
- Outbreaks of secondary pests such as green peach aphids, melon aphids, thrips and spider mites.
- Selection for pyrethroid-resistance in pest populations. Some common vegetable pests that have shown resistance to pyrethroids include: diamondback moth, beet armyworm, eastern U.S. Colorado potato beetle populations, western flower thrips, melon aphid, green peach aphid, and corn earworm.

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