

Assessment and Use Strategies of Baculovirus for Control of Fall Armyworm and Black Cutworm

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Three independent bioassays were conducted at the University of Wisconsin-Madison, Auburn University and Penn State University to assess the effectiveness of the baculovirus product Exilon (0.6% *Agrotis ipsilon* multinucleopolyhedrovirus, Andermatt Biocontrol AG, Switzerland) for control of black cutworm (*Agrotis ipsilon*) and fall armyworm (*Spodoptera frugiperda*). This product contained 5×10^{11} viral occlusion bodies per liter and is currently labeled as a insect virus for Black cutworm (BCW), but not fall armyworm (FAW). Both are in the same family (Lepidoptera: Noctuidae) while sod webworm is in the Lepidopteran family Pyralidea, consequently we hypothesized that the baculovirus would likely have little impact on sod webworm. As a result, we elected to not include sod webworm in this study. BCW and FAW were assessed on creeping bentgrass, at the University of Wisconsin-Madison and Penn State University, respectively and FAW was assessed on bermudagrass at Auburn University. Our results suggest that the baculovirus (Exilon) has little to no effect on FAW in the field or laboratory, regardless of application rate or turfgrass species reared on. The Exilon did however provide measurable control (mortality) of BCW larvae in the field when larvae were placed in turf treated with the baculovirus 7 days after treatment (DAT) at the manufacturer's label rate (i.e., medium rate for bioassay; 33,945,000 occlusion bodies/m²) and high rate (500,000,000 occlusion bodies/m²) and exposed for 7 days. However, no meaningful differences were observed at 1, 3 or 14 DAT, these results may be attributed to the relatively high mortality (> 40%) that occurred in the untreated controls in the field. In summary, the baculovirus Exilon appears limited to efficacy against BCW.

Field Trials

Penn State University: Fall Armyworm (Creeping Bentgrass)- recovery was poor from all treatments, including untreated checks

No differences in mortality were observed between treatments

Larvae recovered from field plots (all treatments) declined rapidly in laboratory

Auburn University: Fall Armyworm (Bermudagrass)-recovery was good

At 1 DAT, there was no significant rate effect for the Exilon treatments, but survival was significantly lower than untreated control for larvae exposed to the label rate of Exilon

University of Wisconsin-Madison: Black Cutworm (Creeping Bentgrass)- mortality was relatively high in 1, 3 and 14 days after treatment in the untreated checks

Exilon exhibited measurable control (mortality) of BCW larvae at 7 DAT at the label rate (i.e., medium) and high rate

The performance of Exilon at 14 DAT, regardless of application rate, was not significantly different from the untreated control at 14 DAT

Laboratory Trials

Penn State University: Fall Armyworm (Creeping Bentgrass)

No mortality was observed with any of the baculovirus treatments when larvae fed on treated diet

No statistical differences were observed between baculovirus-treated and untreated checks for larval or pupal weight

The proportion of larvae developing into pupae by 8 DAT was high in all treatments (> 90%). Despite this, significantly fewer pupae were found in the high baculovirus treatments.

Auburn University: Fall Armyworm (Bermudagrass)

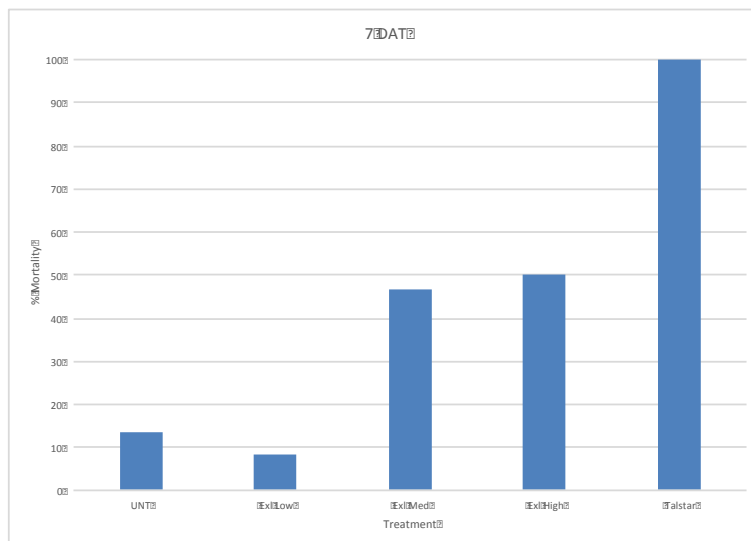
Recovered larvae that survived rearing in the lab had

>95% pupation and no malformations in pupation were noted

University of Wisconsin-Madison: Black Cutworm (Creeping Bentgrass)

No significant mortality was observed with any of the baculovirus treatments

University of Wisconsin-Madison: Percent (%) mortality of black cutworm larvae when placed in turf treated with the baculovirus (Exilon) 7 days after treatment (DAT) and exposed for 7 days



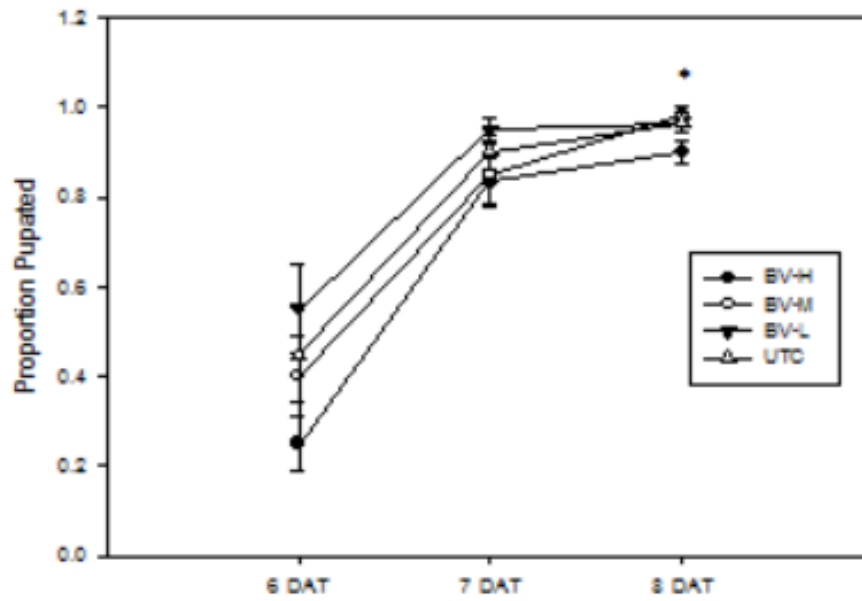
Auburn University: Percent survival of fall armyworm larvae exposed for 24 h exposure to baculovirus (Exilon) treated bermudagrass then reared in the lab for 7 d

Treatment	Rate (amt product per 36 ft ²)	Percent survival of larvae exposed to residues at:			
		1 DAT	3 DAT	7 DAT	15 DAT
Exilon label	220 µl	33 ± 7b	40 ± 13a	53.6 ± 8a	87.3 ± 3a
Exilon low	33.4 µl	64.2 ± 8ab	45.2 ± 14a	49.1 ± 7a	90.7 ± 5a
Exilon high	3.34 ml	66.7 ± 13ab	49.4 ± 17a	68.3 ± 8a	92.3 ± 2a
Talstar S	0.27 ml	67.9 ± 11ab	62.1 ± 8a	65.7 ± 8a	74.3 ± 10a
UTC	NA	87.5 ± 21a	69.4 ± 14a	80 ± 13a	94 ± 7a
Average (range) % recovery		23.7% 11-41%	62.1% 55-72%	77.1% 71-82%	81.1% 74-88%
Statistics					
F		1.82	0.85	1.05	0.64
Df		4,12	4,12	4,12	4,12
P		0.30	0.52	0.42	0.65

Means separation by Student's t test (JMP)

Penn State University

Effects of Baculovirus -treated Artificial Diet on Fall Armyworm Days -to-Pupation



Effects of Baculovirus -treated Artificial Diet on Fall Armyworm Pupal Weight

