



Bacillus thuringiensis israelensis (*Bti*) Fact Sheet

What is *Bti* - *Bacillus thuringiensis israelensis*?

Bacillus thuringiensis subsp. *israelensis* (*Bti*) is a naturally occurring soil bacteria used as a microbial insecticide to control the spread of vector-borne diseases, protect public health, and manage insect pest species. *Bti* was first discovered in a stagnant pond in Israel in 1976 (Margalit and Dean 1985). Initial testing of *Bti* revealed acute toxicity to mosquitoes (Goldberg and Margalit 1977) and black flies (Undeen and Nagel 1978). Further research demonstrated that *Bti* is nontoxic to humans, mammals, birds, beneficial insects, fish, plants, and most aquatic organisms ([EPA 1998 *Bti* EG2215 Factsheet](#)). *Bti* an ideal pesticide with greatly reduced environmental impacts in comparison to man-made chemical insecticides. In addition, *Bti* is species specific, breaks down rapidly, limited non-target impacts (de Barjac and Sutherland 1990), There are 26 *Bti* products in the United States with some of the following trade Names: [Vectobac](#), Teknar, Aquabac, Bactimos, LarvX, etc.

Bti application for black fly control

Bti is applied by via aerial spraying or boat spraying at a safe rate specified by the United States Environmental Protection Agency in the form of liquid. *Bti* is currently being used in several states to control black flies and mosquitoes. Both Pennsylvania and West Virginia have large black fly suppression programs and use *Bti* as the treatment. *Bti* is also currently being used to suppress mosquito populations throughout Maryland.

How *Bti* impacts black flies

Black flies must actively ingest *Bti* in order for the material to be effective. *Bti* is a spore-forming bacterium that produces protoxins in the form of parasporal protein crystals. *Bti* works best in black flies with alkaline guts because the protoxins become activated into highly toxic delta-endotoxins. The endotoxins cause a rapid breakdown in the lining of the midgut and necrosis of skeletal muscles, resulting in paralysis and mortality of target insect pests. *Bti* is nontoxic to other non-target species due to their acidic digestive system.

Non-target impacts of *Bti*

Research has demonstrated that *Bti* is nontoxic to humans, mammals, birds, fish (trout and bluegill), and most invertebrates when properly applied ([EPA 1998 Reregistration Eligibility Decision](#)). Data from a large number of studies indicate that *Bti* can be used in a carefully managed treatment program to selectively control insect pest and vector species with minimal adverse environmental impacts (Jackson et al. 2002), (Laird et al. 1990).

Further Reading

- de Barjac H. and D.J. Sutherland (eds.). 1990. Bacterial control of mosquitoes and black flies: Biochemistry, genetics and applications of *Bacillus thuringiensis israelensis* and *Bacillus sphaericus*. Rutgers University Press, New Brunswick, NJ. 349 pp.
- Environmental Protection Agency (EPA). 1998. [EPA *Bacillus thuringiensis* subspecies *israelensis* strain EG2215 Factsheet](#); available from
- [Environmental Protection Agency \(EPA\). 1998. EPA Re-registration Eligibility Decision \(RED\) *Bacillus thuringiensis* EPA738-R-98-004](#)
- Goldberg, L.J. and J. Margalit. 1977. A bacterial spore demonstrating rapid larvicidal activity activity against *Anopheles sergentii*, *Uranotaenia unguiculata*, *Culex univittatus*, *Aedes aegypti* and *Culex pipiens* complex. *Mosquito News* 37: 355-358.
- Jackson, J.K., R.J. Horwitz and B.W. Sweeney. 2002. Effects of *Bacillus thuringiensis israelensis* on black flies and non-target macroinvertebrates and fish in a large river. *Transactions of the American Fisheries Society* 131: 910-930.
- Laird, M., L.A. Lacey and E.W. Davidson (eds.). 1990. Safety of Microbial Insecticides. CRC Press, Inc. Boca Raton, Florida. 259 pp.