

BIOCONTROL

Biocontrol Around the Home: Mosquito Control

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What's biological control?

Biological control (biocontrol for short) uses living organisms—natural enemies—to keep pests in check. How? Natural enemies might eat pests, make them sick, or lay their eggs in or on them. When those eggs hatch, *voila*—their meal is ready and waiting. But not all natural enemies are members of the bug-eats-bug club. Microbes such as bacteria, fungi, and viruses make compounds toxic to pests. They could also use up space or other resources a pest needs. Or they could make garden vegetables, flowers, and even houseplants more resilient to attack.

The basics of Bt

Bacillus thuringiensis bacteria are found in a variety of natural habitats. The species was discovered more than 100 years ago; for more than 50 years it's been used as a biocontrol in agriculture. It kills pests by making proteins that become toxic only in the digestive system of some insects—and certainly not in ours, our pets, or those of other mammals and birds.

Bt kills only immature insects—the larvae—which must eat Bt to die. But not all Bt proteins are the same. Different subspecies of Bt produce proteins specific to different insect groups. Matching the right subspecies of Bt with the pest you're dealing with is essential for success.

You can learn more about the history and safety of Bt from the [Entomological Society of America \(entsoc.org/sites/default/files/files/Science-Policy/2018/ESA-Factsheet-Bt.pdf\)](https://www.entsoc.org/sites/default/files/files/Science-Policy/2018/ESA-Factsheet-Bt.pdf).

Name of active ingredient

All pesticide product labels will tell you which ingredients control the pest. These are called the *active ingredients*. When you want to deal with mosquitoes biologically, look for *Bacillus thuringiensis* subspecies *israelensis* (Bti for short) in the active ingredient list on the label of the pesticide product.

Does Bti actually work?

Yes. But Bti's effectiveness depends on many things. For mosquitoes, here's what matters:

- its species and age—You don't need to identify the species or determine the age of the mosquito larvae before you treat a container, but variations here may impact your success. In general, Bti products will be more effective (and you can use less product) if the mosquito larvae are younger. Multiple applications might be needed. Always follow the label.
- characteristics of the water being treated—See more under "How should it be used?"

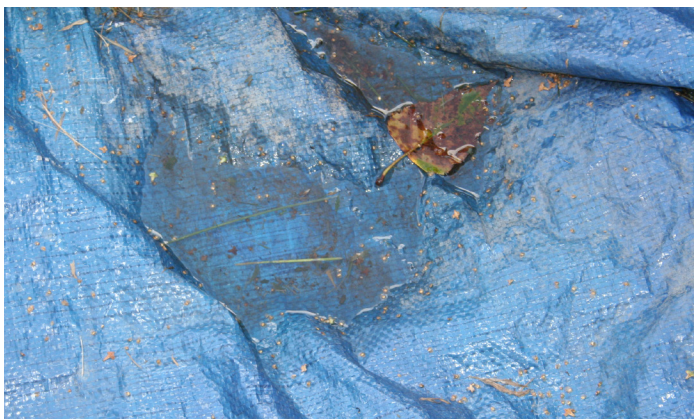


Image 1. Any item in your yard that holds even a small amount of water can be a breeding ground for mosquitoes. The first step for mosquito control around your home should be to dump out standing water so that you eliminate breeding places for mosquitoes. Photo: Joellen Lampman, NYS IPM.

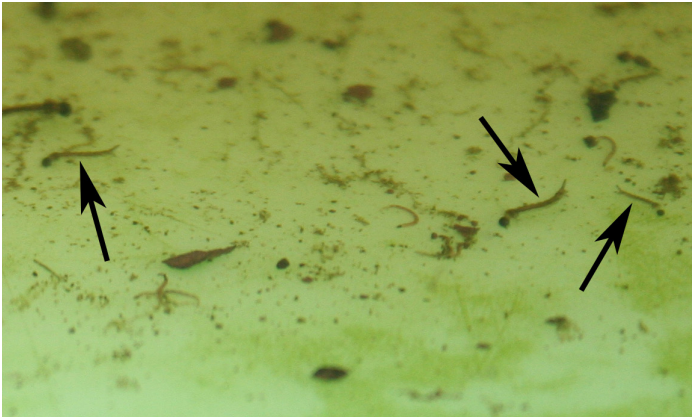


Image 2. Mosquito eggs laid in standing water hatch into the wriggling larvae. Several are marked with arrows in this picture. Larvae that consume Bti will die. Photo: Joellen Lampman, NYS IPM.



Image 3. An adult mosquito emerges, while other immature mosquitoes (larvae) are still present in this container of standing water. Only larvae (not adults) are susceptible to Bti. Photo: Matt Frye, NYS IPM.

- number of immature mosquitoes in the container—Some product labels recommend different product rates for “low” or “high” numbers of larvae. Always read and follow the label.
- and the way each Bti product is made—These products include other ingredients besides the active ingredient. Read the labels and choose a product that is recommended for the type of container you want to treat, how frequently you are willing to apply it, etc.

Read the label carefully to know how much Bti to use and how frequently to apply, depending on whether it’s for a bird bath, a garden pool with a liner, or other container.

And know that other strategies can lessen the likelihood of a mosquito bite. Using Bti is just one of them.

How does Bti work?

Bti forms tough spores to survive when it’s hot, dry, or cold. These spores contain proteins that can kill susceptible insects. But they need to be dissolved and digested in the gut of a susceptible insect before they’re fully active. Once that happens, they damage the cells that line the insect’s gut, killing it. Because of differences in the guts of many animals, this process can’t occur in other animals, including mammals, birds, and most other insects.



Image 4. Bti-containing products may only be applied to containers by homeowners or renters on property they own or rent. But the easiest mosquito control technique is to empty these containers frequently. Bti-containing products can be a good option for containers that are difficult to empty regularly (like this lined pond). Photo: Joyce Tomaselli, CCE Dutchess County.

The screenshot shows the NYSPAD search interface. At the top, there are three main sections: 'Product EPA Registration Number', 'Names', and 'Registrant'. The 'Names' section has a 'Product Name' field containing 'mosquito dunks'. A red arrow labeled '1) Enter product name here' points to this field. Below the 'Names' section is an 'Advanced Search...' button. To the right, the 'Registrant' section has fields for 'Name' and 'EPA Company Number'. Below these is a 'Search' button with a magnifying glass icon and a 'Reset' button with a circular arrow icon. A red arrow labeled '2) Click here' points to the 'Search' button. Below the search buttons, the results are displayed: 'Showing 1 - 1 out of 1 Products'. A red arrow labeled '3) Products allowed in NYS will be listed here' points to this text. Below the results text, there is a box for 'MOSQUITO DUNKS' with details: 'EPA Reg. No. 6218-47, Registrant SUMMIT CHEMICAL CO', 'Restrictions None', 'LI Use Yes', 'Status REGISTERED', and 'Type INSECTICIDE, MOSQUITO LARVICIDE'. A 'More' button is also present.

Image 5. Use the product registration section of the New York State's Pesticide Administration Database ([NYSPAD; dec.ny.gov/nyspad/products](https://dec.ny.gov/nyspad/products)) to check if a specific Bti product is allowed in NY. When you get to the website, follow the three simple steps shown here.

What types of products contain this ingredient and can be used in New York?

Products that contain Bti could be granules you sprinkle on water, floating briquettes, liquids, or pouches that dissolve in water. You can read more about products allowed for mosquito management in New York at the NYS Department of Environmental Conservation (DEC) website (dec.ny.gov/chemical/105244.html). Not all products available online are legal to use in NYS. To check if a specific product is allowed, go to the pesticide product information section of the New York State Pesticide Administration Database (NYSPAD; dec.ny.gov/nyspad/products). Just enter the product's name into the "Product Name" field and click "Search"; if the product isn't found, you cannot use it in NYS.

How should it be used? The label is the law.

Always follow all instructions on the label when you use any pest control product—including those containing Bti. In NYS, you may legally apply products containing Bti only to water in containers on property you own, rent, or lease unless you have a special license and permit from the DEC. Without such a license and permit, you may not apply Bti (or *any* pesticide) to streams or other natural bodies of water; roadside ditches; unlined, man-made ponds; or roof gutters that are not for collecting rainwater. If you want to manage mosquitoes in these habitats around your home, contact a professional.

Mosquito management works best if you integrate multiple strategies, and use Bti products correctly. Here's what you should do:

- Discard unneeded items like old tires that might collect water.

- Don't let water stand in containers (birdbaths, lawn toys, flower pots, roof gutters, rain barrels, etc.) for more than a week. If you can't empty these items often enough, then applying Bti to them is a good option; however, you can apply Bti to roof gutters only if they are used for collecting rainwater (e.g., by directing water into a rain barrel rather than onto the lawn or into a drain).
- Bti works best in clear water—no soil or leaves.
- You'll need to treat with Bti more than once; how frequently depends on the product, number of larvae in the water, and environmental conditions. Follow instructions on the label for when to re-treat.
- Bti will be less effective if fresh water constantly enters a container and dilutes the Bti. In cases like these, water will need to be re-treated more frequently.
- Bti won't work as well if the water temperature is below 50°F.
- Bti will be more effective in containers located in shady spots. This is because the Bti proteins break down quickly when exposed to sunlight.

Does Bti pose any risk to you, your pets or livestock, or other organisms?

You've learned that Bti is active only in the digestive system of certain insect species and is inactive in people, pets, and most other insects. Still, products containing Bti also contain other substances needed to make the granules, pellets, pouches, liquids, or dunks that release Bti in water. These could irritate your skin, eyes, or respiratory tract, so follow label directions to minimize your exposure to them.

When mosquito larvae feed on Bti, other insects that eat those larvae are not harmed. Bti doesn't harm birds or other animals that could bathe or live in treated water, either. Some Bti products may be used in water drunk by livestock. They may not, however, be used in the water we drink.

Finally, the risks associated with any pesticide increase if you use it improperly. **The label is the law.** Follow all label directions: preventing harm is paramount.

For questions about pesticide use, regulations, and safety:

Cornell Pesticide Management Education Program: 607-255-1866 or pmep_webmaster@cornell.edu.

For questions about biocontrol:

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For questions about integrated pest management:

New York State Integrated Pest Management, nysipm.cornell.edu

Curious about the science behind all this? References include:

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