



Bacillus thuringiensis var. israelensis (Bti)

January 2008

Introduction to Biopesticides Registered for Mosquito Control

Bacillus thuringiensis var israelensis ([Bti](#)), *Bacillus sphaericus* and [methoprene](#) are three [biopesticides](#) that may be applied to standing water and other breeding sites (e.g. stormwater retention areas, ditches, or ponds) for the purpose of selectively reducing populations of mosquito larvae or “wrigglers” that hatch from eggs. Biopesticides include products derived from naturally occurring bacteria and insect growth regulators (IGRs). Bti has been used worldwide as a biological pesticide since 1980 for mosquito control. Bti was registered by EPA in 1983 and has been used as a Best Management Practice ([BMP](#)) option to manage mosquito larvae.



How is Bti regulated in Washington?

Distribution and use of Bti and other pesticides in Washington are subject to compliance with federal and state regulations including the Washington Pesticide Control Act ([15.58 RCW](#)), the Washington Pesticide Application Act ([17.21 RCW](#)), and General Pesticide Rules ([WAC 16-228](#)). Larvicides are registered by WSDA as [state restricted use pesticides](#) (RUP) or general use pesticides that are [home and garden use only pesticides](#). Larvicides designated as state RUP products may require a National Pollutant Discharge Elimination System (NPDES) permit before making an application. Permitting information is available from the Washington State Department of [Ecology](#), Washington State Department of [Health \(DOH\)](#) and [local health departments](#).

What are home and garden use only pesticides?

"[Home and garden use only pesticides](#)" means any pesticide determined by WSDA to be packaged, labeled and marketed in a manner that clearly indicates the product is intended for personal use by the general public in and around a residence. Mosquito larvicides that are labeled for “home and garden use only” and applied only to waters that will not drain off of the property are generally exempt from NPDES permitting requirements.

Which Bti products are registered?

WSDA and WSU provide guidance on Bti and other [larvicides registered](#) for control of mosquito. Product selection may be based on the species, life stage, habitat, population, temperature, non-target impacts, resistance management, and cost. Some species, such as *Anopheles* and *Culex*, may require the higher labeled rates to achieve acceptable control. Bti products are formulated as liquid concentrate, granular and dust. The granular forms are useful against mosquito larvae (e.g. *Culex* spp.) found in used tires and other artificial containers. *B. sphaericus* may be a better choice than Bti when targeting larvae in turbid water with high organic content (e.g. animal waste lagoons). Refer to the American Mosquito Control Association Bulletin No. 7 or WSU’s publications, “[Pest Management for Prevention and Control of Mosquitoes](#)” and “[Pesticide Regulations on use of Mosquito Larvicides](#)”, for more information on Bti.

REGISTRATION, LICENSING AND EDUCATION INFORMATION:

Pesticide Registration

- Wendy Sue Wheeler, Aquatic Pesticides 360.902.1972
- Steve Foss, Biopesticides 360.902.2049
- Shannon Lumsden, Home & Garden Products 360.902.2032

<http://agr.wa.gov/PestFert>

Pesticide Licensing

Many people who use, sell or consult on the use of pesticides are required to be licensed by the Washington State Department of Agriculture (WSDA). This requirement does not generally apply to homeowners who use home and garden pesticides on their own property. To learn more about licensing for mosquito control, go to the fact sheet [Pesticide Licensing for Professional Mosquito Control](#).

Licensing Question?

Contact us toll-free at (877) 301-4555 or by e-mail at license@agr.wa.gov

WSU Pesticide Safety Education

This program provides training and study manuals for WSDA exams.

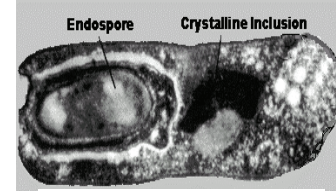
Pesticide Education Web site is <http://pep.wsu.edu>

**ALWAYS READ
AND FOLLOW THE
LABEL**



How does Bti work?

Mosquito larvae must eat the Bti-formulated product containing dormant bacterial spores. Crystals, which are known as Insecticidal Crystal Proteins (ICP) or delta-endotoxin, are produced during Bti sporulation. The mosquito larvae stop feeding and die when these proteins are converted into toxins that work by damaging the gut wall of mosquitoes. This reaction cannot take place in humans and other mammals. Bti is effective against the early stages of mosquito larvae and does not affect mosquito eggs, mature larvae, pupae, or adults. The length of effectiveness can vary between formulations and environmental conditions. More information on the mosquito life cycle may be found on [WSU's](#) web page or DOH's [Guidance](#) for Surveillance, Prevention, and Control of Mosquito-borne Disease web page .



Electron Micrograph of a Sporulating Bt Cell

What are some benefits of using Bti?

Bti is inherently less toxic than conventional pesticides and has relatively minimal impact upon most non-target organisms. According to EPA, the toxicology of Bti is well-established and exhibits minimal to nonexistent risk to humans, pets, birds, aquatic organisms (e.g. fish and invertebrates), non-target plants and honey bees. Bti is one of two biological pesticides that may be applied for mosquito control in certain sensitive sites in Washington due to its increased margin of safety. EPA reports that the use of biopesticides can reduce the use of other pesticides (e.g. adulticides) when used as part of an IPM program. Refer to [DOH's](#) for answers to common health-related questions on [Bti](#) or [EPA's](#) web site for other advantages of using Bti.

When should Bti be used?

Mosquito (larval and adult) and bird-based surveillance, historical records (dates of previous treatment), mapping, experience, and current temperature and wind conditions are useful in determining when to apply Bti. Pesticide applicators with Mosquito Control Districts in Washington State systematically monitor field reference sites to determine when applications are necessary. These licensed and trained applicators follow uniform treatment standards before applying Bti in accordance with world standards that comply with federal pesticide (EPA) and other state regulations. They may use counts from traps (e.g. light or CO₂-baited Encephalitis Vector Survey) as timing-indicators for treating potential problem areas with pesticides. The Center for Disease Control (CDC) recommends alternating [biorational larvicides](#) and IGRs annually or at longer intervals to prevent the onset of pesticide resistance. Reducing incidents of mosquito-borne disease, such as West Nile virus, can be aided by effective mosquito control.

References

- Antonelli A., T. Murray, and C. Daniels. 2007. [Pest Management for Prevention and Control of Mosquitoes with Special Attention to West Nile Virus](#). WSU-Puyallup PLS-121.
- US EPA Reregistration Eligibility Decision (RED): [Bacillus thuringiensis](#). March 1998. EPA Publication Number EPA738-R-98-004.
- Bajwa, W.I. and M. Kogan. *Bacillus thuringiensis* - Based Biological Control of Insect Pests. Integrated Plant Protection Center (IPPC), Oregon State University, Corvallis. June 2001.
- Lacey, L.A. and R. W. Merritt. 2003. [The Safety of Bacterial Microbial Agents used for Black Fly and Mosquito Control in Aquatic Environments](#). In: Environmental Impacts of Microbial Insecticides: Need and Methods for Risk Assessment. (H. M. T. Hokkanen and A. E. Hajek, eds.), pp. 151-168. Kluwer Academic Publishers Dordrecht, The Netherlands.
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- Platt, T. and C. Ramsay. [Pesticide Regulations on Use of Mosquito Larvicides](#). August 2007.
- [Pesticide Licensing for Professional Mosquito Control](#). WSDA AGR Pub 640-118 (N/10/04).
- Washington State Department of Ecology. Best Management Practices for Mosquito Control. Ecology publication #03-10-023. May 2004.