



TECHNICAL USE BULLETIN

# VectoMax<sup>®</sup>

Biological Larvicide

MADE WITH

 BioFuse<sup>™</sup>

TECHNOLOGY

# Combining our strengths™



U.S. Patent Nos. 7,989,180 and 8,454,983

 For Organic Production

MADE WITH  
  
TECHNOLOGY

VectoMax® Biological Larvicide is an advanced mosquito larvicide based on BioFuse™ technology—a patented formulation and manufacturing process that combines the time-proven and environmentally compatible bacterial active ingredients *Bacillus thuringiensis* subsp. *israelensis* strain AM65-52 and *Bacillus sphaericus* strain ABTS-1743 into a single microparticle. The mosquito larvae get a dose of a carefully selected ratio of both toxins when VectoMax particles are ingested.



# Features and Benefits

## FEATURES

Biorational larvicide  
Highly specific activity on mosquitoes

BioFuse patented technology  
(combines *Bti* and *Bsph* in a carefully selected ratio in every microparticle)

Quickly kills mosquito larvae

Offers residual control of several mosquito species

Controls all mosquito species  
Can be used in clean and polluted habitats

VectoMax WSP is easy to apply  
(malleable, slips into tight spots)

National Organic Program (NOP) listed

VectoMax WSP initially releases product/activity at water surface

Virtually dust-free granules

Dust-free catch basin option

Uniform carrier

## BENEFITS

- Not harmful to non-target organisms

- VectoMax WSP provides up to 56 days of residual control in catch basins\*
- VectoMax FG provides up to 28 days of residual control in open habitats\*

- Results observed quickly in the field

- Reduced number of applications

- Application flexibility

- Peace of mind when treating mosquito larval habitats on organic farms

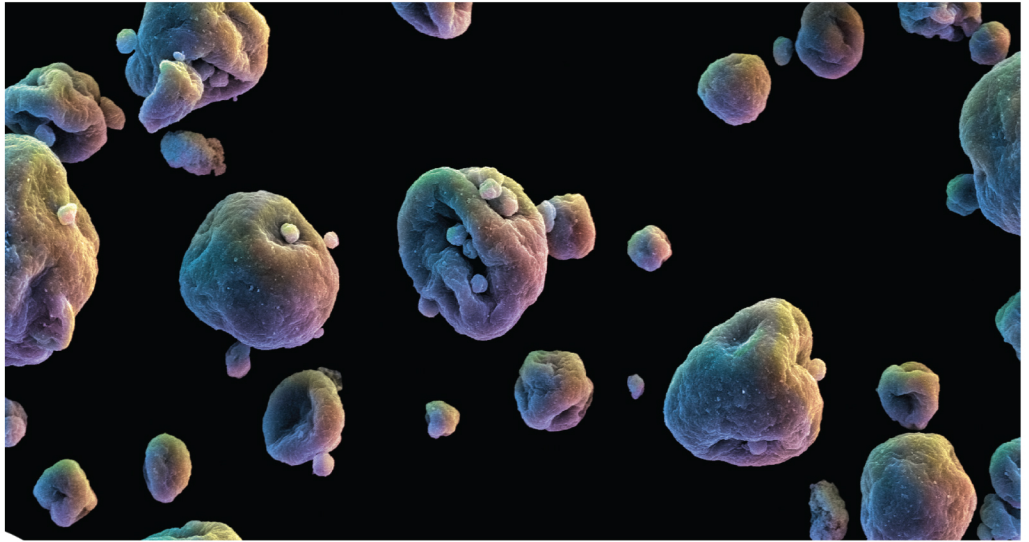
- Does not get hung up in debris or sludge at the bottom of catch basins

- Less respirable and particulate dust

- Eliminates cleanup of PPE

- Even applications with no bridging at lower application rates

\*Length of control dependent on local conditions and rate used.



Biological mosquito larvicides have gained considerable acceptance around the globe. The value of *Bti* and *Bsph* to mosquito control programs worldwide is well established.<sup>1</sup> *Bti* and *Bsph* each offer unique advantages relative to traditional chemical and biochemical insecticides. Both *Bti* and *Bsph* offer relative safety to humans and non-target organisms.<sup>2,3,4</sup> *Bti* provides broad-spectrum activity against mosquitoes, rapid control, and low potential for resistance; while *Bsph* exhibits extended residual control, efficacy in polluted water, and high target specificity.<sup>5</sup>

Due to these unique advantages, Sumitomo Biorational developed BioFuse technology, a globally patented technology that combines *Bti* and *Bsph* in a specific toxin ratio into every microparticle. This technology offers mosquito control professionals the ability to take advantage of each biological larvicide's strengths while significantly reducing the limitations that each possesses.

1. Becker N, Petric D, Zgomba M, Boase C, Dahl C, Lane J and A Kaiser. 2003. Mosquitoes and their control. Kluwer Academic; Plenum Publishers, New York; ISBN 0-306-47360-7
2. Lacey LA and RW 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" (HMT Hokkanen and AE Hajek, eds.), pp 151-168. Kluwer Academic Publishers; Dordrecht, The Netherlands.
3. World Health Organization, 1999, Environmental health criteria 217 microbial pest control agent *Bacillus thuringiensis*, WHO, Geneva, Switzerland; ISBN 92 4 157217 5.
4. Siegel JP and DA Shadduk. 1990. Mammalian safety of *Bacillus sphaericus*, Chp. 21 in "Bacterial Control of Mosquitoes and Black Flies" (de Barjac & Sutherland eds.). Rutgers University Press, ISBN 0-8135-1546-7
5. Lacey LA. 1990. Chp. 18 In: "Bacterial control of mosquitoes and black flies" (deBarjac H and DJ Sutherland eds.). Rutgers University Press, New Brunswick, NJ.

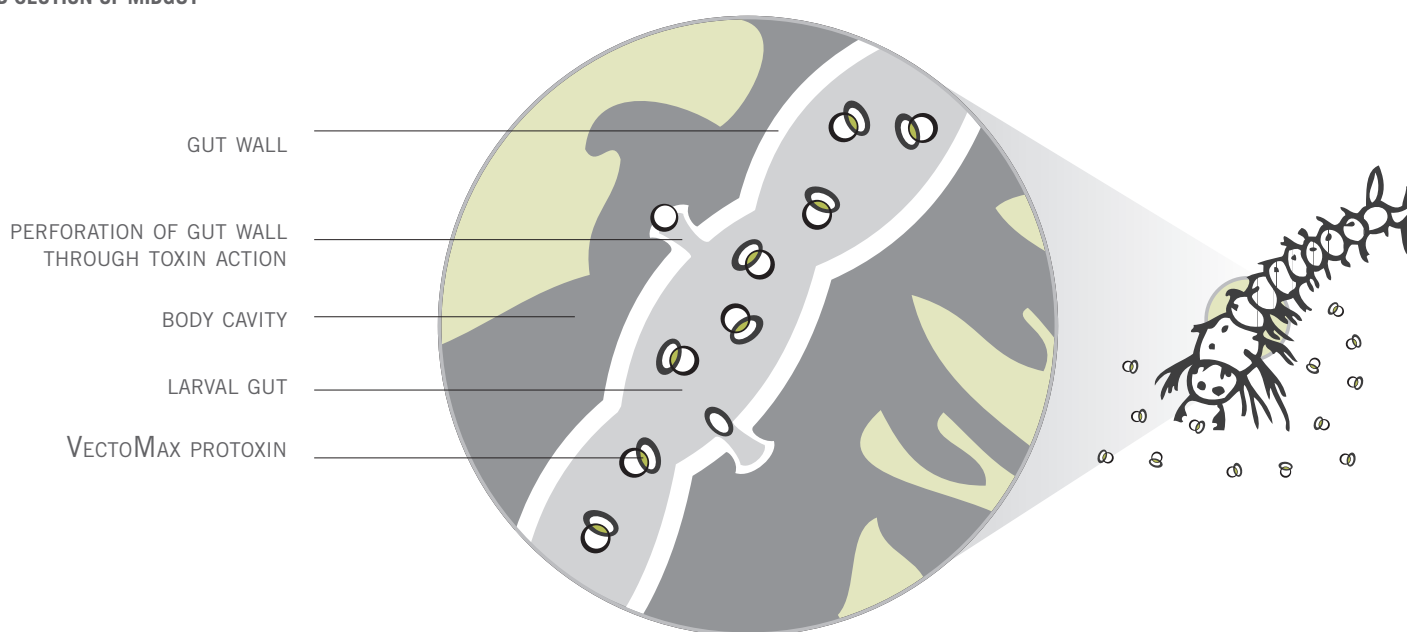
## Mode of Action

Both *Bti* and *Bsph* produce complex crystal proteins known as protoxins during sporulation. When these proteins are applied to larval habitats of mosquitoes, the mosquito larvae ingest them by filter feeding. The crystal proteins are solubilized by the alkaline juices in the larval midgut and are cleaved by the midgut proteases, yielding active peptide toxins called delta-endotoxins. The delta-endotoxins cause the formation of holes in the midgut cell wall, leading to lysis of cells and larvae death.

However, activity of the delta-endotoxin for *Bsph* differs from that of *Bti* in several important ways. For *Bsph*, the toxin is attached to the bacterial spore, while *Bti* toxins are not attached to the spore (parasporal). The toxins of *Bsph* and *Bti* bind to chemically different receptor sites on cells. They are not related immunologically and are thought to have completely different molecular modes of action.

Operationally, the most important differences between the toxins of *Bsph* and *Bti* are speed of action and persistence in natural larval habitats. *Bsph* toxin is much slower-acting than *Bti* toxin. Larval mortality can take several days but is usually expressed within 48 hours of ingestion, while *Bti* provides quick kill. Initial results with *Bti* can be seen within 2–24 hours. *Bsph* toxin is also much more persistent in natural larval habitats than *Bti*. This persistence is thought to be the result of a combination of features, including protection of the protein by the spore coat; slower settling rate; and the unique ability of *Bsph* spores to germinate, grow, and produce toxins in cadavers of mosquito larvae treated with the material. VectoMax combines the quick kill seen with *Bti* in combination with the residual properties of *Bsph*.

### ENLARGED SECTION OF MIDGUT



### VECTOMAX MODE OF ACTION

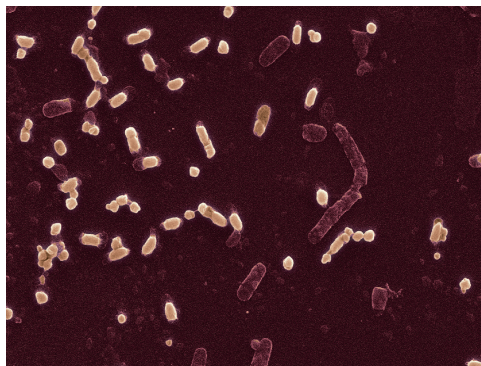
- Mosquito larvae ingest specific protoxin ratio of *Bti* and *Bsph* with every microparticle
- Protoxin activated in alkaline environment of the midgut
- Larval proteolytic enzymes break down activated protoxin into polypeptide fractions
- Polypeptide fractions act on midgut cells
- Midgut cells lyse
- Larvae die

## Low Risk, Environmentally Compatible

ORGANISM	STUDY TYPE	RESULT
<b>Odonata</b>		
Dragonflies/Damselflies		
<i>T. corruptum</i>	Lab/naiads fed infected larvae	No effect
<i>E. civile</i>	Lab/naiads fed infected larvae	No effect
<b>Ephemoptera</b>		
Mayflies		
<i>C. pacificus</i>	Field treatment ( <i>Bti</i> technical powder 0.56 kg/ha)	No effect
<i>C. pacificus</i>	Field treatment ( <i>Bsph</i> technical powder 0.22 kg/ha)	No effect
<b>Heteroptera</b>		
Corixids/Notonectids		
<i>C. decolor</i>	Field treatment ( <i>Bsph</i> technical powder 0.25 kg/ha; <i>Bsph</i> technical powder 0.25 kg/ha)	No effect
<i>N. undulata</i>	Lab/fed infected larvae	No effect
<i>A. bouvieri</i>	Lab/LC50 ( <i>Bsph</i> )	500X mosquito LC50
<i>N. unifasciata</i>	Field study/treated ponds	No effect
<i>Buenoa spp.</i>	Field study/treated ponds	No effect
<b>Coleoptera</b>		
Dytiscidae	Field studies	No effect
Hydrophilidae	Field studies	No effect
<b>Crustacea</b>		
<i>Daphnia spp.</i>		
<i>E. bampo</i>	Laboratory ( <i>Bti</i> )	100-200X mosquito rate
<i>D. similis</i>	Laboratory ( <i>Bsph</i> )	Effect at 27,000X mosquito rate
<b>Fairy Shrimp</b>		
<i>S. dichotomus</i>	Laboratory ( <i>Bsph</i> )	Effect at 15,000X mosquito rate
<b>Crawfish</b>		
<i>P. clarkii</i>	Laboratory	Effect at 1,000X mosquito rate

Lacey and Mulla (1990). Safety of *Bacillus thuringiensis* subsp. *israelensis* and *Bacillus sphaericus* to non-target organisms in the aquatic environment. In "Safety of Microbial Insecticides" (Marshall Laird, Lawrence Lacey, and Elizabeth Davidson eds.), Chap. 12. CRC Press, Inc. Boca Raton, Florida. (Unless otherwise indicated, studies include evaluations of both *Bti* and *Bsph*.)

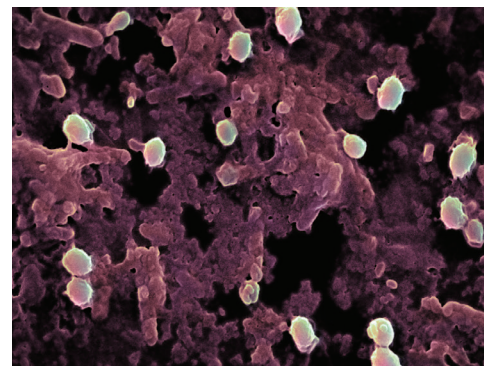
*Bti* and *Bsph* have been extensively tested, and they are not human health hazards when handled as instructed by the product label.



### **BACILLUS THURINGIENSIS SUBSP. ISRAELENسيس (STRAIN AM65-52)**

*Bti* is a naturally occurring spore-forming bacterium found in soil and aquatic environments throughout the world. At the time of sporulation, *Bti* produces a highly specific delta-endotoxin that is toxic upon ingestion only to larvae of mosquitoes, black flies, and closely related flies.

With over 30 years of field use in a variety of settings around the globe, *Bti* has been shown to provide effective, reliable, and environmentally compatible control of mosquito larvae. In addition to the effectiveness of *Bti*, it has an excellent safety record and very low mammalian toxicity: LD50 values for both oral and dermal toxicity are more than 30,000 mg/kg. The mosquitocidal crystal proteins, spores and vegetative cells of *Bti* administered by different routes have been found to be non-pathogenic and non-toxic to various animal species in maximum challenge tests.<sup>1</sup> *Bti* is safe for use in aquatic environments, including drinking water reservoirs, for the control of mosquito, black fly, and nuisance insect larvae.<sup>2</sup>



### **BACILLUS SPHAERICUS (STRAIN ABTS-1743)**

*Bsph* is also a naturally occurring spore-forming bacterium found throughout the world in soil and aquatic environments. Early development of *Bsph* formulations for mosquito control focused on strains isolated and maintained by the Pasteur Institute, WHO Collaborating Center, Paris, France. Since 1995, *Bsph* strain ABTS-1743 has demonstrated the ability to provide residual control of mosquito larvae in a great variety of aquatic habitats. This biological larvicide is capable of providing residual control in highly organic environments, including catch basins, sewage effluent, sewage lagoons, oxidation ponds, animal waste lagoons, septic ditches, animal waste ponds, septic tanks, irrigation ditches and roadside ditches.

1. Becker N, Petric D, Zgomba M, Boase C, Dahl C, Lane J and A Kaiser. 2003. Mosquitoes and their control. Kluwer Academic; Plenum Publishers, New York: ISBN 0-306-47360-7.

2. Lacey LA and RW 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" (HMT Hokkanen and AE Hajek, eds.), pp 151-168. Kluwer Academic Publishers Dordrecht, The Netherlands.



**Sumitomo Biorational Company LLC is  
an ISO 9001:2008 Certified Company**

[sumitomobiorational.com/public-health](http://sumitomobiorational.com/public-health)

**Sumitomo Biorational**  
1910 Innovation Way, Suite 100  
Libertyville, Illinois 60048

VECTOPRIME, BIOFUSE, VECTOBAC, VECTOLEX, and VECTOMAX are registered trademarks of Sumitomo Biorational Company LLC. CYCLONE is a trademark of Cyclone Seeder Company. ORTHO and WHIRLYBIRD are registered trademarks of OMS Investments Inc. MARUYAMA is a registered trademark of Maryuma US, Inc. STIHL is a registered trademark of Andreas Stihl AG & CO KG. HERD is the trademark of Kasco Manufacturing Co., Inc.

© 2026 Sumitomo Biorational Company LLC

