IR-4 Ornamental Horticulture Program
Management of Borers, Beetles, and White Grubs:

Ambrosia Beetle (*Xylosandrus crassiusculus*)
Black Vine Weevil (*Otiorhynchus sulcatus*)
Bronze Birch Borer (*Agrilus anxius*)
Flat-headed Apple Tree Borer (*Chrysobothris femorata*)
Flea Beetle (*Epitrix sp.*)
Japanese Beetle (*Popillia japonica*)
Strawberry Rootworm (*Paria fragariae ssp. fragariae*)
Viburnum Leaf Beetle (*Pyrrhalta viburni*)

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Abstract

Collectively, managing coleopteran insects can be challenging because the adult and larval stages may both cause damage and sometimes occur on different hosts or on different plant parts. While organophosphates, pyrethroids, and neonicotinoids can provide good to excellent control of coleopteran insects, not all products work equally well in all situations. Treatments for borers are very different than treatments targeting white grubs. Developing newer classes of chemistry are important to reduce the environmental consequences and to minimize the development of resistance. Starting with the 2004 Annual Workshop, screening a number of products to manage coleopteran insects became one of the high priority projects for entomology. From 2004 through 2007, 42 products representing 30 different active ingredients were tested for management of adult and larval stages of coleopteran insects. These products represented both biological and chemical tools. Some products were already registered but more data were needed or they were considered standards to measure the level of efficacy achieved with other materials. Other products were in development but have not yet been registered with the EPA. While a number of coleopteran species were tested, only enough experiments were able to be completed on black vine weevil, Japanese beetle, oriental beetle and viburnum leaf beetles to recommend actions to register or amend labels for these pests.

Introduction

Collectively, managing coleopteran insects can be challenging because the adult and larval stages may both cause damage and sometimes occur on different hosts or on different plant parts. While organophosphates, pyrethroids, and neonicotinoids can provide good to excellent control of coleopteran insects, not all products work equally well in all situations. Treatments for borers are very different than treatments targeting white grubs. Developing newer classes of chemistry are important to reduce the environmental consequences and to minimize the development of resistance. At the 2004 Annual Workshop, screening a number of products to manage coleopteran insects became one of the high priority projects for entomology. The following research was conducted between 2004 and 2007.

Materials and Methods

Forty-two insecticides were tested against two species of soil dwelling larvae, 4 species of borers, and 3 species of foliar feeding adults and larvae. However, not all products were tested against all species. Depending upon product characteristics either foliar or drench applications were made. A minimum of four plants (replicate treatments) were required with most researchers exceeding this minimum. Insect counts were recorded at timings suitable for each pest. Phytotoxicity, when observed, was recorded. For more detailed materials and methods, including application rates for various products, please see Appendix 1: Protocols.

Products were supplied to researchers (See list of researchers in Appendix 2) by their respective manufacturers.

Table 1. List of Products and Rates Tested from 2004 to 2007.

Product	Active Ingredient(s)	Manufacturer	Application Method & Rate(s)		# Trials
Ammo 2.5 EC	Cypermethrin	Helena	Dipping bolt	66.3 g ai	1
			Dipping bolt	144.9 g ai	1
Arena 50WDG	Clothianidin	Arysta	Curative drench	1.28 oz	1
			Drench	1.9 g/inch DBH	1
Asana XL	Esfenvalerate	DuPont	Dipping bolt	8 g ai	1
			Dipping bolt	76.5 g ai	1
			Dipping bolt	95.9 g ai	1
			Dipping bolt	153.5 g ai	1
Azatin XL			Dipping bolt	2 %	1
BAS 320i	Metaflumizone	BASF	Curative drench	50 ppm	1
			Curative drench	100 ppm	1
			Dipping bolt	16 fl oz	1
			Drench	12 fl oz	1
			Drench	16 fl oz	1
			Foliar	4.5 fl oz	1
			Foliar	16 fl oz	5
			Preplant incorporation	25 ppm	1
			Preplant incorporation	50 ppm	1

Product	Active Ingredient(s)	Manufacturer	Application Method & Rate(s)		# Trials
			Preplant incorporation	100 ppm	1
			Preplant incorporation	200 ppm	1
Bifenthrin	Bifenthrin		Dipping bolt	42.5 g ai	1
			Dipping bolt	85 g ai	1
			Dipping bolt	170 g ai	1
			Drench		1
Cal-Agri 50 1 %	Potassium phosphate	Cal-Agri Products	Drench	128 fl oz	1
Celero 16WSG	Clothianidin	Valent	Dipping bolt	38.8 g ai	1
			Dipping bolt	77.6 g ai	1
			Dipping bolt	170 g ai	1
			Dipping bolt	8 oz	1
			Drench	0.5 oz*	1
			Drench	0.5 oz	1
			Drench	1.2 oz	2
			Drench	4 oz	2
			Drench	12 oz	1
			Drench	16 oz	1
			Drench	20 oz	1
			Drench	4 oz/1320 pots	1
			Foliar	4 oz	9
			Foliar	6 oz	2
Discus	Imidacloprid + cyfluthrin	OHP	Dipping bolt	83.3 + 19.8 g ai	2
			Dipping bolt	169.6 + 39.6 g ai	1
			Dipping bolt	100 oz	1
			Dipping bolt	?	1
			Curative Drench	13 fl oz	1
			Drench	10 fl oz	1
			Drench	?	1
DEET	N, N-diethyl-m-toluamide		Dipping bolt	40 %	2
			Dipping bolt	90 %	1
DPX-E2Y45	Chlorantraniliprole	DuPont	Dipping bolt	47 g ai	1
			Dipping bolt	189.4 g ai	1
			Dipping bolt	32 oz	1
			Dipping bolt	754.4 g ai	1
			Curative drench	0.8 fl oz	1
			Curative drench	6.5 fl oz	1
			Curative drench	14.8 ml/inch DBH	1
			Drench	0.8 fl oz	3
			Drench	0.8 fl oz*	1
			Drench	6.47 fl oz	2
			Drench	11.5 fl oz	1
			Drench	16 fl oz	1
			Drench	23 fl oz	1
			Drench	46 fl oz	1
			Drench	47.9 fl oz	2
			Foliar	2 fl oz	1
			Foliar	4 fl oz	1
			Foliar	8 fl oz	1

Product	Active Ingredient(s)	Manufacturer	Application Method & Rate(s)		# Trials
			Foliar	47.9 fl oz	1
			Foliar	10 fl oz	9
			Foliar	16 fl oz	1
			Preplant incorporation	5 ppm	1
			Preplant incorporation	10 ppm	1
			Preplant incorporation	20 ppm	1
DuraGuard	Chlorpyrifos	Whitmire	Drench	50 fl oz	1
Dursban	Chlorpyrifos	Dow	Dipping bolt	92.8 g ai	1
			Dipping bolt	32 oz	1
			Foliar	16 oz	1
Flagship	Thiamethoxam	Syngenta	Curative drench	8 oz	1
			Drench	0.4 oz	1
			Drench	8 oz	1
			Drench	0.18 oz per 1000 sq ft	1
			Foliar	5 oz	1
			Foliar	8 oz	1
			Trunk spray	16 oz/acre	1
Lorban 4E	Chlorpyrifos	Dow	Dipping bolt	474 g ai	1
			Dipping bolt	767.5 g ai	1
Mach 2 2SC	Halofenozide	Dow	Drench	2 lb ai/A	1
			Drench	2.9 fl oz per 1000 sq ft	1
Marathon	Imidacloprid	OHP	Drench	2.7 g per pot	1
			Drench	20 g per 3000 sq ft	1
Marathon 1G	Imidacloprid	OHP	Premixed to soil media	0.1 g ai/gal	1
Marathon II 2F	Imidacloprid	OHP	Drench	20 g/650 pots	2
			Drench	20 g/244 pots	1
Merit 75	Imidacloprid	Bayer	Foliar	10 tsp	1
Met 52	*Metarhizium anisopliae*	Novozymes	Drench	58 oz	2
Metarhizium anisopliae (Strain F52)	*Metarhizium anisopliae*	Novozymes	Dipping bolt	1.3×10^9	1
			Dipping bolt	3.9×10^8	1
			Dipping bolt	3.9×10^9	1
			Curative drench	4.5×10^8 spores/L	1
			Drench	14.04 cfu/pot	2
			Drench	28.08 cfu/pot	2
			Drench	56.16 cfu/ pot	1
			Foliar	29 fl oz	3
			Premixed to soil media	6.25 g/pot	1
NEI 25925	Acetamiprid	Cleary	Trunk spray	4 ml/inch DBH	1
Onyx 2EC	Bifenthrin	FMC	Dipping bolt	212.3 g ai	5
			Dipping bolt	32 oz	7
			Dipping bolt		1
			Foliar	12.8 fl oz	3
			Trunk spray	6.4 fl oz	3
			Trunk spray	12.8 fl oz	3
			Trunk spray	16 fl oz	3
Ornazin	Azaridachtin	SePro	Drench	10 oz per 100 gal	1
Orthene	Acephate	Arysta	Drench	12 oz per 100 gal	1

Product	Active Ingredient(s)	Manufacturer	Application Method & Rate(s)		# Trials
Permethrin 2.5 EC	Permethrin	Bonide Products	Drench	128 fl oz	1
Precise	Acephate	Purcell Technologies	Foliar	12 oz	2
Precise G & N	Acephate	Purcell Technologies	Premixed to soil media	6 g product/can	1
Proclaim	Emamectin benzoate	Syngenta	Dipping bolt		1
Safari 20SG	Dinotefuran	Valent	Curative drench	24 oz	1
			Curative drench	12 g/inch DBH	1
			Drench	12 oz	4
			Drench	24 oz	12
			Drench	48 oz	3
			Drench	6.8 g/gal	1
			Foliar	8 oz	9
Sevin XLR 4F	Carbaryl	Bayer	Drench	6 fl oz/1000 sq ft	1
Scimitar	Lambda-cyhalothrin	Syngenta	Drench	60 oz	1
			Foliar	5 oz	1
Talstar 0.2G	Bifenthrin	FMC	Premixed to soil media	10 ppm	1
			Preplant incorporation	25 ppm	1
Talstar F	Bifenthrin	FMC	Dipping bolt	41 g ai	1
			Dipping bolt	135.3 g ai	1
			Dipping bolt	214 g ai	1
			Drench	80 fl oz	1
			Drench	25 fl oz per 100 gal	1
			Foliar	40 fl oz	1
			Trunk spray	40 fl oz	3
Talstar L & T	Bifenthrin	FMC	Dipping bolt		1
Tempo 2	Cyfluthrin	Bayer	Dipping bolt		1
Thiodan 3EC	Endosulfan	UCPA	Dipping bolt	83 g ai	1
TickEx EC	*Metarhizium anisopliae*	Novozymes	Foliar	29 fl oz	3
Tolfenpyrad	Tolfenpyrad	Nichino	Foliar		1
TriStar 70WSP	Acetamiprid	Cleary	Foliar	96 g	6
V-10112	Dinotefuran	Valent	Foliar		1

* 1 pint per 2.25 sq ft

Results: Foliar Feeding Beetles

*Comparative Efficacy on Black Vine Weevil Adults (*Otiorhynchus sulcatus*)*

It is suspected that the black vine weevil (*Otiorhynchus sulcatus*) originated in northern Europe. However, it has been identified in North America since 1835 and was a notable pest in Missouri by 1871. It is found predominantly in the northern portions of the United States, but its range extends into Virginia. Throughout Asia, Europe, and North America, the black vine weevil larvae feeds on the roots and damage a tremendously varied number of species, including azalea, strawberry, begonia, blackberry, blueberry, and cranberry, cyclamen, euonymus, forsythia, fuchsia, hemlock, impatiens, primrose, rhododendron, sedum and yew (http://www.mortonarb.org/res/CLINIC_pests_BlackVineWeevil.pdf; http://www.entomology.umn.edu/cues/blackvw/blackvh.html).

Nielsen 2007

In 2007, Nielsen (Table 2) tested six products for their residual efficacy in controlling black vine weevil adults on foliage. Foliage of rhododendron or yew was sprayed and then adults were caged with treated leaves 1, 3, 7, and 13 DAT. After exposure for 72 hours, the number of dead weevils was counted and any moribund adult was moved to untreated foliage and reevaluated 3 days later. Only the standard Talstar and BAS 320i treatments provided any mortality of adult black vine weevils. Data were similar for all evaluation dates. No phytotoxicity was observed.

Table 2. Efficacy of several insecticides for black vine weevil adults (*Otiorhynchus sulcatus*) on Yew (*Taxus sp.*) or Rhododendron (*Rhododendron sp.*), Nielsen, 2007.

Treatment [z]	Rate (per 100 gal)	Plant Host	Percent Mortality after 3 day exposure [y]
BAS 320i (metaflumizone)	16 oz	Rhododendron	100
DPX-E2Y45 (chlorantraniliprole)	10 oz	Yew	0
Metarhizium	29 oz	Yew	0
Safari 20SG (dinotefuran)	8 oz	Yew	0
Talstar F (bifenthrin)	40 fl oz	Yew	100
Tolfenpyrad	21 oz	Yew	0
	Untreated	Yew	0

[z] Treatments were applied 13 August 2007 and evaluated through 13-DAT. Four plants per treatment were used.
[y] Exposed 5 weevils/replicate in plastic cups with treated foliage.

*Comparative Efficacy on Japanese Beetle Adults (*Popillia japonica*)*

During 2006 and 2007, four researchers examined the efficacy of 12 products and unregistered materials for managing Japanese beetle adults. The products tested included BAS 320i, Celero 16 WSG, DPX-E2Y45, Flagship, Precise, Safari 20SG, Scimitar, Talstar, Tick Ex EC, TriStar 70WP, and Tolfenpyrad. In these experiments, the assessment typically made was percent leaf damaged by adult beetle feeding. Even though Reding (Tables 9 and 10) was unable to achieve statistical separation in two experiments, in the six experiments conducted by Alm, Braman and Schultz, there were clear differences in efficacy (Tables 4 – 8, 11). As the standard, bifenthrin in Onyx and Talstar, provided good to excellent control. DPX-E2Y45 performed well achieving greater than 95% control in all but one experiment.

Table 3. Summary of Japanese Beetle Adult (*Popillia japonica*) Efficacy.

Treatments	Sargent Cherry	Sargent Cherry	Shamrock Linden	Black Pussy Willow	Willow	Rose
	19 DAT	17 DAT	19 DAT	2 WAT	4 DAT	14 DAT
	Alm 2006a	Alm 2007	Alm 2006b	Braman 2006	Braman 2007	Schultz 2007
BAS 320i (metaflumizone)						++
Celero 16WSG (clothianidin)	-		+	-	+/-	++
DPX-E2Y45(chlorantraniliprole)	++	++	++	+/-	++	++
Flagship (thiamethoxam)				-		
Onyx 2EC (bifenthrin)	++	++	+			
Precise (acephate)				-		
Safari 20SG (dinotefuran)	-		+/-	-	+/-	+
Scimitar (lambda-cyhalothrin)				+		
Tick Ex (*Metarhizium anisopliae*)					-	- (by 28 DAT 100% control was achieved)
Talstar F (bifenthrin)						++
TriStar 70WP (acetamiprid)	++		++	+/-	+	
Tolfenpyrad						++

* Not an IR-4-sponsored experiment.

[1] Rating Scale: ++ = clearly statistically better than untreated and greater than 95% control; + = statistically better than untreated and between 85 and 95% control; +/- statistically better than untreated with control between 70 and 85%; - = statistically equivalent to untreated and/or efficacy less than 70%.

[2] Where more than one rate or application type for a product was included in the experiment and each performed statistically different, the better rating is provided in this table.

Alm 2006

In 2006, Alm ran two experiments to determine efficacy of five products to control Japanese beetle adults on foliage of Sargent cherry and shamrock linden. In both experiments, a single terminal branch was selected from each plant, and the top five treated leaves were rated for percent Japanese beetle feeding damage on July 10, July 19, and July 31 (10, 19 and 31 DAT, respectively). The mean percent feeding damage was calculated for the top five leaves. An overall mean percent feeding damage was calculated from four replicates.

For Sargent cherry, there was no statistically significant Japanese beetle feeding damage to any of the treated trees at 10 DAT (Table 4), but by 19 and 31 DAT there was significantly more feeding damage on the untreated and the Safari treated trees than any of the other treatments. Celero, DPX-E2Y45, Onyx, and TriStar 70WP significantly reduced feeding; however, Celero only provided approximately 50% control whereas the other treatments provided 95% control or better.

For shamrock linden, all treatments provided statistically significant control of Japanese beetle feeding by the time trees were rated on10 and 19 DAT (Table 5). When trees were rated on 31 DAT, there was significant feeding damage on the Safari treated trees compared to the other treatments. With the exception of Safari at 31 DAT, all treatments provided 82% control or better based upon percent feeding damage. No phytotoxicity was observed.

Table 4. Efficacy of several insecticides for *Popillia japonica* on Sargent Cherry, *Prunus sargentii*, Alm, 2006a.

Treatment	Rate per 100 gal	Average Percent Leaf Damage [z]		
		10 July 10 DAT	19 July 19 DAT	31 July 31 DAT
Celero 16 WSG (clothianidin)	6 oz	0.0 a (100%)	23.0 b (59%)	40.0 b (50%)
DPX-E2Y45 1.67SC (chlorantraniliprole)	10 fl oz	0.0 a (100%)	1.0 bc (98%)	2.0 c (98%)
Onyx 2EC (bifenthrin)	12.8 fl oz	0.0 a (100%)	2.5 bc (95%)	2.0 c (98%)
Safari 20SG (dinotefuran) + Capsil	8 oz + 6 fl oz	2.5 a (0%)	49.0 a (12%)	65.0 a (19%)
TriStar 70WP (acetamiprid)	3.38 oz	0.0 a (100%)	0.0 c (100%)	0.0 c (100%)
	Untreated	2.5 a (0%)	55.5 a (0%)	80.5 a (0%)

[z] Means in the same column followed by the same letter are not significantly different, ($P = 0.05$, LSD test).

Table 5. Efficacy of several insecticides for Japanese Beetle (*Popillia japonica*) on Shamrock Linden (*Tilia cordata*) 'Bailyei', Alm, 2006b.

Treatment	Rate per 100 gal	Average Percent Leaf Damage [z]		
		10 July 10 DAT	19 July 19 DAT	31 July 31 DAT
Celero 16 WSG (clothianidin)	6 oz	0.5 b (93%)	3.5 b (88%)	14.5 c (82%)
DPX-E2Y45 1.67SC (chlorantraniliprole)	10 fl oz	0.5 b (93%)	0.0 b (100%)	3.5 c (96%)
Onyx 2EC (bifenthrin)	12.8 fl oz	0.0 b (100%)	3.5 b (88%)	11.0 c (86%)
Safari 20SG (dinotefuran) + Capsil	8 oz + 6 fl oz	2.0 b (71%)	5.0 b (83%)	41.0 b (48%)
TriStar 70WP (acetamiprid)	3.38 oz	0.0 b (100%)	0.0 b (100%)	0.0 c (100%)
	Untreated	7.0 a (0%)	29.5 a (0%)	78.5 a (0%)

[z] Means in the same column followed by the same letter are not significantly different, ($P = 0.05$, LSD test).

Alm 2007

In 2007, Alm compared the efficacy of DPX-E2Y45 with Onyx to control Japanese beetle adults on foliage of Sargent cherry. In this experiment, two terminal branches were selected from each plant, and ten treated leaves were rated for percent Japanese beetle feeding damage on July 18, July 27, and August 14 (8, 17 and 34 DAT, respectively). The mean percent feeding damage was calculated for these ten leaves. An overall mean percent feeding damage was calculated from five replicates.

In this experiment, DPX-E2Y45 and Onyx significantly reduced Japanese beetle adult feeding by 8 DAT. By 17 DAT, percent control was 91% or greater for all rates of both products. This level of management remained through 34 DAT, the last reading date.

No phytotoxicity was observed.

Table 6. Efficacy of DPX-E2Y45 and Onyx for Japanese Beetle (*Popillia japonica*) on Sargent Cherry (*Prunus sargentii*), Alm, 2007.

		Average Percent Leaf Damage (% Control)[z]		
Treatment	Rate per 100 gal	18 July 8 DAT	27 July 17 DAT	14 Aug 34 DAT
DPX-E2Y45 1.67SC (chlorantraniliprole)	2 fl oz	6.4 b (56%)	2.3 b (94%)	3.3 b (92%)
DPX-E2Y45 1.67SC (chlorantraniliprole)	4 fl oz	4.4 bc (69%)	3.4 b (91%)	4.2 b (90%)
DPX-E2Y45 1.67SC (chlorantraniliprole)	8 fl oz	2.0 c (86%)	0.7 b (98%)	1.6 b (96%)
Onyx 2EC (bifenthrin)	12.8 fl oz	2.4 bc (83%)	1.9 b (95%)	2.0 b (95%)
	Untreated	14.4 a (0%)	39.0 a (0%)	41.3 a (0%)

[z] Means in the same column followed by the same letter are not significantly different, ($P = 0.05$, LSD test).

Braman 2006

In 2006, Braman compared seven treatments for the impact on the number of Japanese beetles on black pussy willows and the percent defoliation. Plants were treated on June 13, 2006 and arranged in an area with historically heavy Japanese beetle populations in southeastern Spalding County, GA. Beetle density was recorded at one week, two weeks, and one month post application (1, 2, and 4 WAT, respectively). A final damage (% defoliation) assessment was made one month after application. All data were subjected to analysis of variance using the GLM procedure of SAS and means were separated using LSD.

In this test, the Japanese beetle pressure was high. Within one week, beetle density varied by treatment, with Scimitar, Flagship, TriStar and DPX-E2Y45 providing significant reductions relative to the untreated control (Table 7). Celero, Safari and Precise were statistically similar to the untreated control 1 WAT. At two weeks post treatment all except Safari had significantly reduced beetle densities relative to the control. Defoliation was reduced in all treatments relative to the control and was least on plants treated with Scimitar, Precise, TriStar or DPX-E2Y45.

Throughout the experiment, no phytotoxicity was observed. At the completion of the study, there was no discernable difference in growth among the treatments (data not shown).

Braman 2007

In 2007, Braman compared the efficacy of five treatments for efficacy of Japanese beetle adults on willow. In this experiment, 5 adult beetles were caged on treated foliage using nylon screen bags; at 1 and 4 days after exposure (6 and 9 DAT), the number of surviving beetles were counted, and at Day 4 foliar feeding was estimated as percent feeding damage. Data were subjected to analysis of variance using the GLM procedure of SAS and mean separation is by LSD.

Beetle survival was high for all treatments one day after caging on the willows (Table 8). After 4 days, however, survival was significantly reduced in all but the Tick Ex cages. Fewest beetles survived in the DPX-E2Y45 treatment. TriStar and DPX-E2Y45 provided the best reduction in damage.

Table 7. Efficacy of several insecticides for *Popillia japonica* on black pussy willows, *Salix gracilistyla* 'Melanostachys', Braman, 2006.

Product	Rate per 100 gal	Mean no. Beetles per plant [z]			Mean % defoliation 4 WAT
		1 WAT	2 WAT	4 WAT	
Celero 16WSG (clothianidin)	4 oz	15.6 ab (28)	16.1 bc (41)	0.0 b (100)	44.5 b
DPX-E2Y45 (chlorantraniliprole)	10 oz	3.8 bc (83)	6.3 cd (77)	0.0 b (100)	20.5 cd
Flagship 25WG (thiamethoxam)	8 oz	5.9 bc (73)	12.6 bcd (54)	0.0 b (100)	29.0 c
Precise (acephate)	3 tsp/pot	22.4 a (0)	11.5 bcd (58)	0.0 b (100)	18.5 cd
Safari 20SG (dinotefuran)	8 oz	14.4 abc (34)	21.1 ab (22)	0.0 b (100)	44.5 b
Scimitar (lambda-cyhalothrin)	5 oz	0.4 c (98)	2.9 d (89)	0.0 b (100)	18.5 cd
TriStar 70WSP (acetamiprid)	96 g	1.3 bc (94)	5.1 d (81)	0.0 b (100)	14.5 d
	Untreated	21.8 a (0)	27.1 a (0)	0.3 a (0)	61.0 a

[z] Means followed by the same letter are not significantly different, P> 0.05

Table 8. Efficacy of several insecticides for *Popillia japonica* adults feeding on willow leaves, *Salix hakuro nishiki*, Braman, 2007.

Treatment [z]	Rate	Survival (5 adult beetles caged on leaves) [y]		Percent Damage Day 4 (9 DAT)
		Day 1 (6 DAT)	Day 4 (9 DAT)	
Celero 16WSG (clothianidin)	4 oz/100 gal	4.29 a	2.30 bc	21.10 b
DPX-E2Y45 (chlorantraniliprole)	10 oz/100 gal	4.40 a	1.56 c	1.44 d
Safari 20SG (dinotefuran)	8 oz/100 gal	4.56 a	2.70 b	17.20 bc
Tick Ex EC *(Metarhizium anisopliae)*	29 oz/100 gal	4.86 a	4.40 a	57.50 a
TriStar 70WSP (acetamiprid)	96 gm/100 gal	4.50 a	2.50 bc	4.90 cd
	Untreated	4.56 a	4.40 a	56.00 a

[z] Treatments were applied on July 17, 2007.

[y] Means followed by the same letter are not significantly different, P> 0.05

Reding 2006

In this experiment, a no choice feeding bioassay was run in the laboratory seven days after foliar applications. Leaves were collected, and stems were inserted into water soaked oasis cubes and placed into lidded containers with two Japanese beetle adults per leaf sample. Leaf area measurements were taken after 12 days of feeding. There was no mortality during the trial. Square centimeters consumed were compared using analysis of variance (ANOVA) with no differences found between treatments (Table 9).

In addition to running a bioassay, insect counts and feeding damage were recorded two weeks after Japanese beetles were observed feeding on test plants or 17 days after treatment (17 DAT). Insect counts did not prove to be a good source of efficacy data due to the continual flight of adults during the counting process. Percent of leaves damaged from feeding and leaves with more than 25% of the leaf eaten were compared using analysis of variance (ANOVA) with no differences found between treatments (Table 9).

Throughout the experiment, no phytotoxicity was observed. All plants were marketable at the completion of the study, and there was no discernable difference in growth among the treatments.

Table 9. Efficacy of several insecticides for *Popillia japonica* adults on Hibiscus, *Hibiscus syriacus*, Reding, 2006.

Treatment	Rate (per 100 gal)	Mean leaf area removed in Feeding Bioassay	Feeding Data	
			% Leaves with Damage	% Leaves with >25% Leaf Area Removed
Celero 16WSG	4 oz	1.49	38.9	7.5
DPX-E2Y45	47.9 oz	1.91	34.7	10.4
Safari 20SG	8 oz	1.24	32.9	4.6
TriStar 70WSP	96 g	1.17	34.6	5.7
	Untreated	0.88	36.2	5.0

Reding 2007

In this experiment, feeding damage on leaves was recorded in the field 7 and 14 days after first treatment and 14 days after second treatment for leaves. There were differences in severity of damage between treatments for leaf feeding (Table 10) with BAS 320i, and Tick Ex demonstrating significantly higher damage than the untreated control. Celero 16WSG and DPX-E2Y45 were equivalent to the untreated control. Flower numbers were recorded (7 and 14 days after second treatment) rather than flower damage because when Japanese beetles feed on flowers they become so severely damaged that they fall from the plant and cannot be accurately counted. Comparing the difference in number of blooms was a more accurate method to evaluate efficacy. Some treatments had a larger number of hibiscus flowers than untreated plants but were not statistically significant (Table 10).

No phytotoxicity was detected on any of the insecticide treated plants.

Table 10. Efficacy of several insecticides for *Popillia japonica* adults on Hibiscus, *Hibiscus syriacus*, Reding, 2007.

Treatment [z]	Rate per 100 gal	Percent Leaves Damaged [y]			Mean Number of Blossoms	
		7 DAT	14 DAT	28 DAT	21 DAT	28 DAT
BAS 320i (metaflumizone)	4.5 oz	13.4	21.1c	16.8c	68.4	79.4
Celero 16 WSG (clothianidin)	4 oz	11.0	13.9ab	12.6abc	55.7	70.7
DPX-E2Y45 (chlorantraniliprole)	10 fl oz	9.7	11.8a	9.5a	40.5	57.7
Tick Ex EC *(Metarhizium anisopliae)*	29 oz	17.4	17.4bc	14.7bc	65.8	80.6
Untreated		11.7	12.5a	11.5ab	47.8	58.5

[z] Treatments were applied as foliar sprays on 7/10/2007 and 7/30/2007

[y] Means within columns followed by the same letter are not significantly different ANOVA ($P = 0.05$), means separated by LSD ($\alpha = 0.05$).

Schultz 2007

In this experiment, Schultz examined Celero, DPX-E2Y45, Safari SG., BAS320i, *Metarhizium*, tolfenpyrad, and bifenthrin for their ability to control Japanese beetle adults on rose. Applications were made either June 25th or 28th as foliar sprays or drenches (Table 11). After foliage had dried (and one week after the Safari drench), 10 Japanese beetle adults were introduced into a mesh cage on a single branch. Mortality was assessed weekly (7, 14, and 21 DAT). After the 21 DAT counts, dead and remaining live beetles were removed, mesh bags were relocated on the plant, and new adults introduced. Mortality of the newly introduced beetles was taken for 7 and 14 days after introduction (28 and 35 DAT).

At 7 DAT all treatments, except Safari applied as a drench and Tick Ex, had significantly higher adult mortality for caged beetles than the untreated plants. At 7 DAT, BAS 320i and DPX-E2Y45 had 100% mortality 7 DAT. By 14 DAT, Bifenthrin and Celero also exhibited 100% mortality. At 21 DAT, Safari and tolfenpyrad reached 100% mortality.

There was a high background population of beetles, and observations were taken on their feeding. Throughout the experiment roses treated with Celero, DPX-E2Y45, Safari SG, BAS320i, and bifenthrin sustained no damage to the foliage regardless of adult beetle mortality. Foliage in the other treatments (*Metarhizium*, tolfenpyrad, and untreated check) did exhibit foliar damage.

Table 11. Efficacy of several insecticides for *Popillia japonica* on 'Julia Child TM. Butter Gold' Rose, Schultz, 2007.

Treatments	Rate per 100 gal	Mean Number Dead Beetles per Cage (Corrected Percent Control)					
		First Challenge (after foliar applications had dried)				Second Challenge	
		0 DAT	7 DAT	14 DAT	21 DAT	28 DAT	35 DAT
BAS 320i (metaflumizone)	Foliar – 16 oz	1.1 c (8%)	10.0 a (100%)	10.0 a (100%)	10.0 a (100%)	1.5 c (6%)	10.0 a (100%)
Bifenthrin	Foliar ?	5.6 a (55%)	6.9 b (68%)	10.0 a (100%)	10.0 a (100%)	10.0 a (100%)	10.0 a (100%)
Celero 16WSG (clothianidin)	Foliar – 4 oz	5.8 a (57%)	9.8 a (98%)	10.0 a (100%)	10.0 a (100%)	10.0 a (100%)	10.0 a (100%)
DPX-E2Y45 (chlorantraniliprole)	Foliar – 10 fl oz	3.6 b (34%)	10.0 a (100%)	10.0 a (100%)	10.0 a (100%)	8.3 b (81%)	10.0 a (100%)
Safari 20SG (dinotefuran)	Drench – 24 oz	--	1.3 c (10%)	9.5 a (94%)	10.0 a (100%)	10.0 a (100%)	10.0 a (100%)
Tick Ex EC *(Metarhizium anisopliae)*	Foliar – 29 oz	0.4 c (1%)	0.5 c (2%)	2.5 b (10%)	9.1 a (74%)	9.9 a (99%)	9.9 a (99%)
Tolfenpyrad	Foliar – 14 oz ?	2.1 bc (19%)	7.4 b (73%)	9.6 a (95%)	10.0 a (100%)	9.0 ab (89%)	9.6 a (95%)
	Untreated	0.3 c (0%)	0.3 c (0%)	1.7 c (0%)	6.6 b (0%)	1.0 c (0%)	1.4 b (0%)

Comparative Efficacy on Viburnum Leaf Beetle (Pyrrhalta viburni)

Viburnum leaf beetle is native to Europe and Asia and was first detected in North America in 1947 in Ontario, Canada. Since 1978 when breeding populations were discovered in the Ottawa/Hull region of Canada, viburnum leaf beetle has slowly spread south and was found in Maine in 1994 and in New York in 1996. Currently, it has been found as far south as Pennsylvania and Ohio. Viburnum leaf beetle feeds exclusively on viburnum species. The most susceptible include arrowwood viburnum (*V. dentatum*), European cranberry bush viburnum (*Viburnum opulus*), Rafinesque viburnum (*V. rafinesquianum*), and Sargent viburnum (*V. sargentii*). It will also feed on wayfaring tree viburnum (*V. lantana*), nannyberry viburnum (*V. lentago*), blackhaw viburnum (*V. prunifolium*) and several other species (http://creatures.ifas.ufl.edu/orn/beetles/viburnum_leaf_beetle.htm).

In the series of experiments presented here, most tested products reduced viburnum leaf beetle populations and feeding damage. The best consistently performing products in these three experiments were BAS 320i, Celero, and Safari. See the individual reports below for more information.

Costa 2006

In this experiment, Costa examined 5 products for efficacy of Viburnum leaf beetle larvae. Treatments were applied on May 16 to runoff using a handheld, pump sprayer with a second TriStar treatment made on June 13. The extent (percentage of affected leaves) and severity (percentage area affected on damaged leaves) of leaf feeding by larvae were assessed at 2, 7, 14, and 28 DAT by visually inspecting each plant and rating damage on a scale ranging from 1– 10.

By 2 DAT, no live larvae were detected outside of plants in the water control. By 14 DAT all insecticide treatments had significantly less feeding damage than the water-treated control (Table 12). None of the treatments varied significantly from each other. The second application of TriStar was made according an industry-prescribed protocol and was not necessary for larval control. All chemical insecticide treatments provided effective control of VLB larvae.

No phytotoxicity was observed.

Table 12. Efficacy of several insecticides for Viburnum Leaf Beetle (*Pyrrhalta viburni*) larval management on Arrowwood viburnum (*Viburnum dentatum*) – Defoliation Severity, Costa, 2006.

Product	Rate per 100 gal	Defoliation Severity Rating Relative Area [z]			
		2 DAT	7 DAT	14 DAT [y]	28 DAT
Celero 16WSG (clothianidin)	4 oz	2.6	3.4	3.4*	3.0*
DPX-E2Y45 (chlorantraniliprole)	16 fl oz	2.2	3.0	3.8*	2.8*
Permethrin 2.5EC	128 fl oz	2.4	3.0	3.8*	3.2*
Safari 20SG (dinotefuran)	8 oz	2.8	3.4	3.8*	3.4*
TriStar 70WSP (acetamiprid) + Cohere	96 g + 0.125%	2.8	3.4	4.2*	3.4*
	Untreated	2.8	5.6	6.2	7.0

[z] The severity of larval feeding post treatment as determined by qualitative rating of relative area affected on damaged leaves. Scale 1-10 is for 0 to 100% (1=0, 2=1-5, 3=6-15, 4=16-30, 5=31-50, 6=51-70, 7=71-85, 8=86-95, 9=96-99, 10=100% affected).

[y] An '*' indicates a significant difference between insecticide treatments and the water treated control (alpha = 0.05; one sided Dunnett's after GLM). There were no significant differences among insecticide treatments (P>0.05, GLM-ANOVA).

Costa 2007
In this experiment, Costa examined 8 products for efficacy of Viburnum leaf beetle larvae. All products except V-10112 were applied as foliar sprays. V-10112 was broadcast by hand around the plant base.

By 7 DAT, Viburnum plants treated with BAS 320i, Celero, DPX-E2Y45, Permethrin, Safari, and Tolfenpyrad exhibited significantly less feeding damage than the untreated plants (Table 14). Throughout this experiment Met 52 was equivalent to the untreated. V-10112 2G did reduce feeding damage at 14 DAT. While most products reduced severity of feeding, the extent of defoliation was only reduced by BAS 320i and Safari through 14 DAT (Table 15). By 28 DAT, these two products plus Celero, Permethrin and Tolfenpyrad reduced defoliation as compared to the untreated plants.

Table 13. Efficacy of several insecticides for Viburnum Leaf Beetle (*Pyrrhalta viburni*) larval management on Arrowwood viburnum (*Viburnum dentatum*) – Defoliation Extent, Costa, 2006.

Product	Rate per 100 gal	Defoliation Extent Rating [z]			
		2 DAT	7 DAT	14 DAT [y]	28 DAT
Celero 16WSG (clothianidin)	4 oz	3.0	3.4	3.8*	2.8*
DPX-E2Y45 (chlorantraniliprole)	16 fl oz	2.8	3.2	4.2*	2.6*
Permethrin 2.5EC	128 fl oz	3.0	3.8	4.4*	3.2*
Safari 20SG (dinotefuran)	8 oz	3.0	3.6	4.2*	3.2*
TriStar 70WSP (acetamiprid) + Cohere	96 g + 0.125%	3.2	3.8	5.0*	3.4*
	Untreated	3.6	4.4	6.6	7.0

[z] The extent of larval feeding post treatment as determined by qualitative rating of percentage of affected leaves. Scale 1-10 is for 0 to 100% (1=0, 2=1-5, 3=6-15, 4=16-30, 5=31-50, 6=51-70, 7=71-85, 8=86-95, 9=96-99, 10=100% affected).
[y] An '*' indicates a significant difference between insecticide treatments and the water treated control (alpha = 0.05; one sided Dunnett's after GLM). There were no significant differences among insecticide treatments (P>0.05, GLM-ANOVA).

Table 14. Efficacy of several insecticides for Viburnum Leaf Beetle (*Pyrrhalta viburni*) larval management on Arrowwood viburnum (*Viburnum dentatum*) – Defoliation Severity, Costa, 2007.

Product	Rate per 100 gal	Defoliation Severity Rating (±SE) Relative Area [z]			
		Pre-Trt [y]	Week 1 [x]	Week 2	Week 4
BAS 320i (metaflumizone)	16 oz	3.6 (0.4)	4.2 (0.5)*	4.4 (0.2)*	4.2 (0.2)*
Celero 16WSG (clothianidin)	4 oz	4.2 (0.4)	4.2 (0.2)*	4.4 (0.2)*	4.4 (0.2)*
DPX-E2Y45 (chlorantraniliprole)	10 fl oz	5.2 (0.2)	4.6 (0.2)*	4.6 (0.2)*	4.4 (0.2)*
Metarhizium anisopliae (Strain F52)	29 oz	4.6 (0.2)	6.6 (0.5)	6.4 (0.5)	5.8 (0.4)
Permethrin	128 fl oz	4.0 (0.5)	4.2 (0.2)*	4.4 (0.2)*	4.0 (0.3)*
Safari 20SG (dinotefuran)	8 oz	4.0 (0.0)	4.5 (0.3)*	4.5 (0.3)*	4.3 (0.5)*
Tolfenpyrad	?	3.5 (0.3)	4.0 (0.0)*	4.3 (0.3)*	4.5 (0.5)
V-10112 2G (dinotefuran)	?	4.8 (0.6)	5.5 (0.9)	5.0 (0.4)*	5.0 (0.6)
	Untreated	4.8 (0.6)	6.2 (0.0)	6.4 (0.5)	5.8 (0.5)

[z] The severity of larval feeding post treatment as determined by qualitative rating of relative area affected on damaged leaves. Scale 1-10 is for 0 to 100% (1=0, 2=1-5, 3=6-15, 4=16-30, 5=31-50, 6=51-70, 7=71-85, 8=86-95, 9=96-99, 10=100% affected).
[y] Pre-treatment (Pre-Trt) ratings were taken the day applications were made.
[x] An '*' indicates a significant difference between insecticide treatments and the water treated control (alpha = 0.05; one sided Dunnett's after GLM). There were no significant differences among insecticide treatments (P>0.05, GLM-ANOVA).

Table 15. Efficacy of several insecticides for Viburnum Leaf Beetle (*Pyrrhalta viburni*) larval management on Arrowwood viburnum (*Viburnum dentatum*) – Defoliation Extent, Costa, 2007.

Product	Rate per 100 gal	Defoliation Extent Rating (±SE) [z]			
		Pre-Trt [y]	Week 1 [x]	Week 2	Week 4
BAS 320i (metaflumizone)	16 oz	5.0 (0.6)	4.8 (0.7)*	4.8 (0.4)*	4.2 (0.4)*
Celero 16WSG (clothianidin)	4 oz	5.0 (0.5)	5.4 (0.7)	6.0 (0.7)	4.8 (0.6)*
DPX-E2Y45 (chlorantraniliprole)	10 fl oz	5.8 (0.2)	7.0 (0.6)	6.6 (0.6)	5.8 (0.6)
Metarhizium anisopliae (Strain F52)	29 oz	5.4 (0.2)	7.2 (0.6)	7.4 (0.2)	7.2 (0.4)
Permethrin	128 fl oz	5.4 (0.5)	5.2 (0.7)	5.6 (0.7)	4.6 (0.4)*
Safari 20SG (dinotefuran)	8 oz	4.8 (0.5)	5.0 (0.7)*	4.8 (0.9)*	4.3 (0.8)*
Tolfenpyrad	?	4.5 (0.3)	4.5 (0.7)	5.3 (0.9)	4.5 (0.7)*
V-10112 2G (dinotefuran)	?	5.5 (0.7)	6.3 (1.4)	6.0 (0.9)	5.8 (0.8)
	Untreated	6.0 (0.6)	7.4 (1.1)	7.6 (0.8)	7.0 (0.8)

[z] The extent of larval feeding post treatment as determined by qualitative rating of percentage of affected leaves. Scale 1-10 is for 0 to 100% (1=0, 2=1-5, 3=6-15, 4=16-30, 5=31-50, 6=51-70, 7=71-85, 8=86-95, 9=96-99, 10=100% affected).

[y] Pre-treatment (Pre-Trt) ratings were taken the day applications were made.

[x] An '*' indicates a significant difference between insecticide treatments and the water treated control (alpha = 0.05; one sided Dunnett's after GLM). There were no significant differences among insecticide treatments (P>0.05, GLM-ANOVA).

<u>Weston 2007</u>

In this experiment, Weston tested seven products for their efficacy on viburnum leaf beetle infesting established arrowwood viburnum (*Viburnum dentatum*) in field plots at the Bluegrass Lane Turf and Ornamentals Research Farm in Ithaca, NY. The shrubs, which had been growing under field conditions for 7 years, were approximately 6' tall and were naturally infested by viburnum leaf beetle in previous years. Products were applied as foliar sprays on May 22, 2007 when viburnum leaf beetle was in its first larval instar (egg hatch had begun on May 9). Five plants (replicates) were used for each treatment, and larval feeding damage was assessed 1 and 2 weeks after treatment. Data were analyzed with randomized complete block ANOVA, and treatments were compared with LSD.

The range of feeding damage was dramatic, ranging from 55% on the untreated control to near zero for the most effective treatments (Table 16). *Metarhizium anisopliae*, a fungus effective against many immature insects, had no effect on larvae (defoliation was virtually identical to that of the untreated control). The remaining products were as effective (or more so) than our previous standard, Merit. Most effective were Safari and Celero, two new neonicotinoids, which were more effective than Merit. BAS 320i, DPX-E2Y45, and Tolfenpyrad provided good control (statistically equivalent to Merit) through 14 DAT.

[NOTE: Earlier field trials by Weston have shown that soil drenches with Merit 75 WP have resulted in nearly complete protection from viburnum leaf beetle for several years. In the current trial, Merit was applied as a foliar spray, like all of the other test products.]

Table 16. Efficacy of several insecticides for Viburnum Leaf Beetle (*Pyrrhalta viburni*) management on Arrowwood viburnum (*Viburnum dentatum*), Weston, 2007.

Product (active ingredient)	Rate per 100 gal	Defoliation	
		1 WAT	2 WAT
BAS 320i (metaflumizone)	16 oz	2.5 b	2.2 bc
Celero (clothianidin)	4 oz	0.7 b	0.7 d
DPX-E2Y45 (chlorantraniliprole)	10 fl oz	3.3 ab	4.3 b
Merit (imidacloprid)	10 tsp	3.6 ab	3.6 b
Metarhizium anisopliae (Strain F52)	29 oz	22.2 ab	50.2 a
Safari (dinotefuran)	8 oz	2.7 b	1.7 cd
Tolfenpyrad	21 oz	4.4 ab	3.9 b
Untreated	--	24.4 a	55.4 a

Results: Soil Dwelling Immatures

Comparative Efficacy on Japanese Beetle Grubs (Popillia japonica)

The Japanese beetle (*Popillia japonica*) is a widespread and destructive exotic pest of turf, landscape, and ornamental plants in the United States. Outside of its native Japan, it is also found in China, Russia, Portugal, and Canada. Since the first detection in the US in a nursery near Riverton, New Jersey in 1916, it has spread to many states east of the Mississippi River, as well as parts of Wisconsin, Minnesota, Iowa, Missouri, Nebraska, Kansas, Arkansas and Oklahoma. Despite regulatory efforts, by 2002 it has become established in at least 30 states. Occasional introductions are made into western states such as California and Oregon when the adult beetles or larvae are shipped in commerce.

The Japanese beetle has a total host range of more than 400 plant species, including turf, ornamentals, fruits, and vegetables. Currently the Japanese beetle is the most widespread pest of turf and costs the turf and ornamental industry approximately $450 million each year in management alone (http://ohioline.osu.edu/hyg-fact/2000/2504.html, http://edis.ifas.ufl.edu/IN630).

Braman 2006

In 2006, Braman tested seven products as soil applications for efficacy on Japanese beetle grubs infesting Caldwell Pink Roses. Pots were treated on June 13 with drenches or surface application of granular products. On August 2 (50 DAT), five replications of the 8 treatments were infested with 5 second instar grubs recovered from turf plot cages used to enable adult beetles to lay eggs and larvae to grow. Pots were destructively sampled on August 16 (64 DAT) and evaluated for surviving larvae. Data were subjected to ANOVA using the GLM procedure of SAS.

Recovery in control pots was 92% of the original larvae used to infest the pots. Although mortality ranged from 8 to 60%, differences among treatments were not significant (Table 17). Several factors could have contributed to the lack of mortality observed including evaluating populations at 2 weeks instead of 4 weeks post infestation and infesting 5 weeks after application date

Braman 2007

In the experiment conducted in 2007, Braman examined 5 products for efficacy on Japanese beetle grubs infesting rose. Caldwell Pink roses, grown in 3 gallon pots, were treated (drenched) July 17. Design was a randomized complete block with 5 replications. Ten, first instar grubs were inserted into pots by inserting a pencil into the pots and dropping in the larvae on July 19. Pots were destructively sampled on October 5 (80 DAT) and the number of grubs were recorded. Data were analyzed using the GLM procedure of SAS and mean separation was by LSD.

Very few grubs survived in the pots. Differences were only significant at the 10% level and all treatments were equivalent to the UTC (Table 18).

Table 17. Efficacy of several insecticides for *Popillia japonica* on rose (*Rosa sp.)* 'Caldwell Pink', Braman, 2006.

Product	Rate per 100 gal	Number of Grubs per Pot 2 weeks after infestation (64 DAT) [z]
Celero 16WSG (clothianidin)	0.5 oz, Apply 1 pint per 2.25 sq ft	3.4 a
DPX-E2Y45 (chlorantraniliprole)	0.8 oz, Apply 1 pint per 2.25 sq ft	3.8 a
Flagship 25WG (thiamethoxam)	5 oz	3.6 a
Precise (acephate)	3 tsp/pot	2.8 a
Safari 20 SG (dinotefuran)	24 oz	3.6 a
Scimitar (lambda-cyhalothrin)	60 oz	2.0 a
TriStar 70 WSP (acetamipid)	8 oz	2.8 a
	Untreated	4.6 a

[z] Means followed by the same letter are not significantly different, P> 0.05

Table 18. Efficacy of several insecticides for *Popillia japonica* on rose (*Rosa sp.)* 'Caldwell Pink', Braman, 2007.

Product	Rate per 100 gal	Drench Volume per pot	Number of Grubs per Pot 80 DAT [z]
BAS 320i (metaflumizone)	16 oz	400 ml	1.60 a
Celero 16/WSG (clothianidin)	16 oz	500 ml	0.80 a
DPX-E2Y45 (chlorantraniliprole)	0.8 oz	100 ml	0.80 a
Met 52 (*Metarhizium anisopliae*)	58 oz	400 ml	1.00 a
Talstar (bifenthrin)	80 oz	400 ml	0.80 a
	Untreated		1.00 a

[z] Means followed by the same letter are not significantly different, P> 0.05

Comparative Efficacy on Black Vine Weevil (Agrilus anxius)

Black vine weevil (BVW) is a serious pest of ornamental nursery crops (field and container-grown), vineyards, strawberries and hops. In general, preventative applications provided better control than curative rescue treatments (Table 19). The preventative applications were incorporated into the soil prior to transplanting or were drenched prior to infestation. In at least one experiment, BAS 320i, Celero, DPX-E2Y45, Safari, and Talstar provided excellent (greater than 95%) control of black vine weevil. Curative drenches can reduce populations also, but in this series of experiments only BAS 320i provided excellent control when used in this manner.

Table 19. Summary of Black Vine Weevil (*Agrilus anxius*) Efficacy.

		Gilrein	Reding	Reding	Reding	Cowles	Reding	Alm	Nielsen
		Astilbe	Rhododendron	Sedum	Sedum	Strawberry	Yew	Yew	Yew
		2005*	2004	2004	2006	2007	2004	2006	2006
		47 DAT	16 DAT	138 DAT	149 DAT	70 DAT	138 DAT	121 DAT	119 DAT
Treatment	Timing	45 larvae	40 larvae	4 adults	5 adults	45 eggs	4 adults	4,263 eggs	eggs
Arena 50WDG (clothianidin)	Curative drench					-			
BAS 320i EC (metaflumizone)	Pre-plant incorporation					++			
	Curative drench					++			
Celero 16WSG (clothianidin)	Pre-infestation drench				++			-	
	Curative drench								+
Discus (imidacloprid + cyfluthrin)	Curative drench					-			
DPX-E2Y45 (chlorantraniliprole)	Pre-infestation drench				++			-	
	Pre-plant incorporation					++			
	Curative drench					+/-			+
Flagship 25WDG (thiamethoxam)	Curative drench					-			+
Mach 2 SC	Curative drench								-
Marathon 1G (imidacloprid)	Soil incorporation								-
Marathon II 2F	Curative drench	-							
Metarhizium anisopliae	Soil incorporation					-			-
	Curative drench	+/-							
Precise G & N (acephate)	Soil incorporation								-
Safari 20SG (dinotefuran)	Pre-infestation drench			++	++			-	
	Curative drench	-	-			-			+
	Foliar spray						-		
Talstar 0.2G (bifenthrin)	Pre-plant incorporation					++			-

* Not an IR-4-sponsored experiment.

[1] Rating Scale: ++ = clearly statistically better than untreated and greater than 95% control; + = statistically better than untreated and between 85 and 95% control; +/- statistically better than untreated with control between 70 and 85%; - = statistically equivalent to untreated and/or efficacy less than 70%.

[2] Where more than one rate or application type for a product was included in the experiment and each performed statistically different, the better rating is provided in this table.

Alm 2006

In 2006, Alm examined the efficacy of three products to control black vine weevil larvae on yew. This experiment also tested these products on oriental beetle; see that section for information on this pest. Drenches of Celero, DPX-E2Y45, and Safari were applied on July 11. Alm collected black vine weevil eggs as detailed in his report and the placed eggs into the pots on twelve dates: July 13, July 20, July 24, Aug. 1, Aug. 7, Aug. 9, Aug. 17, Aug. 23, Aug. 29, Sept. 6, Sept. 15, and Sept. 26. A total of 4,263 eggs were added to each pot. Pots were destructively sampled on Nov 9 and the number of live larvae were counted.

None of the treatments provided significant control of black vine weevil larvae. This could have been due to the constant, but realistic, repeat infestations after application. Another factor could be the length of residual control for these three products and that no repeat drench applications were made.

Table 20. Efficacy of several insecticides for Black Vine Weevil on Yew (*Taxus media)* 'Nigra', Alm, 2006.

Treatment	Rate	Mean Number Larvae per pot 121 DAT (Nov 9, 2006) [z]
Celero 16WSG (clothianidin)	1.2 oz	164.6 ± 28.0 a
DPX-E2Y45 1.67SC (chlorantraniliprole)	6.47 fl oz	91.8 ± 13.8 a
Safari 20SG (dinotefuran)	24 oz	132.4 ± 23.8 a
	Untreated	145.6 ± 27.5 a

[z] Means in the same column followed by the same letter are not significantly different, (*P* = 0.05, LSD test).

Cowles 2007

This study, sponsored by the IR-4 Program, used potted strawberries as a model system to determine which insecticides would provide protection against BVW larvae. Special attention was paid to determine whether there was a dose-response for two new insecticides (DPX-E2Y45 and BAS 320i), to compare neonicotinoids, and to compare preventive preplant incorporation into potting media with curative drenches targeting 3rd instars. Strawberry daughter plants were taken from research plots at the Valley Laboratory on 16 Nov 2006. Cultivars used were 'Allstar', 'Annapolis', 'Darselect', 'Idea' (two replicates), and 'Jewel'. Black vine weevil eggs were obtained from a colony at the Valley Laboratory. About 200 adults were enclosed in a 20 L plastic bucket with yew foliage, and eggs were collected by shaking foliage on a weekly basis. Sufficient eggs were not available on any one collection date, and so pots were repeatedly infested 9 Jan - 6 Feb until there were 45 eggs added per pot. Eggs were placed 1 – 2 cm deep in the soil, close to the crown of the plant. Larvae were counted on 16 and 17 April by sifting through the potting media shaken from the strawberry root system.

All preplant potting mix incorporation treatments, including the positive control standard Talstar 0.2G, were completely effective. All tested concentrations of BAS 320i caused complete mortality. Although the DPX-E2Y45 pretreatment was completely effective, only the higher dosage of this product applied as an early curative drench suppressed the BVW population. Neonicotinoid products performed poorly against BVW larvae as early curative drench treatments. Results with *Metarhizium anisopliae* were disappointing. Other tests (not presented here) have provided variable results, ranging from lack of control to complete elimination of BVW larval populations. The cool temperatures and poor quality inoculum may have contributed to its ineffectiveness.

Table 21. Efficacy of several insecticides for *Black Vine Weevil* on Strawberry (*Fragraria sp.)*, Cowles, 2007.

Treatment	Application Method	Application Date	Rate	Active Ingredient (mg/pot) [z]	Number of Larvae 10 weeks after last infestation [y, x]	Percent Control
Arena 50WDG (clothianidin)	Curative drench	Mar 15	1.28 oz/100 gal	4.79	5.4 a	0
BAS 320i SC (metaflumizone)	Curative drench	Mar 15	50 ppm	30.2	0.0 d	100
			100 ppm	60.4	0.0 d	100
BAS 320i EC (metaflumizone)	Pre-plant incorporation	Nov 10	25 ppm	15.1	0.0 d	100
			50 ppm	30.2	0.0 d	100
			100 ppm	60.4	0.0 d	100
			200 ppm	121	0.0 d	100
Discus (imidacloprid + cyfluthrin)	Curative drench	Mar 15	13 fl oz/100 gal	1.0 + 0.239	4.2 ab	0
DPX-E2Y45 (chlorantraniliprole)	Curative drench	Mar 15	0.8 fl oz/100 gal	0.873	4.8 a	0
			6.5 fl oz/100 gal	7.07	0.8 cd	75
DPX-E2Y45 (chlorantraniliprole)	Pre-plant incorporation	Nov 10	5 ppm	3.02	0.0 d	100
			10 ppm	6.03	0.0 d	100
			20 ppm	12.1	0.0 d	100
Flagship 25WDG (thiamethoxam)	Curative drench	Mar 15	8 oz/100 gal	0.5	3.8 ab	0
Metarhizium anosipliae	Soil incorporation	Jan 9	4.5×10^8 spores/L	28.3	4.8 a	0
Safari 20SG (dinotefuran)	Curative drench	Mar 15	24 oz/100 gal	27.0	1.0 bcd	69
Talstar 0.2G (bifenthrin)	Pre-plant incorporation	Nov 10	10 ppm	6.03	0.0 d	100
				Untreated	3.2 abc	0

[z] Expressed in µl per pot. This amounts to 1.00 mg of imidacloprid and 0.239 mg cyfluthrin per pot.
[y] Pots were infested repeated from Jan 9 to Feb 6 until there were 45 eggs added per pot.
[x] Means followed by the same letter do not significantly differ (Fisher's protected LSD test, $P < 0.05$).

Gilrein 2005

In 2005, Gilrein tested whether Marathon II, *Metarhizium anisopliae* and Safari as curative applications would control black vine weevil on *Astilbe simplicifolia* 'Pink Sprite'. Laboratory reared black vine weevil larvae were placed into pots on Sept 10, Oct 5, and Oct 26. Treatments were drenched on Nov 5 using 120 ml solution per pot. ANOVA and multiple comparisons among treatment means were performed using a statistical multiple comparison procedure (SuperAnova v. 1.1, Abacus Concepts).

Only *Metarhizium anisopliae* provided both statistically and biologically significant levels of control 47 days after treatment. Applications to early instars may have improved control so early curative or preventative applications could have reduced populations to a greater extent.

Table 22. Efficacy of several insecticides for curative control of Black Vine Weevil on Astilbe (*Astilbe simplicifolia*) 'Pink Sprite', Gilrein, 2005*.

Product (active ingredient)	Rate	Live Grubs per pot 47 DAT (% control) [z]
Marathon II 2F	20 g/650 pots	9.6 bc (18.6%)
Metarhizium anisopliae (Strain F52)	14.04 cfu/pot	2.0 a (83.1%)
	28.08 cfu/pot	2.6 a (78.0%)
	56.16 cfu/pot	3.5 a (70.3%)
Safari 20SG (dinotefuran)	12 oz / 100 gal	9.0 b (23.7%)
	24 oz / 100 gal	8.7 b (26.3%)
Untreated	--	11.8 c (0.0%)

* Not an IR-4 experiment.

[z] Means within columns followed by the same letter are not significantly different at p=0.05 (Fisher's LSD).

Nielsen 2006

Nielsen tested nine products for their control of black vine weevil larvae on yew. Treatments consisted of preventative soil mixtures or curative top dressings and drenches approximately 3 weeks before or 2 weeks after infestations, respectively. Incubated, black vine weevil eggs were obtained from weevils collected from a yew nursery and maintained in a rearing room on yew foliage. Plants were maintained outdoors under standard nursery management conditions throughout the growing season. Phytotoxicity was assessed 7 & 14 days after treatment, periodically after that and at the time of efficacy evaluation, when roots were evaluated for phytotoxicity.

Larval establishment in untreated check containers was marginal but sufficient to compare treatment effects. Marathon and Talstar, the industry standards, Metarhizium, Mach 2 and Precise failed in this trial. Celero, DPX-E2Y45 and Safari drenches prevented establishment of black vine weevil larvae: No larvae were found in any containers that received these treatments. The Flagship drench was nearly as effective.

No phytotoxicity was observed.

Table 23. Efficacy of several insecticides for Black Vine Weevil on Yew (*Taxus media densiformis*), Nielsen, 2006.

Treatment	Rate	Application Method	Number of larvae per pot 12/6/06 17 WAT [z]
Celero 16WSG (clothianidin)	20 oz/100 gal	8 oz drench per pot	0.0 a
DPX-E2Y45 1.67SC (chlorantraniliprole)	16 oz/100 gal	8 oz drench per pot	0.0 a
Flagship 25WG (thiamethoxam)	8 oz/100 gal	8 oz drench per pot	0.2 a
Mach 2 SC	2 lb ai/Acre	8 oz drench per pot	8.2 b
Marathon 1G (imidacloprid)	0.1 g ai/gal	Premixed into soil media	3.0 ab
Metarhizium	6.25 grams/pot	Premixed into soil media	9.4 b
Precise G & N (acephate)	6 g product/can	Premixed into soil media	6.8 ab
Safari 20 SG (dinotefuran)	6.8 g/gallon	8 oz drench per pot	0.0 a
Talstar 0.2 G (bifenthrin)	25 ppm	Premixed into soil media	4.8 b
		Untreated	4.2 ab

[z] Means within columns followed by the same letter are not significantly different at p=0.05 (Fisher-Hayter LSD).

Reding 2004

In 2004, Reding conducted a series of experiments testing Safari as a tool to manage black vine weevil.

For the first experiment, Rhododendron plants were purchased as 6" plants and transplanted into 2 gallon pots on April 23. The containers were then infested with black vine weevil larvae (40 larvae per pot). Because the larvae were mature and many had begun to pupate by the time the drench was applied, the treatments were considered curative, rescue applications. The containers were put outdoors in a container nursery and irrigated when needed with a drip irrigation system. On 28 April the pots were drenched with 240 ml of solution per each 2 gallon pot. On May 14 (16 DAT), the containers were dumped and the soil sifted for black vine weevils. There was no biologically significant impact on black vine weevil larvae with drenches on late instars (Table 24).

For the second experiment, sedum plants were purchased as 4" bare root plants and transplanted into 2 gallon pots on 15 April. The drench treatment was applied on 2 June and four hours later each container was infested with 4 adult black vine weevils and caged to prevent the insects from leaving. The containers were put outdoors in a container nursery and irrigated as needed with a drip irrigation system. Plants were evaluated for feeding damage on three dates (Table 25). To determine efficacy, the containers were dumped on 18 October and the roots and soil carefully examined for black vine weevil larvae. Many of the larvae found were within the roots. The plants were destroyed in the process of examination. All Safari drench applications significantly reduced feeding damage and the number of larvae found in Sedum roots.

For the third experiment, yew plants were purchased as 6" bare root plants and transplanted into 2 gallon pots on 7 May. The foliar spray was applied on 2 June and four hours later each container was infested with 4 adult black vine weevils and caged to prevent the insects from leaving. The containers were put outdoors in a container nursery and irrigated as needed with a drip irrigation system. Plants were evaluated for feeding damage on three dates. To determine efficacy, the containers were dumped on 18 October and the roots and soil carefully examined for black vine weevil larvae. Many of the larvae found were within the roots. The plants were destroyed in the process of examination. There were no significant differences in the number of larvae or in feeding damage.

There was no phytotoxicity on any of the treated plants.

Table 24. Efficacy of Safari 20SG for Black Vine Weevil on Rhododendron (*Rhododendron sp.*) 'Nova Zembla', Reding, 2004.

Treatment	Rate per 100 gal [z]	Insect Counts 5/14/04 16 DAT [y]
Larvae		
Safari 20SG (dinotefuran)	0.75 lb	3.8
Safari 20SG (dinotefuran)	1.5 lb	3.8
Safari 20SG (dinotefuran)	3.0 lb	2.8
	Untreated	3.8
Pupae		
Safari 20SG (dinotefuran)	0.75 lb	14.3
Safari 20SG (dinotefuran)	1.5 lb	10.6
Safari 20SG (dinotefuran)	3.0 lb	7.0
	Untreated	14.3
Adults		
Safari 20SG (dinotefuran)	0.75 lb	1.5
Safari 20SG (dinotefuran)	1.5 lb	2.0
Safari 20SG (dinotefuran)	3.0 lb	5.2
	Untreated	3.8
Total		
Safari 20SG (dinotefuran)	0.75 lb	19.7
Safari 20SG (dinotefuran)	1.5 lb	15.5
Safari 20SG (dinotefuran)	3.0 lb	15.5
	Untreated	22.0

[z] Treatments were applied as 240 ml of solution to each 10" (2 gallon) pot on April 23, 2004.
[y] There were no statistical differences according to ANOVA and Fisher-Hayter LSD.

Table 25. Efficacy of Safari 20SG drenches for Black Vine Weevil on Sedum (*Sedum sp.*) 'Vera Jameson', Reding, 2004.

Treatment	Rate per 100 gal [z]	Feeding damage [y] 6/22/04 20 DAT	7/27/04 57 DAT	8/20/04 79 DAT	Number of live larvae 10/18/04 138 DAT
Safari 20SG (dinotefuran)	0.75 lb	1.5 a	1.0 a	1.3 a	0.0 a
Safari 20SG (dinotefuran)	1.5 lb	0.6 a	0.5 a	0.3 a	0.0 a
Safari 20SG (dinotefuran)	3.0 lb	0.6 a	0.3 a	0.1 a	0.5 a
	Untreated	8.8 b	10.0 b	6.8 b	8.3 b

[z] Treatments were applied as 240 ml of solution to each 10" (2 gallon) pot on June 2, 2004.
[y] Means within columns followed by the same letter are not significantly different at p=0.05 (Fisher-Hayter LSD).

Table 26. Efficacy of Safari 20SG drenches for Black Vine Weevil on Yew (*Taxus sp.*) 'Brownii', Reding, 2004.

Treatment	Rate per 100 gal [z]	Feeding damage 6/22/04 20 DAT [y]	Feeding damage 7/27/04 57 DAT	Feeding damage 8/20/04 79 DAT	Number of live larvae 10/18/04 138 DAT
Safari 20SG (dinotefuran)	0.75 lb	2.3	3.0	2.0	4.0
Safari 20SG (dinotefuran)	1.5 lb	0.5	0.4	0.3	0.5
Safari 20SG (dinotefuran)	3.0 lb	1.0	1.3	1.0	3.8
	Untreated	2.5	2.8	1.5	5.5

[z] Treatments were applied as 240 ml of solution to each 10" (2 gallon) pot on June 2, 2004.

[y] There were no statistical differences according to ANOVA and Fisher-Hayter LSD.

Reding 2006

Sedum spurium 'Vera Jameson' plants, grown in one gallon containers, were used to test the efficacy of soil drench treatments of various products against black vine weevil (BVW). All treatment rates were applied in 200 ml of solution as a surface drench poured over the potting media, on June 5. On June 6, four adult BVW were placed on each caged plant. One additional BVW adult was added to each cage two weeks later.

To determine any differences in insecticidal activity on adults and larvae, efficacy was measured by rating feeding damage on foliage by adults on 8 August (percent of total damaged leaves and number of remaining blossoms per plant) and number of larvae found in the roots, on 2 November. There was a significant difference in percentage of leaves fed on and number of flower blossoms on untreated and DPX treated plants compared to Celero and Safari treated plants. There was also a significant difference in numbers of larvae recovered from untreated plants compared to all three insecticide treatments

Table 27. Efficacy of several insecticides for Black Vine Weevil on Sedum (*Sedum spurium)* 'Vera Jameson', Reding, 2006.

Treatment	Rate per 100 gal [z]	Percentage of leaves with feeding damage [y]	Mean # of Sedum Blooms	Mean number of larvae per plant 149 DAT
Celero 16WSG (clothianidin)	4 oz	21.5 b	11.8 b	0.0 b
DPX-E2Y45 (chlorantraniliprole)	47.9 oz	93.2 a	2.5 a	1.0 b
Safari 20SG (dinotefuran)	24 oz	22.0 b	9.8 b	0.0 b
	Untreated	93.2 a	1.8 a	12.2 a

[z] Each treatment was drenched onto soil using 200 ml per plant.

[y] Means within columns followed by the same letter are not significantly different ANOVA ($P = 0.05$), means separated by LSD ($\alpha = 0.05$).

Comparative Efficacy on Oriental Beetle (Anomala orientalis)

In general, growers and landscapers should target applications at or immediately after peak oriental beetle mating flights.

Alm 2006

As part of a combined study examining Celero, DPX-E2Y45 and Safari for black vine weevil and oriental beetle control, Alm collected 500 second instar oriental beetle larvae from turf and placed 20 larvae on the surface of each pot (Aug 31). Drenches of Celero, DPX-E2Y45, and Safari were applied as preventative treatments on July 11.

All treatments did provide significant control of oriental beetle larvae, and no phytotoxicity was observed.

Table 28. Efficacy of several insecticides for Oriental Beetle grubs on Yew (*Taxus media)* 'Nigra', Alm, 2006.

Treatment	Rate	Mean Number Larvae per pot 20 WAT (Nov 9, 2006) [z]
Celero 16WSG (clothianidin)	1.2 oz	1.2 $\pm$ 0.6 a
DPX-E2Y45 1.67SC (chlorantraniliprole)	6.47 fl oz	0.0 $\pm$ 0.0 a
Safari 20SG (dinotefuran)	24 oz	0.0 $\pm$ 0.0 a
	Untreated	7.6 $\pm$ 1.1 b

[z] Means in the same column followed by the same letter are not significantly different, (P = 0.05, LSD test).

Freiberger 2005

Arborvitae 'Emerald' and Holly 'Blue Girl' were planted into field soil at Rutgers University Tree Fruit Research & Extension Center in Cream Ridge, NJ. The field where the arborvitae and holly were planted had formerly been planted with strawberries heavily infested with oriental beetle. In 2005, four products were drenched once either during summer (Aug 3) or fall (Nov 1) with 1 pint of diluted product per plant – Celero (clothianidin), Discus (bifenthrin + imidacloprid), DPX-E2Y45 (chlorantraniliprole), and Flagship (thiamethoxam). Starting April 24, 2006, arborvitae and holly plants were destructively harvested and the number of oriental beetle larvae in and around each root ball was counted.

Timing of the applications was critical. When the drenches occurred in the summer all products significantly reduced larvae on both crops. However, when the drench applications occurred in the fall, only DPX-E2Y45 exhibited a statistically significant reduction in population on arborvitae, and for holly Celero, Discus and DPX-E2Y45 reduced oriental beetle grubs.

Table 29. Efficacy of several insecticides for Oriental Beetle on Arborvitae (*Thuja sp)* 'Emerald Giant' and holly (*Ilex sp*) 'Blue Girl' – Number of Grubs, Freiberger, 2005.

		Mean number of larvae per plant [y]			
		Arborvitae		Holly	
Treatment [z]	Rate per 100 gal	Summer Drench	Fall Drench	Summer Drench	Fall Drench
Celero 16WSG (clothianidin)	0.5 oz	2.6 ab	4.6 ab	1.7 a	1.7 a
Discus (imidacloprid + cyfluthrin)	10.0 oz	3.7 ab	5.0 ab	0.7 a	0.8 a
DPX-E2Y45 (chlorantraniliprole)	0.8 fl oz	2.2 a	4.5 a	0.8 a	1.2 a
Flagship (thiamethoxam)	0.4 oz	4.2 b	4.9 ab	0.9 a	2.2 ab
	Untreated	6.3 c	6.3 b	3.0 b	4.0 b

[z] Each plant was drenched with 1 pint of solution.

[y] Means within columns followed by the same letter are not significantly different according to Fisher-Hayton ($P<0.05$).

Table 30. Efficacy of several insecticides for Oriental Beetle on Arborvitae (*Thuja sp)* 'Emerald Giant' and holly (*Ilex sp*) 'Blue Girl' – Plant Height, Freiberger, 2005.

		Plant Height [y]			
		Arborvitae		Holly	
Treatment [z]	Rate per 100 gal	Summer Drench	Fall Drench	Summer Drench	Fall Drench
Celero 16WSG (clothianidin)	0.5 oz	43.8 a	44.0 a	17.4 b	18.0 c
Discus (imidacloprid + cyfluthrin)	10.0 oz	41.9 a	42.4 a	13.9 a	13.2 a
DPX-E2Y45 (chlorantraniliprole)	0.8 fl oz	41.3 a	43.7 a	16.3 b	15.5 b
Flagship (thiamethoxam)	0.4 oz	43.4 a	42.6 a	14.4 a	15.4 ab
	Untreated	42.4 a	43.5 a	15.8 ab	16.2 bc

[z] Each plant was drenched with 1 pint of solution.

[y] Means within columns followed by the same letter are not significantly different according to Fisher-Hayton ($P<0.05$).

<u>Gilrein 2005</u>

In 2005, Gilrein examined drenches of five products to manage oriental beetle larvae in lawn-type grass grown in pots. After grass was well-established in 1 gal pots, third instar larvae were collected and 10 place in each pot on Oct 21 and Oct 24. Treatments were applied on Nov 4 and pots were destructively harvested on Dec 27. ANOVA and multiple comparisons among treatment means were performed using a statistical multiple comparison procedure (SuperAnova v. 1.1, Abacus Concepts).

Only Celero and Marathon provided good control of third instar grubs. Cal-Agri, DPX-E2Y45, *Metarhizium anisopliae* and Sevin did not provide acceptable control in this test. First or second instar larvae may be more susceptible to these products.

Table 31. Efficacy of several insecticides for Oriental Beetle (*Anomala orientalis*) on lawn type grass, Gilrein, 2005*.

Product (active ingredient)	Rate	Live Grubs per pot (% control) 53 DAT [z]
Cal-Agri 50 1%	128 fl oz/100 gal	8.6 d (0.0%)
Celero 16WSG (clothianidin)	4 oz/1320 pots	0.6 a (93.0%)
DPX-E2Y45 1.67SC (chlorantraniliprole)	11.5 fl oz/A	8.2 cd (4.7%)
DPX-E2Y45 1.67SC (chlorantraniliprole)	23 fl oz/A	7.6 bcd (11.6%)
DPX-E2Y45 1.67SC (chlorantraniliprole)	46 fl oz/A	7.1 bc (17.4%)
Marathon II 2F (imidacloprid)	20 g/650 pots	1.1 a (87.2%)
Marathon II 2F (imidacloprid)	20 g/244 pots	0.6 a (93.0%)
Metarhizium anisopliae (Strain F52)	14.04 cfu/pot	7.1 bc (17.4%)
Metarhizium anisopliae (Strain F52)	28.08 cfu/pot	6.3 b (26.7%)
Sevin XLR 4F (carbaryl)	6 fl oz/1000 sq ft	7.7 bcd (10.4%)
Untreated	--	8.6 d (0.0%)

* Not an IR-4 experiment.

[z] Means within columns followed by the same letter are not significantly different at p=0.05 (Fisher's LSD).

Reding 2006

Lilac (*Syringa vulgaris*) plants were used to determine efficacy of soil drenches of various products against oriental beetle larvae (*Anomala orientalis*). Bare root lilacs were planted in one gallon pots on April 17, 2006 for the study. All treatment rates were applied in 200 ml of solution as a surface drench poured over the potting media, on June 5. Each lilac plant was then placed in a separate cage. On June 12 three pairs (male/female) of OBs were placed on each caged plant.

To determine efficacy, plant roots and potting media were searched for oriental beetle larvae on 19 September, 2006. No larvae were found in any of the treatments, including the untreated controls, therefore no efficacy data was acquired (Table 32). Foliar feeding damage by adult OBs could not be accessed on lilac because feeding by adults is minimal. Adult OBs were observed within the cages, on the lilac plants and potting media surface for several weeks after infestation, subsequently the lack of larvae in all pots was unexpected.

Table 32. Efficacy of several insecticides for Oriental Beetle on Lilac (*Syringa vulgaris*), Reding, 2006.

Treatment	Rate per 100 gal [z]	Mean number of larvae per plant [y]
Celero 16WSG (clothianidin)	4 oz	0.0 a
DPX-E2Y45 (chlorantraniliprole)	47.9 oz	0.0 a
Safari 20SG (dinotefuran)	24 oz	0.0 a
Untreated		0.0 a

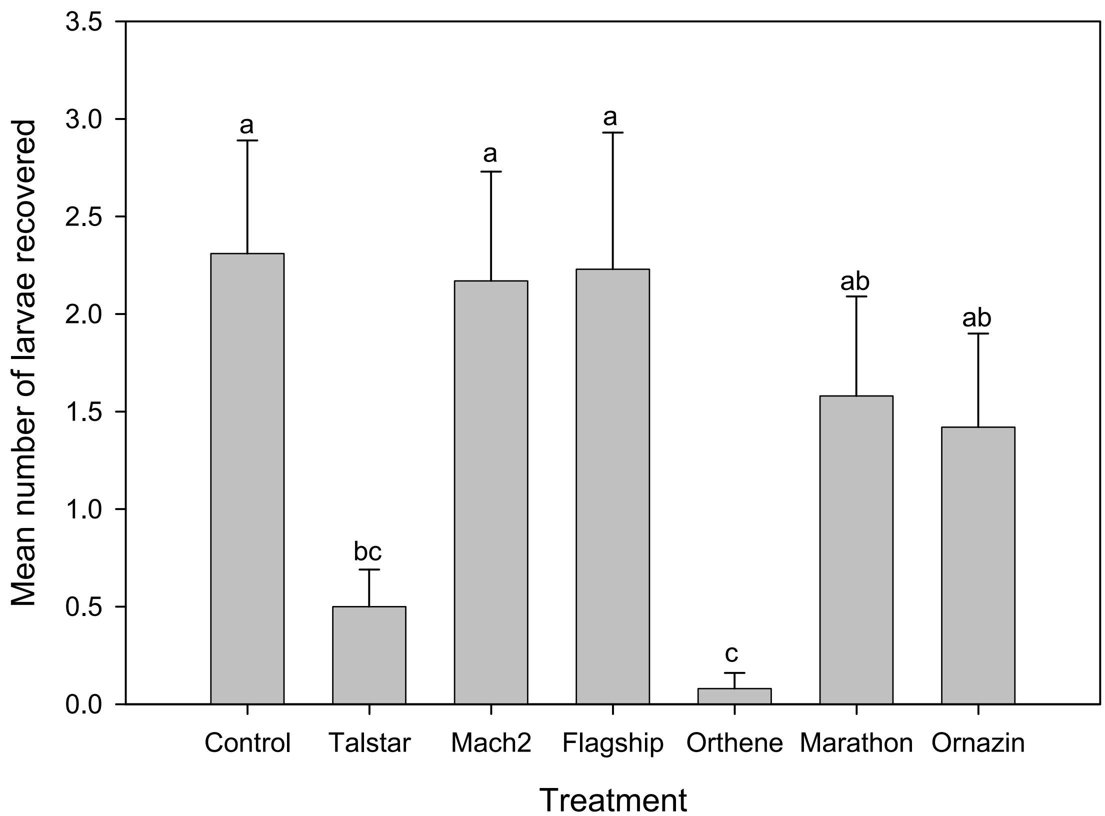
[z] Each treatment was drenched onto soil using 200 ml per plant.

[y] Means within columns followed by the same letter are not significantly different ANOVA ($P = 0.05$), means separated by LSD ($\alpha = 0.05$).

Comparative Efficacy on Strawberry Rootworm (Paria fragariae)

Two experiments were conducted for efficacy on strawberry rootworm infesting azalea. In 2005, Hesselein examined six products: Flagship, Mach 2, Marathon, Ornazin, Orthene, and Talstar. Of these the best control was achieved with Orthene and Talstar (Graph 33). In 2007 the strawberry rootworm populations were not sufficiently high to provide a good test of the six treatments planned for that year (Table 34).

Graph 33. Efficacy of several insecticides for Strawberry Rootworm larvae (Paria fragariae) on Azalea (*Rhododendron sp.*), Hesselein, 2005.



Treatment columns topped by the same letter are not different, α=0.05.

Table 34. Efficacy of several insecticides for Strawberry Rootworm (Paria fragariae) on Azalea (*Rhododendron sp.*), Hesselein, 2007.

Treatment	Rate per 100 gal	Adults collected on sticky cards	
		9/25 & 26	11/8
Safari (dinotefuran)	24 oz	0.29 a	0
Celero (clothianidin)	12 oz	0.29 a	0
BAS320i (metaflumizone)	12 fl oz	0.57 a	0
DPX-E2Y45 (chlorantraniliprole)	0.8 fl oz	0.29 a	0
Met52	58 fl oz	0.29 a	0
DuraGuard	50 fl oz	0.29 a	0
Untreated Control		0.43 a[z]	0

[z]Means separation tests performed using Tukey's Studentized Range (HSD) Test, α=0.05.
Treatments applied on August 23 using 375 ml per pot for all but Met52 which used 750 ml per pot.

Results: Trunk and Stem Borers

Bark beetles species in general are often difficult to control due to their behavior or physiology. The need for effective insecticides for the nursery industry to manage this group of pests is imperative.

Comparative Efficacy on Asian Ambrosia Beetle (Xylosandrus crassiusculus)

The Asian ambrosia beetle or granulate ambrosia beetle, *Xylosandrus crassiusculus,* was introduced into the U.S. from Asia or Africa. In the United States, it is found in Hawaii, Delaware, Maryland, Ohio, and it is widely established in the Southeast. Unlike most ambrosia beetles, this one is known to attack apparently healthy plants. It is reported to attack over 200 species of plants in 41 families, although it prefers hardwoods. Mated females construct galleries, inoculate the wood with the ambrosia fungus, and lay their eggs in excavated galleries of susceptible trees and shrubs. They have become a very important nursery and landscape pest from TX to NJ. In nurseries, seedling and small diameter trees and shrubs are attacked causing girdling, stunting, and death. Asian ambrosia beetle can also attack and kill larger trees, particularly if they are stressed. Between 5 and 10 attacks on trees less than 10 -15 cm in diameter usually kill this sized tree. The trend in the nursery industry is to grow larger trees in larger pots for instant landscapes. As a result there are higher numbers of stressed trees available.

Ludwig 2004

In 2004, Ludwig conducted an experiment at the Tram-Tex Nursery in Tyler, TX examining the efficacy of Onyx and Talstar Flowable preventative trunk spray applications against ambrosia beetles on container produced redbuds and Bradford pears. Onyx and Talstar were applied to the tree trunks until run-off. Repeat applications were made once for Onyx and twice for Talstar. Tree trucks were visually inspected once a month for signs of beetle attack. Trees that were attacked in one sample period were not check in following sample periods.

In the first block of redbud trees, both Onyx and Talstar reduced the overall number of ambrosia beetle attacks throughout the experiment from 72% in the untreated control to as low as 41% (Table 35).

However, various levels of control were achieved at each reading date. This was probably a result of a beetle flight and the pesticide residues declining over time. Both Onyx and Talstar were applied after the assessment in June. The count on July 16 revealed only beetle attacks in the control plants. The results from this block suggest a shorter spray period should be evaluated.

In the second block of redbud trees, the results were mixed (Table 36). The untreated trees had an attack rate of 40%, but Onyx at 6.4 oz had more attacks. The other two rates of Onyx did reduce attacks with 12.8 oz having no evidence of ambrosia beetle damage. Talstar reduced the attacks down to 5% of the treated trees.

In the Bradford pear block, the untreated trees only had one tree attacked so no conclusions on efficacy can be drawn (Table 37).

Table 35. Efficacy of Onyx and Talstar for *Xylosandrus crassiusculus* on Redbud (*Cercis canadensis*), Ludwig, 2004a.

Treatment [z]	Rate (per 100 gal)	Number New Attacks			Total Trees	Percent with Attacks
		5/10/04	6/10/04	7/16/04		
Onyx (bifenthrin)	6.4 oz	1	11	0	24	50%
Onyx(bifenthrin)	12.8	0	7	0	17	41%
Onyx(bifenthrin)	16 oz	2	8	0	23	43%
Talstar (bifenthrin)	40 oz	3	9	0	22	55%
	Untreated	4	13	4	29	72%

[z] The Onyx treatments were applied on 9 April and 15 June. The Talstar treatment was applied on 9 April, 10 May, and 15 June.

Table 36. Efficacy of Onyx and Talstar for *Xylosandrus crassiusculus* on Redbud (*Cercis canadensis*), Ludwig, 2004b.

Treatment [z]	Rate (per 100 gal)	Number New Attacks		Total Trees	Percent with Attacks
		5/10/04	6/10/04		
Onyx (bifenthrin)	6.4 oz	1	6	12	58%
Onyx(bifenthrin)	12.8	0	0	20	0%
Onyx(bifenthrin)	16 oz	2	1	11	27%
Talstar (bifenthrin)	40 oz	0	1	22	5%
	Untreated	2	4	15	40%

[z] The Onyx treatments were applied on 9 April and 15 June. The Talstar treatment was applied on 9 April, 10 May, and 15 June.

Table 37. Efficacy of Onyx and Talstar for *Xylosandrus crassiusculus* on Bradford Pear (*Pyrus sp*), Ludwig, 2004.

Treatment [z]	Rate (per 100 gal)	Number New Attacks			Total Trees	Percent with Attacks
		5/10/04	6/10/04	7/16/04		
Onyx (bifenthrin)	6.4 oz	0	0	0	26	0%
Onyx(bifenthrin)	12.8	5	3	1	24	37%
Onyx(bifenthrin)	16 oz	0	0	0	27	0%
Talstar (bifenthrin)	40 oz	1	3	1	20	25%
	Untreated	1	0	0	20	5%

[z] The Onyx treatments were applied on 9 April and 15 June. The Talstar treatment was applied on 9 April, 10 May, and 15 June.

Mizell 2005

During 2005, Mizell conducted a series of five experiments testing various products for their efficacy in controlling Asian ambrosia beetle. For each experiment, bolts from mimosa (*Albizia julibrissin*) were cut to approximately 46 cm long x 2-7 cm in diameter. Bolts were treated immediately with insecticide by dipping the bolts for 5 sec into the insecticide solution. After the bolts dried a few minutes, they were placed in the field and subjected to a proprietary induction technique and exposed to attack by AAB. Each test consisted of six replicate bolts per insecticide treatment along with six control bolts. Blocks were separated by 20-50 m in a location with known populations and/or active infestations of AAB. AAB attacks observed on each bolt were counted and recorded daily for 7-12 days. The tests were terminated when the number of AAB attacks on the control bolts exceeded an average of 20 per bolt or the time after treatment reached 21 days. Seven to 12 days of field exposure was usually required to attain the number of attacks on the test bolts. The mean number of successful attacks per bolt per treatment was used to evaluate the efficacy of the insecticides. Analysis of variance using the Proc Mixed procedure from SAS 8.1 (Littell et al. 1996) was conducted to analyze the results.

In living nursery trees of less than 10 cm in diameter, the formation of 5-10 successful galleries usually kills the attacked trees and statistics often do not tell the true story. However, because cut bolts were used, these experiments present a distinctly more challenging situation than a typically growing environment. Any product demonstrating significantly lower attacks than the untreated bolts may provide higher levels of control in a landscape or nursery setting.

In this series of experiments, Onyx routinely reduced Asian ambrosia beetle attacks. Discus performed well in the two experiments where it was tested. Ammo, Asana, Celero, chlorpyrifos and Talstar were variable in performance. In single experiments, DPX-E2Y45 and Thiodan were not statistically different from the untreated controls.

Table 38. Efficacy of several insecticides for Asian ambrosia beetle (*Xylosandrus crassiusculus*) on Mimosa (*Albizia julibrissin*) bolts – Experiment 1, Mizell, 2005.

Treatment	Rate per 100 gal	Mean Attacks per Bolt [z]
Ammo EC (cypermethrin)	66.3 g	6.3 a
Dursban Turf (chlorpyrifos)	92.8 g	8.0
Onyx (bifenthrin)	212.3 g	6.5 a
Talstar F (bifenthrin)	41.0 g	8.7
Thiodan EC (endosulfan)	83.0	10.7
	Untreated	12.5

[z] Means followed by the same letter are significantly different from the control as determined by a least squares mean test at P<0.05.

Table 39. Efficacy of several insecticides for Asian ambrosia beetle (*Xylosandrus crassiusculus*) on Mimosa (*Albizia julibrissin*) bolts – Experiment 2, Mizell, 2005.

Treatment	Rate per 100 gal	Mean Attacks per Bolt [z]
Asana XL (esfenvalerate)	8.0 g	27.2
Bifenthrin 8% ME (bifenthrin)	42.5 g	10.2
Bifenthrin 8% ME (bifenthrin)	85.0 g	13.5
Onyx (bifenthrin)	212.3 g	0.2 a
	Untreated	48.2

[z] Means followed by the same letter are significantly different from the control as determined by a least squares mean test at P<0.05.

Table 40. Efficacy of several insecticides for Asian ambrosia beetle (*Xylosandrus crassiusculus*) on Mimosa (*Albizia julibrissin*) bolts – Experiment 3, Mizell, 2005.

Treatment	Rate per 100 gal	Mean Attacks per Bolt [z]
Asana XL (esfenvalerate)	76.5 g	5.2 a
Asana XL (esfenvalerate)	153.5 g	3.8 a
Bifenthrin 8% ME (bifenthrin)	170.0 g	0.7 a
Lorsban 4E (chlorpyrifos)	767.5 g	2.7 a
Onyx (bifenthrin)	212.3	0.0 a
Talstar F (bifenthrin)	135.3	0.5 a
	Untreated	15.0

[z] Means followed by the same letter are significantly different from the control as determined by a least squares mean test at P<0.05.

Table 41. Efficacy of several insecticides for Asian ambrosia beetle (*Xylosandrus crassiusculus*) on Mimosa (*Albizia julibrissin*) bolts – Experiment 4, Mizell, 2005.

Treatment	Rate per 100 gal	Mean Attacks per Bolt [z]
Ammo 2.5EC (cypermethrin)	144.9 g	10.5
Asana XL (esfenvalerate)	95.9 g	11.3
Celero 16WSG (clothianidin)	170.0 g	8.2 a
Discus (cyfluthrin + imidacloprid)	19.8 + 83.3 g	6.3 a
Lorsban 4E (chlorpyrifos)	474.0 g	6.7 a
Onyx (bifenthrin)	212.3 g	4.2 a
Talstar F (bifenthrin)	214.0 g	5.0 a
	Untreated	13.8

[z] Means followed by the same letter are significantly different from the control as determined by a least squares mean test at P<0.05.

Table 42. Efficacy of several insecticides for Asian ambrosia beetle (*Xylosandrus crassiusculus*) on Mimosa (*Albizia julibrissin*) bolts – Experiment 5, Mizell, 2005.

Treatment	Rate per 100 gal	Monticello Mean Attacks per Bolt	Quincy Mean Attacks per Bolt [z]
Celero 16WSG (clothianidin)	38.8 g	2.3	2.8
Celero 16WSG (clothianidin)	77.6 g	2.2	4.7
Discus (cyfluthrin + imidacloprid)	19.8 + 83.3 g	2.0	1.8 a
Discus (cyfluthrin + imidacloprid)	39.6 + 169.6 g	1.5	3.8
DPX-E2Y45 (chlorantraniliprole)	47.0 g	5.3	6.2
DPX-E2Y45 (chlorantraniliprole)	189.4 g	6.3	6.3
DPX-E2Y45 (chlorantraniliprole)	754.4 g	3.5	6.3
Onyx (bifenthrin)	212.3 g	2.3	2.5
	Untreated	3.0	6.3

[z] Means followed by the same letter are significantly different from the control as determined by a least squares mean test at P<0.05.

Mizell 2006

In 2006, Mizell further explored insecticides along with the common repellent, DEET to prevent Asian ambrosia beetle infestations on mimosa bolts. Methods of treatment and infestation were as in 2005.

In experiment 1, DEET, Discus, Discus + DEET, Onyx, Onyx + Celero, Onyx + DEET, and Onyx + Dursban significantly reduced Asian ambrosia beetle attacks (Table 43). Although the number of attacks was lower for Azatin, Celero, Dursban and Onyx + Azatin than the untreated controls, they were not statistically different 12 DAT.

In experiment 2, while there was a trend for the combination treatments with DEET to have reduced attacks, there were no statistical differences for either location.

Table 43. Efficacy of several insecticides for Asian ambrosia beetle (*Xylosandrus crassiusculus*) on Mimosa (*Albizia julibrissin*) bolts – Experiment 1, Mizell, 2006.

Treatment	Rate per 100 gal	Mean Attacks per Bolt [z]
Azatin XL	2%	21.3
Celero 16WSG (clothianidin)	8 oz	14.7
DEET	40%	0.0 a
DEET	90%	0.0 a
Discus (cyfluthrin + imidacloprid)	100 oz	8.3 a
Discus + DEET	100 oz + 40%	0.0 a
Dursban 2E (chlorpyrifos)	32 oz	10.3
Onyx (bifenthrin)	32 oz	2.7 a
Onyz + Azatin XL	32 oz + 2%	10.3
Onyx + Celero 16WSG	32 oz + 8 oz	0.0 a
Onyx + DEET	32 oz + 40%	3.5 a
Onyx + Dursban 2E	32 oz + 32 oz	0.0 a
	Untreated	37.2

[z] Number of attacks assessed 12 DAT. Means followed by the same letter are significantly different from the control as determined by a least squares mean test at P<0.05.

Table 44. Efficacy of several insecticides for Asian ambrosia beetle (*Xylosandrus crassiusculus*) on Mimosa (*Albizia julibrissin*) bolts – Experiment 2, Mizell, 2006.

Treatment	Rate per 100 gal	Location 1 Mean Attacks per Bolt [z]	Location 2 Mean Attacks per Bolt
DEET	40%	5.5	13.5
Discus (cyfluthrin + imidacloprid)	100 oz	20.0	15.5
Discus + DEET	100 oz + 40%	2.3	8.3
Onyx (bifenthrin)	32 oz	19.7	11.2
Onyx + DEET	32 oz + 40%	3.5	9.0
Proclaim	2%	9.8	12.3
Talstar L&T (bifenthrin)	32 oz	20.8	27.5
Talstar L&T + DEET	32 oz + 40%	3.3	16.2
Tempo 2 (cyfluthrin)	32 oz	7.3	11.0
Tempo 2 + DEET	32 oz + 40%	1.2	11.7
	Untreated	17.5	15.7

[z] Number of attacks assessed 12 DAT. Means followed by the same letter are significantly different from the control as determined by a least squares mean test at P<0.05.

<u>Mizell 2007</u>

In 2007, Mizell conducted three experiments examining Onyx, *Metarhizium*, BAS 320i, and DPS-E2Y45. Only in experiment 1 were there any statistical differences between treated and untreated bolts (Tables 45 – 47). In this experiment, Onyx alone and in combination with two different surfactants provided acceptable reduction in Asian ambrosia beetle attacks. In experiment 2, *Metarhizium* at several concentrations and in combination with oil did not reduce attacks. In experiment 3, BAS 320i, DPX-E2Y45 and Onyx did not reduce attacks in comparison to the untreated controls.

Table 45. Efficacy of Onyx with and without surfactants for Asian ambrosia beetle (*Xylosandrus crassiusculus*) on Mimosa (*Albizia julibrissin*) bolts – Experiment 1, Mizell, 2007.

Treatment	Rate (per 100 gal)	Mean Attacks per Bolt (14 DAT)
Onyx (bifenthrin)	32 oz	3.3 ± 1.7 a
Onyx + PentaBark	32 oz + 1%	3.0 ± 1.1 a
Onyx + Previa	32 oz + 1%	2.0 ± 0.3 a
	Untreated	13.8 ± 1.5 b

[z] Means followed by the same letter are significantly different from the control as determined by a least squares mean test at P<0.05.

Table 46. Efficacy of *Metarhizium* for Asian ambrosia beetle (*Xylosandrus crassiusculus*) on Mimosa (*Albizia julibrissin*) bolts – Experiment 2, Mizell, 2007.

Treatment	Rate (per 100 gal)	Mean Attacks per Bolt (14 DAT)
Metarhizium	1.3×10^9	19.8 ± 4.4 a
Metarhizium	3.9×10^8	18.0 ± 3.6 a
Metarhizium	3.9×10^9	14.5 ± 3.9 a
Metarhizium (oil)	3.9×10^9	16.9 ± 4.4 a
	Untreated	18.3 ± 2.4 a

[z] Means followed by the same letter are significantly different from the control as determined by a least squares mean test at P<0.05.

Table 47. Efficacy of several insecticides for Asian ambrosia beetle (*Xylosandrus crassiusculus*) on Mimosa (*Albizia julibrissin*) bolts – Experiment 3, Mizell, 2007.

Treatment	Rate (per 100 gal)	Mean Attacks per Bolt (14 DAT)
BAS320i (metaflumizone)	16 oz/100 gal	11.3 ± 1.4 a
DPX-E2Y45 (chlorantraniliprole) + PentaBark	32 oz +1%	11.0 ± 3.3 a
DPX-E2Y45 (chlorantraniliprole)	32 oz/100 gal	18.2 ± 1.5 a
Onyx (bifenthrin)	32 oz/100 gal	11.8 ± 4.0 a
	Untreated	16.5 ± 3.6 a

[z] Means followed by the same letter are significantly different from the control as determined by a least squares mean test at P<0.05.

Comparative Efficacy on Bronze Birch Borer (Agrilus anxius)

The bronze birch borer is a native insect which occurs throughout the range of birch in North America. It is a serious pest of ornamental birch plantings. The bronze birch borer attacks paper (canoe), European white (especially cutleaf variety), gray, yellow, and other birches, as well as poplar, cottonwood and willow. The larva bores in the trunk and larger limbs, often girdling them. Trees weakened by drought or injured are most susceptible to attack. Tree injury is caused by larval tunneling in the inner bark or cambium (http://www.uri.edu/ce/factsheets/sheets/brbiborer.html).

In 2006, Nielsen located infested trees in early May followed by applying treatments on May 24 when red horse chestnuts were in bloom. Trees were cut May 15, 2007, and all old emergence holes circled with a wax pencil. Tree trunks were placed upright in the shade at Wooster. New emergence holes (EH) were counted and trunk surface area measured, August 29, 2007, to evaluate treatment effects.

In the first experiment, Arena, DPX-E2Y45, and Safari reduced the number of exit holes, but not statistically. In the second experiment, both NEI 25925 and Flagship significantly reduced infestations.

Table 48. Efficacy of several insecticides for Bronze Birch Borer (*Agrilus anxius*) on Weeping European white birch (*Betula pendula*) – Experiment 1, Nielsen, 2006.

Treatment [z]	Rate per inch DBH	Number of Exit Holes [y]
Arena 50WGD (clothianidin)	1.9 g	2.5
DPX-E2Y45 (chlorantraniliprole)	14.8 ml	1.3
Safari 20SG (dinotefuran)	12 g	0
	Untreated	7.3

[z] All treatments applied in 1 gal water as drench to root flare and soil.

[y] Means within columns followed by the same letter are not significantly different according to Fisher-Hayton (P<0.05).

Table 49. Efficacy of several insecticides for Bronze Birch Borer (*Agrilus anxius*) on Weeping European white birch (*Betula pendula*) – Experiment 2, Nielsen, 2006.

Treatment [z]	Rate	Number of Exit Holes
NEI 25925 9.25% (acetamiprid) + Capsil	4 ml/ inch DBH + 1%	3.1 a
Flagship WP (thiamethoxam)	16 oz./acre (1200 trees/acre - nursery)	2.1 a
	Untreated	28.9 b

[z] All treatments applied in 1 liter of water/tree spraying 18” of lower tree trunk.

[y] Means within columns followed by the same letter are not significantly different according to Fisher-Hayton (P<0.05).

Comparative Efficacy on Flatheaded Apple Tree Borer (Chrysobothris femorata)

Flatheaded apple tree borer is a native pest of apple, beech, cherry, chestnut, cotoneaster, dogwood, elm, flowering crabapple, hawthorn, hickory, linden, maple, mountain ash, oak, peach, pear, pecan, plum, poplar, quince, shadbush, sycamore, willow, and other hardwood species. This borer preferentially attacks diseased or dying trees, inhabiting all parts of the tree from the base of the trunk to the limbs. Its hosts are primarily newly transplanted nursery stock and trees that have been weakened from causes such as inappropriate pruning, drought, or inadequate soil or nutrient conditions. Trees suffering from sun scald are regarded as being particularly subject to attack. Like many borers, the flatheaded apple tree borer will often girdle a small tree, with a single larva sometimes capable of killing the tree (http://www.nysipm.cornell.edu/factsheets/treefruit/pests/ab/ab.asp).

In 2005, Potter tested Discus and Flagship as treatments for two cultivars of red maple. The infestation rate in control trees was > 60% in 2005 (Table 50). Trees that are stressed are more attractive to FHATB so the hot dry 2005 summer likely contributed to borer attacks in this trial. Although Discus significantly reduced the overall proportion of infested trees, the level of control obtained would not be acceptable in nursery production, nor was it comparable to the > 95% control previously obtained with lindane or chlorpyrifos bark sprays.

Insecticide Trial 2. Only three of the 300 total trees at the two study sites showed symptoms of FHATB attack, so no conclusions can be drawn regarding efficacy of the treatments. Two of those borers were in untreated trees; the other was in a tree that received DPX-E2Y45. The 2006 growing season was relatively cool and had record rainfall so absence of tree stress, as occurs in more typical Kentucky summers, may have contributed to the low incidence of borers.

Table 50. Efficacy of Discus and Flagship Drenches for Flatheaded Apple Tree Borer (*Chrysobothris femorata*) on Red Maples (*Acer rubrum*), Potter, 2005*.

	Number Infested Trees			Percent with No Attacks		
Treatment	October Glory	Red Sunset	Total	October Glory	Red Sunset	Total
Discus	9	2	11**	44%	88%	66%
Flagship	10	6	16	38%	63%	50%
Untreated	14	6	20	13%	63%	38%

* Not an IR-4 experiment.
Treatments were applied at high label rate with 1 L per tree.
* Proportion of trees infested is significantly lower for Discus than untreated (χ^2 = 5.07, 1 df, P = 0.02) but does not differ between Flagship and untreated (χ^2 = 1.02, 1 df, P = 0.31).

Efficacy Summary by Product

Ammo EC (cypermethrin)
This cypermethrin-based product provided reasonable reduction in Asian ambrosia beetle infestations of mimosa bolts.

Arena 50WDG/Celero 16WSG (clothianidin)
No significant reduction in black vine weevil adults or Asian ambrosia beetle infestation was observed with these two products. For Japanese beetle adults, efficacy levels were variable possibly due to differences in techniques and assessments among researchers. Excellent control of viburnum leaf beetle was achieved. Celero also provided good to excellent control of oriental beetle grubs. There were mixed levels of efficacy on black vine weevil larvae.

Asana XL (esfenvalerate)
In two out of four trials, Asana reduced Asian ambrosia beetle infestations. This warrants further exploration.

BAS 320i (metaflumizone)
Metaflumizone exhibited excellent efficacy for black vine weevil adults, Japanese beetle adults, and viburnum leaf beetle. There was virtually no impact on Asian ambrosia beetle infesting mimosa bolts. Excellent efficacy was achieved with black vine weevil larvae.

Bifenthrin 8%ME, Onyx, Talstar (bifenthrin)
These bifenthrin products provided excellent management of Asian ambrosia beetle. Onyx also gave excellent efficacy for Japanese beetle adults. Talstar NL exhibited excellent control of black vine weevil adults.

DEET
This repellent exhibited inconsistent control of Asian ambrosia beetle infestations. There, however, was some indication of improved efficacy for conventional materials when tank mixed with DEET.

Discus (imidacloprid + cyfluthrin)
In two out of four trials, Discus provided a good reduction in Asian ambrosia infestations. It also reduced oriental beetle grubs.

DPX-E2Y45 (chlorantraniliprole)
This unregistered material did not impact black vine weevil adults or Asian ambrosia beetle, but it did control adult Japanese beetles in six out of nine trials. DPX-E2Y45 also provided excellent control of viburnum leaf beetle. Variable efficacy was observed among researchers for oriental beetle grubs, excellent efficacy was routinely achieved for black vine weevil larvae.

DuraGard/Dursban/Lorsban 4E (chlorpyrifos)
Very little impact was observed for Asian ambrosia beetle with the Dursban formulation, but the Lorsban 4E formulation provided good efficacy.

Flagship (thiamethoxam)
Flagship provided some control of Japanese beetle adults, but good control of oriental beetle larvae.

Metarhizium anisopliae
This biological organism was tested as two formulations (Met 52, Tick Ex EC). No efficacy was observed for viburnum leaf beetles, Asian ambrosia beetle, or Japanese beetle adults. While good control of black vine weevil larvae in the greenhouse, little was seen with trials in field containers.

TriStar 30SG/NEI 25925 (acetamiprid)
Variable levels of efficacy were observed among researchers working with Japanese beetle adults.

Safari 20SG (dinotefuran)
Variable levels of efficacy were observed among researchers working with Japanese beetle adults. Safari did provide very effective control of viburnum leaf beetle. In single trials, Safari gave excellent control of oriental beetle, but had little impact on black vine weevil larvae.

Tolfenpyrad
For this new compound, no control was observed in a single experiment for black vine weevil adults, but good control was achieved for Japanese beetle adults, and excellent for viburnum leaf beetle.

Phytotoxicity

No phytotoxicity was observed during these experiments.

Table 51. Summary of Efficacy By Product – Borers and Foliar Feeding Beetles

Note: Table entries are sorted by crop Latin name. Only those trials received by 8/15/2008 are included in the table below.

PR #	Product	Crop: Latin Name	Crop: Common Name	Pest Common Name	Production Site	Researcher	Year	Results	Link
27963	Ammo EC	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 4: Virtually no impact on attacks per bolt treated with 144.9 g ai per 100 gal.	20060218z.pdf
27963	Ammo EC	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 1: About 50% reduction in attacks per bolt treated with 66.3 g ai per 100 gal.	20060218z.pdf
26098	Arena 50WDG	*Betula pendula*	European White Birch	Bronze Birch Borer	Field Container	Nielsen	2006	Very low infestation	20071220e.pdf
27965	Asana XL	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 2: Approximately 50% reduction in attacks per bolt treated with 8 g ai per 100 gal.	20060218z.pdf
27965	Asana XL	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 4: Virtually no impact on attacks per bolt treated with 95.9 g ai per 100 gal.	20060218z.pdf
27965	Asana XL	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 3: Approximately 60 to 80% reduction in attacks per bolt treated with 76.5 and 153.5 g ai per 100 gal.	20060218z.pdf
26181	Azatin XL	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 1: Poor efficacy with a 2% rate.	20070411d.pdf
27617	BAS 320i	*Rhododendron sp.*	Rhododendron	Black Vine Weevil - adults	Field Container	Nielsen	2007	Excellent efficacy at 16 oz per 100 gal	20071220a.pdf
26825	BAS 320i	*Hibiscus syriacus*	Rose-Of-Sharon, Althaea	Japanese Beetle - adults	Field In-Ground	Reding	2007	No significant reduction of feeding damage at 4.5 oz per 100 gal; no phytotoxicity and growth effect	20080128g.pdf
26945	BAS 320i	*Rosa sp.*	Rose	Japanese Beetle - adults	Field Container	Schultz	2007	Excellent efficacy	20071219k.pdf

PR #	Product	Crop Latin Name	Crop Common Name	Pest Common Name	Production Site	Researcher	Year	Results	Link
26402	BAS 320i	*Viburnum sp.*	Arrowwood	Viburnum leaf beetle	TBD	Costa	2007	Efficacy equal to the standard permethrin	20071219l.pdf
26402	BAS 320i	*Viburnum sp.*	Arrowwood	Viburnum leaf beetle	TBD	Weston	2007	Effective control at 16 oz per 100 gal; equal to imidacloprid	20071219m.pdf
26849	BAS 320i	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	TBD	Mizell	2007	No significant control at 16 oz per 100 gal	20080204g.pdf
27966	Bifenthrin 8% ME	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 3: Almost complete reduction in attacks per bolt treated with 170 g ai per 100 gal.	20060218z.pdf
27966	Bifenthrin 8% ME	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 2: Approximately 75% reduction in attacks per bolt treated with 42.5 and 85 g ai per 100 gal.	20060218z.pdf
25908	Celero 16WSG	*TBD*	TBD	Flatheaded Apple Tree Borer	TBD	Potter	2006	Very little insect pressure so no conclusions can be drawn.	20061114a.pdf
25511	Celero 16WSG	*Oenothera sp.*	Evening Primrose, Sundrops	Flea beetles, garden	Field Container	Schultz	2006	Population declined but numbers too low for statistical analysis	20061110j.pdf
27618	Celero 16WSG	*Taxus media*	Yew	Black Vine Weevil - adults	Field Container	Nielsen	2007	Poor efficacy at 4 oz per 100 gal	20071220a.pdf
26756	Celero 16WSG	*Hibiscus syriacus*	Rose-Of-Sharon, Althaea	Japanese Beetle - adults	Field In-Ground	Reding	2006	No significant reduction of feeding damage; no phytotoxicity and growth effect	20070410c.pdf
26756	Celero 16WSG	*Hibiscus syriacus*	Rose-Of-Sharon, Althaea	Japanese Beetle - adults	Field In-Ground	Reding	2006	No difference among treatment or untreated plants in this study; no phytotoxicity and no impacts on growth.	20070410c.pdf
26756	Celero 16WSG	*Hibiscus syriacus*	Rose-Of-Sharon, Althaea	Japanese Beetle - adults	Field In-Ground	Reding	2007	No significant reduction of feeding damage at 4 oz per 100 gal; no phytotoxicity and growth effect	20080128g.pdf
25520	Celero 16WSG	*Prunus sargentii*	Cherry, Sargent	Japanese Beetle - adults	Field Container	Alm	2006	Excellent control up to 10 DAT	20061110o.pdf

PR #	Product	Crop		Pest Common Name	Production Site	Researcher	Year	Results	Link
		Latin Name	Common Name						
26946	Celero 16WSG	*Rosa sp.*	Rose	Japanese Beetle - adults	Field Container	Schultz	2007	Excellent efficacy	20071219k.pdf
27787	Celero 16WSG	*Rubus sp.*	Caneberry (Non-Bearing)	Japanese Beetle - adults	Field Container	Alm	2007	Infestations too low to determine efficacy.	20080213a.pdf
26487	Celero 16WSG	*Salix sp.*	Willow	Japanese Beetle - adults	Field Container	Braman	2006	Poor efficacy	20070110o.pdf
26487	Celero 16WSG	*Salix sp.*	Willow	Japanese Beetle - adults	Field Container	Braman	2007	Fair efficacy at 4 oz per 100 gal.	20080116f.pdf
25515	Celero 16WSG	*Tilia cordata*	Linden, Shamrock	Japanese Beetle - adults	TBD	Alm	2006	Good control up to 19 DAT	20061110p.pdf
27782	Celero 16WSG	*Vitis sp.*	Grape (Non-Bearing)	Japanese Beetle - adults	Field Container	Alm	2007	Infestations too low to determine efficacy.	20080213b.pdf
25733	Celero 16WSG	*Viburnum sp.*	Arrowwood	Viburnum leaf beetle	TBD	Costa	2006	Effective control; equal to standard permethrin	20061110n.pdf
25733	Celero 16WSG	*Viburnum sp.*	Arrowwood	Viburnum leaf beetle	TBD	Costa	2007	Efficacy equal to the standard permethrin	20071219l.pdf
25733	Celero 16WSG	*Viburnum sp.*	Arrowwood	Viburnum leaf beetle	TBD	Weston	2007	Effective control at 4 oz per 100 gal; better than imidacloprid	20071219m.pdf
25479	Celero 16WSG	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 4: Some impact on attacks per bolt treated with 144.9 g ai per 100 gal.	20060218z.pdf
25479	Celero 16WSG	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 5: Quincy - Results inconclusive due to low numbers of attacks per bolt.	20060218z.pdf
25479	Celero 16WSG	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 5: Monticello - Results inconclusive due to low numbers of attacks per bolt.	20060218z.pdf
25479	Celero 16WSG	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 1: Mediocre efficacy (about 50% reduction in attacks per bolt) with 8 oz per 100 gal.	20070411d.pdf

PR #	Product	Crop		Pest Common Name	Production Site	Researcher	Year	Results	Link
		Latin Name	Common Name						
26828	Celero 16WSG	*Cornus kousa*	Dogwood, Kousa	Ambrosia Beetle	Field Container	Reding	2007	No infestation	20080128d.pdf
26180	DEET	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 2: Quincy - no statistically significant differences among treatments.	20070411d.pdf
26180	DEET	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 2: Monticello - some reduction in attacks on bolts with 40%, but not statistically significant.	20070411d.pdf
26180	DEET	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 1: Excellent control at 40% and 90%.	20070411d.pdf
25477	Discus	*Oenothera sp.*	Evening Primrose, Sundrops	Flea beetles, garden	Field Container	Schultz	2006	Inconclusive; population too low	20061110j.pdf
24764	Discus	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 5: Quincy - Results inconclusive due to low numbers of attacks per bolt.	20060218z.pdf
24764	Discus	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 4: Approximately 50% reduction in attacks per bolt treated with 144.9 g ai per 100 gal.	20060218z.pdf
24764	Discus	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 5: Monticello - Results inconclusive due to low numbers of attacks per bolt.	20060218z.pdf
24764	Discus	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 2: Monticello - no statistical differences among treatments.	20070411d.pdf
24764	Discus	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 2: Quincy - no statistical differences among treatments.	20070411d.pdf
24764	Discus	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 1: Approximate 70% reduction in attacks per bolt treated with 100 oz per 100 gal.	20070411d.pdf
26100	DPX-E2Y45	*Betula pendula*	European White Birch	Bronze Birch Borer	Field Container	Nielsen	2006	Very low infestation	20071220e.pdf

PR #	Product	Crop		Pest Common Name	Production Site	Researcher	Year	Results	Link
		Latin Name	Common Name						
25909	DPX-E2Y45	*TBD*	TBD	Flatheaded Apple Tree Borer	TBD	Potter	2006	Very little insect pressure so no conclusions can be drawn.	20061114a.pdf
25512	DPX-E2Y45	*Oenothera sp.*	Evening Primrose, Sundrops	Flea beetles, garden	Field Container	Schultz	2006	Inconclusive; population too low	20061110j.pdf
27619	DPX-E2Y45	*Taxus media*	Yew	Black Vine Weevil - adults	Field Container	Nielsen	2007	No efficacy at 10 oz per 100 gal	20071220a.pdf
26757	DPX-E2Y45	*Hibiscus syriacus*	Rose-Of-Sharon, Althaea	Japanese Beetle - adults	Field In-Ground	Reding	2006	No significant reduction of feeding damage; no phytotoxicity and growth effect	20070410c.pdf
26757	DPX-E2Y45	*Hibiscus syriacus*	Rose-Of-Sharon, Althaea	Japanese Beetle - adults	Field In-Ground	Reding	2006	No difference among treatment or untreated plants in this study; no phytotoxicity and no impacts on growth.	20070410c.pdf
26757	DPX-E2Y45	*Hibiscus syriacus*	Rose-Of-Sharon, Althaea	Japanese Beetle - adults	Field In-Ground	Reding	2007	No significant reduction of feeding damage at 10 oz per 100 gal; no phytotoxicity and growth effect	20080128g.pdf
25521	DPX-E2Y45	*Prunus sargentii*	Cherry, Sargent	Japanese Beetle - adults	Field Container	Alm	2006	Excellent control up to 31 DAT	20061110o.pdf
25521	DPX-E2Y45	*Prunus sargentii*	Cherry, Sargent	Japanese Beetle - adults	Field Container	Alm	2007	Excellent control of Japanese beetle adults at 0.026, 0.052 and 0.104 lb ai per 100 gal; equal to bifenthrin	20071120x.pdf
26948	DPX-E2Y45	*Rosa sp.*	Rose	Japanese Beetle - adults	Field Container	Schultz	2007	Excellent efficacy	20071219k.pdf
27788	DPX-E2Y45	*Rubus sp.*	Caneberry (Non-Bearing)	Japanese Beetle - adults	Field Container	Alm	2007	Infestations too low to determine efficacy.	20080213a.pdf
26488	DPX-E2Y45	*Salix sp.*	Willow	Japanese Beetle - adults	Field Container	Braman	2006	Good efficacy	20070110o.pdf

PR #	Product	Crop		Pest Common Name	Production Site	Researcher	Year	Results	Link
		Latin Name	Common Name						
26488	DPX-E2Y45	*Salix sp.*	Willow	Japanese Beetle - adults	Field Container	Braman	2007	Excellent efficacy at 10 oz per 100 gal	20080116f.pdf
25516	DPX-E2Y45	*Tilia cordata*	Linden, Shamrock	Japanese Beetle - adults	TBD	Alm	2006	Excellent control up to 31 DAT	20061110p.pdf
27783	DPX-E2Y45	*Vitis sp.*	Grape (Non-Bearing)	Japanese Beetle - adults	Field Container	Alm	2007	Infestations too low to determine efficacy.	20080213b.pdf
25734	DPX-E2Y45	*Viburnum sp.*	Arrowwood	Viburnum leaf beetle	TBD	Costa	2006	Effective control; equal to standard permethrin	20061110n.pdf
25734	DPX-E2Y45	*Viburnum sp.*	Arrowwood	Viburnum leaf beetle	TBD	Costa	2007	Efficacy equal to the standard permethrin	20071219l.pdf
25734	DPX-E2Y45	*Viburnum sp.*	Arrowwood	Viburnum leaf beetle	TBD	Weston	2007	Effective control at 10 oz per 100 gal; equal to imidacloprid	20071219m.pdf
25481	DPX-E2Y45	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 5: Quincy - Results inconclusive due to low numbers of attacks per bolt.	20060218z.pdf
25481	DPX-E2Y45	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 5: Monticello - Results inconclusive due to low numbers of attacks per bolt.	20060218z.pdf
25481	DPX-E2Y45	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2007	No control at 32 oz per 100 gal	20080204g.pdf
26826	DPX-E2Y45	*Cornus kousa*	Dogwood, Kousa	Ambrosia Beetle	Field Container	Reding	2007	No infestation	20080128d.pdf
25480	Dursban	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 1: Some reduction in attacks per bolt treated with 92 g ai per 100 gal.	20060218z.pdf
25480	Dursban	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 1: Poor efficacy	20070411d.pdf
26099	Flagship 25WG	*Betula pendula*	European White Birch	Bronze Birch Borer	Field Container	Nielsen	2006	Data inconclusive	20071220d.pdf
25791	Flagship 25WG	*Oenothera sp.*	Evening Primrose, Sundrops	Flea beetles, garden	Field Container	Schultz	2006	Inconclusive; population too low	20061110j.pdf

PR #	Product	Crop		Pest Common Name	Production Site	Researcher	Year	Results	Link
		Latin Name	Common Name						
26491	Flagship 25WG	*Salix sp.*	Willow	Japanese Beetle - adults	Field Container	Braman	2006	Fair efficacy	20070110o.pdf
27967	Lorsban 4E	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 3: Approximately 80% reduction in attacks per bolt treated with 767.5 g ai per 100 gal.	20060218z.pdf
27967	Lorsban 4E	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 4: Approximately 50% reduction in attacks per bolt treated with 144.9 g ai per 100 gal.	20060218z.pdf
27620	Met52	*Taxus media*	Yew	Black Vine Weevil - adults	Field Container	Nielsen	2007	No efficacy at 29 fl oz per 100 gal	20071220a.pdf
26403	Met52	*Viburnum sp.*	Arrowwood	Viburnum leaf beetle	TBD	Costa	2007	No efficacy	20071219l.pdf
26403	Met52	*Viburnum sp.*	Arrowwood	Viburnum leaf beetle	TBD	Weston	2007	No efficacy at 29 oz per 100 gal	20071219m.pdf
26850	Met52	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2007	No significant control at rates up to 3.9 X 10,000,000,000	20080204g.pdf
26101	NEI 25925	*Betula pendula*	European White Birch	Bronze Birch Borer	Field Container	Nielsen	2006	Data inconclusive	20071220d.pdf
25912	NEI 25925	*TBD*	TBD	Flatheaded Apple Tree Borer	TBD	Potter	2006	Very little insect pressure so no conclusions can be drawn.	20061114a.pdf
25910	Onyx	*TBD*	TBD	Flatheaded Apple Tree Borer	TBD	Potter	2006	Very little insect pressure so no conclusions can be drawn.	20061114a.pdf
25831	Onyx	*Oenothera sp.*	Evening Primrose, Sundrops	Flea beetles, garden	Field Container	Schultz	2006	Inconclusive; population too low	20061110j.pdf
25524	Onyx	*Prunus sargentii*	Cherry, Sargent	Japanese Beetle - adults	Field Container	Alm	2006	Excellent control up to 31 DAT	20061110o.pdf

PR #	Product	Crop		Pest Common Name	Production Site	Researcher	Year	Results	Link
		Latin Name	Common Name						
25524	Onyx	*Prunus sargentii*	Cherry, Sargent	Japanese Beetle - adults	Field Container	Alm	2007	Excellent control of Japanese beetle adults at 0.2 lb ai per 100 gal	20071120x.pdf
26949	Onyx	*Rosa sp.*	Rose	Japanese Beetle - adults	Field Container	Schultz	2007	Excellent efficacy	20071219k.pdf
27791	Onyx	*Rubus sp.*	Caneberry (Non-Bearing)	Japanese Beetle - adults	Field Container	Alm	2007	Infestations too low to determine efficacy.	20080213a.pdf
25519	Onyx	*Tilia cordata*	Linden, Shamrock	Japanese Beetle - adults	TBD	Alm	2006	Good control up to 31 DAT	20061110p.pdf
27786	Onyx	*Vitis sp.*	Grape (Non-Bearing)	Japanese Beetle - adults	Field Container	Alm	2007	Infestations too low to determine efficacy.	20080213b.pdf
25220	Onyx	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 5: Monticello - Results inconclusive due to low numbers of attacks per bolt.	20060218z.pdf
25220	Onyx	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 5: Quincy - Results inconclusive due to low numbers of attacks per bolt.	20060218z.pdf
25220	Onyx	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 4: Approximately 70% reduction in attacks per bolt treated with 144.9 g ai per 100 gal.	20060218z.pdf
25220	Onyx	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 2: Approximately 99% reduction in attacks per bolt treated with 212.3 g ai per 100 gal.	20060218z.pdf
25220	Onyx	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 1: About 50% reduction in attacks per bolt treated with 212.3 g ai per 100 gal.	20060218z.pdf
25220	Onyx	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 3: 100% reduction in attacks per bolt treated with 212.3 g ai per 100 gal.	20060218z.pdf

PR #	Product	Crop		Pest Common Name	Production Site	Researcher	Year	Results	Link
		Latin Name	Common Name						
25220	Onyx	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 1: Effective control using 32 fl oz per 100 gal.	20070411d.pdf
25220	Onyx	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 2: Monticello - no significant differences among treatments.	20070411d.pdf
25220	Onyx	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 2: Quincy - no significant differences among treatments.	20070411d.pdf
25220	Onyx	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2007	Test 1; significant control at 16 oz per 100 gal	20080204g.pdf
25220	Onyx	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2007	Test 2: no significant control at 32 oz per 100 gal	20080204g.pdf
26137	Onyx	*Cercis canadensis*	Red Bud, Eastern	Ambrosia Beetle	Field In-Ground	Ludwig	2004	Inconclusive results due to application timing	20031101a.pdf
27721	Onyx	*Cornus kousa*	Dogwood, Kousa	Ambrosia Beetle	Field Container	Reding	2007	No infestation	20080128d.pdf
26429	Perm-Up 3.2EC	*Oenothera sp.*	Evening Primrose, Sundrops	Flea beetles, garden	Field Container	Schultz	2006	Inconclusive; population too low	20061110j.pdf
26492	Precise	*Salix sp.*	Willow	Japanese Beetle - adults	Field Container	Braman	2006	Fair efficacy	20070110o.pdf
28002	Proclaim	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 2: Quincy - no statistical difference among treatments.	20070411d.pdf
28002	Proclaim	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 2: Monticello - no statistical difference among treatments.	20070411d.pdf
26102	Safari 20SG	*Betula pendula*	European White Birch	Bronze Birch Borer	Field Container	Nielsen	2006	Very low infestation	20071220e.pdf
25911	Safari 20SG	*TBD*	TBD	Flatheaded Apple Tree Borer	TBD	Potter	2006	Very little insect pressure so no conclusions can be drawn.	20061114a.pdf

PR #	Product	Crop		Pest Common Name	Production Site	Researcher	Year	Results	Link
		Latin Name	Common Name						
25513	Safari 20SG	*Oenothera sp.*	Evening Primrose, Sundrops	Flea beetles, garden	Field Container	Schultz	2006	Population declined but numbers too low for statistical analysis	20061110j.pdf
27623	Safari 20SG	*Taxus media*	Yew	Black Vine Weevil - adults	Field Container	Nielsen	2007	No efficacy at 8 oz per 100 gal	20071220a.pdf
26758	Safari 20SG	*Hibiscus syriacus*	Rose-Of-Sharon, Althaea	Japanese Beetle - adults	Field In-Ground	Reding	2006	No significant reduction of feeding damage; no phytotoxicity and growth effect	20070410c.pdf
26758	Safari 20SG	*Hibiscus syriacus*	Rose-Of-Sharon, Althaea	Japanese Beetle - adults	Field In-Ground	Reding	2006	No difference among treatment or untreated plants in this study; no phytotoxicity and no impacts on growth.	20070410c.pdf
25522	Safari 20SG	*Prunus sargentii*	Cherry, Sargent	Japanese Beetle - adults	Field Container	Alm	2006	Virtually no control	20061110o.pdf
26947	Safari 20SG	*Rosa sp.*	Rose	Japanese Beetle - adults	Field Container	Schultz	2007	Excellent efficacy	20071219k.pdf
27789	Safari 20SG	*Rubus sp.*	Caneberry (Non-Bearing)	Japanese Beetle - adults	Field Container	Alm	2007	Infestations too low to determine efficacy.	20080213a.pdf
26489	Safari 20SG	*Salix sp.*	Willow	Japanese Beetle - adults	Field Container	Braman	2006	Poor efficacy	20070110o.pdf
26489	Safari 20SG	*Salix sp.*	Willow	Japanese Beetle - adults	Field Container	Braman	2007	Fair efficacy at 8 oz per 100 gal	20080116f.pdf
25517	Safari 20SG	*Tilia cordata*	Linden, Shamrock	Japanese Beetle - adults	TBD	Alm	2006	Good control up to 19 DAT	20061110p.pdf
27784	Safari 20SG	*Vitis sp.*	Grape (Non-Bearing)	Japanese Beetle - adults	Field Container	Alm	2007	Infestations too low to determine efficacy.	20080213b.pdf
25735	Safari 20SG	*Viburnum sp.*	Arrowwood	Viburnum leaf beetle	TBD	Costa	2006	Effective control; equal to standard permethrin	20061110n.pdf

PR #	Product	Crop		Pest Common Name	Production Site	Researcher	Year	Results	Link
		Latin Name	Common Name						
25735	Safari 20SG	*Viburnum sp.*	Arrowwood	Viburnum leaf beetle	TBD	Costa	2007	Efficacy equal to or better than the standard permethrin	20071219l.pdf
25735	Safari 20SG	*Viburnum sp.*	Arrowwood	Viburnum leaf beetle	TBD	Weston	2007	Effective control at 8 oz per 100 gal; better than imidacloprid	20071219m.pdf
26827	Safari 20SG	*Cornus kousa*	Dogwood, Kousa	Ambrosia Beetle	Field Container	Reding	2007	No infestation	20080128d.pdf
26493	Scimitar	*Salix sp.*	Willow	Japanese Beetle - adults	Field Container	Braman	2006	Excellent efficacy	20070110o.pdf
26138	Talstar	*Cercis canadensis*	Red Bud, Eastern	Ambrosia Beetle	Field In-Ground	Ludwig	2004	Results inconclusive due to application timing	20031101a.pdf
27622	Talstar NF	*Taxus media*	Yew	Black Vine Weevil - adults	Field Container	Nielsen	2007	Excellent efficacy at 0.2 lb ai per 100 gal	20071220a.pdf
25482	Talstar NF	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 1: Some reduction in attacks per bolt treated with 41 g ai per 100 gal.	20060218z.pdf
25482	Talstar NF	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 4: Approximately 66% reduction in attacks per bolt treated with 144.9 g ai per 100 gal.	20060218z.pdf
25482	Talstar NF	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 3: Almost complete reduction in attacks per bolt treated with 135.3 g ai per 100 gal.	20060218z.pdf
25482	Talstar NF	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 2: Quincy - no statistical difference among treatments.	20070411d.pdf
25482	Talstar NF	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 2: Monticello - no statistical difference among treatments.	20070411d.pdf
28000	Tank Mix: Discus + DEET	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 2: Quincy - No statistical difference among treatments.	20070411d.pdf

PR #	Product	Crop: Latin Name	Crop: Common Name	Pest Common Name	Production Site	Researcher	Year	Results	Link
28000	Tank Mix: Discus + DEET	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 2: Monticello - Approximately 80% reduction in bolt attacks but not statistically significant.	20070411d.pdf
28000	Tank Mix: Discus + DEET	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 1: Excellent control using 100 oz Discus per 100 gal and 40% DEET.	20070411d.pdf
27997	Tank Mix: Onyx + Azatin XL	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 1: Approximately 66% reduction in bolt attacks, but not statistical significant.	20070411d.pdf
27998	Tank Mix: Onyx + Celero 16WSG	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 1: Excellent control at 32 oz + 8 oz per 100 gal.	20070411d.pdf
27996	Tank Mix: Onyx + Deet	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 1: Great control with 32 oz Onyx + 40% DEET.	20070411d.pdf
27996	Tank Mix: Onyx + Deet	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 2: Monticello - some reduction in bolt attacks but not statistically significant.	20070411d.pdf
27996	Tank Mix: Onyx + Deet	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 2: Quincy - no statistical difference among treatments.	20070411d.pdf
27999	Tank Mix: Onyx + Dursban	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 1: Excellent control using 32 oz + 32 oz per 100 gal.	20070411d.pdf
28003	Tank Mix: Talstar L&T + DEET	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 2: Monticello - approximately 80% reduction in attacks per bolt, but no statistical significance.	20070411d.pdf
28003	Tank Mix: Talstar L&T + DEET	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 2: Quincy - no statistical difference among treatments.	20070411d.pdf
28001	Tank Mix: Tempo 2 + DEET	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 2: Monticello - approximate 90% reduction in attacks per bolt, but not statistically different.	20070411d.pdf
28001	Tank Mix: Tempo 2 + DEET	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 3: Quincy - no statistical differences among treatments.	20070411d.pdf

PR #	Product	Crop		Pest Common Name	Production Site	Researcher	Year	Results	Link
		Latin Name	Common Name						
26182	Tempo 20WP	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 2: Monticello - no statistical difference among treatments.	20070411d.pdf
26182	Tempo 20WP	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2006	Experiment 2: Quincy - no statistical difference among treatments.	20070411d.pdf
27964	Thiodan EC	*Albizia julibrissin*	Mimosa Silk Tree	Ambrosia Beetle	Field Container	Mizell	2005	Experiment 1: Very little impact on attacks per bolt treated with 83 g ai per 100 gal	20060218z.pdf
27720	TickEx	*Hibiscus syriacus*	Rose-Of-Sharon, Althaea	Japanese Beetle - adults	Field In-Ground	Reding	2007	No significant reduction of feeding damage at 29 oz per 100 gal; no phytotoxicity and growth effect	20080128g.pdf
26950	TickEx	*Rosa sp.*	Rose	Japanese Beetle - adults	Field Container	Schultz	2007	Poor efficacy - very slow acting and short residual	20071219k.pdf
26547	TickEx	*Salix sp.*	Willow	Japanese Beetle - adults	Field Container	Braman	2007	No efficacy at 29 oz per 100 gal	20080116f.pdf
27621	Tolfenpyrad (Nichino)	*Taxus media*	Yew	Black Vine Weevil - adults	Field Container	Nielsen	2007	No efficacy at 21 fl oz per 100 gal	20071220a.pdf
26951	Tolfenpyrad (Nichino)	*Rosa sp.*	Rose	Japanese Beetle - adults	Field Container	Schultz	2007	Good efficacy; some foliar feeding damage	20071219k.pdf
26404	Tolfenpyrad (Nichino)	*Viburnum sp.*	Arrowwood	Viburnum leaf beetle	TBD	Costa	2007	Efficacy equal to the standard permethrin	20071219l.pdf
26404	Tolfenpyrad (Nichino)	*Viburnum sp.*	Arrowwood	Viburnum leaf beetle	TBD	Weston	2007	Effective control at 21 oz per 100 gal; equal to imidacloprid	20071219m.pdf
25514	TriStar 30SG	*Oenothera sp.*	Evening Primrose, Sundrops	Flea beetles, garden	Field Container	Schultz	2006	Inconclusive; population too low	20061110j.pdf
25523	TriStar 30SG	*Prunus sargentii*	Cherry, Sargent	Japanese Beetle - adults	TBD	Alm	2006	100 % control up to 31 DAT	20061110o.pdf

PR #	Product	Crop		Pest Common Name	Production Site	Researcher	Year	Results	Link
		Latin Name	Common Name						
25518	TriStar 30SG	*Tilia cordata*	Linden, Shamrock	Japanese Beetle - adults	TBD	Alm	2006	100 % control up to 31 DAT	20061110p.pdf
25736	TriStar 30SG	*Viburnum sp.*	Arrowwood	Viburnum leaf beetle	TBD	Costa	2006	Effective control; equal to standard permethrin	20061110n.pdf
26759	TriStar 70WSP	*Hibiscus syriacus*	Rose-Of-Sharon, Althaea	Japanese Beetle - adults	Field In-Ground	Reding	2006	No significant reduction of feeding damage; no phytotoxicity and growth effect	20070410c.pdf
26759	TriStar 70WSP	*Hibiscus syriacus*	Rose-Of-Sharon, Althaea	Japanese Beetle - adults	Field In-Ground	Reding	2006	No difference among treatment or untreated plants in this study; no phytotoxicity and no impacts on growth.	20070410c.pdf
27790	TriStar 70WSP	*Rubus sp.*	Caneberry (Non-Bearing)	Japanese Beetle - adults	Field Container	Alm	2007	Infestations too low to determine efficacy.	20080213a.pdf
26490	TriStar 70WSP	*Salix sp.*	Willow	Japanese Beetle - adults	Field Container	Braman	2006	Excellent efficacy	20070110o.pdf
26490	TriStar 70WSP	*Salix sp.*	Willow	Japanese Beetle - adults	Field Container	Braman	2007	Provided about 50% efficacy 4 DAT however, there was a significant reduction in feeding although adult Japanese beetle were still alive using 96 g per 100 gal	20080116f.pdf
27785	TriStar 70WSP	*Vitis sp.*	Grape (Non-Bearing)	Japanese Beetle - adults	Field Container	Alm	2007	Infestations too low to determine efficacy.	20080213b.pdf
26613	V-10112 2G	*Viburnum sp.*	Arrowwood	Viburnum leaf beetle	TBD	Costa	2007	Efficacy inferior to the standard permethrin	20071219l.pdf

Table 52. Summary of Efficacy By Product – White Grubs and Weevils

Note: Table entries are sorted by crop Latin name. Only those trials received by 8/15/2008 are included in the table below.

PR #	Product	Crop		Pest	Production Site	Researcher	Year	Results	Link
		Latin name	Common Name	Common Name					
26471	BAS 320i	*Fragaria sp.*	Strawberry (Non-Bearing)	Black Vine Weevil - grubs	Field Container	Cowles	2007	Excellent efficacy using 50 and 100 ppm as curative drenches.	20070418g.pdf
26471	BAS 320i	*Fragaria sp.*	Strawberry (Non-Bearing)	Black Vine Weevil - grubs	Field Container	Cowles	2007	Excellent efficacy with 25, 50, 100, and 200 ppm pre-plant soil incorporation.	20070418g.pdf
27614	BAS 320i	*Rhododendron sp.*	Rhododendron	Black Vine Weevil - grubs	Field Container	Nielsen	2007	Excellent efficacy at 16 oz per 100 gal	20071220b.pdf
27610	BAS 320i	*Rhododendron sp.*	Azalea	Strawberry Rootworm	Field Container	Hesselein	2007	Low infestation levels and no statistical significance among treatments.	20071219p.pdf
27675	BAS 320i	*Rosa sp.*	Rose	Japanese Beetle - grubs	Field Container	Braman	2007	Only ~10 % grub survival; no statistical difference among treatments	20080116f.pdf
26070	Cal-Agri-50	*TBD*	TBD	Oriental Beetle	Greenhouse	Gilrein	2005	No efficacy at 128 fl oz per 100 gal	20060517c.pdf
25119	Celero 16WSG	*Ilex sp.*	Holly	Oriental Beetle	Field In-Ground	Freiberger	2005	Good reduction of grubs with Aug drench of 0.5 oz per 100 gal; good control with Nov application.	20080522a.pdf
26760	Celero 16WSG	*Syringa vulgaris*	Lilac, Common	Oriental Beetle	Field Container	Reding	2006	No infestation developed; no phytotoxicity or impact on growth.	20070410b.pdf
26069	Celero 16WSG	*TBD*	TBD	Oriental Beetle	Greenhouse	Gilrein	2005	Excellent control at 4 oz per 1320 0.2 sq ft pots	20060517c.pdf
25120	Celero 16WSG	*Thuja sp.*	Arborvitae	Oriental Beetle	Field In-Ground	Freiberger	2005	Good reduction of grubs with Aug drench of 0.5 oz per 100 gal; good control with Nov application.	20080522a.pdf
26468	Celero 16WSG	*Fragaria sp.*	Strawberry (Non-Bearing)	Black Vine Weevil - grubs	Field Container	Cowles	2007	No efficacy using 1.28 oz per 100 gal curative drench.	20070418g.pdf

PR #	Product	Crop: Latin name	Crop: Common Name	Pest Common Name	Production Site	Researcher	Year	Results	Link
26753	Celero 16WSG	*Sedum spurium*	Stonecrop	Black Vine Weevil - grubs	Field Container	Reding	2006	0.64 oz ai per 100 gal; excellent efficacy on larvae; significantly reduced adult feeding damage; no phytotoxicity; plant significantly taller than Untreated	20070412m.pdf
26090	Celero 16WSG	*Taxus media*	Yew	Black Vine Weevil - grubs	Field Container	Alm	2006	No control of black vine weevil, good control of oriental beetle larvae	20061212w.pdf
26090	Celero 16WSG	*Taxus media*	Yew	Black Vine Weevil - grubs	Field Container	Nielsen	2006	Excellent efficacy with 20 oz per 100 gal drenched pre-infestation.	20070228a.pdf
26090	Celero 16WSG	*Taxus media*	Yew	Black Vine Weevil - grubs	Field Container	Nielsen	2007	Excellent efficacy at 16 oz per 100 gal	20071220b.pdf
27609	Celero 16WSG	*Rhododendron sp.*	Azalea	Strawberry Rootworm	Field Container	Hesselein	2007	Low infestation levels and no statistical significance among treatments.	20071219p.pdf
26494	Celero 16WSG	*Rosa sp.*	Rose	Japanese Beetle - grubs	Field Container	Braman	2006	No statistical difference among treatments	20070411a.pdf
26494	Celero 16WSG	*Rosa sp.*	Rose	Japanese Beetle - grubs	Field Container	Braman	2007	Only ~10 % grub survival; no statistical difference among treatments	20080116f.pdf
25125	Discus	*Ilex sp.*	Holly	Oriental Beetle	Field In-Ground	Freiberger	2005	Excellent reduction of grubs with Aug drench of 0.8 oz per 100 gal; good control with Nov application.	20080522a.pdf
25126	Discus	*Thuja sp.*	Arborvitae	Oriental Beetle	Field In-Ground	Freiberger	2005	Some reduction of grubs with Aug drench of 0.8 oz per 100 gal; no statistical difference from untreated with Nov application.	20080522a.pdf

PR #	Product	Crop		Pest Common Name	Production Site	Researcher	Year	Results	Link
		Latin name	Common Name						
26857	Discus	*Fragaria sp.*	Strawberry (Non-Bearing)	Black Vine Weevil - grubs	Field Container	Cowles	2007	No control with 13 fl oz per 100 gal as curative drench.	20070418g.pdf
25123	DPX-E2Y45	*Ilex sp.*	Holly	Oriental Beetle	Field In-Ground	Freiberger	2005	Excellent reduction of grubs with Aug drench of 0.8 oz per 100 gal; great control with Nov application.	20080522a.pdf
26761	DPX-E2Y45	*Syringa vulgaris*	Lilac, Common	Oriental Beetle	Field Container	Reding	2006	No infestation developed; no phytotoxicity or impact on growth.	20070410b.pdf
26067	DPX-E2Y45	*TBD*	TBD	Oriental Beetle	Greenhouse	Gilrein	2005	No significant control at 11.5, 23 and 46 fl oz per acre	20060517c.pdf
25124	DPX-E2Y45	*Thuja sp.*	Arborvitae	Oriental Beetle	Field In-Ground	Freiberger	2005	Good reduction of grubs with Aug drench of 0.8 oz per 100 gal; good control with Nov application.	20080522a.pdf
26469	DPX-E2Y45	*Fragaria sp.*	Strawberry (Non-Bearing)	Black Vine Weevil - grubs	Field Container	Cowles	2007	Great control with 6.5 fl oz per 100 gal, but poor control with 0.8 fl oz per 100 gal as curative drenches.	20070418g.pdf
26469	DPX-E2Y45	*Fragaria sp.*	Strawberry (Non-Bearing)	Black Vine Weevil - grubs	Field Container	Cowles	2007	Excellent efficacy with 5, 10, and 20 ppm pre-plant soil incorporation.	20070418g.pdf
26754	DPX-E2Y45	*Sedum spurium*	Stonecrop	Black Vine Weevil - grubs	Field Container	Reding	2006	0.8 oz ai per 100 gal; excellent efficacy on larvae; no significant reduction of adult feeding damage; no phytotoxicity; plant not significantly taller than Untreated	20070412m.pdf
26091	DPX-E2Y45	*Taxus media*	Yew	Black Vine Weevil - grubs	Field Container	Alm	2006	No significant control of black vine weevil, excellent control of oriental beetle larvae	20061212w.pdf

PR #	Product	Crop: Latin name	Crop: Common Name	Pest Common Name	Production Site	Researcher	Year	Results	Link
26091	DPX-E2Y45	*Taxus media*	Yew	Black Vine Weevil - grubs	Field Container	Nielsen	2006	Excellent efficacy with 16 oz per 100 gal drenched pre-infestation.	20070228a.pdf
26091	DPX-E2Y45	*Taxus media*	Yew	Black Vine Weevil - grubs	Field Container	Nielsen	2007	Excellent efficacy at 0.8 fl oz per 100 gal	20071220b.pdf
27611	DPX-E2Y45	*Rhododendron sp.*	Azalea	Strawberry Rootworm	Field Container	Hesselein	2007	Low infestation levels and no statistical significance among treatments.	20071219p.pdf
26495	DPX-E2Y45	*Rosa sp.*	Rose	Japanese Beetle - grubs	Field Container	Braman	2006	No statistical difference among treatments	20070411a.pdf
26495	DPX-E2Y45	*Rosa sp.*	Rose	Japanese Beetle - grubs	Field Container	Braman	2007	Only ~10 % grub survival; no statistical difference among treatments	20080116f.pdf
27613	DuraGuard	*Rhododendron sp.*	Azalea	Strawberry Rootworm	Field Container	Hesselein	2007	Low infestation levels and no statistical significance among treatments.	20071219p.pdf
25121	Flagship 25WG	*Ilex sp.*	Holly	Oriental Beetle	Field In-Ground	Freiberger	2005	Excellent reduction of grubs with Aug drench of 10 oz per 100 gal; excellent control with Nov application.	20080522a.pdf
25122	Flagship 25WG	*Thuja sp.*	Arborvitae	Oriental Beetle	Field In-Ground	Freiberger	2005	Some reduction of grubs with Aug drench of 10 oz per 100 gal; no statistical difference from untreated with Nov application.	20080522a.pdf
26858	Flagship 25WG	*Fragaria sp.*	Strawberry (Non-Bearing)	Black Vine Weevil - grubs	Field Container	Cowles	2007	No control with 8 oz per 100 gal as curative drench.	20070418g.pdf
26096	Flagship 25WG	*Taxus media*	Yew	Black Vine Weevil - grubs	Field Container	Nielsen	2006	Great efficacy with 8 oz per 100 gal drench pre-infestation.	20070228a.pdf
25032	Flagship 25WG	*Rhododendron sp.*	Azalea	Strawberry Rootworm	Field Container	Hesselein	2005	Little efficacy using 0.18 oz per 1000 sq ft drenched post-infestation.	20060626a.pdf

PR #	Product	Crop Latin name	Crop Common Name	Pest Common Name	Production Site	Researcher	Year	Results	Link
26497	Flagship 25WG	*Rosa sp.*	Rose	Japanese Beetle - grubs	Field Container	Braman	2006	No statistical difference among treatments	20070411a.pdf
26498	Mach 2 Granular	*Rosa sp.*	Rose	Japanese Beetle - grubs	Field Container	Braman	2006	No statistical difference among treatments	20070411a.pdf
26097	Mach 2 Liquid	*Taxus media*	Yew	Black Vine Weevil - grubs	Field Container	Nielsen	2006	Little efficacy with 2 lb ai per acre drenched pre-infestation.	20070228a.pdf
25034	Mach 2 Liquid	*Rhododendron sp.*	Azalea	Strawberry Rootworm	Field Container	Hesselein	2005	Little efficacy using 2.9 fl oz per 1000 sq ft drenched post-infestation.	20060626a.pdf
26093	Marathon 1% granular	*Taxus media*	Yew	Black Vine Weevil - grubs	Field Container	Nielsen	2006	Good efficacy with 0.1 g ai per gal soil as soil incorporation.	20070228a.pdf
25035	Marathon 60WP	*Rhododendron sp.*	Azalea	Strawberry Rootworm	Field Container	Hesselein	2005	Little efficacy using 20 g per 3000 sq ft drenched post-infestation.	20060626a.pdf
26068	Marathon II	*TBD*	TBD	Oriental Beetle	Greenhouse	Gilrein	2005	Good control at 20 g per 650, excellent at 20 g per 244 0.2 sq ft pots	20060517c.pdf
26065	Marathon II	*Astilbe sp.*	False Spirea	Black Vine Weevil - grubs	Greenhouse	Gilrein	2005	Poor control at 20 g per 650 pots.	20060517b.pdf
26824	Met52	*Cornus kousa*	Dogwood, Kousa	Oriental Beetle	Field Container	Reding	2007	No infestation	20080128h.pdf
27722	Met52	*Syringa vulgaris*	Lilac, Common	Oriental Beetle	Field Container	Reding	2007	No infestation	20080128h.pdf
26066	Met52	*TBD*	TBD	Oriental Beetle	Greenhouse	Gilrein	2005	Poor control at 14.04 and 28.08 cfu per 0.2 sq ft pot	20060517c.pdf
26064	Met52	*Astilbe sp.*	False Spirea	Black Vine Weevil - grubs	Greenhouse	Gilrein	2005	Good control at 14.04, 28.08 and 56.16 cfu per 0.2 sq ft pot	20060517b.pdf
26467	Met52	*Fragaria sp.*	Strawberry (Non-Bearing)	Black Vine Weevil - grubs	Field Container	Cowles	2007	No efficacy using 450,000,000 spores per L.	20070418g.pdf

PR #	Product	Crop Latin name	Crop Common Name	Pest Common Name	Production Site	Researcher	Year	Results	Link
26092	Met52	*Taxus media*	Yew	Black Vine Weevil - grubs	Field Container	Nielsen	2006	Little efficacy with 6.25 g per pot incorporated into soil pre-infestation.	20070228a.pdf
26092	Met52	*Taxus media*	Yew	Black Vine Weevil - grubs	Field Container	Nielsen	2007	Poor efficacy at 6.25 g per pot	20071220b.pdf
27612	Met52	*Rhododendron sp.*	Azalea	Strawberry Rootworm	Field Container	Hesselein	2007	Low infestation levels and no statistical significance among treatments.	20071219p.pdf
27674	Met52	*Rosa sp.*	Rose	Japanese Beetle - grubs	Field Container	Braman	2007	Only ~10 % grub survival; no statistical difference among treatments	20080116f.pdf
26790	Ornazin 3%EC	*Rhododendron sp.*	Azalea	Strawberry Rootworm	Field Container	Hesselein	2005	Little efficacy using 10 oz per 100 gal drenched post-infestation.	20060626a.pdf
25279	Orthene TTO 97	*Rhododendron sp.*	Azalea	Strawberry Rootworm	Field Container	Hesselein	2005	Excellent efficacy using 12 oz per 100 gal drenched post-infestation.	20060626a.pdf
26094	Precise	*Taxus media*	Yew	Black Vine Weevil - grubs	Field Container	Nielsen	2006	Little efficacy wit 6 g ai per pot incorporated into soil pre-infestation.	20070228a.pdf
26499	Precise	*Rosa sp.*	Rose	Japanese Beetle - grubs	Field Container	Braman	2006	No statistical difference among treatments	20070411a.pdf
26823	Safari 20SG	*Cornus kousa*	Dogwood, Kousa	Oriental Beetle	Field Container	Reding	2007	No infestation	20080128h.pdf
25796	Safari 20SG	*Syringa vulgaris*	Lilac, Common	Oriental Beetle	Field Container	Reding	2005	Excellent control at 6, 12 and 24 oz per 100 gal	20060214a.pdf
25796	Safari 20SG	*Syringa vulgaris*	Lilac, Common	Oriental Beetle	Field Container	Reding	2006	No infestation developed; no phytotoxicity or impact on growth.	20070410b.pdf
25796	Safari 20SG	*Syringa vulgaris*	Lilac, Common	Oriental Beetle	Field Container	Reding	2007	No infestation	20080128h.pdf
26063	Safari 20SG	*Astilbe sp.*	False Spirea	Black Vine Weevil - grubs	Greenhouse	Gilrein	2005	Poor control at 12 and 24 oz per 100 gal	20060517b.pdf

PR #	Product	Crop		Pest Common Name	Production Site	Researcher	Year	Results	Link
		Latin name	Common Name						
26470	Safari 20SG	*Fragaria sp.*	Strawberry (Non-Bearing)	Black Vine Weevil - grubs	Field Container	Cowles	2007	Good efficacy using 24 oz per 100 gal.	20070418g.pdf
25795	Safari 20SG	*Picea glauca*	Spruce, White; Cat	Black Vine Weevil - grubs	Field Container	Reding	2005	No infestation developed.	20060214a.pdf
25200	Safari 20SG	*Rhododendron sp.*	Azalea, & Rhododendron	Black Vine Weevil - grubs	Field Container	Reding	2004	Very little efficacy at 0.75, 1.5 and 3.0 lb product per 100 gal when drenched onto mature and pupating larvae; no injury at any rate.	20080522b.pdf
25201	Safari 20SG	*Sedum sp.*	Stonecrop	Black Vine Weevil - grubs	Field Container	Reding	2004	Excellent efficacy at 0.75, 1.5, and 3.0 lb product per 100 gal when drenched shortly before adults laid eggs; no injury at any rate.	20080522c.pdf
25201	Safari 20SG	*Sedum sp.*	Stonecrop	Black Vine Weevil - grubs	Field Container	Reding	2005	No efficacy at 6, 12, and 24 oz product per 100 gal with drench application prior to adults laying eggs; no injury.	20060214a.pdf
26755	Safari 20SG	*Sedum spurium*	Stonecrop	Black Vine Weevil - grubs	Field Container	Reding	2006	4.8 oz ai per 100 gal; excellent efficacy on larvae; significantly reduced adult feeding damage; no phytotoxicity; plant significantly taller than Untreated	20070412m.pdf
25432	Safari 20SG	*Taxus sp.*	Yew	Black Vine Weevil - grubs	Field Container	Alm	2006	No significant control of black vine weevil, excellent control of oriental beetle larvae	20061212w.pdf
25432	Safari 20SG	*Taxus sp.*	Yew	Black Vine Weevil - grubs	Field Container	Nielsen	2006	Excellent efficacy with 6.8 g ai per pot drenched pre-infestation.	20070228a.pdf

PR #	Product	Crop: Latin name	Crop: Common Name	Pest Common Name	Production Site	Researcher	Year	Results	Link
25432	Safari 20SG	*Taxus sp.*	Yew	Black Vine Weevil - grubs	Field Container	Nielsen	2007	Excellent efficacy at 12 oz per 100 gal	20071220b.pdf
25432	Safari 20SG	*Taxus sp.*	Yew	Black Vine Weevil - grubs	Field Container	Reding	2004	Good to excellent efficacy at 0.75, 1.5, and 3.0 lb product per 100 gal with foliar application shortly before adults laid eggs; no injury at any rate.	20080522d.pdf
25432	Safari 20SG	*Taxus sp.*	Yew	Black Vine Weevil - grubs	Field Container	Reding	2005	No larvae in any treatment at final rating; no injury.	20060214a.pdf
27608	Safari 20SG	*Rhododendron sp.*	Azalea	Strawberry Rootworm	Field Container	Hesselein	2007	Low infestation levels and no statistical significance among treatments.	20071219p.pdf
26496	Safari 20SG	*Rosa sp.*	Rose	Japanese Beetle - grubs	Field Container	Braman	2006	No statistical difference among treatments	20070411a.pdf
26071	Sevin SL	*TBD*	TBD	Oriental Beetle	Greenhouse	Gilrein	2005	No significant control at 6 fl oz per 1000 sq ft	20060517c.pdf
25033	Talstar	*Rhododendron sp.*	Azalea	Strawberry Rootworm	Field Container	Hesselein	2005	Highly efficacious using 25 fl oz per 100 gal drenched post-infestation.	20060626a.pdf
26500	Talstar	*Rosa sp.*	Rose	Japanese Beetle - grubs	Field Container	Braman	2006	No statistical difference among treatments	20070411a.pdf
26500	Talstar	*Rosa sp.*	Rose	Japanese Beetle - grubs	Field Container	Braman	2007	Only ~10 % grub survival; no statistical difference among treatments	20080116f.pdf
26856	Talstar NG	*Fragaria sp.*	Strawberry (Non-Bearing)	Black Vine Weevil - grubs	Field Container	Cowles	2007	Excellent control with 10 ppm pre-plant soil incorporation.	20070418g.pdf
26095	Talstar NG	*Taxus media*	Yew	Black Vine Weevil - grubs	Field Container	Nielsen	2006	Poor efficacy with 25 ppm incorporated into soil pre-infestation.	20070228a.pdf

PR #	Product	Crop		Pest Common Name	Production Site	Researcher	Year	Results	Link
		Latin name	Common Name						
26095	Talstar NG	*Taxus media*	Yew	Black Vine Weevil - grubs	Field Container	Nielsen	2007	Poor efficacy at 25 ppm ai	20071220b.pdf
27616	V-10112 2G	*Taxus media*	Yew	Black Vine Weevil - grubs	Field Container	Nielsen	2007	Excellent efficacy at 2.2 g per can	20071220b.pdf

Label Suggestions

Based upon data accumulated through the IR-4 research program in 2005-2007, we suggest that registrants consider the following updates to their current product labels:

- Arena/Celero
  - add drench applications at time of male oriental beetle flight to these labels
  - add viburnum leaf beetle to these labels
  - if additional favorable data are available, add soil incorporation, pre-infestation drench and post-infestation drench to the Celero 20SG label to control black vine weevil larvae
- BAS 320i
  - if additional favorable data are available, add Japanese beetle adults to the initial label
  - if additional favorable data are available, add viburnum leaf beetle to the initial label
- DPX-E2Y45
  - add drench applications at time of male oriental beetle flight to the initial label
  - include both Japanese beetle adults and larvae at appropriate rates in the initial label for ornamental horticulture crops
  - include viburnum leaf beetle on the initial label at 16 oz per 100 gal
  - if additional favorable data are available, add soil incorporation and pre-infestation drench to the label to control black vine weevil larvae
- Safari 20SG
  - add pre-infestation drench to the label to control black vine weevil larvae
  - add viburnum leaf beetle to the existing label at 8 oz per 100 gal
  - if additional favorable data are available, add drench applications at time of male oriental beetle flight to this label
- Tolfenpyrad
  - if additional favorable data are available, add Japanese beetle adults to the initial label
  - if additional favorable data are available, add viburnum leaf beetle to the initial label
- TriStar
  - if additional favorable data are available, add viburnum leaf beetle to the label

Appendix 1: Protocols

Managing Coleopteran Borers in Woody Ornamentals.

Ornamental Protocol Number: 06-006

Objective: Determine efficacy of soil drenches or trunk applications with various products against borers in various products to managing borers of ornamental plants.

Experimental Design:

Target Species: Flat-headed appletree borer or other suitable borer species

Plot Size: May be individual plants in a field setting.

Replicates: Minimum of 4 replications if using container stock seeded with eggs. A minimum of 6 replications required if relying on natural field populations.

Application Instructions: Applications should be made using application equipment consistent with conventional commercial equipment.

Plant Hosts: Use a plant host suitable for target scale species, recording species and variety used.

Use Site: Field in-ground or container.

Evaluations: Use suitable rating scheme to evaluate efficacy at 0, 3 months, 6 months and 1 year after application, or until no control is achieved. Record plant height & width at initial and final evaluations only. Record phytotoxicity at each rating date on a scale of 0 to 10 (0 = no phytotoxicity; 10 = complete kill). If phytotoxicity is observed in treated plants, take pictures comparing treated and untreated plant material.

Recordkeeping: Keep detailed records of weather conditions throughout the test including temperature and precipitation, soil-type or soil-less media, application equipment, application volume per acre, irrigation, liner size, plant height & width, and plant growth stage at application and data collection dates.

Reports:

Reports must include:

Results summary (no more than one page)

Summary table with appropriate statistical analyses

Experimental design and materials and methods

Appendices: raw data and recordkeeping information as listed above

If pictures were taken, please include them.

A report submitted electronically is preferred but not required. If the report is provided electronically, the basic report can be sent in MS Word or WordPerfect, the recordkeeping information as pdf or other electronic documents, and the raw data in MS Excel or other suitable program such as ARM.

Please direct questions to: Cristi Palmer, IR-4 HQ, Rutgers University, 681 US Hwy 1 S, North Brunswick, NJ 08902-3390, Phone 732-932-9575 x629, palmer@aesop.rutgers.edu **OR** Ely Vea, 308 Aston Forest Lane, Crownsville, MD 21032, Phone & FAX#: 410-923-4880, E-mail: evvea@comcast.net.

Revision Date: 5/8/2006
Revised By: CLP

Treatments:

Priority	#	Product	Rate	Application Instructions	Contact Information to obtain materials and any needed adjuvants
A	1	Celero 16WSG (clothianadin)	20 g per inch dbh	Apply as a trunk spray	Arysta, Doug Houseworth, 904-321-0795, LIHouse9@aol.com
	2	DPX-E2Y45	1 quart per 100 gallons	Apply as a trunk spray	Dupont, Chuck Silcox, 302-999-5953, charles.a.silcox@usa.dupont.com
	3	Onyx (bifenthrin)	Bark Borers: 1 pint per 100 gallons 2 pints per 100 gallons	Apply as a trunk spray	FMC, Gary Cramer, 520-318-0705, gary_c_cramer@fmc.com
			Other borers: Ash borer, banded ash clearwing borer, Dogwood borer, Lesser peachtree borer, Lilac borer, Oak borer, Bronze Birch Borer, and Flatheaded appletree borer. 8 oz per 100 gal 12.8 oz per 100 gal		
	4	Safari (dinotefuron)	Container: 24 oz/ 100 gal In-ground: 6 grams/ foot of plant height or trunk diameter	4 oz solution/ gallon of potting media 2 quarts solution/ foot of plant height or trunk diameter	Valent, Joe Chamberlin, 770-985-0303, jcham@valent.com
	5	NEI 25925 (acetamiprid 9.25%)	4 ml per inch dbh	Trunk injection or trunk spray. For trunk sprays include an organosilicate penetrant.	Cleary Chemical, Rick Fletcher, 732-329-8399, rick.fletcher@clearychemical.com
C	6	Flagship 25WG (thiamethoxam)	Container: 8 oz/100gal In-ground and trunk application: 16 oz/A	Apply a volume of solution that is 1/3 the drench volume. Directed application as a banded treatment (2-3 ft band) treating 18" up the trunk and ground	Syngenta, Dave Ross, 336-632-6411, david.ross@syngenta.com
	7	Discus (imidacloprid + cyfluthrin)	44 ml per inch dbh	Soil drench in suitable volume (1 liter per pot)	OHP, Dick Lindquist, 406-587-2562, rlindquist@olympichort.com
	8	Precise (acephate)	Contact manufacturer for rates and use directions		
	9	Scimitar (lambda-cyhalothrin)	Contact manufacturer for rate and application instructions		Syngenta, Dave Ross, 336-632-6411,

					david.ross@syngenta.com
Standards (Pick One)	10a	permethrin	See label directions		
	10b	Thiodan (endosulfan)	See label directions		
	11	Untreated	--	--	--

Managing Foliar Feeding Beetles in Woody Ornamentals.

Ornamental Protocol Number: 06-007
Objective: Determine efficacy of various products against foliar feeding beetles of ornamental plants.

Experimental Design:

Target Species: Asian Ambrosia Beetle, Viburnum Leaf Beetle, Oriental Beetle Adults, Japanese Beetle Adults, or other suitable species.

Plot Size: May be individual plants in a field setting.

Replicates: Minimum of 4 replications if using container stock seeded with eggs. A minimum of 6 replications required if relying on natural field populations.

Application Instructions:. Applications should be made using application equipment consistent with conventional commercial equipment.

Plant Hosts: Use a plant host suitable for target scale species, recording species and variety used.

Use Site: Field in-ground or container.

Evaluations: Use suitable rating scheme to evaluate efficacy at 0, 1 week, 2 weeks, 1 month, and, if suitable with target species, 3 and 6 months after application. Record plant height & width at initial and final evaluations only. Record phytotoxicity at each rating date on a scale of 0 to 10 (0 = no phytotoxicity; 10 = complete kill). If phytotoxicity is observed in treated plants, take pictures comparing treated and untreated plant material.

Recordkeeping: Keep detailed records of weather conditions throughout the test including temperature and precipitation, soil-type or soil-less media, application equipment, application volume per acre, irrigation, liner size, plant height & width, and plant growth stage at application and data collection dates.

Reports:

Reports must include:

Results summary (no more than one page)

Summary table with appropriate statistical analyses

Experimental design and materials and methods

Appendices: raw data and recordkeeping information as listed above

If pictures were taken, please include them.

A report submitted electronically is preferred but not required. If the report is provided electronically, the basic report can be sent in MS Word or WordPerfect, the recordkeeping information as pdf or other electronic documents, and the raw data in MS Excel or other suitable program such as ARM.

Please direct questions to: Cristi Palmer, IR-4 HQ, Rutgers University, 681 US Hwy 1 S, North Brunswick, NJ 08902-3390, Phone 732-932-9575 x629, palmer@aesop.rutgers.edu **OR** Ely Vea, 308 Aston Forest Lane, Crownsville, MD 21032, Phone & FAX#: 410-923-4880, E-mail: evvea@comcast.net.

Revision Date: 2/21/2006
Revised By: CLP

Treatments:

Priority	#	Product	Rate	Application Instructions	Contact Information to obtain materials and any needed adjuvants
A	1	Celero 16WSG (clothianadin)	Contact manufacturer for rate and application instructions		Arysta, Doug Houseworth, 904-321-0795, LIHouse9@aol.com
	2	DPX-E2Y45	10 fl oz per 100 gal	Apply to run off	Dupont, Chuck Silcox, 302-999-5953, charles.a.silcox@usa.dupont.com
	3	Safari (Dinotefuron)	8 oz/ 100 gal 24 oz/ 100 gal 3 grams/ ft of plant height or trunk diameter	Foliar spray Container soil drench: 4 oz solution/ gallon of potting media In ground soil drench: 2 qts solution/ foot of plant height or trunk diameter	Valent, Joe Chamberlin, 770-985-0303, jcham@valent.com
	4	Tristar (acetamiprid)	96 g per 100 gal	Two sprays 14 days apart. Include wetting agent such as Capsil.	Cleary Chemical, Rick Fletcher, 732-329-8399, rick.fletcher@clearychemical.com
C	5	Flagship 25WG (thiamethoxam)	Container: 8 oz/100gal In-ground and trunk application: 16 oz/A	Apply a volume of solution that is 1/3 the drench volume. Directed application as a banded treatment (2-3 ft band) treating 18" up the trunk and ground	Syngenta, Dave Ross, 336-632-6411, david.ross@syngenta.com
	6	Discus (imidacloprid + cyfluthrin)	50 fl oz per 100 gal	Two applications 14 days apart. Do not use wetting agent.	OHP, Dick Lindquist, 406-587-2562, rlindquist@olympichort.com
	7	Onyx (bifenthrin)	Contact manufacturer for rate and application instructions		FMC, Bobby Walls, 919-735-3862, bobby_walls@fmc.com
	8	Precise (acephate)	Contact manufacturer for rates and use directions		
Standards (Pick One)	9a	bifenthrin	See label directions		
	9b	permethrin	See label directions		
	9c	Scimitar (lambda-cyhalothrin)	See label directions		
	9d	Thiodan (endosulfan)	See label directions		
	10	Untreated	--	--	--

Managing Coleopteran Borers in Woody Ornamentals.

Ornamental Protocol Number: 07-006

Objective: Determine efficacy of soil drenches or trunk applications with various products against borers in various products to managing borers of ornamental plants.

Experimental Design:

Target Species: Flat-headed appletree borer or other suitable borer species

Plot Size: May be individual plants in a field setting.

Replicates: A minimum of 6 replications required if relying on natural field populations.

Application Instructions: Applications should be made using application equipment consistent with conventional commercial equipment.

Plant Hosts: Use a plant host suitable for target scale species, recording species and variety used.

Use Site: Field in-ground or container.

Evaluations: Use suitable rating scheme to evaluate efficacy at 0, 3 months, 6 months and 1 year after application, or until no control is achieved. Record plant height & width at initial and final evaluations only. Record phytotoxicity at each rating date on a scale of 0 to 10 (0 = no phytotoxicity; 10 = complete kill). If phytotoxicity is observed in treated plants, take pictures comparing treated and untreated plant material.

Recordkeeping: Keep detailed records of weather conditions throughout the test including temperature and precipitation, soil-type or soil-less media, application equipment, application volume per acre, irrigation, liner size, plant height & width, and plant growth stage at application and data collection dates.

Reports:

Reports submitted on the standard IR-4 Ornamental Horticulture Research Report Form are preferred. However, reports in the AMT Tests format are acceptable as long as those reports are amended with detailed experimental design and materials and methods, along with raw data, recordkeeping information, and any pictures.

A report submitted electronically is preferred but not required. If the report is provided electronically, the basic report can be sent in MS Word or WordPerfect, the recordkeeping information as pdf or other electronic documents, and the raw data in MS Excel or other suitable program such as ARM.

Please direct questions to: Cristi Palmer, IR-4 HQ, Rutgers University, 500 College Road East, Suite 201W, Princeton, NJ 08540, Phone 732-932-9575 x4629, palmer@aesop.rutgers.edu.

Revision Date: 3/21/2007
Revised By: CLP

Treatments:

Priority	#	Product	Rate	Application Instructions	Contact Information to obtain materials and any needed adjuvants
A	1	Celero 16WSG (clothianadin)	20 g per inch dbh	Apply as a trunk spray	Arysta, Doug Houseworth, 904-321-0795, LIHouse9@aol.com
	2	DPX-E2Y45	1 quart per 100 gallons	Apply as a trunk spray	Dupont, Chuck Silcox, 302-999-5953, charles.a.silcox@usa.dupont.com
	3	Safari 20SG (dinotefuron)	In-ground: 12 grams/ inch dbh for trees and 6 grams/ foot of height shrubs Container: 24 oz/100 gal	Apply 1-2 quarts/ foot of height for shrubs or inch of trunk diameter for trees. Apply to soil at base of trunk within 1 foot of trunk 4 oz of solution/ gal of potting media	Valent, Joe Chamberlin, 770-985-0303, jcham@valent.com
		Optional: V-10112 2G (dinotefuron)	120 grams/ inch dbh for trees and 60 grams/ foot of height for shrubs Container: 2.2 grams/ gallon of potting media	Broadcast dry by hand to the soil at base of trunk within 1 foot of trunk. Rake back mulch first if more than 1/2"	
	4	NEI 25925 (acetamiprid 9.25%)	6 ml per inch dbh	Trunk injection or trunk spray. For trunk sprays include an organosilicate penetrant.	Cleary Chemical, Rick Fletcher, 732-329-8399, rick.fletcher@clearychemical.com
B		Discus (imidacloprid + cyfluthrin)	44 ml per inch dbh	Soil drench in suitable volume (1 liter per pot)	OHP, Dick Lindquist, 406-587-2562, rlindquist@olympichort.com
		Tolfenpyrad	14 fl oz per 100 gal 21 fl oz per 100 gal	Apply to run off	Nichino, Marie Maks, 302-636-9001 x 3, mmaks@nichino.net
C		Flagship 25WG (thiamethoxam)	Container: 8 oz/100 gal In-ground and trunk application: 16 oz/A	Apply a volume of solution that is 1/3 the drench volume. Directed application as a banded treatment (2-3 ft band) treating 18" up the trunk and ground	Syngenta, Dave Ross, 336-632-6411, david.ross@syngenta.com
		Tick-EX EC (Metarhizium anisopliae F52)	Dilute 1 part EC with 3 parts oil (provided)	Apply as trunk spray	Novozymes Biologicals Inc., Jarrod Leland, 540-302-1225, JRRL@novozymes.com

		Scimitar (lambda-cyhalothrin)	5oz/100 gal	Directed spray to the trunk. Use a NIS or Silicone surfactant Application should target ovipositional period	Syngenta, Nancy Rechcigl, 941-238-7413, nancy.rechcigl@syngenta.com
		UPI 301 (imidacloprid + acephate)	Contact manufacturer for use rate and directions		UPI, Don Guy, 919-567-1489, dguy@upi-usa.com
Standards (Pick One)	10a	permethrin	See label directions		
	10b	Thiodan (endosulfan)	See label directions		
	10c	Onyx (bifenthrin)	Bark Borers: 1 pint per 100 gallons 2 pints per 100 gallons	Apply as a trunk spray	FMC, Bobby Walls, 919-735-3862, bobby_walls@fmc.com
			Other borers: Ash borer, banded ash clearwing borer, Dogwood borer, Lesser peachtree borer, Lilac borer, Oak borer, Bronze Birch Borer, and Flatheaded appletree borer.		
			8 oz per 100 gal 12.8 oz per 100 gal		
	11	Untreated	--	--	--

Managing Foliar Feeding Beetles in Woody Ornamentals.

Ornamental Protocol Number: 07-007
Objective: Determine efficacy of various products against foliar feeding beetles of ornamental plants.

Experimental Design:

Target Species: Viburnum Leaf Beetle, Japanese Beetle Adults, or other suitable species.

Plot Size: May be individual plants in a field setting.

Replicates: Minimum of 6 replications if using insects caged on treated plants. A minimum of 8 replications required if relying on natural field populations.

Application Instructions:. Applications should be made using application equipment consistent with conventional commercial equipment.

Plant Hosts: Use a plant host suitable for target scale species, recording species and variety used.

Use Site: Field in-ground or container.

Evaluations: Use suitable rating scheme to evaluate efficacy at 0, 1 week, 2 weeks, 1 month, and, if suitable with target species, 3 and 6 months after application. Record plant height & width at initial and final evaluations only. Record phytotoxicity at each rating date on a scale of 0 to 10 (0 = no phytotoxicity; 10 = complete kill). If phytotoxicity is observed in treated plants, take pictures comparing treated and untreated plant material.

Recordkeeping: Keep detailed records of weather conditions throughout the test including temperature and precipitation, soil-type or soil-less media, application equipment, application volume per acre, irrigation, liner size, plant height & width, and plant growth stage at application and data collection dates.

Reports:

Reports submitted on the standard IR-4 Ornamental Horticulture Research Report Form are preferred. However, reports in the AMT Tests format are acceptable as long as those reports are amended with detailed experimental design and materials and methods, along with raw data, recordkeeping information, and any pictures.

A report submitted electronically is preferred but not required. If the report is provided electronically, the basic report can be sent in MS Word or WordPerfect, the recordkeeping information as pdf or other electronic documents, and the raw data in MS Excel or other suitable program such as ARM.

Please direct questions to: Cristi Palmer, IR-4 HQ, Rutgers University, 500 College Road East, Suite 201W, Princeton, NJ 08540, Phone 732-932-9575 x4629, palmer@aesop.rutgers.edu.

Revision Date: 3/21/07
Revised By: CLP

Treatments:

Priority	#	Product	Rate	Application Instructions	Contact Information to obtain materials and any needed adjuvants
A	1	BAS 320i (metaflumizone)	16 oz per 100 gal	Foliar spray. Use 2 – 4 applications at 7 day intervals, based on pest pressure.	BASF, Kathie Kalmowitz, 919-270-4592, kathie.kalmowitz@basf.com
	2	Celero 16WSG (clothianadin)	4 oz per 100 gal		Arysta, Doug Houseworth, 904-321-0795, LIHouse9@aol.com
	3	DPX-E2Y45	10 fl oz per 100 gal	Apply to run off	Dupont, Chuck Silcox, 302-999-5953, charles.a.silcox@usa.dupont.com
	4	Safari 20SG (dinotefuron) Choose one of the three methods:	8 oz/ 100 gal	Foliar spray	Valent, Joe Chamberlin, 770-985-0303, jcham@valent.com
			24 oz/ 100 gal	Container soil drench: 4 oz solution/ gallon of potting media	
			In-ground soil drench: 12 grams/ inch dbh for trees and 6 grams/ foot of height shrubs.	Apply 1-2 quarts/ foot of height for shrubs or inch of trunk diameter for trees. Apply to soil at base of trunk within 1 foot of trunk.	
		Optional: V-10112 2G (dinotefuron)	120 grams/ inch dbh for trees and 60 grams/ foot of height for shrubs. Container: 2.2 grams / gallon of potting media	Broadcast dry by hand to the soil at base of trunk within 1 foot of trunk. Rake back mulch first if more than 1/2".	
	5	Tick-EX EC (Metarhizium anisopliae F52)	29 oz per 100 gal	Apply to run off	Novozymes Biologicals Inc., Jarrod Leland, 540-302-1225, JRRL@novozymes.com
	6	Tolfenpyrad	14 fl oz per 100 gal OR 21 fl oz per 100 gal	Apply to run off	Nichino, Marie Maks, 302-636-9001 x 3, mmaks@nichino.net
B		Discus (imidacloprid + cyfluthrin)	50 fl oz per 100 gal	Two applications 14 days apart. Do not use wetting agent.	OHP, Dick Lindquist, 406-587-2562, rlindquist@olympichort.com
C		Flagship 25WG (thiamethoxam)	Container: 8 oz/100gal	Apply a volume of solution that is 1/3 the drench volume.	Syngenta, Nancy Rechsigl, 941-708-9338, nancy.rechcigl@syngenta.com
			In-ground and trunk application: 16 oz/A	Directed application as a banded treatment (2-3 ft band) treating 18" up the trunk and ground	
		Allectus (imidacloprid + bifenthrin)	21.3 fl oz per 100 gal	Foliar spray	Bayer, Mike Gorrell, 919-549-2423, mike.gorrell@bayercropscience.com
			27 ml/in dbh	Soil injection	
		UPI 301 (imidacloprid + acephate)	Contact manufacturer for use rates and directions		UPI, Don Guy, 919-567-1489, dguy@upi-usa.com
Standards	10a	bifenthrin	See label directions		

(Pick One)	10b	imidacloprid	See label directions		
	10c	permethrin	See label directions		
	10d	Scimitar (lambda-cyhalothrin)	See label directions		
	10e	Thiodan (endosulfan)	See label directions		
	10f	TriStar (acetamiprid)	96 g per 100 gal	Two sprays 14 days apart. Include wetting agent such as Capsil.	Cleary Chemical, Rick Fletcher, 732-329-8399, rick.fletcher@clearychemical.com
	11	Untreated	--	--	--

Appendix 2: Contributing Researchers

Dr. Scott Alm	University of Rhode Island Dept. of Plant Science 9 E. Alumni Ave., Suite 7 Kingston, RI 02881
Dr. Kris Braman	University of Georgia Department of Entomology Griffin Campus Griffin, GA 30223-1797
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Dr. Michael Reding	USDA-ARS Hort Insects Lab 1680 Madison Ave. Wooster, OH, 44691
Dr. Pete Schultz	Virginia Technical Institute Hampton Roads AREC 1444 Diamond Springs Road Virginia Beach, VA 23455
Dr. Paul Weston	Cornell University Department of Entomology Ithaca, NY 14853

Appendix 3: Submitted Data Reports

The reports in this Appendix cover multiple PR numbers and are arranged alphabetically by researcher and year the experiments were conducted.

These reports can also be found at www.rutgers.ir4.edu by searching under the borer/beetle and white grubs/root weevils efficacy projects.