
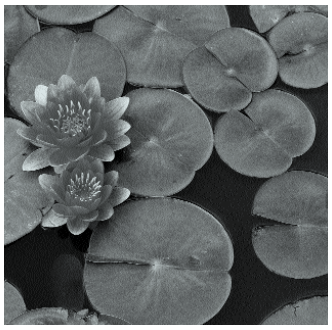


VectoLex® CG
Technical Use Bulletin

VectoLex CG is the granular formulation of Bacillus sphaericus(strain 2362). It is designed for application to mosquito larval habitats. The product has a potency of 50 BsITU/mg (B. sphaericus International Units/mg). It is available in 40 pound bags

History

B. sphaericus is a naturally occurring, spore-forming bacterium found throughout the world in soil and aquatic environments. At the time of sporulation, *B. sphaericus* produces a d-endotoxin which is toxic to many species of mosquito larvae upon ingestion. Early development of *B. sphaericus* for mosquito control focused on strains isolated and maintained by the Pasteur Institute, WHO collaborating Center, Paris, France. VectoLex is based on strain 2362, which was isolated in Nigeria.

All tested species of *Culex* larvae are susceptible to *B. sphaericus*. Many species of *Aedes, Ochlerotatus, Psorophora, Coquillettidia, Mansonia* and *Anopheles* are also very susceptible. However, susceptibility of species within these genera is variable.

B. sphaericus has demonstrated the ability to provide residual control of mosquito larvae in a great variety of aquatic habitats. It is also the only biological larvicide capable of providing residual control in highly organic environments, including sewage, waste lagoons, animal waste ponds, septic ditches etc.

Bioassay

A standardized bioassay, similar to that developed for Bti H-14 has been developed for determining the potency of *B. sphaericus* preparations. The bioassay utilizes 3rd-4th instar larvae of *Culex quinquefasciatus.*

Mode of Action

The d-endotoxin of *B. sphaericus* is only toxic to the larval stages of mosquitoes. It must first be ingested by the larvae, then partially digested before it becomes activated. The toxin's mode of action is similar to *Bti*, causing disruption of the midgut epithelium.

However, activity of the d-endotoxin of *B. sphaericus* differs from that of *Bti* in several important ways. The toxin is attached to the bacterial spore, while *Bti* toxins are not attached to the spore. The toxins of *B. sphaericus* 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 *B. sphaericus* and *Bti* are speed of action and persistence in the larval habitat. *B. sphaericus* toxin is much slower acting than *Bti* toxin. Larval mortality can take several days, but is usually expressed within 48 hours of ingestion. *B. sphaericus* toxin is also much more persistent in the larval habitat than *Bti.* This persistence is thought to be the result of the stability and slower settling rate of the *B. sphaericus* toxin, as well as the unique ability of *B. sphaericus* spores to germinate, grow and produce toxin in cadavers of mosquito larvae treated with the material. This process is known as recycling.

VectoLex CG is labeled for the control of the following mosquitoes:

Culex (all species)
Aedes vexans
Oc. melanimon
Oc. stimulans
Oc. nigromaculis
Coquillettidia perturbans
Psorophora columbiae
Psorophora ferox
Oc. triseriatus
Oc. sollicitans
Anopheles quadrimaculatus

Several other species of mosquitoes are susceptible to VectoLex, but have not been listed on the label. Use for control of such species in the absence of a listed species is therefore not advised. Check with your state agency responsible for FIFRA enforcement if further interpretation is desired.

Habitats	**Rate Range**
Crops and Dormant Fields: Pastures/hay fields, citrus groves, irrigated crops, orchards, rice, impounded water in dormant fields	5-20 lbs/acre
Marine/Coastal Areas: Salt marshes, Mangroves estuaries	5-20 lbs/acre

Stormwater/Drainage Systems: Storm sewers, catch basins, drainage ditches, retention, detention and seepage ponds	5-20 lbs/acre
Wastewater Sewage effluent, sewage lagoons, oxidation ponds, sewage treatment plants, septic ditches, animal waste lagoons, impounded wastewater associated with fruit and vegetable processing	5-20 lbs/acre
Water Bodies Natural and manmade aquatic sites such as lakes, ponds, rivers canals, wetlands and streams	5-20 lbs/acre

Use higher rates (10-20 lbs/acre) in habitats having deep water, high organic loading, high larval populations or dense surface cover.

Application

VectoLex CG is available in 10/14 mesh. The granules are designed to be applied by ground or aerial application. The size, shape and density of the granules lessens the potential for off-target application due to aerial drift and enables good penetration of dense vegetation. The presence of both floating and sinking granules helps ensure the distribution of the active ingredient throughout the larval feeding zone.

Bulk Density

Bulk density should be measured with multiple lots and data included (this varies somewhat with RH and each batch).

Ground Applications

VectoLex CG granular treatments can be made with many types of ground equipment designed for granule application. These include manually or mechanically driven devices relying on a whirling disk (e.g. Cyclone® seeder, Ortho Whirlybird seeder) and air-blast applicators (Buffalo® turbine, Maruyama® or Stihl® power backpacks.) VectoLex CG is suitable for Horn seeder applications.

When using VectoLex granules, it is important to properly calibrate application equipment. Granule output at a given setting should be determined as well as swath width and required speed or travel. (Please refer to "Successfully Calibrating Applications of VectoBac and VectoLex Mosquito Control Products" AG5293)

Aerial Applications

VectoLex granules can be applied aerially with conventional fixed-wing aircraft or helicopter granule application equipment. Each application unit should be calibrated and the swath characterized using VectoLex granules before being used operationally. The variety of equipment in use precludes specific instructions on settings, airspeed, etc. As an example: ram-air type of applications used on most fixed-wing aircraft usually requires a simple adjustment of the baffle plate or gate to decrease the granule flow rate. Most aerial treatment rate will be in the range of 5 to 10 pounds of VectoLex granules per acre (5 to 10 kg of VectoLex per hectare).

The following table can be used as a guide in determining rates of VectoLex CG application:

Number of Granules Per F2 or Per M2

Rate in Pounds/Acre VectoLex CG (Kilograms/Hectare) 10/14 Mesh

	Ft2	**M2**
5.0 (5.6)	19	202
7.5 (8.4)	28	303
10.0 (11.2)	38	404

361 granules = gram

Residual Activity

Based upon extensive field evaluations, residual activity of VectoLex CG has been shown to persist for 4-6 weeks after single application at labeled rates. Effective treatment intervals of three or more weeks are typical from single applications to most habitats. Both persistence of the toxin in the water column and recycling of the bacteria contribute to the extended control.

Duration of residual control is generally determined by habitat factors, rather than by application rate. Factors that can reduce residual activity include flushing and water movement, water depth and possibly chemical contamination. In addition, spot treatments with VectoLex CG tend to deliver less residual than treatment of whole water bodies.

Summary of Toxicological Data

Bacillus sphaericus, the technical material was not infective, pathogenic, or overtly toxic by the oral, dermal, intravenous or pulmonary routes of exposure. No mortalities or treatment-related evidence of toxicological effects were observed. The technical material is slightly irritating to the skin and is a moderate eye irritant.
Oral exposure of B. sphaericus is practically non-toxic to mallard duck. No mortalities or signs of toxicity occurred following oral treatment. Birds fed diets containing the technical material experienced no apparent infective, pathogenic or overtly toxic effects after 30 days of treatment.

B. sphaericus is not infective or pathogenic and presents no hazard to aquatic freshwater or saltwater organisms.

Storage

When stored in a cool, dry place, out of direct sunlight, useful life is expected to be greater than two seasons. Precautions should be taken to provide a storage area that is dry with temperatures below 24°C (75°F) and rodent proof. In northern areas, product can be held in unheated storage facilities. Freezing will not reduce potency.

Container Disposal

Completely empty bag by shaking and tapping sides and bottom to loosen clinging particles into application equipment. Dispose of empty bag in a sanitary l,and fill or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke. *Do not contaminate potable water, food or feed by storage or disposal.*

Effects on Non-Target and Beneficial Organisms

Due to the very narrow spectrum of effect of the B. sphaericus toxin, effects of label approved applications on non-target organisms are practically nonexistent. A review of the literature (Lacey and Mulla 1990)1 showed the following:

Organism	Study Type	Result
Odonata		
Dragonflies/Damselflies		
T. corruptum	laboratory/naiads fed infected larvae	No effect
E. civile	laboratory/naiads fed infected larvae	No effect
Ephemoptera		
Mayflies		
C. pacificus	field treatment (Technical powder 0.22 kg/ha)	No effect
Heteroptera		
Corixids/Notonectids		
C. decolor	field treatment Technical powder 0.22 kg/ha)	No effect
N. Undulata	laboratory/fed infected larvae	No effect
A. bouvieri	laboratory/LC50	500x mosquito LC50
N. Undulata	field study/treated ponds	No effect
N. unifasiciata	field study/treated ponds	No effect
Buenoa sp.	field study/treated ponds	No effect
Coleoptera		
Dytiscidae	field studies	No effect
Hydrophylidae	field studies	No effect
Diptera		
Chironomidae		
C. crassicaudatus laboratory/LC50		10,000 - 250,000x mosquito LC50
various species	mesocsom study (Technical powder 11 kg/ha)	No Effect No Effect
Crustacea		
Daphnia		
D. similis	laboratory	Effect at 15,000x mosquito rate
Fairy Shrimp		
S. dichotomus	laboratory	Effect at 27,000x mosquito rate
Crawfish		
P. Clarkii	laboratory	Effect at 1000x mosquito rate

1Lacey and Mulla (1990). Safety of Bacillus thuringensis ssp. 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. Baco Raton, Florida.

Recent unpublished laboratory studies by Ernest Ruber at Northeastern University and field studies in California rice fields by Deborah Dritz of UC Davis confirm the high level of safety of VectoLex products to nontarget organisms.

VectoLex CG has been extensively tested and is not a human health hazard when handled as instructed by the product label. VectoLex CG has a hazard classification signal word of Caution.

For more information, contact:

Dr. Steven Krause	(800) 323-9597
Mr. Ernest Dankwa	(800) 323-9597
Dr. Robert Fusco	(717) 436-5043
Mr. Peter DeChant	(503) 618-8113

870 Technology Way
Libertyville, IL 60048 - 800-323-9597

AG4943/R3 January 2003

www.valentbiosciences.com