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Use of bacillus thuringiensis for insect control in Colorado

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Quick Facts

Bacillus thuringiensis is a naturally occurring bacterial disease of insects. Insecticides have been manufactured which contain this bacteria as the active ingredient.

Bacillus thuringiensis insecticides are most widely used against certain leaf and needle feeding caterpillars. Recently, strains of the bacteria have been produced that affect certain fly larvae such as mosquitoes.

Bacillus thuringiensis is considered very safe to apply and is exempted by the E.P.A. from residue tolerance requirements on food crops.

Several Colorado insect pests can be controlled with *Bacillus thuringiensis* insecticides.

meoptera: Symphyta). Among the various Bt strains, insecticidal activity is quite specific (e.g., Bt strains developed for mosquito larvae work poorly against caterpillars). Development of Bt products is currently an active area and many manufacturers are producing a variety of products. Effectiveness of the various formulations may differ.

The shelf life of current Bt products will continue for years if the insecticide is not exposed to light or water. Bt typically persists on foliage less than a week following application.

Activity

The specific activity of Bt is generally considered beneficial. Since Bt insecticides, unlike most, are not broad spectrum, beneficial insects are not killed by applications of Bt. This includes the natural enemies of insects (predators and parasites) as well as beneficial pollinators such as honeybees.

Bacillus thuringiensis (Bt) is an insecticide with unusual properties that make it useful for certain pest control. Bt is a naturally occurring disease of insects that is mass produced and sold under a variety of trade names (Dipel, Thuricide, Javelin, Biological Worm Spray, etc.). At present Bt is the only "microbial insecticide" in widespread use for insect control. Recently, new formulations of Bt have become available and insecticidal activity has greatly improved.

Properties

Bt is safe to humans, pets and wildlife and affects only a few groups of insects. The most commonly used strains of Bt (*thuringiensis* strain, *kurstaki* strain) will only kill leaf and needle-feeding caterpillars. Recently, Bt strains have been developed that control certain types of fly larvae (*israelensis* strain) such as mosquitoes, black flies and fungus gnats. Experimental strains exist with activity against some leaf beetles (*Coleoptera: Chrysomelidae* and sawflies (*Hy-*

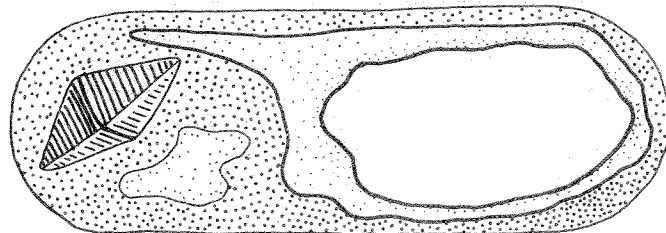


Figure 1: Sporangium of *Bacillus thuringiensis*; note the protein crystal that has most of the insecticidal activity (greatly magnified).

Unlike other nerve-poison insecticides, Bt insecticides contain spores of the bacteria and within these spores are protein crystals that react with the "gut" of susceptible insects. After feed-

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ing on the spore-containing crystals, the digestive system of the infected insect becomes paralyzed. Within a short time after exposure, the insect stops feeding. Bacteria then develop on the blood and cells of the insect and within two to three days the insect dies from the bacterial infection (septicemia).

The highly specific activity of Bt insecticides might limit their use on crops where problems with several pests occur, including non-susceptible insects (aphids, grasshoppers, etc.). As strictly a stomach poison insecticide Bt must be eaten to be effective and application coverage must be thorough. The use of additives (stickers, wetting agents) often is useful in a Bt application to improve performance. Since Bt does not cause a rapid kill, users may incorrectly assume that it's ineffective a day or two after treatment.

Application

The greatest use of Bt is for control of caterpillars on vegetable crops. Because it's considered non-toxic by the U.S. Environmental Protection Agency and exempted from pesticide tolerance restrictions Bt may be used on all crops up to harvest. This aspect of Bt registrations also makes it useful in pesticide applications where pesticide drift is likely to occur, such as treating trees and shrubs. The exceptional safety of Bt products makes them useful where exposure to pesticides, during mixing and application, is likely.

To control mosquito larvae put the insecticide into the stagnant water used as a mosquito breeding site. These Bt strains will kill mosquito larvae and a few closely related species of fly larvae in the stream but will not kill most aquatic insects. Adult mosquitoes are not affected by Bt.

Controlled Insects

Colorado insects that may be controlled with Bt include:

Vegetable insects

Cabbage "worms" (cabbage looper, imported cabbageworm, diamondback moth, etc.)

Tomato and tobacco hornworm

Corn earworm (directed ear tip treatment at silk emergence)

Field crop and range insects

European corn borer (granular formulations have been superior for control of first generation corn borers)

Alfalfa caterpillar, alfalfa webworm

Range caterpillar

Armyworm

Fruit crops

Leafrollers

Greenhouse

Leafrollers

Fungus gnats

Tree and shrub insects

Tent caterpillars

Fall webworm

Leafrollers

Red-humped caterpillar

Spiny elm caterpillar

Western spruce budworm

Pine budworm

Pine butterfly

Douglas fir tussock moth (results have been inconsistent, thorough application is essential)

Mosquito control

Larvae (various)

Stored products

Indian meal moth