

Questions and Answers: Using *Btk* to control Gypsy Moth



Gypsy moth caterpillar. Image credit: Didier Descouens, Museum of Toulouse. Wikipedia Creative Commons

What is the gypsy moth and why is it a problem?

The gypsy moth is an insect with a big appetite for oaks and other tree species. Each caterpillar can grow up to 2 inches long and can consume 11 square feet of tree leaves during May and June. When abundant, caterpillars completely defoliate trees. Millions of acres of forests have been defoliated by gypsy moth caterpillars in the Northeast United States.

Although healthy trees can survive defoliation, repeated removal of leaves can kill a tree. Older, less vigorous trees suffering from drought can be killed by a single defoliation. Capable of feeding on 500 different kinds of plants, gypsy moth threatens Iowa forests and suburban landscapes.

Gypsy moth caterpillars are also a public nuisance in recreational areas where host trees are prevalent. The large number of caterpillars and their excrement falling from treetops can discourage even the heartiest hikers and campers from using parks. Some people that come in contact with the caterpillar hairs develop skin rashes or allergies.



Gypsy moth caterpillars congregating on side of home. Image credit: Luz, WNEP Pennsylvania.



Excrement fallen from gypsy moths feeding in trees. Image credit: Phil Burt, CapeCodWeather.net

Where did the gypsy moth come from?

The gypsy moth was introduced to North America in 1869 from Europe in an experiment to improve the silk industry. A windstorm knocked over cages and this insect was accidentally released into Massachusetts's forests. Since that time, gypsy moth has been spreading slowly west and south.

Is gypsy moth in Iowa?

Gypsy moth is getting closer to Iowa as the main population from eastern neighboring states moves westward. Each summer traps are placed to detect start-up populations. Since 2010, Iowa has treated nine start-up populations.

How does the gypsy moth move?

Because adult females cannot fly, the natural spread of this exotic pest is when young caterpillars crawl to treetops to feed and are blown by the wind to new sites. Gypsy moths can be moved long distances when people unknowingly carry them from infested areas as egg masses or cocoons attached to firewood, campers, nursery stock, outdoor furniture, or vehicles. Most of the isolated pockets of infestation in Iowa are a result of this long-distance movement.

What is Btk?

Bacillus thuringiensis (*Bt* for short) is a naturally occurring bacterium commonly found in soil and on plants. Thousands of *Bt* strains exist in nature; most are pathogens that cause disease in certain insect groups. The U.S. Environmental Protection Agency has registered several *Bt* strains as insecticides. These have been used commercially (including organic production) for more than 30 years in the U.S. to control insect pests on food, forage crops, and

forests. Also, *Bt* is frequently used by commercial landscapers and home gardeners for its effectiveness, low risk, and selectivity. A specific *Bt* strain called '*kurstaki*' (thus *Btk*) is formulated as an insecticide that kills gypsy moth and other caterpillars.

How does Btk kill gypsy moths?

Gypsy moth caterpillars ingest *Btk* when they eat host leaf tissue. The bacteria produce protein crystals that are toxic to the insect's digestive system. Soon after eating leaves sprayed with *Btk*, caterpillars stop feeding and die a short time later.

Is Btk harmful to other insects?

Yes and No. *Btk* is more selective than conventional insecticides, but it can affect other leaf-feeding caterpillars if they eat treated leaves. This is why *Btk* is used only when gypsy moth populations are at high levels. Fortunately, *Btk* degrades quickly and new plant leaves (produced after spraying) will not have any *Btk* on them.

Butterfly and moth populations within the management area could be impacted, but research from other states shows populations will recover and re-establish to former levels within three years. If left unchecked, a gypsy moth infestation would result in defoliation of many host trees and also impact other butterfly species by reducing their habitat and food supply.

Scientists have found that *Btk* has little or no effect on the large majority of insects such as honey bees, lacewings, ladybugs, and other beneficial species. In contrast, conventional insecticides are toxic to many kinds of insects.

What happens to Btk in the environment?

Btk is rapidly broken down by sunlight on plant surfaces (3-7 days) and on the soil surface (a few days). Also, microbes in soil will break down these bacteria. *Btk* does not readily leach through the soil, but remains in the upper soil surface until it is broken down.

Is Btk similar to Bt corn?

The same species of bacteria, *Bacillus thuringiensis*, is used to produce *Btk* insecticide and *Bt* corn. Susceptible insects feeding on *Bt* corn (which is incorporated into the plant's genetics) and *Btk* treated leaves die from bacterial infection after the protein crystal tears the intestinal lining.

What is Foray® 48B?

Foray® 48B is a microbial insecticide that contains *Btk*. It is produced by fermentation in sterilized stainless steel tanks by Valent BioSciences. The product is applied at a rate of about one-half gallon per acre.

Why is aerial application necessary?

There is no alternative treatment method as effective as aerial spraying against gypsy moth caterpillars. *Btk* must be applied to the site where young caterpillars are feeding, in this case to the leaves of in the upper crown of host trees. Airplanes or helicopters can fly just above the top of the trees and deposit *Btk* on the host leaves.



Image credit: John Ghent, Bugwood.org

How many sprays will there be?

For the greatest effectiveness, two sprays will be applied when gypsy moth caterpillars are small and most susceptible. Iowa officials will be carefully watching egg masses in early spring to see when the young caterpillars are active. The first spray will be applied within a week of egg hatch and the second spray will be applied 3 to 14 days later.

How effective is Btk in controlling gypsy moth caterpillars?

When properly applied, *Btk* kills 80-85% of these caterpillars with each spray. After two consecutive sprays, timed two weeks apart, approximately 99% of the caterpillars will be killed.

Will the spray take the paint off my car?

No. Some people living in the treatment area have reported the presence of small droplets or fine dust on surfaces following spraying. According to Valent BioSciences (the manufacturer), there is nothing in the spray (*Btk* or inert ingredients) that will cause damage to automobile finishes. Washing the vehicle soon after spraying will remove any residues.

Will the sprays interfere with my organic crop certification?

No. *Btk* is an Organic Materials Review Institute (OMRI) listed product. It may be used in certified organic production or food processing and handling according to the USDA National Organic Program Rule.

Is Btk harmful to people or pets?

No. Most people have already been exposed to *Bt* in their diet, at very low levels. Since *Bt* is commonly found in soils, exposures not related to spraying are also possible. The US EPA and Health and Welfare Canada have reviewed extensive animal research studies on *Btk*, and no evidence of any poisonous or disease-causing effects have been found. This safety has been confirmed with over 30 years of *Btk* use in urban and rural applications.

Following aerial applications, most people surveyed were not affected. However, some people with hay fever reported certain symptoms, including difficulty sleeping, upset stomach, and nose or throat irritation. Seasonal factors (pollen) may have contributed to some of these effects. Farmworkers exposed to *Bt* for 1-4 months did not experience any problems related to their airways, nose or skin.

How can I protect myself from the effects of Btk sprays?

Although not necessary, some people may choose to minimize their exposure to the *Btk* spray, even though it has proven to be one of the safest pest control methods available. Remain inside at least 15 minutes after the helicopter has finished spraying. Wait until spray droplets or dew has dried before letting children or pets outside. If you come in contact with the *Btk* spray, wash the affected area with soap and water.

What danger do the inert ingredients pose during Btk spraying?

Canadian scientists analyzed the volatiles produced by spraying *Btk* and concluded that these materials did not constitute a health hazard. *Btk* products contain stickers and binders that allow the spray to remain on tree leaves after it is sprayed. These ingredients include food products that also provide temporary nutrition for bacterial survival (potato starch), sugars (glucose, sucrose), protein (corn or soy), and water. Other inert ingredients could include sodium hydroxide (used to adjust pH in chocolates, ice cream, and margarine), potassium phosphate, and a thickening agent found in ice cream and cheese. No petroleum products are used as carriers.

For more information on gypsy moths:

Visit Iowa State University Extension's Website:
<https://www.extension.iastate.edu/psep/gypsymoth.html>

Visit Iowa Department of Agriculture and Land Stewardship's Iowa Gypsy Moth Website:
<http://www.iowagypsymoth.com/>

Contact Iowa State University Extension Entomology, Life Sciences II, Ames, IA 50011 or call 515-294-1101

Contact Iowa State University Plant and Insect Diagnostic Clinic at 2445 ATRB, 2213 Pammel Drive, Ames, IA 50011 or call 515-294-0581

Contact Mike Kintner, Gypsy Moth Outreach Coordinator, State Entomologist Office, 2230 South Ankeny Blvd, Ankeny, IA 50023 or call 515-745-2877

Contact Iowa Department of Natural Resources, 502 East 9th Street, Des Moines, IA 50319 or call 515-725-8453

Contact USDA APHIS Plant Protection Quarantine, 11213 Aurora Avenue, Urbandale, IA 50322 or call 515-251-4083

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Anonymous. 2015. *Bacillus thuringiensis* General Fact Sheet. National Pesticide Information Center, Oregon State University, 4 pages.

Ellis, J.A. Undated. Commonly asked questions about *Btk* (*Bacillus thuringiensis* var. *kurstaki*). Purdue University Extension, 4 pages.

McCullough, D.G. and Bauer, L.S. 2000. *Bt*: One option for gypsy moth management. Michigan State Extension Bulletin E-2724, 4 pages.

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