

Commercial Applications of *Beauveria bassiana*

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Beauveria bassiana (Hypocreales: Clavicipitaceae) is an entomopathogenic fungus that occurs naturally in soil. Many strains exist and can vary in host range, pathogenicity (ability to infect a host), and virulence (ability to multiply in the host). The fungus was first isolated in 1835 by Italian scientist Agostino Bassi, who found that it killed and mummified silkworm larvae in what was called *muscardine disease*. The first commercial formulations of *B. bassiana* were developed in 1995 using the strains GHA and ATCC 74040, which are mass-produced by fermentation and sold under the trade names BotaniGard, Mycotrol, and Naturalis. Another strain, ANT-03, was isolated in 2000 and marketed in 2013 under the name BioCeres. Additional strains are available commercially for a variety of insect pests.

B. bassiana is a contact insecticide, meaning its spores must physically contact the insect cuticle to be effective. It is therefore important to ensure thorough and even coverage when making applications. The insect doesn't need to ingest *B. bassiana*, as the fungal spores adhere to the insect and penetrate the body cavity when they germinate. Once inside, secondary metabolites (chemicals) are produced, including the toxin beauvericin and the antibiotic oosporein, which weaken the host's immune system and outcompete intestinal bacteria. White mold may grow out of the insect's body after it has died, but mold growth is not required to achieve control.

As a generalist feeder, *B. bassiana* controls all life stages of leaf-feeding insects, including common pests such as aphids, thrips, whiteflies, mealybugs, caterpillars, beetles, and others. Immature stages tend to be more susceptible than adults. Spray formulations can be applied in greenhouse or field settings and on ornamental or edible crops. Efficacy is dependent on climatic conditions; the greatest control occurs within 68-86 degrees Fahrenheit and above 60 percent relative humidity. *B. bassiana* is a slow-acting insecticide because spores require time to germinate and penetrate insects. In greenhouses, control may be reached in three to seven days, but it is not uncommon for control to take seven to 10 days in field settings. Repeat applications are recommended every five to seven days until a desired level of control is reached.

A commercial suspension of *B. bassiana* spores has a shelf life of one year when stored at room temperature and longer when stored in the refrigerator. The product should not be stored below 0 degrees Fahrenheit or above 85 degrees Fahrenheit. Spray mixes should be applied as soon as possible after mixing, as spores cannot survive in water for more than 24 hours and are susceptible to degradation from UV light. Spores remain viable for longer when applied to leaf undersides or in the evening because of reduced sunlight exposure.

B. bassiana as a biological insecticide is generally not considered systemic (moving throughout the plant) or translaminar (moving throughout the leaf), but in some crops such as corn and cotton the fungus can inhabit the plant as an endophyte (living inside the plant tissue without causing disease). In corn, *B. bassiana* has been found to move internally in the plant and provide extended control of European corn borer caterpillars throughout the season.

B. bassiana is considered safe for beneficial insects, although avoiding spraying directly in areas where bees are actively foraging is recommended. If bees are contacted directly, they can bring fungal spores back to the hive and infect the susceptible brood. *B. bassiana* has no reported phytotoxicity effects and has a zero-day preharvest interval (PHI). The reentry interval (REI) is four to 12 hours depending on the product formulation. Some formulations of *B. bassiana* are approved by the OMRI (Organic Materials Review Institute) for organic pest control. *According to label regulations, B. bassiana may be tank-mixed with other insecticides but should never be mixed with fungicides.*