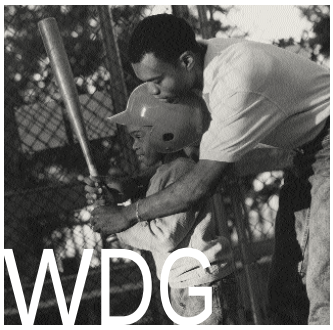
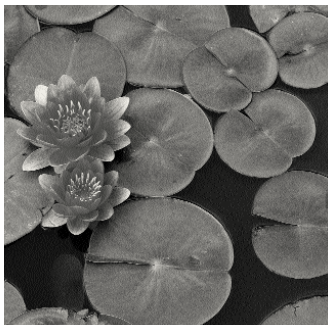




VectoLex® WDG
Technical Use Bulletin

VectoLex WDG is the water dispersible granular formulation of Bacillus sphaericus (strain 2362). It is designed for preparation of aqueous spray mixes. The product has a potency of 650 BsITU/mg (*B. sphaericus *International Units/mg). It is available in 1 pound cans.

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*, *Psorophora*, *Ochlerotatus*, *Coquillettidia*, *Mansonia* and *Anopheles* are also very susceptible. However, susceptibility of species within these genera is variable. Isolation and identification of the toxin responsible for larval activity has demonstrated that the primary toxin is a protein with a molecular weight of 43-55 kD.

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.

Bioassy

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 imunologically, 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.

Application

Ground or Aerial Application

VectoLex WDG may be applied with conventional ground or aerial application equipment with quantities of water sufficient to provide uniform coverage of the target area. The amount of water will depend on weather, spray equipment, and mosquito habitat characteristics. Do not mix more VectoLex WDG than can be used in a 72 hour period.

For most ground spraying, 3 - 10 gallons of water per acre is usually sufficient, but up to 100 gallons per acre may be used to penetrate dense vegetative canopies. Applications may be made with manual backpack sprayers, compressed air sprayers, and small hand pump sprayers. Power equipment such as mist blowers, truck mounted hydraulic sprayers, and other conventional power sprayers may also be used.

For aerial application, VectoLex WDG should be applied diluted in 1-10 gallons of water per acre. Generally, 1-3 gallons of water per acre is sufficient. For application of more than 1.0 lbs VectoLex WDG per acre, at least two gallons of water per acre is recommended. Apply through fixed wing or helicopter aircraft equipped with either conventional boom and nozzle systems or rotary atomizers at a dilution sufficient to produce a smooth flowing suspension of the material and sufficient penetration of vegetative canopy.

Preparation of Spray Mixes

Spray mixes in backpacks and compressed air sprayers should be made by first putting one half of the desired amount of water into the sprayer, then add the VectoLex WDG followed by the rest of the water. Provide moderate agitation by shaking for one minute before spraying.

Spray mixes in power sprayers and aircraft should also be made by first putting one half of the desired amount of water into the mix tank or hopper. Start the mechanical or hydraulic agitation to provide moderate circulation before adding the VectoLex WDG, followed by the rest of the water. Continue moderate agitation for one minute prior to spraying.

VectoLex WDG suspends readily in water and will stay suspended over normal application periods. Brief recirculation may be necessary if the spray mixture has sat for several hours or longer. AVOID CONTINUOUS AGITATION OF THE SPRAY MIXTURE DURING SPRAYING.

Residual Activity

Based upon extensive field evaluations, residual activity of VectoLex WDG has been shown to persist for extended periods 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. Factors that can reduce residual activity include flushing and water movement, water depth and possibly chemical contamination. In addition, spot treatments with VectoLex WDG tend to deliver less residual than treatment of whole water bodies.

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

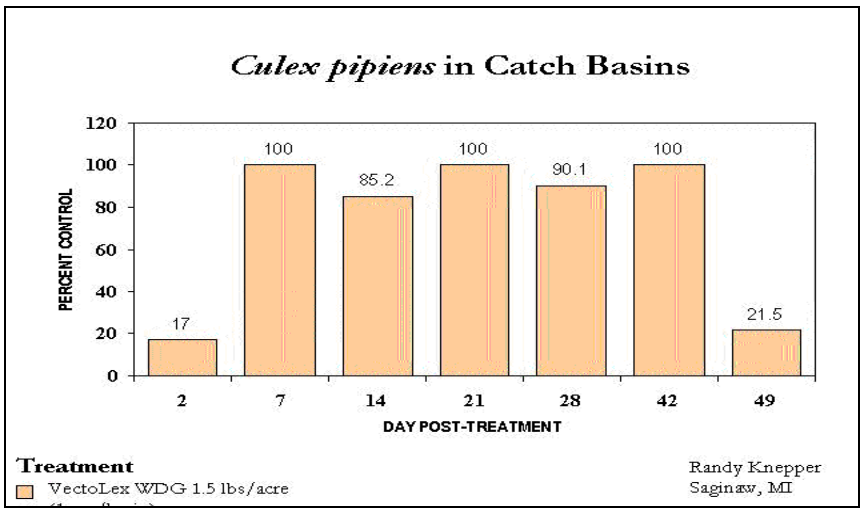
Culex (all species)
Aedes vexans
Ochlerotatus melanimon
Ochlerotatus stimulans
Ochlerotatus nigromaculis
Coquillettidia perturbans
Psorophora columbiae
Psorophora ferox
Ochlerotatus triseriatus
Ochlerotatus sollicitans
Anopheles quadrimaculatus

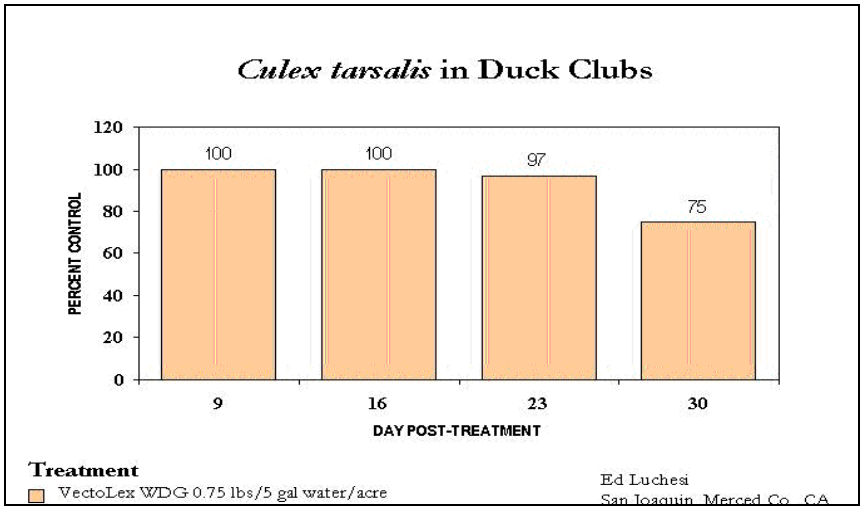
Several other species of mosquitoes are susceptible to VectoLex, but have not been listed on the label. Use for control of such species in the absence of a listed species is therefore not advised. Check with your state agency responsible for FIFRA enforcement if further interpretation is desired.

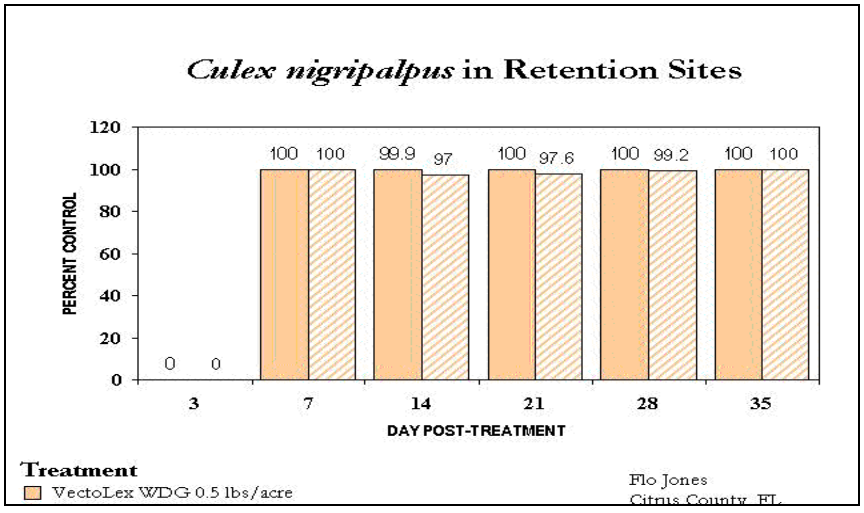
Habitats	**Rate Range**
Crops and Dormant Fields: Pastures/hay fields, citrus groves, irrigated crops, orchards, rice, impounded water in dormant fields	0.5 - 1.5 lbs/acre (8 - 24oz/acre)
Marine/Coastal Areas: Salt marshes, Mangroves estuaries	0.5 - 1.5 lbs/acre (8 - 24oz/acre)
Stormwater/Drainage Systems: Storm sewers, catch basins, drainage ditches, retention, detention and seepage ponds	0.5 - 1.5 lbs/acre (8 - 24oz/acre)
Wastewater Sewage effluent, sewage lagoons, oxidation ponds, sewage treatment plants, septic ditches, animal waste lagoons, impounded wastewater associated with fruit and vegetable processing	0.5 - 1.5 lbs/acre (8 - 24oz/acre)
Water Bodies Natural and manmade aquatic sites such as lakes, ponds, rivers canals, wetlands and streams	0.5 - 1.5 lbs/acre (8 - 24oz/acre)

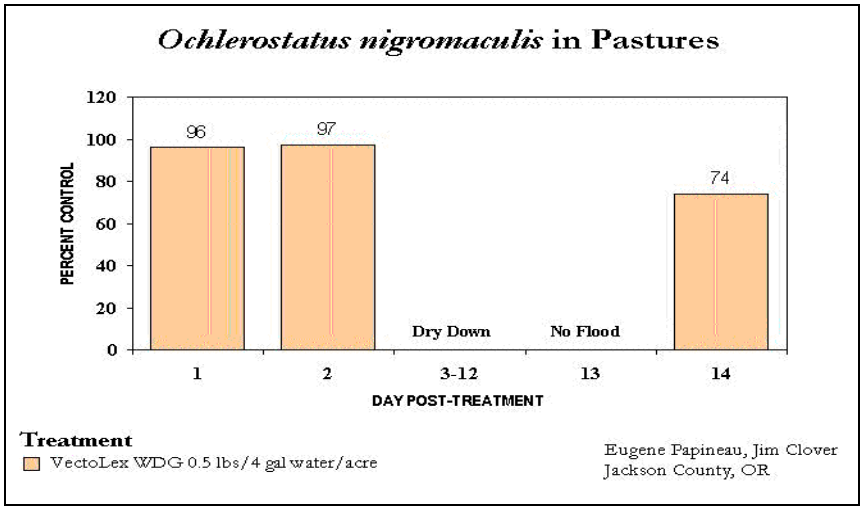
Use higher rates (1 - 1.5 lbs/acre) in habitats having deep water, high organic loading, high larval populations or dense surface cover.

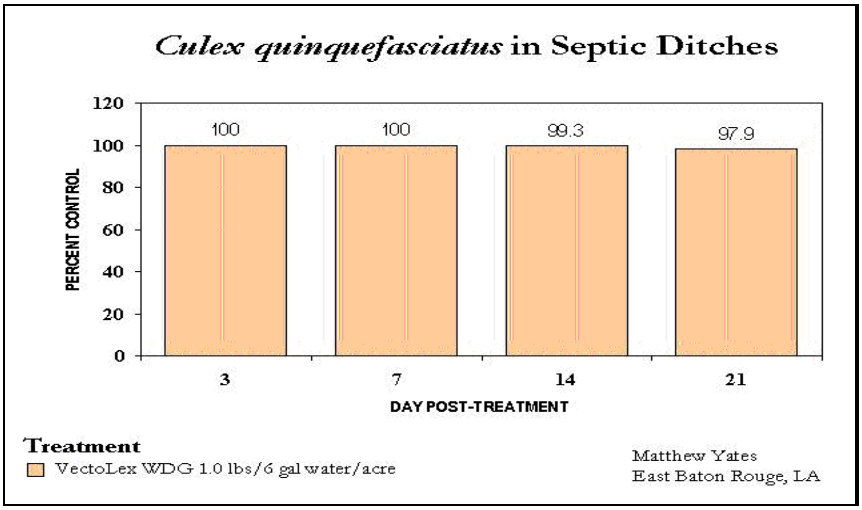
VectoLex® WDG Effects on:

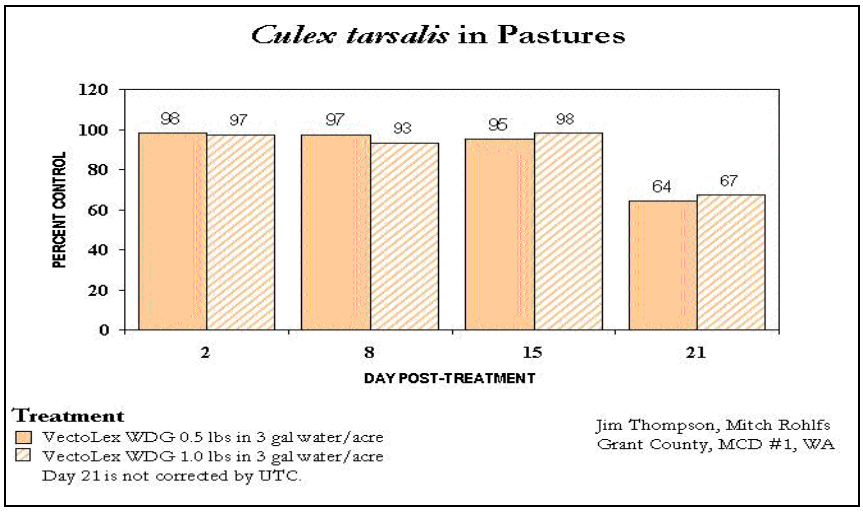







Ochlerostatus nigromaculis in Pastures
120
100
80
60
40
20
0
PERCENT CONTROL
96
97
74
Dry Down
No Flood
1
2
3-12
13
14
DAY POST-TREATMENT
Treatment
VectoLex WDG 0.5 lbs/4 gal water/acre
Eugene Papineau, Jim Clover
Jackson County, OR


Culex quinquefasciatus in Septic Ditches
120
100
80
60
40
20
0
PERCENT CONTROL
100
100
99.3
97.9
3
7
14
21
DAY POST-TREATMENT
Treatment
VectoLex WDG 1.0 lbs/6 gal water/acre
Matthew Yates
East Baton Rouge, LA


Culex tarsalis in Pastures
120
100
80
60
40
20
0
PERCENT CONTROL
98
97
97
93
95
98
64
67
2
8
15
21
DAY POST-TREATMENT
Treatment
VectoLex WDG 0.5 lbs in 3 gal water/acre
VectoLex WDG 1.0 lbs in 3 gal water/acre
Day 21 is not corrected by UTC.
Jim Thompson, Mitch Rohlfs
Grant County, MCD #1, WA

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	mosquito LC50	10,000 - 250,000x
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 mosquito rate	Effect at 1000x

[1]Lacey 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.

Safety

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

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 toxicologic 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

VectoLex WDG should be stored in a cool, dry place, in an intact product package. Once the VectoLex WDG package is opened, moisture can be absorbed by the product leading to loss of activity over time. Refrigeration is not necessary.

Container Disposal

Triple rinse (or equivalent). Then puncture and dispose in a sanitary landfill or by incineration, or, if allowed by state and local authorities, by burning. If burned, stay out of smoke.

For more information, contact:

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