

### Section III.

#### Biological & Cultural Control

##### Black vine weevil control in field and container-grown nursery stock

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Experiments were conducted in 2003 to evaluate the efficacy of various biological and as well as a chemical agent for the control of black vine weevil, *Otiorhynchus sulcatus*, larvae in field and container-grown nursery stock. The biological control agents evaluated included entomopathogenic nematodes (*Heterorhabditis marelatus*, *Heterorhabditis bacteriophora* and *Steinernema kraussei*), a fungus (*Metarhizium anisopliae*, TAENURE™) and diatomaceous earth. The insecticide Talstar® was also evaluated.

##### 2003 Field Trial

Studies were conducted in the spring of 2003 to evaluate the efficacy of entomopathogenic nematodes (*Heterorhabditis marelatus*, *Heterorhabditis bacteriophora* and *Steinernema kraussei*) and the fungus (*Metarhizium anisopliae*, TAENURE™) for black vine weevil control in field-grown *Taxus*. The study was performed as a completely randomized design with 10 replications. Each experimental plot was approximately 9 ft<sup>2</sup> and encompassed five *Taxus* plants. Nematodes were applied both as a standard liquid formulation (75 IJs/cm<sup>2</sup>) and as infected wax worm (*Galleria mellonella*) cadavers (one cadaver/plant) which were either buried or placed on the soil surface at the base of each plant. *Metarhizium anisopliae* was applied at the rates of 40 or 80 kg/ha. Plots were treated 14, April 2003 and evaluated 2, May 2003.

Because of the warmer than average spring in 2003, black vine pupation began soon after treatments were applied and was approximately 50% when plots were evaluated. Nematodes and fungi are best suited for controlling larvae and their efficacy is significantly reduced against pupae. The time between treatment and evaluation (two weeks) was also less than ideal in order to allow time for the nematodes and fungi to infect the larvae. However, because pupae were beginning to eclose and adults emerge, the plots were evaluated. Application of *M. anisopliae* at the rate of 40 kg/ha was the only treatment to significantly reduce black vine weevil populations. However, the high rate of *M. anisopliae* was not significantly different than the control. No nematode application significantly reduced black vine weevil populations. Because of the clumped distribution of weevil larvae in the field and the variability within treatments (least

significant difference of 4.8 larvae) it was difficult to detect significant differences between treatments. These are the results of the first year of a multi-year study.

<u>Treatment</u>	<u>Total # BVW larvae/plot</u>
Control	6.7ab
<i>H. marelatus</i> @ 75 IJs/cm <sup>2</sup>	5.7ab
<i>H. bacteriophora</i> @ 75 IJs/cm <sup>2</sup>	6.9ab
<i>S. kraussei</i> @ 75 IJs/cm <sup>2</sup>	6.3ab
<i>H. marelatus</i> infected cadavers (buried)	4.3ab
<i>H. bacteriophora</i> infected cadavers (buried)	5.5ab
<i>S. kraussei</i> infected cadavers (buried)	6.7ab
<i>H. marelatus</i> infected cadavers (surface)	8.8a
<i>H. bacteriophora</i> infected cadavers (surface)	7.4a
<i>S. kraussei</i> infected cadavers (surface)	5.0ab
<i>M. anisopliae</i> @ 40 kg/ha	2.5b
<i>M. anisopliae</i> @ 80 kg/ha	7.5a

#### 2003 Container Trial

An experiment was performed in 2003 to evaluate the efficacy of diatomaceous earth and Talstar® for black vine weevil control in container-grown nursery stock. The study was performed in a randomized complete block design with 6 replications and 3 plants per replicate. The plants used in the experiment were rooted cuttings of *Picea abies* 'Nidiformis'. The plants were planted in 4 inch pots containing a standard nursery mix (OBC Northwest Nursery Mix #1) and were infested with 60 black vine weevil eggs. Eggs were applied in groups of 10-20 over a period of several weeks to simulate natural egg laying. The experimental treatments were diatomaceous earth (6 lb/yd<sup>3</sup>) and Talstar® (4 lb/yd<sup>3</sup>) incorporated into the potting mix at planting and an untreated control. The experiment was began in May of 2003 and evaluated in October.

Treatment with diatomaceous earth and Talstar® significantly reduced the number of black vine weevil larvae per plant. There were no larvae present in the Talstar® treatment. A few larvae did survive the diatomaceous earth treatment but not significantly more than the Talstar® treatment. These results are from one trial only and the experiment is currently being repeated to validate the results.

<u>Treatment</u>	<u>Average # BVW/plant</u>
Control	0.56a
Diatomaceous Earth (6lb/yd <sup>3</sup> )	0.17b
Talstar® (4lb/yd <sup>3</sup> )	0.00b