Environmental Horticulture Program Research Summaries

IR-4 Environmental Horticulture Program
Scale and Mealybug Efficacy

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Abstract

Managing scale and mealybug insects presents unique challenges. Products with contact modes of action must be applied at specific timings in order to reach the most susceptible crawler stages. Products with systemic modes of action may work well for certain species and not others based on application timing and whether the insect feeds within phloem or xylem. In 2003, IR-4 initiated a high priority project to determine efficacy of several insecticides on several scale and mealybug species so data can be obtained to add appropriate species to existing registrations. This research was conducted between 2004 and 2020.This report is a brief summary of available data from 94 experiments received through the IR-4 Environmental Horticulture Program.

Several neonicotinoids (Aloft SC/Celero 16WSG, Flagship 0.22G/25WP, Safari 2G/20SG/Transtect 70WSP, and TriStar 30SG/70WSP), insect growth regulators (Distance and Talus 40SC/70DF), and other products were tested against scales and mealybugs. All products tested generally provided excellent control of elongate hemlock scale, cryptomeria scale, gloomy scale, citrus mealybug and Mexican mealybug, generally mediocre to excellent control of false oleander scale, Fletcher scale, Florida wax scale, magnolia scale, and poor control of armored scale. For other species, efficacy levels varied with the active ingredient and method/timing of application. In single trials, Altus, Talus and Ventigra provided good efficacy on cycad scale, while Altus, Pradia, Sarisa and Talus provided good efficacy on lobate lac scale.

All products tested on citrus mealybug and Mexican mealybug, including Aria, Flagship, Safari, Talus, and TriStar, generally provided good to excellent control of these species. An experiment on Madeira mealybug showed excellent control when TriStar was mixed with Capsil surfactant, and poor control without Capsil. Rycar, Safari and Talus provided good to excellent control of this species, while A16901B provided mediocre control when applied as drench but good when applied as foliar treatment. Pradia and Ventigra also provided excellent control of Madeira mealybug. Phormium mealybug control was good to excellent with all neonicotinoids tested – Flagship, Safari and TriStar. Good to excellent control of Rhizoecus root mealybug was obtained with A16901B, Aria, Kontos, MBI-203, MBI-205 and Safari in single experiments. ISM555 provided good control of crapemyrtle bark scale and Madeira mealybug, while SP3014 provided good control of Madeira mealybug, in single trials.

Seven recently registered products (Altus, Mainspring, Pradia, Rycar, Sarisa, Ventigra and XXpire) looked promising on several species based on their efficacy relative to standards. Further research is needed to obtain additional efficacy data to recommend actions to register or amend labels for these pests.

Introduction

Managing scale and mealybug insects presents unique challenges. Products with contact modes of action should be applied at specific timings in order to reach the most susceptible crawler stages. Products with systemic modes of action may work well for certain species and not others based on application timing and whether the insect feeds within phloem or xylem. In 2003, IR-4 initiated a high priority project to determine efficacy of several insecticides on several scale and mealybug species so data can be obtained to add appropriate species to existing registrations.This research was conducted during 2004 and continued through 2020. This report is a brief summary of available data from 94 experiments received through the IR-4 Environmental Horticulture Program.

Materials and Methods

Several neonicotinoids (Aloft SC/Celero 16WSG, Flagship 0.22G/25WP, Safari 2G/20SG, and TriStar 30SG/70WSP) and insect growth regulators (Distance and Talus 40SC) were tested against scales and mealybugs. Other products, including A16901B, Aria 50SG, BAS 440/Ventigra, BotaniGard ES, BW133, BW238, BYI-2960/Altus GF-2626 1SC, IKI-3106/Sarisa, IKI-3326/Pradia, ISM555, KOC22018-8, Kontos (BYI 8330), Mainspring, MBI-203, MBI 205, MBI-306, and Rycar 20SC, SP3014, TetraCURB, V-10433, Velifer and Xxpire 40WG, were also included in some studies. Two foliar applications of insecticides were made approximately 14 days apart. Safari, Flagship and Mainspring were also applied as container drench, in-ground drench, trunk spray, soil broadcast, or media mix. A minimum of four plants (replicate treatments) were required with most researchers exceeding this minimum. Insect counts were recorded pre-treatment and then 7, 14 (prior to 2nd application), 28 and 42 days after initial application. Phytotoxicity was recorded on a scale of 0 to 10 (0 = No phytotoxicity; 10 = Complete kill) at each rating date.The following protocols were used: 09-021, 10-005, 10-006, 10-007, 11-018, 11-019, 11-020, 12-003, 12-004, 14-006, 14-007, 15-006, 17-007, 18-010 19-010 and 20-004. For more detailed materials and methods, including application rates for various products, please visit https://www.ir4project.org/ehc/ehc-registration-support-research/env-hort-researcher-resources/#Protocols to view and download these protocols. Products were supplied to researchers (See list of researchers in Appendix 1) by their respective manufacturers.

For all research data tables, product names have been updated where manufacturers have established trade names and tables have been rearranged by product alphanumeric order.

Table 1. List of Products and Rates Tested from 2004 to 2020

Product	Active Ingredient(s)	Manufacturer	Application Method & Rates		# Experiments
A16901B	A16901B	Syngenta	Drench	5 oz per 100 gal	6
			Drench	10 oz per 100 gal	11
			Foliar	6.7 oz per 100 gal	4
Acelepryn	Chlorantraniliprole	DuPont	Foliar	0.8 fl oz per 100 gal	2
			Foliar	4.0 fl oz per 100 gal	1
Acephate 75WP	Acephate		Foliar	0.67 lb per 100 gal	1
Admire 2F	Imidacloprid	Bayer	Drench	0.5 lb per acre	1
Aloft SC **	Clothianidin + bifenthrin	Arysta	Sprench	5 fl oz per 100 gal	3
			Sprench	10 fl oz per 100 gal	6
Altus, BYI-2960	Flupyradifurone	Bayer	Foliar	2.7 fl oz per acre	3
			Foliar	5.4 fl oz per acre	3
			Foliar	10.5 fl oz per acre	1
			Foliar	14 fl oz per acre	9
Arena 50WDG	Clothianidin	Valent	Drench	2.4 g per ft ht	2
			Drench	2.4 g per in DBH	1
			Drench	4.8 g per in DBH	1
			Drench	3.6 g ai per in DBH	1
Aria 50SG	Flonicamid	FMC	Foliar	60 g per 100 gal	3
			Foliar	120 g per 100 gal	3
			Drench	120 g per 100 gal	1
AzaGuard,	Azadirachtin	BioSafe	Foliar	16 fl oz per 100 gal	8
			Foliar	20 fl oz per 100 gal	2
			Foliar	32 fl oz per 100 gal	4
BAS 440, Ventigra	Afidopyropen	BASF	Foliar	4.8 fl oz per 100 gal	6
			Foliar	7.0 fl oz per 100 gal	14
BotaniGard ES	*Beauveria bassiana*	BioWorks	Foliar	64 fl oz per acre	1
BW133	BW133	BioWorks	Foliar	5 lb per 100 gal	2
BW238 ES	BW238	BioWorks	Foliar	64 fl oz per 100 gal	2
BW238 WP	BW238	BioWorks	Foliar	2 lb per 100 gal	2
Celero 16WSG **	Clothianidin	Valent/Arysta	Foliar	4 oz per 100 gal	5
Cygon 267	Dimethoate		Drench	60 ml per tree	1
			Foliar	32 fl oz per 100 gal	1
Diazinon	Diazinon		Foliar	8.96 oz per 100 gal	1
Discus	Cyfluthrin+Imidacloprid	OHP	Banded	1.91 gal per acre	1
			Foliar	25 fl oz per 100 gal	1
Distance	Pyriproxifen	Valent	Foliar	8 fl oz per 100 gal	5
			Foliar	12 fl oz per 100 gal	36
			Foliar	16 fl oz per 100 gal	5
			Foliar	32 fl oz per 100 gal	5
Dursban Pro	Chlorpyrifos	Dow	Foliar	1 qt per 100 gal	1
Esteem 35WP	Pyriproxyfen	Valent	Foliar	2.5 oz per 100 gal	1
Facin 25 % EC	*Chenopodium ambrosioides* Extract	AgraQuest	Foliar	0.25 % w ai/v	2
			Foliar	0.50 % w ai/v	2
Flagship 0.22G	Thiamethoxam	Syngenta	Broadcast	6 g per gal media	1
			Broadcast	20 g per gal media	1
			Broadcast	6 g per 6-in pot	2
			Broadcast	60 g per plant	3

Product	Active Ingredient(s)	Manufacturer	Application Method & Rates		# Experiments
			Broadcast	114 g per ft ht	3
			Broadcast	227 g per ft ht	6
			Broadcast	227 g per in DBH	1
			Broadcast	454 g per in DBH	1
			Media mix	40 g per 2-gal pot	1
			Banded	0.125 lb ai per acre	1
Flagship 25WG	Thiamethoxam	Syngenta	Drench	8.0 oz per 100 gal	2
			Drench	0.5 g per ft ht	1
			Drench	1 g per ft ht	1
			Drench	4 g per ft ht	5
			Drench	4 g per in DBH	3
			Foliar	2.0 oz per 100 gal	19
			Foliar	4.0 oz per 100 gal	19
			Foliar	8.0 oz per 100 gal	15
GF-2626 1SC	GF-2626	Dow	Foliar	11 fl oz per 100 gal	3
			Foliar	3.5 oz per 100 gal	3
Hachi-Hachi	Tolfenpyrad	Nichino	Foliar	32 fl oz per 100 gal	1
Horticultural Oil	Horticultural Oil	Various	Foliar	1 gal per 100 gal	1
			Foliar	2 gal per 100 gal	4
			Foliar	4 fl oz per 100 gal	1
IKI-3106, Sarisa	Cyclaniliprole	ISK	Foliar	22 fl oz per 100 gal	8
			Foliar	28 fl oz per 100 gal	8
IKI-3326 SL, Pradia	Cyclaniliprole + Flonicami	ISK	Foliar	12 fl oz per 100 gal	3
			Foliar	16.5 fl oz per 100 gal	3
ISM555	ISM555	Syngenta	Foliar	3.8 fl oz per 100 gal	2
KOC22018-8	Botanical Oil Blend	Kemin	Foliar	16.5 fl oz per 100 gal	1
			Foliar	128 fl oz per 100 gal	4
Kontos	Spirotetramat	OHP	Drench	3.4 fl oz per 100 gal	1
			Foliar	3.4 fl oz per 100 gal	15
			Foliar	20 fl oz per 100 gal	1
			Foliar	40 fl oz per 100 gal	1
			Foliar	1 gal per 100 gal	1
Lesco Oil	Paraffinic oil		Foliar	2 gal per 100 gal	1
			Foliar	0.66 lb per 100 gal	1
Lorsban 75WDG	Chlorpyrifos	Dow	Foliar	1.7 fl oz per 100 gal	1
Mainspring/ A20520A	Cyantraniliprole	DuPont	Drench	0.125 fl oz/inch DBH	4
			Drench	0.25 fl oz/inch DBH	5
			Drench	3.4 fl oz per 100 gal	4
			Drench	8 fl oz per 100 gal	7
			Drench	12 fl oz per 100 gal	7
			Foliar	4 fl oz per 100 gal	1
			Foliar	8 fl oz per 100 gal	2
Marathon II	Imidacloprid	OHP	Drench	3 g per ft ht	1
Meridian 25WG	Thiamethoxam	Syngenta	Drench	0.2 fl oz per in DBH	1
Merit 2F	Imidacloprid	Bayer	Drench	0.2 fl oz per ft ht	1
			Drench	20 g per 1250 6-in pots	1
Merit 75WP	Imidacloprid	Bayer	Foliar	0.5 lb per 100 gal	1
Mesurol	Methiocarb	Gowan	Foliar	0.3888889	1
MBI-203	*Chromobacterium subtsugae*	Marrone	Drench	2 qt per 100 gal	1
			Foliar	1 gal per 100 gal	2

Product	Active Ingredient(s)	Manufacturer	Application Method & Rates		# Experiments
			Foliar	2 gal per 100 gal	2
MBI-205	MBI 205	Marrone	Drench	4 qt per 100 gal	1
			Foliar	3 gal per 100 gal	2
			Foliar	5 fl oz per acre	1
MBI-306	MBI 306	Marrone	Foliar	5 fl oz per acre	2
MOI 201	MOI 201	Marrone	Foliar	0.5972222	1
Movento 240SC (Kontos)	Spirotetramat	OHP	Foliar	10 fl oz per acre	1
			Foliar	0.7361111	1
Natural Solutions	*Verticillium lecanii*		Foliar	8.6 fl oz per 100 gal	1
Rycar/SP-3009	Pyrifluquinazon	Nichino	Foliar	12 fl oz per 100 gal	1
			Foliar	18 fl oz per 100 gal	15
			Foliar	2.6 oz per 100 gal	1
Onyx	Bifenthrin	FMC	Foliar	6.4 fl oz per acre	1
			Foliar	10.5 oz per 100 gal	2
Orthene	Acephate	Ortho	Foliar	150 fl oz per 100 gal	1
Orthene 75S	Acephate		Foliar	8 oz per 100 gal	14
Orthene TTO	Acephate	Valent	Foliar	8 oz per 100 gal	1
			Foliar	10.7 oz per 100 gal	2
			Foliar	16 oz per 100 gal	1
			Foliar	1.5 gal per 100 gal	1
Paraffinic Oil	Paraffinic Oil		Foliar	2 gal per 100 gal	7
			Foliar	128 oz per 100 gal	1
QRD 452	QRD 452	AgraQuest	Broadcast	1 g per 6-in pot	1
Safari 2G	Dinotefuran	Valent	Broadcast	7.8 g per plant	2
			Broadcast	60 g per ft ht	5
			Broadcast	60 g in DBH	4
			Broadcast	3 g ai per in DBH	1
			Foliar	4.0 oz per 100 gal	11
			Media mix	2.6 g per gal media	5
			Foliar	8.0 oz per 100 gal	13
Safari 20SG	Dinotefuran	Valent	Banded	12 oz per 100 gal	1
			Banded	24 oz per 100 gal	1
			Banded	48 oz per 100 gal	1
			Drench	12 oz per 100 gal	9
			Drench	24 oz per 100 gal	23
			Drench	48 oz per 100 gal	4
			Drench	6 g per in DBH	5
			Drench	12 g per in DBH	1
			Drench	3 g per ft ht	5
			Drench	6 g per ft ht	15
			Drench	12 g per ft ht	1
			Drench	0.68 lb per acre	1
			Drench	12 oz per acre	2
			Drench	24 oz per acre	2
			Drench	1.35 lb per acre	1
			Drench	2.7 lb per acre	1
			Foliar	8 oz per 100 gal	3
			Foliar	12 oz per 100 gal	2
			Foliar	18 oz per 100 gal	1
			Foliar	24 oz per 100 gal	1
			Foliar	48 oz per 100 gal	1

Product	Active Ingredient(s)	Manufacturer	Application Method & Rates		# Experiments
			Foliar	2 gal per 100 gal	1
			Foliar	2 gal per 100 gal	1
			Incorporation	2.6 g per gal soil media	1
			Soil injection	7.6 g per in DBH	1
			Soil injection	8.85 g per in DBH	1
			Trunk spray	13 oz per 1.1 gal	1
			Trunk spray	24 oz per 100 gal	1
			Trunk spray	0.68 lb per acre	1
			Trunk spray	1.35 lb per acre	1
			Trunk spray	2.7 lb per acre	1
Saf-T-Side Oil	Petroleum Oil	Monterey	Foliar	2 gal per 100 gal	2
SP3014	SP3014	SePro	Foliar	13 fl oz per 100 gal	2
SuffOil-X	Horticultural Oil	BioWorks	Foliar	1 gal per 100 gal	2
			Foliar	2 gal per 100 gal	2
			Foliar	3 gal per 100 gal	1
Sunspray Ultrafine Oil	Paraffinic Oil		Foliar	10 fl oz per 100 gal	1
			Foliar	20 fl oz per 100 gal	3
Talstar F	Bifenthrin	FMC	Foliar	20 fl oz per 100 gal	2
			Foliar	21.5 fl oz per 100 gal	27
			Foliar	43.0 fl oz per 100 gal	8
Talus 40SC	Buprofezin	SePro/BASF	Foliar	86.0 fl oz per 100 gal	6
			Foliar	12 oz per 100 gal	2
			Foliar	14 oz per 100 gal	8
Talus 70DF	Buprofezin	SePro	Foliar	14 oz per 100 gal	15
			Foliar	28 oz per 100 gal	1
Talus 70WP	Buprofezin	BASF	Drench	1.45 g ai per in DBH	1
			Trunk Spray	1.7 g ai per in DBH	1
TetraCURB Conc	Rosemary Oil	Kemin	Foliar	128 fl oz per 100 gal	5
TetraCURB Org			Foliar	128 fl oz per 100 gal	5
Transtect 70WSP	Dinotefuran	Rainbow Treecare	Foliar	2 gal per 100 gal	2
			Foliar	32 g per 100 gal	1
			Soil incorp	1.46 g ai per in DBH	2
TriAct 70	Neem oil extract	OHP	Foliar	64 g per 100 gal	2
TriStar 8.5SL	Acetamiprid	Cleary	Foliar	16.5 fl oz per 100 gal	1
TriStar 30SG	Acetamiprid	Cleary	Foliar	112 g per 100 gal	4
			Foliar	128 g per 100 gal	2
			Foliar	224 g per 100 gal	4
			Foliar	4 oz per 100 gal	5
			Foliar	8 oz per 100 gal	23
			Foliar	32 g per 100 gal	5
			Foliar	48 g per 100 gal	5
TriStar 70WSP	Acetamiprid	Cleary	Drench	1.38 g ai per in DBH	1
			Foliar	64 g per 100 gal	5
			Foliar	96 g per 100 gal	5
			Foliar	112 g per 100 gal	2
			Foliar	128 g per 100 gal	5
			Foliar	224 g per 100 gal	2
			Trunk Spray	1.7 g ai per in DBH	1
Ultra-Pure Oil	Mineral Oil	BASF	Foliar	12 fl oz per 100 gal	1
V-10433	V-10433	Valent	Foliar	11 fl oz per 100 gal	2

Product	Active Ingredient(s)	Manufacturer	Application Method & Rates		# Experiments
Velifer		BASF	Foliar	13 fl oz per 100 gal	1
XXpire 40WG / GF-2860	Spinetoram + Sulfoxaflor	Dow	Foliar	2 oz per 100 gal	10
			Foliar	2.75 qt per 100 gal	11
			Foliar	3.5 oz per 100 gal	11
			Foliar	5 qt per 100 gal	1
			Foliar	7 oz per 100 gal	3
Xytect 75WSP	Imidacloprid	Bayer	Drench	1.38 g ai per in DBH	1
			Trunk Spray	1.7 g ai per in DBH	1

** Product not registered for the production of environmental horticulture crops.

Results and Summary

Comparative Efficacy on Felt Scale

Crapemyrtle Bark Scale.

In 2018, Vafaie conducted an experiment examining efficacy of various products on crapemyrtle bark scale (*Acanthococcus lagerstroemiae*) infesting crapemyrtles (*Lagerstroemia* sp.). Although the data had too much variability to provide reliable results, the researcher's preliminary conclusions demonstrate reliable scale suppression with Distance, Safari, Talus, and Altus at 10.5 fl oz/100 gal (Table 2, Table 3). Further work is needed to determine efficacy of Cyclaniliprole at 22 fl oz/100 gal. No phytotoxicity was observed on any of the treated plants.

In 2020, Held conducted an experiment examining efficacy of various products on crapemyrtle bark scale (*Acanthococcus lagerstroemiae*) infesting crapemyrtles (*Lagerstroemia* sp.). RTSA-721 and Transtect were applied on June 18 but pretreatment counts were not collected so Henderson-Tilton percent control was not able to be calculated; However, both RTSA-721 and Transtect treatments provided excellent efficacy throughout the experiment. ISM 555 provided good efficacy; all other treatments were ineffective (Table 4. Efficacy on Crapemyrtle Bark Scale Crawlers and Adults on Crapemyrtles (*Lagerstroemia* sp.), Held, AL, 2020.). No phytotoxicity was observed on any of the treated plants.

Table 2. Efficacy on Crapemyrtle Bark Scale Crawlers on Crapemyrtles (*Lagerstroemia* sp.) 'Natchez', Vafaie, TX, 2018.

Median Number of Crawlers									
Treatment	**Rate Per 100 Gal**	**Applic. Dates**	**Pretrt**	**2 WAT**	**4 WAT**	**6 WAT**	**10 WAT**	**15 WAT**	**20 WAT**
Altus (flupyradifurone)	10.5 fl oz	May 11; May 25	0.02	0.38	0	0	0.02	0.15	0.04
	14 fl oz	May 11; May 25	2.31	0.51	0	0	0	0.15	0.25
AzaGuard (azadirachtin)	16 fl oz	May 11; May 25	0.02	0.31	0.1	0	0.51	4.56	0.92
	32 fl oz	May 11; May 25	0.02	0.34	0.02	0.03	0.32	5.89	2.15
Cyclaniliprole (cyclaniliprole)	22 fl oz	May 11, 25; Jun 8	0.02	0.12	0.08	0.02	0.25	0.67	2.2
	28 fl oz	May 11, 25; Jun 8	0	0.25	0	0	0	0.74	0.24
Distance (pyriproxyfen)	12 fl oz	May 11; Jun 1	0	0.4	0	0	0	0.04*	0
IKI-3326 SL ((cyclaniliprole + flonicamid)	12 oz	May 11, 25; Jun 8	0	0.15	0	0	0	1.64	0.93
	16.5 oz	May 11, 25; Jun 8	0	0.68	0.02	0	0.09	1.78	1.19
Safari (dinotefuran)	8 oz	May 11	0	0	0	0	0.03	0.18	0.21
Talus 70DF (buprofezin)	14 oz	May 11; May 25	0	0	0	0	0	0.09	0.04
Ventigra (afidopyropen) + Ultra Pure Oil	4.8 fl oz	May 11; May 25	0	0	0	0	0.02	0.25	0.12
	7 fl oz	May 11; May 25	0	0.06	0.01	0	0.04	1.29	0.15
Untreated	-	-	0	0.21	0	0.01	0.07	4.27	0.57
Maximum Number of Crawlers									
Treatment	**Rate Per 100 Gal**	**Applic. Dates**	**Pretrt**	**2 WAT**	**4 WAT**	**6 WAT**	**10 WAT**	**15 WAT**	**20 WAT**
Altus (flupyradifurone)	10.5 fl oz	May 11; May 25	4.51	1.26	0.07	0.03	0.08	0.73	0.25
	14 fl oz	May 11; May 25	17.7	3.41	0	0	0.12	6.11	0.42
AzaGuard (azadirachtin)	16 fl oz	May 11; May 25	3.71	1.17	0.42	0.08	7.44	17.5	11.5
	32 fl oz	May 11; May 25	1.27	0.82	0.14	0.09	1.7	11.7	4.08
Cyclaniliprole (cyclaniliprole)	22 fl oz	May 11, 25; Jun 8	1.23	2.75	0.52	0.26	0.79	4.83	4.93
	28 fl oz	May 11, 25; Jun 8	0.75	1.07	0.2	0.06	0.13	11.8	2.29
Distance (pyriproxyfen)	12 fl oz	May 11; Jun 1	0.38	2.81	0.16	0	0.08	0.08*	0.1
IKI-3326 SL ((cyclaniliprole + flonicamid)	12 oz	May 11, 25; Jun 8	0.72	1.42	0.18	0.06	1.8	7.46	5.63
	16.5 oz	May 11, 25; Jun 8	0.69	1.61	0.46	0.06	0.29	5.27	2.53
Safari (dinotefuran)	8 oz	May 11	0.43	0.65	0	0	0.11	1.64	0.4
Talus 70DF (buprofezin)	14 oz	May 11; May 25	0.67	0.38	0	0.05	0.03	1.43	0.26
Ventigra (afidopyropen) + Ultra Pure Oil	4.8 fl oz	May 11; May 25	0.46	2.82	0.77	0.34	3.36	40.7	4.37
	7 fl oz	May 11; May 25	0.61	4.8	0.09	0.27	2.61	19.3	5.56
Untreated	-	-	0.2	1.1	0.09	0.36	1.89	20.3	4.15

* Significantly different from the untreated check within the same column using a Dunn with Control for Joint Ranks (non-parametric).

** Significantly different from the untreated check within the same column using a Dunn with Control/ Statistics performed on log-transformed data (log(x+1)).

Table 3. Efficacy on Crapemyrtle Bark Scale Male Pupae and Egg Sacs on Crapemyrtles (*Lagerstroemia* sp.) 'Natchez', Vafaie, TX, 2018.

Mean Number of Male Pupae									
Treatment	**Rate Per 100 Gal**	**Applic. Dates**	**Pretrt**	**1 WAT**	**3 WAT**	**4 WAT**	**6 WAT**	**9 WAT**	**20 WAT**
Altus (flupyradifurone)	10.5 fl oz	May 11; May 25	0.33	0	0	0	0.17	0.17**	0**
	14 fl oz	May 11; May 25	2	0	0	0.33	0	1.17	17
AzaGuard (azadirachtin)	16 fl oz	May 11; May 25	0.5	0	0.5	6.17	4	4.33	21
	32 fl oz	May 11; May 25	0.33	0	0	0.33	2	2.33	2.67
Cyclaniliprole (cyclaniliprole)	22 fl oz	May 11, 25; Jun 8	0.5	0	0	1.5	1.33	15.7	0.17**
	28 fl oz	May 11, 25; Jun 8	0	0	0	0.17	0.83	15.2	8
Distance (pyriproxyfen)	12 fl oz	May 11; Jun 1	0.17	0	0	0.33	0.83	0**	0**
IKI-3326 SL ((cyclaniliprole + flonicamid)	12 oz	May 11, 25; Jun 8	0.33	0	0	0	0	0**	7
	16.5 oz	May 11, 25; Jun 8	0.17	0	0	0.33	4	10.3	5
Safari (dinotefuran)	8 oz	May 11	0.17	0	0	0	0	0**	0.67
Talus 70DF (buprofezin)	14 oz	May 11; May 25	0.67	0	0.17	0.17	0.33	0	0**
Ventigra (afidopyropen) + Ultra Pure Oil	4.8 fl oz	May 11; May 25	0	0	0.33	4.83	4.67	18.3	18.3
	7 fl oz	May 11; May 25	1.83	0	0.33	2.17	2.5	7.83	33.3
Untreated	-	-	1	0	1	0.17	2.83	56.7	47.3
Mean Number of Egg Sacs									
Treatment	**Rate Per 100 Gal**	**Applic. Dates**	**Pretrt**	**1 WAT**	**3 WAT**	**4 WAT**	**6 WAT**	**9 WAT**	**20 WAT**
Altus (flupyradifurone)	10.5 fl oz	May 11; May 25	2.67	2.67	0.67	0.17	0.17**	0.67	0.5
	14 fl oz	May 11; May 25	6.67	2	0.83	0**	0.83	1.33	4
AzaGuard (azadirachtin)	16 fl oz	May 11; May 25	2	1.83	0.83	0.33	9.83	16	51.5
	32 fl oz	May 11; May 25	1.67	1.83	1.33	0.83	5.33	11	41.3
Cyclaniliprole (cyclaniliprole)	22 fl oz	May 11, 25; Jun 8	2.83	2.5	1	1.17	3.33	6	12.7
	28 fl oz	May 11, 25; Jun 8	3.5	1	0.17	0.17	2.17	5.17	21.8
Distance (pyriproxyfen)	12 fl oz	May 11; Jun 1	1.5	1.5	1.67	1	0.5	0.17	0.17
IKI-3326 SL ((cyclaniliprole + flonicamid)	12 oz	May 11, 25; Jun 8	1.83	0.83	0.5	0.33	1	4	19
	16.5 oz	May 11, 25; Jun 8	0.33	1.33	0.67	0.5	3.83	9.83	16.5
Safari (dinotefuran)	8 oz	May 11	1.17	0.5	0.17	0**	0**	0.17	4.83
Talus 70DF (buprofezin)	14 oz	May 11; May 25	3	1.83	0.33	0.17	0.17**	0**	0.17
Ventigra (afidopyropen) + Ultra Pure Oil	4.8 fl oz	May 11; May 25	1	0.83	0.67	0.17	6.83	6.83	28.5
	7 fl oz	May 11; May 25	3.5	1	0.67	0.5	5.33	11.2	37.3
Untreated	-	-	2	0.83	0	4.5	14	6.5	23.3

* Significantly different from the untreated check within the same column using a Dunn with Control for Joint Ranks (non-parametric).

** Significantly different from the untreated check within the same column using a Dunn with Control/ Statistics performed on log-transformed data (log(x+1)).

Table 4. Efficacy on Crapemyrtle Bark Scale Crawlers and Adults on Crapemyrtles (*Lagerstroemia* sp.), Held, AL, 2020.

Mean number of CMBS Crawlers [x]							
Treatment	**Rate Per 100 Gal**	**Pretreat (July 9)**	**July 13**	**July 16**	**July 23**	**Aug 6**	**Oct 3**
BW133	5 lb	13.4 abc	16.6 c (3)	20.2 bc (0)	41.4 a (0)	5.2 b (85)	126.6 cd (0)
BW 238 ES	2 qt	12.4 abc	112.8 a (0)	91.6 a (0)	42.8 a (0)	106.8 a (0)	108.2 cd (0)
BW238 WP	2 lb	28.4 a	38.2 bc (0)	23.6 bc (0)	28.6 abc (0)	11.4 b (85)	225.4 ab (0)
ISM-555+ Capsil	3.84 fl oz	24.2 ab	12.4 c (60)	1.2 c (93)	6.0 cd (69)	0.0 b (100)	0.6 e (100)
MBI-203	128 fl oz	6.6 bc	87.8 ab (0)	48.8 b (0)	29.2 abc (0)	19.6 b (0)	289.0 a (0)
MBI-306	5 fl oz	28.2 a	42.0 bc (0)	10.2 c (48)	8.6 bcd (62)	19.8 b (74)	81.4 de (63)
RTSA-721	Drench 10 ml/ft shrub ht	0.0 c	0.0 c (na)	0.0 c (na)	0.0 d (na)	0.0 b (na)	1.2 e (na)
RTSA-721	Drench 5 ml/ft shrub ht	0.0 c	0.3 c (na)	0.2 c (na)	0.3 d (na)	1.2 b (na)	2.3 e (na)
SP3014 + Capsil	13 fl oz	18.4 abc	21.2 c (10)	17.8 bc (0)	33.4 ab (0)	3.8 b (92)	193.8 abc (0)
V-10433	Drench 11 fl oz	14.0 abc	27.4 c (0)	9.0 c (7)	4.2 cd (62)	35.4 b (6)	136.6 bcd (0)
Transtect 70 WSP	1 pack/ft shrub ht	0.0 c	0.0 c (na)	0.0 c (na)	0.0 d (na)	0.5 b (na)	0.0 e (na)
Untreated	-	14.5 abc	18.5 c (0)	10.0 c (0)	11.5 bcd (0)	38.8 b (0)	114.7 cd (0)
Mean number of CMBS Adults [x]							
Treatment	**Rate Per 100 Gal**	**Pretreat (July 9)**	**July 13**	**July 16**	**July 23**	**Aug 6**	**Oct 3**
BW133	5 lb	18.2 ab	3.4 bc (87)	2.4 cde (86)	9.0 c (26)	10.0 c (86)	68.2 bcd (46)
BW 238 ES	2 qt	20.2 ab	26.8 a (7)	21.0 b (0)	7.6 c (43)	160.8 a (0)	81.6 bcd (42)
BW238 WP	2 lb	20.4 a	24.4 a (16)	21.4 ab (0)	15.8 bc (0)	63.4 bc (21)	87.8 bc (38)
ISM-555+ Capsil	3.84 fl oz	19.4 ab	18.8 ab (32)	11.0 b-e (41)	17.2 bc (0)	0.8 c (99)	14.6 cd (89)
MBI-203	128 fl oz	23.8 a	19.2 ab (43)	33.6 a (0)	37.8 ab (0)	106.0 ab (0)	119.4 b (28)
MBI-306	5 fl oz	16.6 ab	18.6 ab (21)	21.8 ab (0)	45.4 a (0)	30.0 bc (54)	273.2 a (0)
RTSA-721	Drench 10 ml/ft shrub ht	0.0 c	0.2 c (na)	0.7 e (na)	1.2 c (na)	0.5 c (na)	0.3 d (na)
RTSA-721	Drench 5 ml/ft shrub ht	0.7 c	0.8 c (20)	1.2 de (0)	1.5 c (0)	1.5 c (45)	8.3 cd (0)
SP3014 + Capsil	13 fl oz	22.6 a	21.0 a (35)	10.2 b-e (53)	19.0 bc (0)	44.8 bc (49)	63.2 bcd (60)
V-10433	Drench 11 fl oz	23.2 a	21.8 a (34)	13.8 bc (38)	8.2 c (47)	51.8 bc (43)	49.0 bcd (70)
Transtect 70 WSP	1 pack/ft shrub ht	0.0 c	0.0 c (na)	0.0 e (na)	0.0 c (na)	0.0 c (na)	0.0 d (na)
Untreated	-	12.5 b	17.8 ab (0)	12.0 bcd (0)	8.3 c (0)	49.0 bc (0)	86.7 bc (0)

[x] The letters within each column followed by the same letter were not significantly different (LSD, $P< 0.05$).

Table 5. Efficacy on Crapemyrtle Bark Scale Total Population on Crapemyrtles (*Lagerstroemia* sp.), Held, AL, 2020.

Mean Total number of CMBS [x]							
Treatment	**Rate Per 100 Gal**	**Pretreat (July 9)**	**July 13**	**July 16**	**July 23**	**Aug 6**	**Oct 3**
BW133	5 lb	31.6 ab	20.0 c (53)	22.6 cd (12)	50.4 abc (0)	15.2 b (85)	194.8 c (17)
BW238 ES	2 qt	32.6 ab	139.6 a (0)	112.6 a (0)	50.4 abc (0)	267.6 a (0)	189.8 c (22)
BW238 WP	2 lb	48.8 a	62.6 bc (5)	45.0 bc (0)	44.4 abc (0)	74.8 b (53)	313.2 abc (14)
ISM-555+ Capsil	3.84 fl oz	43.6 ab	31.2 c (47)	12.2 cd (66)	23.2 bcd (27)	0.8 b (99)	15.2 d (95)
MBI-203	128 fl oz	30.4 ab	107.0 ab (0)	82.4 ab (0)	67.0 a (0)	125.6 b (0)	408.4 a (0)
MBI-306	5 fl oz	44.8 ab	60.6 bc (0)	32.0 cd (12)	54.0 ab (0)	49.8 b (66)	354.6 ab (0)
RTSA-721	Drench 10 ml/ft shrub ht	0.0 c	0.2 c (na)	0.7 d (na)	1.2 d (na)	0.5 b (na)	1.5 d (na)
RTSA-721	Drench 5 ml/ft shrub ht	0.7 c	1.2 c (na)	1.3 d (na)	1.8 d (na)	2.7 b (na)	10.7 d (na)
SP3014+Capsil	13 fl oz	41.0 ab	42.2 bc (23)	28.0 cd (16)	52.4 abc (0)	48.6 b (64)	257.0 bc (16)
V-10433	Drench 11 fl oz	37.2 ab	49.2 bc (2)	22.8 cd (25)	12.4 cd (55)	87.2 b (28)	185.6 c (33)
Transtect 70 WSP	1 pack/ft shrub ht	0.0 c	0.0 c (na)	0.0 d (na)	0.0 d (na)	0.5 b (na)	0.0 d (na)
Untreated	-	27.0 b	36.3 c (0)	22.0 cd (0)	19.8 bcd (0)	87.8 b (0)	201.3 c (0)

[x] The letters within each column followed by the same letter were not significantly different (LSD, $P < 0.05$).

Comparative Efficacy on Soft Scale

Calico Scale. In 2007, Potter conducted an experiment examining efficacy of Safari 20SG (dinotefuran) on calico scale (*Eulecanium cerasorum*) infesting Japanese zelkova (*Zelkova serrata*). Safari 20SG was applied using two methods of systemic application: soil injection or basal trunk trunk spray with Pentra-Bark, a bark-penetrating surfactant. Treatments were made to 4 trees either April 18 or May 15, 2007. Efficacy was evaluated from July 30 to August 2 by sampling eight twigs within each tree canopy, removing the two oldest leaves from each twig, and counting all living scale nymphs on the left half of the abaxial surface of each leaf. Safari 20SG, particularly the application with Pentra-Bark, provided significant control of calico scale nymphs on the leaves (Table 6), which should translate to fewer honeydew-producing adults the next spring.

Table 6. Efficacy on Calico Scale on Japanese Zelkova, Potter, KY, 2007.

Treatment	Rate	Application Method (Treatment Date)	Population Counts	Percent Control
Safari 20SG (dinotefuran)	8.85 g/inch trunk diam.	Soil Injection (18 April)	159 ± 33*	61.9
Safari 20SG (dinotefuran)	8.85 g/inch trunk diam.	Soil Injection (15 May)	119± 34*	71.5
Safari 20SG (dinotefuran) + Pentra-Bark	13 oz/1.1 gal	Trunk Spray (18 April)	65± 29*	84.4
Untreated	-	-	332± 109	-

* Asterisk denotes mean is significantly lower than mean for untreated trees (Dunnett's test, $P < 0.05$).

In 2011, Sadoff conducted experiments examining efficacy of systemic and foliar insecticides targeted to egg-laying calico scale females infesting honeylocust (Tables 3 and 4). Systemic insecticides were applied to the soil or sprayed to trunk with Pentrabark. Systemics were applied April 10 (clothianidin and imidacloprid) and May 4 (dinotefuran). Foliar treatments were applied on May 4. Systemic insecticides provided significant, but generally mediocre, control of calico scales; high scale mortality on trees treated with Arena was attributed to the phytotoxic effects of this product on honeylocust. Similarly, the foliar insecticides generally provided mediocre efficacy.

No phytotoxicity was observed on any of the treated plants except with Arena which caused up to 50 % leaf drop.

Table 7. Efficacy of Systemic Insecticides on Calico Scale on Honeylocust (*Gleditzia triacanthos inermis)*, Sadoff, IN, 2011.

Applic. Method	Treatment	Rate Per Inch DBH	% Dead Female Adults[x]		First Instar Mortality 29 DAT (6/14)		Second Instar Mortality 59 DAT	
			7 DAT (5/11)	14 DAT (5/18)	No. Live Scales	% Dead Scales	No. Live Scales	% Dead Scales
Trunk Applic.	Transtect 70WSP (dinotefuran)	1.7 g ai	16.00 ab	18.94 a	12.58 c	23.77 bcd	7.70 c	49.84 ab
	Transtect 70WSP + Pentrabark	1.7 g ai	27.33 a	42.98 a	6.36 ab	36.83 bc	2.47 ab	68.54 a
	Xytect 75WSP (imidacloprid)	1.7 g ai	10.83 b	23.89 a	13.93 bc	12.47 d	5.81 ab	42.52 b
	Xytect 75WSP + Pentrabark	1.7 g ai	12.50 ab	20.00 a	11.80 c	20.50 bcd	6.81 bc	41.33 b
Soil Applic.	Arena 50WDG (clothianidin)	3.6 g ai	9.00 b	46.00 a	1.82 a	80.90 a	0.75 a	58.68 ab
	Safari 2G	3.0 g ai	12.00 ab	23.45 a	5.60 a	39.83 b	2.95 abc	58.15 ab
	Transtect 70WSP	1.45 g ai	6.67 b	36.67 a	4.59 a	26.92 bcd	1.92 ab	61.84 ab
	Xytect 75WSP	1.38 g ai	16.25 ab	43.81 a	5.98 a	26.76 bcd	4.50 abc	56.94 ab
-	Untreated	-	7.25 b	20.00 a	12.50 c	13.96 cd	4.71 abc	44.06 ab

[x] Means within a column followed by the same letter are not significantly different based on LSD test (P=0.05).

In 2012, Sadoff conducted two experiments examining efficacy of Distance and other insecticides targeted to egg-laying calico scale females in Carmel, IN (Table 10) and to settled crawler stages in Indianapolis Table 10) on honeylocust. In Carmel, treatments were applied on Mar 20, except Transtect which was applied Mar 25. At 44 DAT, Distance and Safari significantly reduced scale numbers; at 74 DAT, Safari and Transtech, Talstar, and Mainspring had significantly reduced scales. In Indianapolis, treatments were applied on June 6, targeted to crawler stages, showed significant effects of treatment at 14 DAT. Talstar had the lowest number of scales, followed by Distance. Transtect failed to reduce scale abundance likely due to the short period of time between application and evaluation.

Overall, these studies suggest that dinotefuran (Safari or Transtect) works to suppress calico scale if applied to target ovipositing females. Mainspring may also provide some level of scale suppression if applied at this time. Talstar would require repeated applications targeting ovipositing females and settled crawlers.

Table 8. Efficacy of Foliar Insecticides on Calico Scale on Honeylocust (*Gleditzia triacanthos inermis)*, Sadoff, IN, 2011.

Treatment	Rate Per 100 Gal	% Dead Female Adults[x]		First Instar Mortality 29 DAT (6/14)		Second Instar Mortality 59 DAT (7/13)	
		7 DAT (5/11)	14 DAT (5/18)	No. Live Scales	% Dead Scales	No. Live Scales	% Dead Scales
Acelepryn (chlorantraniprilole)	4 fl oz	8.33 c	23.93 bc	6.18 abc	42.14 a	1.71 a	85.12 a
Acelepryn + Capsil	4 + 8 fl oz	7.14 c	22.62 bc	8.96 bc	25.44 b	1.49 a	67.78 ab
Capsil	8 fl oz	4.59 c	10.71 c	10.58 cd	21.77 b	4.04 a	37.33 c
HWG 355 (cyantraniprilole) + Capsil	4 + 8 oz	10.06 c	44.48 b	3.82 a	50.12 a	1.56 a	62.13 b
Talstar One (bifenthrin)	20 fl oz	19.29 b	70.00 a	6.47 abc	16.98 b	2.66 a	25.78 c
Talstar One + Capsil	20 + 8 fl oz	35.00 a	77.14 a	4.14 ab	15.73 b	2.04 a	23.97 c
Untreated	-	5.71 c	9.37 c	14.85 d	11.70 b	3.72 a	38.62 c

[x] Means within a column followed by the same letter are not significantly different based on LSD test (P=0.05).

Table 9. Efficacy of Foliar Insecticides on Calico Scale on Honeylocust (*Gleditzia triacanthos inermis*), 'Skyline' Sadoff, Carmel, IN, 2012.

Treatment	Rate Per 100 Gal	Number of Dead Ovipositing Females [x]		Live Females at 74 DAT (5/31)	
		29 DAT (4/18)	44 DAT (5/3)	Number	% Reduction
Distance (pyriproxyfen)	12 fl oz	14.03 a	45.62 a	34.64 ab	23.05
Mainspring (cyantraniprilole)	4 fl oz	19.25 a	41.94 ab	24.91 a	44.66
Safari 20SG (dinotefuran) soil	1.52 gm ai/in DBH	10.47 a	43.64 a	20.34 a	54.81
Talstar One (bifenthrin)	20 fl oz	18.61 a	34.08 ab	29.68 a	34.07
Transtect 70WSP (dinotefuran) soil	1.46 gm ai/ in DBH	7.20 a	40.14 ab	27.06 a	39.89
Untreated	-	8.32 a	32.93 b	45.02 b	0

[x] Means within a column followed by the same letter are not significantly different based on LSD test (P=0.05).

Table 10. Efficacy of Foliar Insecticides on Calico Scale on Honeylocust (*Gleditzia triacanthos inermis*), 'Skyline' Sadoff, Indianapolis, IN, 2012.

Treatment	Rate Per 100 Gal	Pretrt (6/6)	14 DAT (6/20)		
		No. Live Females	No. Live Females	% Change	% Reduction
Distance (pyriproxyfen)	12 fl oz	28.01 ab	17.48a	-60.28	28.67b
Talstar One (bifenthrin)	20 fl oz	23.03 a	12.12a	-90.10	69.32a
Transtect 70WSP (dinotefuran) soil	1.46 gm ai/ in DBH	ND	ND	-31.21*	12.01b
Untreated	-	33.97 ab	23.99 ab	-41.58	11.23b

[x] Means within a column followed by the same letter are not significantly different based on LSD test (P=0.05).
* Estimated from average of pre treatment densities.

In 2014, Persad conducted an experiment examining efficacy of systemic and foliar insecticides on calico scale (*Eulecanium cerasorum*) infesting honeylocust (*Gleditzia triacanthos inermis*).The systemic insecticide Safari provided the best control, with the other systemic Mainspring, and the foliar products Kontos and Xxpire generally less effective (Table 11).

Table 11. Efficacy of Insecticides on Calico Scale on Honeylocust (*Gleditzia triacanthos inermis)*, Persad, OH, 2014.

Treatment*	Rate Per 100 Gal	Population Averages[x] (Henderson's Percent Control)				
		Pre	7 DAT	15 DAT	28 DAT	107 DAT
Kontos (spirotetramat)	3.4 oz	14.75 a	6.75 c (53)	2.50 cd (76)	2.50 b (77)	0 a
Mainspring (cyantraniliprole)	0.25 fl oz/inch DBH	13.25 a	13 ab (11)	4.25 bcd (54)	0.25 b (84)	0 a
Safari 20SG (dinotefuran)	6 g/inch DBH	14.25 a	12.25 ab (0)	0.75 d (92)	0.00 b (100)	0 a
Xxpire 40WG (spinoteram+sulfoxaflor)	2.0 oz	13.75 a	9.00 bc (32)	7.50 ab (18)	5.75 b (42)	0 a
	2.75 oz	17.5 a	6.00 c (65)	5.75 bc (53)	3.75 b (70)	0 a
	3.5 oz	23.00 a	5.75 c (74)	5.25 bcd (67)	2.00 b (88)	0 a
Untreated Check	-	16.25 a	15.75 a (0)	11.25 a (0)	11.75 a (0)	0 a

[x] Numbers of live nymphs were counted on 3 branchlets15 cm in length randomly selected and cut from each tree
Means within column followed by the same letter are not significantly different (LSD, P=0.05).
* Mainspring and Safari applied as drench.

Cottony Maple Scale. In 2005, Davis and Smitley examined various treatments to manage cottony maple scale (*Pulvinaria innumerabilis*) on silver maple (*Acer saccharinum*). Treatments were applied to 5 trees starting July 19, 2005. Safari 20SG was drenched once; the remaining treatments were foliar sprays applied on July 19 and August 2. Populations were assessed prior to the first applications and then on August 15 and August 22 by collecting 5 leaves per tree and counting the number of crawlers. The untreated populations declined rapidly after the 28 DAT confounding the results (Table 12). However, at 28 DAT there appeared to be good control achieved with foliar applications of Flagship 25WP (2 and 4 oz per 100 gallons) and Safari 20SG (4 oz per 100 gallons), although populations were not statistically different from the untreated control. More research is needed to clarify response of cottony maple scale with these treatments.

Table 12. Efficacy on Cottony Maple Scale on Silver Maple, Smitley & Davis, MI, 2005.

Treatment	Rate Per 100 Gal (No. Applications)	Pretreatment Counts	Counts (Henderson's Percent Control)		
			28 DAT	35 DAT	Combined 28 + 35 DAT
Flagship 25WP	2.0 oz (2)	45.0 a	0.2 a (96)	0.8 a (0)	1.0 a (82)
Flagship 25WP	4.0 oz (2)	37.0 a	0.8 a (81)	1.0 a (0)	1.8 a (61)
Safari 20SG	4.0 oz (2)	43.2 a	1.2 a (76)	1.6 a (0)	2.8 a (48)
Safari 20SG	8.0 oz (2)	63.8 a	3.4 a (54)	2.6 a (0)	6.0 a (25)
Safari 20SG – Drench	3 g (2)	39.2 a	6.6 a (0)	0.6 a (0)	7.2 a (0)
Safari 20SG – Drench	6 g (2)	37.2 a	1.4 a (67)	1.8 a (0)	3.2 a (31)
Talus 40SC	21.5 fl oz (2)	51.4 a	2.6 a (56)	0.8 a (0)	3.4 a (47)
TriStar 30SG	112 g (2)	35.8 a	5.0 a (0)	0.0 a (100)	5.0 a (0)
TriStar 30SG	224 g (2)	40.4 a	1.8 a (61)	0.2 a (49)	2.0 a (60)
Marathon II	1.7 fl oz (2)	61.2 a	4.2 a (41)	2.6 a (0)	6.8 a (11)
Talstar 0.67 F	10 fl oz (2)	55.2 a	2.0 a (69)	6.4 a (0)	8.4 a (0)
Untreated check	-	62.4 a	7.2 a (0)	0.6 a (0)	7.8 a (0)

* B-1956 surfactant mixed with Safari and TriStar foliar applications.

Fletcher Scale. In 2004, Smitley and Davis conducted an experiment examining efficacy on Fletcher scale (*Lecanium fletcheri*) on yew (*Taxus sp.*). These researchers added a number of treatments above and beyond the 2004 IR-4 protocol for scale efficacy, testing a total of 23 treatments as either foliar applications or banded applications around the base. The best efficacy was achieved with foliar applications of Discus + OSS and TriStar at 128 grams per 100 gal (Table 13). However, Dursban Pro, Flagship either banded or foliar sprays, Safari banded, Talus, and Tristar provided statistically equivalent control levels.

Table 13. Efficacy on Fletcher Scale on Yew, Smitley & Davis, MI, 2004.

Treatment	Rate	Application Type	Application Date(s)	Population Counts	Percent Control
Discus	1.91 gal/A	banded	6/18	3.00 ± 2.83 abcde	67
Discus + OSS	25 fl oz/100	foliar	6/29 & 7/14	1.17 ± 1.33 a	87
Distance 0.86E+ OSS	8fl oz/100 gal	foliar	6/29 & 7/20	8.17 ± 12.00 def	9
Distance 0.86E+ OSS	16 fl oz/100 gal	foliar	6/29 & 7/14	3.33 ± 2.07 bcde	63
Distance 0.86E+ OSS	32fl oz/100 gal	foliar	6/29 & 7/20	4.50 ± 2.59 def	50
Dursban Pro + OSS	1 qt/100 gal	foliar	6/29 & 7/14	2.83 ± 2.32 abcde	69
Flagship 25 WP	0.125 lb ai/A	banded	6/15	1.67 ± 1.97 abc	81
Flagship 25WP+ OSS	2 oz/100 gal	foliar	6/29 & 7/14	2.00 ± 1.55 abcd	78
Flagship 25WP+ OSS	4 oz/100 gal	foliar	6/29 & 7/14	3.33 ± 1.97 bcde	63
Flagship 25WP+ OSS	8 oz/100 gal	foliar	6/29 & 7/14	2.50 ± 0.84 abcde	72
Safari 20SG + OSS	8 oz/100 gal	foliar	6/29 & 7/14	3.50 ± 2.17 cde	61
Safari 20SG	12 oz/100 gal	banded	6/15	4.67 ± 1.75 ef	48
Safari 20SG	24 oz/100 gal	banded	6/15	2.00 ±1.10 abcde	78
Safari 20SG	48 oz/100 gal	banded	6/15	3.17 ± 2.93 abcde	72
Talus 40SC+ OSS	21.5 fl oz/100 gal	foliar	6/29	2.00 ± 1.79 abcd	78
Talus 40SC+ OSS	43.0 fl oz/100 gal	foliar	6/29	2.33 ± 1.21 abcde	74
Talus 40SC+ OSS	86.0 fl oz/100 gal	foliar	6/29	3.17 ± 2.93 abcde	65
Talus 70WP+ OSS	14 oz/100 gal	foliar	6/29	2.17 ± 1.47 abcde	76
Talus 70WP+ OSS	28 oz/100 gal	foliar	6/29	3.83 ± 2.64 de	57
Talus 70WP+ OSS	14 oz/100 gal **	foliar	6/29	4.83 ± 4.45 def	46
TriStar	32 grams/100 gal	foliar	6/29 & 7/14	3.50 ± 2.43 abcde	61
TriStar	64 grams/100 gal	foliar	6/29 & 7/14	2.00 ± 1.10 abcde	78
TriStar	128 grams/100 gal	foliar	6/29 & 7/14	1.17 ± 1.17 ab	87
Untreated Control	-	-	-	9.00 ± 3.63 f	0

* All data were transformed log (1+x) before statistical analysis.Means followed by the same letter are not significantly different ($p<0.05$). Untransformed means are presented in the table.See experiment report in Appendix 3 for additional information on statistical separation.

** This treatment was supposed to have been 56 oz/100 gal

Florida Wax Scale.

From 2004 through 2009, 5 experiments were conducted to examine insecticide efficacy for Florida wax scale (*Ceroplastes floridensis*). In general, the neonicotinoids Flagship, Safari and TriStar provided excellent control, and the IGR Talus provided good control.

During 2004 and 2005, Ludwig conducted four Florida wax scale (*Ceroplastes floridensis*) efficacy experiments on dwarf Burford holly (*Ilex cornuta* 'Burfordii Nana'), holly ‘China Doll’ (*Ilex sp*.), and Indian hawthorn (*Rhaphiolepis indica*).

Ludwig 2004. Dwarf Burford hollies with natural infestations of Florida wax scale were treated with foliar or drench applications depending on the product. Three rates of each product were applied to 4 plant replicates. Foliar applications were applied at 0 DAT and 16 DAT. Safari 20SG drenches were applied just at 0 DAT. Visual assessments of live scales on twenty leaves per plant were made using the same leaves throughout the experiment. At 45 DAT these same leaves were harvested, taken to the lab, scales were flipped over and live ones were counted. The

best treatments were Flagship (2, 4, and 8 oz), Safari (24 and 48 oz), and TriStar 70WSP (32, 64, and 128 g), however all treatments did reduce the number of live scale (Table 14).

Table 14. Efficacy on Florida Wax Scale (*Ceroplastes floridensis*) on Dwarf Burford Holly, Ludwig, TX, 2004.

	Population Averages (Henderson's Percent Control)				
Treatment (Rate)	0 DAT (Visual)	16 DAT (Visual)	30 DAT (Visual)	43 DAT (Visual)	45 DAT (Microscope)
Distance (8 fl oz/100 gal)	124.8	164.3 (11)	142.5 (14)	118.5 (15)	23.8 bc (73)
Distance (16 fl oz/100 gal)	113.8	173.0 (0)	149.8 (1)	101.5 (20)	19.8 bc (76)
Distance (32 fl oz/100 gal)	143.0	173.0 (18)	199.8 (0)	174.3 (0)	14.0 bc (86)
Flagship (2 oz/100 gal)	128.5	162.5 (14)	89.3 (48)	65.5 (54)	0.3 d (100)
Flagship (4 oz/100 gal)	129.3	146.0 (23)	93.8 (46)	70.5 (51)	0.0 d (100)
Flagship (8 oz/100 gal)	128.3	181.8 (4)	73.3 (57)	47.5 (67)	0.0 d (100)
Safari (12 oz/100 gal) - Drench	117.0	181.3 (0)	164.8 (0)	119.0 (9)	6.0 cd (93)
Safari (24 oz/100 gal) - Drench	129.5	137.8 (28)	125.8 (27)	96.3 (33)	1.0 d (99)
Safari (48 oz/100 gal) - Drench	104.5	131.3 (15)	110.3 (21)	38.5 (67)	0.0 d (100)
Talus 40SC (21.5 fl oz/100 gal)	105.0	152.5 (2)	121.5 (13)	94.0 (20)	13.8 bc (82)
Talus 40SC (43 fl oz/100 gal)	110.8	143.0 (12)	114.3 (23)	96.5 (22)	13.0 bc (84)
Talus 40SC (86 fl oz/100 gal)	185.8	203.5 (26)	200.0 (19)	160.3 (23)	17.5 bc (87)
TriStar 70WSP (32 g/100 gal)	125.5	112.5 (39)	54.8 (67)	40.5 (71)	0.0 d (100)
TriStar 70WSP (64 g/100 gal)	142.8	179.3 (15)	88.5 (54)	79.8 (50)	0.0 d (100)
TriStar 70WSP (128 g/100 gal)	107.3	125.0 (21)	59.3 (59)	42.5 (64)	0.0 d (100)
Untreated	132.5	195.5 (0)	177.0 (0)	147.5 (0)	94.8 a (0)

* Letters after numbers are based on separation of average number of scale on the same 20 leaves throughout the experiment.

Ludwig 2005a. In 2005, Dwarf Burford hollies with natural infestations of Florida wax scale were treated with foliar applications of 4 products (Celero 16WSG, Flagship 25WG, Orthene TTO97, and TriStar 30SG) with repeat applications 14 days after initial application. This experiment was conducted in a commercial nursery with 5 plants per treatment. Visual assessments of live scales on twenty leaves per plant were made using the same leaves throughout the experiment. At 56 DAT these same leaves were harvested, taken to the lab, scales were flipped over and live ones were counted. By 56 DAT, the three neonicotinoids (Flagship 25WG, TriStar 30SG, Celero 16WSG) provided excellent control of adult scales. Orthene TTO exhibited 60% control, statistically equivalent to the untreated.

Table 15. Efficacy on Florida Wax Scale (*Ceroplastes floridensis*) on Dwarf Burford Holly, Ludwig, TX, 2005a.

Scale Stage	Treatment	Rate Per 100 Gal	Population Averages (Henderson's Percent Control)				
			Pre-treatment counts	14 DAT (visual)	28 DAT (visual)	42 DAT (visual)	56 DAT (microscope)
Nymph	Flagship 25WG	2 oz	0.0	13.4 ab	8.2 ab	3.8 ab	0.0
	Flagship 25WG	4 oz	0.0	21.6 a	12.6 a	10.2 a	0.0
	TriStar 30SG	4 oz	0.0	10.4 ab	7.2 ab	6.0 b	0.0
	TriStar 30SG	8 oz	0.0	10.6 b	6.6 ab	4.6 ab	0.0
	Celero 16WSG	4 oz	0.0	11.8 ab	7.8 ab	7.2 ab	0.0
	Orthene TTO 97	8 oz	0.0	15.2 ab	7.0 ab	4.2 ab	0.0
	Untreated		0.0	8.6 ab	4.2 b	3.6 b	0.0
Adults	Flagship 25WG	2 oz	21.0 ab	57.8 ab (49)	92.2 a (8)	75.0 a (36)	2.4 b (98)
	Flagship 25WG	4 oz	24.6 a	51.6 ab (61)	74.4 ab (37)	72.2 a (47)	2.6 bc (98)
	TriStar 30SG	4 oz	21.0 ab	47.0 ab (58)	41.0 bc (59)	39.0 ab (67)	0.2 d (100)
	TriStar 30SG	8 oz	20.0 ab	33.4 b (69)	34.8 c (64)	30.0 b (73)	0.4 cd (100)
	Celero 16WSG	4 oz	19.2 ab	39.4 ab (62)	49.8 abc (46)	50.2 ab (53)	1.2 bcd (99)
	Orthene TTO 97	8 oz	18.2 ab	61.2 a (38)	84.8 ab (3)	78.6 a (23)	34.0 a (60)
	Untreated		13.8 b	74.4 a (0)	66.0 ab (0)	77.0 a (0)	65.0 a (0)
Total	Flagship 25WG	2 oz	21.0	71.2 (44)	100.4 (6)	78.8 (36)	2.4 (98)
	Flagship 25WG	4 oz	24.6	73.2 (51)	87.0 (30)	82.4 (43)	2.6 (98)
	TriStar 30SG	4 oz	21.0	57.6 (54)	47.6 (55)	43.6 (64)	0.2 (100)
	TriStar 30SG	8 oz	20.0	43.8 (64)	42.0 (59)	36.0 (69)	0.4 (100)
	Celero 16WSG	4 oz	19.2	51.2 (56)	57.6 (41)	57.4 (49)	1.2 (99)
	Orthene TTO 97	8 oz	18.2	76.4 (30)	91.8 (1)	82.8 (22)	34.0 (60)
	Untreated		13.8	83.0 (0)	70.2 (0)	80.6 (0)	65.0 (0)

* Letters after numbers are based on separation of average number of scale on 5 plants.

Ludwig 2005b. In 2005, 'China Doll' hollies with natural infestations of Florida wax scale were treated with foliar applications of 4 products (Celero 16WSG, Flagship 25WG, Orthene TTO97, and TriStar 30SG) with repeat applications 14 days after initial application. This experiment was conducted in a commercial nursery with 4 plants per treatment. Visual assessments of live scales on twenty leaves per plant were made using the same leaves throughout the experiment. At 45 DAT these same leaves were harvested, taken to the lab, scales were flipped over and live ones were counted. By 45 DAT, the best treatments were the 4 oz rate of Flagship 25WP, both rates of TriStar 30SG, and Orthene TTO (Table 16).

Held 2009. In 2009, Held investigated efficacy of the systemic neonicotinoid insecticides Arena, Meridian, Merit and Safari applied as drench at different timings targeted to first or second generation of Florida wax scale on holly 'Needlepoint'. Each product was applied once at pre-crawler hatch (4/13/10) or crawler hatch (5/26/10) for the first generation, or at pre-crawler hatch (8/31/10) for the second generation. All products targeting the first generation (applied at pre-crawler hatch or crawler hatch) provided excellent control, performing better than those applied in August against the second generation (Table 17).

Ludwig 2005c. During 2005, Ludwig tested Florida wax scale efficacy on a third crop, Indian hawthorn. In this test, only neonicotinoids were applied (Table 18). All three products – Celero, Flagship and TriStar – provided great to excellent control.

Table 16. Efficacy on Florida Wax Scale (*Ceroplastes floridensis*) on Holly 'China Doll', Ludwig, TX, 2005b.

Scale Stage	Treatment	Rate Per 100 Gal	Population Averages (Henderson's Percent Control)			
			Pretreatment counts (Visual)	14 DAT (Visual)	28 DAT (Visual)	45 DAT (Microscope)
Nymph	Flagship 25WG	2 oz	247.3 a	13.3 ab (59)	12.3 ab (77)	0.0
	Flagship 25WG	4 oz	121.8 bc	1.5 bcd (91)	6.0 abc (77)	0.0
	TriStar 30SG	4 oz	149.8 bc	1.5 abc (92)	0.5 bcd (98)	0.0
	TriStar 30SG	8 oz	120.0 bc	6.5 cd (59)	2.8 d (89)	0.0
	Celero 16WSG	4 oz	87.3 c	3.0 abcd (74)	4.0 abcd (79)	0.0
	Orthene TTO 97	8 oz	200.5 ab	0.0 d (100)	2.3 cd (95)	0.0
	Talus 40SC	21.5 fl oz	133.0 abc	9.5 ab (46)	13.0 a (55)	0.0
	Untreated		77.5 c	10.3 a (0)	16.8 a (0)	0.0
Adults	Flagship 25WG	2 oz	0.3	184.0 a	80.8 a	37.3 a
	Flagship 25WG	4 oz	0.0	86.8 bc	48.5 abc	5.0 bc
	TriStar 30SG	4 oz	0.0	65.5 abc	21.3 abc	5.8 ab
	TriStar 30SG	8 oz	0.3	77.8 c	44.5 d	13.8 c
	Celero 16WSG	4 oz	0.0	42.0 c	21.8 cd	11.8 ab
	Orthene TTO 97	8 oz	0.0	124.0 ab	57.5 ab	4.8 bc
	Talus 40SC	21.5 fl oz	0.8	87.5 bc	49.8 bc	29.3 a
	Untreated		0.0	54.3 bc	30.5 bc	28.3 a
Total	Flagship 25WG	2 oz	247.5	197.3 (4)	93.0 (38)	37.3 (59)
	Flagship 25WG	4 oz	121.8	88.3 (13)	54.5 (27)	5.0 (89)
	TriStar 30SG	4 oz	120.0	72.0 (28)	24.0 (67)	5.8 (87)
	TriStar 30SG	8 oz	150.0	79.3 (37)	45.0 (51)	13.8 (75)
	Celero 16WSG	4 oz	87.3	45.0 (38)	25.8 (52)	11.8 (63)
	Orthene TTO 97	8 oz	200.5	124.0 (26)	59.8 (51)	4.8 (94)
	Talus 40SC	21.5 fl oz	133.8	97.0 (13)	62.8 (23)	29.3 (40)
	Untreated		77.5	64.5 (0)	47.3 (0)	28.3 (0)

* Letters after numbers are based on separation of average number of scale on 20 leaves on each of 5 plants.

Table 17. Efficacy on Florida Wax Scale (*Ceroplastes floridensis*) on Holly 'Needlepoint', Held, AL, 2009.

Treatment	Rate	Application Timing	Total Population Counts [z], Means Separations [x], and Henderson's Percent Control		
			Pretreatment	First Generation 6/24/10	Second Generation 10/25/10
Arena 50WDG	2.4 g/ft ht	April 13	28.25 ± 10.3	0.0 (100) b	0.0 (100) b
Meridian 25WG	3 g/ft ht	April 13	42.75 ± 23.9	1.0 ± 0.4 (96) b	0.0 (100) b
Merit 2F	0.2 fl oz/ft ht	April 13	30.75 ± 13.9	0.0 (100) b	0.0 (100) b
Safari 20SG	6 g/ft ht	April 13	30 ± 12.1	1.25 ± 1.25 (92) b	0.0 (100) b
Arena 50WDG	2.4 g/ft ht	May 26	21 ± 7.1	0.0 (100) b	0.0 (100) b
Meridian 25WG	3 g/ft ht	May 26	20.75 ± 8.1	0.25 ± 0.25 (98) b	0.0 (100) b
Merit 2F	0.2 fl oz/ft ht	May 26	21.75 ± 7.9	1.5 ± 0.87 (87) b	0.0 (100) b
Safari 20SG	6 g/ft ht	May 26	21.25 ± 7.2	0.25 ± 0.25 (98) b	0.5 ± 0.5 (99) b
Arena 50WDG	2.4 g/ft ht	August 31	40.75 ± 30	---	3.5 ± 1.7 (96) b
Meridian 25WG	3 g/ft ht	August 31	16.0 ± 8.8	---	9.25 ± 5.5 (73) ab
Merit 2F	0.2 fl oz/ft ht	August 31	15.25 ± 9	---	1.75 ± 1.75 (95) b
Safari 20SG	6 g/ft ht	August 31	15.5 ± 6.6	---	6.0 ± 2.9 (82) ab
Untreated	-		44.25 ± 7.4	---	95.0 ± 78.6 (0) a

[x] Means within a column followed by the same letter are not significantly different based on Tukey's HSD test P=0.05).

Table 18. Efficacy on Florida Wax Scale (*Ceroplastes floridensis*) on Indian Hawthorn, Ludwig, TX, 2005.

Scale Stage	Treatment	Rate Per 100 Gal	Population Averages (Henderson's Percent Control)				
			Pretreatment counts (Visual)	15 DAT (Visual)	28 DAT (Visual)	41 DAT (Visual)	57 DAT (Microscope)
Nymph	Celero 16WSG	4 oz	0.0	42.0 a	50.4 a	12.2 bc	14.0 b
	Flagship 25WG	2 oz	0.0	32.2 a	45.4 a	24.2 b	13.6 ab
	Flagship 25WG	4 oz	0.0	42.8 a	55.6 a	30.2 b	9.2 ab
	TriStar 30SG	4 oz	0.0	35.5 a	6.5 a	4.0 c	7.5 b
	TriStar 30SG	8 oz	0.0	25.2 a	7.8 a	1.8 c	5.4 b
	Untreated		0.0	42.0 a	64.2 a	140.2 a	32.0 a
Adults	Celero 16WSG	4 oz	41.4 a	--	--	--	27.8 b (90)
	Flagship 25WG	2 oz	51.0 a	--	--	--	22.0 b (94)
	Flagship 25WG	4 oz	48.6 a	--	--	--	13.8 b (96)
	TriStar 30SG	4 oz	46.8 a	--	--	--	6.5 b (98)
	TriStar 30SG	8 oz	32.6 a	--	--	--	6.2 b (97)
	Untreated		37.2 a	--	--	--	248.6 a (0)
Total	Celero 16WSG	4 oz	41.4	42.0 (10)	50.4 (29)	12.2 (92)	41.8 (87)
	Flagship 25WG	2 oz	51.0	32.2 (44)	45.4 (48)	24.2 (87)	35.6 (91)
	Flagship 25WG	4 oz	48.6	42.8 (22)	55.6 (34)	30.2 (84)	23.0 (94)
	TriStar 30SG	4 oz	46.8	35.5 (33)	6.5 (92)	4.0 (98)	14.0 (96)
	TriStar 30SG	8 oz	32.6	25.2 (32)	7.8 (86)	1.8 (99)	11.6 (95)
	Untreated		37.2	42.0 (0)	64.2 (0)	140.2 (0)	280.6 (0)

* Letters after numbers are based on separation of average number of scale on 20 leaves on each of 5 plants. See experiment report in Appendix 3 for statistical separation details and scale averages for each treatment.

Magnolia White Scale. In 2014, Chen conducted anexperiment examining efficacy on magnolia white scale (*Pseudaulacaspis cockerelli*) on Southern magnolia (*M. grandiflora*) 'Little Gem'. All treatments, except AzaGuard and the lowest rate of XXpire, provided100 % control of a moderate infestation within 30-60 days after the second application (Table 19).

Table 19. Efficacy of Insecticides on Magnolia White Scale on Southern Magnolia (*M. grandiflora*), Chen, LA, 2014.

Treatment	Rate Per 100 Gal	Applic. Method, Timing	Population Averages[x] (Percent Control)				
			30 DAT2	60 DAT2	90 DAT2	120 DAT2	180 DAT2
AzaGuard (azadirachtin)	20 fl oz	Foliar, 3/28	2.9 b (55)	2.8 b (54)	2.3 b (56)	3.4 a (35)	6.2 ab (9)
Distance (pyriproxyfen)	12 fl oz	Foliar, 3/28, 4/18	2.1 b (67)	0 c (100)	0 c (100)	0 c (100)	0.4 c (94)
Mainspring 200SC (cyanthraniliprole)	8 fl oz	Drench, 4/11, 5/12	0 c (100)	0 c (100)	0 c (100)	0 c (100)	0.3 c (96)
Mainspring 200SC	12 fl oz	Drench, 4/11	0 c (100)	0 c (100)	0 c (100)	0 c (100)	0.8 c (88)
SuffOil-X (horticultural oil)	1 gal	Foliar 3/28, 4/11	0 c (100)	0 c (100)	0 c (100)	0 c (100)	1.7 bc (75)
Talus 70DF (buprofezin)	14 oz	Foliar, 3/28	0 c (100)	0 c (100)	0 c (100)	0 c (100)	0.8 c (88)
XXpire 40WG (spinetoram + sulfoxaflor) + Capsil	2 oz + 6 fl oz	Foliar, 3/28, 4/11	1.0 bc (84)	0.9 b (85)	1.5 bc (71)	2.6 ab (50)	4.1 abc (40)
XXpire 40WG + Capsil	2.75 oz + 6 fl oz	Foliar, 3/28, 4/11	0 c (100)	0 c (100)	0 c (100)	0 c (100)	1.7 bc (75)
XXpire 40WG + Capsil	3.5 oz + 6 fl oz	Foliar, 3/28, 4/11	1.6 bc (75)	0 c (100)	0 c (100)	0 c (100)	0.2 c (97)
Untreated (water)	-	Foliar 3/28, 4/11	6.4 a (0)	6.1 a (0)	5.2 a (0)	5.2 a (0)	6.8 a (0)

[x] Numbers of large size nymphs and adults on 6 leaves at days after 2nd application (DAT2). Means within column followed by the same letter are not significantly different (LSD, P=0.05).

Comparative Efficacy on Armored Scale

Armored Scale on Wax Myrtle

In 2008 and 2009, Chong conducted four experiments on armored scale (*Melanaspis deklei*) on wax myrtle (*Myrica cerifera*) to evaluate efficacy of neonicotinoids (Aloft, Flagship, Merit, Safari and TriStar), insect growth regulators (Distance and Talus) and other insecticides. In three of the four experiments, no statistical differences were observed among treatments (Table 20-Table 23). In two experiments, the comparatively low number of live scales on the untreated plants resulting from parasitoid activities might have confounded results of these experiments. In a 2009 test, all insecticides, Distance, Talus, Safari and paraffinic oil, significantly reduced armored scale population only by 6 weeks after treatment (Table 23). The management of *M. deklei* may require repeated applications of insecticides at the time of crawler emergence over a 2-3 year period. In 2014, Chong conducted another experiment to evaluate the efficacy of GF-2860/XXpire on armored scale (*Melanaspis deklei*) on wax myrtle (*Myrica cerifera*) (Table 24). Both GF-2860 and the standard paraffinic oil provided significant controlof adults and nymphs at 14 DAT and for the rest of the growing season. Paraffinic oil was the most efficacious treatment, followed by GF-2860 at 2.75 and 3.5 oz/100 gal.

No phytotoxicity was observed on any of the treated wax myrtle shrubs.

Table 20. Efficacy on Armored Scale on Wax Myrtle, Chong, SC, 2008a.

Treatment	Rate	Application Method, Timing	Population Averages (Henderson's Percent Control)				
			Pretreatment Counts	1 WAT	2 WAT	4 WAT	8 WAT
Aloft LC SC (clothianidin + bifenthrin)	5 fl oz per 100 gal	Sprench, May	1.0 a	0.7 a (42)	2.9 a (0)	1.8 a (38)	0.9 a (0)
Aloft LC SC (clothianidin + bifenthrin)	10 fl oz per 100 gal	Sprench, May	0.7 a	0.9 a (0)	1.2 a (33)	2.0 a (0)	1.5 a (0)
Flagship 25 WG (thiamethoxam)	8 oz per 100 gal	Foliar, May	0.4 a	0.7 a (0)	0.1 a (29)	1.7 a (0)	2.3 a (0)
Merit 2F (imidacloprid)	0.2 fl oz/in DBH	Drench, May	1.0 a	0.5 a (58)	0.2 a (80)	2.4 a (0)	1.9 a (0)
Orthene TTO (acephate)	8 oz per 100 gal	Foliar, May	1.2 a	1.6 a (0)	3.9 a (0)	4.8 a (0)	2.4 a (0)
Safari 20SG (dinotefuran)	12 g/in DBH	Drench, May	1.1 a	0.3 a (77)	0.5 a (17)	0.6 a (0)	0.1 a (67)
Safari 20SG (dinotefuran)	12 g/in DBH	Drench, July	0.8 a	1.0 a (0)	1.8 a (10)	2.5 a (0)	0.5 a (60)
Safari 20SG (dinotefuran) + PentraBark	12 g/in DBH	Drench, May	1.3 a	1.4 a (10)	2.4 a (14)	3.8 a (0)	6.4 a (0)
TriStar 30 SG (acetamiprid)	4 oz per 100 gal	Foliar, May	0.4 a	0.7 a (0)	0.5 a (64)	1.0 a (0)	2.6 a (0)
TriStar 30 SG (acetamiprid)	8 oz per 100 gal	Foliar, May	0.3 a	0.4 a (0)	0.2 a (75)	0.9 a (0)	0.6 a (0)
Untreated	-	-	0.5 a	0.6 a (0)	1.2 a (0)	1.2 a (0)	0.6 a (0)

* Means within a column followed by the same letter are not significantly different based on data analysis using PROC GLM for completely randomized design with sub-sampling (SAS).

Table 21. Efficacy on Armored Scale on Wax Myrtle, Chong, SC, 2008b.

Treatment	Rate	Application Method, Timing	Population Averages (Henderson's Percent Control)				
			Pretreatment Counts	1 WAT	2 WAT	4 WAT	8 WAT
Distance (pyriproxyfen)	12 fl oz/100 gal	Foliar, July	3.8 a	10.1 a (0)	3.8 a (0)	4.6 a (32)	45.5 a (37)
Safari 20 SG (dinotefuran)	8 oz/100 gal	Foliar, July	1.0 a	1.4 a(43)	0.8 a(0)	1.3 a(9)	28.2 a(0)
SunSpray Ultrafine	2% (2 gal/100 gal)	Foliar, July	3.4 a	7.3 a(13)	2.5 a(0)	1.4 a(68)	20.8 a(6)
Talus 40 SC (buprofezin)	21.5 fl oz/100 gal	Foliar, July	5.1 a	9.2 a (27)	4.5 a (0)	3.5 a (56)	29.5 a (47)
Untreated	-	-	4.7 a	11.6 a(0)	2.7 a(0)	4.8 a(0)	75.7 a(0)

* Means within a column followed by the same letter are not significantly different based on data analysis using PROC GLM for completely randomized design with sub-sampling (SAS).

Table 22. Efficacy on Armored Scale on Wax Myrtle, Chong, SC, 2009a.

Treatment	Rate	Application Method	Population Averages (Henderson's Percent Control)				
			Pretreatment Counts	1 WAT	2 WAT	4 WAT	8 WAT
Aloft LC SC (clothianidin + bifenthrin)	10 fl oz/100 gal	Sprench	1.6 a	0.6 a (0)	0.8 a (0)	3.2 a (14)	0.4 a (34)
Flagship 25 WG (thiamethoxam)	4 g/ft height	Drench	0.5 a	0.9 a (0)	0.2 a (83)	0.1 a (89)	0.2 a (0)
Flagship 0.22G (thiamethoxam)	227 g/ft height	Broadcast	10.1 a	0.6 a (81)	1.0 a (0)	15.7 a (0)	3.2 a (0)
Rycar (pyrifluquinazon)	18 fl oz/100 gal	Foliar	4.6 a	1.8 a (0)	1.6 a (33)	5.0 a (32)	0.4 a (58)
Orthene TTO (acephate)	8 oz/100 gal	Foliar	0.6 a	1.1 a (0)	2.0 a (0)	4.7 a (49)	3.1 a (0)
Safari 20SG (dinotefuran)	6 g/ft height	Drench	0.2 a	0.9 a (0)	0.3 a (75)	0.7 a (50)	0.2 a (0)
Safari 2G (dinotefuran)	60 g/ft height	Soil surface	3.2 a	0.7 a (31)	0.7 a (25)	0.5 a(85)	0 a (100)
TriStar 30 SG (acetamiprid) + Capsil	8 oz/100 gal + 6 fl oz/100 gal	Foliar	2.8 a	0.8 a (10)	0.6 a (44)	3.3 a (0)	1.3 a (0)
Untreated	-	-	1.9 a	0.6 a (0)	0.8 a (0)	3.7 a (0)	0.7 a (0)

* Means within a column followed by the same letter are not significantly different based on data analysis using PROC GLM for completely randomized design with sub-sampling (SAS).

Table 23. Efficacy on Armored Scale on Wax Myrtle, Chong, SC, 2009b.

Treatment	Rate	Application Method	Population Averages (Henderson's Percent Control)				
			Pretreatment Counts	1 WAT	2 WAT	4 WAT	8 WAT
Distance 10EC (pyriproxyfen)	12 fl oz/100 gal; twice 14 days apart	Foliar	3.0 a	3.6 a (42)	2.3 a (37)	2.7 a (0)	2.7 b (31)
Paraffinic oil	2 gal/100 gal	Foliar	2.1 a	2.5 a (58)	2.6 a (0)	3.6 a (0)	2.9 b (45)
Safari 20 SG (dinotefuran)	8 oz/100 gal	Foliar	4.5 a	12.2 a (0)	4.2 a (66)	3.1 a (0)	3.6 b (20)
Talus 40 SC (buprofezin)	21.5 fl oz/100 gal	Foliar	2.8 a	11.0 a (0)	5.6 a (50)	4.2 a (0)	4.1 b (33)
Untreated	-	-	7.0 a	14.4 a (0)	14.6 a (0)	5.3 a (0)	7.7 a (0)

* Means within a column followed by the same letter are not significantly different based on data analysis using PROC GLM for completely randomized design with sub-sampling (SAS).

Table 24. Efficacy on Armored Scale on Wax Myrtle, Chong, SC, 2014.

Treatment	Rate (per 100 gal)	Population Averages (Henderson's Percent Control) [x]				
		Pretreat	7 DAT [y]	13 DAT	27 DAT	6 MAT
GF-2860	2 oz	18.5 a	13.2 a (43)	7.8 ab (51)	6.2 b (59)	8.0 b (51)
GF-2860	2.75 oz	19.0 a	9.8 a (59)	5.3 b (67)	3.2 bc (79)	5.5 b (68)
GF-2860	3.5 oz	12.5 a	9.2 a (41)	4.5 b (58)	2.8 bc (73)	5.5 b (51)
Paraffin oil	2%	16.3 a	7.5 a (63)	2.7 b (81)	1.3 c (90)	3.8 b (74)
Untreated	-	13.8 a	17.3 a (0)	11.8 a (0)	11.3 a (0)	12.3 a (0)

[x] Means followed by same letter do not significantly differ (Fisher's LSD test, P=0.05).
[y] DAT = days after the first treatment; MAT = months after first treatment.
* Treatments applied foliar on 5/13 and 5/26; Capsil (at 6 fl oz/100 gal) was mixed in the solutions of GF-2860.

Camellia Scale

In 2010, Chong investigated the efficacy of systemic neonicotenoids (Arena, Flagship, Safari and Tristar) and A16901B for the control of camellia scale (*Lepidosaphes camelliae*) on camellia (*Camellia japonica*). A16901B, Arena, Flagship 25WG and Safari 20SG were applied as drench while Flagship 0.22G and Safari 2G were applied as broadcast on Sept 9; Orthene and Tristar were applied as foliar spray on Sept 9 and 24. No significant difference in the percent mortality of nymphs among the treatments was observed, and significant difference in the percent mortality of adult camellia scales was observed only at 6 WAT (Table 25).Safari 2G was the only treatment that provided significantly higher mortality from the untreated control (20% difference). Unfavorable rainfall conditions during the experiment might have contributed to the poor performance of products. More research is needed to determine viable product choices for this species.

In 2014, Chong evaluated the efficacy of GF-2860/XXpire, Mainspring, Distance, Talus 70DF, Kontos and paraffinic oil against the camellia scale.Treatments were targeted on the emergence of crawlers. Mainspring was applied as soil drench on Jun 13 and Jul 11, while other products were applied as foliar spray. Talus 70DF was applied on Jun 13, GF-2860 + Capsil, Kontos and paraffinic oil applied on Jun 13 and 27, and Distance applied on Jun 13 and Jul 3. Overall, XXpire at 2.75 and 3.5 oz/100 gal, Distance, Kontos and paraffinic oil provided consistent and high efficacy against the camellia scales in outdoor, landscape situation (Table 26). One application of Talus 70DF did not significantly reduced the numbers of nymphs at 28 DAT; however, when considering the total number of camellia scales, Talus performed as well as the effective products before 28 DAT. It is therefore prudent to make a second Talus application at 28 DAT or during the time of crawler emergence of the next generation to achieve long-term reduction in the scale insect population. Performance of Mainspring was inconsistent, indicating that it may not provide sufficient suppression when applied as soil drench.

No phytotoxicity or insecticide residue was observed on the treated camellia shrubs.

Table 25. Efficacy on Camellia Scale on Camellia, Chong, SC, 2010.

Scale Stage	Treatment	Rate	Average Percent Mortality				
			Pretreat	1 WAT	2 WAT	4 WAT	6 WAT
Nymphs	A16901B	10 oz/100 gal	63.6 ± 3.1	66.1 ± 4.8	79.1 ± 3.9	77.0 ± 4.6	64.6 ± 7.7
	Arena 50 WDG	2.4 g/ft ht	58.7 ± 7.8	56.3 ± 5.5	80.3 ± 4.5	68.7 ± 8.5	74.0 ± 5.8
	Flagship 0.22G	227 g/ft ht	56.1 ± 4.7	64.9 ± 8.9	77.4 ± 5.2	78.7 ± 4.1	71.9 ± 10.3
	Flagship 25WG	1 g/ft ht	64.5 ± 3.3	58.2 ± 10.8	82.6 ± 3.9	79.7 ± 1.7	76.7 ± 4.2
	Flagship 25WG	4 g/ft ht	59.0 ± 3.8	76.8 ± 4.0	82.2 ± 3.8	76.5 ± 1.9	72.3 ± 3.2
	Orthene TTO	8 oz/100 gal	60.9 ± 4.1	69.4 ± 3.8	82.0 ± 5.0	78.6 ± 7.4	75.5 ± 9.1
	Safari 2G	60 g/ft ht	64.7 ± 4.8	67.5 ± 5.4	87.1 ± 4.3	79.6 ± 3.0	81.2 ± 5.3
	Safari 20SG	6 g/ft ht	62.6 ± 4.2	81.3 ± 3.9	82.6 ± 5.2	83.2 ± 4.5	68.8 ± 5.2
	Tristar 30SG + Capsil	8 oz + 6 fl oz/100 gal	53.0 ± 4.4	65.3 ± 4.2	81.5 ± 5.8	71.7 ± 4.6	73.5 ± 11.2
	Untreated	-	58.5 ± 6.6	64.1 ± 6.3	74.1 ± 5.4	75.9 ± 6.2	83.2 ± 4.2
Adults	A16901B	10 oz/100 gal	32.6 ± 4.2	36.9 ± 6.6	44.7 ± 13.1	47.9 ± 3.4	32.0 ± 5.3 d
	Arena 50 WDG	2.4 g/ft ht	40.6 ± 7.5	44.8 ± 10.2	45.6 ± 4.7	54.6 ± 5.8	49.3 ± 5.1 bcd
	Flagship 0.22G	227 g/ft ht	35.4 ± 7.8	44.6 ± 10.3	43.3 ± 12.3	52.4 ± 4.9	53.0 ± 5.1 bc
	Flagship 25WG	1 g/ft ht	44.0 ± 5.3	31.5 ± 6.9	46.4 ± 4.1	49.8 ± 4.1	45.7 ± 3.4 cd
	Flagship 25WG	4 g/ft ht	28.4 ± 4.3	49.7 ± 4.2	48.9 ± 4.3	54.5 ± 7.7	65.1 ± 1.9 ab
	Orthene TTO	8 oz/100 gal	39.1 ± 5.0	49.1 ± 10.7	47.7 ± 5.6	49.3 ± 5.7	54.5 ± 9.7 abc
	Safari 2G	60 g/ft ht	31.9 ± 5.1	44.7 ± 2.9	65.1 ± 9.1	62.1 ± 3.3	69.0 ± 7.0 a
	Safari 20SG	6 g/ft ht	41.5 ± 3.3	45.6 ± 8.7	48.4 ± 13.7	58.5 ± 6.7	60.4 ± 4.9 abc
	Tristar 30SG + Capsil	8 oz + 6 fl oz/100 gal	39.7 ± 2.4	33.3 ± 4.6	60.9 ± 6.0	46.0 ± 5.2	48.8 ± 5.8 bcd
	Untreated	-	37.5 ± 4.2	42.6 ± 10.4	55.6 ± 12.5	40.6 ± 8.3	49.3 ± 7.0 bcd

* ANOVA for Completely Randomized Design at $\alpha = 0.05$. Means within a column with the same letters are not significantly different among the treatments by LSD.

Table 26. Efficacy on Camellia Scale on Camellia, Chong, SC, 2014.

Treatment	Rate (per 100 gal)	Population Averages (Henderson's Percent Control) [x]				
		Pretreat	7 DAT [y]	14 DAT	28 DAT	6 MAT
Adults						
Distance	12 fl oz	14.0 a	0.2 a (81)	0 c (100)	0.5 b (95)	0.2 d (89)
Kontos	3.4 fl oz	17.0 a	0 a (100)	0.5 bc (74)	0 b (100)	0.3 d (86)
Mainspring*	0.125 fl oz	13.0 a	2.2 a (0)	0.8 abc (46)	10.0 a (0)	3.8 a (0)
Mainspring	0.25 fl oz	12.7 a	0.3 a (68)	0.3 c (79)	10.2 a (0)	1.7 bcd (0)
Paraffin oil	2%	8.2 a	0.3 a (50)	0.2 c (78)	0 b (100)	0 d (100)
Talus 70DF	14 oz	11.8 a	0.2 a (77)	0.3 c (77)	1.3 b (84)	3.2 ab (0)
XXpire**	2 oz	12.2 a	1.0 a (0)	1.8 ab (0)	6.0 ab (30)	0.5 cd (68)
XXpire	2.75 oz	13.7 a	0.2 a (80)	0.2 c (87)	0 b (100)	0 d (100)
XXpire	3.5 oz	13.8 a	0 a (100)	0.2 c (87)	0.5 b (95)	1.3 bcd (28)
Untreated	-	17.7 a	1.3 a (0)	2.0 a (0)	12.5 a (0)	2.3 abc (0)
Nymphs						
Distance	12 fl oz	13.3 a	0.5 c (98)	0.8 bc (90)	2.5 b (90)	0.3 bc (97)
Kontos	3.4 fl oz	12.5 a	1.7 c (91)	0.5 bc (94)	1.2 b (98)	0.5 d (95)
Mainspring*	0.125 fl oz	12.7 a	7.0 ab (63)	1.3 bc (84)	16.7 a (30)	10.5 a (6)
Mainspring	0.25 fl oz	6.2 a	5.2 bc (44)	0.7 bc (82)	13.5 a (0)	5.3 a (3)
Paraffin oil	2%	6.5 a	1.2 c (88)	0.8 bc (80)	0.5 b (96)	1.0 cd (83)
Talus 70DF	14 oz	16.5 a	0.5 c (98)	0.5 bc (95)	10.3 ab (67)	1.2 cd (92)
XXpire**	2 oz	17.0 a	9.7 ab (62)	2.8 ab (74)	13.7 a (57)	1.7 cd (89)
XXpire	2.75 oz	15.5 a	4.8 bc (79)	1.3 bc (87)	2.0 b (93)	0 d (100)
XXpire	3.5 oz	6.8 a	3.5 bc (66)	0.3 c (93)	0.7 b (95)	2.3 cd (62)
Untreated	-	8.3 a	12.5 a (0)	5.2 a (0)	15.7 a (0)	7.3 ab (0)
Total						
Distance	12 fl oz	27.3 a	0.7 d (95)	0.8 b (89)	3.0 b (90)	0.5 d (95)
Kontos	3.4 fl oz	29.5 a	1.7 cd (89)	1.0 b (88)	1.2 b (96)	0.8 d (93)
Mainspring*	0.125 fl oz	25.7 a	9.2 abc (33)	2.2 b (69)	27.7 a (1)	14.3 a (0)
Mainspring	0.25 fl oz	18.8 a	5.5 bcd (45)	1.0 b (81)	23.7 a (15)	7.0 bc (0)
Paraffin oil	2%	14.7 a	1.5 cd (81)	1.0 b (75)	0.5 b (97)	1.0 d (82)
Talus 70DF	14 oz	28.3 a	0.7 d (95)	0.8 b (90)	11.7 ab (62)	4.3 bcd (59)
XXpire**	2 oz	29.7 a	10.7 ab (32)	2.2 b (73)	19.7 a (39)	2.2 cd (80)
XXpire	2.75 oz	29.2 a	5.0 bcd (68)	1.5 b (81)	2.0 b (94)	0 d (100)
XXpire	3.5 oz	20.7 a	3.5 bcd (68)	0.5 b (91)	2.5 a (89)	3.7 cd (52)
Untreated	-	26.0 a	13.8 a (0)	7.2 a (0)	28.2 a (0)	9.7 ab (0)

[x] Means followed by same letter do not significantly differ (Fisher's LSD test, P=0.05).

[y] DAT = days after the first treatment; MAT = months after first treatment.

* Mainspring applied as drench once at 0.25 fl oz per foot shrub height on Jun 13, and twice at the lower rate on Jun 13 and Jul 11.

** Capsil (at 6 fl oz/100 gal) was mixed in the solutions of GF-2860.

Cycad Scale

In 2019, Dale evaluated the efficacy of several products applied foliar on cycad scale (*Aulacaspis yasumatsui*) on sago palm (*Cycas revoluta*). Overall, the top-performing products were Ventigra, Altus and Talus (Table 27). Ventigra and Talus clearly provided the best control of cycad aulacaspis scale, as reflected in the data and in the visual quality/appearance of the plants. Ventigra- and Talus-treated plants were easily distinguished visually in the greenhouse blocks. Importantly, Ventigra was only applied once, while Talus and Altus were applied twice. All other products were applied more frequently but still provided little control. Despite the statistical differences, scale numbers on plants treated by the most effective products were still potentially damaging, especially towards the end of the trial almost 3 months after initial applications. Subsequent applications of products like horticultural oils and/or mechanical removal of infested plant tissue (pruning) would provide more effective and integrated control of this scale insect. No phytotoxic effects were observed for the duration of the trial.

Elongate Hemlock and Cryptomeria Scales

In 2005 and 2008, Cowles conducted two experiments for control of both elongate hemlock scale (*Fiorinia externa*) and Cryptomeria scale (*Aspidiotus cryptomeriae*) on Frasier Fir (*Abies fraseri*). In 2005, Flagship 25WP, Safari 20SG, Talus 40SC, and TriStar 70WSP provided excellent control at all tested rates (Table 28). Cygon 267 and Onyx also performed well. Another product providing good efficacy was Esteem 35WP. Lesco Oil provided poor control except when paired with Silwet L-77. In 2008, Safari trunk spray was the only treatment that provided good control, better than the standard Onyx foliar spray (Table 29). Safari also has minimal impact on natural enemies that may make this treatment a preferable approach for scale management.

Table 27. Efficacy on Cycad Scale (*Aulacaspis yasumatsui*) on Sago Palm (*Cycas revoluta*), Dale, 2019.

Treatment	Rate	Pretreat	7 DAIT	14 DAIT	21 DAIT	28 DAIT	77 DAIT
Number of aulacaspis scale adults per cm of leaflet length [x]							
Altus (flupyradifurone)	14 fl oz	0.1 b	0.3 (29)	0.9 (0)	1.6 abc (0)	1.0 b (0)	1.4 abc (0)
Azaguard (azadirachtin)	16 fl oz	0.1 b	0.2 (52)	0.9 (0)	2.2 ab (0)	1.8 ab (0)	1.9 abc (0)
KOC22018-8 (botanical oil blend)	128 fl oz	0.4 ab	0.1 (94)	-	2.1 ab (0)	1.8 ab (34)	2.5 ab (8)
Pradia SL (cyclaniliprole + flonicamid)	16.5 fl oz	0.2 ab	0.2 (76)	0.7 (0)	3.3 a (0)	3.0 a (0)	3.1 a (0)
Sarisa (cyclaniliprole)	28 fl oz	0.4 ab	0.1 (94)	-	3.0 a (0)	3.3 a (0)	3.2 a (0)
Talus 70DF (buprofezin)	14 oz	0.2 ab	0.1 (88)	0.1 (85)	0.1 c (90)	0.1 c (93)	1.0 bc (26)
TetraCURB Conc (rosemary oil)	128 fl oz	1.0 a	1.4 (67)	1.4 (59)	2.0 abc (60)	1.5 ab (78)	1.8 abc (74)
TetraCURB Org (rosemary oil)	128 fl oz	0.2 ab	0.1 (88)	0.8 (0)	2.0 abc (0)	2.0 ab (0)	3.8 a (0)
Ventigra (afidopyropen)	7 fl oz	0.0 b	0.1 (nc)	0.6 (nc)	0.7 bc (nc)	0.8 bc (nc)	0.6 c (nc)
Untreated	-	0.5 ab	2.1 (0)	1.7 (0)	2.5 ab (0)	3.4 a (0)	3.4 a (0)
Number of aulacaspis scale nymphs per cm of leaflet length [x]							
Altus (flupyradifurone)	14 fl oz	7.3 ab	5.3 abc (24)	3.0 (0)	1.9 ab (0)	2.1 b (81)	7.2 (18)
Azaguard (azadirachtin)	16 fl oz	11.9 a	8.2 a (28)	5.0 (0)	3.9 a (0)	11.2 a (37)	6.4 (55)
KOC22018-8 (botanical oil blend)	128 fl oz	6.2 ab	6.5 ab (0)	-	2.1 ab (0)	6.1 ab (34)	4.7 (37)
Pradia SL (cyclaniliprole + flonicamid)	16.5 fl oz	9.0 ab	3.6 abc (58)	3.3 (4)	1.0 ab (22)	5.4 ab (60)	4.5 (59)
Sarisa (cyclaniliprole)	28 fl oz	7.5 ab	7.5 ab (0)	-	2.1 ab (0)	9.6 a (14)	8.4 (7)
Talus 70DF (buprofezin)	14 oz	7.5 ab	2.9 bc (59)	6.2 (0)	1.5 ab (0)	3.7 ab (67)	4.6 (49)
TetraCURB Conc (rosemary oil)	128 fl oz	4.7 b	3.2 bc (29)	2.3 (0)	0.7 ab (0)	5.8 ab (17)	6.0 (0)
TetraCURB Org (rosemary oil)	128 fl oz	8.1 ab	6.4 ab (17)	3.1 (0)	0.6 ab (48)	7.1 a (41)	4.5 (54)
Ventigra (afidopyropen)	7 fl oz	6.9 ab	0.8 c (88)	2.9 (0)	0.1 b (90)	1.3 b (87)	3.1 (63)
Untreated	-	6.3 ab	6.0 abc (0)	2.4 (0)	0.9 ab (0)	9.4 a (0)	7.6 (0)
Number of aulacaspis scale crawlers per cm of leaflet length [x]							
Altus (flupyradifurone)	14 fl oz	0.4 ab	0.1 (0)	0.0 (nc)	0.0 (100)	0.9 (6)	1.1 (0)
Azaguard (azadirachtin)	16 fl oz	1.9 ab	0.2 (0)	0.1 (nc)	0.7 (39)	1.4 (69)	1.4 (57)
KOC22018-8 (botanical oil blend)	128 fl oz	1.4 ab	0.0 (100)	-	0.1 (88)	1.7 (49)	2.3 (3)
Pradia SL (cyclaniliprole + flonicamid)	16.5 fl oz	2.1 a	0.0 (100)	0.0 (nc)	0.2 (84)	3.4 (33)	1.4 (61)
Sarisa (cyclaniliprole)	28 fl oz	1.5 ab	0.0 (100)	-	0.6 (33)	3.4 (6)	2.6 (0)
Talus 70DF (buprofezin)	14 oz	1.8 ab	0.0 (100)	0.1 (nc)	0.6 (44)	0.3 (93)	3.4 (0)
TetraCURB Conc (rosemary oil)	128 fl oz	1.7 ab	0.3 (0)	0.0 (nc)	0.2 (80)	2.4 (41)	1.8 (38)
TetraCURB Org (rosemary oil)	128 fl oz	0.4 ab	0.0 (100)	0.1 (nc)	0.1 (58)	3.7 (0)	3.6 (0)
Ventigra (afidopyropen)	7 fl oz	0.3 b	0.0 (100)	0.0 (nc)	0.2 (0)	1.5 (0)	0.8 (0)
Untreated	-	1.0 ab	0.1 (0)	0.0 (nc)	0.6 (0)	2.4 (0)	1.7 (0)

[x] Means within a column followed by same letter do not significantly differ (Tukey HSD test, P=0.05). When treatment did not have a significant effect on number of scale, no letters follow the means for that evaluation

Table 28. Efficacy on Elongate Hemlock Scale and Cryptomeria Scale on Frasier Fir, Cowles, CT, 2005.

Treatment	Rate (No. of applications)	Live per 1000 needles	Percent Control
Admire 2F - Drench	0.5 lb/Acre, drench	3080 ab	63
Cygon 267	32 fl oz/100 gal (2)	507 b-f	94
Cygon 267 - Drench	60 ml/tree, drench	313 efg	96
Esteem 35WP	2.5 oz/100 gal (2)	800 b-f	90
Flagship 25WP	2.0 oz/100 gal (2)	273 c-f	97
Flagship 25WP	4.0 oz/100 gal (2)	240 b-f	97
Lesco Oil	1%	3280 ab	60
Lesco Oil	2%	5270 a	36
Lesco Oil + Silwet L-77	2% + 4 fl oz/100 gal	2244 abc	73
Lorsban 75WDG	0.66 lb/100 gal (2)	1320 a-d	84
Onyx	2.6 oz/100 gal	452 b-e	94
Onyx + Lesco Oil	2.6 oz/100 gal + 1%	1160 a-d	86
Safari 20SG	4.0 oz/100 gal (2)	453 b-f	94
Safari 20SG	8.0 oz/100 gal (2)	49.1 fgh	99
Safari 20SG – Drench	3 g/ft of tree height	12.4 gh	100
Safari 20SG – Drench	6 g/ft of tree height	0.0 h	100
Talus 40SC	21.5 fl oz/100 gal (2)	348 b-f	96
TriStar 70WSP	48 g/100 gal (2)	225 def	97
TriStar 70WSP	96 g/100 gal (2)	554 fgh	93
Untreated check	-	8220 a	-

* Letters after numbers are based on separation of average number of scale on 4 plants. See experiment report in Appendix 3 for statistical separation details.

Table 29. Efficacy on Elongate Hemlock Scale and Cryptomeria Scale and its Parasite *Encarsia citrina* on Frasier Fir, Cowles, CT, 2008.

Treatment	Rate per acre	Application Method, Timing	# Scales per 100 needles	Percent Control	Percent Parasitism
BotaniGard ES (*Beauveria bassiana*)	64 fl oz	Foliar, June 3	1530 a	0	15.5 a
BotaniGard ES (*Beauveria bassiana*) + Prev-Am	64 fl oz	Foliar, June 3	1230 abc	0	8.5 bcde
Movento 240SC 240(spirotetramat) + MSO	5 fl oz	Foliar, May 19	1470 ab	0	14.3 ab
Movento 240SC 240(spirotetramat) + MSO	10 fl oz	Foliar, May 19	742 def	7	13.2 ab
Movento 240SC (spirotetramat) + MSO	5 fl oz	Foliar, June 3	1090 bcd	0	14.5 ab
Movento 240SC (spirotetramat) + MSO	10 fl oz	Foliar, June 3	857 cde	0	10.9 abcd
Onyx Pro (bifenthrin)	6.4 fl oz	Foliar, June 3	279 g	65	2.5 e
Safari 20SG (dinotefuran)	0.68 lb	Soil, June 3	528 efg	34	7.2 cde
Safari 20SG (dinotefuran)	1.35 lb	Soil, June 3	810 cde	0	9.6 abcd
Safari 20SG (dinotefuran)	2.7 lb	Soil, June 3	328 fg	59	8.9 abcde
Safari 20SG (dinotefuran)	0.68 lb	Trunk spray, June 3	106 g	87	5.6 de
Safari 20SG (dinotefuran)	1.35 lb	Trunk spray, June 3	114 g	86	7.6 cde
Safari 20SG (dinotefuran)	2.7 lb	Trunk spray, June 3	194 g	76	5.3 de
Untreated	-	-	796 de	-	11.8 abcd

* Means followed by the same letter in the same column are not significantly different, for non-transformed data(LSD test, $P < 0.05$).

Euonymus Scale

From 2004 through 2014, several researchers have examined insecticide efficacy for euonymus scale. In general, neonicotinoids tended to provide good control, as did Distance; variable control was obtained with Talus, A16901B and XXpire.

Freiberger. In 2004 and 2005, efficacy of several products and new active ingredients were tested in two experiments conducted at the Rutgers Cream Ridge Station for winged euonymus scale (*Lepidosaphes yanagicola*) on euonymus. In the 2004 experiment, treatments did not start exhibiting good efficacy until 27 DAT, but only Talus SC provided 100% control by 45 DAT (Table 30). Most of the systemic products had delayed efficacy similar to the growth regulators Talus and Distance. Kontos provided some efficacy in this experiment. In the 2005 experiment, none of the products performed better than 87% control with only Orthene and Flagship providing reasonable control throughout the experiment (Table 31). Talus did achieve the same level by the end of the experiment. Safari 20SG did not reduce mealybug populations either as a drench or foliar application.

Table 30. Efficacy on Winged Euonymus Scale on Euonymus, Freiberger, NJ, 2004.

		Population Averages (Henderson's Percent Control)				
Treatment	**Rate**	**Pretreatment counts (6/28/04 & 6/30/04)**	**6 DAT**	**13 DAT**	**27 DAT**	**45 DAT**
Diazinon	8.96 oz/100 gal	7.2	13.4 (13)	7.9 (28)	5.3 (71)	48.8 (38)
Distance 0.86E	8 fl oz/100 gal	14.5	30.4 (3)	22.9 (0)	20.6 (44)	72.1 (55)
Distance 0.86E	16 fl oz/100 gal	3.4	19.2 (0)	11.8 (0)	6.4 (26)	26.3 (30)
Distance 0.86E	32 fl oz/100 gal	12.5	32.1 (0)	14.9 (22)	7.2 (77)	19.4 (86)
Flagship 25 WG	2 oz/100 gal	9.7	15.4 (26)	11.1 (25)	11.5 (53)	113.1 (0)
Flagship 25 WG	4 oz/100 gal	32.4	30.6 (56)	13.3 (73)	14.7 (82)	80.0 (77)
Flagship 25 WG	8 oz/100 gal	31.9	47.3 (31)	23.1 (53)	22.8 (72)	105.0 (70)
Kontos *	20 fl oz/100 gal	18.7	26.9 (33)	7.8 (73)	6.3 (87)	58.8 (71)
Kontos *	40 fl oz/100 gal	7.3	10.8 (32)	7.1 (37)	9.6 (49)	97.0 (0)
Safari 20SG **	12 oz/100 gal	9.8	23.5 (0)	21.6 (0)	35.0 (0)	228.6 (0)
Safari 20SG **	24 oz/100 gal	3.4	11.5 (0)	17.2 (0)	20.8 (0)	80.5 (0)
Safari 20SG **	48 oz/100 gal	6.2	10.6 (20)	13.6 (0)	15.5 (1)	101.4 (0)
Talus 40 SC	21.5 fl oz/100 gal	8.8	20.2 (0)	20.4 (0)	12.4 (45)	25.9 (73)
Talus 40 SC	43 fl oz/100 gal	9.0	23.5 (0)	9.3 (33)	7.0 (69)	0.0 (100)
Talus 40 SC	86 fl oz/100 gal	15.4	29.3 (12)	10.7 (55)	5.6 (86)	0.7 (100)
TriStar 70WSP	32 g/100 gal	8.6	26.1 (0)	6.3 (53)	6.9 (68)	33.2 (65)
TriStar 70WSP	64 g/100 gal	9.8	17.0 (19)	12.0 (20)	12.7 (49)	18.3 (83)
TriStar 70WSP	128 g/100 gal	33.0	50.5 (29)	21.5 (58)	20.8 (75)	87.3 (76)
Untreated Control	---	13.7	29.6 (0)	21.1 (0)	34.8 (0)	150.5 (0)

* Kontos (BYI-8330) was applied solely on 7/2/04.

** Safari SG was applied as foliar spray instead of drench.

Table 31. Efficacy on Euonymus Scale on Euonymus, Freiberger, NJ, 2005.

Treatment	Rate	Population Averages (Henderson's Percent Control)				
		Pretreatment Counts	7 DAT	15 DAT	29 DAT	44 DAT
Flagship	2 oz per 100 gal	21.2	25.9 (55)	36.7 (36)	20.7 (63)	22.6 (66)
Flagship	4 oz per 100 gal	25.4	16.6 (76)	22.8 (67)	9.1 (87)	15.6 (81)
Orthene TTO	8 oz per 100 gal	24.0	12.1 (81)	21.9 (66)	20.1 (69)	10.7 (86)
Safari drench	12 oz/acre	3.9	8.1 (24)	10.9 (0)	10.9 (0)	24.0 (0)
Safari drench	24 oz/acre	5.1	16.2 (0)	22.3 (0)	22.7 (0)	41.8 (0)
Safari foliar	4 oz per 100 gal	11.4	20.7 (32)	39.7 (0)	39.0 (0)	57.9 (0)
Safari foliar	8 oz per 100 gal	11.8	14.0 (56)	20.3 (36)	16.2 (48)	28.7 (23)
Talus 40SC	21.5 fl oz per 100 gal	5.3	13.8 (4)	8.6 (40)	2.1 (85)	4.7 (72)
TriStar 70WSP	112 g per 100 gal	20.3	24.1 (56)	30.6 (44)	33.8 (37)	29.5 (54)
TriStar 70WSP	224 g per 100 gal	16.1	14.7 (66)	41.5 (4)	59.8 (0)	42.3 (17)
Untreated Control		16.2	43.6 (0)	43.5 (0)	43.1 (0)	51.0 (0)

* Note: outlier data point in Flagship 4 oz per 100 gallon rate was removed. This bush started with 348 scale in the initial count, an amount far greater than any other plant.

Nielsen. In 2007 and 2009, Nielsen investigated the efficacy of neonicotinoids (Flagship, Safari and TriStar), insect growth regulators (Distance and Talus) and Rycar (pyrifluquinazon)on euonymus scale (*Unaspis euonymi*) infesting euonymus (*Euonymus vegetus*) 'Fortunei' in the landscape.

In the 2007 experiment comparing drench and trunk spray applications of Safari, only the spray treatment controlled first generation nymphs at 34 DAT (Table 32). The drench application looked somewhat succesful on the second generation nymphs at 89 DAT. The early spray treatment was beginning to fail at that time, indicating that two spray applications might be required to "clean-up" scale-infested euonymus in the landscape.

In the 2009 experiment on container plants, foliar sprays of Distance, Talus and UltraFine oil, and Safari drench provided a high level of scale control. TriStar looked promising, but Flagship, Rycar and Safari top-dress were relatively ineffective. These results were mostly reflected when evaluating treatment effects on second generation production of new adults in mid-September. At this time, TriStar looked ineffective.

No phytotoxicity was observed in either experiment.

Table 32. Efficacy on Euonymus Scale on Euonymus 'Fortunei', Nielsen, OH, 2007.

Treatment	Rate	Application Method, Timing	Percent Nymphs Dead	
			34 DAT	89 DAT
Safari 20SG (dinotefuran)	24 oz/100gal	Trunk spray, May 3	98	84
Safari 20SG (dinotefuran)	6 g/ ft height	Drench, May 3	3	80
Safari 20SG (dinotefuran)	6 g/ ft height	Drench, May 30	9	44
Untreated	-	-	6	4

Table 33. Efficacy on Euonymus Scale on Euonymus 'Sunspot', Nielsen, OH, 2009.

Treatment	Rate	Application Method, Timing	% Nymph Mortality 15 DAT (6/27/09)	# Live adult scales 91 DAT (9/11/09)
Distance 10EC (pyriproxyfen)	12 fl oz/100 gal	Foliar, June 12, 26	99	0
Flagship 0.22G (thiamethoxam)	114 g/ft. ht	Top-dress, June 26	-	100+
Flagship 25WG (thiamethoxam)	8 oz/100gal	Foliar, June 12, 26	63	75
Rycar 20SC (pyrifluquinazon)	12 fl oz/100 gal	Foliar, June 12, 26	49	100+
Safari 2G (dinotefuran)	60 g/ft. ht	Top-dress, June 12	71	38
Safari 20SG (dinotefuran)	6 g/ft. ht	Drench, June 12	91	3
Talus 40 SC (buprofezin)	21.5 fl oz/100 gal	Foliar, June 12, 26	92	0
TriStar 30 SG (acetamiprid)	8 oz/100 gal	Foliar, June 12, 26	88	91
UltraFine Oil	3 % solution	Foliar, June 12, 26	90	0
Untreated	-	-	15	100+

Frank. In 2009 and 2010, Frank evaluated the efficacy of neonicotinoids (Flagship, Safari and TriStar),insect growth regulators (Distance and Talus), A16901B, Kontos,Rycarand Talstar on euonymus scale (*Unaspis euonymi*) infesting spindle tree (*Euonymus japonica*) 'Mycrophylla'. All treatments significantly reduced scale population, comparable to the standard Acephate and Horticultural oil (Table 34,Table 35).

No phytotoxicity was observed on any of the treated plants.

Table 34. Efficacy on Euonymus Scale on Spindle Tree'Microphylla', Frank, NC, 2009.

Treatment	Rate	Application Method	Population Averages (Henderson's Percent Control)				
			Pretreatment Counts	1 WAT	2 WAT	4 WAT	6 WAT
Acephate 75WP	0.67 lb/100 gal	Foliar	151.2 a	68.0 c (45)	4.3 d (67)	2.5 c (18)	0.5 b (56)
Distance 10EC (pyriproxyfen)	12 fl oz/100 gal	Foliar	102.3 a	50.8 c (40)	5.7 d (41)	0.5 c (88)	0.2 b (11)
Flagship 0.22G (thiamethoxam)	60 g/plant	Broadcast	203.7 a	108.0 bc (36)	32.0 abc (0)	18.0 b (20)	3.7 b (54)
Flagship 25WG (thiamethoxam) + Dyne-Amic	8 oz/100gal	Foliar	184.5 a	103.0 bc (32)	12.3 cd (37)	0.5 c (94)	1.3 b (0)
Rycar20SC (pyrifluquinazon)	18 fl oz/100 gal	Foliar	265.2 a	160.2 ab (27)	9.5 cd (69)	1.3 c (81)	1.2 b (0)
Safari 2G (dinotefuran)	7.8 g/plant	Broadcast	213.0 a	129.7 bc (26)	39.7 ab (0)	5.0 c (82)	1.2 b (47)
Safari 20SG (dinotefuran)	24 oz/100gal	Drench	166.7 a	167.0 ab (0)	3.2 d (90)	1.0 c (56)	0.5 b (0)
Talus 40 SC (buprofezin)	21.5 fl oz/100 gal	Foliar	204.3 a	65.0 c (68)	4.7 d (62)	2.7 c (19)	0.2 b (32)
TriStar 30 SG (acetamiprid) + Capsil	8 oz/100 gal + 6 fl oz/100 gal	Foliar	158.3 a	111.5 bc (14)	17.3 bcd (18)	4.2 c (66)	2.5 b (0)
Untreated	-	-	265.5 a	218.3 a (0)	41.5 a (0)	29.3 a (0)	13.2 a (0)

* Means followed by same letter do not significantly differ (Duncan's New MRT, P=0.05)

Table 35. Efficacy on Euonymus Scale on Spindle Tree 'Microphylla', Frank, NC, 2010.

Treatment	Rate	Application Method	Population Averages (Henderson's Percent Control)				
			Pretreat	1 WAT	2 WAT	4 WAT	6 WAT
A16901B	5 oz/100 gal	Drench	221.5 a	65.8 a (61)	9.0 b (95)	6.2 b (97)	6.2 b (95)
Distance 10EC (pyriproxyfen)	12 fl oz/100 gal	Foliar	242.0 a	122.7 a (33)	76.8 b (59)	33.5 b (87)	9.0 b (93)
Flagship 0.22G (thiamethoxam)	60 g/plant	Broadcast	202.5 a	64.2 a (58)	39.5 b (75)	14.0 b (94)	4.8 b(96)
Flagship 25WG (thiamethoxam) + Dyne-Amic	8 oz/100gal	Foliar	225.3 a	102.0 a (41)	43.7 b (75)	22.5 b (91)	2.8 b (98)
Horticultural Oil	5 qt/100 gal	Foliar	135.0 a	48.3 a (53)	8.2 b (92)	3.0 b (98)	1.0 b(99)
Kontos (spirotetramat)	3.4 fl oz/100gal	Foliar	234.7 a	68.7 a (62)	24.3 b (87)	7.8 b (97)	0.5 b (100)
Rycar 20SC (pyrifluquinazon)	18 fl oz/100 gal	Foliar	229.7 a	109.3 a (38)	46.8 b (74)	3.2 b (99)	0.0 b (100)
Safari 2G (dinotefuran)	7.8 g/plant	Broadcast	172.7 a	86.7 a (34)	33.8 b (75)	7.0 b (96)	1.0 b (99)
Safari 20SG (dinotefuran)	24 oz/100gal	Drench	206.8 a	109.3 a (31)	41.8 b (74)	7.2 b (97)	2.2 b (98)
Talstar (bifenthrin)	21.7 oz/100 gal	Foliar	166.3 a	122.3 a (3)	41.8 b (68)	4.7 b (97)	1.0 b (99)
Talus70 DF (buprofezin)	14 oz/100 gal	Foliar	199.2 a	55.7 a (63)	50.3 b (68)	2.7 b (99)	0.8 b (99)
TriStar 30 SG (acetamiprid) + DyneAmic	8 oz/100 gal	Foliar	184.3 a	95.3 a (32)	32.3 b (78)	6.8 b (97)	1.8 b (98)
Untreated	-	-	238.0 a (0)	181.3 a (0)	186.3 a (0)	261.8 a (0)	127.0 a (0)

* Means followed by same letter do not significantly differ (Duncan's New MRT, P=0.05).

Ludwig. In 2009, Ludwig evaluated the efficacy of neonicotinoids (Aloft, Flagship, Safari and TriStar), insect growth regulators (Distance and Talus) and Triact (neem oil extract) on euonymus scale (*Unaspis euonymi*) infesting spindle tree (*Euonymus japonica*) 'Mycrophylla'. All treatments provided significantlyhigher scale mortality 57 days after the first application (Table 36).Safari was the best, and Tristar the least effective treatment.

Table 36. Efficacy on Euonymus Scale on Spindle Tree 'Microphylla', Ludwig, TX, 2009.

Treatment	Rate	Application Method	Percent Female Adult Scale Mortality		
			Pretreatment	29 DAT	57 DAT
Aloft SC	5 fl oz/100 gal	Foliar	23.3a	94.0a	77.3ab
Aloft SC	10 fl oz/100 gal	Foliar	32.7a	82.7abc	97.3ab
Distance 10EC (pyriproxyfen)	12 fl oz	Foliar	38.7a	46.7cde	92.8ab
Flagship 25WG (thiamethoxam)	8 oz/100gal	Foliar	26.7a	68.0abcd	80.1ab
Safari 2G (dinotefuran)	2.6 g / gallon of media	Media mix	34.7a	96.0a	99.2a
Safari 20SG (dinotefuran)	24 oz/100gal	Drench	18.7a	66.4abcd	99.3a
Talus 40 SC (buprofezin)	21.5 fl oz/100 gal	Foliar	21.3a	29.3de	82.7ab
Triact 70 (neem oil extract)	2 gal/100 gal	Foliar	29.6a	91.3ab	90.0ab
TriStar 30 SG (acetamiprid)	8 oz/100 gal + 6 fl oz/100 gal	Foliar	30.0 a	57.3 bcde	62.0 b
Untreated	-	-	25.3 a	17.3 e	12.0 c

* Means within a column followed by the same letter are not significantly different (Tukey's HSD, P< 0.05).

Potter. In 2010, Potter evaluated the efficacy of neonicotinoids (Flagship, Safari and TriStar), insect growth regulators (Distance and Talus), A16901B, Kontos and Rycar on euonymus scale (*Unaspis euonymi*) infesting spindle tree (*Euonymus japonica*) 'Moonshadow'. Distance, Safari and Talus provided good control while A16901B, Flagship, Kontos, Rycar, Tristar and the standard Horticultural Oil performed poorly (Table 37). No phytotoxicity was observed on any of the treated plants.

Kunkel. In 2011, Kunkel evaluated the efficacy of neonicotinoids (Flagship, Safari and TriStar), insect growth regulators (Distance and Talus), QRD 452 and Rycar on euonymus scale (*Unaspis euonymi*) infesting wintercreeper (*Euonymus fortunei*) 'Radicans'. Safari and Talus provided good control while Distance, Horticultural Oil, QRD 452 and Tristar were generally inferior (Table 38). No phytotoxicity or growth reduction was observed on any of the treated plants.

Table 37. Efficacy on Euonymus Scale on Spindle Tree 'Moonshadow', Potter, KY, 2010.

Treatment	Rate (per 100 gal)	Application Method, Timing	No. Live Scales, 1st Generation (% Control)	No. Live Scales, 2nd Generation (% Control)
A16901B	5 oz	Drench, May 10	16.8 ± 3.7 e (0)	20.5 ± 4.3 d (0)
Distance 10EC (pyriproxyfen)	12 fl oz	Foliar, May 10, June 1	1.1 ± 0.5 ab (84)	2.8 ± 1.3 a (59)
Flagship 0.22G broadcast	40 g/2 gal pot	Media mix, May 10	5.6 ± 1.5 cd (20)	9.4 ± 2.3 bc (0)
Flagship 25WG + spreader-sticker	8 oz	Foliar, May 10, June 1	5.4 ± 1.6 bcd (23)	13.3 ± 2.5 c (0)
Horticultural Oil	2 gal	Foliar, May 10	3.7 ± 0.9 a-d (47)	9.4 ± 2.4 bc (0)
Kontos (spirotetramat)	3.4 fl oz	Foliar, May 10	7.7 ± 2.8 d (0)	6.3 ± 1.4 ab (7)
Rycar 20SC (pyrifluquinazon)	18 fl oz	Foliar, May 24	2.1 ± 0.9 abc (70)	9.9 ± 2.5 bc (0)
Safari 20SG (dinotefuran)	24 oz	Drench, May 10	0.2 ± 0.1 a (97)	0.7 ± 0.3 a (90)
Talus 40 SC (buprofezin)	21.5 fl oz	Foliar, May 10	0.3 ± 0.1 a (96)	1.0 ± 0.6 a (85)
TriStar 30 SG (acetamiprid)	8 oz	Foliar, May 10, 24	2.2 ± 0.7 abc (69)	4.8 ± 1.3 ab (29)
Untreated	-	-	7.0 ± 1.7 d (0)	6.8 ± 2.4 ab (0)

* Means within a column followed by the same letter are not significantly different (LSD All-Pairwise Comparisons Test). First and 2nd generation scales counted June 21-22 and October 4-7, respectively.

Table 38. Efficacy on Euonymus Scale on Wintercreeper, (*Euonymus fortunei*) 'Radicans', Kunkel, DE, 2011.

Treatment	Rate (per 100 gal)	Average % Mortality[x]				
		Pretreat	7 DAT	14 DAT	28 DAT	42 DAT
Distance 10EC	12 fl oz	6.6 a	30.4 a	30.3 ab	72.4 ab	73.5 bc
Flagship 25WG + Capsil	8 oz	10.3 a	46.6 a	27.7 ab	46.5 cd	64.7 cd
Flagship 0.22G broadcast	20 g/1 gal pot	8.4 a	30.1 a	55.4 a	60.2 abc	65.4 cd
Horticultural Oil	1 gal	11.1 a	33.0 a	46.7 ab	69.7 abc	71.7 bc
Rycar 20SC	18 fl oz	7.7 a	30.0 a	43.3 ab	51.8 bcd	56.3 cd
QRD 452	128 oz	4.3 a	42.0 a	31.1 ab	58.9 abc	73.0 bc
Safari 20SG drench	24 oz	10.3 a	51.3 a	35.6 ab	72.2 abc	90.0 ab
Talus 40SC	21.5 fl oz	17.5 a	62.3 a	49.6 a	76.5 a	92.0 a
TriStar 30SG + Capsil	8 oz	3.9 a	41.4 a	41.7 ab	47.8 bcd	69.3 bc
Untreated	-	7.6 a	24.6 a	12.0 b	30.0 d	43.0 d

[x] Means followed by same letter do not significantly differ (Tukey's HSD, P=0.05).

Gilrein. In 2011, Gilrein evaluated the efficacy of neonicotinoids (Flagship, Safari and TriStar), insect growth regulators (Distance and Talus), A16901B, Kontos and Rycar on euonymus scale (*Unaspis euonymi*) infesting euonymus (*Euonymus japonicus*) 'Green Spire'. Talus and Distance were most effective for controlling euonymus scale, followed closely by Kontos (Table 39). No or nearly no live females were found at final observation (Sept. 11) on plants treated with Distance or Talus. TriStar, Safari, Rycar and A16901 all had noticeably lower numbers of females on treated plants than the untreated, but differences were not significant; Flagship was ineffective. No differences in plant heights, widths and overall quality were seen among treatments (data not shown). No phytotoxicity was observed in any of the treated plants.

Table 39. Efficacy on Euonymus Scale on Euonymus, (*Euonymus japonicus*) 'Green Spire', Gilrein, NY, 2011.

Treatment	Rate Per 100 Gal	Applic. Method, Timing	Population Averages[x] (Percent Control)						
			Crawlers 6/10	Crawlers 7/11	Females 7/11	Males 7/11	Females + Males 7/11	All Stages 7/11	Females 9/19
A16901B 40WG	5 oz	Drench, 6/15	135.6 a	36.2a (0)	115.6a (0)	18.4ab (0)	134.0a (0)	170.0a (0)	22.4ab (53)
Distance 0.86EC	12fl oz	Spray, 6/15, 7/6	147.0 a	16.6 ab (0)	16.8 cd (71)	0.6 c (81)	17.4 cd (71)	34.0 b (55)	0.4 cd (99)
Flagship 25WG	0.5 g/ft ht	Drench, 6/15	128.2 a	48.4a (0)	77.0ab (0)	61.8a (0)	138.8a (0)	187.2a (0)	53.4a (0)
Kontos 2F	3.4 fl oz	Spray, 6/15	128.6 a	6.2 b (59)	23.2 bc (60)	26.6 bc (0)	32.8 b (46)	7.8 bc (90)	26.6 bc (44)
Rycar 1.80SC	18 fl oz	Spray, 6/15	144.2 a	13.0 ab (14)	51.4 abc (10)	3.8 bc (0)	55.2 abc (9)	68.2 ab (10)	12.4 ab (74)
Safari 20SG	24 oz	Drench, 6/15	153.0 a	54.6 a (0)	33.2 abc (42)	46.6 a (0)	79.8 ab (0)	134.4 a (0)	17.8 ab (62)
Talus 70DF	14 oz	Spray, 6/15	131.6 a	3.2 b (80)	5.6 d (90)	0.2 c (94)	5.8 d (90)	9.0 c (88)	0.0 d (100)
TriStar 30SG + Capsil	8 oz + 6 fl oz	Spray, 6/15, 6/29	141.6 a	33.2 a (0)	49.6 abc (14)	9.4 abc (0)	59.0 abc (3)	92.2 ab (0)	17.6 ab (63)
Untreated	water	Spray, 6/15	133.8 a	15.2 ab (0)	57.4 abc (0)	3.2 bc (0)	60.6 abc (0)	75.8 ab (0)	47.2 a (0)

[x] Means within columns followed by the same letter are not significantly different at p=0.05 (LSMeans Tukey's HSD).

Braman. In 2014, Braman evaluated the efficacy of various insecticides applied as foliar sprays on May 14 and 28 for euonymus scale (*Unaspis euonymi*) infesting euonymus in containers. All treatments provided excellent control of nymphs within 2 weeks after treatment and through 6 months for adults (Table 40).

Table 40. Efficacy on Euonymus Scale on Euonymus, Braman, GA, 2014.

Treatment	Rate Per 100 Gal	Population Averages[x] (Percent Control)				
		Nymphs			Adults	
		Day 0	Day 7	Day 14	4 Months	6 Months
Distance	12 floz	14.2 a	3.2 a (98)	3.2 ab (99)	0.0 b	0.0 b (100)
Horticultural Oil	2 gal	0.7 b	5.3 a (29)	0.5 b (96)	0.0 b	0.0 b (100)
Mainspring 200SC	8 floz	7.3 ab	14.5 a (81)	0.2 b (99)	0.3 b	2.7 b (99)
	12 floz	0.8 b	0.8 a (91)	0.3 b (98)	0.0 b	0.0 b (100)
Orthene TTO 97	8 oz	1.7 b	3.2 a (82)	0.8 b (97)	0.0 b	0.0 b (100)
Safari 20SG	24 oz	7.0 ab	18.7 a (75)	1.5 ab (99)	0.0 b	0.0 b (100)
Talus 70DF	14 oz	0.2 b	1.0 a (53)	0.0 b (100)	0.0 b	0.0 b (100)
XXpire 40WG + Capsil	2 oz + 6 floz	0.7 b	0.3 a (96)	0.0 b (100)	0.0 b	0.0 b (100)
	2.75 oz + 6 floz	14.7 a	0.8 a (99)	0.0 b (100)	0.0 b	0.0 b (100)
	3.5 oz + 6 floz	0.2 b	2.5 a (0)	0.5 b (84)	0.0 b	0.0 b (100)
Untreated	-	0.3 b	3.2 a (0)	4.8 a (0)	0.0 b	9.8 a (0)

[x] Number counted from 3 leaves. Means followed by same letter do not significantly differ (LSD, P=0.05).
* Mainspring and Safari applied as drench.

Potter. In 2014, Potter evaluated the efficacy of several insecticides on euonymus scale (*Unaspis euonymi*) infesting potted wintercreeper (*Euonymus fortunei*) 'Emerald N Gold'. Orthene and XXpire (3.5 oz rate) provided the best control (more than 70%) of scale populations (Table 41). XXpire (2.0 oz rate) and Mainspring (12 oz rate) both significantly reduced scale populations, but to lower degree at 61.0% and 36.4%, respectively. The IGR's Distance and Talus looked ineffective. No phytotoxicity was observed on any of the treated plants.

Table 41. Efficacy on Euonymus Scale on Wintercreeper (*Euonymus fortunei*) 'Emerald N Gold', Potter, KY, 2014.

Treatment	Rate (per 100 gal)	Application Method, Timing	Adult Female Scales[x]	Percent Reduction
Distance	12 fl oz	Foliar At crawler stage. Repeat at 3 wks	7.8± 2.6 bc	0%
Mainspring 200SC	8 floz	Soil drench. 30 day prior to hatch. 3 floz per pot.	6.0 ± 1.2 bc	22.1%
	12 floz		4.9± 1.5 ab	36.4%
Orthene	150 fl oz	Foliar At crawler stage. Repeat at 1 wk	2.0± 0.5 a	74.0%
Talus 70DF	14 oz	Foliar At crawler stage.	5.6 ± 1.4 bc	27.3%
XXpire 40WG + Capsil	2 oz + 6 floz	Foliar At crawler stage. Repeat at 2 wks.	3.0± 0.6 ab	61.0%
	2.75 oz + 6 floz		5.9 ± 1.7 bc	23.4%
	3.5 oz + 6 floz		1.9± 0.4 a	75.3%
Untreated	-	-	7.7 ± 1.5 c	-

[x] Number per 10 cm of twig. Means within a column followed by the same letter are not significantly different (LSD All-Pairwise Comparisons Test).

False Florida Red Scale

In 2009, Chong evaluatedthe efficacy of neonicotinoids (Flagship, Safari and TriStar), insect growth regulators (Distance and Talus) and Rycar (pyrifluquinazon) on false Florida red scale (*Chrysomphalus bifasciculatus*) on Chinese holly (*Ilex cornuta*) 'Carissa'. Insecticide treatments did not significantly reduce the numbers of live scales in the first 2 weeks after the application (Table 42). At 4 and 6 WAT, only Flagship and Safari provided effective control, providing 99% mortality (Table 43).

No phytotoxicity was observed on any of the treated holly shrubs.

Table 42. Efficacy on False Florida Red Scale on Chinese Holly 'Carissa', Chong, SC, 2009.

Treatment	Rate	Application Method	Population Averages (Henderson's Percent Control)				
			Pretreatment Counts	1 WAT	2 WAT	4 WAT	6 WAT
Distance 10EC (pyriproxyfen)	12 fl oz	Foliar	28.9 a	12.4 a (87)	12.9 a (50)	4.5 b(0)	10.7 bc(0)
Flagship 25 WG (thiamethoxam)	4 g/ft height	Drench	33.3 a	24.2 a (78)	84.6 a (0)	14.3 ab(46)	1.1 c(94)
Rycar20SC (pyrifluquinazon)	18 fl oz/100 gal	Foliar	49.5 a	24.6 a (85)	14.2 a (72)	12.3 ab(0)	21.0 abc (0)
Paraffinic oil	2 gal/100 gal	Foliar	49.6 a	44.7 a (73)	47.8 a (49)	14.0 ab(7)	17.6 abc(7)
Safari 20SG (dinotefuran)	6 g/ft height	Drench	11.1 a	16.8 a (55)	24.3 a (31)	2.2 b(71)	0.2 c(93)
Talus 40 SC (buprofezin)	21.5 fl oz/100 gal	Foliar	58.1 a	47.8 a (75)	44.6 a (56)	36.3 a(0)	30.4 ab (38)
TriStar 30 SG (acetamiprid) + Capsil	8 oz/100 gal + 6 fl oz/100 gal	Foliar	41.2 a	50.3 a (63)	30.3 a (71)	15.3 ab(0)	11.6 abc(44)
Untreated	-	-	14.5 a	48.5 a (0)	101.8 a (0)	32.1 a(0)	43.3 a(0)

* Means within columns with the same letter are not significantly different (LSD test, $P<0.10$).

Table 43. Efficacy on False Florida Red Scale on Chinese Holly, 'Carissa', Chong, SC, 2009.

Treatment	Rate	Application Method	Average % Mortality				
			Pretreatment	1 WAT	2 WAT	4 WAT	6 WAT
Distance 10EC (pyriproxyfen)	12 fl oz	Foliar	85.9 a	90.8 a	93.8 a	96.8 a	95.1 ab
Flagship 25WG (thiamethoxam)	4 g/ft height	Drench	72.6 a	80.5 a	81.0 a	90.6 abc	99.4 a
Rycar20SC (pyrifluquinazon)	18 fl oz/100 gal	Foliar	73.5 a	84.6 a	89.8 a	93.3 abc	90.9 bc
Paraffinic oil	2 gal/100 gal	Foliar	67.5 a	83.9 a	79.4 a	94.0 abc	89.3 bc
Safari 20SG (dinotefuran)	6 g/ft height	Drench	85.8 a	89.6 a	91.8 a	98.5 a	99.9 a
Talus 40SC (buprofezin)	21.5 fl oz/100 gal	Foliar	71.3 a	80.0 a	76.4 a	82.1 bc	88.6 bc
TriStar 30SG (acetamiprid) + Capsil	8 oz/100 gal + 6 fl oz/100 gal	Foliar	62.3 a	71.9 a	81.3 a	90.0 abc	90.6 bc
Untreated	-	-	86.7 a	80.9 a	73.3 a	75.8 c	80.3 c

* Means within columns with the same letter are not significantly different (LSD test, $P<0.10$).

False Oleander Scale.
In 2004, Ludwig investigated efficacy of Flagship, Safari, Talus and TriStar on false oleander scale (*Pseudaulacaspis cockerelli)* on aucuba (*Aucuba japonica*).None of the treatments provided statistically or biologically significant mortality on this scale species at 13 or 27 days after treatment (Table 44).

Table 44. Efficacy on False Oleander Scaleon Aucuba, Ludwig, TX, 2004.

Treatment	Rate (per 100 gal)	Population Averages (Henderson's Percent Control)		
		Pretreatment	13 DAT	27 DAT
Flagship 25WG + NIS	2 oz	65.0 a	230.3 a (8)	55.5 a (28)
Flagship 25WG + NIS	4 oz	54.0 a	197.3 a (5)	44.3 a (0)
Flagship 25WG+ NIS	8 oz	68.8 a	181.3 a (32)	65.5 a (0)
Safari 20SG – Drench	12 oz	61.8 a	166.3 a (30)	43.0 a (23)
Safari 20SG – Drench	24 oz	55.0 a	172.3 a (19)	68.0 a (0)
Safari 20SG – Drench	48 oz	78.5 a	118.8 a (61)	56.8 a (0)
Talus 40SC+ NIS	21.5 fl oz	52.0 a	187.5 a (6)	62.5 a (1)
Talus 40SC+ NIS	43 fl oz	73.3 a	179.3 a (36)	53.3 a (11)
Talus 40SC+ NIS	86 fl oz	73.3 a	173.5 a (39)	50.0 a (14)
Tristar 30SG + NIS	32 g	71.5 a	192.0 a (30)	63.0 a (2)
Tristar 30SG + NIS	64 g	59.8 a	141.0 a (39)	30.8 a (35)
Tristar 30SG + NIS	128 g	79.0 a	261.3 a (14)	70.5 a (20)
Untreated	-	43.0 a	165.5 a (0)	55.5 a (0)

* Means within columns with the same letter are not significantly different (LSD test, $P<0.05$).

In 2010, Chong conducted two experiments to evaluate the efficacy of neonicotinoids (Arena, Flagship, Safari and TriStar), insect growth regulators (Distance and Talus), A16901B, Kontos and Rycar on false oleander scale (*Pseudaulacaspis cockerelli*) on Southern magnolia (Table 45 and Table 46). In the first experiment, only the soil drench with Safari achieved 90% mortality in the scale insect population by 6 WAT. By 4 months after treatment, Arena drench, Flagship drench, and Safari broadcast and drench applications provided significant increase in scale mortality. A16901B, Kontos, Orthene and Tristar were ineffective. In the second experiment, Distance, Talus and paraffinic oil provided significantly higher mortality (30.8-50.2%) than the untreated check (2.5%) by 2 WAT. Rycar looked ineffective.

In 2012, Braman conducted a field experiment to determine efficacy of neonicotinoids (Arena, Flagship and Safari), insect growth regulators (Distance and Talus), A16901B, GF-2626 and GF-2860 on false oleander scale on Southern magnolia (Table 47). In general, all treatments providedgood to excellent control of immatures, comparable to the standard Orthene at 7 days post-treatment. At 28 DAT, A16901B, GF-2626, GF-4860, Arena, Flagship and Safari provided better control of immatures compared to Orthene. Five months after initial treatment, A16901B, Arena, Flagship, GF-2626 at the high rate and Safari were still showing significant suppression of egg production.

No phytotoxicity was observed from any treatment.

In 2014, Chong conducted an experiment to evaluate the efficacy of GF-2860/XXpire on false oleander scale (*Pseudaulacaspis cockerelli*) on Southern magnolia (Table 48). Both GF-2860 and the standard paraffin oil provided good control of adults and immatures throughout the growing season, resulting in significantly lower numbers of live false oleander scales. No phytotoxicity or residue of the insecticides was observed during the course of this experiment.

Table 45. Efficacy on False Oleander Scale on Southern Magnolia, Chong, SC, 2010a.

Treatment	Rate	Applic. Method	Mean Percent Mortality[x]						
			5/20 Pretreat	6/2 1 WAT	6/11 2 WAT	6/24 4 WAT	7/8 6 WAT	9/17 4 MAT	5/31/11 1 YAT
A16901B	10 oz/100 gal	Drench	16.7 ± 2.9	12.7 ± 5.5	15.8 ± 7.8	30.1 ± 13.8	23.2 ± 6.1 cd	28.8 ± 5.9 cde	58.8 ± 4.6 c
Arena 50WDG	4.8 g/in dbh	Drench	15.9 ± 4.9	8.5 ± 4.6	7.0 ± 3.2	26.3 ± 7.9	69.1 ± 12.0 b	73.4 ± 5.6 bc	64.4 ± 12.1 bc
Flagship 0.22G	227 g/in dbh	Broadcast	11.8 ± 2.7	0.3 ± 0.3	11.0 ± 4.3	25.6 ± 9.6	34.9 ± 12.9 cd	47.9 ± 3.4 de	71.5 ± 6.4 bc
	454 g/in dbh		10.2 ± 3.0	13.3 ± 3.7	16.1 ± 5.6	22.8 ± 7.1	38.2 ± 4.3 cd	62.9 ± 4.6 bcde	81.2 ± 8.7 b
Flagship 25WG	4 g/in dbh	Drench	11.8 ± 5.3	3.2 ± 3.2	15.5 ± 7.7	28.8 ± 9.5	38.5 ± 12.1 cd	67.3 ± 5.6 bc	70.5 ± 10.1 bc
Kontos	3.4 fl oz/100gal	Foliar	13.3 ± 3.3	12.8 ± 6.4	16.7 ± 6.4	33.8 ± 7.3	35.0 ± 14.3 cd	51.1 ± 2.6 de	59.6 ± 4.1 c
Orthene 97	8 oz/100gal	Foliar	11.8 ± 4.3	11.3 ± 3.2	19.8 ± 9.6	33.9 ± 12.5	31.8 ± 8.7 cd	43.5 ± 2.6 e	61.0 ± 3.8 c
Safari 2G	60 g/in dbh	Broadcast	11.5 ± 3.5	11.2 ± 5.0	7.2 ± 4.1	44.4 ± 10.1	46.5 ± 11.9 bc	75.1 ± 7.8 b	83.5 ± 6.4 b
Safari 20SG	6 g/in dbh	Drench	24.0 ± 7.2	11.0 ± 3.7	12.7 ± 4.6	44.3 ± 13.4	90.3 ± 34.5 a	87.9 ± 8.0 a	97.6 ± 1.5 a
TriStar 30 SG + Capsil	8 oz/100 gal	Foliar	18.7 ± 6.3	9.0 ± 4.5	12.7 ± 3.5	11.7 ± 6.0	25.9 ± 12.3 cd	49.8 ± 7.6 de	62.8 ± 3.6 c
Untreated	-	-	12.3 ± 1.7	9.8 ± 4.6	3.3 ± 1.4	34.7 ± 9.9	14.5 ± 7.4 d	41.2 ± 3.8 e	57.1 ± 2.3 c

[x] Means followed by same letter do not significantly differ (LSD test, P=0.05). No significant differences from Pretreatment to 4 WAT.

* All treatments applied once on 5/25/10 except Tristar which was applied 5/25/10 and 6/11/10.

Table 46. Efficacy on False Oleander Scale on Southern Magnolia, Chong, SC, 2010b.

Treatment	Rate (per 100 gal	Mean Percent Mortality[x]				
		Pretreat	1 WAT	2 WAT	4 WAT	6 WAT
Distance 10EC	12 fl oz	17.7 ± 5.0 a	26.4 ± 4.2 a	32.3 ± 4.8 ab	80.4 ± 9.9 a	85.1 ± 2.2 a
Rycar 20SC	18 fl oz	22.0 ± 3.0 a	18.0 ± 1.4 a	17.8 ± 5.8 bc	15.6 ± 4.9 cd	51.1 ± 2.1 b
Paraffinic Oil	2 gal	42.4 ± 16.8 a	28.9 ± 5.3 a	30.8 ± 4.6 b	33.8 ± 10.5 bc	86.8 ± 8.3 a
Talus70 DF	14 oz	19.6 ± 7.2 a	27.2 ± 0.8 a	50.2 ± 11.7 a	57.1 ± 8.4 b	85.2 ± 1.9 a
Untreated	-	17.5 ± 2.2 a	20.3 ± 3.9 a	2.5 ± 1.6 c	1.7 ± 1.1 d	5.3 ± 2.3 c

[x] Means followed by same letter do not significantly differ (LSD test, P=0.05).

* Treatments applied foliar starting on 5/27/10; Distance and Paraffinic oil applied a second time on 6/17/10.

Table 47. Efficacy on False Oleander Scale on Southern Magnolia 'Little Gem', Braman, GA, 2012.

Count Date	Treatment	Rate	Application Method	Mean No. Per 2 Leaves (% Control)			
				Adults	Crawlers	Eggs	Nymphs
Pretreat 5/03	A16901B	5 oz/100 gal	Drench	2.0 a	3.2 a	8.8 a	0.0 a
	A16901B	10 oz/100 gal	Drench	2.7 a	10.0 a	5.2 a	0.0 a
	Arena 50WDG	2.4 g/in dbh	Drench	1.2 a	9.2 a	4.0 a	0.0 a
	Distance 10EC	12 fl oz/100 gal	Foliar	1.7 a	21.0 a	5.7 a	0.0 a
	Flagship 0.22G	114 g/ft ht	Broadcast	1.7 a	9.7 a	14.3 a	0.0 a
	Flagship 0.22G	227 g/ft ht	Broadcast	2.5 a	18.0 a	16.0 a	0.0 a
	GF-2626 1SC	8 fl oz/100 gal	Foliar	2.0 a	4.2 a	4.5 a	0.0 a
	GF-2626 1SC	11 fl oz/100 gal	Foliar	1.8 a	8.3 a	3.0 a	0.0 a
	Xxpire 40WG	3.5 oz/100 gal	Foliar	0.8 a	13.0 a	10.5 a	0.0 a
	Xxpire 40WG	7 oz/100 gal	Foliar	1.7 a	5.0 a	5.5 a	0.0 a
	Orthene TTO	10.7 oz/100 gal	Foliar	1.2 a	2.5 a	9.0 a	0.0 a
	Safari 20SG	6 g/in dbh	Drench	0.3 a	10.3 a	0.0 a	0.0 a
	Talus 70DF	14 oz/100 gal	Foliar	1.0 a	3.5 a	2.0 a	0.0 a
	Untreated	-	-	1.0 a	13.6 a	14.2 a	0.0 a
7 DAT 5/10	A16901B	5 oz/100 gal	Drench	1.3 a	1.7 bc (95)	6.0 b (76)	1.3 b (89)
	A16901B	10 oz/100 gal	Drench	1.3 a	15.7 b (54)	6.2 b (75)	0.7 b (94)
	Arena 50WDG	2.4 g/in dbh	Drench	1.2 a	0.7 c (98)	4.0 b (84)	0.7 b (94)
	Distance 10EC	12 fl oz/100 gal	Foliar	1.6 a	0.2 c (99)	2.2 b (94)	0.2 b (98)
	Flagship 0.22G	114 g/ft ht	Broadcast	0.5 a	0.2 c (99)	0.8 b (97)	0 b(100)
	Flagship 0.22G	227 g/ft ht	Broadcast	0.3 a	0 c (100)	0 b (100)	0.3 b (98)
	GF-2626 1SC	8 fl oz/100 gal	Foliar	0.5 a	2.0 bc (94)	3.2 b (87)	0 b(100)
	GF-2626 1SC	11 fl oz/100 gal	Foliar	1.0 a	2.3 bc (93)	7.8 b (68)	0 b(100)
	Xxpire 40WG	3.5 oz/100 gal	Foliar	0.8 a	1.3 c (96)	10.0 b (60)	1.8 b (85)
	Xxpire 40WG	7 oz/100 gal	Foliar	0.3 a	0.8 c (98)	0 b (100)	0 b(100)
	Orthene TTO	10.7 oz/100 gal	Foliar	0.7 a	0.8 c (98)	4.2 b (83)	0 b(100)
	Safari 20SG	6 g/in dbh	Drench	0.5 a	0.3 c (99)	3.3 b (87)	0 b(100)
	Talus 70DF	14 oz/100 gal	Foliar	0.7 a	6.2 bc (82)	0.3 b (99)	0 b(100)
	Untreated	-	-	3.0 a	33.8 a (0)	24.7 a (0)	12 a (0)
14 DAT 5/17	A16901B	5 oz/100 gal	Drench	2.2 a	0.7 a	22.5 a	3.7 a
	A16901B	10 oz/100 gal	Drench	1.0 a	1.3 a	10.0 a	2.2 a
	Arena 50WDG	2.4 g/in dbh	Drench	1.3 a	0.0 a	3.3 a	1.3 a
	Distance 10EC	12 fl oz/100 gal	Foliar	0.5 a	1.3 a	26.3 a	2.3 a
	Flagship 0.22G	114 g/ft ht	Broadcast	1.7 a	1.3 a	19.2 a	0.8 a
	Flagship 0.22G	227 g/ft ht	Broadcast	1.3 a	0.7 a	3.0 a	0.5 a
	GF-2626 1SC	8 fl oz/100 gal	Foliar	1.5 a	0.8 a	9.0 a	0.8 a

Count Date	Treatment	Rate	Application Method	Mean No. Per 2 Leaves (% Control)			
				Adults	Crawlers	Eggs	Nymphs
	GF-2626 1SC	11 fl oz/100 gal	Foliar	2.2 a	0.3 a	1.3 a	0.3 a
	Xxpire 40WG	3.5 oz/100 gal	Foliar	1.3 a	0.5 a	15.5 a	2.3 a
	Xxpire 40WG	7 oz/100 gal	Foliar	2.2 a	0.5 a	2.0 a	1.7 a
	Orthene TTO	10.7 oz/100 gal	Foliar	1.0 a	0.8 a	10.5 a	3.2 a
	Safari 20SG	6 g/in dbh	Drench	0.7 a	0.7 a	3.0 a	0.7 a
	Talus 70DF	14 oz/100 gal	Foliar	2.0 a	0.8 a	9.3 a	3.2 a
	Untreated	-	-	2.7 a	1.0 a	11.1 a	0.7 a
28 DAT 5/31	A16901B	5 oz/100 gal	Drench	3.5 a	0.2 c (95)	20.7 bc (53)	3.2 b (90)
	A16901B	10 oz/100 gal	Drench	3.0 a	1.0 bc (76)	15.0 bc (66)	3.5 b (89)
	Arena 50WDG	2.4 g/in dbh	Drench	2.7 a	0.5 bc (88)	6.2 c (86)	12.5 ab (59)
	Distance 10EC	12 fl oz/100 gal	Foliar	5.0 a	6.7 a (0)	67.0 a (0)	13.7 ab (55)
	Flagship 0.22G	114 g/ft ht	Broadcast	3.5 a	2.7 bc (36)	22.2 bc (50)	11.0 ab (64)
	Flagship 0.22G	227 g/ft ht	Broadcast	2.7 a	0.5 bc (88)	5.3 c (88)	6.0 b (80)
	GF-2626 1SC	8 fl oz/100 gal	Foliar	2.7 a	0.5 bc (88)	7.8 c (82)	19.5 ab (36)
	GF-2626 1SC	11 fl oz/100 gal	Foliar	2.3 a	0.0 c (100)	23.2 a (48)	5.5 b (82)
	Xxpire 40WG	3.5 oz/100 gal	Foliar	1.2 a	1.0 bc (76)	15.7 bc (64)	4.7 b (85)
	Xxpire 40WG	7 oz/100 gal	Foliar	2.7 a	2.8 abc (33)	27.3 abc (38)	7.2 b (76)
	Orthene TTO	10.7 oz/100 gal	Foliar	4.3 a	3.5 abc (17)	55.3 ab (0)	20.5 ab (33)
	Safari 20SG	6 g/in dbh	Drench	4.8 a	0.8 bc (81)	2.8 c (94)	20.8 ab (32)
	Talus 70DF	14 oz/100 gal	Foliar	2.8 a	2.7 bc (36)	67.0 a (0)	12.5 ab (59)
	Untreated	-	-	4.5 a	4.2 ab (0)	44.2 abc (0)	30.5 a (0)
5 Mo. 10/03	A16901B	5 oz/100 gal	Drench	2.8 cde	3.2 a	29.5 bcd (63)	2.3 a
	A16901B	10 oz/100 gal	Drench	2.0 de	0.5 a	20.5 bcd (74)	6.2 a
	Arena 50WDG	2.4 g/in dbh	Drench	0.3 e	0.5 a	0.3 d (100)	1.8 a
	Distance 10EC	12 fl oz/100 gal	Foliar	3.0 a-e	2.7 a	59.0 ab (26)	2.0 a
	Flagship 0.22G	114 g/ft ht	Broadcast	4.2 a-e	0.5 a	12.3 bcd (85)	1.2 a
	Flagship 0.22G	227 g/ft ht	Broadcast	2.2 de	3.8 a	3.5 cd (96)	3.8 a
	GF-2626 1SC	8 fl oz/100 gal	Foliar	5.5 a-d	7.0 a	46.3 a-d (42)	12.7 a
	GF-2626 1SC	11 fl oz/100 gal	Foliar	7.7 a	1.7 a	17.8 bcd (78)	9.2 a
	Xxpire 40WG	3.5 oz/100 gal	Foliar	6.8 abc	2.5 a	58.8 ab (27)	9.0 a
	Xxpire 40WG	7 oz/100 gal	Foliar	7.2 ab	4.0 a	36.3 a-d (55)	8.0 a
	Orthene TTO	10.7 oz/100 gal	Foliar	6.8 abc	5.8 a	51.0 abc (36)	20.2 a
	Safari 20SG	6 g/in dbh	Drench	0.0 e	0.0 a	0.0 d (100)	0.0 a
	Talus 70DF	14 oz/100 gal	Foliar	7.0 abc	0.2 a	38.4 a-d (52)	1.8 a
	Untreated	-	-	7.7 a	6.2 a	80.0 a (0)	7.8 a

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

* First app 5/3 to coincide with crawler emergence. Second app 5/17 except for Distance which was applied on the 5/24 as a 21-day post second app.

Table 48. Efficacy on False Oleander Scale on Southern Magnolia, Chong, SC, 2014.

Treatment	Rate (per 100 gal)	Population Averages (Henderson's Percent Control) [x]				
		Pretreat	1 WAT [y]	2 WAT	4 WAT	6 MAT
Xxpire 40WG	2 oz	15.0 a	17.3 a (29)	3.8 b (87)	2.7 b (86)	3.5 b (84)
	2.75 oz	17.8 a	16.8 a (42)	2.7 b (92)	2.8 b (88)	2.8 b (89)
	3.5 oz	21.8 a	7.5 bc (79)	3.7 b (92)	2.7 b (90)	2.0 b (94)
Paraffin oil	2%	19.5 a	7.2 c (77)	1.3 b (97)	1.0 b (96)	1.8 b (94)
Untreated	-	10.0 a	16.2 ab (0)	20.0 a (0)	12.8 a (0)	14.5 a (0)

[x] Means followed by same letter do not significantly differ (Fisher's LSD test, P=0.05).

[y] WAT = weeks after the first treatment; MAT = months after first treatment.

* Treatments applied foliar on 4/13 and 4/27; Capsil (at 6 fl oz/100 gal) was mixed in the solutions of GF-2860.

In 2018 and 2019, Held conducted two experiments to evaluate the efficacy efficacy of various products applied as foliar sprays against false oleander scale on potted *Aucuba japonica*. In 2018, all treatments, including the standards (Distance, Talus and Tristar), provided poor control, (Table 45, Table 50, Table 51). When examining percent control applying the Henderson's Tilton equation, Sarisa and Ventrigra provided population suppression between 7 and 28 days after treatment. Talus and Tristar provided suppression starting towards the end of the experiment (6 months after application). Held commented that the application timing might have been too early to provide adequate control of false oleander scale. In 2019, while there were some statistically different reductions between treatments and the nontreated controls up to 28 DAT, only suppression was observed when comparing Henderson's percent control for all life stages with Altus, Azaguard. However, 6 months after treatment, all treatments suppressed populations of all life stages, with Pradia providing 97% efficacy with Altus, Azaguard, and KOC22018 providing good management. No product could reduce the visible appearance of false oleander scale on leaves. The biology of this pest presents unique management challenges.

Table 49. Efficacy on False Oleander Scale (Adult Females) on Japanese Aucuba, Held, MS, 2018.

Treatment	Rate	Mean percentage of live females before and after treatment (Henderson's Percent Control) [x]					
		Pretreat	7 DAIT[c]	14 DAIT[c]	28 DAIT[c]	4 MAIT[c]	6 MAIT[c]
Altus (flupyradifurone)	14 fl oz	80.0 a-d	38.0 bc (0)	40.0 abc (18)	36.0 abc (32)	56.0 abc (9)	42.0 a (21)
Azaguard (azadirachtin)	16 fl oz	76.0 cd	34.0 bcd (3)	43.0 ab (7)	49.0 ab (3)	47.0 abc (20)	51.0 a (0)
	32 fl oz	82.0 a-d	31.0 cde (18)	44.0 ab (12)	31.0 abc (43)	58.0 abc (8)	49.0 a (10)
Distance (pyriproxifen)	12 fl oz	88.0 abc	49.0 ab (0)	35.0 bc (35)	42.0 abc (28)	31.0 c (54)	38.0 a (35)
Pradia SL (cyclaniliprole + flonicamid) + Capsil	12 fl oz	90.0 ab	37.0 bc (11)	42.0 ab (23)	46.0 ab (23)	47.0 abc (32)	38.0 a (36)
	16.5 fl oz	77.0 cd	56.0 a (0)	58.0 a (0)	57.0 a (0)	64.0 a (0)	55.0 a (0)
Sarisa (cyclaniliprole) + NIS	22 fl oz	78.0 bcd	26.0 cde (27)	42.0 ab (11)	30.0 abc (42)	60.0 ab (0)	51.0 a (1)
	28 fl oz	84.0 a-d	30.0 cde (22)	32.0 bc (37)	22.0 cd (60)	48.0 abc (26)	50.0 a (10)
Talus 70DF (buprofezin)	14 oz	79.0 a-d	32.0 b-e (12)	41.0 abc (15)	48.0 ab (8)	35.0 bc (42)	59.0 a (0)
TriStar 8.5SL (acetamiprid)	16.5 fl oz	85.0 a-d	38.0 bc (3)	40.0 abc (23)	42.0 abc (25)	50.0 abc (24)	57.0 a (0)
Ventigra (afidopyropen) + UltraPure Oil	4.8 fl oz	76.0 cd	16.0 e (54)	28.0 bc (39)	27.0 bc (46)	57.0 abc (3)	61.0 a (0)
	7 fl oz	92.0 a	19.0 de (55)	23.0 c (59)	14.0 c (77)	32.0 bc (55)	43.0 a (29)
Untreated	-	74.0 d	34.0 bcd (0)	45.0 ab (0)	49.0 ab (0)	57.0 abc (0)	49.0 a (0)
Statistics	-	F = 1.56 *P* =0.137	F = 3.05 *P* =0.003	F = 1.26 *P* =0.270	F = 1.55 *P* =0.138	F = 1.13 *P* =0.362	F = 1.06 *P* =0.414
P value (LSD)	-	*P*= 0.05	*P*= 0.05	*P*= 0.1	*P*= 0.05	*P*= 0.05	

[x] LSD tests were conducted at both P=0.05 and 0.1. The letters within each column followed by the same letter were not significantly different at the P value listed in this cell under each column. No letters after each mean indicates no differences were detected at *P*=0.1.

* A sample of 25 adult female scales on a minimum of 5 leaves on each plant.

Post-treatments samples observed at days after initial treatment (DAIT) and months after initial treatment (MAIT).

Table 50. Efficacy on False Oleander Scale (All Stages) on Japanese Aucuba, Held, MS, 2018.

Treatment	Rate	Mean number (±SEM) of live FOS (all life stages) before and after treatment [x]					
		Pretreat	7 DAIT[c]	14 DAIT[c]	28 DAIT[c]	4 MAIT[c]	6 MAIT[c]
Altus (flupyradifurone)	14 fl oz	33.0 a	36.8 abc (22)	44.4 ab (0)	45.2 a (0)	53.8 bc (32)	128.2 ab (26)
Azaguard (azadirachtin)	16 fl oz	26.0 a	29.8 abc (19)	29.0 ab (10)	30.6 ab (10)	109.4 abc (0)	133.4 ab (2)
	32 fl oz	27.6 a	27.2 abc (31)	19.8 b (42)	13.8 b (62)	61.6 bc (6)	92.2 abc (36)
Distance (pyriproxifen)	12 fl oz	33.8 a	47.2 a (2)	56.3 ab (0)	27.4 ab (38)	75.8 abc (6)	93.8 abc (47)
Pradia SL (cyclaniliprole + flonicamid) + Capsil	12 fl oz	36.8 a	46.2 ab (12)	62.8 a (0)	27.8 ab (42)	122.8 abc (0)	120.6 abc (37)
	16.5 fl oz	30.4 a	37.4 abc (13)	19.2 b (49)	21.0 ab (47)	102.0 abc (0)	155.6 a (2)
Sarisa (cyclaniliprole) + NIS	22 fl oz	44.0 a	11.8 bc (81)	8.8 b (84)	8.6 b (85)	82.0 abc (22)	114.4 abc (50)
	28 fl oz	42.2 a	47.8 a (20)	39.2 ab (25)	26.0 ab (53)	149.8 ab (0)	103.8 abc (53)
Talus 70DF (buprofezin)	14 oz	31.4 a	23.0 abc (48)	21.2 b (46)	17.0 ab (59)	74.4 abc (1)	40.0 c (76)
TriStar 8.5SL (acetamiprid)	16.5 fl oz	35.4 a	36.6 abc (27)	24.0 ab (45)	12.4 b (73)	33.6 c (60)	59.0 bc (68)
Ventigra (afidopyropen) + UltraPure Oil	4.8 fl oz	42.2 a	9.8 c (84)	12.4 b (76)	12.6 b (77)	63.0 abc (37)	78.0 abc (65)
	7 fl oz	26.8 a	25.6 abc (33)	15.0 b (55)	5.6 b (84)	177.0 a (0)	117.7 abc (16)
Untreated	-	25.6 a	36.4 abc (0)	31.8 ab (0)	33.6 ab (0)	61.0 abc (0)	133.6 ab (0)
Statistics	-	F= 0.57 *P* = 0.856	F= 1.01 *P* = 0.451	F= 1.28 *P* = 0.262	F= 0.88 *P* = 0.571	F= 0.81 *P* = 0.638	F= 0.68 *P* = 0.763
P value (LSD)	-		*P* = 0.05	*P* = 0.05	*P* = 0.1	*P* = 0.1	*P* = 0.1

[x] LSD tests were conducted at both P=0.05 and 0.1. The letters within each column followed by the same letter were not significantly different at the P value listed in this cell under each column. No letters after each mean indicates no differences were detected at *P*=0.1.

* A sample of 10 leaves on each plant.

Post-treatments samples observed at days after initial treatment (DAIT) and months after initial treatment (MAIT).

Table 51. Number of Infested Leaves with Live False Oleander Scale on Japanese Aucuba, Held, MS, 2018.

Treatment	Rate	Mean number (±SEM) of leaves infested with live FOS before and after treatment [x]					
		Pretreat	7 DAIT[c]	14 DAIT[c]	28 DAIT[c]	4 MAIT[c]	6 MAIT[c]
Altus (flupyradifurone)	14 fl oz	7±0.71 ab	5.6±0.93	5.4±0.51 a	4.6±0.40 a-d	6.6±0.81 cd	9.6±0.24 a
Azaguard (azadirachtin)	16 fl oz	7±0.84 ab	5±0.55	4.2±0.58 abc	4.2±0.49 a-e	9.4±0.40 a	9.6±0.40 a
	32 fl oz	7.2±0.73 a	5.6±0.51	3.8±0.97 abc	3.4±0.51 b-e	7.6±1.03 a-d	8.6±0.93 abc
Distance (pyriproxifen)	12 fl oz	6.6±0.68 b	6±0.55	4.3±0.85 bc	3.6±0.68 b-e	3.6±1.2 e	9±0.41 abc
Pradia SL (cyclaniliprole + flonicamid) + Capsil	12 fl oz	7±0.71 ab	4.6±0.87	4.8±0.86 ab	4.8±0.73 abc	9±0.32 ab	8±1.0 bc
	16.5 fl oz	7.2±0.74 a	5.2±1.02	4.2±1.4 abc	5±1.05 ab	9.2±0.49 a	9.4±0.24 ab
Sarisa (cyclaniliprole) + NIS	22 fl oz	7±0.45 ab	4.4±0.68	2.8±0.73 c	2.6±0.93 cde	8.2±0.92 abc	8.8±0.37 abc
	28 fl oz	7±0.55 ab	4.2±1.2	4±0.63 abc	3.6±0.75 b-e	9±0.63 ab	9±0.45 abc
Talus 70DF (buprofezin)	14 oz	7.2±0.86 a	4.6±1.3	5.4±0.68 a	3.8±1.1 a-e	5.4±1.4 de	7.8±0.85 c
TriStar 8.5SL (acetamiprid)	16.5 floz	7±0.45 ab	5.6±0.75	4±0.71 abc	2.6±0.68 cde	6.8±0.37 bcd	8.8±0.37 abc
Ventigra (afidopyropen) + UltraPure Oil	4.8 fl oz	7.2±0.58 a	5±0.5	2.6±0.68 c	2.4±1.2 de	7.4±1.1 a-d	8.6±0.40 abc
	7 fl oz	6.8±0.66 ab	5.2±0.73	4±1.1 abc	2±0.71 e	6±2.1 e	9.3±0.67 ab
Untreated	-	7±0.71 ab	5.4±0.24	3.8±0.86 abc	6±0.55 a	8.4±0.24 abc	8.4±1.1 abc
Statistics	-	F= 0.63 *P*= 0.804	F= 0.46 *P*= 0.927	F = 1.04 *P*= 0.427	F= 2.10 *P*=0.035	F= 3.67 *P*=0.0007	F= 0.80 *P*= 0.650
P value (LSD)	-	*P*= 0.1		*P*= 0.1	*P*= 0.05	*P*= 0.05	*P*= 0.1

[x] LSD tests were conducted at both P=0.05 and 0.1. The letters within each column followed by the same letter were not significantly different at the P value listed in this cell under each column. No letters after each mean indicates no differences were detected at *P*=0.1.

* A sample of 25 adult female scales on a minimum of 5 leaves on each plant.

Post-treatments samples observed at days after initial treatment (DAIT) and months after initial treatment (MAIT).

Table 52. Efficacy on False Oleander Scale on Japanese Aucuba, Held, AL, 2019.

Treatment	Rate	Pretreat	7 DAIT[c]	14 DAIT[c]	28 DAIT[c]	4 MAIT[c]	6 MAIT[c]
Mean percentage (±SEM) of live females before and after treatment [x]							
Altus (flupyradifurone)	14 fl oz	14.7	12.8 abc (23)	12.7 (15)	14.7 ab (5)	23.2 a (0)	18.0 b (19)
Azaguard (azadirachtin)	16 fl oz	13.5	12.3 abc (19)	13.5 (1)	13.7 abc (4)	21.3 ab (0)	21.3 ab (0)
Distance (pyriproxifen)	12 fl oz	12.5	14.3 ab (0)	13.3 (0)	9.3 c (29)	5.8 c (71)	18.0 b (4)
Pradia SL (cyclaniliprole + flonicamid)	16.5 fl oz	12.7	10.7 abc (25)	12.0 (7)	16.5 a (0)	20.8 ab (0)	19.7 ab (0)
Sarisa (cyclaniliprole)	28 fl oz	14.2	8.7 c (46)	10.3 (29)	11.2 bc (25)	21.7 a (3)	19.7 ab (8)
KOC22018 (botanical oil blend)	16.5 fl oz	14.7	9.7 bc (41)	11.3 (24)	17.2 a (0)	19.5 ab (16)	20.0 ab (10)
Talus 70DF (buprofezin)	14 oz	12.8	11.7 abc (19)	10.5 (19)	9.5 c (29)	19.0 ab (6)	20.7 ab (0)
TetraCURB Conc (rosemary oil)	128 fl oz	14.5	12.7 abc (22)	12.2 (17)	17.3 a (0)	17.0 b (26)	19.2 ab (12)
TetraCURB Conc (rosemary oil)	128 fl oz	13.7	9.2 c (40)	10.8 (22)	10.7 bc (26)	20.7 ab (4)	22.3 a (0)
Ventigra (afidopyropen)	7 fl oz	10.3	10.8 abc (7)	13.6 (0)	17.0 a (0)	19.8 ab (0)	19.4 ab (0)
Untreated	-	13.5	15.2 a (0)	13.7 (0)	14.2 ab (0)	21.3 ab (0)	20.3 ab (0)
P value (LSD)	-	$P = 0.622$	$P = 0.224$	$P = 0.902$	$P = 0.0008$	$P < 0.0001$	$P = 0.371$
Mean % reduction (±SEM) of live FOS (all life stages) before and after treatment [x]							
Altus (flupyradifurone)	14 fl oz	477.8	57.9 abc (70)	63.8 bcd (65)	67.4 cd (69)	51.0 ab (0)	22.3 bc (81)
Azaguard (azadirachtin)	16 fl oz	340.3	60.1 abc (56)	41.8 e (67)	64.6 d (58)	28.8 bc (21)	16.6 bc (81)
Distance (pyriproxifen)	12 fl oz	180.3	60.6 abc (16)	70.8 abc (0)	84.3 a (0)	70.3 a (0)	59.9 a (0)
Pradia SL (cyclaniliprole + flonicamid)	16.5 fl oz	290.5	55.5 abc (52)	63.7 bcd (42)	63.2 d (51)	11.3 c (64)	2.3 c (97)
Sarisa (cyclaniliprole)	28 fl oz	309.0	74.6 a (40)	74.1 ab (36)	82.1 ab (41)	32.1 bc (3)	16.8 bc (78)
KOC22018 (botanical oil blend)	16.5 fl oz	274.5	43.0 c (61)	50.4 de (51)	71.8 bcd (42)	15.6 bc (47)	13.4 c (80)
Talus 70DF (buprofezin)	14 oz	253.8	63.6 abc (37)	70.0 abc (27)	78.7 abc (31)	40.4 bc (0)	18.7 bc (71)
TetraCURB Conc (rosemary oil)	128 fl oz	223.8	59.6 abc (34)	56.4 cde (33)	74.5 abcd (26)	36.1 bc (0)	14.8 c (74)
TetraCURB Conc (rosemary oil)	128 fl oz	206.8	57.0 abc (31)	79.9 a (0)	85.0 ±a (8)	42.3 bc (0)	25.6 bc (51)
Ventigra (afidopyropen)	7 fl oz	194.8	49.2 bc (37)	62.4 bcd (15)	72.1 bcd (17)	33.1 bc (0)	21.6 bc (56)
Untreated	-	167.0	66.9 ab (0)	62.9 bcd (0)	74.9 abcd (0)	17.8 bc (0)	41.8 ab (0)
P value (LSD)	-	-	$P = 0.2092$	$P = 0.001$	$P = 0.005$	$P = 0.0283$	$P = 0.054$

[x] LSD tests were conducted at both P=0.05 and 0.1. The letters within each column followed by the same letter were not significantly different at the P value listed in this cell under each column. No letters after each mean indicates no differences were detected at *P*=0.1.

* A sample of 25 adult female scales on a minimum of 5 leaves on each plant. A sample of all life stage on 10 leaves on each plant. A 10 leaf sample from each plant was used to record the number of leaves infested.

Post-treatments samples observed at days after initial treatment (DAIT) and months after initial treatment (MAIT).

Table 53. Efficacy on False Oleander Scale on Japanese Aucuba, Held, AL, 2019.

Treatment	Rate	Mean number (±SEM) of leaves infested with live FOS before and after treatment [x]					
		Pretreat	7 DAIT[c]	14 DAIT[c]	28 DAIT[c]	4 MAIT[c]	6 MAIT[c]
Altus (flupyradifurone)	14 fl oz	10±0.0	10±0.0a	9.8±0.17a	10±0.0a	9.8±0.20a	10±0.0a
Azaguard (azadirachtin)	16 fl oz	10±0.0	10±0.0a	9.8±0.17a	9.5±0.22ab	10±0.0a	9.8±0.17a
Distance (pyriproxifen)	12 fl oz	10±0.0	9.7±0.33ab	9.8±0.17a	9±0.52ab	6.7±1.20b	8.7±0.49b
Pradia SL (cyclaniliprole + flonicamid)	16.5 fl oz	10±0.0	10±0.0a	10±0.0a	10±0.0a	10±0.0a	10±0.0a
Sarisa (cyclaniliprole)	28 fl oz	10±0.0	10±0.0a	9.2±0.31b	8.8±0.31b	9.7±0.33a	10±0.0a
KOC22018 (botanical oil blend)	16.5 fl oz	10±0.0	10±0.0a	9.8±0.17a	10±0.0a	10±0.0a	10±0.0a
Talus 70DF (buprofezin) TetraCURB	14 oz	9.8±0.17	10±0.0a	9.5±0.34ab	9±0.37ab	10±0.0a	10±0.0a
TetraCURB Conc (rosemary oil)	128 fl oz	10±0.0	9.5±0.22b	10±0.0a	9.8±0.17ab	10±0.0a	9.8±0.17a
TetraCURB Conc (rosemary oil)	128 fl oz	9.7±0.33	9.8±0.17ab	9.8±0.17a	7.2±0.75c	9.8±0.17a	10±0.0a
Ventigra (afidopyropen)	7 fl oz	9.8±0.17	10±0.0a	10±0.0a	9±0.45ab	10±0.0a	9.8±0.20a
Untreated	-	10±0.0	10±0.0a	9.7±0.21ab	9.3±0.49ab	10±0.0a	10±0.0a
P value (LSD)	-	$P = 0.623$	$P = 0.107$	$P = 0.104$	$P = 0.0001$	$P < 0.01$	$P < 0.001$

[x] LSD tests were conducted at both P=0.05 and 0.1. The letters within each column followed by the same letter were not significantly different at the P value listed in this cell under each column. No letters after each mean indicates no differences were detected at *P*=0.1.

* A sample of 25 adult female scales on a minimum of 5 leaves on each plant. A sample of all life stage on 10 leaves on each plant. A 10 leaf sample from each plant was used to record the number of leaves infested.

Post-treatments samples observed at days after initial treatment (DAIT) and months after initial treatment (MAIT).

Florida Red Scale

Ludwig investigated efficacy offour neonicotinoids (Celero, Flagship, Safari and TriStar) have activity on Florida red scale (*Chrysomphalus aonidum*) infesting dwarf Burford holly (*Ilex cornuta* 'Burfordii Nana'). During this research, the average daily temperatures decreased which may have contributed to the increased mortality observed in all the treatments throughout the experiment. None of the treatments provided statistically or biologically significant mortality on this scale species at 32 or 43 days after treatment. Only the standard, Orthene provided statistically significant mortality for both small and large nymphs, but only 72% and 32% mortality was achieved respectively. More research is needed to determine viable product choices for Florida red scale.

Table 54. Efficacy on Florida Red Scale on Dwarf Burford Holly, Ludwig, TX, 2005.

Stage	Treatment	Rate	Population Averages (Henderson's Percent Control)			
			Pretreatment	7 DAT	15 DAT	29 DAT
Small Nymphs	Celero 16WSG	4 oz per 100 gal	50.0	39.2 cd (0)	27.2 a (0)	60.3 ab (0)
	Flagship	2 oz per 100 gal	50.0	69.6 a (0)	27.2 a (0)	56.3 ab (0)
	Flagship	4 oz per 100 gal	50.0	59.2 ab (0)	12.8 a (0)	81.9 a (0)
	Orthene TTO	8 oz per 100 gal	50.0	72.0 a (0)	37.6 a (0)	57.6 ab (0)
	Safari drench	12 oz/acre	50.0	61.6 ab (0)	24.8 a (0)	58.8 ab (0)
	Safari drench	24 oz/acre	50.0	44.0 bcd (0)	20.0 a (0)	60.7 ab (0)
	Safari foliar	4 oz per 100 gal	50.0	60.8 ab (0)	16.0 a (0)	71.8 ab (0)
	Safari foliar	8 oz per 100 gal	50.0	47.2 bcd (0)	14.4 a (0)	72.9 ab (0)
	TriStar 30SG	112 g per 100 gal	50.0	44.0 bcd (0)	35.2 a (0)	61.8 ab (0)
	TriStar 30SG	224 g per 100 gal	50.0	56.0 abc (0)	23.2 a (0)	54.7 ab (0)
	Untreated Control		50.0	31.2 d (0)	8.8 a (0)	49.5 b (0)
Large Nymphs	Celero 16WSG	4 oz per 100 gal	0.0	4.0 c	36.0 a	53.7 a
	Flagship	2 oz per 100 gal	0.0	6.4 bc	18.4 ab	43.2 a
	Flagship	4 oz per 100 gal	0.0	13.6 bc	11.2 b	55.1 a
	Orthene TTO	8 oz per 100 gal	0.0	32.0 a	18.4 ab	64.0 a
	Safari drench	12 oz/acre	0.0	9.6 bc	25.6 ab	56.5 a
	Safari drench	24 oz/acre	0.0	20.0 ab	19.2 ab	67.7 a
	Safari foliar	4 oz per 100 gal	0.0	12.0 bc	12.0 b	56.1 a
	Safari foliar	8 oz per 100 gal	0.0	7.2 bc	14.4 ab	62.4 a
	TriStar 30SG	112 g per 100 gal	0.0	7.2 bc	18.4 ab	57.5 a
	TriStar 30SG	224 g per 100 gal	0.0	9.6 bc	25.6 ab	55.0 a
	Untreated Control		0.0	7.2 bc	11.2 b	47.3 a
Total	Celero 16WSG	4 oz per 100 gal	50.0	43.2 (0)	63.2 (0)	114.0 (0)
	Flagship	2 oz per 100 gal	50.0	76.0 (0)	45.6 (0)	99.6 (0)
	Flagship	4 oz per 100 gal	50.0	72.8 (0)	24.0 (0)	137.0 (0)
	Orthene TTO	8 oz per 100 gal	50.0	104.0 (0)	56.0 (0)	121.6 (0)
	Safari drench	12 oz/acre	50.0	71.2 (0)	50.4 (0)	115.4 (0)
	Safari drench	24 oz/acre	50.0	64.0 (0)	39.2 (0)	128.4 (0)
	Safari foliar	4 oz per 100 gal	50.0	72.8 (0)	28.0 (0)	127.9 (0)
	Safari foliar	8 oz per 100 gal	50.0	54.4 (0)	28.8 (0)	135.2 (0)
	TriStar 30SG	112 g per 100 gal	50.0	51.2 (0)	53.6 (0)	119.3 (0)
	TriStar 30SG	224 g per 100 gal	50.0	65.6 (0)	48.8 (0)	109.8 (0)
	Untreated Control		50.0	38.4 (0)	20.0 (0)	96.8 (0)

Gloomy Scale

In 2011 and 2014, Frank investigated the efficacy of systemic neonicotenoids (Flagship, Safari and Tristar), insect growth regulators (Distance and Talus), A16901B, Kontos, Rycar, Mainspring, SuffOil-X and XXpire for the control ofgloomy scale (*Melanaspis tenebricosa*) on red maple (*Acer rubrum*). In 2011, all treatments were effective on nymphs and adults, with over 90 % control by 14 days after application (Table 55). However, abundance of gloomy scale was not significantly different between treatments on any of the observations in 2014 (Table 56).

No phytotoxicity was observed from any treatment.

Table 55. Efficacy on Gloomy Scale on Red Maple (*Acer rubrum)*, Frank, NC, 2011.

Scale Stage	Treatment	Rate	Application Method	Mean No. Per Inch (Henderson's % Control)				
				Pretreat	7 DAT	14 DAT	28 DAT	180 DAT
Nymphs	A16901B	5 oz/100 gal	Drench	14.2 a	7.5b (87)	3.8b (97)	4.3b (99)	0.3b (99)
	Distance	12 fl oz/100 gal	Foliar	12.7 a	0.2b (100)	0.0b (100)	0.0b (100)	0.0b (100)
	Flagship 0.22G	114 g/ft ht	Broadcast	18.3 a	6.3 b (93)	0.5 b (100)	0.2 b (100)	0.0 b (100)
	Flagship 25WG	1 g/ft ht	Drench	8.7 a	2.5 b (97)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Kontos	3.4 fl oz/100 gal	Foliar	12.3 a	8.0 b (94)	5.2 b (96)	4.8 b (98)	0.2 b (99)
	Rycar 20SC	18 fl oz/100 gal	Foliar	19.5 a	11.8 b (85)	6.8 b (96)	5.7 b (99)	0.3 b (99)
	Paraffinic Oil	1.5 gal/100 gal	Foliar	10.5 a	5.3 b (87)	3.2 b (97)	5.3 b (98)	0.3 b (99)
	Safari 2G	60 g/in dbh	Broadcast	12.7 a	5.0 b (90)	0.7 b (99)	0.0 b (100)	0.0 b (100)
	Safari 20SG	12 oz/1 gal	Trunk	18.0 a	4.7 b (93)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Talus 70DF	14 oz/100 gal	Foliar	14.7 a	2.2 b (96)	0.2 b (100)	0.0 b (100)	0.0 b (100)
	Tristar 30SG	8 oz/100 gal	Foliar	13.0 a	3.3 b (94)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Untreated	-	-	12.8 a	51.2 a (0)	125.8 a (0)	284.5 a (0)	34.0 a (0)
Adults	A16901B	5 oz/100 gal	Drench	3.3 a	1.7 bc (74)	1.0 b (94)	1.2 b (95)	3.0 b (98)
	Distance	12 fl oz/100 gal	Foliar	4.7 a	0.0 c (100)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Flagship 0.22G	114 g/ft ht	Broadcast	8.7 a	2.3 bc (87)	0.5 b (99)	0.0 b (100)	0.0 b (100)
	Flagship 25WG	1 g/ft ht	Drench	2.5 a	0.8 bc (84)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Kontos	3.4 fl oz/100 gal	Foliar	5.7 a	3.3 bc (71)	2.0 b (93)	1.3 b (97)	3.7 b (99)
	Rycar 20SC	18 fl oz/100 gal	Foliar	10.2 a	5.2 b (74)	3.0 b (94)	2.2 b (97)	4.3 b (99)
	Paraffinic Oil	1.5 gal/100 gal	Foliar	3.5 a	1.7 bc (75)	1.2 b (93)	1.3 b (95)	3.8 b (98)
	Safari 2G	60 g/in dbh	Broadcast	4.8 a	2.0 bc (89)	0.0 b (100)	0.2 b (99)	0.0 b (100)
	Safari 20SG	12 oz/1 gal	Trunk	8.0 a	2.0 bc (87)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Talus 70DF	14 oz/100 gal	Foliar	6.7 a	0.7 c (96)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Tristar 30SG	8 oz/100 gal	Foliar	6.0 a	0.3 c (97)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Untreated	-	-	5.5 a	10.8 a (0)	27.7 a (0)	37.3 a (0)	315.5 a (0)

* Means within a column followed by the same letter are not significantly different (LSD test, P= 0.05).

Table 56. Efficacy on Gloomy Scale on Red Maple (*Acer rubrum)*, Frank, NC, 2014.

Treatment	Rate	Application Method	Mean No. Per Inch			
			Pre	14 DAT	30 DAT	172 DAT
Distance	12.0 oz/100 gal	Foliar	78.1 a	29.4 a	24.9 a	18.8 a
Mainspring 200SC	0.125 fl oz/in DBH	Drench	70.4 a	35.0 a	22.3 a	10.5 a
Mainspring 200SC	0.25 fl oz/in DBH	Drench	51.9 a	26.2 a	21.7 a	25.0 a
Suffoil-X	2 gal/100 gal	Foliar	27.5 a	14.0 a	17.2 a	17.9 a
Talus 70DF	14.0 oz/100 gal	Foliar	26.7 a	22.7 a	18.3 a	10.3 a
Tristar 30SG	8.0 oz/100 gal	Foliar	40.4 a	68.4 a	23.5 a	7.5 a
XXpire 40WG	2.0 oz/100 gal	Foliar	39.8 a	52.4 a	20.1 a	12.1 a
XXpire 40WG	2.75 oz/100 gal	Foliar	64.9 a	52.1 a	22.1 a	12.9 a
XXpire 40WG	3.5 oz/100 gal	Foliar	38.9 a	38.3 a	18.0 a	25.4 a
Untreated	-	-	45.5 a	24.6 a	17.1 a	12.5 a

* Means within a column followed by the same letter are not significantly different (LSD test, P= 0.05).

Holly Pit Scale

Holly pit scale (*Aterolecanium puteanum*) attacks certain hollies including American holly, Burford holly, and Japanese holly. It causes pitting and distortion of woody tissue on branches and trunk of the tree. Severe infestations may result in branch dieback.

In 2009, Buss conducted a test on the efficacy of neonicotinoids (Aloft, Flagship, Safari and TriStar), insect growth regulators (Distance and Talus) and Rycar (pyrifluquinazon) for control of holly pit scale on holly (*Ilex x attenuata*). No statistically significant differences were observed until 6 weeks after treatment (Table 57). At this date, only Aloft provided good control.

No significant phytotoxicity was observed.

Oystershell Scale

In three experiments on oystershell scale (*Lepidosaphes ulmi*), Nielsen (Table 58 - Table 60) demonstrated that drench applications of Safari 20SG and foliar applications of Talus 40SC provided great control of this pest on tree lilac (*Syringasp*.) and Carolina silverbell (*Halesia carolina* var. 'Carolina'). The other products tested, Flagship 25WP, foliar Safari 20SG, MOI 201, Orthene TTO 97 and Tristar provided unacceptable control.

No phytotoxicity was observed on any of the treated plants.

Table 57. Efficacy on Holly Pit Scale on Holly, 'East Palatka', Buss, FL, 2009.

Treatment	Rate Per 100 Gal	Application Method	Number of Holly Pit Scale Nymphs(Henderson's % Control)				
			Pretreat	1 WAT	2 WAT	4 WAT	6 WAT
Aloft SC	10 fl oz	Foliar	44.7 a	131.5 a (0)	90.8 a (0)	123.2 a (0)	26.5 a (80)
Distance IGR	12 fl oz	Foliar	31.0 a	281.3 a (0)	217.5 a (0)	386.7 a (0)	181.8 c (57)
Flagship 25WG	4 gm/in DBH	Drench	55.5 a	343.7 a (0)	243.0 a (0)	177.5 a (0)	74.7 abc (62)
Rycar 20SC	18 fl oz	Foliar	64.0 a	137.5 a (17)	153.0 a (0)	155.5 a (0)	58.7 abc (66)
Orthene TTO	8 oz	Foliar	26.2 a	262.7 a (0)	157.8 a (11)	80.2 a (29)	45.8 ab (48)
Safari 20SG	6 g/ft ht	Sprench	38.0 a	170.5 a (0)	153.2 a (0)	108.8 a (0)	43.2 ab (64)
Safari 2G	60 g/ft ht	Soil surface	155.8 a	350.5 a (13)	117.5 a (50)	222.2 a (0)	91.2 abc (63)
Talus 40 SC	21.5 fl oz	Foliar	17.8 a	313.5 a (0)	191.5 a (9)	255.0 a (0)	76.2 abc (73)
TriStar 30 SG	8 oz	Foliar	102.2 a	204.5 a (23)	77.7 a (43)	190.0 a (0)	80.0 abc (62)
Untreated	-	-	122.5 a	316.5 a (0)	212.7 a (0)	151.2 a (0)	166.2 bc (0)

* Means within columns with the same letter are not significantly different ($P<0.05$, LSD test).

Table 58. Efficacy on Oystershell Scale on Tree Lilac 'Sensation', Nielsen, OH, 2005.

Treatment	Rate (Number of Applications)	No. Live Females in a 5 min Search*	Percent Control
Flagship 25WP	2.0 oz/100 gal (2)	4	27
Flagship 25WP	4.0 oz/100 gal (2)	7	0
Orthene 97	8.0 oz/100 gal (2)	3	45
Safari 20SG	4.0 oz/100 gal (2)	7	0
Safari 20SG	8.0 oz/100 gal (2)	5	9
Safari 20SG – Drench	3 g/ft of tree height	0.67	88
Safari 20SG – Drench	6 g/ft of tree height	0.25	95
Talus 40SC	21.5 fl oz/100 gal (2)	0.25	95
TriStar 70WSP	48 g/100 gal (2)	4.3	22
TriStar 70WSP	96 g/100 gal (2)	7.5	0
Untreated check	-	5.5	-

* Two evaluators, so this equates to a 10 minute search/sample.

Table 59. Efficacy on Oystershell Scale on Carolina Silverbell, Nielsen, OH, 2005.

Treatment	Rate (Number of Applications)	No. Females with Eggs/m	Percent Control
Flagship 25WP	2.0 oz/100 gal (2)	11	21
Flagship 25WP	4.0 oz/100 gal (2)	8	43
Safari 20SG	4.0 oz/100 gal (2)	23	0
Safari 20SG	8.0 oz/100 gal (2)	55	0
Safari 20SG – Drench	3 g/ft of tree height	0	100
Safari 20SG – Drench	6 g/ft of tree height	0	100
Talus 40SC	21.5 fl oz/100 gal (2)	0	100
TriStar 70WSP	48 g/100 gal (2)	20	0
TriStar 70WSP	96 g/100 gal (2)	2*	86
Orthene 97	8.0 oz/100 gal (2)	10	26
Untreated check	-	14	-

* Many dead nymphs.

Table 60. Efficacy on Oystershell Scale on Carolina Silverbell, Nielsen, OH, 2008.

Treatment	Rate Per 100 Gal	Application Method	Percent Infested 6/24/2008	Percent Infested 9/8/2008
Aloft SC	5 fl oz	Sprench	50	0
Aloft SC	10 fl oz	Sprench	50	0
MOI 201	1:500	Spray	100	0
MOI 201	1:800	Spray	100	0
Safari 20SG	6 g/ft height	Drench	50	0
Safari 20SG	12 g/ft height	Drench	0	0
TriStar 30SG	4 oz	Spray	100	0
TriStar 30 SG	8 oz	Spray	100	0
Untreated	-	-	100	0

Applications were made on June 6, 2008.
Evaluations were made on June 24, 2008 for the 1st generation and on Sept 8, 2008 for the 2nd generation as number of live scales in a 2 minute search.

Pine Needle Scale.

Nielsen. In 2010 and 2011, Nielsen conducted two field experiments to determine the efficacy of several products on pine needle scale (*Phenacaspis pinifoliae*) on pine (*Pinus* sp.). In 2010, Aloft SC, Distance, Kontos, Rycar, Talus 70DF and Tristar 30SG provided complete or nearly complete control of second generation pine needle scale (Table 61). The only soil treatment that was effective 16-DAT was Safari 20SG. By 57-DAT, both formulations of Safari eliminated pine needle scale from treated trees. A16901B dramatically reduced scale survival. Neither formulation of Flagship was effective. In 2011, Talus 70DF, Tristar 30SG and horticultural oil provided complete control of pine needle scale nymphs within 12 DAT; Rycar was almost as effective (Table 62). Nineteen days later, control with Flagship 25WG, Safari 2G and Kontos improved. On Oct 6, more than 3.5 months after treatment, the scale population on trees treated with Kontos had recovered somewhat. No reproduction had occurred on trees treated with A16901B, Flagship 25WG, Safari 2G or Safari 20SG. No phytotoxicity was observed on any of the treated plants.

Jones. In 2012, Jones conducted a field experiment to determine the efficacy of several products on pine needle scale on Scotch pine (*Pinus sylvestris*).All treatments significantly reduced scale survival by 28 days post-treatment; Flagship provided poor control, GF-2626 and Safari provided mediocre control, and Xxpire provided good control at the high rate (Table 63). By 180 DAT, all treatments, except Flagship, significantly reduced scale cover presence and increased aesthetic appearance of pine leaves. No phytotoxicity was observed on any of the treated plants.

Sadof. In 2015, Sadof conducted a field experiment to determine the efficacy of several products targeted to overwintering females and young crawlers of the first generation on pine needle scale on white pine (*Pinus strobus*). There were no significant differences among scale densities on 7 and 14 DAT (Table 64). However, at 28 and 167 DAT, XXpire and Distance significantly reduced densities of pine needle scale. To directly assess the capacity of an insecticide to kill the scales, mortality at different times was calculated. At 7 DAT Horticultural oil caused higher mortality when compared with the water control; XXpire and Horticultural oil caused higher mortality at 14 DAT (Table 65). At 167 DAT, Distance, Horticultural oil and XXpire at the high rate showed superior mortality when compared with the water control.

Table 61. Efficacy on Pine Needle Scale on Pine, Nielsen, OH, 2010.

Treatment	Rate per 100 Gal	Application Method	No New Adults (% Control) 7/30/2010	% Mortality of 1st Gen Nymphs 7/30/2010	No. New Adults (% Control) 9/9/2010
A16901B	10 oz	Drench	89 (11)	34	7 (88)
Aloft SC	10 fl oz	Sprench	0 (100)	100	-
Distance	12 fl oz	Spray	0 (100)	100	-
Flagship 0.22G	227 g/in dbh	Broadcast	100 (0)	8	78 (0)
Flagship 25WG	4 g/in dbh	Drench	100 (0)	18	42 (28)
Kontos	3.4 fl oz	Spray	0 (100)	62	-
Rycar	18 fl oz	Spray	0 (100)	100	-
Safari 2G	60 g/in dbh	Broadcast	84 (16)	63	0 (100)
Safari 20SG	6 g/in dbh	Drench	0 (100)	96	0 (100)
Talus 70DF	14 oz	Spray	1 (99)	99	-
TriStar 30SG	8 oz	Spray	0 (100)	100	-
Untreated	-	-	100 (0)	24	58 (0)

Applications were made on July 14, 2010.
Evaluations were made on July 30 and September 9 (soil treatments only).

Table 62. Efficacy on Pine Needle Scale on Pine, Nielsen, OH, 2011.

Treatment	Rate per 100 Gal	Application Method	% Mortality of 1st Gen Nymphs		Presence (+) or Absence (A) of 2nd Gen Eggs on 10/6/11			
			6/1/11	6/20/11	Rep 1	Rep 2	Rep 3	Rep 4
A16901B	10 oz	Drench	27	29	A	A	A	A
Flagship 0.22G	227 g/ft ht	Broadcast	23	13	+	A	A	+
Flagship 25WG	4 g/ft ht	Drench	27	83	A	A	A	A
Kontos	3.4 fl oz	Spray	52	90	+	+	+	+[y]
Rycar	18 fl oz	Spray	97[x]	*	This treatment not re-sampled			
Safari 2G	60 g/in dbh	Broadcast	8	67	A	A	A	A
Safari 20SG	6 g/in dbh	Drench	82	100	A	A	A	A
Sunspray Ultra-Fine Oil	2 % v:v	Spray	100	*	This treatment not re-sampled			
Talus 70DF	14 oz	Spray	100	*	This treatment not re-sampled			
TriStar 30SG	8 oz	Spray	100	*	This treatment not re-sampled			
Untreated	-	-	12	13	+	+	+	+

Applications were made on May 20, 2011.
[x] Scales died more slowly in this, effective treatment.
[y] Many fewer new female scales on new growth than on untreated check trees.
* This treatment not re-sampled.

Table 63. Efficacy on Pine Needle Scale on Scotch Pine, Jones, OH, 2012.

Treatment	Rate	Application Method	% Scale Infestation 5/2	% Mortality 5/10	% Mortality 5/17	% Mortality 5/31	% Mortality 10/23	% Scale Infestation 10/23	% Reduction 10/23
Flagship G	227 g/ft ht	Broadcast	29.17 a	56.00 a	30.17 a	49.00 b	55.33 a	11.25 a	62.11 ab
GF-2626 1SC	8 oz/100 gal	Foliar	11.5 a	38.17 a	40.50 a	57.67 b	42.83 a	1.83 a	82.33 a
GF-2626 1SC	11 fl oz/100 gal	Foliar	34.17 a	54.33 a	36.83 a	69.00 ab	65.83 a	9.08 a	78.47 a
XXpire 40WG	3.5 oz/100 gal	Foliar	23.17 a	33.67 a	13.33 a	53.67 b	52.33 a	8.83 a	69.06 a
XXpire 40WG	7 oz/100 gal	Foliar	31.17 a	46.50 a	37.67 a	83.83 a	53.67 a	7.67 a	70.06 a
Safari 20SG	6 g/ft ht	Drench	26.83 a	51.67 a	20.83 a	71.83 ab	54.50 a	4.50 a	84.93 a
Untreated	-	-	23.92 a	0.00 a	0.00 a	3.67 c	13.67 b	16.00 a	33.06 b

[x]Means followed by same letter do not significantly differ (P=.05, Duncan's New MRT).

* All treatments applied on 5/3/12; foliar treatments applied a second time on 7/6/12.

Table 64. Efficacy on Pine Needle Scale on White Pine (*Pinus strobus)*, Sadof, IN, 2015a.

Treatment	Rate Per 100 Gal	Applic Dates	Number of Live Scales Per cm [x]				
			Pretreat	7 DAT (1st instar) [y]	14 DAT (2nd instar)	28 DAT (Adults)	167 DAT (Adults)
Distance	12 fl oz	5/1	0.86 a	0.08 a (0)	0.38 a (0)	0.66 bc (0)	0.01 a (62)
Horticultural oil	labeled rate	5/1	1.08 a	0.14 a (0)	0.23 a (29)	0.29 ab (24)	0.03 ab (20)
IKI-3106	28 fl oz	5/1, 14	1.76 a	0.09 a (0)	0.43 a (19)	1.01 cd (0)	0.18 c (0)
IKI-3106	22 fl oz	5/1, 14	1.40 a	0.18 a (0)	0.70 a (0)	0.97 cd (0)	0.18 c (0)
Kontos Drench	3.4 fl oz	5/1	1.95 a	0.11 a (0)	0.52 a (11)	0.99 cd (0)	0.11 c (0)
Kontos Foliar	3.4 fl oz	5/1	1.91 a	0.14 a (0)	0.53 a (7)	0.56 abc (18)	0.11 c (0)
Mainspring 200SC	0.125 fl oz per ft ht	5/1	2.85 a	0.17 a (0)	0.84 a (2)	1.66 d (0)	0.13 c (0)
Mainspring 200SC	0.25 fl oz per ft ht	5/1	1.00 a	0.05 a (0)	0.47 a (0)	0.94 cd (0)	0.16 c (0)
Safari 20SG	18 oz	5/1	1.62 a	0.16 a (0)	1.22 a (0)	0.68 bc (0)	0.02 ab (67)
XXpire 40WG + Capsil	2.75 oz + 6 fl oz	5/1, 14	2.21 a	0.11 a (0)	0.69 a (0)	0.51 abc (35)	0.08 bc (0)
XXpire 40WG + Capsil	3.5 oz + 6 fl oz	5/1, 14	1.35 a	0.11 a (0)	0.41 a (0)	0.13 a (73)	0.01 a (75)
Untreated	-	-	2.56 a	0.10 a (0)	0.77 a (0)	0.91 c (0)	0.09 bc (0)

[x] Means within a column followed by the same letter are not significantly different (Fisher's LSD, P= 0.05).

[y] DAT = days after the first treatment.

* Mainspring applied as drench at 0.125 and 0.25 fl oz per foot tree height.

Table 65. Efficacy on Pine Needle Scale on White Pine (*Pinus strobus)*, Sadof, IN, 2015b.

Treatment	Rate Per 100 Gal	Application Dates	Mortality on Needles			
			7 DAT (1st instar) [y]	14 DAT (2nd instar)	28 DAT (Adults)	167 DAT (Adults)
Distance	12 fl oz	5/1	0.27 bc	0.40 cde	0.26 a	0.81 a
Horticultural oil		5/1	0.55 a	0.55 bc	0.29 a	0.84 a
IKI-3106	28 fl oz	5/1, 14	0.30 bc	0.26 def	0.51 a	0.31 c
IKI-3106	22 fl oz	5/1, 14	0.09 c	0.40 cde	0.54 a	0.37 bc
Kontos Drench	3.4 fl oz	5/1	0.13 c	0.20 e	0.62 a	0.45 bc
Kontos Foliar	3.4 fl oz	5/1	0.17 bc	0.42 cd	0.42 a	0.38 bc
Mainspring 200SC	0.125 fl oz per ft ht	5/1	0.16 bc	0.14 f	0.63 a	0.48 bc
Mainspring 200SC	0.25 fl oz per ft ht	5/1	0.06 c	0.29 def	0.51 a	0.39 bc
Safari 20SG	18 oz	5/1	0.38 ab	0.35 def	0.35 a	0.67 ab
XXpire 40WG + Capsil	2.75 oz + 6 fl oz	5/1, 14	0.12 c	0.65 b	0.20 a	0.20 c
XXpire 40WG + Capsil	3.5 oz + 6 fl oz	5/1, 14	0.17 bc	0.81 a	0.55 a	0.82 a
Untreated	-	-	0.14 bc	0.29 def	0.66 a	0.41 bc

[x] Means within a column followed by the same letter are not significantly different (Fisher's LSD, P= 0.05).
[y] DAT = days after the first treatment.
* Mainspring applied as drench at 0.125 and 0.25 fl oz per foot tree height.

Tea Scale.
During 2009, two researchers evaluated the efficacy of several products on tea scale (*Fiorinia theae*). Hesselein evaluated Safari on tea scale infesting dwarf Burford holly (*Ilex cornuta*)' Burfordii 'Nana' in a commercial landscape. Both Safari 20SG drench and 2G soil treatment significantly increased mortality of female tea scale (Table 66). Ludwig evaluated efficacy of Safari, Talus and Triact on tea scale (*Fiorinia theae*) infesting Japanese camellia (*Camellia japonica*) grown in containers. Safari drench was the only treatment that resulted in significantly higher mortality 32 and 68 days after treatment (Table 67). Sixty-eight days after the Safari 20SG treatment was applied, 100% of the female scales were dead.

In 2010, Frank evaluated Kontos, Safari and Talus on tea scale infesting Japanese camellia (*Camellia japonica*) grown in containers. Scale abundance was significantly less than the untreated control in all treatments by 7 DAT (Table 68). Differences persisted through the experiment to the last sample date 70 DAT.

In 2014, Chen conducted an experiment examining efficacy of various insecticides on tea scale on sasanqua (*Camellia sasanqua*) 'Mountain Snow'. All treatments, including the standard SuffOil-X, provided good to excellent control of a moderate to high infestation within 60 days after the second application (Table 69). XXpire at 3.5 oz per 100 gal provided the best control.

In 2014, Arthurs evaluated the efficacy of various insecticides applied in the spring against crawler stages of tea scale infesting Japanese camellia (*C. japonica*) 'In the Pink'. All treatments provided excellent control of tea scale during the experiment (Table 70, Table 71). XXpire, Distance, SuffOil-X and Safari, eliminated (or came close to eliminating) the scale infestation, whereas some residual scale infestation remained in the Mainspring and Talus treatments at the end of the experiment, providing the likelihood for scale reestablishment in the following year.

Table 66. Efficacy on Tea Scale on Dwarf Burford Holly 'Burfordii Nana', Hesselein, AL, 2009.

Treatment	Rate	Application Method	Average % Mortality				
			Pretreatment	10 DAT	14 DAT	31 DAT	42 DAT
Safari 20SG	6 g/ft height	Drench	52 a	96 a	84 a	90 a	94 a
Safari 2G	60 g/ft height	Soil surface	50 a	91 a	86 a	81 ab	92 a
Saf-T-Side Oil	2 % solution	Foliar	50 a	93 a	91 a	91 a	97 a
Untreated	-	-	51 a	63 b	59 b	68 b	67 b

* Means within a column followed by the same letter are not significantly different (Tukey'sHSD, P< 0.05).

Table 67. Efficacy on Tea Scale on Japanese Camellia (*Camellia japonica*), Ludwig, TX, 2009.

Treatment	Rate	Application Method	Percent Female Adult Scale Mortality			
			Pretreatment	14 DAT	32 DAT	68 DAT
Safari 2G	2.6 g/gallon of media	Media mix	41.6a	90.4a	69.0ab	45.6a
Safari 20SG	24 oz/100gal	Drench	37.4a	92.0a	98.4b	100b
Talus 40 SC	21.5 fl oz/100 gal	Foliar	52.7a	85.3a	54.7a	69.3a
Triact 70	2 gal/100 gal	Foliar	76.0a	93.3a	60.0a	72.7a
Untreated	-	-	60.7a	78.0a	38.7a	45.3a

* Means within a column followed by the same letter are not significantly different (Tukey's HSD, P< 0.05).

Table 68. Efficacy on Tea Scale on Japanese Camellia, Frank, NC, 2010.

Treatment	Rate	Application Method	No. of Scales (Henderson's % Control)				
			Pretreatment	7 DAT	14 DAT	28 DAT	70 DAT
Kontos	3.4 fl oz/100 gal	Foliar	133.5 a	9.2 b (91)	4.5 b (95)	0.8 b (99)	0.0 b (100)
Safari 2G	2.6 g/gal media	Broadcast	134.7 a	14.0 b (87)	6.5 b (93)	2.0 b (97)	0.0 b (100)
Safari 20SG	24 oz/100 gal	Drench	161.7 a	14.7 b (88)	7.2 b (94)	1.5 b (98)	0.0 b (100)
Talus 70DF	14 oz/100 gal	Foliar	152.0 a	13.5 b (89)	6.3 b (94)	1.8 b (98)	6.3 b (92)
Untreated	-	-	128.8 a	99.7 a (0)	90.7 a (0)	68.8 a (0)	66.7 a (0)

* Means within a column followed by the same letter are not significantly different (LSD test, P= 0.05).

Table 69. Efficacy of Insecticides on Tea Scale on Sasanqua (*Camellia sasanqua*), Chen, LA, 2014.

Treatment	Rate Per 100 Gal	Applic. Method, Timing	No. of Scales (% Control)			
			Nymphs	Adults	Crawlers	Total
30 DAT2						
AzaGuard (azadirachtin)	20 fl oz	Foliar, 3/28	2.4 a (71)	1.4 ab (72	0.9 ab (0)	4.7 ab (66)
Distance (pyriproxyfen)	12 fl oz	Foliar, 3/28, 4/18	3.4 a (60)	4.3 ab (14)	0 b (100)	7.7 ab (44)
Mainspring 200SC	12 fl oz	Drench, 4/11	1.8 a (79)	2.0 ab (60)	1.6 a (0)	5.4 ab (61)
Mainspring 200SC (cyanthraniliprole)	8 fl oz	Drench, 4/11, 5/12	3.0 a (64)	0 b (100)	0.2 ab (50)	3.2 b (77)
SuffOil-X (horticultural oil)	1 gal	Foliar 3/28, 4/11	6.1 a (27)	0 b (100)	0 b (100)	6.1 ab (56)
Talus 70DF (buprofezin)	14 oz	Foliar, 3/28	1.3 a (85)	6.7 a (0)	0 b (100)	8.0 ab (42)
Xxpire 40WG (spinetoram + sulfoxaflor) + Capsil	2 oz + 6 fl oz	Foliar, 3/28, 4/11	3.4 a (60)	0 b (100)	0 b (100)	3.4 b (75)
Xxpire 40WG + Capsil	2.75 oz + 6 fl oz	Foliar, 3/28, 4/11	2.5 a (70)	1.8 ab (64)	0.2 ab (50)	4.5 ab (67)
Xxpire 40WG + Capsil	3.5 oz + 6 fl oz	Foliar, 3/28, 4/11	4.9 a (42)	0.7 b (86)	0 b (100)	5.6 ab (59)
Untreated (water)	-	Foliar 3/28, 4/11	8.4 a (0)	5.0 ab (0)	0.4 ab (0)	13.8 a (0)
60 DAT2						
AzaGuard (azadirachtin)	20 fl oz	Foliar, 3/28	1.7 b (88)	0.6 b (92)	0.3 b (62)	2.5 bc (88)
Distance (pyriproxyfen)	12 fl oz	Foliar, 3/28, 4/18	2.8 b (80)	2.1 b (71)	0 b (100)	4.8 bc (78)
Mainspring 200SC	12 fl oz	Drench, 4/11	4.2 b (69)	3.4 b (53)	2.0 a (0)	9.5 b (56)
Mainspring 200SC (cyanthraniliprole)	8 fl oz	Drench, 4/11, 5/12	1.9 b (86)	0.4 b (95)	0 b (100)	2.3 bc (89)
SuffOil-X (horticultural oil)	1 gal	Foliar 3/28, 4/11	3.7 b (73)	0 b (100)	0 b (100)	3.7 bc (83)
Talus 70DF (buprofezin)	14 oz	Foliar, 3/28	2.4 b (82)	3.3 b (55)	0.3 b (62)	6.0 bc (72)
Xxpire 40WG (spinetoram + sulfoxaflor) + Capsil	2 oz + 6 fl oz	Foliar, 3/28, 4/11	0.1 b (99)	0.5 b (93)	0.3 b (62)	0.9 bc (96)
Xxpire 40WG + Capsil	2.75 oz + 6 fl oz	Foliar, 3/28, 4/11	1.9 b (86)	2.3 b (68)	0 b (100)	4.2 bc (81)
Xxpire 40WG + Capsil	3.5 oz + 6 fl oz	Foliar, 3/28, 4/11	0 b (100)	0 b (100)	0 b (100)	0 c (100)
Untreated (water)	-	Foliar 3/28, 4/11	13.7 a (0)	7.3 a (0)	0.8 ab (0)	21.8 a (0)

[x] Numbers on 6 leaves at days after 2nd application (DAT2). Means within column followed by the same letter are not significantly different (LSD, P=0.05).

Table 70. Efficacy on Tea Scale on Japanese Camellia, (*Camellia japonica*) 'In the Pink' (Counts), Arthurs, FL, 2014.

Treatment	Rate Per 100 Gal	Applic. Method, Timing	Population Averages[x] (Henderson's Percent Control)						
			Pretreat	7 DAT	14 DAT	21 DAT	35 DAT	76 DAT	150 DAT
Total # tea scale (adults + large nymphs) per older leaf									
Distance	12 floz	Foliar, 3/13, 4/3	71.0 a	53.8 a (36)	60.8 a (3)	33.9 a (19)	38.2 a (9)	3.1 a-d (63)	0.3 d (99)
Xxpire 40WG + Capsil	2 oz + 6 fl oz	Foliar, 3/13, 3/27	71.8 a	64.9 a (23)	64.9 a (0)	58.6 a (0)	28.8 a (32)	0.3 d (96)	2.0 cd (96)
Xxpire 40WG + Capsil	2.75 oz + 6 fl oz	Foliar, 3/13, 3/27	63.7 a	44.9 a (40)	37.5 a (33)	19.6 a (48)	21.8 a (42)	0.3 d (96)	0..1 d (99)
Xxpire 40WG + Capsil	3.5 oz + 6 fl oz	Foliar, 3/13, 3/27	67.3 a	47.8 a (40)	60.1 a (0)	35.0 a (12)	28.4 a (39)	3.4 a-d (57)	0.3 d (99)
Mainspring 200SC	8 floz	Drench, 3/13, 4/10	68.7 a	65.5 a (19)	48.9 a (19)	42.6 a (0)	31.8 a (22)	15.4 ab (0)	9.6 bc (78)
Mainspring 200SC	12 floz	Drench, 3/13	71.0 a	93.8 a (0)	61.7 a (1)	38.6 a (8)	36.3 a (14)	16.9 a (0)	13.3 b (71)
Safari 20SG	24 oz	Drench, 3/13	70.3 a	62.5 a (24)	79.8 a (0)	24.1 a (42)	27.1 a (35)	2.6 bcd (68)	0.0 d (100)
SuffOil-X	2 gal	Foliar, 3/13, 3/27, 4/10	67.7 a	47.6 a (40)	57.0 a (4)	20.6 a (48)	20.2 a (50)	1.8 cd (77)	0.0 d (100)
Talus 70DF	14 oz	Foliar, 3/13, 3/27	68.4 a	71.2 a (12)	72.9 a (0)	43.6 a (0)	38.5 a (5)	14.7 abc (0)	1.5 cd (97)
Untreated	-	-	75.9 a	89.3 a (0)	66.7 a (0)	44.8 a (0)	44.9 a (0)	8.9 abc (0)	49.2 a (0)
Total # tea scale (adults + large nymphs) per new leaf (seasonal growth)									
Distance	12 floz	Foliar, 3/13, 4/3	n/a	n/a	0.0 a (100)	0.0 a (100)	0.0 b (100)	0.0 b (100)	0.3 c (99)
Xxpire 40WG + Capsil	2 oz + 6 fl oz	Foliar, 3/13, 3/27	n/a	n/a	0.0 a (100)	0.0 a (100)	0.0 b (100)	0.1 b (99)	0.2 c (99)
Xxpire 40WG + Capsil	2.75 oz + 6 fl oz	Foliar, 3/13, 3/27	n/a	n/a	0.0 a (100)	0.0 a (100)	0.0 b (100)	0.0 b (100)	0.1 c (99)
Xxpire 40WG + Capsil	3.5 oz + 6 fl oz	Foliar, 3/13, 3/27	n/a	n/a	0.0 a (100)	0.0 a (100)	0.0 b (100)	0.0 b (100)	0.3 c (99)
Mainspring 200SC	8 floz	Drench, 3/13, 4/10	n/a	n/a	0.0 a (100)	0.0 a (100)	0.2 ab (75)	0.4 b (98)	7.4 b (84)
Mainspring 200SC	12 floz	Drench, 3/13	n/a	n/a	0.0 a (100)	0.0 a (100)	1.0 a (0)	0.1 b (99)	5.0 b (90)
Safari 20SG	24 oz	Drench, 3/13	n/a	n/a	0.1 a (95)	0.2 a (78)	0.0 b (100)	0.0 b (100)	0.0 c (100)
SuffOil-X	2 gal	Foliar, 3/13, 3/27, 4/10	n/a	n/a	0.0 a (100)	0.0 a (100)	0.0 b (100)	0.0 b (100)	0.0 c (100)
Talus 70DF	14 oz	Foliar, 3/13, 3/27	n/a	n/a	0.0 a (100)	0.7 a (22)	0.2 ab (75)	0.0 b (100)	3.5 b (93)
Untreated	-	-	n/a	n/a	2.0 a (0)	0.9 a (0)	0.8 a (0)	21.3 a (0)	47.6 a (0)

[x] Data based on average of 6 plants. Column means followed by different letters (where present) are significantly different($P<0.05$, Tukey's HSD).

[y] Data based on average of 6 plants rated on a 5 point scale where 0 = no infestation, 1 = ≤ 10% leaf infestation, 2 = 11–30%, 3 = 31–50%, 4 =51–70%, 5 = ≥71% leaf infestation. Chi-square values (2-sided tests) based on cross tabulation among treatment and infestation scale.

Table 71. Efficacy on Tea Scale on Japanese Camellia, (*Camellia japonica*) 'In the Pink' (Infestation Index), Arthurs, FL, 2014.

Treatment	Rate Per 100 Gal	Applic. Method, Timing	Population Averages[x] (Henderson's Percent Control)						
			Pretreat	7 DAT	14 DAT	21 DAT	35 DAT	76 DAT	150 DAT
Infestation Index[y]									
Distance	12 floz	Foliar, 3/13, 4/3	2.7 a	2.2 a	2.0 a	1.8 a	1.3 a	0.8 a	0.0 a
Xxpire 40WG + Capsil	2 oz + 6 fl oz	Foliar, 3/13, 3/27	2.2 a	2.0 a	1.8 a	1.7 a	1.3 a	0.8 a	0.5 a
Xxpire 40WG + Capsil	2.75 oz + 6 fl oz	Foliar, 3/13, 3/27	2.0 a	1.8 a	1.8 a	1.3 a	1.2 a	1.0 a	0.2 a
Xxpire 40WG + Capsil	3.5 oz + 6 fl oz	Foliar, 3/13, 3/27	2.2 a	1.7 a	1.8 a	1.5 a	1.3 a	1.0 a	0.2 a
Mainspring 200SC	8 floz	Drench, 3/13, 4/10	2.5 a	2.5 a	2.2 a	1.7 a	1.3 a	1.0 a	1.3 a
Mainspring 200SC	12 floz	Drench, 3/13	2.7 a	2.7 a	2.3 a	1.7 a	1.5 a	1.2 a	2.0 a
Safari 20SG	24 oz	Drench, 3/13	2.5 a	2.5 a	2.2 a	1.3 a	1.3 a	0.8 a	0.0 a
SuffOil-X	2 gal	Foliar, 3/13, 3/27, 4/10	2.7 a	2.0 a	1.7 a	1.3 a	1.3 a	0.5 a	0.0 a
Talus 70DF	14 oz	Foliar, 3/13, 3/27	2.5 a	2.8 a	2.5 a	1.8 a	1.5 a	1.2 a	0.8 a
Untreated	-	-	2.3 a	2.3 a	2.3 a	1.7 a	1.8 a	1.0 a	2.5 b

[x] Data based on average of 6 plants. Column means followed by different letters (where present) are significantly different (P<0.05, Tukey's HSD).

[y] Data based on average of 6 plants rated on a 5 point scale where 0 = no infestation, 1 = ≤ 10% leaf infestation, 2 = 11–30%, 3 = 31–50%, 4 =51–70%, 5 = ≥71% leaf infestation. Chi-square values (2-sided tests) based on cross tabulation among treatment and infestation scale.

During 2015, four researchers investigated the efficacy of various insecticides on tea scale (*Fiorinia theae*). Braman evaluated effficacy of BAS 440, BYI-2960, Distance, Distance + Tristar, IKI-3106, Mainspring and Talus on tea scale crawlers infesting Japanese camellia (*C. japonica*). All treatments, except Mainspring at the low rate, provided significant control by 28 DAT after applying most of the 2nd and 3rd applications (Table 72). Six months after the initial application, all treatments kept the population to low levels. Chen evaluated efficacy of Distance, IKI-3106, Mainspring, Talus 70DF, Ultra-Pure Oil, Distance + TriStar, and BAS 440 + Ultra-Pure Oil applied foliar twice on 14-day intervals on tea scale crawlers infesting Japanese camellia. Talus 70DF provided the best control keeping total scale density less than 0.6 per leaf for up to 157 DAT. Distance and Distance + TriStar provided similar control with both being effective in keeping total scale density below 1 per leaf for up to 157 DAT. BAS440 + Ultra-Pure Oil provided better control than Ultra-Pure Oil alone, with the former being effective up to 128 DAT and the later up to 90 DAT. Mainspring and IKI-3106 provided less residual efficacy. Chong evaluated efficacy of BAS 440 + Ultra-Pure Oil, BYI-2960, Distance, IKI-3106, Mainspring, and Talus 70DF on tea scale crawlers infesting holly (Table 73). Distance, Talus, Distance + TriStar and BAS 440 + Ultra-Pure Oil provided the best control in this experiment; BYI-2960, IKI-3106, and Mainspring were less effective. Frank evaluated efficacy of BAS 440, BYI-2960, Distance, IKI-3106, Mainspring, and Talus 70DF on tea scale crawlers infesting holly. No significant differences between treatments and untreated check was obtained probably because of high variance due to patchy scale distribution within plants (Table 74). Also unexpected precipitation occurred 3 hours after one application.

Table 72. Efficacy on Tea Scale on Japanese Camellia, (Camellia japonica), Braman, GA, 2015.

Treatment	Rate Per 100 Gal	Application Dates	Number of Crawlers Per 3 Leaves [x]				
			Pretreat	7 DAT [y]	14 DAT	28 DAT	6 MAT
BAS 440 00I	7 fl oz	5/20, 6/3, 17	4.87 abc	2.25 b (63)	0.25 c (88)	0.87 bc (80)	0.37 b (95)
BYI-2960 200 SL	2.7 fl oz	5/20, 27, 6/3	3.87 abc	4.25 ab (12)	1.87 abc (0)	2.37 bc (31)	0.87 b (85)
BYI-2960 200 SL	5.4 fl oz	5/20, 27, 6/3	9.25 a	7.00ab (39)	4.25 a (0)	0.25 c (97)	0.37 b (97)
Distance	12 fl oz	5/20, 6/10	3.37 bc	2.87 b (31)	4.00 a (0)	1.75 bc (41)	1.50 b (71)
Distance + Tristar	12 fl oz + 12 fl oz	5/20	6.00 abc	5.12 ab (31)	2.37abc (9)	1.12 bc (79)	0.83 b (91)
IKI-3106	22 fl oz	5/20, 6/3	4.75 abc	6.25 ab (0)	1.12 bc (46)	2.12 bc (50)	0.50 b (93)
IKI-3106	28 fl oz	5/20	6.62 abc	3.62 ab (56)	1.12 bc (61)	1.25 bc (79)	0.62 b (94)
Mainspring 200SC	.125 fl oz/ft ht	5/20, 6/17	4.50 bc	5.75 ab (0)	1.62 abc (17)	4.00 ab (0)	0.33 b (95)
Mainspring 200SC	.25 fl oz/ft ht	5/20	3.87 bc	3.25 b (32)	2.25abc (0)	1.87 bc (46)	0.71 b (88)
Talus 70DF	14 oz	5/20	2.75 c	1.62 b (53)	0.25 c (79)	0.37 c (85)	0.57 b (87)
UTC	-	-	7.75 ab	9.62 a (0)	3.37 ab (0)	6.87 a (0)	12.0 a (0)

[x] Means within a column followed by the same letter are not significantly different (LSD, P= 0.05).

[y] DAT = days after the first treatment; MAT = months after first treatment.

* Mainspring applied as drench at 0.125 and 0.25 fl oz per foot shrub height.

Table 73. Efficacy on Tea Scale on Japanese Camellia, (Camellia japonica), Chen, LA, 2015.

Treatment	Rate (per 100 gal)	Number of Scales Per Leaf (Henderson's Percent Control) [x]					
		30 DAT	68 DAT	90 DAT	128 DAT	157 DAT	197 DAT
Immatures							
BAS440 + Ultra-Pure Oil	7 fl oz + 12 fl oz	0.3 a (70)	0 b (100)	0.4 c (67)	0.5 a (17)	1.0 b (55)	11.1 a (0)
Distance	12 fl oz	0.3 a (70)	3.2 b (76)	0.1 c (92)	0.1 a (83)	0.7 b (68)	1.3 a (0)
Distance + TriStar	12 fl oz + 12 fl oz	0.5 a (50)	0.1 b (99)	0.2 c (83)	0.3 a (50)	0.3 b (86)	0.4 a (0)
IKI-3106	22 fl oz	0.3 a (70)	0.3 b (98)	2.6 a (0)	1.3 a (0)	6.8 a (0)	11.0 a (0)
IKI-3106	28 fl oz	0.9 a (10)	2.5 b (81)	0.7 bc (42)	0.9 a (0)	2.3 b (0)	0.1 a (67)
Mainspring 200SC	8 fl oz	0.3 a (70)	0.5 b (96)	0.7 bc (42)	0.6 a (0)	2.7 b (0)	0.7 a (0)
Talus 70DF	14 oz	0 a (100)	0 b (100)	0 c (100)	0.5 a (17)	0.1 b (95)	1.2 a (0)
Ultra-Pure Oil	12 fl oz	0.3 a (70)	1.8 b (87)	2.0 ab (0)	2.25 a (0)	1.9 b (14)	1.5 a (0)
Untreated	-	1.0 a (0)	13.4 a (0)	1.2 abc (0)	0.6 a (0)	2.2 b (0)	0.3 a (0)
Adults							
BAS440 + Ultra-Pure Oil	7 fl oz + 12 fl oz		0 b (100)	0.8 a (0)	0 b (100)	0.5 ab (44)	22.8 a (0)
Distance	12 fl oz		0.3 b (91)	0.7 a (0)	0.1 b (91)	0 b (100)	13.0 a (0)
Distance + TriStar	12 fl oz + 12 fl oz		0 b (100)	1.7 a (0)	0.1 b (91)	0.1 b (89)	20.4 a (0)
IKI-3106	22 fl oz		0 b (100)	0.1 a (86)	0.1 b (91)	1.9 a (0)	27.4 a (0)
IKI-3106	28 fl oz		0 b (100)	0.4 a (43)	0.2 b (82)	1.5 ab (0)	21.8 a (0)
Mainspring 200SC	8 fl oz		0 b (100)	0.1 a (86)	0 b (100)	0.9 ab (0)	30.4 a (0)
Talus 70DF	14 oz		0.1 b (97)	0 a (100)	0.1 b (91)	0 b (100)	45.7 a (0)
Ultra-Pure Oil	12 fl oz		0.1 b (97)	0.6 a (14)	5.3 a (0)	0.4 ab (56)	37.3 a (0)
Untreated	-		3.2 a (0)	0.7 a (0)	1.1 b (0)	0.9 ab (0)	12.4 a (0)
Total							
BAS440 + Ultra-Pure Oil	7 fl oz + 12 fl oz		0 b (100)	1.2 a (37)	0.5 b (93)	1.5 b (52)	33.9 a (0)
Distance	12 fl oz		3.5 b (79)	0.8 a (58)	0.1 b (99)	0.7 b (77)	14.3 a (0)
Distance + TriStar	12 fl oz + 12 fl oz		0.1 b (99)	1.9 a (0)	0.4 b (94)	0.4 b (87)	20.8 a (0)

IKI-3106	22 fl oz		0.3 b (98)	2.7 a (0)	1.4 b (79)	8.6 a (0)	38.4 a (0)
IKI-3106	28 fl oz		2.5 b (85)	1.1 a (42)	1.1 ab (84)	3.7 b (0)	21.9 a (0)
Mainspring 200SC	8 fl oz		0.5 b (97)	0.8 a (58)	0.6 b (91)	3.6 b (0)	31.1 a (0)
Talus 70DF	14 oz		0.1 b (99)	0 a (100)	0.6 b (91)	0.1 b (97)	46.9 a (0)
Ultra-Pure Oil	12 fl oz		1.9 b (89)	2.6 a (0)	2.3 ab (66)	2.2 b (29)	38.8 a (0)
Untreated	-		16.6 a (0)	1.9 a (0)	6.8 a (0)	3.1 b (0)	12.8 a (0)

[x] Numbers on new growth at days after 1st application (DAT). Means within column followed by the same letter are not significantly different (LSD, P=0.05).
[y] DAT = days after the first treatment; MAT = months after first treatment.

Table 74. Efficacy on Tea Scale on Holly (Ilex sp.) 'Nellie Stevens', Chong, SC, 2015.

Treatment	Rate (per 100 gal)	Application Dates	Number of Scales Per Square Inch Leaf Surface (Henderson's Percent Control) [x]						
			Pretreat	7 DAT [y]	14 DAT	21 DAT	28 DAT	4 MAT	6 MAT
BAS 440 + UltraPure Oil	7 fl oz + 1%	7/10, 24, 8/7	8.7 a	2.5 e (74)	1.0 c (89)	1.5 ef (85)	1.0 d (90)	1.2 cd (81)	1.0 a (84)
BYI-2960	2.7 fl oz	7/10, 17, 24	9.0 a	4.5 cde (54)	5.7 ab (41)	6.7 ab (37)	3.7 b (63)	3.3 ab (51)	2.0 a (69)
BYI-2960	5.4 fl oz	7/10, 17, 24	8.2 a	3.3 de (63)	4.5 b (49)	4.8 bc (50)	1.3 cd (86)	2.0 bc (67)	2.0 a (65)
Distance	12 fl oz	7/10, 31	9.3 a	3.2 e (69)	1.3 c (87)	1.2 f (89)	1.0 d (90)	1.0 cd (85)	1.5 a (77)
Distance + TriStar	12 + 12 fl oz	7/10, 31	8.8 a	3.5 de (64)	1.2 c (87)	1.2 f (88)	1.0 d (90)	1.0 cd (85)	1.3 a (79)
IKI-3106 + Capsil	22 + 6 fl oz	7/10, 24, 8/7	9.5 a	5.5 bc (47)	4.3 b (58)	3.7 cd (67)	1.5 bcd (86)	2.7 b (62)	1.3 a (81)
IKI-3106 + Capsil	28 + 6 fl oz	7/10, 24, 8/7	8.5 a	5.5 bcd (41)	3.5 b (62)	2.5 de (75)	1.2 cd (87)	1.7 bcd (73)	1.3 a (78)
Mainspring	8 fl oz	7/10, 8-7	10.9 a	7.2 ab (40)	7.8 a (34)	7.5 ab (42)	2.8 bc (77)	2.7 bcd (67)	1.5 a (81)
Talus 70DF	14 oz	7/10	8.5 a	3.3 e (65)	1.2 c (87)	1.2 f (88)	0.8 d (92)	0.8 d (87)	1.0 a (83)
Untreated	-	-	8.5 a	9.3 a (0)	9.2 a (0)	10.0 a (0)	9.5 a (0)	6.3 a (0)	6.0 a (0)

[x] Means followed by same letter do not significantly differ (Fisher's LSD test, P=0.05).
[y] DAT = days after the first treatment; MAT = months after first treatment.
* All treatments applied foliar, except Mainspring applied as drench to potting medium.

Table 75. Efficacy on Tea Scale on Holly (Ilex sp.), Frank, NC, 2015.

Treatment	Rate (per 100 gal)	Application Dates	Number of Scales Per 5 Leaves (Henderson's Percent Control)[x]			
			Pretreat	7 DAT[y]	14 DAT	28 DAT
BAS 440 00I	7 fl oz	10/20, 11/3	13.3 a	31.3 a (32)	34.5 a (15)	10.8 bc (55)
BYI-2960 200 S	2.7 fl oz	10/20, 11/3	7.3 a	7.0 a (72)	28.3 abc (0)	5.5 c (59)
BYI-2960 200 SL	5.4 fl oz	10/20, 11/3	5.3 a	21.5 a (0)	12.0 bc (25)	6.0 c (38)
Distance	12 fl oz	10/20	7.5 a	30.5 a (0)	16.0 abc (30)	20.8 a (0)
Distance + TriStar	12 + 12 fl oz	10/20	15.5 a	50.3 a (6)	31.8 a (32)	16.3 ab (42)
IKI-3106	22 fl oz	10/20, 11/3	8.5 a	39.0 a (0)	35.0 a (0)	10.8 bc (30)
IKI-3106	28 fl oz	10/20, 11/3	4.5 a	26.8 a (0)	10.5 c (23)	8.0 bc (2)
Mainspring 200SC	8 fl oz	10/20	12.0 a	31.0 a (25)	30.5 ab (16)	21.3 a (3)
Mainspring 200SC	12 fl oz	10/20	7.0 a	38.3 a (0)	11.5 bc (46)	12.0 abc (6)
Untreated	-	-	6.75 a	23.3 a (0)	20.5 abc (0)	12.3 abc (0)

[x] Means followed by same letter do not significantly differ (LSD test, P=0.05).
[y] DAT = days after the first treatment.
* All treatments applied foliar, except Mainspring applied as drench to potting medium.

Comparative Efficacy on Cushion Scale

Cushion scale species are not as common as the other scale species tested in this program. They are a unique group and, unlike other scale species, adults are able to move around.

Cottony Cushion Scale

Three researchers evaluated the efficacy of neonicotinoids (Flagship, Safari and TriStar), insect growth regulators (Distance and Talus), A16901B, GF-2626, XXpire, Kontos and Rycar on cottony cushion scale (*Icerya purchasi*). A test on cleyera (*Ternstroemeria sp*.) had and extremely high scale population that caused early plant death in some treatments and the test was terminated early. No statistically significant differences were observed until 21 DAT; on this date, TriStar and Orthene provided good control (Table 76). Two experiments on heavenly bamboo (*Nandina domestica*) showed all treatments providing good to excellent controlof nymphs and adults in 2011 (Table 77); Flagship, GF-2626, XXpire, and Distance provided good to excellent control of nymphs in 2012 (Table 78). In a 2011 experiment on pittosporum (*P. tobira*), all treatments except A16901B significantly reduced live nymphs (Table 79). Of the neonicotinoids, Safari performed the best with no difference in efficacy between the drench and broadcast applications. On the other hand, foliar sprays of Flagship appeared to perform slightly (though not significantly) better than broadcast application. For the insect growth regulators, Talus provided better efficacy than Distance. In a 2012 experiment on pittosporum, both rates of GF-2626 andXXpire, along with Distance, Talus 70DF, Safari G and paraffinic oil, significantly reduced the numbers of nymphs feeding on the leaves one week after treatment (Table 80). At 4 WAT, both rates of GF-2626 and XXpire, along with all other treatments except for Flagship G and Kontos, achieved significantly lower nymphs densities. At this time, all treatments significantly reduced adult numbers on the leaves. However, none of the treatments were effective in reducing the numbers of nymphs and adults feeding on the stems (Data not shown, refer to researcher report).

No phytotoxicity was observed on any of the treated plants.

Table 76. Efficacy on Cottony Cushion Scale on Cleyera, Ludwig, TX, 2005.

Treatment	Rate	Population Averages (Henderson's Percent Control)			
		Pretreat-ment	9 DAT (Visual)	16 DAT (Visual)	21 DAT (Microscope)
Celero	4 oz	197.3 a	210.0 a (0)	210.5 a (0)	209.3 ab (48)
Safari 20SG	4 oz	156.5 a	97.5 a (42)	64.8 a (57)	100.8 a (69)
Safari 20SG	8 oz	170.0 a	158.5 a (13)	221.0 a (0)	259.3 a (26)
Safari 20SG – Drench	12 oz	101.0 a	155.7 a (0)	190.3 a (0)	346.7 a (0)
Safari 20SG – Drench	24 oz	190.8 a	216.3 a (0)	125.0 a (32)	205.5 ab (47)
TriStar 30SG	112 g	132.8 a	115.0 a (19)	84.0 a (34)	58.8 bc (78)
TriStar 30SG	124 oz	111.8 a	155.0 a (0)	121.5 a (0)	30.3 cd (87)
Orthene TTO 97	8 oz	403.0 a	330.0 a (23)	200.0 a (48)	80.0 d (90)
Untreated	-	160.5 a	171.5 a (0)	154.0 a (0)	328.8 a (0)

* Letters after numbers are based on separation of average number of scale on 5 plants. See experiment report in Appendix 3 for statistical separation details.

Table 77. Efficacy on Cottony Cushion Scale on Heavenly Bamboo 'Harbour Dwarf', Frank, NC, 2011.

Stage	Treatment	Rate	Applic. Method	Population Averages (Henderson's % Control)				
				Pretreat	7 DAT	14 DAT	28 DAT	75 DAT
Adults	A16901B	5 oz/100 gal	Drench	1.0 a	0.0 b (100)	0.3 b (97)	0.2 b (98)	0.7 b (86)
	Distance IGR	8 fl oz/100 gal	Foliar	0.3 a	0.0 b (100)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Flagship 0.22G	30 g/plant	Broadcast	0.7 a	0.0 b (100)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Flagship 25WG	0.5 g/plant	Drench	0.2 a	0.0 b (100)	0.3 b (86)	0.3 b (83)	0.2 b (80)
	Horticultural Oil	50 fl oz/100 gal	Foliar	1.0 a	0.3 b (94)	0.7 b (93)	0.3 b (97)	0.8 b (84)
	Kontos	3.4 fl oz/100 gal	Foliar	0.5 a	0.0 b (100)	0.3 b (94)	0.2 b (96)	0.3 b (88)
	Rycar 20SC	18 fl oz/100 gal	Foliar	0.5 a	0.0 b (100)	0.5 b (90)	0.3 b (93)	1.0 b (60)
	Safari 2G	2.6 g/plant	Broadcast	0.7 a	0.0 b (100)	0.0 b (100)	0.2 b (97)	0.0 b (100)
	Safari 20SG	24 oz/100 gal	Drench	1.0 a	0.2 b (96)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Talus 70DF	14 oz/100 gal	Foliar	0.5 a	0.5 b (80)	1.0 b (81)	0.0 b (100)	0.0 b (100)
	Tristar 30SG	8 oz/100 gal	Foliar	1.5 a	0.0 b (100)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Untreated	-	-	0.7 a	3.5 a (0)	7.3 a (0)	6.3 a (0)	3.5 a (0)
Nymphs	A16901B	5 oz/100 gal	Drench	8.8a	1.5 b (89)	1.0 b (89)	1.2 b (89)	0.0 b (100)
	Distance IGR	8 fl oz/100 gal	Foliar	11.0 a	0.7 b (96)	0.3 b (98)	0.7 b (95)	0.0 b (100)
	Flagship 0.22G	30 g/plant	Broadcast	8.3 a	0.0 b (100)	0.0 b (100)	0.2 b (98)	0.0 b (100)
	Flagship 25WG	0.5 g/plant	Drench	10.7 a	1.2 b (92)	0.5 b (97)	0.8 b (94)	0.0 b (100)
	Horticultural Oil	50 fl oz/100 gal	Foliar	9.0 a	3.7 b (72)	3.0 b (81)	2.5 b (78)	0.0 b (100)
	Kontos	3.4 fl oz/100 gal	Foliar	8.7 a	1.5 b (88)	1.7 b (89)	1.2 b (89)	0.0 b (100)
	Rycar 20SC	18 fl oz/100 gal	Foliar	9.8 a	2.8 b (85)	2.2 b (87)	2.5 b (80)	0.0 b (100)
	Safari 2G	2.6 g/plant	Broadcast	11.0 a	0.3 b (98)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Safari 20SG	24 oz/100 gal	Drench	11.0 a	0.3 b (98)	0.2 b (99)	0.0 b (100)	0.0 b (100)
	Talus 70DF	14 oz/100 gal	Foliar	8.5 a	1.7 b (97)	0.7 b (95)	0.3 b (97)	0.0 b (100)
	Tristar 30SG	8 oz/100 gal	Foliar	9.5 a	0.0 b (100)	0.0 b (100)	0.0 b (100)	0.0 b (100)
	Untreated	-	-	9.7 a	14.5 a (0)	16.7 a (0)	12.5 a (0)	1.3 a (0)

* Means within a column followed by the same letter are not significantly different (LSD test, P= 0.05).

Table 78. Efficacy of Insecticides on Cottony Cushion Scale on Heavenly Bamboo 'Harbour Dwarf', Frank, NC, 2012.

Scale Stage	Treatment*	Rate Per 100 Gal	Population Averages (Henderson's Percent Control)				
			Pre	6 DAT	14 DAT	28 DAT	134 DAT
Nymphs	A16901B	5 fl oz	45.3 a	32.8 a (30)	25.2 a (49)	42.5 ab (70)	0.2 a
	A16901B	10 fl oz	45.2 a	43.3 a (21)	15.0 a (70)	50.5 ab (65)	0.0 a
	Distance	12 fl oz	34.2 a	29.7 a (28)	5.5 a (85)	22.5 b (79)	0.0 a
	Flagship G	40 g/pot	44.3 a	30.0 a (44)	15.8 a (84)	10.3 b (93)	0.0 a
	GF-2626 ISC	8 fl oz	51.8 a	38.5 a (38)	12.3 a (78)	0.0 b (100)	0.0 a
	GF-2626 ISC	11 fl oz	55.7 a	27.7 a (59)	1.2 a (98)	16.7 b (91)	0.2 a
	Xxpire 40WG	3.5 oz	49.8 a	9.7 a (84)	12.0 a (78)	2.0 b (99)	0.0 a
	Xxpire 40WG	7 oz	43.8 a	21 a (60)	4.8 a (90)	3.5 b (97)	0.0 a
	Horticultural Oil	150 fl oz	21.2 a	16.8 a (35)	4.2 a (82)	21.2 b (68)	0.0 a
	Kontos	3.4 fl oz	21.7 a	16.8 a (36)	19.7 a (18)	41.8 ab (39)	0.2 a
	Talus 70DF	14 fl oz	33.2 a	12.0 a (70)	30.8 a (16)	51.2 ab (51)	0.0 a
	Untreated	-	25.7 a	31.0 a (0)	28.3 a (0)	81.2 a (0)	0.0 a
Adults	A16901B	5 fl oz	2.0 a	2.2 a (4)	3.0 a (0)	4.5 ab (0)	0.0 a
	A16901B	10 fl oz	5.0 a	4.0 a (51)	3.5 a (49)	3.7 ab (59)	0.0 a
	Distance	12 fl oz	1.7 a	1.5 a (23)	1.2 a (98)	0.7 bc (77)	0.0 a
	Flagship G	40 g/ pot	1.5 a	2.2 a (0)	2.2 a (0)	3.3 abc (0)	0.0 a
	GF-2626 ISC	8 fl oz	1.5 a	1.0 a (42)	1.3 a (36)	0.7 bc (74)	0.0 a
	GF-2626 ISC	11 fl oz	2.7 a	1.8 a (42)	3.3 a (10)	2.7 abc (45)	0.0 a
	Xxpire 40WG	3.5 oz	7.0 a	4.2 a (48)	4.7 a (51)	2.3 abc (82)	0.0 a
	Xxpire 40WG	7 oz	2.3 a	2.0 a (24)	2.3 a (27)	0.5 c (88)	0.0 a
	Horticultural Oil	150 fl oz	2.3 a	2.5 a (6)	3.2 a (0)	2.2 bc (47)	0.0 a
	Kontos	3.4 fl oz	2.2 a	2.0 a (21)	2.8 a (7)	2.0 bc (50)	0.0 a
	Talus 70DF	14 fl oz	2.5 a	3.2 a (0)	4.0 a (0)	4.0 abc (12)	0.2 a
	Untreated	-	3.3 a	3.8 a (0)	4.5 a (0)	6.0 a (0)	0.0 a

[x] Numbers of live nymphs or adults per plant counted days after initial treatment. Means within column followed by the same letter are not significantly different (LSD, P=0.05).

* A16901B applied as drench, Flagship as soil broadcast, and the other products as foliar treatments.

Table 79. Efficacy on Cottony Cushion Scale on Pittosporum 'Variegata', Chong, SC, 2011.

Treatment	Rate	Applic. Method	Number of Nymphs (Henderson's % Control)				
			Pretreat	1 WAT	2 WAT	4 WAT	6 WAT
A16901B	10 oz/100 gal	Drench	19.7 a	19.8 a (0)	19.2 a (0)	20.0 a (0)	20.2 a (0)
Distance IGR	12 fl oz/100 gal	Foliar	20.7 a	11.0 bc (41)	9.5 b (50)	3.7 b (81)	2.8 bc (86)
Flagship 25WG	8 oz/100 gal	Foliar	18.5 a	2.7 de (84)	2.2 d (87)	2.5 b (86)	1.8 bc (90)
Flagship 0.22G	227 g/ft ht	Broadcast	20.7 a	8.0 cd (57)	8.8 bc (53)	3.7 b (81)	4.3 b (78)
Kontos	3.4 fl oz/100gal	Foliar	17.8 a	7.8 cd (77)	6.8 bc (58)	0.2 b (99)	0 d (100)
Rycar 20SC	18 fl oz/100 gal	Foliar	20.8 a	10.8 b (42)	4.8 bcd (75)	1.7 b (91)	0.3 d (98)
Orthene TTO97	8 oz/100 gal	Foliar	19.7 a	5.8 cde (67)	6.0 bc (67)	3.8 b (80)	3.8 bc (79)
Safari 20SG	6 g/ft ht	Drench	19.7 a	2.2 de (88)	1.2 d (93)	0 b (100)	0 d (100)
Safari 2G	60 g/ft ht	Broadcast	18.7 a	0.7 e (96)	0.8 d (95)	0 b (100)	0 d (100)
Talus70 DF	14 oz/100 gal	Foliar	17.7 a	4.0 de (75)	1.3 d (92)	0.2 b (99)	0 d (100)
TriStar 30 SG	8 oz/100 gal	Foliar	16.5 a	2.5 de (83)	3.0 c (80)	0.8 b (95)	0.5 cd (97)
Untreated	-	-	19.0 a	17.0 ab (0)	17.3 a (0)	18.0 a (0)	17.8 a (0)

* ANOVA for Completely Randomized Design at $\alpha = 0.05$. Means within a column with the same letters are not significantly different among the treatments by LSD.

Table 80. Efficacy on Cottony Cushion Scale on Pittosporum 'Variegata', Chong, SC, 2012.

Scale Stage	Treatment	Rate	Applic Method	Mean No. Per 3 Leaves (Henderson's % Control)					
				0 DAT	1 WAT	2 WAT	4 WAT	6 WAT	6 MAT
Nymphs	A16901B	5 oz/100 gal	Drench	17.5 a	15.5 ab (25)	72.7 a (0)	25.3 bc (40)	39.7 ab (0)	12.7 a (0)
	A16901B	10 oz/100 gal	Drench	24.7 a	14.2 ab (51)	41.0 a (18)	15.7 c (74)	35.2 abc (0)	21.7 a (0)
	Distance	12 fl oz/100 gal	Foliar	23.0 a	11.8 b (57)	47.0 a (0)	20.5 bc (63)	15.2 cd (0)	17.3 a (0)
	Flagship G	60 g/plant	Broadcast	69.5 a	28.2 a (66)	79.5 a (44)	44.0 ab (74)	20.7 bcd (51)	11.0 a (76)
	GF-2626 1SC	8 fl oz/100 gal	Foliar	24.2 a	10.2 b (64)	37.7 a (23)	7.3 c (87)	12.7 d (14)	7.0 a (57)
	GF-2626 1SC	11 fl oz/100 gal	Foliar	19.3 a	5.0 b (78)	31.3 a (20)	4.2 c (91)	11.7 d (1)	16.8 a (0)
	Xxpire 40WG	3.5 oz/100 gal	Foliar	35.2 a	10.2 b (75)	26.7 a (63)	7.2 c (91)	15.0 cd (31)	8.5 a (64)
	Xxpire 40WG	7 oz/100 gal	Foliar	24.8 a	6.3 b (78)	29.8 a (41)	9.7 c (84)	6.5 d (57)	8.2 a (50)
	Kontos	3.4 fl oz/100 gal	Drench	32.0 a	16.2 ab (57)	59.8 a (8)	54.3 a (29)	37.7 ab (0)	23.8 a (0)
	Paraffinic oil	2% v/v	Foliar	30.8 a	8.2 b (77)	30.0 a (52)	26.2 bc (65)	11.8 d (38)	11.2 a (45)
	Safari 2G	2.6 g/gal pot	Broadcast	23.3 a	8.8 b (68)	27.0 a (43)	22.2 bc (60)	44.8 a (0)	22.2 a (0)
	Talus 70DF	14 oz/100 gal	Foliar	11.5 a	8.0 b (41)	27.2 a (0)	15.2 c (45)	6.0 d (15)	16.2 a (0)
	Untreated	-	-	23.3 a	27.5 a (0)	47.3 a (0)	56.0 a (0)	14.3 cd (0)	15.5 a (0)
Adults	A16901B	5 oz/100 gal	Drench	0.7 a	0.3 a (98)	0.5 a (93)	0.7 cd (97)	1.5 b (57)	0 a (100)
	A16901B	10 oz/100 gal	Drench	2.3 a	2.0 a (96)	0.3 a (97)	0.5 cd (99)	1.0 b (91)	0.8 a (91)
	Distance	12 fl oz/100 gal	Foliar	0.8 a	2.8 a (82)	1.7 a (47)	3.0 bc (89)	4.8 a (0)	0.2 a (94)
	Flagship G	60 g/plant	Broadcast	5.8 a	9.7 a (92)	1.2 a (95)	0.7 cd (100)	1.2 b (96)	0 a (100)
	GF-2626 1SC	8 fl oz/100 gal	Foliar	1.5 a	2.5 a (92)	0.2 a (93)	0 d (100)	0.5 b (93)	0.3 a (95)
	GF-2626 1SC	11 fl oz/100 gal	Foliar	1.7 a	5.3 a (84)	0 a (100)	0.2 d (100)	0.3 b (96)	0 a (100)
	Xxpire 40WG	3.5 oz/100 gal	Foliar	4.2 a	1.0 a (99)	0.2 a (99)	0.2 d (100)	0.5 b (98)	0.3 a (98)
	Xxpire 40WG	7 oz/100 gal	Foliar	1.5 a	3.2 a (89)	0.7 a (95)	0.3 d (99)	0.5 b (93)	0.3 a (95)
	Kontos	3.4 fl oz/100 gal	Drench	1.7 a	3.5 a (90)	1.5 a (78)	4.0 b (93)	1.8 b (79)	0.7 a (90)
	Paraffinic oil	2% v/v	Foliar	2.5 a	2.7 a (95)	1.2 a (88)	1.8 bcd (98)	2.2 b (82)	0.5 a (95)
	Safari 2G	2.6 g/gal pot	Broadcast	1.8 a	2.8 a (95)	0.2 a (97)	1.0 cd (98)	1.8 b (82)	0.7 a (90)
	Talus 70DF	14 oz/100 gal	Foliar	1.2 a	7.0 a (71)	1.6 a (67)	0.5 cd (99)	0.4 b (93)	2.2 a (54)
	Untreated	-	-	0.2 a	4.0 a (0)	0.8 a (0)	6.7 a (0)	1.0 b (0)	0.8 a (0)

* Means within a column followed by the same letter are not significantly different (LSD test, P= 0.05).

Comparative Efficacy on Lac Scale

Lac scale species are not as common as the other scale species tested in this program. The lobate lac scale has recently been identified as a pest in Florida and Hawaii. However, there is a potential for the spread of this insect into other areas that are climatologically similar, like California, especially when plant materials are moved out of these infested states. Lobate lac sscale has been found feeding on both native and non-native plant species in Florida and Hawaii.

Lobate Lac Scale

Cheng evaluated the efficacy of several products applied foliar on lobate lac scale (*Paratrichodorus pseudolabata*) on hibiscus (*Hibiscus rosa-sinensis*) in 2018. Based on a rating scale of 1 to 5, Marathon (imidacloprid) provided the most effective control (Table 78). When examining population counts, only the precounts had statistical separation; however, Altus, Marathon and Ventigra at the higher rate provided excellent control through 5 months after application. Pradia, Sarisa and Talus demonstrated good efficacy through 3 months after treatment, while AzaGuard had some suppressive activity. In terms of plant growth, Pradia at 16.5 fl oz and Altus at 14 fl oz increased number of twigs while Ventigra at 7 fl oz and Altus at 14 fl oz increased hibiscus stem diameter compared to untreated water control. No phytotoxicity was observed on any of the treated plants. (Data not shown, refer to researcher report).

Table 81. Efficacy of Insecticides on Lobate Lac Scale on Hibiscus (*Hibiscus rosa-sinensis*) 'Dainty White', Cheng, HI, 2018.

Treatment	Rate Per 100 Gal	PreTreatment (12/16/19 - 2DBT)	First evaluation (2/8/20 – 52 DAT)	Second evaluation 3/23/20 – 98 DAT	Third evaluation 5/18/20 – 154 DAT)
Scale Infestation (1-5 scale: 1= none present, 5 = kill plants)					
Afidopyropen	4.8 fl oz	1.8 ± 0.5 a	2.8 ± 0.3 bc	2.3 ± 0.8 ab	2.9 ± 0.4 ab
Afidopyropen	7 fl oz	2.0 ± 0.4 a	3.0 ± 0.4 abc	3.0 ± 0.4 ab	2.5 ± 0.5 ab
Azadirachtin	16 fl oz	2.0 ± 0.4 a	3.3 ± 0.3 abc	2.3 ± 0.5 ab	3.0 ± 0.4 ab
Azadirachtin	32 fl oz	2.0 ± 0.4 a	3.5 ± 0.4 ab	3.0 ± 0.4 ab	3.6 ± 0.4 a
Buprofezin	14 oz	2.0 ± 0.4 a	3.4 ± 0.5 abc	2.5 ± 0.6 ab	2.4 ± 0.4 b
Cyclaniliprole	22 fl oz	2.0 ± 0.4 a	2.9 ± 0.4 abc	2.5 ± 0.3 ab	2.9 ± 0.5 ab
Cyclaniliprole	28 fl oz	2.0 ± 0.4 a	3.1 ± 0.3 abc	3.3 ± 0.5 a	3.0 ± 0.4 ab
Cyclaniliprole + Flonicamid	12 fl oz	2.0 ± 0.4 a	2.9 ± 0.4 abc	2.8 ± 0.6 ab	3.3 ± 0.3 ab
Cyclaniliprole + Flonicamid	16.5 fl oz	2.0 ± 0.4 a	3.5 ± 0.5 ab	2.3 ± 0.5 ab	3.3 ± 0.5 ab
Flupyradifurone	14 fl oz	2.0 ± 0.4 a	2.8 ± 0.8 bc	2.3 ± 0.5 ab	3.0 ± 0.4 ab
Imidacloprid	1.5 fl oz	2.0 ± 0.4 a	2.4 ± 0.2 c	1.8 ± 0.3 b	2.1 ± 0.1 b
Water	-	2.0 ± 0.4 a	3.9 ± 0.3 a	2.3 ± 0.6 ab	3.1 ± 0.5 ab
Number of lobate lac scale adults (Henderson's Percent Control)					
Afidopyropen	4.8 fl oz	8.8 ab	2.0 a (98)	2.5 a (94)	33.3 a (44)
Afidopyropen	7 fl oz	8.8 ab	3.3 a (96)	3.8 a (92)	6.8 a (89)
Azadirachtin	16 fl oz	10.0 ab	26.0 a (73)	15.3 a (71)	21.8 a (68)
Azadirachtin	32 fl oz	10.8 ab	24.3 a (77)	29.0 a (48)	30.0 a (59)
Buprofezin	14 oz	18.0 ab	5.0 a (97)	25.3 a (73)	11.5 a (91)
Cyclaniliprole	22 fl oz	14.0 ab	14.0 a (90)	21.5 a (70)	22.0 a (77)
Cyclaniliprole	28 fl oz	15.8 ab	26.5 a (83)	6.8 a (92)	22.8 a (79)
Cyclaniliprole + Flonicamid	12 fl oz	11.8 ab	8.0 a (93)	13.3 a (78)	19.5 a (75)
Cyclaniliprole + Flonicamid	16.5 fl oz	12.5 ab	17.8 a (85)	34.5 a (47)	56.5 a (33)
Flupyradifurone	14 fl oz	20.0 b	5.0 a (97)	8.8 a (92)	15.8 a (88)
Imidacloprid	1.5 fl oz	7.8 ab	2.5 a (97)	1.3 a (97)	2.8 a (95)
Water	-	5.8 a	56.0 a (0)	29.8 a (0)	38.8 a (0)

Comparative Efficacy on Mealybugs

Citrus Mealybug

Ludwig. In the first of two experiments conducted by Ludwig on citrus mealybug (*Planococcus citri*) in 2004, five pesticides wereevaluated against this pest on greenhouse grown coleus (*Coleus* sp.). Plants grown in 6.5 inch azalea pots were infested with all mealybug life stages at the initiation of the experiment. Treatments were applied on 0 and 13 DAT. To monitor the mealybug population, the same two inches of plant stem was monitored each sample period. All three of the systemic insecticides provided excellent control of the mealybug by 13 DAT (Table 82). Talus and Distance (32 oz) were slightly slower acting but were providing control by 21 DAT.

Ludwig's second experiment was a repeat of the first, except treatments were only applied at 0 DAT. In this experiment Flagship (4 oz) was the only treatment to result in a population lower than the control on 7 DAT (Table 83). All the treatments were significantly lower than the control by 17 DAT. Distance at 8 oz had higher populations than the other chemical treatments. This is most likely a result of the fact that the population was three times higher than the other treatments at the start of the experiment.

Oetting. In an experiment conducted by Oetting for control of citrus mealybug on coleus, most of the tested products provided good to excellent control by 6 weeks after the initial treatment (Table 84). Those that exhibited excellent control 2 weeks after application included Facin at both 0.25% and 0.5%, Safari drenched at 24 oz per 100 gal, TriStar at 96 oz per 100 gal, and Orthene at 10.5 oz per 100 gal.

Parrella. Parella conducted studies for control of citrus mealybug on coleus ((*Solenostemon x hybridus)* in 2005-06, on zinnia (*Zinnia elegans*) 'Sunny Time' in 2009, and on rose (*Rosa* sp) 'Akita' in 2011. In the 2005-06 experiment, Flagship, Tristar and Safari (foliar) significantly reduced mealybugs for the duration of the experiment (Data not shown; refer to researcher report). Aria, Marathon and Talus took longer to control the mealybugs and did not control the mealybugs for the duration of the experiment. Facin foliar and Safari drench were not effective. In the 2009 experiment, all pesticides except the low rate of Aria provided some degree of citrus mealybug control (Table 85). Of most interest to a grower, however, is those materials that quickly reduced mealybug populations to the lowest levels. One week after application, no mealybugs were observed on the Natural Solutions and the high rate of Tristar treatments. The low rate of Tristar and high rate of the Safari foliar application and had very low mealybug levels. The Safari foliar applications and both rates of Tristar continued to provide the best control for the duration of the experiment. Natural Solutions provided good initial control but did not provide sustained mealybug management; populations on plants treated with this material began to rise one month after the initial infestation. In the 2011 experiment of chemical and biorational products on rose, A16901B applied twice as a foliar spray provided the best mealybug control; good control was obtained with A16901B drench, Rycar (foliar twice), Kontos (foliar once) and the standards Safari drench and Talstar foliar (Data not shown; refer to researcher report). Of the biorationals, only Talus provided mealybug reduction comparable to that of the industry standard Talstar; Distance, MBI 203 and MBI 205 did not significantly reduce mealybug levels.

Joseph. In an experiment conducted by Joseph for control of citrus mealybug on coleus, Pradia, Talus and the higher rate of Ventigra statistically increased percent mortality as compared to the nontreated control plants by 2 weeks after initial application, but this was generally not to commercially acceptable levels (Table 86).

Nansen. Nansen conducted an experiment for control of citrus mealybug on miniature rose (*Rosa* sp.) in 2019. Count data were collected pretreatment and 1, 2, 4 and 5 weeks after the first applications. One fully matured compound leaf, consisting of 5 leaflets, was selected per plant, from an infested area. Crawlers, mobiles (immatures larger than crawlers + adults), and egg masses were counted on both sides of the compound leaf. The initial precounts were variable across treatments; the Henderson Tilton calculation was applied to the data supplied by Nansen. Highly effective treatments included Pradia, Talus and TetraCURB Concentrate (Table 87. Efficacy on Citrus Mealybug on Rose 'Salmon Sunblaze', Nansen, CA, 2019.). Also providing effective population management were Altus and KOC22018. Some population suppression was observed with Azaguard, Sarisa and Ventigra. TetraCURB Organic and Duraguard were largely ineffective. The number of crawlers and egg masses were not significantly impacted by treatments (data not shown; refer to researcher report). Moderate phytotoxicity symptoms were visible in all plants exposed to KOC22018-8 by 4 weeks after treatment, and mild statistically insignificant injury was visible in all plants exposed to TetraCURB Concentrate and Talus (data not shown).

Chong. In an experiment conducted on new actives to manage citrus mealybug on coleus, ISM 555 and UltraPure Oil provided the most effective control (Table 88. Efficacy on Citrus Mealybug on Coleus (*Solenostemon scutellarioides*), 'Wizard Jade', Chong, SC, 2020.). BW133, BW238 ES, BW238 WP, and SP3014 showed some level of mealybug reduction; however, results were not consistent for all life stages. V-10433 and Velifer initially reduced immature and gravid adults but did not effectively reduce the total number of mealybugs. MBI-203 and MBI-306 provided limited suppression. However, none of the treatments reduced mealybug abundance to levels acceptable according to industry standard or typical grower tolerance by the end of the experiment. Chong suggested that the failure for all treatments to produce saleable plants was due to 2 factors: 1) treatments were initiated against a mixed life stage population, instead of a population consisted mainly of crawlers or young nymphs (which should have been the target life stage); and 2) a spreader-sticker type adjuvant, such as Capsil, was not added to all spray solutions which may have improved performance. No phytotoxicity or residue was observed on the treated plants at anytime during this experiment.

Table 82. Efficacy on Citrus Mealybug on Coleus - 1, Ludwig, TX, 2004.

Treatment (Rate)	Population Averages (Henderson's Percent Control)				
	0 DAT	6 DAT	13 DAT	21 DAT	28 DAT
Distance (8 fl oz / 100 gal)	27.0	41.3 ab (0)	57.8 ab (0)	68.3 a (0)	70.0 a (0)
Distance (16 fl oz / 100 gal)	16.0	37.3 a (0)	58.3 a (0)	58.8 a (0)	62.8 a (0)
Distance (32 fl oz / 100 gal)	17.0	9.0 bcd (46)	3.3 cdefg (72)	0.0 e (100)	0.0 c (100)
Flagship (2 oz / 100 gal)	27.8	14.5 abcd (47)	9.0 bcd (53)	0.8 cde (98)	0.8 bc (99)
Flagship (4 oz / 100 gal)	28.3	5.8 cd (79)	1.3 efg (94)	0.3 e (99)	0.0 c (100)
Flagship (8 oz / 100 gal)	30.8	4.3 cd (86)	0.5 fg (98)	0.0 e (100)	0.0 c (100)
Safari (12 oz / 100 gal) - Drench	21.5	16.5 abcd (22)	11.3 cdef (24)	3.0 cde (87)	0.0 c (100)
Safari (24 oz / 100 gal) - Drench	17.8	10.8 abcd (38)	2.3 cdefg (81)	1.5 cde (92)	0.3 c (99)
Safari (48 oz / 100 gal) - Drench	11.3	5.5 cd (50)	1.5 defg (81)	0.5 de (96)	0.0 c (100)
Talus 40SC (21.5 fl oz)	22.8	17.8 abc (21)	27.3 ab (0)	13.8 ab (45)	5.5 b (88)
Talus 40SC (43 fl oz)	10.5	12.0 abcd (0)	23.8 abc (0)	6.8 bc (42)	6.5 bc (68)
Talus 40SC (86 fl oz)	16.5	24.3 abcd (0)	22.8 bcd (0)	1.0 cde (94)	1.8 bc (95)
TriStar 70WSP (32 g / 100 gal)	11.8	4.0 cd (65)	3.0 cdefg (63)	0.8 cde (94)	0.0 c (100)
TriStar 70WSP (64 g / 100 gal)	15.0	3.0 cd (80)	1.0 defg (90)	0.0 e (100)	0.0 c (100)
TriStar 70WSP (128 g / 100 gal)	21.8	1.3 d (94)	0.0 g (100)	0.3 e (99)	0.0 c (100)
Untreated	27.8	27.3 abcd (0)	19.0 bcde (0)	30.5 bcd (0)	54.0 a (0)

* Letters after numbers are based on separation of average number of mealybug on the same 2 inches of stem. See experiment report in Appendix 3 for statistical separation details.

Table 83. Efficacy on Citrus Mealybug on Coleus - 2, Ludwig, TX, 2004.

Treatment (Rate)	Population Averages (Henderson's Percent Control)			
	0 DAT	17 DAT	22 DAT	28 DAT
Distance (8 fl oz / 100 gal)	135.0	74.8 ab (64)	16.8 ab (93)	7.3 a (97)
Distance (16 fl oz / 100 gal)	24.3	11.0 a (71)	4.8 a (90)	1.5 a (96)
Distance (32 fl oz / 100 gal)	19.8	14.8 bcd (52)	2.8 cdefg (93)	6.3 e (82)
Flagship (2 oz / 100 gal)	53.3	18.5 abcd (78)	3.0 bcd (97)	2.5 cde (97)
Flagship (4 oz / 100 gal)	41.8	10.3 cd (84)	0.5 efg (99)	0.0 e (100)
Flagship (8 oz / 100 gal)	25.5	37.3 cd (6)	9.0 fg (81)	5.0 e (89)
Safari (12 oz / 100 gal) - Drench	47.3	34.3 abcd (53)	0.0 cdef (100)	0.0 cde (100)
Safari (24 oz / 100 gal) - Drench	37.8	24.5 abcd (58)	0.3 cdefg (100)	0.3 cde (100)
Safari (48 oz / 100 gal) - Drench	27.8	41.5 cd (4)	1.0 defg (98)	1.5 de (97)
Talus 40SC (21.5 fl oz)	19.0	18.5 abc (37)	0.3 ab (99)	0.3 ab (99)
Talus 40SC (43 fl oz)	33.5	21.3 abcd (59)	3.8 abc (94)	0.8 bc (99)
Talus 40SC (86 fl oz)	43.3	39.3 abcd (42)	4.3 bcd (95)	3.8 cde (95)
TriStar 70WSP (32 g / 100 gal)	28.0	17.0 cd (61)	0.3 cdefg (100)	0.0 cde (100)
TriStar 70WSP (64 g / 100 gal)	19.0	14.0 cd (53)	0.3 defg (99)	0.0 e (100)
TriStar 70WSP (128 g / 100 gal)	28.5	16.8 d (62)	0.3 g (100)	0.0 e (100)
Untreated	26.0	40.5 abcd (0)	49.0 bcde (0)	45.8 bcd (0)

* Letters after numbers are based on separation of average number of mealybug on the same 10 leaves throughout the experiment. See experiment report in Appendix 3 for statistical separation details.

Table 84. Efficacy on Citrus Mealybug on Coleus, Oetting, GA, 2005.

Treatment	Rate (per 100 gal)	Pre Treatment Rating	Percent Control (Henderson's)				
			Week 2	Week 3	Week 4	Week 5	Week 6
Aria (flonicamid)	60 g	2.6 cde	37 ab	72 bcde	88 cdef	89 def	89 e
Aria (flonicamid)	120 g	4.3 abcde	81 bcde	93 def	100 f	98 f	99 e
Facin	0.25%	2.4 de	96 e	82 bc	84 bc	79 b	80 bc
Facin	0.50%	3.8 abcde	93 de	81 b	88 bcd	91 cd	87 bc
Flagship (thiamethoxam)	2 oz	2.4 de	52 bcd	91 ef	93 def	87 cdef	92 e
Flagship (thiamethoxam)	4 oz	3.8 abcde	79 bcde	86 cdef	96 def	97 ef	98 e
Safari (dinotefuran)	4 oz	3.1 cde	65 bcde	73 bc	81 bcde	85 cde	81 cd
Safari (dinotefuran)	8 oz	2.9 cde	46 ab	73 bcd	71 b	77 bc	67 b
Safari (dinotefuran) – drench	12 oz	4.5 abcd	68 abc	96 f	96 def	97 ef	100 e
Safari (dinotefuran) - drench	24 oz	2.8 cde	94 e	94 f	97 f	98 f	100 e
Talus (buprofezin)	21.5 oz	3.7 bcde	67 bcde	83 bcdef	95 def	98 f	99 e
Talus (buprofezin)	43 oz	2.1 e	49 bcde	80 cdef	84 cdef	95 f	97 e
TriStar (acetamiprid)	48 oz	5.9 ab	86 bcde	95 def	95 cdef	98 ef	97 e
TriStar (acetamiprid)	96 oz	4.8 abc	92 de	96 f	97 ef	96 def	95 de
Orthene (acephate)	10.5 oz	6.1 a	92 cde	96 def	98 ef	98 ef	97 e
Untreated	-	2.1 e	0 a	0 a	0 a	0 a	0 a
Untreated (Population Rating)		2.1	10.2	16.6	20.8	28.5	38.7

* Letters after numbers are based on separation of raw whole plant population rating. See experiment report in Appendix 3 for statistical separation details.

Table 85. Efficacy on Citrus Mealybug on Zinnia 'Sunny Time', Parella, CA, 2009.

Treatment	Rate Per 100 Gal	Population Averages (Henderson's Percent Control)				
		Pretreat	1 WAT	2 WAT	4 WAT	6 WAT
Aria (flonicamid)	2.1 oz	4.72 a	4.44 a (0)	10.44 ab (70)	2.89 b (89)	43.00 ab (0)
Aria (flonicamid)	4.3 oz	5.06 a	3.00 a (9)	4.28 b (82)	0.28 b (97)	2.24 b (0)
Flagship (thiamethoxam)	2 oz	8.06 a	3.11 a (42)	0.44 b (98)	0.44 b (60)	2.67 b (0)
Flagship (thiamethoxam)	4 oz	3.28 a	4.22 a (0)	2.28 b (93)	0.11 b (98)	1.89 b (0)
Mesurol (methiocarb)	0.5 lb	4.33 a	5.00 a (0)	9.11 ab (77)	7.44 b (67)	14.41 b (0)
Natural Solutions (*Verticillium lecanii*)	1:1000	5.06a	0.00 a (100)	0.67 b (97)	2.33 b (0)	12.6 b (0)
Safari (dinotefuran) - drench	12 oz	2.50 a	5.78 a (0)	6.00 b (87)	4.06 b (73)	13.94 b (0)
Safari (dinotefuran) - drench	24 oz	6.22 a	5.39 a (0)	2.00 b (95)	3.83 b (23)	23.72 ab (0)
Safari (dinotefuran)	0.2 oz	4.83 a	0.47 a (85)	0.39 b (89)	0.17 b (82)	0.00 b (100)
Safari (dinotefuran)	0.4 oz	2.83 a	0.50 a (73)	0.28 b (93)	0.11 b (84)	0.06 b (64)
Talus (buprofezin)	12 oz	2.06 a	0.39 a (71)	3.33 b (0)	4.11 b (50)	5.56 b (11)
Tristar (acetamiprid)	2.7 oz	6.00 a	0.06 a (98)	1.56 b (0)	0.39 b (90)	0.06 b (90)
Tristar (acetamiprid)	5.3 oz	3.17 a	0.00 a (100)	0.11 b (99)	0.06 b(78)	0.00 b (100)
Untreated	-	4.00 a	2.61 a (0)	20.5 a (0)	51.11 a (0)	77.24 a (0)

* Means within a column followed by the same letter are not significantly different (Tukey's means separation test, $P< 0.05$).

Table 86. Efficacy on Citrus Mealybug on Coleus, Joseph, GA, 2018.

Treatment	Rate	Mean Percent Mortality (Henderson's Percent Control)[x]							
		6/28	7/5	7/12	7/19	7/26	8/2	8/9	8/16
Altus (flupyradifurone)	14 fl oz	6.4 a	12.9 ab (4)	20.1 a-d (27)	23.8 c (24)	27.1 a (0)	28.9 ab (0)	27.8 a (0)	49.6 a (0)
Azaguard (azadirachtin)	32 fl oz	5.6 a	11.2 abc (4)	22.7 abc (5)	21.2 abc (22)	20.6 a (0)	30.4 ab (0)	19.5 bcd (5)	44.5 a (0)
Pradia (cyclaniliprole + flonicamid)	12 fl oz	5.7 a	7.9 cde (34)	17.3 b-e (29)	17.4 cd (37)	21.2 a (0)	28.7 ab (0)	16.2 de (22)	54.8 a (0)
	16.5 fl oz	3.2 a	4.9 e (27)	17.7 b-e (0)	14.3 cd (8)	24.5 a (0)	17.2 cd (0)	17.4 b-d (0)	92.5 a (0)
Sarisa (cyclaniliprole) + Dyne-Amic	22 fl oz	4.7 a	12.9 ab (0)	23.6 ab (0)	28.4 ab (0)	21.5 a (0)	29.9 ab (0)	23.7 a-d (0)	57.1 a (0)
	28 fl oz	5.2 a	14.3 a (0)	27.9 a (0)	31.0 a (0)	24.3 a (0)	37.2 a (0)	21.9 a-d (0)	46.2 a (0)
Talus 70DF (buprofezin)	14 oz	3.9 a	6.1 de (25)	13.4 de (20)	10.5 d (45)	16.5 a (0)	21.8 bc (0)	19.6 bcd (0)	58.6 a (0)
UltraPure Oil (mineral oil)	2 gal	2.7 a	10.5 a-d (0)	15.8 cde (0)	14.1 cd (0)	19.1 a (0)	11.4 d (0)	13.1 e (0)	57.7 a (0)
Ventigra (afidopyropen) + Ultra Pure Oil	4.8 fl oz	6.1 a	13.0 ab (0)	23.9 ab (9)	23.6 abc (21)	28.5 a (0)	25.3 abc (0)	21.2 a-d (5)	52.7 a (0)
	7 fl oz	4.2 a	7.4 cde (16)	13.1 e (27)	19.8 abc (3)	20.5 a (0)	19.7 bc (0)	16.7 cde (0)	47.6 a (0)
Untreated	-	6.6 a	13.8 a (0)	28.3 a (0)	32.2 a (0)	24.1 a (0)	27.3 abc (0)	24.1 a (0)	34.3 a (0)
	F value	1.6	3.3	3.9	3.6	1.1	3.6	2.9	1.4

[x] Means followed by same letter do not significantly differ (LSD test, P=0.05). No significant differences from Pretreatment to 4 WAT.
Foliar sprays applied Jun 21 and Jul 19.

Table 87. Efficacy on Citrus Mealybug on Rose 'Salmon Sunblaze', Nansen, CA, 2019.

Treatment	RatePer 100 Gal	Pretreat	1 WAIT	2 WAIT	4 WAIT	5 WAIT	Statistics
Number of Citrus Mealybug Mobiles Per Leaf (Henderson's Percent Control) [x]							
Altus (flupyradifurone)	14 fl oz	66.1 ab	25.4 (41)	15.0 (61)	3.0 (85)	4.7 (74)	cd
Azaguard (azadirachtin)	16 fl oz	71.0 ab	40.1 (13)	23.4 (43)	10.3 (51)	8.3 (57)	bcd
Duraguard ME	7 fl oz	70.1 ab	42.9 (29)	42.3 (21)	16.7 (39)	18.7 (26)	b
KOC22018 (botanical oil blend)	16.5 fl oz	82.7 ab	37.3 (19)	18.9 (54)	4.7 (78)	7.1 (63)	bcd
Pradia SL (cyclaniliprole + flonicamid)	28 fl oz	49.1 b	22.9 (58)	9.7 (80)	1.6 (93)	0.4 (98)	d
Sarisa (cyclaniliprole)	64 fl oz	92.3 ab	43.4 (0)	43.6 (0)	13.3 (9)	10.6 (21)	bc
Talus 70DF	128 fl oz	70.7 ab	44.1 (34)	14.7 (75)	7.3 (76)	1.4 (95)	bcd
TetraCURB Concentrate	14 oz	102.3 ab	21.4 (50)	9.7 (74)	2.9 (85)	0.9 (95)	d
TetraCURB Organic	128 fl oz	65.3 ab	39.3 (17)	14.9 (64)	10.0 (54)	14.1 (29)	bcd
Ventigra (afidopyropen)	128 fl oz	72.6 ab	23.7 (48)	14.1 (65)	3.0 (86)	8.3 (57)	cd
Untreated	-	112.3 a	73.3 (0)	64.9 (0)	33.3 (0)	30.6 (0)	a
Statistics			A	B	C	C	
Total Number of Citrus Mealybug Crawlers and Mobiles Per Leaf (Henderson's Percent Control) [x]							
Altus	14 fl oz	74.7 ab	25.6 (44)	15.1 (62)	3.0 (87)	4.7 (75)	cd
Azaguard (azadirachtin)	16.5 fl oz	78.0 ab	41.6 (13)	24.3 (42)	10.4 (57)	8.3 (57)	d
Duraguard ME	7 fl oz	80.6 ab	43.4 (13)	42.7 (1)	14.3 (42)	28.6 (0)	b
KOC22018 (botanical oil blend)	28 fl oz	95.7 ab	38.9 (34)	19.0 (63)	4.7 (84)	7.1 (70)	bcd
Pradia SL (cyclaniliprole + flonicamid)	16 fl oz	59.0 b	23.4 (36)	9.9 (69)	1.6 (91)	0.4 (97)	bcd
Sarisa (cyclaniliprole)	128 fl oz	105.9 ab	44.7 (31)	43.9 (22)	19.0 (42)	10.9 (58)	bc
Talus 70DF	28 fl oz	80.9 ab	44.7 (10)	15.1 (65)	7.3 (71)	1.4 (93)	bcd
TetraCURB Concentrate	14 oz	112.1 ab	21.9 (68)	9.7 (84)	3.7 (89)	0.9 (97)	d
TetraCURB Organic	128 fl oz	76.1 ab	40.3 (14)	14.9 (63)	13.7 (42)	16.0 (15)	bcd
Ventigra (afidopyropen)	128 fl oz	82.0 ab	24.4 (52)	14.3 (67)	4.3 (83)	8.3 (59)	cd
Untreated (Control)	-	123.6 a	76.1 (0)	65.9 (0)	38.1 (0)	30.6 (0)	a
Statistics			A	B	C	C	

* Plants were repeatedly infested with mealybugs 4 and 3 weeks before the start of treatment applications. Mealybug numbers of week 0 represent a pre-count, before treatment applications. The industry standard Duraguard ME was applied only once, other treatments were applied weekly or biweekly (every two weeks). For a more detailed explanation of experimental treatments, see "Experimental Information" below. Data for time point 0 were analyzed by one-way ANCOVA with treatment as factor and block as covariate, followed by Tukey test (in blue). Data for time points 1-5 were analyzed using RM two-way ANOVA with treatment and time as factors, followed by Tukey test. Different uppercase letters indicate significant differences between time points ($P < 0.05$), and different lowercase letters indicate significant differences between treatments ($P < 0.05$).

Table 88. Efficacy on Citrus Mealybug on Coleus (*Solenostemon scutellarioides*), 'Wizard Jade', Chong, SC, 2020.

Treatment	Rate	Pretreat	7 DAIT	14 DAIT	21 DAIT	28 DAIT
Number of immature and gravid adult citrus mealybugs counted in 2 minutes [x]						
BW133	5 lb	15.4 a	1.2 a (96)	13.0 cde (92)	21.0 def (88)	154.4 ab (64)
BW238ES	2 qt	13.8 a	9.4 a (66)	26.0 b-e (81)	37.6 b-f (76)	222.6 a (42)
BW238WP	2 lb	10.6 a	11.2 a (48)	32.0 b-e (70)	60.2 a-e (49)	98.0 b (67)
ISM-555 + Capsil	3.82 fl oz	14.4 a	2.4 a (92)	6.2 e (96)	12.8 f (92)	112.6 b (72)
MBI-203 SC2	128 fl oz	6.8 a	21.2 a (0)	59.4 ab (14)	38.2 b-f (50)	176.6 ab (6)
MBI-306	5 fl oz	11.2 a	10.4 a (54)	51.8 abc (54)	82.8 ab (34)	142.8 ab (54)
SP3014 + Capsil	13 fl oz	12.2 a	1.6 a (94)	23.8 b-e (81)	21.3 c-f (84)	180.8 ab (47)
UltraPure Oil	2%	13.2 a	5.6 a (79)	7.4 de (94)	14.8 ef (90)	146.8 ab (60)
V-10433	11 fl oz	12.6 a	2.6 a (90)	44.0 a-e (65)	74.6 abc (47)	172.8 ab (51)
Velifer (*Beauveria bassiana* strain PPRI 5339) + Capsil	13 fl oz	10.6 a	3.2 a (85)	48.8 a-d (54)	65.8 a-d (44)	187.5 ab (36)
Untreated	-	8.0 a	16.2 a (0)	80.8 a (0)	89.2 a (0)	221.8 a (0)
Total number of citrus mealybugs counted in 2 minutes [x]						
BW133	5 lb	17.0 a	3.2 a (89)	31.8 de (76)	49.4 ef (74)	206.6 a-d (45)
BW238ES	2 qt	14.4 a	19.0 a (24)	43.0 b-e (62)	84.8 cde (46)	254.4 ab (20)
BW238WP	2 lb	13.0 a	13.0 a (42)	37.6 cde (64)	100.6 bc (30)	197.8 bcd (31)
ISM-555 + Capsil	3.82 fl oz	16.4 a	4.6 a (84)	15.4 e (88)	27.4 f (85)	146.6 d (59)
MBI-203 SC2	128 fl oz	11.4 a	23.4 a (0)	87.8 abc (3)	91.6 cd (27)	245.8 abc (2)
MBI-306	5 fl oz	13.0 a	14.0 a (38)	89.8 ab (13)	140.6 a (2)	223.3 abc (22)
SP3014 + Capsil	13 + 6 fl oz	16.0 a	4.0 a (86)	46.4 b-e (63)	53.4 def (70)	228.6 abc (35)
UltraPure Oil	2%	14.4 a	21.0 a (15)	36.6 de (68)	39.2 f (75)	183.4 cd (42)
V-10433	11 fl oz	15.2 a	12.4 a (53)	59.4 a-e (51)	113.8 abc (32)	223.3 abc (33)
Velifer (*Beauveria bassiana* strain PPRI 5339) + Capsil	13 fl oz	14.0 a	7.6 a (69)	80.6 a-d (27)	98.4 bc (36)	222.0 abc (28)
Untreated	-	12.4 a	21.4 a (0)	98.4 a (0)	136.2 ab (0)	272.4 a (0)

* Means within a column followed by the same letter are not significantly different (Fisher's LSD test, P= 0.05).

Madeira Mealybug.
Four experiments were conducted between 2005 and 2011 evaluating several insecticides for efficacy on Madeira mealybug.

Oetting 2005. In an experiment conducted by Oetting to control Madeira mealybug (*Phenacoccus madeiresis*) on coleus (*Coleus sp.*), Talus at 21.5 and 43 oz per 100 gal, TriStar at 48 oz + Capsil at 6 oz per 100 gal, and Orthene at 10.5 oz per 100 gal provided the best control by 6 weeks after initial application (Table 89). However, products did not begin to provide good to excellent control until 3 weeks after initial applications. The addition of Capsil at 6 oz enhanced the level of control of both Safari at 4 oz and TriStar at 48 oz.

Ludwig 2011. An experiment conducted by Ludwig in 2011 showed Hachi-Hachi, Rycar (18 fl oz/100 gal), Safari 20SG, Safari 2G, SuffOil-X and Talus providing good to excellent control by 4 weeks after initial applications (Table 90). A16901B (foliar) and Kontos (foliar or drench) required longer to provide good to excellent control.

Davis 2010 and 2011. In an experiment conducted by Davis in 2010 for control of Madeira mealybug on marigold (*Tagetes patula*), Distance, Rycar, Tristar, Talus and Orthene applied as foliar applications twice, 2 weeks apart, all gave 80-100 % control with the standard Orthene providing the best population reduction (Table 91). A16901B as a drench, Safari 20SG as a drench, Flagship 0.22G and Safari 2G (both applied to media surface in pot) all gave 60-80 % population reduction. Flagship 25WG, Kontos and Merit applied as drench provided poor control. In a 2011 experiment, A16901B and Flagship 25WG were applied as drench or foliar, Horticultural Oil and Orthene applied foliar, and Flagship 0.22G applied broadcast to media surface in pot. All foliar treatments provided excellent control while broadcast and drench treatments were inferior (Table 92).

Gilrein 2018. In an experiment conducted by Gilrein to control Madeira mealybug on coleus (*Plectranthus scutellarioides)*, 5 treatments – AzaGuard at 32 fl oz, IKI-3326 at both rates, Talus 70, and Safari – provided the most effective control of Madeira mealybug populations (Table 90). Plants treated with the highest rate of BAS 440 also had significantly lower numbers of mealybugs on 7/16. Levels on plants treated with Altus were significantly lower on some dates and the lowest tested rates of BAS 440 and AzaGuard also appeared to be suppressive, though mealybug levels were not significantly different from those on control plants.

Gilrein 2019. In an experiment conducted by Gilrein to control Madeira mealybug on coleus, 6 treatments – Pradia, Safari and Ventigra provided the most effective control of Madeira mealybug populations, with levels significantly and much lower at the end of the trial than those on control plants (Table 94. Efficacy on Madeira Mealybug on Coleus, 'Wizard Velvet Red' Gilrein, NY, 2019.). Plants treated with Altus, KOC22018-8, TetraCURB Concentrate and TetraCURB Organic also had significantly lower numbers of mealybugs than on control plants but only on the final evaluation date (7/3); populations tended to be lower than the controls for most of the trial but differences were not statistically significant. Sarisa and Mainspring looked ineffective for controlling Madeira mealybug in this experiment. Phytotoxicity was observed

across most treatments at some point of the trial, but with only KOC 22018-8, causing moderate injury, and TetraCURB Concentrate and TetraCURB Organic minor injury, at the end of trial.

Vafaie 2019. In an experiment conducted by Vafaie to control Madeira mealybug on coleus (*Plectranthus scutellarioides*), Ventigra at both rates and Pradia suppressed mealybug adults throughout the experiment, and immature population levels were gretly reduced starting 28 DAT as assessed by counting populations on 3 randomly selected leaves for 30 seconds. (Table 95.

Efficacy on Immature and Mature Madeira Mealybug on Coleus (*Plectranthus scutellarioides*), 'Premium Sun Chocolate Mint', Vafaie, TX, 2019.). In addition, both products effectively reduced the formation of male pupae by 49 DAT (Table 96). Altus, KOC22018, and both TetraCurb products provided suppression of adult and immature mealybugs at similar timepoints but not at statistically significant levels. No significant phytotoxicity or insecticide residue was observed for the duration of the trial.

Table 89. Efficacy on Madeira Mealybug on Coleus, Oetting, GA, 2005.

Treatment	Rate per 100 gal	Pre Treatment Rating	Percent Control (Henderson's)				
			Week 2	Week 3	Week 4	Week 5	Week 6
Facin	0.25%	12.3 ab	26 abc	42 bc	54 bc	50 bc	55 bc
Facin	0.50%	12.9 ab	1 a	39 bc	47 bc	62 cd	75 cd
Orthene (acephate)	10.5 oz	7.1 cd	78 d	93 d	100 d	100 f	99 d
Safari (dinotefuran)	4 oz	4.8 d	46 a	65 bc	70 bc	80 cde	71 bc
Safari (dinotefuran) +Capsil	4 oz +6 oz	9.6 abc	62 abc	62 bc	90 cd	91 def	82 cd
Talus (buprofezin)	21.5 oz	13.5 a	29 bcd	90 d	95 d	98 f	98 d
Talus (buprofezin)	43 oz	8.7 bcd	62 bcd	82 cd	97 d	96 ef	98 d
TriStar (acetamiprid)	48 oz	7.0 cd	55 abc	34 a	49 a	57 ab	57 ab
TriStar (acetamiprid)	96 oz	6.0 cd	19 a	42 bc	57 bc	58 bc	42 ab
TriStar (acetamiprid) +Capsil	48 oz+6 oz	7.4 cd	53 cd	77 cd	61 cd	95 ef	93 d
Untreated	-	6.4 cd	0 a	0 a	0 a	0 a	0 a
Untreated (Population Rating)		6.4	16.8	13.3	12.3	16.2	15.3

* Letters after numbers are based on separation of raw whole plant population rating. See experiment report in Appendix 3 for statistical separation details.

Table 90. Efficacy on Madeira Mealybug on Coleus 'King Salmon Pink', Ludwig, TX, 2011.

Stage	Treatment	Rate per 100 gal	Applic. Method	Number of Mealybugs (Henderson's % Control)				
				Pretreat	1 WAT	2 WAT	4 WAT	6 WAT
Crawlers	A16901B	6.7 oz	Foliar	17.5±5.3 abc	27.2±7.1 abc (0)	25.8±5.1 a-d (0)	1.3±0.6 bcd (87)	0.0±0.0 d (100)
	A16901B	10 oz	Drench	46.0±6.8 a	27.0±9.7 abc (6)	29.5±10.1 a-d (48)	2.7±1.6 bcd (89)	4.5±2.8 bc (29)
	Capsil	6 fl oz	Foliar	23.7±6.5 abc	14.8±5.9 bcd (0)	66.8±16.8 c (0)	12.5±5.5 ab (5)	16.2±6.5 a (0)
	Distance	12 fl oz	Foliar	24.0±14.4 abc	10.3±6.4 de (31)	16.0±4.6 cd (46)	10.5±7.1 abc (21)	4.0±2.6 bcd (0)
	Flagship 0.22G	6 g/gal media	Broadcast	8.7±3.9 c	17.3±7.8 cde (0)	26.8±12.3 bcd (0)	9.3±4.2 ab (0)	9.5±7.0 ab (0)
	Flagship 25WG	8 oz	Foliar	21.0±8.9 abc	10.2±2.2 cde (22)	13.0±5.0 d (50)	0.2±0.2 cd (98)	1.2±1.2 cd (58)
	Hachi-Hachi	32 fl oz	Foliar	38.6±16.2 abc	67.8±15.7 a (0)	60.6±11.8 ab (0)	20.4±7.9 a (4)	0.6±0.6 cd (89)
	Kontos	3.4 fl oz	Foliar	41.2±12.5 ab	20.5±6.6 a-d (20)	10.3±3.3 cd (80)	2. 7±1.7 bcd (88)	0.0±0.0 d (100)
	Kontos	3.4 fl oz	Drench	25.2±10.9 abc	53.0±6.6 ab (0)	22.7±7.1 a-d (27)	3.5±1.5 a-d (75)	0.0±0.0 d (100)
	MBI 203	2 gal	Foliar	21.7±8.3 abc	8.0±2.8 cde (41)	28.6±14.0 a-d (0)	8.8±4.9 ab (27)	9.2±5.4 ab (0)
	MBI 205	3 gal	Foliar	30.5±10.3 abc	17.0±4.8 a-d (11)	45.2±15.4 abc (0)	4.8±3.5 bcd (72)	0.0±0.0 d (100)
	Rycar	18 fl oz	Foliar	10.0±3.7 bc	4.3±2.8 e (31)	22.5±11.4 cd (0)	2.0±1.6 bcd (64)	0.0±0.0 d (100)
	Safari 2G	2.6 g/gal media	Broadcast	11.3±6.8 c	20.2±12.7 cde (0)	24.7±10.2 a-d (0)	0.0±0.0 d (100)	0.0±0.0 d (100)
	Safari 20SG	24 oz	Drench	15.3±5.5 abc	30.3±10.8 a-d (0)	19.0±7.8 bcd (0)	5.7±5.7 bcd (33)	0.0±0.0 d (100)
	SuffOil-X	2 gal	Foliar	25.5±15.4 abc	14.3±6.8 cde (10)	51.5±22.8 a-d (0)	5.0±3.0 a-d (65)	1.0±1.0 cd (71)
	Talus 70DF	12 oz	Foliar	12.5±11.3 c	1.7±01.0 e (78)	0.0±0.0 e (100)	0.0±0.0 d (100)	0.0±0.0 d (100)
	Untreated	-	-	24.8±11.1 abc	15.5±8.5 cde (0)	30.7±17.5 cd (0)	13.7±11.8 a-d (0)	3.4±3.2 bcd (0)
Nymphs (not including crawlers)	A16901B	6.7 oz	Foliar	4.3±1.5 a	2.0±1.0 efg (42)	1.8±0.7 f-i (77)	14.2±7.4 cd (0)	1.3±0.5 efg (88)
	A16901B	10 oz	Drench	8.0±3.4 a	26.5±5.0 a (0)	39.2±10.7 a (0)	23.0±8.3 abc (0)	31.7±10.1 a (0)
	Capsil	6 fl oz	Foliar	10.8±4.4 a	11.8±4.4 bc (0)	32.8±7.4 ab (0)	27.5±4.1 a (0)	21.8±5.1 ab (17)
	Distance	12 fl oz	Foliar	9.0±6.2 a	4.7±1.9 cde (34)	15.2±11.6 c-f (7)	8.7±2.8 cd (57)	4.5±1.7 de (79)
	Flagship 0.22G	6 g/gal media	Broadcast	5.7±1.7 a	6.8±4.0 def (0)	15.7±6.9 b-e (0)	14.7±7.0 bcd (0)	14.8±6.5 bc (0)
	Flagship 25WG	8 oz	Foliar	3.5±1.5 a	0.2±0.2 gh (93)	4.5±2.8 f-i (29)	7.5±2.3 cd (5)	2.8±1.4 def (67)
	Hachi-Hachi	32 fl oz	Foliar	10.4±4.0 a	0.6±0.4 gh (99)	6.6±3.3 d-g (65)	1.4±0.7 efg (94)	2.0±1.5 efg (92)
	Kontos	3.4 fl oz	Foliar	5.8±2.7 a	6.3±3.7 def (0)	9.2±6.9 e-h (13)	8.3±5.8 de (36)	0.2±0.2 fg (99)
	Kontos	3.4 fl oz	Drench	10.3±3.0 a	6.2±1.2 bcd (24)	3.5±2.4 f-i (81)	12.0±7.3 de (48)	1.3±1.0 fg (95)
	MBI 203	2 gal	Foliar	9.8±2.3 a	11.7±3.0 ab (0)	14.4±4.5 a-d (19)	11.4±4.0 cd (48)	12.8±2.3 ab (46)
	MBI 205	3 gal	Foliar	4.7±1.1 a	0.5±0.2 gh (87)	11.8±4.5 cde (0)	4.0±1.7 def (62)	6.5±2.3 cd (43)
	Rycar	18 fl oz	Foliar	4.2±2.0 a	0.5±0.5 gh (85)	0.3±0.3 hi (96)	0.8±0.8 fg (92)	0.2±0.2 fg (98)
	Safari 2G	2.6 g/gal media	Broadcast	3.7±0.7 a	0.2±0.2 gh (93)	0.3±0.2 hi (96)	0.0±0.0 g (100)	0.0±0.0 g (100)
	Safari 20SG	24 oz	Drench	9.7±5.6 a	1.7±1.3 fgh (78)	0.8±0.4 ghi (95)	1.7±0.8 efg (92)	0.8±0.8 fg (97)
	SuffOil-X	2 gal	Foliar	10.7±4.3 a	0.3±0.3 gh (96)	1.8±0.9 f-i (91)	0.2±0.2 g (99)	0.0±0.0 g (100)
	Talus 70DF	12 oz	Foliar	5.7±2.1 a	0.0±0.0 h (100)	0.0±0.0 i (100)	0.0±0.0 g (100)	0.0±0.0 g (100)
	Untreated	-	-	12.3±5.3 a	9.8±4.5 bcd (0)	22.3±11.8 abc (0)	27.7±7.2 ab (0)	29.8±10.1 ab (0)

Stage	Treatment	Rate per 100 gal	Applic. Method	Number of Mealybugs (Henderson's % Control)				
				Pretreat	1 WAT	2 WAT	4 WAT	6 WAT
Egg Masses	A16901B	6.7 oz	Foliar	4.7±2.2 a-d	5.3±1.9 a-d (57)	4.5±2.3 b-e (46)	1.2±0.6 d-g (94)	1.2±0.7 bcd (96)
	A16901B	10 oz	Drench	2.5±0.4 a-d	3.2±0.7 b-g (49)	6.2±2.3 a-d (0)	6.7±1.9 ab (37)	13.8±2.4 a (6)
	Capsil	6 fl oz	Foliar	4.8±1.8 a-d	11.0±3.6 a (9)	12.0±4.5 a (0)	7.8±2.8 a (62)	10.2±3.3 a (64)
	Distance	12 fl oz	Foliar	1.8±0.7 bcd	9.3±4.7 abc (0)	7.7±4.3 abc (0)	5.2±3.0 a-d (32)	3.2±1.4 b (70)
	Flagship 0.22G	6 g/gal media	Broadcast	5.5±1.5 ab	6.3±1.2 abc (55)	6.3±1.9 abc (35)	6.7±2.2 ab (71)	10.0±4.6 a (69)
	Flagship 25WG	8 oz	Foliar	5.2±1.9 a-d	0.8±0.3 fg (94)	0.7±0.3 e (92)	0.2±0.2 fg (99)	0.5±0.3 cd (98)
	Hachi-Hachi	32 fl oz	Foliar	6.0±0.7 a	4.0±1.0 a-e (74)	2.0±0.7 b-e (81)	0.8±0.5 efg (97)	0.4±0.4 d (99)
	Kontos	3.4 fl oz	Foliar	2.2±0.8 bcd	6.2±2.6 a-e (0)	1.7±0.8 de (56)	2.8±1.5 c-f (70)	0.2±0.2 d (98)
	Kontos	3.4 fl oz	Drench	3.5±1.1 a-d	4.0±0.8 a-e (55)	4.3±1.6 a-d (30)	1.5±0.5 c-g (90)	0.2±0.2 d (99)
	MBI 203	2 gal	Foliar	3.0±0.9 a-d	8.7±1.5 ab (0)	7.4±3.5 ab (0)	5.4±2.0 abc (57)	8.0±1.7 a (46)
	MBI 205	3 gal	Foliar	2.5±1.0 bcd	4.0±1.7 b-f (37)	5.7±2.3 abc (0)	2.0±1.6 d-g (81)	2.2±1.0 bc (85)
	Rycar	18 fl oz	Foliar	1.7±0.7 cd	1.3±1.0 g (70)	2.3±1.1 b-e (23)	0.2±0.2 fg (97)	0.2±0.2 d (98)
	Safari 2G	2.6 g/gal media	Broadcast	2.3±1.3 bc	1.8±0.8 d-g (69)	1.5±0.7 de (63)	1.0±0.8 efg (90)	0.0±0.0 d (100)
	Safari 20SG	24 oz	Drench	2.0±0.8 bcd	1.5±1.0 fg (70)	2.2±1.4 cde (38)	1.0±0.5 efg (88)	0.0±0.0 d (100)
	SuffOil-X	2 gal	Foliar	3.5±1.1 ad	2.0±1.3 efg (77)	2.8±1.1 b-e (55)	0.0±0.0 g (100)	0.0±0.0 d (100)
	Talus 70DF	12 oz	Foliar	4.2±0.9 abc	7.0±2.2 abc (34)	6.2±1.7 ab (16)	2.8±1.0 b-e (84)	0.0±0.0 d (100)
	Untreated	-	-	1.7±0.8 d	4.3±1.9 c-g (0)	3.0±1.3 b-e (0)	7.2±2.5 ab (0)	10.0±3.1 a (0)

[x] Means within column with the same letter are not significantly different (P>0.05, Tukey's HSD Test).

* All treatments applied on 4/7/11; foliar treatments applied a second time on 4/23/11 except Distance which was applied on 4/29/11.

Table 91. Efficacy on Madeira Mealybug on Marigold, Davis, MI, 2010.

Treatment	Rate	Applic. Method	Population Averages (Henderson's Percent Control)[x]					
			Pretreat	1 WAT	2 WAT	3 WAT	4 WAT	5 WAT
A16901B	10 oz/100 gal	Drench	48.8 a	17.2 bc (77)	15.7 bc (68)	30.5 de (73)	19.5 bcd (83)	31.5 def (73)
Distance 10EC	12 fl oz/100 gal	Foliar	60.7 a	10.7 b (88)	13.7 b (78)	15.7 cd (89)	26.2 bcd (81)	18.3 de (87)
Flagship 0.22G	6 g/6-in pot	Broadcast	48.2 a	28.0 b-e (62)	38.8 cd (20)	40.3 ef (64)	46.0 def (59)	39.7 ef (65)
Flagship 25WG	8 oz/100 gal	Drench	59.7 a	41.3 b-e (55)	41.7 bcd (31)	68.2 def (51)	57.7 cde (58)	68.7 def (52)
Kontos	3.4 fl oz/100gal	Drench	49.3 a	60.0 cde (20)	40.8 cd (18)	63.5 ef (44)	71.5 ef (37)	67.0 fgh (43)
Merit 75WP	20 g/1250 pots	Drench	49.7 a	76.7 de (0)	44.3 d (12)	102.0 f (11)	103.5 f (10)	110.7 gh (7)
Rycar 20SC	18 fl oz/100 gal	Foliar	62.0 a	47.7 cde (50)	30.8 bcd (51)	30.3 cde (79)	20.2 bc (86)	20.8 cd (86)
Orthene 97WP	8 oz/100gal	Foliar	57.2 a	1.3 a (99)	1.8 a (97)	1.0 a (99)	0.3 a (100)	1.5 a (99)
Safari 2G	1 g/6-in pot	Broadcast	60.8 a	30.8 bcd (67)	10.2 b (83)	15.5 cde (89)	27.8 cde (80)	40.8 ef (72)
Safari 20SG	24 oz/100 gal	Drench	48.7 a	29.2 b-e (61)	21.2 bcd (57)	40.5 ef (64)	33.2 cde (70)	44.8 fg (61)
Talus70 DF	14 oz/100 gal	Foliar	49.8 a	92.7 e (0)	10.5 b (79)	5.0 ab (96)	2.5 a (98)	5.3 ab (96)
TriStar 30 SG + Dynamic	8 oz/100 gal	Foliar	54.3 a	65.3 cde (21)	18.3 bc (67)	10.7 bc (91)	11.7 b (91)	9.8 bc (92)
Untreated			49.8 a	76.2 e (0)	50.2 d (0)	115.3 f (0)	115.0 f (0)	118.7 h (0)

[x] Number of mealybugs counted in 1 minute. Means followed by the same letter are not significantly different. All data were transformed log (x+1) prior to ANOVA ($p < 0.05$). Untransformed means are presented in table.

* All treatments applied on 8/16/10; foliar treatments applied a second time on 8/31/10.

Table 92. Efficacy on Madeira Mealybug on Marigold, Davis, MI, 2011.

Treatment	Rate	Application Method	Population Averages (Henderson's Percent Control)[x]				
			Pretreat	9 DAT	16 DAT	23 DAT	29 DAT
A16901B	6.7 oz/100 gal	Foliar	16.33 a	4.50 b (76)	1.50 ab (95)	1.67 b (97)	5.00 b (95)
A16901B	10 oz/100 gal	Drench	17.50 a	9.67 c (52)	3.50 cd (87)	11.00 c (82)	15.17 cd (85)
Flagship 0.22G	6 g/6-in pot	Broadcast	15.33 a	10.17 c (42)	2.83 bcd (89)	10.50 c (81)	18.33 d (79)
Flagship 25WG	8 oz/100 gal	Foliar	18.83 a	3.33 b (85)	1.50 abc (95)	0.00 a (100)	0.83 a (99)
Flagship 25WG	8 oz/100 gal	Drench	16.00 a	11.50 c (37)	6.50 d (77)	6.50 c (89)	8.17 c (91)
Horticultural Oil	2 % v/v	Foliar	15.67 a	3.83 b (79)	2.83 bc (90)	0.00 a (100)	0.00 a (100)
Orthene 97WP	8 oz/100gal	Foliar	19.67 a	0.67 a (97)	0.50 a (99)	0.00 a (100)	0.33 a (100)
Untreated			18.00 a	20.67 d (0)	31.33 e (0)	64.33 d (0)	101.83 e (0)

[x] Number of mealybugs counted in 1 minute. Means followed by the same letter are not significantly different. All data were transformed log (x+1) prior to ANOVA ($p < 0.05$). Untransformed means are presented in table.

* All treatments applied on 9/27/11; foliar treatments applied a second time on 10/12/11.

Table 93. Efficacy on Madeira Mealybug on Coleus, 'Wizard Velvet Red' Gilrein, NY, 2018.

Treatment	Rate Per 100 Gal	Population Averages [x]			
		6/19	6/26	7/2	7/16
Altus (flupyradifurone)	14.0 fl oz	115.17	35.3 cd	37.5 abc	51.3 abc
Azaguard (azadirachtin)	16.0 fl oz	137.3	106.3 abc	69.0 ab	41.2 abcd
	32.0 fl oz	123.3	94.3 abc	38.7 abc	6.3 cde
IKI-3106 (cyclaniliprole)	22.0 fl oz	138.5	120.3 ab	123.8 a	100.8 a
	28.0 fl oz	123.0	132.5 abc	104.2 a	165.7 a
IKI-3326 SL (cyclaniliprole + flonicamid)	12.0 fl oz	106.3	34.5 bcd	23.5 bc	6.2 de
	16.5 fl oz	159.5	38.8 abcd	14.5 bc	4.5 de
Safari (dinotefuran)	8.0 oz	112.2	19.0 d	11.3 c	0.7 e
Talus 70DF (buprofezin)	14.0 oz	128.0	118.3 abc	22.3 bc	7.7 cde
Ventigra, BAS 440 (afidopyropen)	4.8 fl oz	141.17	45.3 abcd	32.3 abc	61.8 ab
	7.0 fl oz	114.0	31.0 cd	8.8 c	15.7 bcd
Untreated		132.5	148.7 a	108.0 a	75.0 ab

[x] Mean number of mealybugs counted on 4 randomly selected middle-aged leaves. Means followed by the same letter are not significantly different at p=0.05 (LS Means Tukey's HSD). Data were transformed prior to analysis using sqrt(y). Original data are presented in table.
The first applications were made on Jun 19, with repeat applications on Jun 26 and/or Jul 3. Ventigra/BAS 440 00I, Altus, and Talus were applied twice at a weekly interval. IKI-3106, IKI-3326 SL, and Safari were applied twice at a biweekly interval. Azaguard was applied three times at a weekly interval.

Table 94. Efficacy on Madeira Mealybug on Coleus, 'Wizard Velvet Red' Gilrein, NY, 2019.

Treatment	Rate Per 100 Gal	Population Averages (Henderson's Percent Control)[x]					
		5/29	6/5	6/12	6/19	6/25	7/3
Altus (flupyradifurone)	14 fl oz	84.9 a	72.9 ab (35)	53.1 abc (26)	28.6 ab (39)	17.6 a (17)	20.4 b (75)
Azaguard (azadirachtin)	16 fl oz	62.8 a	57.6 ab (31)	30.1 c (44)	14.9 bc (57)	5.0 bc (68)	32.3 ab (47)
KOC22018-8 (botanical oil blend)	128 fl oz	85.4 a	37.1 bc (67)	35.8 bc (51)	18.6 bc (61)	6.3 bc (71)	17.6 bc (79)
Mainspring GNL (cyantraniliprole)	12 fl oz	85.9 a	78.8 ab (31)	80.1 ab (0)	61.5 a (0)	32.8 a (0)	39.9 ab (52)
Pradia SL (cyclaniliprole + flonicamid)	16.5 fl oz	109.6 a	24.3 bc (83)	2.5 d (97)	0.3 d (100)	0.0 d (100)	0.3 d (100)
Sarisa (cyclaniliprole)	28 fl oz	79.9 a	56.8 ab (46)	64.6 abc (5)	42.1 ab (5)	31.5 a (0)	77.3 a (1)
Safari (dinotefuran)	8 oz	129.0 a	17.5 c (90)	5.5 d (95)	4.8 cd (93)	0.4 d (99)	1.9 cd (99)
TetraCURB Conc (rosemary oil)	128 fl oz	113.3 a	58.5 ab (61)	32.5 bc (66)	20.0 bc (68)	5.6 c (80)	15.5 b (86)
TetraCURB Organic (rosemary oil)	128 fl oz	95.9 a	63.5 ab (50)	37.9 abc (54)	28.9 ab (46)	14.8 ab (39)	12.0 bc (87)
Ventigra (afidopyropen)	7 fl oz	92.0 a	10.5 c (91)	7.1 d (91)	3.6 cd (93)	0.3 d (99)	2.9 d (97)
Untreated	-	96.1 a	127.6 a (0)	81.8 a (0)	53.4 a (0)	24.1 a (0)	93.5 a (0)
Phytotoxicity Rating (0-10) 0=no damage, 10=100% damage [x]							
Altus (flupyradifurone)	14 fl oz	0.00 a	0.00 c	0.75 bc	0.75abc	0.38 cd	0.00 c
Azaguard (azadirachtin)	16 fl oz	0.00 a	0.00 c	0.56 bc	0.63 bc	0.44 cd	0.00 c
KOC22018-8 (botanical oil blend)	128 fl oz	0.00 a	2.25 a	2.00 a	2.25 a	2.00 a	3.5 a
Mainspring GNL (cyantraniliprole)	12 fl oz	0.00 a	0.00 c	0.38 cd	0.63 bc	0.81abc	0.00 c
Pradia SL (cyclaniliprole + flonicamid)	16.5 fl oz	0.00 a	0.25 bc	1.13 ab	0.75 abc	0.25 cd	0.00 c
Sarisa (cyclaniliprole)	28 fl oz	0.00 a	0.63 b	1.25 ab	0.13 c	0.75 bc	0.00 c
Safari (dinotefuran)	8 oz	0.00 a	0.00 c	1.25 ab	0.75 abc	0.50 cd	0.00 c
TetraCURB Conc (rosemary oil)	128 fl oz	0.00 a	0.00 c	1.25 ab	0.88 abc	0.56 bc	1.25 b
TetraCURB Organic (rosemary oil)	128 fl oz	0.00 a	0.00 c	1.31 ab	1.5 ab	1.44 ab	1.50 b
Ventigra (afidopyropen)	7 fl oz	0.00 a	0.00 c	0.25 cd	0.63 bc	0.00 d	0.00 c
Untreated	-	0.00 a	0.00 c	0.00 d	0.75 abc	0.00 d	0.25 c

[x] Means followed by the same letter are not significantly different at p=0.05 (LS Means Tukey's HSD).

Table 95. Efficacy on Immature and Mature Madeira Mealybug on Coleus (*Plectranthus scutellarioides*), 'Premium Sun Chocolate Mint', Vafaie, TX, 2019.

Treatment	Rate Per 100 Gal	Population Counts on Three Leaves for 30 Seconds (Henderson's Percent Control)				
		Pretreat	7 DAT	14 DAT	28 DAT	49 DAT
Number of Immature Mealybugs						
Altus (flupyradifurone)	14 fl oz	11.0	10.6 (0)	36.7 (0)	108.9 (4)	22.4 (70)
KOC22018 (botanical oil blend)	128 fl oz	10.3	6.4 (0)	51.3 (0)	71.6 (33)	40.3 (42)
Pradia SL (cyclaniliprole + flonicamid)	16.5 fl oz	8.6	2.3 (6)	11.4 (0)	4.7 * (95)	0.1 * (100)
Sarisa (cyclaniliprole) + Capsil	28 fl oz	11.4	5.6 (0)	53.0 (0)	180.3 (0)	82.4 (0)
TetraCURB Conc (rosemary oil)	128 fl oz	12.9	9.0 (0)	13.4 (0)	66.7 (50)	32.0 (63)
TetraCURB Org (rosemary oil)	128 fl oz	12.1	7.1 (0)	48.6 (0)	86.1 (31)	39.9 (51)
Ventigra (afidopyropen)	4.8 fl oz	11.0	4.6 (0)	15.6 (0)	26.6 (77)	2.1 * (97)
Ventigra (afidopyropen)	7 fl oz	15.4	8.3 (0)	12.0 (0)	105.7 (34)	6.4 * (94)
Capsil (non-ionic surfactant)	9 fl oz	12.9	8.7 (0)	21.7 (0)	150.0 (0)	43.0 (50)
Untreated	-	11.0	3.1 (0)	7.7 (0)	113.7 (0)	73.9 (0)
p-value		0.96	0.88	0.08	<0.01	<0.01
Number of Mature Mealybugs						
Altus (flupyradifurone)	14 fl oz	1.6	3.3 (76)	5.7 (61)	11.0 (0)	8.0 (83)
KOC22018 (botanical oil blend)	128 fl oz	4.1	4.3 (88)	4.9 (87)	12.1 (56)	15.1 (88)
Pradia SL (cyclaniliprole + flonicamid)	16.5 fl oz	1.3	0.9 * (92)	0.3 * (98)	1.3 (85)	0.0 * (100)
Sarisa (cyclaniliprole) + Capsil	28 fl oz	1.3	7.1 (38)	8.0 (33)	12.4 (0)	15.3 (62)
TetraCURB Conc (rosemary oil)	128 fl oz	0.9	3.7 (51)	6.6 (17)	2.7 (52)	8.3 (69)
TetraCURB Org (rosemary oil)	128 fl oz	1.3	1.4 (87)	2.7 (77)	13.1 (0)	9.4 (76)
Ventigra (afidopyropen)	4.8 fl oz	1.6	2.3 (84)	3.4 (76)	3.1 (70)	2.1 * (96)
Ventigra (afidopyropen)	7 fl oz	0.4	4.7 (0)	9.3 (0)	2.0 (30)	2.9 * (78)
Capsil (non-ionic surfactant)	9 fl oz	1.4	4.1 (67)	6.9 (48)	13.0 (0)	11.0 (75)
Untreated	-	0.7	6.3 (0)	6.6 (0)	4.7 (0)	21.9 (0)
p-value		0.99	0.04	<0.01	<0.01	<0.01

*significantly different from UTC on log(x+1) transformed data using Dunnett's test within sampling date and mealybug life stage.

Table 96. Efficacy on Madeira Mealybug Egg Sacs and Male Pupae on Coleus (*Plectranthus scutellarioides*), 'Premium Sun Chocolate Mint', Vafaie, TX, 2019.

Treatment	Rate Per 100 Gal	Population Counts on Three Leaves for 30 Seconds				
		Mealybug Egg Sacs				Male Pupae
		Pretreat	7 DAT	14 DAT	28 DAT	49 DAT
Altus (flupyradifurone)	14 fl oz	0.71	1.14	2.86	4.86	15.43
KOC22018 (botanical oil blend)	128 fl oz	0.57	1.29	2.29	3.57	20.71
Pradia SL (cyclaniliprole + flonicamid)	16.5 fl oz	1.00	0.57	0.14	0.43*	0.14*
Sarisa (cyclaniliprole) + Capsil	28 fl oz	0.71	1.57	3.71	6.43	41.29
TetraCURB Conc (rosemary oil)	128 fl oz	0.71	0.86	1.00	4.86	19.29
TetraCURB Org (rosemary oil)	128 fl oz	0.71	1.00	2.29	5.14	26.29
Ventigra (afidopyropen)	4.8 fl oz	0.86	1.00	0.71	2.57*	5.29*
Ventigra (afidopyropen)	7 fl oz	0.57	2.43	1.57	5.57	6.43*
Capsil (non-ionic surfactant)	9 fl oz	0.71	1.86	3.43	7.14	33.71
Untreated	-	1.14	1.57	2.43	8.71	27.57
p-value		0.99	0.78	0.08	<0.01	<0.01

*significantly different from UTC on log(x+1) transformed data using Dunnett's test within sampling date and mealybug life stage.

Mexican Mealybug

In a single experiment conducted by Smitley & Davis to control Mexican mealybug (*Phenacoccus gossypii*) on marigold (*Tagetes* sp.) 'Queen Sophia', all products tested provided good to excellent control starting 17 days after initial applications with excellent control continuing through the end of the experiment at 38 days after initial applications (Table 97).

Table 97. Efficacy on Mexican Mealybug on Marigold, Smitley & Davis, MI, 2005.

Treatment	Rate Per 100 Gal	Pre Treatment Count	Henderson's Percent Control				
			7 DAT	17 DAT	25 DAT	33 DAT	38 DAT
Aria 50SG	60 g	21.0	90	93	100	100	100
Aria 50SG	120 g	17.3	91	95	98	100	100
Flagship 25WP	2 oz	17.0	0	81	99	100	93
Flagship 25WP	4 oz	16.2	68	95	100	100	100
Safari 20SG	4 oz	18.7	71	98	99	100	100
Safari 20SG	8 oz	15.8	49	93	99	100	100
Safari 20SG - Drench	12 oz	17.8	70	84	95	96	100
Safari 20SG - Drench	24 oz	17.2	27	80	97	100	99
Talus 40SC	18 fl oz	19.7	10	66	98	99	99
TriStar 30SG	112 g	18.5	56	90	98	97	97
TriStar 30SG	224 g	17.5	80	83	99	89	96
Orthene 97	1 lb	16.0	95	100	100	100	100
Untreated	-	20.5	0	0	0	0	0
Untreated (Population Average)		20.5	105.3	221.0	240.3	323.8	489.8

*B-1956 surfactant mixed with Flagship, Safari, TriStar and Orthene foliar applications.

Phormium Mealybug

In one experiment with Phormium mealybug (*Balanococcus diminutus*) on New Zealand flax (*Phormium tenax*) 'Dazler', both adults and nymphs were assessed. Very few adults were observed, so the remaining discussion will be on total nymph counts. Flagship 25WG applied as a foliar spray provided good to great control from 8 DAT to 43 DAT. Precise, commonly used for this pest, only provided approximately 50% control 4 and 6 weeks after treatment. Safari 20SG provided excellent control (>95%) at 4 and 6 weeks after treatment. TriStar 70WSP exhibited good to excellent control throughout this experiment (Table 98).

Table 98. Efficacy on Phormium Mealybug on New Zealand Flax, Bethke, CA, 2005.

Scale Stage	Treatment	Rate per 100 gal	Population Averages (Henderson's Percent Control)				
			Pre-treatment counts	8 DAT	15 DAT	29 DAT	43 DAT
Live Nymphs	Flagship 25WG	2 oz	41.0 a	10.7 (83)	0.3 (99)	13.2 (85)	0.5 (98)
	Flagship 25WG	4 oz	45.5 a	0.0 (100)	1.2 (98)	0.5 (99)	0.0 (100)
	Precise	1 tbs per pot	36.7 a	33.5 (40)	77.0 (0)	33.7 (57)	14.8 (42)
	Safari 20SG	4 oz	30.7 a	14.5 (69)	15.7 (67)	0.0 (100)	0.2 (99)
	Safari 20SG	8 oz	9.5 a	23.5 (0)	1.3 (91)	0.0 (100)	0.0 (100)
	Safari 20SG – Drench	12 oz	22.5 a	6.3 (82)	0.8 (98)	0.2 (100)	0.7 (96)
	Safari 20SG – Drench	24 oz	15.8 a	23.8 (1)	19.2 (21)	1.2 (97)	6.7 (40)
	TriStar 70WSP	4 oz	37.5 a	4.7 (92)	2.2 (96)	0.0 (100)	1.2 (96)
	TriStar 70WSP	8 oz	42.7 a	11.3 (83)	1.7 (97)	0.0 (100)	1.5 (95)
	Untreated	-	33.2 a	50.7 (0)	50.7 (0)	70.7 (0)	23.3 (0)
Live Adults	Flagship 25WG	2 oz	1.0 a	0.0 (100)	29.7 (0)	0.0 (100)	0.0 (100)
	Flagship 25WG	4 oz	2.0 a	0.0 (100)	18.8 (0)	0.0 (100)	0.0 (100)
	Precise	1 tbs per pot	3.0 a	1.7 (76)	10.3 (0)	5.7 (0)	1.3 (92)
	Safari 20SG	4 oz	3.0 a	0.5 (93)	11.2 (0)	0.0 (100)	0.2 (99)
	Safari 20SG	8 oz	1.3 a	0.2 (95)	15.0 (0)	0.0 (100)	0.2 (98)
	Safari 20SG – Drench	12 oz	4.2 a	0.2 (98)	11.8 (0)	0.0 (100)	0.0 (100)
	Safari 20SG – Drench	24 oz	0.5 a	0.2 (85)	7.5 (0)	0.0 (100)	0.3 (88)
	TriStar 70WSP	4 oz	1.2 a	0.0 (100)	9.2 (0)	0.7 (0)	0.5 (93)
	TriStar 70WSP	8 oz	0.3 a	0.7 (13)	3.7 (0)	0.0 (100)	0.0 (100)
	Untreated	-	1.2 a	2.7 (0)	2.7 (0)	0.3 (0)	6.7 (0)
Total Live	Flagship 25WG	2 oz	42.0 a	10.7 cd (84)	30.0 bc (54)	13.2 c (85)	0.5 d (99)
	Flagship 25WG	4 oz	47.5 a	0.0 d (100)	20.0 c (73)	0.5 c (99)	0.0 d (100)
	Precise	1 tbs per pot	39.7 a	35.2 ab (43)	87.3 a (0)	39.3 b (52)	16.2 b (53)
	Safari 20SG	4 oz	33.7 a	15.0 bcd (71)	26.8 bc (49)	0.0 c (100)	0.3 d (99)
	Safari 20SG	8 oz	10.8 a	23.7 bc (0)	16.3 c (3)	0.0 c (100)	0.2 d (98)
	Safari 20SG – Drench	12 oz	26.7 a	6.5 cd (84)	12.7 c (69)	0.2 c (100)	0.7 d (97)
	Safari 20SG – Drench	24 oz	16.3 a	24.0 bc (5)	26.7 abc (0)	1.2 c (97)	7.0 bc (51)
	TriStar 70WSP	4 oz	38.7 a	4.7 cd (92)	11.3 c (81)	0.7 c (99)	1.7 d (95)
	TriStar 70WSP	8 oz	43.0 a	12.0 cd (82)	5.3 c (92)	0.0 c (100)	1.5 cd (96)
	Untreated	-	34.3 a	53.3 a (0)	53.3 ab (0)	71.0 a (0)	30.0 a (0)

* Letters after numbers are based on separation of average number of scale on 5 plants. See experiment report in Appendix 3 for statistical separation details.

Rhizoecus Root Mealybug

In 2010, Hara conducted an experiment with Acelepryn, Aria, Kontos and Safari for control of rhizoecus root mealybug, (*Rhizoecus hibisci*) on Rhapis palm (*Rhapis robusta*). Products were applied once as drench; in addition, Kontos was applied as foliar spray in two weekly applications (Table 99). All treatments except Acelepryn provided good to excellent control of root mealybug. In 2012, Hara conducted another experiment on parapara or birdcatcher tree (*Pisonia brunoniana*). A16901B, Orthene and Safari were applied as drench once, MBI 203 and MBI 205 applied as drench twice, while Kontos was applied as drench or foliar spray twice (Table 100). All treatments except Orthene provided good to excellent control of root mealybug.

No phytotoxicity was observed on any of the treated plants.

Table 99. Efficacy on Rhizoecus Root Mealybug on Rhapis Palm, Hara, HI, 2010.

Treatment	Rate Per 100 Gal	Application Method	Live Adults and Nymphs[x]	
			Pretreatment	4 WAT
Acelepryn	0.8 fl oz	Drench	75.11 ±14.9 a	75.89 ±23.3 (51) b
Aria 50 SG	120 g	Drench	75.56 ±14.5 a	9.22 ±2.3 (94) c
Kontos	3.4 fl oz	Drench	75.11 ±15.1 a	0.44 ±0.4 (100) c
Kontos + Silwet	3.4 + 3 fl oz	Foliar	75.33 ±15.3 a	13.56±7.0 (91) c
Safari 20SG	6 g/ft ht	Drench	75.56 ±15.8 a	0.00 ±0.0 (100) c
Untreated	-	-	63.61 ±9.0* a	130.44 ±19.3* (0) a

[x] Means within a column followed by the same letter are not significantly different based on Tukey's HSD, P = 0.05.
* Does not include Rep3 Plant 2 data.

Table 100. Efficacy on Rhizoecus Root Mealybug on Parapara or Birdcatcher Tree, Hara, HI, 2012.

Treatment	Rate Per 100 Gal	Application Method	Live Adults and Nymphs[x] (Henderson's Percent Control)	
			Pretreatment	5 WAT
A16901B	10 oz	Drench 4/11	21.86 a	0.43 b (98)
Kontos	3.4 fl oz	Drench4/11,4/25	35.14 a	4.29 b (90)
Kontos	3.4 fl oz	Foliar 4/11,4/25	38.57 a	6.57 b (86)
MBI 203	2 qt	Drench 4/11,4/25	22.00 a	2.57 b (90)
MBI 205	4 qt	Drench 4/11,4/25	22.43 a	2.71 b (90)
Orthene TTO	10.7 oz	Drench 4/11	21.43 a	33.57 a (0)
Safari 20SG	24 oz	Drench 4/11	30.43 a	2.29 b (94)
Untreated	-	-	18.43 a	22.57 a (0)

[x] Means within a column followed by the same letter are not significantly different based on Tukey's HSD, P = 0.05.

Efficacy Summary by Active Ingredient

A16901B. This product applied as drench provided poor control of camellia scale in one experiment, mixed results on Euonymus scale in three experiments, and on false oleander scale in two experiments, and mediocre control of pine needle scale in two experiments. On cottony cushion scale, it provided excellent control in one, but no to mediocre efficacy in three other experiments. It had excellent control of gloomy scale in one experiment. On rhizoecus root mealybug, it provided excellent control in one experiment. It provided excellent control of citrus mealybug when applied foliar, and good control when applied as drench treatment. Control of Madeira mealybug was good to excellent when applied foliar, and poor to good when applied as drench treatment.

Aloft SC/Celero 16WSG. Celero provided poor control of cottony cushion scale and mixed results in 3 experiments on Florida wax scale with minimal to excellent control of nymphs and adults. Aloft provided good control of euonymus scale and holly pit scale, but poor control of armored scale and oystershell scale.

Aria 50SG. Aria foliar provided good to excellent control of citrus mealybug and Mexican mealybug; when applied as drench, it provided good control of rhizoecus root mealybug in one experiment.

Altus/BYI-2960 200 SL. This product applied foliar provided poor and excellent control of tea scale in two experiments; a third experiment was inconclusive. An experiment on false oleander scale on potted *Aucuba japonica* showed Altus and all other treatments, including the standards (Distance, Talus and Tristar), providing poor control because application timing might have been too early to provide adequate control; similarly, it showed poor activity in another trial. Results of an experiment on crapemyrtle indicate reliable suppression of crapemyrtle bark scale (*Acanthococcus lagerstroemiae*). It provided good control of cycad scale (*Aulacaspis yasumatsui*) in a sago palm trial, and excellent control of lobate lac scale (*Paratrichodorus pseudolabata*) in a hibiscus trial. In an experiment for control of citrus mealybug, Altus provided poor control on coleus, and mediocre control on rose in single trials. It provided poor to mediocre control of Madeira mealybug in 3 coleus trials.

Azaguard. An experiment on false oleander scale on potted *Aucuba japonica* showed Azaguard and all other treatments, including the standards (Distance, Talus and Tristar), providing poor control because application timing might have been too early to provide adequate control; similarly, it showed poor activity in another trial. It provided poor control of cycad scale (*Aulacaspis yasumatsui*) in a sago palm trial, and of lobate lac scale (*Paratrichodorus pseudolabata*) in a hibiscus trial. In an experiment for control of citrus mealybug, Azaguard provided poor control on coleus and mediocre control on rose in single trials. It provided poor and excellent control of Madeira mealybug in 2 coleus trials.

Botanigard ES. This biological product provided no control of elongate hemlock scale and cryptomeria scale in one experiment on Frasier fir.

BW133. This product provided poor control of crapemyrtle bark scale and citrus mealybug in single experiments on crapemyrtle and coleus.

BW238. Both formulations (ES and WP) of this product provided poor control of crapemyrtle bark scale and citrus mealybug in single experiments on crapemyrtle and coleus.

Discus. In one experiment, Discus foliar provided good control of Fletcher scale on yew.

Distance 0.86E. Distance generally provided excellent control of false oleander scale, gloomy scale,pine needle scale, magnolia white scale, and camellia scale, good to excellent control of tea scale and euonymus scale, good control of Florida wax scale, mixed efficacy on cottony cushion scale, and poor control of Fletcher scale, armored scale, false Florida red scale, holly pit scale and calico scale. Results of a pine needle scale experiment were inconclusive. Mixed results were obtained with citrus and Madeira mealybugs, with poor control in one experiment and good control in another. Results of an experiment on crapemyrtle indicate reliable suppression of crapemyrtle bark scale (*Acanthococcus lagerstroemiae*).

Facin. Facin provided good control of citrus mealybug and poor to good control of Madeira mealybug at 0.25 and 0.5 % rates.

Flagship 0.22G/25WG. Flagship foliar at both rates provided excellent control of elongate hemlock scale and cryptomeria scale, mediocre to good control of cottony maple scale, and poor control of armored scale, false oleander scale, and oystershell scale. On Florida wax scale, overall control was excellent although mixed results were obtained in 3 experiments, with good control of nymphs and excellent control of adults at both rates in one experiment, minimal impact on nymphs and excellent control of adults at both rates in another experiment, and minimal impact on adults and excellent control of nymphs at the higher rate in a third experiment. Better control of Fletcher scale was obtained with banded vs. foliar application. Euonymus scale control with foliar application was variable - good in a 2005, two 2009 and a 2010 experiments, mediocre in a 2004 and another 2009 experiment and poor in a 2010 experiment. Drench application provided excellent control of false Florida red scale but poor control of pine needle scale in two experiments, and of camellia, false oleander and holly pit scales in single experiments. On cottony cushion scale, foliar, drench and soil broadcast application provided good to excellent control. Flagship 0.22G applied broadcast provided excellent conttol of false oleander scale in one experiment, poor and good control of cottony cushion scale, and poor control of pine needle scale in single experiments. On gloomy scale, Flagship applied broadcast or drench provided excellent control. Flagship at both rates applied as foliar treatment provided good to excellent control of citrus mealybug, Mexican mealybug and phormium mealybug. Mixed efficacy on Madeira mealybug (poor to excellent) was obtained in three experiments, with foliar generally superior to drench or broadcast treatment.

GF-2626 1SC. GF-2626 foliar provided excellent control of false oleander scale, mediocre control of pine needle scale, and poor and excellent control of cottony cushion scale, in single experiments.

ISM-555. This product provided good control of crapemyrtle bark scale and citrus mealybug in single experiments on crapemyrtle and coleus.

Kontos/Movento 240SC. This product provided mixed results on euonymus scale (poor, mediocre, good and excellent) in single experiments. It provided excellent control of gloomy scale, tea scale and camellia scale, but mediocre control of calico scale, and no control of elongate hemlock scale, cryptomeria scale, false oleander scale and pine needle scale in single experiments. Kontos applied foliar provided good to excellent control of pine needle scale, and poor to excellent control of cottony cushion scale in three experiments; when applied drench, it was poor on cottony cushion scale in a single experiment. Control of Madeira mealybug was variable – good in one, and poor in another experiment. It provided good to excellent control of

rhizoecus root mealybug applied as foliar or drench in two experiments.

KOC22018-8. This product applied foliar provided provided poor control of cycad scale (*Aulacaspis yasumatsui*) in a sago palm trial. It showed poor activity on false oleander scale in an aucuban experiment. In an experiment for control of citrus mealybug, it provided mediocre control on rose. Poor to mediocre control of Madeira mealybug was obtained in 2 coleus trials.

Mainspring 200SC. This product applied as drench provided good to excellent control of tea scale in six experiments; a seventh experiment was inconclusive. In single experiments, excellent control of magnolia white scale, good control of calico scale, poor and excellent control of euonymus scale, and poor control of camellia scale were obtained. When applied foliar, Mainspring provided good control of tea scale in one experiment. It provided poor control of Madeira mealybug in a coleus trial.

MBI 203. MBI 203 foliar provided no control of Madeira mealybug in a coleus experiment, and of citrus mealybug in single coleus and rose experiments. It provided good control of rhizoecus root mealybug applied as drench on parapara.

MBI 205. MBI 205 foliar provided no control of Madeira mealybug in a coleus experiment and of citrus mealybug in a rose experiment. It provided good control of rhizoecus root mealybug applied as drench on parapara.

MBI 306. MBI 306 foliar provided no control of crapemyrtle bark scale and citrus mealybug in single experiments on crapemyrtle and coleus.

MOI 201. In one Carolina silverbell experiment, MOI 201 foliar provided no control of oystershell scale.

Natural Solutions. This biological product provided good initial control of citrus mealybug though with relatively short residual activity in one experiment.

Pradia/IKI-3326. An experiment on false oleander scale on potted *Aucuba japonica* showed IKI-3326 and all other treatments, including the standards (Distance, Talus and Tristar), providing poor control because application timing might have been too early to provide adequate control; similarly, it showed poor activity in another trial. It provided poor control of cycad scale (*Aulacaspis yasumatsui*) in a sago palm trial. Good control of lobate lac scale (*Paratrichodorus pseudolabata*) in a hibiscus trial was obtained with 12 fl oz, but not with 16.5 fl oz, in a hibiscus trial. In an experiment for control of citrus mealybug, Pradia/IKI 3326 provided generally mediocre control on coleus, but excellent control on rose in single trials. It provided excellent control of Madeira mealybug in 3 coleus trials.

Rycar/Rycar20SC. Rycar foliar provided excellent control of gloomy scale and pine needle scale, good to excellent control of cottony cushion scale, poor to good control of euonymus scale, and poor control of armored scale, false Florida red scale, false oleander scale and holly pit scale. Control of citrus mealybug was good in a rose experiment, and on Madeira mealybug, good in coleus and marigold experiments.

Safari 2G/20SG/Transect 70WSP. Safari applied as a trunk spray provided good control of elongate hemlock scale, Cryptomeria scale, and euonymus scale in single experiments. Control of gloomy scale from Safari or Transect applied as trunk spray or soil treatment was excellent, but control of calico scale was mediocre; Pentrabark slightly improved performance. Excellent control of calico scale was obtained when it was applied as a drench in one experiment. Safari at

both rates foliar or drench provided excellent control of elongate hemlock scale and cryptomeria scale, mediocre to good control of Fletcher scale and euonymus scale. On cottony cushion scale, Safari applied as drench or soil broadcast provided excellent control in two experiments but poor control in another experiment; a fourth experiment that was terminated early showed poor control with foliar or drench applications. Drench application provided excellent control of euonymus scale, false Florida red scale, Florida wax scale, and tea scale, variable results on false oleander scale and pine needle scale, and poor control of armored scale and camellia scale. On oystershell scale, Safari at both rates provided excellent control when applied as drench but poor control when applied foliar. Cottony maple scale control was poor to mediocre with foliar, and none to poor with drench application. Holly pit scale efficacy with drench or soil surface application was poor in a single experiment. Results of an experiment on crapemyrtle indicate reliable suppression of crapemyrtle bark scale (*Acanthococcus lagerstroemiae*).Safari at both rates applied foliar provided excellent control of citrus mealybug, better than drench. It provided good to excellent control of Madeira mealybug when applied foliar, and variable efficacy when applied drench. Excellent control of Mexican mealybug and phormium mealybug was obtained with foliar or drench application in single experiments. Also, it provided excellent control of rhizoecus root mealybug applied as foliar or drench.

Sarisa/IKI-3106. This product applied foliar provided good to excellent control of tea scale in 3 experiments; a fourth experiment was inconclusive. Poor control of pine needle scale was obtained in one experiment. An experiment on false oleander scale on potted *Aucuba japonica* showed IKI-3106 and all other treatments, including the standards (Distance, Talus and Tristar), providing poor control because application timing might have been too early to provide adequate control; similarly, it showed poor activity in another trial. It provided good control of lobate lac scale (*Paratrichodorus pseudolabata*) in a hibiscus trial, but poor control of cycad scale (*Aulacaspis yasumatsui*) in a sago palm trial. In an experiment for control of citrus mealybug, IKI-3106/Sarisa provided poor control on coleus and good control on rose in single trials. It provided poor control of Madeira mealybug in 2 coleus trials.

SP3014. SP3014 foliar provided good control of citrus mealybug in a coleus experiment.

Talus 40SC/70DF. Talus provided excellent control of elongate hemlock scale, cryptomeria scale, oystershell scale, gloomy scale, magnolia white scale and camellia scale. Excellent control of pine needle scale and poor to excellent control of cottony cushion scale was also obtained with Talus 70DF in three experiments. It provided good to excellent controlof euonymus scale and tea scale, and good control of Fletcher scale. Variable efficacy on Florida wax scale and false oleander scale, and poor control of cottony maple scale, armored scale, false Florida red scale, and holly pit scale were obtained. Results of an experiment on crapemyrtle indicate reliable suppression of crapemyrtle bark scale (*Acanthococcus lagerstroemiae*). It provided good control of cycad scale (*Aulacaspis yasumatsui*) in a sago palm trial, and excellent control of lobate lac scale (*Paratrichodorus pseudolabata*) in a hibiscus trial. Talus provided excellent control of Madeira mealybug and Mexican mealybug, and mediocre to excellent control of citrus mealybug.

TetraCURB. Two formulations (Concentrate and Organic) of this product applied as foliar sprays provided provided poor control of cycad scale (*Aulacaspis yasumatsui*) and poor activity on false oleander scale. In an experiment for control of citrus mealybug, TetraCURB Concentrate provided excellent control, but TetraCurb Organic provided poor control on rose. Both formulations provided poor and good control of Madeira mealybug in two coleus trials.

TriStar 30SG/70WSP. TriStar provided excellent control of elongate hemlock scale and cryptomeria scale, gloomy scale, and pine needle scale. For Florida wax scale, overall control was excellent although mixed results were obtained in 3 experiments, with good control of nymphs and excellent control of adults at both rates in one experiment, minimal impact on nymphs and excellent control of adults at both rates in another experiment, and minimal impact on adults and excellent control of nymphs in a third experiment. Good control of Fletcher scale was obtained with the higher rate, and of cottony cushion scale with both rates. It provided variable, but generally mediocre, control of euonymus scale. Efficacy was generally none to mediocre on cottony maple scale, armored scale, camellia scale, false Florida red scale, false oleander scale, Florida red scale, holly pit scale, and oystershell scale. Both rates of TriStar provided excellent control of citrus mealybug, Mexican mealybug and phormium mealybug. An experiment on Madeira mealybug showed excellent control when TriStar was mixed with Capsil surfactant and poor control without Capsil; another experiment confirmed the good efficacy with a surfactant.

V-10433. V-10433 foliar provided no control of crapemyrtle bark scale and citrus mealybug in single experiments on crapemyrtle and coleus.

Velifer. Velifer foliar provided no control of citrus mealybug in a coleus experiment.

Ventigra. This product applied foliar provided good to excellent control of tea scale in three experiments; a fourth experiment was inconclusive. An experiment on false oleander scale on potted *Aucuba japonica* showed Ventigra and all other treatments, including the standards (Distance, Talus and Tristar), providing poor control because application timing might have been too early to provide adequate control; similarly, it showed poor activity in another trial. It provided good control of cycad scale (*Aulacaspis yasumatsui*) in a sago palm trial, and of lobate lac scale (*Paratrichodorus pseudolabata*) in a hibiscus trial. In an experiment for control of citrus mealybug, Ventigra provided generally mediocre control on coleus, but good control on rose in single trials. It provided excellent control of Madeira mealybug in three coleus trials.

XXpire 40WG. XXpire foliar provided excellent control of magnolia white scale, false oleander scale, tea scale and camellia scale, good control of armored scale, mediocre control of pine needle scale, poor and excellent control of cottony cushion scale and euonymus scale, and poor to good control of calico scale.

Please see Table 101 and Table 102 for a list of all researchable studies and the summary of experiments conducted from 2004 to 2020.

Phytotoxicity

No phytotoxicity was observed with any treatments by any researcher with the exception of Arena on honeylocust, Precise on Phormium (*Phormium tenax*), KOC22018-8 on rose and coleus, TetraCURB Concentrate and Talus on rose, and TetraCURB Concentrate and TetraCURB Organic on coleus.

Table 101. Summary of Efficacy by Product for Scale

Note: Table entries are sorted by crop Latin name. Only those experiments received by 11/2/2020 are included in the table below.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
30452	A16901B 45WG (Thiamethoxam + cyantraniliprole)	IRAC 4A + IRAC 28	Cottony Cushion Scale (Icerya purchasi)	Cheesewood (Pittosporum sp.) P. tobira cv.'variegata'	Field Container	Chong	SC	2012	Drench	No consistent and significant reduction of scale population with 5 and 10 oz per 100 gal; comparable to standard paraffinic oil.
30296	A16901B 45WG (Thiamethoxam + cyantraniliprole)	IRAC 4A + IRAC 28	Cottony Cushion Scale (Icerya purchasi)	Cheesewood (Pittosporum sp.) P. tobira 'Verigata'	Field In-Ground	Chong	SC	2011	Drench	Did not significantly reduce immatures with 10 oz per 100 gal.
30224	A16901B 45WG (Thiamethoxam + cyantraniliprole)	IRAC 4A + IRAC 28	Cottony Cushion Scale (Icerya purchasi)	Sacred Bamboo (Nandina domestica) 'Harbour Dwarf'	Field Container	Frank	NC	2011	Drench	Significantly reduced adults and immatures with 5 oz per 100 gal applied once; comparable to horticultural oil.
32151	A16901B 45WG (Thiamethoxam + cyantraniliprole)	IRAC 4A + IRAC 28	Cottony Cushion Scale (Icerya purchasi)	Sacred Bamboo (Nandina domestica) 'Harbour Dwarf'	Greenhouse	Frank	NC	2012	Foliar	Did not significantly reduce immatures with 5 and 10 oz per 100 gal applied once.
30079	A16901B 45WG (Thiamethoxam + cyantraniliprole)	IRAC 4A + IRAC 28	Camelia Scale (Lepidosaphes camelliae)	Camellia (Camellia japonica)	Commercial Landscape	Chong	SC	2010	Drench	Did not significantly reduce camellia scale population at 10 oz per 100 gal; comparable to all other treatments including the standard Orthene; no injury observed.
30234	A16901B 45WG (Thiamethoxam + cyantraniliprole)	IRAC 4A + IRAC 28	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2011	Drench	Excellent control of adults and immatures with 5 oz per 100 gal applied once; comparable to standard paraffin oil.
31285	A16901B 45WG (Thiamethoxam + cyantraniliprole)	IRAC 4A + IRAC 28	Magnolia Scale (Neolecanium cornuparvum)	Sweet Bay (Magnolia virginiana) M. grandiflora, 'Little Gem'	Field In-Ground	Braman	GA	2012	Foliar	Great control of false oleander scale immatures with 5 and 10 oz per 100 gal; comparable to Orthene.
29765	A16901B 45WG (Thiamethoxam + cyantraniliprole)	IRAC 4A + IRAC 28	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2010	Drench	Poor efficacy at 10 oz per 100 gal.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
29765	A16901B 45WG (Thiamethoxam + cyantraniliprole)	IRAC 4A + IRAC 28	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2011	Drench	Poor efficacy with 10 oz per 100 gal.
29625	A16901B 45WG (Thiamethoxam + cyantraniliprole)	IRAC 4A + IRAC 28	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora)	Commercial Landscape	Chong	SC	2010	Drench	Charleston, SC: Did not significantly reduce false oleander scale population at 10 oz per 100 gal; comparable to the standard Orthene; no injury observed.
29638	A16901B 45WG (Thiamethoxam + cyantraniliprole)	IRAC 4A + IRAC 28	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus)	Field Container	Frank	NC	2010	Drench	Excellent control with 5 oz per 100 gal; comparable to horticultural oil.
29638	A16901B 45WG (Thiamethoxam + cyantraniliprole)	IRAC 4A + IRAC 28	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. fortunei 'Moonshadow'	Field Container	Potter	KY	2010	Drench	No significant reduction of adult scales with 5 oz per 100 gal.
29638	A16901B 45WG (Thiamethoxam + cyantraniliprole)	IRAC 4A + IRAC 28	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) 'Green Spire'	Field Container	Gilrein	NY	2011	Drench	Did not significantly reduce population with 5 oz per 100 gal applied once.
29264	Acephate Pro 75 WSP (Acephate)	IRAC 1B	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) 'Microphylla'	Field Container	Frank	NC	2009	Foliar	Excellent control at 0.67 lb per 100 gal
28692	Aloft SC (Clothianadin + bifenthrin)	IRAC 4A + IRAC 3	Scale, Holly Pit (Asterolecanium puteanum)	Holly (Ilex sp.) 'East Palatka'	Field In-Ground	Buss	FL	2009	Foliar	Significantly reduced number of immatures at 10 fl oz per 100 gal; comparable to Orthene. 56% control with HendersonsTilton 6 WAT.
28879	Aloft SC (Clothianadin + bifenthrin)	IRAC 4A + IRAC 3	Scale, Oystershell (Diaspidiotus ostreiformis)	Silverbell Carolina (Halesia carolina var. carolina)	Field In-Ground	Nielsen	OH	2008	Sprench	Very low infestation; poor control at 5 and 10 fl oz per 100 gal

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
28130	Aloft SC (Clothianadin + bifenthrin)	IRAC 4A + IRAC 3	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2008	Sprench	Experiment 1: Did not significantly reduce scale population at 5 and 10 fl oz per 100 gal; similar to Orthene std; untreated population very low and no statistical differences were observed.
28130	Aloft SC (Clothianadin + bifenthrin)	IRAC 4A + IRAC 3	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2009	Sprench	Did not significantly reduce scale population at 10 fl oz per 100 gal; similar to Orthene std; very low non treated population so no statistical significance.
29978	Aloft SC (Clothianadin + bifenthrin)	IRAC 4A + IRAC 3	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2010	Sprench	Excellent efficacy at 10 fl oz per 100 gal.
27834	Aloft SC (Clothianadin + bifenthrin)	IRAC 4A + IRAC 3	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. vegetus 'Coloratus'	Field In-Ground	Nielsen	OH	2008	Sprench	Good efficacy at 10 fl oz per 100 gal.
29583	Aloft SC (Clothianadin + bifenthrin)	IRAC 4A + IRAC 3	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) 'Microphylla'	Field Container	Ludwig	TX	2008	Foliar	Good efficacy at 5 and 10 fl oz per 100 gal.
34210	Altus (Flupyradifurone)	IRAC 4d	Scale, Cycad (Aulacaspis yasumatsui)	Sago Palm (Cycas revoluta)	Field Container	Dale	FL	2019	Foliar	Good control of adults but mediocre control of nymphs with 14 fl oz per 100 gal applied twice biweekly.
33575	Altus (Flupyradifurone)	IRAC 4d	Crape Myrtle Bark Scale (Eriococcus lagerstroemia)	Crape Myrtle (Lagerstroemia indica) 'Natchez'	Field Container	Vafaie	TX	2018	Foliar	Data had too much variation to provide reliable results. Researcher's preliminary conclusions demonstrate reliable scale suppresion with Altus at 10.5 fl oz per 100 gal, comparable to the standard Distance.
32353	Altus (Flupyradifurone)	IRAC 4d	Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica)	Field In-Ground	Braman	GA	2015	Foliar	Good and excellent control with 2.7 and 5.4 fl oz per 100 gal applied 3 times weekly.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
32845	Altus (Flupyradifurone)	IRAC 4d	Scale, Tea (Fiorinia theae)	Holly (Ilex sp.)	Field Container	Frank	NC	2015	Foliar	Did not significantly reduce number of adults and nymphs with 2.7 and 5.4 fl oz per 100 gal applied twice biweekly. Protocol required weekly application.
32845	Altus (Flupyradifurone)	IRAC 4d	Scale, Tea (Fiorinia theae)	Holly (Ilex sp.) 'Nellie Stevens'	Field Container	Chong	SC	2015	Foliar	Poor and good efficacy with 2.7 and 5.4 fl oz per 100 gal applied 3 times weekly; inferior to Distance.
33549	Altus (Flupyradifurone)	IRAC 4d	Lobate Lac Scale (Paratachardina pseudolobata)	Rosemallow (Hibiscus sp.) H. rosa-sinensis 'Dainty White'	Field Container	Cheng	HI	2018	Foliar	Exellent efficacy with 14 fl oz per 100 gal and no phytotoxicity.
32287	Altus (Flupyradifurone)	IRAC 4d	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Persad	OH	2015	Foliar	Mediocre control with 2.7 and 5.4 fl oz per 100 gal applied 3 times weekly.
34250	Altus (Flupyradifurone)	IRAC 4d	False Oleander Scale (Pseudaulacaspis cockerelli)	Aucuba (Aucuba sp.)	Field Container	Held	AL	2019	Foliar	Weak efficacy through 1 month after initial treatment with 14 fl oz per 100 gal applied twice biweekly, but good efficacy 6 months after treatment.
33850	Altus (Flupyradifurone)	IRAC 4d	False Oleander Scale (Pseudaulacaspis cockerelli)	Japanese Laurel (Aucuba japonica)	Field Container	Held	AL	2018	Foliar	Poor control with 14 fl oz per 100 gal. Researcher commented that application timing used in this trial might have been too early to provide adequate control for this insect.
32340	Altus (Flupyradifurone)	IRAC 4d	Euonymus Scale (Unaspis euonymi)	Wintercreeper (Euonymus fortunei)	Field Container	Potter	KY	2015	Foliar	Scale failed to establish; no usable data were able to be collected
28974	Arena 50WDG (Clothianadin)	IRAC 4A	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) I. cornuta 'Needlepoint'	Commercial Landscape	Held (MSU)	TN	2009	Drench	Excellent control at 2.4 g per ft height applied for first or second generation.
29847	Arena 50WDG (Clothianadin)	IRAC 4A	Scale, Calico (Eulecanium cerasorum)	Locust (Gleditsia sp.) G. triacanthos inermis	Commercial Landscape	Sadof	IN	2010	Drench	Good efficacy with 3.6 g ai per inch DBH.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
30080	Arena 50WDG (Clothianadin)	IRAC 4A	Camelia Scale (Lepidosaphes camelliae)	Camellia (Camellia japonica)	Commercial Landscape	Chong	SC	2010	Drench	Did not significantly reduce camellia scale population at 2.4 g per ft height; comparable to all other treatments including the standard Orthene; no injury observed.
34211	AzaGuard (Azadirachtin)	IRAC UN	Scale, Cycad (Aulacaspis yasumatsui)	Sago Palm (Cycas revoluta)	Field Container	Dale	FL	2019	Foliar	No significant control of nymphs and adults with 16 fl oz per 100 gal applied 5 times weekly.
33576	AzaGuard (Azadirachtin)	IRAC UN	Crape Myrtle Bark Scale (Eriococcus lagerstroemia)	Crape Myrtle (Lagerstroemia indica) 'Natchez'	Field Container	Vafaie	TX	2018	Foliar	Data had too much variation to provide reliable results.
32407	AzaGuard (Azadirachtin)	IRAC UN	Scale, Tea (Fiorinia theae)	Sasanqua camellia (Camellia sasanqua) 'Mountain Snow'	Field Container	Chen	LA	2014	Foliar	Significantly reduced infestation with 20 fl oz per 100 gal applied once; comparable to standard SuffOil-X.
33545	AzaGuard (Azadirachtin)	IRAC UN	Lobate Lac Scale (Paratachardina pseudolobata)	Rosemallow (Hibiscus sp.) H. rosa-sinensis 'Dainty White'	Field Container	Cheng	HI	2018	Foliar	Efficacy with 16 and 32 fl oz per 100 gal inferior to imidacloprid. No phytotoxicity.
34251	AzaGuard (Azadirachtin)	IRAC UN	False Oleander Scale (Pseudaulacaspis cockerelli)	Aucuba (Aucuba sp.)	Field Container	Held	AL	2019	Foliar	Poor efficacy through 1 month after initial treatment with 16 fl oz per 100 gal applied 5 times weekly, but good efficacy 6 months after treatment.
33851	AzaGuard (Azadirachtin)	IRAC UN	False Oleander Scale (Pseudaulacaspis cockerelli)	Japanese Laurel (Aucuba japonica)	Field Container	Held	AL	2018	Foliar	Poor control with 16 and 32 fl oz per 100 gal. Researcher commented that application timing used in this trial might have been too early to provide adequate control for this insect.
32401	AzaGuard (Azadirachtin)	IRAC UN	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora) 'Little Gem'	Field Container	Chen	LA	2014	Foliar	Significantly reduced infestation with 20 fl oz per 100 gal applied once; much inferior to standard SuffOil-X.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
28386	Botanigard 22WP (Beauveria bassiana GHA)		Scale, Elongate Hemlock (Fiorinia externa)	Fir, Fraser (Abies fraseri)	Field In-Ground	Cowles	CT	2008	Foliar	No control with 64 oz per acre.
34173	BW133 (BW133)	FRAC NC	Crape Myrtle Bark Scale (Eriococcus lagerstroemia)	Crape Myrtle (Lagerstroemia indica)	Field Container	Held	AL	2020	Foliar	No control with 5 lb per 100 gal applied 3 times weekly.
34174	BW238 ES (BW238 ES)		Crape Myrtle Bark Scale (Eriococcus lagerstroemia)	Crape Myrtle (Lagerstroemia indica)	Field Container	Held	AL	2020	Foliar	No control with 2 qt per 100 gal applied 3 times weekly.
34175	BW238 WP (BW238 WP)		Crape Myrtle Bark Scale (Eriococcus lagerstroemia)	Crape Myrtle (Lagerstroemia indica)	Field Container	Held	AL	2020	Foliar	No control with 2 lb per 100 gal applied 3 times weekly.
25729	Celero 16WSG (Clothianidin)	IRAC 4A	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) 'China Doll'	Field Container	Ludwig	TX	2005	Foliar	Minimal impact on adults; some efficacy on nymphs at 14 DAT at 4 oz per 100 gal
25729	Celero 16WSG (Clothianidin)	IRAC 4A	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) I. cornuta 'bufordii nana'	Field Container	Ludwig	TX	2005	Foliar	Minimal impact on nymphs; excellent efficacy on adults by 56 DAT at 4 oz per 100 gal
25773	Celero 16WSG (Clothianidin)	IRAC 4A	Florida Wax Scale (Ceroplastes floridensis)	Indian Hawthorn (Rhaphiolepis indica)	Field Container	Ludwig	TX	2005	Foliar	By 41 DAT, excellent efficacy on nymphs and on adults at 4 oz per 100 gal
25777	Celero 16WSG (Clothianidin)	IRAC 4A	Florida Red Scale (Chrysomphalus aonidum)	Holly, Chinese (Ilex cornuta) 'Dwarf Buford'	Field Container	Ludwig	TX	2005	Foliar	No significant control of nymphs and on adults at 4 oz per 100 gal probably due to cooler temperatures
25731	Celero 16WSG (Clothianidin)	IRAC 4A	Cottony Cushion Scale (Icerya purchasi)	Ternstroemia (Ternstroemia sp.) T. gymnanthera	Field Container	Ludwig	TX	2005	Foliar	Poor efficacy at 4 oz per 100 gallon rate
30589	Cygon 2E (Dimethoate)	IRAC 1B	Indian Wax Scale (Ceroplastes ceriferus)	Paperplant, Japanese Aralia (Fatsia japonica)	Greenhouse	Williams	AL	1977	Foliar	About 50% efficacy with 0.5 lb ai per 100 gal, with a population of mostly adult females and 2nd instar nymphs; no injury.
30583	Cygon 2E (Dimethoate)	IRAC 1B	Florida Wax Scale (Ceroplastes floridensis)	Camellia (Camellia japonica)	Field Container	Schalk	SC	1984	Trunk spray	No injury at 1, 2, and 4 inch band applied to truck; low population and no statistical differences among treatments.
30584	Cygon 2E (Dimethoate)	IRAC 1B	Scale, Elongate Hemlock (Fiorinia externa)	Camellia (Camellia japonica)	Field Container	Williams	AL	1983	Foliar	Good efficacy at 0.5 lb ai per 100 gal; no phytotoxicity.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
30584	Cygon 2E (Dimethoate)	IRAC 1B	Scale, Elongate Hemlock (Fiorinia externa)	Camellia (Camellia japonica)	Field Container	Williams	AL	1983	Trunk spray	Good efficacy with 1 and 2 inch banding; no phytotoxicity.
08765	Cygon 2E (Dimethoate)	IRAC 1B	Scale, Tea (Fiorinia theae)	Camellia (Camellia sp.)	Greenhouse	Schalk	SC	1984	Trunk spray	Insufficient population to determine efficacy; no injury with 1, 2, and 4 inch banding on trunks.
30585	Cygon 2E (Dimethoate)	IRAC 1B	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus)	Field In-Ground	Schuder	IN	1984	Trunk spray	Exceollent efficacy with 1 and 2 inch banding; no phytotoxicity.
30585	Cygon 2E (Dimethoate)	IRAC 1B	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus)	Field Container	Williams	AL	1983	Foliar	Good efficacy with 0.5 lb ai per 100 gal; no injury.
30585	Cygon 2E (Dimethoate)	IRAC 1B	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus)	Field Container	Williams	AL	1983	Trunk spray	Good efficacy with 1 and 2 inch banding; mortality within 1 month of second application at 2 inch banding rate.
00932	Diazinon 4E (Diazinon)	IRAC 1B	Euonymus Scale (Unaspis euonymi)	Winter Creeper (Euonymus radicans)	Field In-Ground	Schuder	IN	1984		Excellent efficacy with 1 lb ai per 100 gal; no phytotoxicity.
25165	Discus (Imidacloprid + cyfluthrin)	IRAC 4 + IRAC 3A	Fletcher Scale (Parthenolecanium fletcheri)	Hybrid Yew (Taxus X media) Densiformis	Field In-Ground	Davis	MI	2004	Banded	Good efficacy with banded application.
25165	Discus (Imidacloprid + cyfluthrin)	IRAC 4 + IRAC 3A	Fletcher Scale (Parthenolecanium fletcheri)	Hybrid Yew (Taxus X media) Densiformis	Field In-Ground	Davis	MI	2004	Foliar	Good efficacy.
28693	Distance (Pyriproxyfen)	IRAC 7C	Scale, Holly Pit (Asterolecanium puteanum)	Holly (Ilex sp.) 'East Palatka'	Field In-Ground	Buss	FL	2009	Foliar	Did not reduce number of immatures at 12 fl oz per 100 gal. 0% control with HendersonsTilton 6 WAT.
25051	Distance (Pyriproxyfen)	IRAC 7C	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) 'Dwarf Buford'	Field Container	Ludwig	TX	2004	Foliar	Significant mortality 45 days with all rates (8, 16, 32 oz per 100 gal).
28685	Distance (Pyriproxyfen)	IRAC 7C	False Florida Red Scale (Chrysomphalus bifasciculatus)	Holly, Chinese (Ilex cornuta) 'Cassina'	Field In-Ground	Chong	SC	2009	Foliar	Good efficacy at 12 fl oz per 100 gal

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
33874	Distance (Pyriproxyfen)	IRAC 7C	Crape Myrtle Bark Scale (Eriococcus lagerstroemia)	Crape Myrtle (Lagerstroemia indica) 'Natchez'	Field Container	Vafaie	TX	2018	Foliar	Data had too much variation to provide reliable results. Researcher's preliminary conclusions demonstrate reliable scale suppresion with the standard Distance.
30415	Distance (Pyriproxyfen)	IRAC 7C	Scale, Calico (Eulecanium cerasorum)	Locust (Gleditsia sp.)	Commercial Landscape	Sadof	IN	2012	Foliar	Carmel: Poor control of ovipositing adults with 12 fl oz per 100 gal.
32037	Distance (Pyriproxyfen)	IRAC 7C	Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica)	Field Container	Chen	LA	2015	Foliar	Great control with 12 oz per 100 gal; comparable to Ultra-Pure Oil.
32037	Distance (Pyriproxyfen)	IRAC 7C	Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica) 'In the Pink'	Field Container	Arthurs (UF)	FL	2014	Foliar	Excellent control with 12 fl oz per 100 gal + Capsil applied twice; comparable to SuffOil X.
32848	Distance (Pyriproxyfen)	IRAC 7C	Scale, Tea (Fiorinia theae)	Holly (Ilex sp.)	Field Container	Frank	NC	2015	Foliar	Did not significantly reduce number of adults and nymphs with 12 fl oz per 100 gal applied once.
32848	Distance (Pyriproxyfen)	IRAC 7C	Scale, Tea (Fiorinia theae)	Holly (Ilex sp.) 'Nellie Stevens'	Field Container	Chong	SC	2015	Foliar	Good efficacy with 12 fl oz per 100 gal applied twice every 21 days; one of 3 most effective treatments.
32404	Distance (Pyriproxyfen)	IRAC 7C	Scale, Tea (Fiorinia theae)	Sasanqua camellia (Camellia sasanqua) 'Mountain Snow'	Field Container	Chen	LA	2014	Foliar	Significantly reduced infestation with 12 fl oz per 100 gal applied twice; comparable to standard SuffOil-X.
30453	Distance (Pyriproxyfen)	IRAC 7C	Cottony Cushion Scale (Icerya purchasi)	Cheesewood (Pittosporum sp.) P. tobira cv.'variegata'	Field Container	Chong	SC	2012	Foliar	No consistent and significant reduction of scale population with 12 fl oz per 100 gal; comparable to standard paraffinic oil.
30297	Distance (Pyriproxyfen)	IRAC 7C	Cottony Cushion Scale (Icerya purchasi)	Cheesewood (Pittosporum sp.) P. tobira 'Verigata'	Field In-Ground	Chong	SC	2011	Foliar	Significantly reduced immatures with 12 fl oz per 100 gal applied twice; comparable to the standard Orthene.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
30225	Distance (Pyriproxyfen)	IRAC 7C	Cottony Cushion Scale (Icerya purchasi)	Sacred Bamboo (Nandina domestica) 'Harbour Dwarf'	Field Container	Frank	NC	2011	Foliar	Significantly reduced adults and immatures with 12 fl oz per 100 gal applied twice; comparable to horticultural oil.
32154	Distance (Pyriproxyfen)	IRAC 7C	Cottony Cushion Scale (Icerya purchasi)	Sacred Bamboo (Nandina domestica) 'Harbour Dwarf'	Greenhouse	Frank	NC	2012	Foliar	Significantly reduced immatures with 12 fl oz per 100 gal applied twice; comparable to horticultural oil.
30081	Distance (Pyriproxyfen)	IRAC 7C	Camelia Scale (Lepidosaphes camelliae)	Camellia (Camellia japonica) C. japonica and C. sasanqua	Commercial Landscape	Chong	SC	2014	Foliar	Consistent and high efficacy with 12 fl oz per 100 gal applied twice every 3 weeks; comparable to the standard paraffin oil.
25151	Distance (Pyriproxyfen)	IRAC 7C	Winged Euonymus Scale (Lepidosaphes yanagicola)	Burning Bush (Euonymus alatus)	Field Container	Freiberger	NJ	2004	Foliar	Good efficacy at 32 oz per 100 gal; lower rates were not effective
28136	Distance (Pyriproxyfen)	IRAC 7C	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2008	Foliar	Experiment 2: Did not significantly reduce scale population at 12 fl oz per 100 gal; similar to Sunspray Ultrafine std
28136	Distance (Pyriproxyfen)	IRAC 7C	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2009	Foliar	Experiment 2: Significantly reduced scale population at 12 fl oz per 100 gal; similar to paraffinic oil std; very low non treated population so no statistical significance.
30235	Distance (Pyriproxyfen)	IRAC 7C	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2011	Foliar	Excellent control of adults and immatures with 12 fl oz per 100 gal applied twice; comparable to standard paraffin oil.
30235	Distance (Pyriproxyfen)	IRAC 7C	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2014	Foliar	Data inconclusive because there were no significant differences between treatments, including untreated check.
31290	Distance (Pyriproxyfen)	IRAC 7C	Magnolia Scale (Neolecanium cornuparvum)	Sweet Bay (Magnolia virginiana) M. grandiflora, 'Little Gem'	Field In-Ground	Braman	GA	2012	Foliar	Excellent control of false oleander scale immatures with 12 fl oz per 100 gal; comparable to Orthene.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
25164	Distance (Pyriproxyfen)	IRAC 7C	Fletcher Scale (Parthenolecanium fletcheri)	Hybrid Yew (Taxus X media) Densiformis	Field In-Ground	Davis	MI	2004	Foliar	Poor efficacy.
29766	Distance (Pyriproxyfen)	IRAC 7C	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. strobus	Field In-Ground	Sadof	IN	2015	Foliar	Significant efficacy on immatures and adults with 12 fl oz per 100 gal.
29766	Distance (Pyriproxyfen)	IRAC 7C	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2010	Foliar	Excellent efficacy at 12 fl oz per 100 gal.
33853	Distance (Pyriproxyfen)	IRAC 7C	False Oleander Scale (Pseudaulacaspis cockerelli)	Japanese Laurel (Aucuba japonica)	Field Container	Held	AL	2018	Foliar	Poor control with 12 fl oz per 100 gal. Researcher commented that application timing used in this trial might have been too early to provide adequate control for this insect.
33853	Distance (Pyriproxyfen)	IRAC 7C	False Oleander Scale (Pseudaulacaspis cockerelli)	Japanese Laurel (Aucuba japonica)	Field Container	Held	AL	2019	Foliar	Poor efficacy with 12 fl oz per 100 gal applied twice every 3 weeks.
29627	Distance (Pyriproxyfen)	IRAC 7C	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora)	Commercial Landscape	Chong	SC	2010	Foliar	Litchfield, SC: Significantly reduced false oleander scale population at 12 fl oz per 100 gal; comparable to the standard Paraffinic oil; no injury observed.
32398	Distance (Pyriproxyfen)	IRAC 7C	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora) 'Little Gem'	Field Container	Chen	LA	2014	Foliar	Excellent control with 12 fl oz per 100 gal applied twice; comparable to standard SuffOil-X.
28947	Distance (Pyriproxyfen)	IRAC 7C	White Peach Scale (Pseudaulacaspis pentagona)	Holly, Blue (Ilex x meserveae)	Field In-Ground	Kunkel	DE	2009	Foliar	Mortality in untreated controls was high; no conclusions can be drawn.
28870	Distance (Pyriproxyfen)	IRAC 7C	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus)	Field Container	Braman	GA	2014	Foliar	Good to excellent control with 12 fl oz per 100 gal applied twice at 14-day interval.
28870	Distance (Pyriproxyfen)	IRAC 7C	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus)	Field Container	Frank	NC	2010	Foliar	Excellent control with 12 fl oz per 100 gal; slower acting than horticultural oil.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
28870	Distance (Pyriproxyfen)	IRAC 7C	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. fortunei 'Emerald N Gold'	Field Container	Potter	KY	2014	Foliar	Did not reduce scales with 12 fl oz per 100 gal applied at crawler stage and 3 weeks later.
28870	Distance (Pyriproxyfen)	IRAC 7C	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. fortunei 'Moonshadow'	Field Container	Potter	KY	2010	Foliar	Significantly reduced 1st generation adult scales with 12 fl oz per 100 gal; better than horticultural oil.
28870	Distance (Pyriproxyfen)	IRAC 7C	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. fortunei 'Radicans'	Field Container	Kunkel	DE	2011	Foliar	Significantly increased mortality with 12 fl oz per 100 gal applied once; comparable to horticultural oil applied twice.
29980	Distance (Pyriproxyfen)	IRAC 7C	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. vegetus 'Coloratus'	Field In-Ground	Nielsen	OH	2008	Foliar	Good efficacy at 12 fl oz per 100 gal.
28870	Distance (Pyriproxyfen)	IRAC 7C	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. vegetus 'SunSpot'	Field Container	Nielsen	OH	2009	Foliar	Excellent control at 12 fl oz per 100 gal
28870	Distance (Pyriproxyfen)	IRAC 7C	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) 'Green Spire'	Field Container	Gilrein	NY	2011	Foliar	Excellent control with 12 fl oz per 100 gal applied twice.
28870	Distance (Pyriproxyfen)	IRAC 7C	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) 'Microphylla'	Field Container	Frank	NC	2009	Foliar	Excellent control at 12 fl oz per 100 gal; equal to Acephate

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28870	Distance (Pyriproxyfen)	IRAC 7C	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) 'Microphylla'	Field Container	Ludwig	TX	2008	Foliar	Fair to good efficacy at 12 fl oz per 100 gal.
30454	Flagship 0.22G (Thiamethoxam)	IRAC 4A	Cottony Cushion Scale (Icerya purchasi)	Cheesewood (Pittosporum sp.) P. tobira cv.'variegata'	Field Container	Chong	SC	2012	Broadcast	No consistent and significant reduction of scale population with 60 g per pot; comparable to standard paraffinic oil.
30298	Flagship 0.22G (Thiamethoxam)	IRAC 4A	Cottony Cushion Scale (Icerya purchasi)	Cheesewood (Pittosporum sp.) P. tobira 'Verigata'	Field In-Ground	Chong	SC	2011	Broadcast	Significantly reduced immatures with 227 g per ft applied once; comparable to the standard Orthene.
30226	Flagship 0.22G (Thiamethoxam)	IRAC 4A	Cottony Cushion Scale (Icerya purchasi)	Sacred Bamboo (Nandina domestica) 'Harbour Dwarf'	Field Container	Frank	NC	2011	Broadcast	Significantly reduced adults and immatures with 30 g per plant applied once; comparable to horticultural oil.
32152	Flagship 0.22G (Thiamethoxam)	IRAC 4A	Cottony Cushion Scale (Icerya purchasi)	Sacred Bamboo (Nandina domestica) 'Harbour Dwarf'	Greenhouse	Frank	NC	2012	Broadcast	Significantly reduced immatures with 40 g per item; comparable to horticultural oil.
30082	Flagship 0.22G (Thiamethoxam)	IRAC 4A	Camelia Scale (Lepidosaphes camelliae)	Camellia (Camellia japonica)	Commercial Landscape	Chong	SC	2010	Broadcast	Did not significantly reduce camellia scale population at 227 g per ft height; comparable to all other treatments including the standard Orthene; no injury observed.
28918	Flagship 0.22G (Thiamethoxam)	IRAC 4A	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2009	Broadcast	Did not significantly reduce scale population at 227 g per ft shrub height; similar to Orthene std; very low non treated population so no statistical significance.
30236	Flagship 0.22G (Thiamethoxam)	IRAC 4A	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2011	Drench	Excellent control of adults and immatures with 4 g per ft ht applied once; comparable to standard paraffin oil.
31286	Flagship 0.22G (Thiamethoxam)	IRAC 4A	Magnolia Scale (Neolecanium cornuparvum)	Sweet Bay (Magnolia virginiana) M. grandiflora, ‘Little Gem’	Field In-Ground	Braman	GA	2012	Broadcast	Excellent control of false oleander scale immatures with 114 and 227 g per ft ht; comparable to Orthene.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
29767	Flagship 0.22G (Thiamethoxam)	IRAC 4A	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Jones	OH	2012	Broadcast	Significant, but poor, control with 227 g per ft height applied once.
29767	Flagship 0.22G (Thiamethoxam)	IRAC 4A	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2010	Broadcast	No efficacy at 227 g per inch DBH.
29767	Flagship 0.22G (Thiamethoxam)	IRAC 4A	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2011	Broadcast	No efficacy with 227 g per ft ht; some second generation eggs were present.
29628	Flagship 0.22G (Thiamethoxam)	IRAC 4A	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora)	Commercial Landscape	Chong	SC	2010	Broadcast	Charleston, SC: Significantly reduced false oleander scale population at 454 g per indbh, but not at 227 g; better than the standard Orthene; no injury observed.
28948	Flagship 0.22G (Thiamethoxam)	IRAC 4A	White Peach Scale (Pseudaulacaspis pentagona)	Holly, Blue (Ilex x meserveae)	Field In-Ground	Kunkel	DE	2009	Broadcast	Mortality in untreated controls was high; no conclusions can be drawn.
28871	Flagship 0.22G (Thiamethoxam)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus)	Field Container	Frank	NC	2010	Broadcast	Excellent control with 60 g ai per 3 gal media; slower acting than horticultural oil.
28871	Flagship 0.22G (Thiamethoxam)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. fortunei 'Moonshadow'	Field Container	Potter	KY	2010	Broadcast	No significant reduction of adult scales with 40 g per 2 gal pot.
28871	Flagship 0.22G (Thiamethoxam)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. fortunei 'Radicans'	Field Container	Kunkel	DE	2011	Broadcast	Significantly increased mortality with 20 g per gal pot applied once; comparable to horticultural oil applied twice.
29087	Flagship 0.22G (Thiamethoxam)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. vegetus 'Coloratus'	Field In-Ground	Nielsen	OH	2008	Broadcast	Poor efficacy at 114 g per ft height.

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28871	Flagship 0.22G (Thiamethoxam)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. vegetus 'SunSpot'	Field Container	Nielsen	OH	2009	Top Dress	Not effective at 112 g per pot.
28871	Flagship 0.22G (Thiamethoxam)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) 'Microphylla'	Field Container	Frank	NC	2009	Broadcast	Good control but slow acting at 60 g per 3 gal container; inferior to Acephate
28694	Flagship 25WG (Thiamethoxam)	IRAC 4A	Scale, Holly Pit (Asterolecanium puteanum)	Holly (Ilex sp.) 'East Palatka'	Field In-Ground	Buss	FL	2009	Drench	Did not significantly reduce number of immatures at 4 g per inch dbh. 1% control with HendersonsTilton 6 WAT.
25052	Flagship 25WG (Thiamethoxam)	IRAC 4A	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) 'China Doll'	Field Container	Ludwig	TX	2005	Foliar	Minimal impact on adults; great efficacy on nymphs at 14 DAT at 4 oz per 100 gal
25052	Flagship 25WG (Thiamethoxam)	IRAC 4A	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) 'Dwarf Buford'	Field Container	Ludwig	TX	2004	Foliar	Excellect efficacy at 2, 4, and 8 oz per 100 gal at 45DAT.
25052	Flagship 25WG (Thiamethoxam)	IRAC 4A	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) I. cornuta 'bufordii nana'	Field Container	Ludwig	TX	2005	Foliar	Minimal impact on nymphs; excellent efficacy on adults by 56 DAT at both 2 and 4 oz per 100 gal
31139	Flagship 25WG (Thiamethoxam)	IRAC 4A	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) I. cornuta 'Needlepoint'	Commercial Landscape	Held (MSU)	MS	2009	Drench	Excellent control at 3 g per ft height applied for first generation, less effective when applied for 2nd generation.
25771	Flagship 25WG (Thiamethoxam)	IRAC 4A	Florida Wax Scale (Ceroplastes floridensis)	Indian Hawthorn (Rhaphiolepis indica)	Field Container	Ludwig	TX	2005	Foliar	By 41 DAT, good efficacy on nymphs and great efficacy on adults at both rates
25775	Flagship 25WG (Thiamethoxam)	IRAC 4A	Florida Red Scale (Chrysomphalus aonidum)	Holly, Chinese (Ilex cornuta) 'Dwarf Buford'	Field Container	Ludwig	TX	2005	Foliar	No significant control of nymphs and on adults at 2 and 4 oz per 100 gal probably due to cooler temperatures
28686	Flagship 25WG (Thiamethoxam)	IRAC 4A	False Florida Red Scale (Chrysomphalus bifasciculatus)	Holly, Chinese (Ilex cornuta) 'Cassina'	Field In-Ground	Chong	SC	2009	Drench	Excellent efficacy at 4 g per ft of shrub height; better than paraffinic oil std.

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25133	Flagship 25WG (Thiamethoxam)	IRAC 4A	Scale, Oystershell (Diaspidiotus ostreiformis)	Lilac, Common (Syringa vulgaris)	Field In-Ground	Nielsen	OH	2005	Foliar	Poor control at 2 and 4 oz per 100 gal
25134	Flagship 25WG (Thiamethoxam)	IRAC 4A	Scale, Oystershell (Diaspidiotus ostreiformis)	Silverbell Carolina (Halesia carolina var. carolina)	Field In-Ground	Nielsen	OH	2005	Foliar	Poor efficacy
25314	Flagship 25WG (Thiamethoxam)	IRAC 4A	Scale, Elongate Hemlock (Fiorinia externa)	Fir, Fraser (Abies fraseri)	Field In-Ground	Cowles	CT	2005	Foliar	Excellent efficacy - both elongate hemlock scale and cryptomeria scale included in population
30299	Flagship 25WG (Thiamethoxam)	IRAC 4A	Cottony Cushion Scale (Icerya purchasi)	Cheesewood (Pittosporum sp.) P. tobira 'Verigata'	Field In-Ground	Chong	SC	2011	Foliar	Significantly reduced immatures with 8 oz per 100 gal applied twice; comparable to the standard Orthene.
30227	Flagship 25WG (Thiamethoxam)	IRAC 4A	Cottony Cushion Scale (Icerya purchasi)	Sacred Bamboo (Nandina domestica) 'Harbour Dwarf'	Field Container	Frank	NC	2011	Drench	Significantly reduced adults and immatures with 0.5 g per plant applied once; comparable to horticultural oil.
30083	Flagship 25WG (Thiamethoxam)	IRAC 4A	Camelia Scale (Lepidosaphes camelliae)	Camellia (Camellia japonica)	Commercial Landscape	Chong	SC	2010	Drench	Did not significantly reduce camellia scale population at 1 and 4 g per ft height; comparable to all other treatments including the standard Orthene; no injury observed.
25152	Flagship 25WG (Thiamethoxam)	IRAC 4A	Winged Euonymus Scale (Lepidosaphes yanagicola)	Burning Bush (Euonymus alatus)	Field Container	Freiberger	NJ	2004	Foliar	Some reduction in scale counts at 4 and 8 oz per 100 gal rates
25152	Flagship 25WG (Thiamethoxam)	IRAC 4A	Winged Euonymus Scale (Lepidosaphes yanagicola)	Burning Bush (Euonymus alatus)	Field Container	Freiberger	NJ	2005	Foliar	Efficacy comparable or better than Orthene at the 4 oz per 100 gal rate
28132	Flagship 25WG (Thiamethoxam)	IRAC 4A	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2008	Foliar	Experiment 1: Did not significantly reduce scale population at 8 oz per 100 gal; similar to Orthene std; untreated population very low and no statistical differences were observed.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
28132	Flagship 25WG (Thiamethoxam)	IRAC 4A	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2009	Drench	Did not significantly reduce scale population at 4 g per ft shrub height; similar to Orthene std; very low non treated population so no statistical significance.
30237	Flagship 25WG (Thiamethoxam)	IRAC 4A	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2011	Drench	Excellent control of adults and immatures with 1 g per ft ht applied once; comparable to standard paraffin oil.
25444	Flagship 25WG (Thiamethoxam)	IRAC 4A	Cottony Maple Scale (Neopulvinaria innumerabilis)	Maple, Silver (Acer saccharinum)	Field In-Ground	Davis	MI	2005	Foliar	Mediocre to good efficacy
25132	Flagship 25WG (Thiamethoxam)	IRAC 4A	Fletcher Scale (Parthenolecanium fletcheri)	Hybrid Yew (Taxus X media) Densiformis	Field In-Ground	Davis	MI	2004	Banded	Great efficacy with banded application.
25132	Flagship 25WG (Thiamethoxam)	IRAC 4A	Fletcher Scale (Parthenolecanium fletcheri)	Hybrid Yew (Taxus X media) Densiformis	Field In-Ground	Davis	MI	2004	Foliar	Good efficacy with foliar application.
29768	Flagship 25WG (Thiamethoxam)	IRAC 4A	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2010	Drench	No efficacy at 4 g per inch DBH.
29768	Flagship 25WG (Thiamethoxam)	IRAC 4A	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2011	Drench	Good efficacy with 4 g per ft ht; no second generation eggs were present.
25057	Flagship 25WG (Thiamethoxam)	IRAC 4A	False Oleander Scale (Pseudaulacaspis cockerelli)	Aucuba (Aucuba sp.)	Field Container	Ludwig	TX	2004	Foliar	No impact on number of adults or nymphs, and only some reduction in percent alive at the highest tested rate (2, 4, 8 oz per 100 gal).
29629	Flagship 25WG (Thiamethoxam)	IRAC 4A	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora)	Commercial Landscape	Chong	SC	2010	Drench	Charleston, SC: Significantly reduced false oleander scale population at 4 g per indbh; better than the standard Orthene; no injury observed.
28949	Flagship 25WG (Thiamethoxam)	IRAC 4A	White Peach Scale (Pseudaulacaspis pentagona)	Holly, Blue (Ilex x meserveae)	Field In-Ground	Kunkel	DE	2009	Drench	Mortality in untreated controls was high; no conclusions can be drawn.

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28872	Flagship 25WG (Thiamethoxam)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus)	Field Container	Frank	NC	2010	Foliar	Excellent control with 8 oz per 100 gal + Dyne-amic; slower acting than horticultural oil.
28872	Flagship 25WG (Thiamethoxam)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. fortunei 'Moonshadow'	Field Container	Potter	KY	2010	Foliar	No significant reduction of adult scales with 8 oz per 100 gal + spreader.
28872	Flagship 25WG (Thiamethoxam)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. fortunei 'Radicans'	Field Container	Kunkel	DE	2011	Foliar	Did not significantly increase mortality with 8 oz per 100 gal + Capsil applied twice.
28872	Flagship 25WG (Thiamethoxam)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. vegetus 'SunSpot'	Field Container	Nielsen	OH	2009	Foliar	Poor control at 8 oz + 6 oz Capsil per 100 gal
28872	Flagship 25WG (Thiamethoxam)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) 'Green Spire'	Field Container	Gilrein	NY	2011	Drench	Did not significantly reduce population with 0.5 g per ft ht applied once.
28872	Flagship 25WG (Thiamethoxam)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) 'Microphylla'	Field Container	Frank	NC	2009	Foliar	Excellent control at 8 oz per 100 gal + Dyne-amic; slower acting than Acephate
28872	Flagship 25WG (Thiamethoxam)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) 'Microphylla'	Field Container	Ludwig	TX	2008	Foliar	Fair to good efficacy at 8 oz per 100 gal.
29981	Flagship 25WG (Thiamethoxam)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Wintercreeper (Euonymus fortunei) E. vegetus 'Coloratus'	Field Container	Nielsen	OH	2008	Drench	Poor efficacy at 4 g per ft height.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
31283	GF-2626 1SC (Sulfoxaflor)		Cottony Cushion Scale (Icerya purchasi)	Cheesewood (Pittosporum sp.) P. tobira cv.'variegata'	Field Container	Chong	SC	2012	Foliar	No consistent and significant reduction of scale population with 8 and 11 fl oz per 100 gal; comparable to standard paraffinic oil.
32153	GF-2626 1SC (Sulfoxaflor)		Cottony Cushion Scale (Icerya purchasi)	Sacred Bamboo (Nandina domestica) 'Harbour Dwarf'	Greenhouse	Frank	NC	2012	Foliar	Significantly reduced immatures with 8 and 11 fl oz per 100 gal applied twice; comparable to horticultural oil.
31288	GF-2626 1SC (Sulfoxaflor)		Magnolia Scale (Neolecanium cornuparvum)	Sweet Bay (Magnolia virginiana) M. grandiflora, 'Little Gem'	Field In-Ground	Braman	GA	2012	Foliar	Excellent control of false oleander scale immatures with 8 and 11 fl oz per 100 gal; comparable to Orthene.
31353	GF-2626 1SC (Sulfoxaflor)		Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Jones	OH	2012	Foliar	Mediocre control with 8 and 11 fl oz per 100 gal applied twice.
32149	Horticultural Oil (Horticultural Oil)	FRAC NC	Cottony Cushion Scale (Icerya purchasi)	Sacred Bamboo (Nandina domestica) 'Harbour Dwarf'	Greenhouse	Frank	NC	2012	Foliar	Significantly reduced immatures with 150 fl oz per 100 gal applied once.
32859	Horticultural Oil (Horticultural Oil)	FRAC NC	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.)	Field In-Ground	Persad	OH	2017	Foliar	Poor control with 1-2 gal per 100 gal applied once.
32859	Horticultural Oil (Horticultural Oil)	FRAC NC	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. strobus	Field In-Ground	Sadof	IN	2015	Foliar	Significant efficacy on immatures and adults with labeled rate.
31227	Horticultural Oil (Horticultural Oil)	FRAC NC	White Peach Scale (Pseudaulacaspis pentagona)	Holly, Blue (Ilex x meserveae)	Field In-Ground	Kunkel	DE	2009	Foliar	Mortality in untreated controls was high; no conclusions can be drawn.
31229	Horticultural Oil (Horticultural Oil)	FRAC NC	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus)	Field Container	Braman	GA	2014	foliar	Excellent control with 2 gal per 100 gal applied twice at 14-day interval.
31229	Horticultural Oil (Horticultural Oil)	FRAC NC	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. fortunei 'Radicans'	Field Container	Kunkel	DE	2011	Foliar	Significantly increased mortality with 1 % v/v solution applied twice.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
29986	Horticultural Oil (Horticultural Oil)	FRAC NC	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. vegetus 'Coloratus'	Field In-Ground	Nielsen	OH	2010	Foliar	Excellent efficacy on nymphs at 3 % v/v; may have short resdidual.
34176	ISM-555 (ISM-555, A21377X)		Crape Myrtle Bark Scale (Eriococcus lagerstroemia)	Crape Myrtle (Lagerstroemia indica)	Field Container	Held	AL	2020	Foliar	Excellent control with 3.84 fl oz per 100 gal + Capsil applied twice biweekly.
28384	Judo 2SC (Spiromesifen)	IRAC 23	Scale, Elongate Hemlock (Fiorinia externa)	Fir, Fraser (Abies fraseri)	Field In-Ground	Cowles	CT	2008	Foliar	Very little control with at 5 and 10 fl oz per acre applied either May 19 or June 3.
34214	KOC22018-8 (Botanical Oil Blend)		Scale, Cycad (Aulacaspis yasumatsui)	Sago Palm (Cycas revoluta)	Field Container	Dale	FL	2019	Foliar	No significant control of nymphs and adults with 128 fl oz per 100 gal applied 5 times weekly.
34252	KOC22018-8 (Botanical Oil Blend)		False Oleander Scale (Pseudaulacaspis cockerelli)	Aucuba (Aucuba sp.)	Field Container	Held	AL	2019	Foliar	Poor efficacy with 16.5 fl oz per 100 gal applied 5 times weekly, but good efficacy 6 months after treatment.
30418	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	Scale, Calico (Eulecanium cerasorum)	Locust (Gleditsia sp.) G. triacanthos var. inermis	Commercial Landscape	Persad	OH	2014	Foliar	Mediocre control of nymphs with 3.4 fl oz per 100 gal by 28 DAT.
29811	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica) C. sasanqua 'Showa-no-sakae'	Field Container	Frank	NC	2010	Foliar	Excellent control with 3.4 fl oz per 100 gal.
30300	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	Cottony Cushion Scale (Icerya purchasi)	Cheesewood (Pittosporum sp.) P. tobira 'Verigata'	Field In-Ground	Chong	SC	2011	Foliar	Significantly reduced immatures with 3.4 oz per 100 gal applied once; comparable to the standard Orthene.
32156	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	Cottony Cushion Scale (Icerya purchasi)	Sacred Bamboo (Nandina domestica) 'Harbour Dwar'	Greenhouse	Frank	NC	2012	Foliar	Did not significantly reduce immatures with 3.4 fl oz per 100 gal applied once.
30228	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	Cottony Cushion Scale (Icerya purchasi)	Sacred Bamboo (Nandina domestica) 'Harbour Dwarf'	Field Container	Frank	NC	2011	Foliar	Significantly reduced adults and immatures with 3.4 fl oz per 100 gal applied once; comparable to horticultural oil.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
32855	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	Camelia Scale (Lepidosaphes camelliae)	Camellia (Camellia japonica) C. japonica and C. sasanqua	Commercial Landscape	Chong	SC	2014	Foliar	Consistent and high efficacy with 3.4 fl oz per 100 gal applied twice biweekly; comparable to the standard paraffin oil.
25149	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	Winged Euonymus Scale (Lepidosaphes yanagicola)	Burning Bush (Euonymus alatus)	Field Container	Freiberger	NJ	2004		Some reduction in scale counts at 20 fl oz per 100 gal
30238	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2011	Foliar	Excellent control of adults and immatures with 3.4 fl oz per 100 gal applied once; comparable to standard paraffin oil.
29769	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. strobus	Field In-Ground	Sadof	IN	2015	Drench	No significant efficacy on immatures and adults with 3.4 oz per 100 gal.
29769	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. strobus	Field In-Ground	Sadof	IN	2015	Foliar	No significant efficacy on immatures and adults with 3.4 oz per 100 gal.
29769	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2010	Foliar	Excellent efficacy at 3.4 oz per 100 gal.
29769	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2011	Foliar	Good efficacy with 3.4 oz per 100 gal through 31 DAT, but second generation eggs were present albeit in lower amounts than the nontreated check.
29630	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora)	Commercial Landscape	Chong	SC	2010	Foliar	Charleston, SC: Did not significantly reduce false oleander scale population at 3.4 fl oz per 100 gal; comparable to the standard Orthene; no injury observed.
29150	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. fortunei 'Moonshadow'	Field Container	Potter	KY	2010	Foliar	No significant reduction of adult scales with 3.4 oz per 100 gal.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
26829	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. vegetus 'Coloratus'	Field In-Ground	Nielsen	OH	2008	Foliar	Some efficacy on nymphs at 3.4 fl oz per 100 gal; may have short residual.
29150	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) 'Green Spire'	Field Container	Gilrein	NY	2011	Foliar	Good control with 3.4 fl oz per 100 gal applied once.
32164	Mainspring GNL 200SC (Cyantraniliprole)	IRAC 28	Scale, Calico (Eulecanium cerasorum)	Locust (Gleditsia sp.) G. triacanthos var. inermis	Commercial Landscape	Persad	OH	2014	Drench	Excellent control of nymphs with 0.25 fl oz per inch DBH by 28 DAT.
32355	Mainspring GNL 200SC (Cyantraniliprole)	IRAC 28	Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica)	Field In-Ground	Braman	GA	2015	Drench	Very good control with 0.125 fl oz per ft height applied twice and 0.25 fl oz per ft height applied once.
32872	Mainspring GNL 200SC (Cyantraniliprole)	IRAC 28	Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica)	Field Container	Chen	LA	2015	Foliar	Excellent control with 8 fl oz per 100 gal; comparable to standards Ultra-Pure Oil and Distance.
32355	Mainspring GNL 200SC (Cyantraniliprole)	IRAC 28	Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica) 'In the Pink'	Field In-Ground	Arthurs (UF)	FL	2014	Drench	Good control with 12 fl oz per 100 gal applied once and 8 fl oz applied twice; inferior to SuffOil X.
32847	Mainspring GNL 200SC (Cyantraniliprole)	IRAC 28	Scale, Tea (Fiorinia theae)	Holly (Ilex sp.)	Field Container	Frank	NC	2015	Drench	Did not significantly reduce number of adults and nymphs with 8 and 12 fl oz per 100 gal applied once.
32847	Mainspring GNL 200SC (Cyantraniliprole)	IRAC 28	Scale, Tea (Fiorinia theae)	Holly (Ilex sp.) 'Nellie Stevens'	Field Container	Chong	SC	2015	Drench	Mediocre efficacy with 8 fl oz per 100 gal applied twice every 28 days; inferior to Distance.
32406	Mainspring GNL 200SC (Cyantraniliprole)	IRAC 28	Scale, Tea (Fiorinia theae)	Sasanqua camellia (Camellia sasanqua) 'Mountain Snow'	Field Container	Chen	LA	2014	Drench	Significantly reduced infestation with 8 fl oz per 100 gal applied twice and 12 fl oz applied twice; comparable to standard SuffOil-X.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
32853	Mainspring GNL 200SC (Cyantraniliprole)	IRAC 28	Camelia Scale (Lepidosaphes camelliae)	Camellia (Camellia japonica) C. japonica and C. sasanqua	Commercial Landscape	Chong	SC	2014	Drench	Poor efficacy with 0.125 oz per ft height applied twice ever 4 weeks and 0.25 fl oz applied once.
32529	Mainspring GNL 200SC (Cyantraniliprole)	IRAC 28	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2014	Drench	Data inconclusive because there were no significant differences between treatments, including untreated check.
32529	Mainspring GNL 200SC (Cyantraniliprole)	IRAC 28	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2014	Foliar	Data inconclusive because there were no significant differences between treatments, including untreated check.
32223	Mainspring GNL 200SC (Cyantraniliprole)	IRAC 28	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. strobus	Field In-Ground	Sadof	IN	2015	Drench	No significant efficacy on immatures and adults with 0.125 and 0.25 oz per ft ht.
32223	Mainspring GNL 200SC (Cyantraniliprole)	IRAC 28	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Persad	OH	2015	Drench	Significant control of nymphs with 0.125 fl oz per 100 gal applied twice bimonthly or 0.25 fl oz applied once; better than horticultural oil applied foliar.
32400	Mainspring GNL 200SC (Cyantraniliprole)	IRAC 28	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora) 'Little Gem'	Field Container	Chen	LA	2014	Drench	Excellent control with 8 fl oz per 100 gal applied twice and 12 fl oz applied twice; comparable to standard SuffOil-X.
32158	Mainspring GNL 200SC (Cyantraniliprole)	IRAC 28	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus)	Field Container	Braman	GA	2014	Drench	Excellent control with 12 fl oz per 100 gal applied once, and with 8 fl oz per 100 gal applied twice at 28-day interval.
32158	Mainspring GNL 200SC (Cyantraniliprole)	IRAC 28	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. fortunei 'Emerald N Gold'	Field Container	Potter	KY	2014	Drench	Significantly reduced scales (36%) with 12 fl oz per 100 gal applied at 30 days before scale hatching; inferior to Orthene.
32342	Mainspring GNL 200SC (Cyantraniliprole)	IRAC 28	Euonymus Scale (Unaspis euonymi)	Wintercreeper (Euonymus fortunei)	Field Container	Potter	KY	2015	Drench	Scale failed to establish; no usable data were able to be collected

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
29590	Marathon II (Imidacloprid)	IRAC 4A	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) I. cornuta 'Needlepoint'	Commercial Landscape	Held (MSU)	MS	2009	Drench	Excellent control with Merit 2F at 6 ml per ft height applied for first or second generation
25448	Marathon II (Imidacloprid)	IRAC 4A	Cottony Maple Scale (Neopulvinaria innumerabilis)	Maple, Silver (Acer saccharinum)	Field In-Ground	Davis	MI	2005	Foliar	Poor efficacy
34520	Marathon II (Imidacloprid)	IRAC 4A	Lobate Lac Scale (Paratachardina pseudolobata)	Rosemallow (Hibiscus sp.) H. rosa-sinensis 'Dainty White'	Field Container	Cheng	HI	2018	Foliar	Excellent efficacy with 1.5 fl oz per 100 gal and no phytotoxicity.
34177	MBI 203 SC2 (MBI 203)		Crape Myrtle Bark Scale (Eriococcus lagerstroemia)	Crape Myrtle (Lagerstroemia indica)	Field Container	Held	AL	2020	Foliar	No control with 128 fl oz per 100 gal applied twice weekly.
34178	MBI 306 (MBI 306)		Crape Myrtle Bark Scale (Eriococcus lagerstroemia)	Crape Myrtle (Lagerstroemia indica)	Field Container	Held	AL	2020	Foliar	No control with 5 fl oz per 100 gal applied twice weekly.
28133	Merit 2F (Imidacloprid)	IRAC 4A	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2008	Drench	Experiment 1: Did not significantly reduce scale population at 0.2 fl oz per indbh; similar to Orthene std; untreated population very low and no statistical differences were observed.
28880	MOI 201 (MOI 201)	FRAC NC	Scale, Oystershell (Diaspidiotus ostreiformis)	Silverbell Carolina (Halesia carolina var. carolina)	Field In-Ground	Nielsen	OH	2008	Foliar	Very low infestation; no control at 1:500 and 1:800 conc.
28385	Onyx (Bifenthrin)	IRAC 3A	Scale, Elongate Hemlock (Fiorinia externa)	Fir, Fraser (Abies fraseri)	Field In-Ground	Cowles	CT	2008	Foliar	Some control with 6.4 fl oz per acre.
29553	Orthene TTO 97 (Valent) (Acephate)	IRAC 1B	Scale, Holly Pit (Asterolecanium puteanum)	Holly (Ilex sp.) 'East Palatka'	Field In-Ground	Buss	FL	2009	Foliar	Significantly reduced number of immatures at 8 oz per 100 gal. 0% control with HendersonsTilton 6 WAT.
25730	Orthene TTO 97 (Valent) (Acephate)	IRAC 1B	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) 'China Doll'	Field Container	Ludwig	TX	2005	Foliar	No efficacy on nymphs, poor on adults at 8 oz per 100 gal.
25730	Orthene TTO 97 (Valent) (Acephate)	IRAC 1B	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) I. cornuta 'bufordii nana'	Field Container	Ludwig	TX	2005	Foliar	No efficacy on nymphs and adults at 8 oz per 100 gal.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
25778	Orthene TTO 97 (Valent) (Acephate)	IRAC 1B	Florida Red Scale (Chrysomphalus aonidum)	Holly, Chinese (Ilex cornuta) 'Dwarf Buford'	Field Container	Ludwig	TX	2005	Foliar	No significant control of nymphs and on adults at 10.5 oz per 100 gal probably due to cooler temperatures
25485	Orthene TTO 97 (Valent) (Acephate)	IRAC 1B	Scale, Oystershell (Diaspidiotus ostreiformis)	Lilac, Common (Syringa vulgaris)	Field In-Ground	Nielsen	OH	2005	Foliar	Poor control at 8 oz per 100 gal
25486	Orthene TTO 97 (Valent) (Acephate)	IRAC 1B	Scale, Oystershell (Diaspidiotus ostreiformis)	Silverbell Carolina (Halesia carolina var. carolina) Carolina silverbell	Field In-Ground	Nielsen	OH	2005	Foliar	Poor efficacy at 8 oz per 100 gal.
31662	Orthene TTO 97 (Valent) (Acephate)	IRAC 1B	Cottony Cushion Scale (Icerya purchasi)	Cheesewood (Pittosporum sp.) P. tobira 'Verigata'	Field In-Ground	Chong	SC	2011	Foliar	Significantly reduced immatures with 8 ox per 100 gal applied once.
25732	Orthene TTO 97 (Valent) (Acephate)	IRAC 1B	Cottony Cushion Scale (Icerya purchasi)	Ternstroemia (Ternstroemia sp.) T. gymnanthera	Field Container	Ludwig	TX	2005	Foliar	Good efficacy at 8 oz per 100 gal.
30084	Orthene TTO 97 (Valent) (Acephate)	IRAC 1B	Camelia Scale (Lepidosaphes camelliae)	Camellia (Camellia japonica)	Commercial Landscape	Chong	SC	2010	Foliar	No significant increase in mortality at 8 oz per 100 gal; no injury observed.
28134	Orthene TTO 97 (Valent) (Acephate)	IRAC 1B	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2008	Foliar	Experiment 1: Did not significantly reduce scale population at 8 fl oz per 100 gal; untreated population very low and no statistical differences were observed.
29265	Orthene TTO 97 (Valent) (Acephate)	IRAC 1B	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Field In-Ground	Chong	SC	2009	Foliar	Did not significantly reduce scale population at 8 oz per 100 gal + Capsil; similar to paraffinic oil std; very low non treated population so no statistical significance.
29636	Orthene TTO 97 (Valent) (Acephate)	IRAC 1B	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora)	Commercial Landscape	Chong	SC	2010	Foliar	Charleston, SC: Did not significantly reduce false oleander scale population at 8 oz per 100 gal; no injury observed.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
32159	Orthene TTO 97 (Valent) (Acephate)	IRAC 1B	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus)	Field Container	Braman	GA	2014	foliar	Good to excellent control with 8 oz per 100 gal applied twice at 14-day interval.
32159	Orthene TTO 97 (Valent) (Acephate)	IRAC 1B	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. fortunei 'Emerald N Gold'	Field Container	Potter	KY	2014	Foliar	Significantly reduced scales (74%) with 1.5 fl oz per 100 gal applied at crawler stage and 1 week later.
32856	Paraffin Oil (Paraffin Oil)		Camelia Scale (Lepidosaphes camelliae)	Camellia (Camellia japonica) C. japonica and C. sasanqua	Commercial Landscape	Chong	SC	2014	Foliar	Consistent and high efficacy with 2 gal per 100 gal applied twice biweekly.
32852	Paraffin Oil (Paraffin Oil)		Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2013	Foliar	Significantly reduced scale population with 2 gal per 100 gal applied twice biweekly.
32851	Paraffin Oil (Paraffin Oil)		False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora)	Commercial Landscape	Chong	SC	2014	Foliar	Good control with 2 gal per 100 gal applied twice biweekly.
34212	Pradia (Cyclaniliprole + Flonicamid)	IRAC 28 + IRAC 9C	Scale, Cycad (Aulacaspis yasumatsui)	Sago Palm (Cycas revoluta)	Field Container	Dale	FL	2019	Foliar	No significant control of nymphs and adults with 16.5 fl oz per 100 gal applied 3 times biweekly.
33578	Pradia (Cyclaniliprole + Flonicamid)	IRAC 28 + IRAC 9C	Crape Myrtle Bark Scale (Eriococcus lagerstroemia)	Crape Myrtle (Lagerstroemia indica) 'Natchez'	Field Container	Vafaie	TX	2018	Foliar	Data had too much variation to provide reliable results.
33547	Pradia (Cyclaniliprole + Flonicamid)	IRAC 28 + IRAC 9C	Lobate Lac Scale (Paratachardina pseudolobata)	Rosemallow (Hibiscus sp.) H. rosa-sinensis 'Dainty White'	Field Container	Cheng	HI	2018	Foliar	Efficacy with 12 and 16.5 fl oz per 100 gal slightly inferior to imidacloprid. No phytotoxicity.
34253	Pradia (Cyclaniliprole + Flonicamid)	IRAC 28 + IRAC 9C	False Oleander Scale (Pseudaulacaspis cockerelli)	Aucuba (Aucuba sp.)	Field Container	Held	AL	2019	Foliar	Poor efficacy with 16.5 fl oz per 100 gal applied 3 times biweekly through 1 month after initial treatment but excellent population reduction 6 months after treatment.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
33854	Pradia (Cyclaniliprole + Flonicamid)	IRAC 28 + IRAC 9C	False Oleander Scale (Pseudaulacaspis cockerelli)	Japanese Laurel (Aucuba japonica)	Field Container	Held	NY	2018	Foliar	Poor control with 12 and 16.5 fl oz per 100 gal + Capsil. Researcher commented that application timing used in this trial might have been too early to provide adequate control for this insect.
31228	QRD 452 (Extract of Chenopodium ambrosioides)		Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. fortunei 'Radicans'	Field Container	Kunkel	DE	2011	Foliar	Significantly increased mortality with 128 oz per 100 gal applied once; comparable to horticultural oil applied twice.
34179	RTSA 721 (RTSA 721)		Crape Myrtle Bark Scale (Eriococcus lagerstroemia)	Crape Myrtle (Lagerstroemia indica)	Field Container	Held	AL	2020	Drench	Excellent control with 5 and 10 ml per ft shrub ht applied once; comparable to the standard Transtect.
28696	Rycar (Pyrifluquinazon)	IRAC UN	Scale, Holly Pit (Asterolecanium puteanum)	Holly (Ilex sp.) 'East Palatka'	Field In-Ground	Buss	FL	2009	Foliar	Did not significantly reduce number of immatures at 18 fl oz per 100 gal. 32% control with HendersonsTilton 6 WAT.
28688	Rycar (Pyrifluquinazon)	IRAC UN	False Florida Red Scale (Chrysomphalus bifasciculatus)	Holly, Chinese (Ilex cornuta) 'Cassina'	Field In-Ground	Chong	SC	2009	Foliar	Good efficacy at 18 fl oz per 100 gal; equivalent to paraffinic oil standard.
30301	Rycar (Pyrifluquinazon)	IRAC UN	Cottony Cushion Scale (Icerya purchasi)	Cheesewood (Pittosporum sp.) P. tobira 'Verigata'	Field In-Ground	Chong	SC	2011	Foliar	Significantly reduced immatures with 18 fl oz per 100 gal applied once; almost comparable to the standard Orthene, though slower-acting.
30229	Rycar (Pyrifluquinazon)	IRAC UN	Cottony Cushion Scale (Icerya purchasi)	Sacred Bamboo (Nandina domestica) 'Harbour Dwarf'	Field Container	Frank	NC	2011	Foliar	Significantly reduced adults and immatures with 18 fl oz per 100 gal applied once; comparable to horticultural oil.
28919	Rycar (Pyrifluquinazon)	IRAC UN	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2009	Foliar	Did not significantly reduce scale population at 18 oz per 100 gal; similar to Orthene std; very low non treated population so no statistical significance.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
30239	Rycar (Pyrifluquinazon)	IRAC UN	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2011	Foliar	Excellent control of adults and immatures with 18 fl oz per 100 gal applied once; comparable to standard paraffin oil.
29770	Rycar (Pyrifluquinazon)	IRAC UN	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2010	Foliar	Excellent efficacy at 18 fl oz per 100 gal.
29770	Rycar (Pyrifluquinazon)	IRAC UN	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2011	Foliar	Excellent efficacy with 18 fl oz per 100 gal.
29631	Rycar (Pyrifluquinazon)	IRAC UN	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora)	Commercial Landscape	Chong	SC	2010	Foliar	Litchfield, SC: Significantly reduced false oleander scale population at 18 fl oz per 100 gal;much inferior to the standard Paraffinic oil; no injury observed.
28951	Rycar (Pyrifluquinazon)	IRAC UN	White Peach Scale (Pseudaulacaspis pentagona)	Holly, Blue (Ilex x meserveae)	Field In-Ground	Kunkel	DE	2009	Foliar	Mortality in untreated controls was high; no conclusions can be drawn.
28873	Rycar (Pyrifluquinazon)	IRAC UN	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus)	Field Container	Frank	NC	2010	Foliar	Excellent control with 18 fl oz per 100 gal; slower acting than horticultural oil.
28873	Rycar (Pyrifluquinazon)	IRAC UN	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. fortunei 'Moonshadow'	Field Container	Potter	KY	2010	Foliar	Significantly reduced 1st generation adult scales with 18 fl oz per 100 gal; better than horticultural oil; no impact on 2nd generation.
28873	Rycar (Pyrifluquinazon)	IRAC UN	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. fortunei 'Radicans'	Field Container	Kunkel	DE	2011	Foliar	Did not significantly increase mortality with 18 fl oz per 100 gal applied once.
29982	Rycar (Pyrifluquinazon)	IRAC UN	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. vegetus 'Coloratus'	Field In-Ground	Nielsen	OH	2008	Foliar	Poor efficacy at 18 fl oz per 100 gal.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
28873	Rycar (Pyrifluquinazon)	IRAC UN	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. vegetus 'Sunspot'	Field Container	Nielsen	OH	2009	Foliar	Poor control at 18 fl oz per 100 gal
28873	Rycar (Pyrifluquinazon)	IRAC UN	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) 'Green Spire'	Field Container	Gilrein	NY	2011	Foliar	Did not significantly reduce population with 18 fl oz per 100 gal applied once.
28873	Rycar (Pyrifluquinazon)	IRAC UN	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) 'Microphylla'	Field Container	Frank	NC	2009	Foliar	Excellent control at 18 fl oz per 100 gal; slower acting than Acephate
28697	Safari 20SG (Dinotefuran)	IRAC 4A	Scale, Holly Pit (Asterolecanium puteanum)	Holly (Ilex sp.) 'East Palatka'	Field In-Ground	Buss	FL	2009	Sprench	Significantly reduced number of immatures at 6 g per ft height; comparable to Orthene. 16% control with HendersonsTilton 6 WAT.
25050	Safari 20SG (Dinotefuran)	IRAC 4A	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) 'Dwarf Buford'	Field Container	Ludwig	TX	2004	Drench	Great to excellent efficacy at 12, 24, and 48 oz per 100 gal at 45DAT.
28972	Safari 20SG (Dinotefuran)	IRAC 4A	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) I. cornuta 'Needlepoint'	Commercial Landscape	Held (MSU)	TN	2009	Drench	Excellent control at 6 g per ft height applied for first generation, less effective when applied for 2nd generation.
25774	Safari 20SG (Dinotefuran)	IRAC 4A	Florida Red Scale (Chrysomphalus aonidum)	Holly, Chinese (Ilex cornuta) 'Dwarf Buford'	Field Container	Ludwig	TX	2005	Drench	No significant control of nymphs and on adults at 12 and 24 oz per 100 gal probably due to cooler temperatures
25774	Safari 20SG (Dinotefuran)	IRAC 4A	Florida Red Scale (Chrysomphalus aonidum)	Holly, Chinese (Ilex cornuta) 'Dwarf Buford'	Field Container	Ludwig	TX	2005	Foliar	No significant control of nymphs and on adults at 4 and 8 oz per 100 gal probably due to cooler temperatures
28689	Safari 20SG (Dinotefuran)	IRAC 4A	False Florida Red Scale (Chrysomphalus bifasciculatus)	Holly, Chinese (Ilex cornuta) 'Cassina'	Field In-Ground	Chong	SC	2009	Drench	Excellent efficacy at 6 g per ft of shrub height; better than paraffinic oil std

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
25140	Safari 20SG (Dinotefuran)	IRAC 4A	Scale, Oystershell (Diaspidiotus ostreiformis)	Lilac, Common (Syringa vulgaris) 'Sensation'	Field In-Ground	Nielsen	OH	2005	Drench	Excellent efficacy with foliar application
25140	Safari 20SG (Dinotefuran)	IRAC 4A	Scale, Oystershell (Diaspidiotus ostreiformis)	Lilac, Common (Syringa vulgaris) 'Sensation'	Field In-Ground	Nielsen	OH	2005	Foliar	Poor efficacy with foliar application
25141	Safari 20SG (Dinotefuran)	IRAC 4A	Scale, Oystershell (Diaspidiotus ostreiformis)	Silverbell Carolina (Halesia carolina var. carolina)	Field In-Ground	Nielsen	OH	2005	Drench	Excellent efficacy with drench application
25141	Safari 20SG (Dinotefuran)	IRAC 4A	Scale, Oystershell (Diaspidiotus ostreiformis)	Silverbell Carolina (Halesia carolina var. carolina)	Field In-Ground	Nielsen	OH	2008	Drench	Very low infestation; poor control at 6, acceptable at 12 g per ft ht
25141	Safari 20SG (Dinotefuran)	IRAC 4A	Scale, Oystershell (Diaspidiotus ostreiformis)	Silverbell Carolina (Halesia carolina var. carolina) Carolina silverbell	Field In-Ground	Nielsen	OH	2005	Foliar	Poor efficacy with foliar application
33873	Safari 20SG (Dinotefuran)	IRAC 4A	Crape Myrtle Bark Scale (Eriococcus lagerstroemia)	Crape Myrtle (Lagerstroemia indica) 'Natchez'	Field Container	Vafaie	TX	2018	Foliar	Data had too much variation to provide reliable results. Researcher's preliminary conclusions demonstrate reliable scale suppresion with Safari at 8 oz per 100 gal, comparable to the standard Distance.
26720	Safari 20SG (Dinotefuran)	IRAC 4A	Scale, Calico (Eulecanium cerasorum)	Japanese Zelkova (Zelkova serrata)	Commercial Landscape	Potter	KY	2007	Soil Injection	Good to great control using 8.5 g product per inch dbh.
26720	Safari 20SG (Dinotefuran)	IRAC 4A	Scale, Calico (Eulecanium cerasorum)	Japanese Zelkova (Zelkova serrata)	Commercial Landscape	Potter	KY	2007	Trunk spray	Excellent control using 13 oz + 3.1 ox Pentrabark per 1.1 gal.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
29845	Safari 20SG (Dinotefuran)	IRAC 4A	Scale, Calico (Eulecanium cerasorum)	Locust (Gleditsia sp.) G. triacanthos inermis	Commercial Landscape	Sadof	IN	2011	Drench	Poor efficacy with Transtect 70WSP at 1.45 g ai per inch DBH.
29845	Safari 20SG (Dinotefuran)	IRAC 4A	Scale, Calico (Eulecanium cerasorum)	Locust (Gleditsia sp.) G. triacanthos inermis	Commercial Landscape	Sadof	IN	2011	Trunk spray	Poor efficacy with Transtect 70WSP at 1.7 g ai per in dbh.
29845	Safari 20SG (Dinotefuran)	IRAC 4A	Scale, Calico (Eulecanium cerasorum)	Locust (Gleditsia sp.) G. triacanthos var. inermis	Commercial Landscape	Persad	OH	2014	Drench	100 % control of nymphs with 6 g per inch DBH by 28 DAT.
25315	Safari 20SG (Dinotefuran)	IRAC 4A	Scale, Elongate Hemlock (Fiorinia externa)	Fir, Fraser (Abies fraseri)	Field In-Ground	Cowles	CT	2005	Drench	Excellent efficacy - 100% control
25315	Safari 20SG (Dinotefuran)	IRAC 4A	Scale, Elongate Hemlock (Fiorinia externa)	Fir, Fraser (Abies fraseri)	Field In-Ground	Cowles	CT	2005	Foliar	Excellent efficacy >90% control
25315	Safari 20SG (Dinotefuran)	IRAC 4A	Scale, Elongate Hemlock (Fiorinia externa)	Fir, Fraser (Abies fraseri)	Field In-Ground	Cowles	CT	2008	Drench	No to some efficacy at 0.68, 1.35, and 2.70 lb product per acre with soil applications.
25315	Safari 20SG (Dinotefuran)	IRAC 4A	Scale, Elongate Hemlock (Fiorinia externa)	Fir, Fraser (Abies fraseri)	Field In-Ground	Cowles	CT	2008	Trunk spray	Good efficacy at 0.68, 1.35, and 2.70 lb product per acre with truck applications.
29585	Safari 20SG (Dinotefuran)	IRAC 4A	Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica)	Field In-Ground	Ludwig	TX	2008	Drench	Good efficacy at 24 fl oz per 100 gal; high mortality in untreated Check.
29858	Safari 20SG (Dinotefuran)	IRAC 4A	Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica) C. sasanqua 'Showa-no-sakae'	Field Container	Frank	NC	2010	Drench	Excellent control with 24 oz per 100 gal.
29858	Safari 20SG (Dinotefuran)	IRAC 4A	Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica) 'In the Pink'	Field Container	Arthurs (UF)	FL	2014	Drench	Excellent control with 24 oz per 100 gal applied once; comparable to SuffOil X.
29362	Safari 20SG (Dinotefuran)	IRAC 4A	Scale, Tea (Fiorinia theae)	Holly (Ilex sp.) 'Burfordii Nana'	Field In-Ground	Hesselein	AL	2009	Drench	Significantly increased % scale mortality at 6 g per ft plant height; equal to petroleum oil spray

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
30302	Safari 20SG (Dinotefuran)	IRAC 4A	Cottony Cushion Scale (Icerya purchasi)	Cheesewood (Pittosporum sp.) P. tobira 'Verigata'	Field In-Ground	Chong	SC	2011	Drench	Significantly reduced immatures with 6 g per ft ht applied once; best product, better than the standard Orthene.
30230	Safari 20SG (Dinotefuran)	IRAC 4A	Cottony Cushion Scale (Icerya purchasi)	Sacred Bamboo (Nandina domestica) 'Harbour Dwarf'	Field Container	Frank	NC	2011	Drench	Significantly reduced adults and immatures with 24 oz per 100 gal applied once; comparable to horticultural oil.
25060	Safari 20SG (Dinotefuran)	IRAC 4A	Cottony Cushion Scale (Icerya purchasi)	Ternstroemia (Ternstroemia sp.) T. gymnanthera	Field Container	Ludwig	TX	2005	Drench	Poor efficacy
25060	Safari 20SG (Dinotefuran)	IRAC 4A	Cottony Cushion Scale (Icerya purchasi)	Ternstroemia (Ternstroemia sp.) T. gymnanthera	Field Container	Ludwig	TX	2005	Foliar	Poor efficacy
30086	Safari 20SG (Dinotefuran)	IRAC 4A	Camelia Scale (Lepidosaphes camelliae)	Camellia (Camellia japonica)	Commercial Landscape	Chong	SC	2010	Drench	Did not significantly reduce camellia scale population at 6 g per ft height; comparable to all other treatments including the standard Orthene; no injury observed.
25153	Safari 20SG (Dinotefuran)	IRAC 4A	Winged Euonymus Scale (Lepidosaphes yanagicola)	Burning Bush (Euonymus alatus)	Field Container	Freiberger	NJ	2004	Foliar	Poor efficacy
25153	Safari 20SG (Dinotefuran)	IRAC 4A	Winged Euonymus Scale (Lepidosaphes yanagicola)	Burning Bush (Euonymus alatus)	Field Container	Freiberger	NJ	2005	Drench	Little to no control
25153	Safari 20SG (Dinotefuran)	IRAC 4A	Winged Euonymus Scale (Lepidosaphes yanagicola)	Burning Bush (Euonymus alatus)	Field Container	Freiberger	NJ	2005	Foliar	Little to no control

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
28129	Safari 20SG (Dinotefuran)	IRAC 4A	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2008	Drench	Experiment 1 (Early and Late Drenches): Did not significantly reduce scale population at 12 g per indbh; similar to Orthene std; untreated population very low and no statistical differences were observed.
28129	Safari 20SG (Dinotefuran)	IRAC 4A	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2008	Foliar	Experiment 2: Reduced scale population but not statistically significantly at 8 oz per 100 gal; similar to Sunspray Ultrafine std
28129	Safari 20SG (Dinotefuran)	IRAC 4A	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2009	Drench	Did not significantly reduce scale population at 6 g per ft shrub height; similar to Orthene std; very low non treated population so no statistical significance.
28129	Safari 20SG (Dinotefuran)	IRAC 4A	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2009	Foliar	Experiment 2: Significantly reduced scale population at 6 g per ft shrub height; similar to Orthene std; very low non treated population so no statistical significance.
30240	Safari 20SG (Dinotefuran)	IRAC 4A	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2011	Trunk spray	Excellent control of adults and immatures with 12 oz per 100 gal applied once; comparable to standard paraffin oil.
25445	Safari 20SG (Dinotefuran)	IRAC 4A	Cottony Maple Scale (Neopulvinaria innumerabilis)	Maple, Silver (Acer saccharinum)	Field In-Ground	Davis	MI	2005	Drench	Poor efficacy
25445	Safari 20SG (Dinotefuran)	IRAC 4A	Cottony Maple Scale (Neopulvinaria innumerabilis)	Maple, Silver (Acer saccharinum)	Field In-Ground	Davis	MI	2005	Foliar	Poor to mediocre efficacy
25139	Safari 20SG (Dinotefuran)	IRAC 4A	Fletcher Scale (Parthenolecanium fletcheri)	Hybrid Yew (Taxus X media) Densiformis	Field In-Ground	Davis	MI	2004	Foliar	Mediocre control.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
25139	Safari 20SG (Dinotefuran)	IRAC 4A	Fletcher Scale (Parthenolecanium fletcheri)	Hybrid Yew (Taxus X media) 'Densiformis'	Field In-Ground	Davis	MI	2004	Banded	Mediocre to good efficacy increasing with rate.
29771	Safari 20SG (Dinotefuran)	IRAC 4A	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. strobus	Field In-Ground	Sadof	IN	2015	Foliar	No significant efficacy on immatures and adults with 18 oz per 100 gal.
29771	Safari 20SG (Dinotefuran)	IRAC 4A	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Jones	OH	2012	Soil injection	Mediocre control with 6 g per ft height applied once.
29771	Safari 20SG (Dinotefuran)	IRAC 4A	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2010	Drench	Excellent efficacy at 6 g per inch DBH.
29771	Safari 20SG (Dinotefuran)	IRAC 4A	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2011	Drench	Excellent efficacy with 6 g per inch DBH.
25055	Safari 20SG (Dinotefuran)	IRAC 4A	False Oleander Scale (Pseudaulacaspis cockerelli)	Aucuba (Aucuba sp.)	Field Container	Ludwig	TX	2004	Drench	No impact on number of adults or nymphs, but some reduction in percent alive with 12, 24, and 48 oz per 100 gal.
29632	Safari 20SG (Dinotefuran)	IRAC 4A	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora)	Commercial Landscape	Chong	SC	2010	Drench	Charleston, SC: Significantly reduced false oleander scale population at 6 g per indbh; best treatment; no injury observed.
28952	Safari 20SG (Dinotefuran)	IRAC 4A	White Peach Scale (Pseudaulacaspis pentagona)	Holly, Blue (Ilex x meserveae)	Field In-Ground	Kunkel	DE	2009	Drench	Mortality in untreated controls was high; no conclusions can be drawn.
28874	Safari 20SG (Dinotefuran)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus)	Field Container	Braman	GA	2014	Drench	Excellent control with 24 oz per 100 gal applied once.
28874	Safari 20SG (Dinotefuran)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus)	Field Container	Frank	NC	2010	Drench	Excellent control with 24 oz per 100 gal; slower acting than horticultural oil.
28874	Safari 20SG (Dinotefuran)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. fortunei 'Moonshadow'	Field Container	Potter	KY	2010	Drench	Significantly reduced 1st generation adult scales with 24 oz per 100 gal; better than horticultural oil.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
28874	Safari 20SG (Dinotefuran)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. fortunei 'Radicans'	Field Container	Kunkel	DE	2011	Drench	Significantly increased mortality with 24 oz per 100 gal applied once; slightly better than horticultural oil applied twice.
26683	Safari 20SG (Dinotefuran)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. vegetus 'Coloratus'	Field In-Ground	Nielsen	OH	2008	Drench	Good efficacy at 6 g per ft height.
28874	Safari 20SG (Dinotefuran)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. vegetus 'Sunspot'	Field Container	Nielsen	OH	2009	Drench	Excellent control at 6 g per ft height.
26683	Safari 20SG (Dinotefuran)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) Euonymus vegetus 'Fortunei'	Field In-Ground	Nielsen	OH	2007	Bark spray	Excellent control of 1st, good control of 2nd generation nymphs with bark spray at 24 oz per 100 gal.
26683	Safari 20SG (Dinotefuran)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) Euonymus vegetus 'Fortunei'	Field In-Ground	Nielsen	OH	2007	Drench	Excellent control of 1st, good control of 2nd generation nymphs with soil drench at 6 g per ft height poor on 1st, fair on second generation.
28874	Safari 20SG (Dinotefuran)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) 'Green Spire'	Field Container	Gilrein	NY	2011	Drench	Did not significantly reduce population with 24 oz per 100 gal applied once.
28874	Safari 20SG (Dinotefuran)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) 'Microphylla'	Field Container	Frank	NC	2009	Drench	Excellent control at 24 oz per 100 gal; slower acting than Acephate

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
28874	Safari 20SG (Dinotefuran)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) 'Microphylla'	Field Container	Ludwig	TX	2008	Foliar	Fair to good efficacy at 24 fl oz per 100 gal.
28878	Safari 2G (Dinotefuran)	IRAC 4A	Scale, Holly Pit (Asterolecanium puteanum)	Holly (Ilex sp.) 'East Palatka'	Field In-Ground	Buss	FL	2009	Broadcast	Did not significantly reduce number of immatures at 60 g per ft height. 57% control with HendersonsTilton 6 WAT.
29846	Safari 2G (Dinotefuran)	IRAC 4A	Scale, Calico (Eulecanium cerasorum)	Locust (Gleditsia sp.) G. triacanthos inermis	Commercial Landscape	Sadof	IN	2011	Broadcast	Mediocre efficacy with 3 g ai per inch DBH.
29586	Safari 2G (Dinotefuran)	IRAC 4A	Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica)	Field In-Ground	Ludwig	TX	2008	Soil Incorporation	No significant efficacy at 2.6 g per gal of media; high mortality in untreated Check.
29859	Safari 2G (Dinotefuran)	IRAC 4A	Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica) C. sasanqua 'Showa-no-sakae'	Field Container	Frank	NC	2010	Broadcast	Excellent control with 2.6 g per gal potting media.
29363	Safari 2G (Dinotefuran)	IRAC 4A	Scale, Tea (Fiorinia theae)	Holly (Ilex sp.) 'Bufordii Nana'	Field In-Ground	Hesselein	AL	2009	Top Dress	Significantly increased % scale mortality at 60 g per ft plant height; equal to petroleum oil
30303	Safari 2G (Dinotefuran)	IRAC 4A	Cottony Cushion Scale (Icerya purchasi)	Cheesewood (Pittosporum sp.) P. tobira 'Verigata'	Field In-Ground	Chong	SC	2011	Broadcast	Significantly reduced immatures with 60 g per ft ht applied once; best product, better than the standard Orthene.
30231	Safari 2G (Dinotefuran)	IRAC 4A	Cottony Cushion Scale (Icerya purchasi)	Sacred Bamboo (Nandina domestica) 'Harbour Dwarf'	Field Container	Frank	NC	2011	Broadcast	Significantly reduced adults and immatures with 2.6 g per plant applied once; comparable to horticultural oil.
30087	Safari 2G (Dinotefuran)	IRAC 4A	Camelia Scale (Lepidosaphes camelliae)	Camellia (Camellia japonica)	Commercial Landscape	Chong	SC	2010	Broadcast	Did not significantly reduce camellia scale population at 60 g per ft height; comparable to all other treatments including the standard Orthene; no injury observed.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
28917	Safari 2G (Dinotefuran)	IRAC 4A	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2009	Broadcast	Did not significantly reduce scale population at 60 g per ft shrub height; similar to Orthene std; very low non treated population so no statistical significance.
30241	Safari 2G (Dinotefuran)	IRAC 4A	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2011	Drench	Excellent control of adults and immatures with 6 g per inch dbh applied once; comparable to standard paraffin oil.
29772	Safari 2G (Dinotefuran)	IRAC 4A	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2010	Broadcast	Poor efficacy at 60 g per inch DBH
29772	Safari 2G (Dinotefuran)	IRAC 4A	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2011	Broadcast	Poor efficacy through 21 DAT with 60 g per inch DBH; however no second generation eggs were present.
29633	Safari 2G (Dinotefuran)	IRAC 4A	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora)	Commercial Landscape	Chong	SC	2010	Broadcast	Charleston, SC: Significantly reduced false oleander scale population at 60 g per indbh; better than the standard Orthene; no injury observed.
28953	Safari 2G (Dinotefuran)	IRAC 4A	White Peach Scale (Pseudaulacaspis pentagona)	Holly, Blue (Ilex x meserveae)	Field In-Ground	Kunkel	DE	2009	Broadcast	Mortality in untreated controls was high; no conclusions can be drawn.
28875	Safari 2G (Dinotefuran)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus)	Field Container	Frank	NC	2010	Broadcast	Excellent control with 7.8 g ai per 3 gal media; slower acting than horticultural oil.
29985	Safari 2G (Dinotefuran)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. vegetus 'Coloratus'	Field In-Ground	Nielsen	OH	2008	Broadcast	Good efficacy at 60 g per ft height.
28875	Safari 2G (Dinotefuran)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. vegetus 'Sunspot'	Field Container	Nielsen	OH	2009	Top Dress	Poor control at 60 g per ft height

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
28875	Safari 2G (Dinotefuran)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) 'Microphylla'	Field Container	Frank	NC	2009	Broadcast	Good control but slow acting at 7.8 g per 3 gal container; inferior to Acephate
28875	Safari 2G (Dinotefuran)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) 'Microphylla'	Field Container	Ludwig	TX	2008	Soil incorporation	Excellent efficacy at 2.6 g per gal of media.
29371	Saf-T-Oil (Horticultural Oil)	FRAC NC	Scale, Tea (Fiorinia theae)	Holly (Ilex sp.) 'Burfordii Nana'	Field Container	Hesselein	AL	2009	Foliar	Significantly increased % scale mortality at 2 gal per 100 gal.
34213	Sarisa 50SL (Cyclaniliprole)	IRAC 28	Scale, Cycad (Aulacaspis yasumatsui)	Sago Palm (Cycas revoluta)	Field Container	Dale	FL	2019	Foliar	No control of nymphs and adults with 28 fl oz per 100 gal applied 3 times biweekly.
33577	Sarisa 50SL (Cyclaniliprole)	IRAC 28	Crape Myrtle Bark Scale (Eriococcus lagerstroemia)	Crape Myrtle (Lagerstroemia indica) 'Natchez'	Field Container	Vafaie	TX	2018	Foliar	Data had too much variation to provide reliable results.
32354	Sarisa 50SL (Cyclaniliprole)	IRAC 28	Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica)	Field In-Ground	Braman	GA	2015	Foliar	Very good control with 22 and 28 fl oz per 100 gal applied twice biweekly.
32871	Sarisa 50SL (Cyclaniliprole)	IRAC 28	Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica)	Field Container	Chen	LA	2015	Foliar	Excellent control with 22 and 28 fl oz per 100 gal; comparable to standards Ultra-Pure Oil and Distance.
32846	Sarisa 50SL (Cyclaniliprole)	IRAC 28	Scale, Tea (Fiorinia theae)	Holly (Ilex sp.)	Field Container	Frank	NC	2015	Foliar	Did not significantly reduce number of adults and nymphs with 22 and 28 fl oz per 100 gal applied twice biweekly.
32846	Sarisa 50SL (Cyclaniliprole)	IRAC 28	Scale, Tea (Fiorinia theae)	Holly (Ilex sp.) 'Nellie Stevens'	Field Container	Chong	SC	2015	Foliar	Good efficacy with 22 and 28 fl oz per 100 gal + Capsil applied 3 times biweekly; inferior to Distance.
33546	Sarisa 50SL (Cyclaniliprole)	IRAC 28	Lobate Lac Scale (Paratachardina pseudolobata)	Rosemallow (Hibiscus sp.) H. rosa-sinensis 'Dainty White'	Field Container	Cheng	HI	2018	Foliar	Efficacy with 22 and 28 fl oz per 100 gal slightly inferior to imidacloprid. No phytotoxicity.
32222	Sarisa 50SL (Cyclaniliprole)	IRAC 28	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. strobus	Field In-Ground	Sadof	IN	2015	Foliar	No significant efficacy on immatures and adults with 22 and 28 fl oz per 100 gal.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
32222	Sarisa 50SL (Cyclaniliprole)	IRAC 28	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Persad	OH	2015	Foliar	Mediocre control with 22 and 28 fl oz per 100 gal applied 3 times weekly.
34254	Sarisa 50SL (Cyclaniliprole)	IRAC 28	False Oleander Scale (Pseudaulacaspis cockerelli)	Aucuba (Aucuba sp.)	Field Container	Held	AL	2019	Foliar	Poor efficacy with 28 fl oz per 100 gal + NIS applied 3 times biweekly through 1 month after initial treatment but some population reduction 6 months after treatment
33852	Sarisa 50SL (Cyclaniliprole)	IRAC 28	False Oleander Scale (Pseudaulacaspis cockerelli)	Japanese Laurel (Aucuba japonica)	Field Container	Held	AL	2018	Foliar	Poor control with 22 and 28 fl oz per 100 gal + NIS. Researcher commented that application timing used in this trial might have been too early to provide adequate control for this insect.
32341	Sarisa 50SL (Cyclaniliprole)	IRAC 28	Euonymus Scale (Unaspis euonymi)	Wintercreeper (Euonymus fortunei)	Field Container	Potter	KY	2015	Foliar	Scale failed to establish; no usable data were able to be collected
34180	SP3014 (SP3014)		Crape Myrtle Bark Scale (Eriococcus lagerstroemia)	Crape Myrtle (Lagerstroemia indica)	Field Container	Held	AL	2020	Foliar	No control with 13 fl oz per 100 gal + Capsil applied 3 times weekly.
32035	SuffOil X (Synergy) (Petroleum Oil)	FRAC NC	Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica) 'In the Pink'	Field Container	Arthurs (UF)	FL	2014	Foliar	Excellent control with 256 fl oz per 100 gal applied 3 times.
32408	SuffOil X (Synergy) (Petroleum Oil)	FRAC NC	Scale, Tea (Fiorinia theae)	Sasanqua camellia (Camellia sasanqua) 'Mountain Snow'	Field Container	Chen	LA	2014	Foliar	Significantly reduced infestation with 1 gal per 100 gal applied twice.
32530	SuffOil X (Synergy) (Petroleum Oil)	FRAC NC	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2014	Foliar	Data inconclusive because there were no significant differences between treatments, including untreated check.
32403	SuffOil X (Synergy) (Petroleum Oil)	FRAC NC	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora) 'Little Gem'	Field Container	Chen	LA	2014	Foliar	Excellent control with 1 gal per 100 gal applied twice.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
28137	Sun Spray Ultra-Fine Spray Oil (Paraffinic oil)	FRAC NC	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2008	Foliar	Experiment 2: Did not significantly reduce scale population at 2 % (2 gal per 100 gal.
30579	Sun Spray Ultra-Fine Spray Oil (Paraffinic oil)	FRAC NC	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2011	Foliar	Excellent efficacy with 2 gal per 100 gal.
29291	Sun Spray Ultra-Fine Spray Oil (Paraffinic oil)	FRAC NC	Euonymus Scale (Unaspis euonymi)	Spindletree (Euonymus sp.) E. vegetus 'Sunspot'	Field Container	Nielsen	OH	2009	Foliar	Excellent control at 3%.
25449	Talstar Flowable Insecticide/Miticide (Bifenthrin)	IRAC 3A	Cottony Maple Scale (Neopulvinaria innumerabilis)	Maple, Silver (Acer saccharinum)	Field In-Ground	Davis	MI	2005	foliar	No efficacy.
28698	Talus 40SC (Buprofezin)	IRAC 16	Scale, Holly Pit (Asterolecanium puteanum)	Holly (Ilex sp.) 'East Palatka'	Field In-Ground	Buss	FL	2009	Foliar	Did not significantly reduce number of immatures at 21.5 fl oz per 100 gal. 0% control with HendersonsTilton 6 WAT.
25049	Talus 40SC (Buprofezin)	IRAC 16	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) 'China Doll'	Field Container	Ludwig	TX	2005	Foliar	Minimal impact on adults; some efficacy on nymphs at 14 DAT at 21.5 fl oz per 100 gal
25049	Talus 40SC (Buprofezin)	IRAC 16	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) 'Dwarf Buford'	Field Container	Ludwig	TX	2004	Foliar	Significant mortality 45 days with all rates (21.5, 43, 86 fl oz per 100 gal).
28690	Talus 40SC (Buprofezin)	IRAC 16	False Florida Red Scale (Chrysomphalus bifasciculatus)	Holly, Chinese (Ilex cornuta) 'Cassina'	Field In-Ground	Chong	SC	2009	Foliar	Good efficacy at 21.5 fl oz per 100 gal + Capsil; similar to paraffinic oil std
25144	Talus 40SC (Buprofezin)	IRAC 16	Scale, Oystershell (Diaspidiotus ostreiformis)	Lilac, Common (Syringa vulgaris)	Field In-Ground	Nielsen	OH	2005	Foliar	Excellent control at 21.5 fl oz per 100 gal
25143	Talus 40SC (Buprofezin)	IRAC 16	Scale, Oystershell (Diaspidiotus ostreiformis)	Silverbell Carolina (Halesia carolina var. carolina)	Field In-Ground	Nielsen	OH	2005	Foliar	Excellent efficacy
25316	Talus 40SC (Buprofezin)	IRAC 16	Scale, Elongate Hemlock (Fiorinia externa)	Fir, Fraser (Abies fraseri)	Field In-Ground	Cowles	CT	2005	Foliar	Great efficacy

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
32038	Talus 40SC (Buprofezin)	IRAC 16	Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica) 'In the Pink'	Field Container	Arthurs (UF)	FL	2014	Foliar	Very good control with 14 oz per 100 gal + Capsil applied twice; inferior to SuffOil X.
25154	Talus 40SC (Buprofezin)	IRAC 16	Winged Euonymus Scale (Lepidosaphes yanagicola)	Burning Bush (Euonymus alatus)	Field Container	Freiberger	NJ	2004	Foliar	Excellent efficacy
25154	Talus 40SC (Buprofezin)	IRAC 16	Winged Euonymus Scale (Lepidosaphes yanagicola)	Burning Bush (Euonymus alatus)	Field Container	Freiberger	NJ	2005	Foliar	Excellent efficacy comparable to Orthene
27842	Talus 40SC (Buprofezin)	IRAC 16	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2008	Foliar	Experiment 2: Did not significantly reduce scale population at 21.5 fl oz per 100 gal; similar to Sunspray Ultrafine std
27842	Talus 40SC (Buprofezin)	IRAC 16	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2009	Foliar	Experiment 2: Significantly reduced scale population at 21.5 fl oz per 100 gal; similar to paraffinic oil std; very low non treated population so no statistical significance.
25446	Talus 40SC (Buprofezin)	IRAC 16	Cottony Maple Scale (Neopulvinaria innumerabilis)	Maple, Silver (Acer saccharinum)	Field In-Ground	Davis	MI	2005	Foliar	Poor efficacy
25156	Talus 40SC (Buprofezin)	IRAC 16	Fletcher Scale (Parthenolecanium fletcheri)	Hybrid Yew (Taxus X media) Densiformis	Field In-Ground	Nielsen	OH	2001	Foliar	
25156	Talus 40SC (Buprofezin)	IRAC 16	Fletcher Scale (Parthenolecanium fletcheri)	Hybrid Yew (Taxus X media) 'Densiformis'	Field In-Ground	Davis	MI	2004	Foliar	Mediocre to good efficacy.
25054	Talus 40SC (Buprofezin)	IRAC 16	False Oleander Scale (Pseudaulacaspis cockerelli)	Aucuba (Aucuba sp.)	Field Container	Ludwig	TX	2004	Foliar	No impact on number of adults or nymphs or percent alive with 21.5, 43 or 86 oz per 100 gal.
28954	Talus 40SC (Buprofezin)	IRAC 16	White Peach Scale (Pseudaulacaspis pentagona)	Holly, Blue (Ilex x meserveae)	Field In-Ground	Kunkel	DE	2009	Foliar	Mortality in untreated controls was high; no conclusions can be drawn.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
28876	Talus 40SC (Buprofezin)	IRAC 16	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. fortunei 'Radicans'	Field Container	Kunkel	DE	2011	Foliar	Significantly increased mortality with 21.5 fl oz per 100 gal applied once; better than horticultural oil applied twice.
28876	Talus 40SC (Buprofezin)	IRAC 16	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. vegetus 'Sunspot'	Field Container	Nielsen	OH	2009	Foliar	Excellent control at 21.5 fl oz per 100 gal
28876	Talus 40SC (Buprofezin)	IRAC 16	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) 'Microphylla'	Field Container	Frank	NC	2009	Foliar	Excellent control at 21.5 fl oz per 100 gal; equal to Acephate
28876	Talus 40SC (Buprofezin)	IRAC 16	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) 'Mycrophylla'	Field Container	Ludwig	TX	2008	Foliar	Fair to good efficacy at 21.5 fl oz per 100 gal.
34215	Talus 70DF (Buprofezin)	IRAC 16	Scale, Cycad (Aulacaspis yasumatsui)	Sago Palm (Cycas revoluta)	Field Container	Dale	FL	2019	Foliar	Excellent control of adults but no nymph control with 14 oz per 100 gal applied twice biweekly; one of 2 best treatments.
33579	Talus 70DF (Buprofezin)	IRAC 16	Crape Myrtle Bark Scale (Eriococcus lagerstroemia)	Crape Myrtle (Lagerstroemia indica) 'Natchez'	Field Container	Vafaie	TX	2018	Foliar	Data had too much variation to provide reliable results. Researcher's preliminary conclusions demonstrate reliable scale suppresion with Talus at 14 oz per 100 gal, comparable to the standard Distance.
29587	Talus 70DF (Buprofezin)	IRAC 16	Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica)	Field In-Ground	Braman	GA	2015	Foliar	Good control with 14 oz per 100 gal.
29860	Talus 70DF (Buprofezin)	IRAC 16	Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica)	Field Container	Chen	LA	2015	Foliar	Excellent control with 14 oz per 100 gal; comparable to standards Ultra-Pure Oil and Distance.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
29587	Talus 70DF (Buprofezin)	IRAC 16	Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica)	Field In-Ground	Ludwig	TX	2008	Foliar	No significant efficacy at 21.5 fl oz per 100 gal; high mortality in untreated Check.
29860	Talus 70DF (Buprofezin)	IRAC 16	Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica) C. sasanqua 'Showa-no-sakae'	Field Container	Frank	NC	2010	Foliar	Excellent control with 14 oz per 100 gal.
32850	Talus 70DF (Buprofezin)	IRAC 16	Scale, Tea (Fiorinia theae)	Holly (Ilex sp.) 'Nellie Stevens'	Field Container	Chong	SC	2015	Foliar	Great efficacy with 14 oz per 100 gal applied once; one of 3 most effective treatments.
32356	Talus 70DF (Buprofezin)	IRAC 16	Scale, Tea (Fiorinia theae)	Sasanqua camellia (Camellia sasanqua) 'Mountain Snow'	Field Container	Chen	LA	2014	Foliar	Significantly reduced infestation with 14 oz per 100 gal applied once; comparable to standard SuffOil-X.
30460	Talus 70DF (Buprofezin)	IRAC 16	Cottony Cushion Scale (Icerya purchasi)	Cheesewood (Pittosporum sp.) P. tobira cv.'variegata'	Field Container	Chong	SC	2012	Foliar	No consistent and significant reduction of scale population with 14 oz per 100 gal; comparable to standard paraffinic oil.
30304	Talus 70DF (Buprofezin)	IRAC 16	Cottony Cushion Scale (Icerya purchasi)	Cheesewood (Pittosporum sp.) P. tobira 'Verigata'	Field In-Ground	Chong	SC	2011	Foliar	Significantly reduced immatures with 14 oz per 100 gal applied once; generally better than the standard Orthene.
30232	Talus 70DF (Buprofezin)	IRAC 16	Cottony Cushion Scale (Icerya purchasi)	Sacred Bamboo (Nandina domestica) 'Harbour Dwarf'	Field Container	Frank	NC	2011	Foliar	Significantly reduced adults and immatures with 14 oz per 100 gal applied once; comparable to horticultural oil.
32155	Talus 70DF (Buprofezin)	IRAC 16	Cottony Cushion Scale (Icerya purchasi)	Sacred Bamboo (Nandina domestica) 'Harbour Dwarf'	Greenhouse	Frank	NC	2012	Foliar	Did not significantly reduce immatures with 14 oz per 100 gal applied once.
32854	Talus 70DF (Buprofezin)	IRAC 16	Camelia Scale (Lepidosaphes camelliae)	Camellia (Camellia japonica) C. japonica and C. sasanqua	Commercial Landscape	Chong	SC	2014	Foliar	Excellent efficacy with 14 oz per 100 gal applied once; would require a second application for longer residual control.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
30242	Talus 70DF (Buprofezin)	IRAC 16	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2011	Foliar	Excellent control of adults and immatures with 14 oz per 100 gal applied once; comparable to standard paraffin oil.
30242	Talus 70DF (Buprofezin)	IRAC 16	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2014	Foliar	Data inconclusive because there were no significant differences between treatments, including untreated check.
31291	Talus 70DF (Buprofezin)	IRAC 16	Magnolia Scale (Neolecanium cornuparvum)	Sweet Bay (Magnolia virginiana) M. grandiflora, 'Little Gem'	Field In-Ground	Braman	GA	2012	Foliar	Good control of false oleander scale immatures with 14 oz per 100 gal; inferior to Orthene.
33550	Talus 70DF (Buprofezin)	IRAC 16	Lobate Lac Scale (Paratachardina pseudolobata)	Rosemallow (Hibiscus sp.) H. rosa-sinensis 'Dainty White'	Field Container	Cheng	HI	2018	Foliar	Efficacy with 14 oz per 100 gal slightly inferior to imidacloprid. No phytotoxicity.
29773	Talus 70DF (Buprofezin)	IRAC 16	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2010	Foliar	Excellent efficacy at 14 oz per 100 gal.
29773	Talus 70DF (Buprofezin)	IRAC 16	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2011	Foliar	Excellent efficacy with 14 oz per 100 gal.
29773	Talus 70DF (Buprofezin)	IRAC 16	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Persad	OH	2015	Foliar	Excellent control with 14 oz per 100 gal applied 3 times weekly.
34255	Talus 70DF (Buprofezin)	IRAC 16	False Oleander Scale (Pseudaulacaspis cockerelli)	Aucuba (Aucuba sp.)	Field Container	Held	AL	2019	Foliar	Poor efficacy with 14 oz per 100 gal applied twice biweekly..
33855	Talus 70DF (Buprofezin)	IRAC 16	False Oleander Scale (Pseudaulacaspis cockerelli)	Japanese Laurel (Aucuba japonica)	Field Container	Held	AL	2018	Foliar	Poor control with 14 oz per 100 gal. Researcher commented that application timing used in this trial might have been too early to provide adequate control for this insect.
29634	Talus 70DF (Buprofezin)	IRAC 16	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora)	Commercial Landscape	Chong	SC	2010	Foliar	Litchfield, SC: Significantly reduced false oleander scale population at 14 oz per 100 gal; comparable to the standard Paraffinic oil; no injury observed.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
32402	Talus 70DF (Buprofezin)	IRAC 16	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora) 'Little Gem'	Field Container	Chen	LA	2014	Foliar	Excellent control with 14 oz per 100 gal applied once; comparable to standard SuffOil-X.
29758	Talus 70DF (Buprofezin)	IRAC 16	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus)	Field Container	Braman	GA	2014	Foliar	Excellent control with 14 oz per 100 gal.
29758	Talus 70DF (Buprofezin)	IRAC 16	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus)	Field Container	Frank	NC	2010	Foliar	Excellent control with 14 oz per 100 gal; slower acting than horticultural oil.
29758	Talus 70DF (Buprofezin)	IRAC 16	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. fortunei 'Emerald N Gold'	Field Container	Potter	KY	2014	Foliar	Did not significantly reduce scales with 14 oz per 100 gal applied at crawler stage.
29758	Talus 70DF (Buprofezin)	IRAC 16	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. fortunei 'Moonshadow'	Field Container	Potter	KY	2010	Foliar	Significantly reduced 1st generation adult scales with 21.5 fl oz per 100 gal; better than horticultural oil.
29983	Talus 70DF (Buprofezin)	IRAC 16	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. vegetus 'Coloratus'	Field In-Ground	Nielsen	OH	2008	Foliar	Good efficacy at 14 oz per 100 gal.
29758	Talus 70DF (Buprofezin)	IRAC 16	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) 'Green Spire'	Field Container	Gilrein	NY	2011	Foliar	Excellent control with 14 oz per 100 gal applied once.
25163	Talus WP (Buprofezin)	IRAC 16	Fletcher Scale (Parthenolecanium fletcheri)	Hybrid Yew (Taxus X media) 'Densiformis'	Field In-Ground	Davis	MI	2004	Foliar	Mediocre to good efficacy.

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26135	Talus WP (Buprofezin)	IRAC 16	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus)	Field Container	Ludwig	TX	2003	Foliar	Excellent efficacy at 0.6, 1.2 and 2.4 lb ai per 100 gallons
32357	Tank Mix: Distance + TriStar (Pyriproxifen + acetamiprid)		Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica)	Field In-Ground	Braman	GA	2015	Foliar	Very good control with 12 fl oz + 12 fl oz per 100 gal.
32873	Tank Mix: Distance + TriStar (Pyriproxifen + acetamiprid)		Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica)	Field Container	Chen	LA	2015	Foliar	Excellent control with 12 fl oz + 12 fl oz per 100 gal; comparable to standards Ultra-Pure Oil and Distance.
32849	Tank Mix: Distance + TriStar (Pyriproxifen + acetamiprid)		Scale, Tea (Fiorinia theae)	Holly (Ilex sp.)	Field Container	Frank	NC	2015	Foliar	Did not reduce number of adults and nymphs.
32849	Tank Mix: Distance + TriStar (Pyriproxifen + acetamiprid)		Scale, Tea (Fiorinia theae)	Holly (Ilex sp.) 'Nellie Stevens'	Field Container	Chong	SC	2015	Foliar	Good efficacy with 12 + 12 fl oz per 100 gal applied twice every 21 days; one of 3 most effective treatments.
32343	Tank Mix: Distance + TriStar (Pyriproxifen + acetamiprid)		Euonymus Scale (Unaspis euonymi)	Wintercreeper (Euonymus fortunei)	Field Container	Potter	KY	2015	Foliar	Scale failed to establish; no usable data were able to be collected
28138	Tank Mix: Safari + Pentrabark (Dinotefuron + Pentrabark)	IRAC 4A +	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2008	Drench	Experiment 1: Did not significantly reduce scale population at 12 g per indbh; similar to Orthene std; untreated population very low and no statistical differences were observed.
34216	TetraCURB Concentrate (Rosemary Oil)		Scale, Cycad (Aulacaspis yasumatsui)	Sago Palm (Cycas revoluta)	Field Container	Dale	FL	2019	Foliar	No significant control of nymphs and adults with 128 fl oz per 100 gal applied 5 times weekly.
34256	TetraCURB Concentrate (Rosemary Oil)		False Oleander Scale (Pseudaulacaspis cockerelli)	Aucuba (Aucuba sp.)	Field Container	Held	AL	2019	Foliar	Poor efficacy with 128 fl oz per 100 gal applied 5 times weekly.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
34217	TetraCURB Organic (Rosemary Oil)		Scale, Cycad (Aulacaspis yasumatsui)	Sago Palm (Cycas revoluta)	Field Container	Dale	FL	2019	Foliar	No significant control of nymphs and adults with 128 fl oz per 100 gal applied 5 times weekly.
34257	TetraCURB Organic (Rosemary Oil)		False Oleander Scale (Pseudaulacaspis cockerelli)	Aucuba (Aucuba sp.)	Field Container	Held	AL	2019	Foliar	Poor efficacy with 128 fl oz per 100 gal applied 5 times weekly.
29588	Triact (Clarified hydrophobic extract of neem oil)	IRAC UN	Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica)	Field In-Ground	Ludwig	TX	2008	Foliar	No significant efficacy at 2 gal per 100 gal; high mortality in untreated Check.
29584	Triact (Clarified hydrophobic extract of neem oil)	IRAC UN	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) 'Microphylla'	Field Container	Ludwig	TX	2008	Foliar	Good efficacy at 2 gal per 100 gal.
28699	TriStar 30SG (Acetamiprid)	IRAC 4A	Scale, Holly Pit (Asterolecanium puteanum)	Holly (Ilex sp.) 'East Palatka'	Field In-Ground	Buss	FL	2009	Foliar	Did not significantly reduce number of immatures at 8 oz per 100 gal + Capsil. 42% control with HendersonsTilton 6 WAT.
25772	TriStar 30SG (Acetamiprid)	IRAC 4A	Florida Wax Scale (Ceroplastes floridensis)	Indian Hawthorn (Rhaphiolepis indica)	Field Container	Ludwig	TX	2005	Foliar	By 41 DAT, excellent efficacy on nymphs and adults at both rates
25776	TriStar 30SG (Acetamiprid)	IRAC 4A	Florida Red Scale (Chrysomphalus aonidum)	Holly, Chinese (Ilex cornuta) 'Dwarf Buford'	Field Container	Ludwig	TX	2005	Foliar	No significant control of nymphs and on adults at 4 and 8 oz per 100 gal probably due to cooler temperatures
28691	TriStar 30SG (Acetamiprid)	IRAC 4A	False Florida Red Scale (Chrysomphalus bifasciculatus)	Holly, Chinese (Ilex cornuta) 'Cassina'	Field In-Ground	Chong	SC	2009	Foliar	Good efficact at 8 oz per 100 gal + Capsil; similar to paraffinic oil std.
28881	TriStar 30SG (Acetamiprid)	IRAC 4A	Scale, Oystershell (Diaspidiotus ostreiformis)	Silverbell Carolina (Halesia carolina var. carolina)	Field In-Ground	Nielsen	OH	2008	Foliar	Very low infestation; no control at 4 and 8 oz per 100 gal
30305	TriStar 30SG (Acetamiprid)	IRAC 4A	Cottony Cushion Scale (Icerya purchasi)	Cheesewood (Pittosporum sp.) P. tobira 'Verigata'	Field In-Ground	Chong	SC	2011	Foliar	Significantly reduced immatures with 8 oz per 100 gal applied twice; comparable to the standard Orthene.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
30233	TriStar 30SG (Acetamiprid)	IRAC 4A	Cottony Cushion Scale (Icerya purchasi)	Sacred Bamboo (Nandina domestica) 'Harbour Dwarf'	Field Container	Frank	NC	2011	Foliar	Significantly reduced adults and immatures with 8 oz per 100 gal applied twice; comparable to horticultural oil.
30088	TriStar 30SG (Acetamiprid)	IRAC 4A	Camelia Scale (Lepidosaphes camelliae)	Camellia (Camellia japonica)	Commercial Landscape	Chong	SC	2010	Foliar	Did not significantly reduce camellia scale population at 8 oz per 100 gal + Capsil; comparable to all other treatments including the standard Orthene; no injury observed.
27995	TriStar 30SG (Acetamiprid)	IRAC 4A	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2008	Foliar	Experiment 1: Did not significantly reduce scale population at 4 and 8 oz per 100 gal; similar to Orthene std; untreated population very low and no statistical differences were observed.
27995	TriStar 30SG (Acetamiprid)	IRAC 4A	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2009	Foliar	Did not significantly reduce scale population at 8 oz per 100 gal + Capsil; similar to Orthene std; very low non treated population so no statistical significance.
30243	TriStar 30SG (Acetamiprid)	IRAC 4A	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2011	Foliar	Excellent control of adults and immatures with 8 oz per 100 gal applied twice; comparable to standard paraffin oil.
30243	TriStar 30SG (Acetamiprid)	IRAC 4A	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2014	Foliar	Data inconclusive because there were no significant differences between treatments, including untreated check.
25447	TriStar 30SG (Acetamiprid)	IRAC 4A	Cottony Maple Scale (Neopulvinaria innumerabilis)	Maple, Silver (Acer saccharinum)	Field In-Ground	Davis	MI	2005	Foliar	No to mediocre efficacy
29774	TriStar 30SG (Acetamiprid)	IRAC 4A	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2010	Foliar	Excellent efficacy at 8 oz per 100 gal.
29774	TriStar 30SG (Acetamiprid)	IRAC 4A	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Nielsen	OH	2011	Foliar	Excellent efficacy with 8 oz per 100 gal.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
29635	TriStar 30SG (Acetamiprid)	IRAC 4A	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora)	Commercial Landscape	Chong	SC	2010	Foliar	Charleston, SC: Did not significantly reduce false oleander scale population at 8 oz per 100 gal; comparable to the standard Orthene; no injury observed.
28955	TriStar 30SG (Acetamiprid)	IRAC 4A	White Peach Scale (Pseudaulacaspis pentagona)	Holly, Blue (Ilex x meserveae)	Field In-Ground	Kunkel	DE	2009	Foliar	Mortality in untreated controls was high; no conclusions can be drawn.
28877	TriStar 30SG (Acetamiprid)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus)	Field Container	Frank	NC	2010	Foliar	Excellent control with 8 oz per 100 gal; slower acting than horticultural oil.
28877	TriStar 30SG (Acetamiprid)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. fortunei 'Moonshadow'	Field Container	Potter	KY	2010	Foliar	Significantly reduced 1st generation adult scales with 12 fl oz per 100 gal; better than horticultural oil; no impact on 2nd generation.
28877	TriStar 30SG (Acetamiprid)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. fortunei 'Radicans'	Field Container	Kunkel	DE	2011		Significantly increased mortality with 8 oz per 100 gal + Capsil applied twice; comparable to horticultural oil applied twice.
29984	TriStar 30SG (Acetamiprid)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. vegetus 'Coloratus'	Field In-Ground	Nielsen	OH	2008	Foliar	Good efficacy at 8 oz per 100 gal.
28877	TriStar 30SG (Acetamiprid)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. vegetus 'Sunspot'	Field Container	Nielsen	OH	2009	Foliar	Poor control at 8 oz + 6 oz Capsil per 100 gal
28877	TriStar 30SG (Acetamiprid)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) 'Green Spire'	Field Container	Gilrein	NY	2011	Foliar	Did not significantly reduce population with 8 oz per 100 gal + Capsil applied twice.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
28877	TriStar 30SG (Acetamiprid)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) 'Microphylla'	Field Container	Frank	NC	2009	Foliar	Excellent control at 8 oz per 100 gal + Dyne-amic; slower acting than Acephate
28877	TriStar 30SG (Acetamiprid)	IRAC 4A	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) 'Microphylla'	Field Container	Ludwig	TX	2008	Foliar	Fair efficacy at 8 oz per 100 gal.
25219	TriStar 70WSP (Acetamiprid)	IRAC 4A	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) 'China Doll'	Field Container	Ludwig	TX	2005	Foliar	Minimal impact on adults; excellent efficacy on nymphs at 28 DAT at 4 oz and 8 oz per 100 gal
25219	TriStar 70WSP (Acetamiprid)	IRAC 4A	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) 'Dwarf Buford'	Field Container	Ludwig	TX	2004	Foliar	Excellent efficacy at 32, 64, and 128 g per 100 gal at 45DAT.
25219	TriStar 70WSP (Acetamiprid)	IRAC 4A	Florida Wax Scale (Ceroplastes floridensis)	Holly (Ilex sp.) I. cornuta 'bufordii nana'	Field Container	Ludwig	TX	2005	Foliar	Minimal impact on nymphs; excellent efficacy on adults by 56 DAT at both 4 and 8 oz per 100 gal
25146	TriStar 70WSP (Acetamiprid)	IRAC 4A	Scale, Oystershell (Diaspidiotus ostreiformis)	Lilac, Common (Syringa vulgaris)	Field In-Ground	Nielsen	OH	2005	Foliar	No to poor control at 48 and 96 g per 100 gal
25147	TriStar 70WSP (Acetamiprid)	IRAC 4A	Scale, Oystershell (Diaspidiotus ostreiformis)	Silverbell Carolina (Halesia carolina var. carolina)	Field In-Ground	Nielsen	OH	2005	Foliar	No control at 48 g/100 gal, good control at 96 g/100 gal
25317	TriStar 70WSP (Acetamiprid)	IRAC 4A	Scale, Elongate Hemlock (Fiorinia externa)	Fir, Fraser (Abies fraseri)	Field In-Ground	Cowles	CT	2005	Foliar	Excellent efficacy
25058	TriStar 70WSP (Acetamiprid)	IRAC 4A	Cottony Cushion Scale (Icerya purchasi)	Ternstroemia (Ternstroemia sp.) T. gymnanthera	Field Container	Ludwig	TX	2005	Foliar	Good efficacy with 124 oz per 100 gallon rate almost to the level of Orthene TTO 97 standard
25155	TriStar 70WSP (Acetamiprid)	IRAC 4A	Winged Euonymus Scale (Lepidosaphes yanagicola)	Burning Bush (Euonymus alatus)	Field Container	Freiberger	NJ	2004	Foliar	Some efficacy at 64 g per 100 gal rate.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
25155	TriStar 70WSP (Acetamiprid)	IRAC 4A	Winged Euonymus Scale (Lepidosaphes yanagicola)	Burning Bush (Euonymus alatus)	Field Container	Freiberger	NJ	2005	Foliar	Little efficacy at either rate
25117	TriStar 70WSP (Acetamiprid)	IRAC 4A	Fletcher Scale (Parthenolecanium fletcheri)	Hybrid Yew (Taxus X media) 'Densiformis'	Field In-Ground	Davis	MI	2004	Foliar	Good efficacy.
25053	TriStar 70WSP (Acetamiprid)	IRAC 4A	False Oleander Scale (Pseudaulacaspis cockerelli)	Aucuba (Aucuba sp.)	Field Container	Ludwig	TX	2004	Foliar	No impact on number of adults or nymphs and some reduction in percent alive at the higher two rates (32, 64, 128 g per 100 gal).
33856	TriStar 8.5SL (Acetamiprid)	IRAC 4A	False Oleander Scale (Pseudaulacaspis cockerelli)	Japanese Laurel (Aucuba japonica)	Field Container	Held	AL	2018	Foliar	Poor control with 16.5 fl oz per 100 gal. Researcher commented that application timing used in this trial might have been too early to provide adequate control for this insect.
32875	Ultra Pure Oil (BASF) (Petroleum Oil)	FRAC NC	Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica)	Field Container	Chen	LA	2015	Foliar	Great control with 12 fl oz per 100 gal.
34181	V-10433 (V-10433)		Crape Myrtle Bark Scale (Eriococcus lagerstroemia)	Crape Myrtle (Lagerstroemia indica)	Field Container	Held	AL	2020	Foliar	No control with 11 fl oz per 100 gal applied 5 times every 3-4 days.
34218	Ventigra Insecticide (Afidopyropen)	IRAC 9D	Scale, Cycad (Aulacaspis yasumatsui)	Sago Palm (Cycas revoluta)	Field Container	Dale	FL	2019	Foliar	Good and excellent control of nymphs and adults with 7 fl oz per 100 gal applied once; one of 2 best treatments.
33580	Ventigra Insecticide (Afidopyropen)	IRAC 9D	Crape Myrtle Bark Scale (Eriococcus lagerstroemia)	Crape Myrtle (Lagerstroemia indica) 'Natchez'	Field Container	Vafaie	TX	2018	Foliar	Data had too much variation to provide reliable results.
32352	Ventigra Insecticide (Afidopyropen)	IRAC 9D	Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica)	Field In-Ground	Braman	GA	2015	Foliar	Very good control with 7 fl oz per 100 gal applied 3 times biweekly.
32844	Ventigra Insecticide (Afidopyropen)	IRAC 9D	Scale, Tea (Fiorinia theae)	Holly (Ilex sp.)	Field Container	Frank	NC	2015	Foliar	Did not reduce number of adults and nymphs with 7 fl oz per 100 gal applied twice biweekly.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
32844	Ventigra Insecticide (Afidopyropen)	IRAC 9D	Scale, Tea (Fiorinia theae)	Holly (Ilex sp.) 'Nellie Stevens'	Field Container	Chong	SC	2015	Foliar	Good efficacy with 7 fl oz per 100 gal + oil applied 3 times biweekly; comparable to Distance.
33548	Ventigra Insecticide (Afidopyropen)	IRAC 9D	Lobate Lac Scale (Paratachardina pseudolobata)	Rosemallow (Hibiscus sp.) H. rosa-sinensis 'Dainty White'	Field Container	Cheng	HI	2018	Foliar	Efficacy with 4.8 and 7 fl oz per 100 gal slightly inferior to imidacloprid. No phytotoxicity.
32286	Ventigra Insecticide (Afidopyropen)	IRAC 9D	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Persad	OH	2015	Foliar	Excellent control with 7 fl oz per 100 gal + Ultra Pure Oil applied 3 times weekly.
34258	Ventigra Insecticide (Afidopyropen)	IRAC 9D	False Oleander Scale (Pseudaulacaspis cockerelli)	Aucuba (Aucuba sp.)	Field Container	Held	AL	2019	Foliar	Poor efficacy with 7 fl oz per 100 gal applied twice biweekly.
33857	Ventigra Insecticide (Afidopyropen)	IRAC 9D	False Oleander Scale (Pseudaulacaspis cockerelli)	Japanese Laurel (Aucuba japonica)	Field Container	Held	AL	2018	Foliar	Poor control with 4.8 and 7 fl oz per 100 gal + UltraPure Oil. Researcher commented that application timing used in this trial might have been too early to provide adequate control for this insect.
32339	Ventigra Insecticide (Afidopyropen)	IRAC 9D	Euonymus Scale (Unaspis euonymi)	Wintercreeper (Euonymus fortunei)	Field Container	Potter	KY	2015	Foliar	Scale failed to establish; no usable data were able to be collected
31486	Xxpire 40WG (Spinetoram + sulfoxaflor)	IRAC 5 + IRAC 4C	Scale, Calico (Eulecanium cerasorum)	Locust (Gleditsia sp.) G. triacanthos var. inermis	Commercial Landscape	Persad	OH	2014	Foliar	Increasing efficacy on nymphs (poor to good by 28 DAT) with increasing rates (2, 2.75 and 3.5 fl oz per 100 gal).
32034	Xxpire 40WG (Spinetoram + sulfoxaflor)	IRAC 5 + IRAC 4C	Scale, Tea (Fiorinia theae)	Camellia (Camellia japonica) 'In the Pink'	Field Container	Arthurs (UF)	FL	2014	Foliar	Excellent control with 2.0, 2.75 and 3.5 oz per 100 gal + Capsil applied twice; comparable to SuffOil X.
32405	Xxpire 40WG (Spinetoram + sulfoxaflor)	IRAC 5 + IRAC 4C	Scale, Tea (Fiorinia theae)	Sasanqua camellia (Camellia sasanqua) 'Mountain Snow'	Field Container	Chen	LA	2014	Foliar	Significantly reduced infestation with 2, 2.75 and 3.5 oz per 100 gal + Capsil applied twice; best treatment.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
31284	Xxpire 40WG (Spinetoram + sulfoxaflor)	IRAC 5 + IRAC 4C	Cottony Cushion Scale (Icerya purchasi)	Cheesewood (Pittosporum sp.) P. tobira cv.'variegata'	Field Container	Chong	SC	2012	Foliar	No consistent and significant reduction of scale population with 3.5 and 7 oz per 100 gal; comparable to standard paraffinic oil.
32150	Xxpire 40WG (Spinetoram + sulfoxaflor)	IRAC 5 + IRAC 4C	Cottony Cushion Scale (Icerya purchasi)	Sacred Bamboo (Nandina domestica) 'Harbour Dwarf'	Greenhouse	Frank	NC	2012	Foliar	Significantly reduced immatures with 3.5 and 7 oz per 100 gal applied twice; comparable to horticultural oil.
31543	Xxpire 40WG (Spinetoram + sulfoxaflor)	IRAC 5 + IRAC 4C	Camelia Scale (Lepidosaphes camelliae)	Camellia (Camellia japonica) C. japonica and C. sasanqua	Commercial Landscape	Chong	SC	2014	Foliar	Consistent and high efficacy with 2.75 and 3.5 oz per 100 gal + Capsil applied twice biweekly; comparable to the standard paraffin oil.
31545	Xxpire 40WG (Spinetoram + sulfoxaflor)	IRAC 5 + IRAC 4C	Wax Myrtle Scale (Melanaspis deklei)	Wax Myrtle (Myrica cerifera)	Commercial Landscape	Chong	SC	2013	Foliar	Significantly reduced scale population with 2.0, 2.75 and 3.5 oz per 100 gal + Capsil applied twice biweekly; comparable to the standard paraffin oil.
32528	Xxpire 40WG (Spinetoram + sulfoxaflor)	IRAC 5 + IRAC 4C	Gloomy Scale (Melanaspis tenebricosa)	Maple (Acer sp.) A. rubrum	Field In-Ground	Frank	NC	2014	Foliar	Data inconclusive because there were no significant differences between treatments, including untreated check.
31289	Xxpire 40WG (Spinetoram + sulfoxaflor)	IRAC 5 + IRAC 4C	Magnolia Scale (Neolecanium cornuparvum)	Sweet Bay (Magnolia virginiana) M. grandiflora, 'Little Gem'	Field In-Ground	Braman	GA	2012	Foliar	Excellent control of false oleander scale immatures with 3.5 and 7 oz per 100 gal; comparable to Orthene.
31354	Xxpire 40WG (Spinetoram + sulfoxaflor)	IRAC 5 + IRAC 4C	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. strobus	Field In-Ground	Sadof	IN	2015	Foliar	Significant efficacy on immatures and adults with 2.75 and 3.5 oz + Capsil per 100 gal; comparable to the standards Distance and Horticultural Oil.
31354	Xxpire 40WG (Spinetoram + sulfoxaflor)	IRAC 5 + IRAC 4C	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Jones	OH	2012	Foliar	Mediocre and good control with 3.5 and 7 oz per 100 gal applied twice.
31354	Xxpire 40WG (Spinetoram + sulfoxaflor)	IRAC 5 + IRAC 4C	Pine Needle Scale (Phenacaspis pinifoliae)	Pine (Pinus sp.) P. sylvestris	Field In-Ground	Jones	OH	2013	Foliar	Good control with 2.0, 2.75 and 3.5 oz per 100 gal + Capsil.

PR#	Product (Active Ingredients)	MOAClass	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
31544	Xxpire 40WG (Spinetoram + sulfoxaflor)	IRAC 5 + IRAC 4C	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora)	Commercial Landscape	Chong	SC	2014	Foliar	Good control with 2.0, 2.75 and 3.5 oz per 100 gal + Capsil applied twice biweekly; comparable to the standard paraffin oil.
32399	Xxpire 40WG (Spinetoram + sulfoxaflor)	IRAC 5 + IRAC 4C	False Oleander Scale (Pseudaulacaspis cockerelli)	Magnolia, Southern (Magnolia grandiflora) 'Little Gem'	Field Container	Chen	LA	2014	Foliar	Good to excellent control with 2, 2.75 and 3.5 oz per 100 gal + Capsil applied twice; comparable to standard SuffOil-X.
32157	Xxpire 40WG (Spinetoram + sulfoxaflor)	IRAC 5 + IRAC 4C	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus)	Field Container	Braman	GA	2014	Foliar	Excellent control with 2, 2.75 and 3.5 fl oz per 100 gal + Capsil applied twice at 14-day interval.
32157	Xxpire 40WG (Spinetoram + sulfoxaflor)	IRAC 5 + IRAC 4C	Euonymus Scale (Unaspis euonymi)	Spindle Tree, Japanese (Euonymus japonicus) E. fortunei 'Emerald N Gold'	Field Container	Potter	KY	2014	Foliar	Significantly reduced scales (up to 75%) with 2, 2.75 and 3.5 oz per 100 gal + Capsil applied at crawler stage and 2 weeks later; comparable to Orthene.
32344	Xxpire 40WG (Spinetoram + sulfoxaflor)	IRAC 5 + IRAC 4C	Euonymus Scale (Unaspis euonymi)	Wintercreeper (Euonymus fortunei)	Field Container	Potter	KY	2015	Foliar	Scale failed to establish; no usable data were able to be collected

Table 102. Summary of Efficacy by Product for Mealybug

Note: Table entries are sorted by crop Latin name. Only those experiments received by 11/2/2020 are included in the table below.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
29618	A16901B 45WG (Thiamethoxam + cyantraniliprole)	IRAC 4A + IRAC 28	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Scarlet'	Greenhouse	Chong	SC	2011	Foliar	Poor control of nymphs with 6.7 oz per 100 gal applied twice at 14-day interval.
29618	A16901B 45WG (Thiamethoxam + cyantraniliprole)	IRAC 4A + IRAC 28	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Drench	No significant reduction of nymphs with 10 oz per 100 gal applied once.
29618	A16901B 45WG (Thiamethoxam + cyantraniliprole)	IRAC 4A + IRAC 28	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Foliar	Significantly reduced number of nymphs with 6.7 oz per 100 gal applied twice.
30487	A16901B 45WG (Thiamethoxam + cyantraniliprole)	IRAC 4A + IRAC 28	Madeira Mealybug (Phenacoccus madeiresis)	Marigold, French (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Drench	About 60-80 % control with 10 oz per 100 gal applied once.
30487	A16901B 45WG (Thiamethoxam + cyantraniliprole)	IRAC 4A + IRAC 28	Madeira Mealybug (Phenacoccus madeiresis)	Marigold, French (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2011	Drench	About 53-89 % control with 10 oz per 100 gal applied once.
30487	A16901B 45WG (Thiamethoxam + cyantraniliprole)	IRAC 4A + IRAC 28	Madeira Mealybug (Phenacoccus madeiresis)	Marigold, French (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2011	Foliar	About 78-97 % control of a high infestation with 6.7 oz per 100 gal applied twice.
30289	A16901B 45WG (Thiamethoxam + cyantraniliprole)	IRAC 4A + IRAC 28	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Akita'	Greenhouse	Parrella	CA	2011	Drench	Experiment 1: Good control of a very high infestation with 10 oz per 100 gal; comparable to Talstar.
30289	A16901B 45WG (Thiamethoxam + cyantraniliprole)	IRAC 4A + IRAC 28	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Akita'	Greenhouse	Parrella	CA	2011	Foliar	Experiment 1: Excellent control of a very high infestation with 6.7 oz per 100 gal applied twice; best treatment, better than Talstar applied once.
31347	A16901B 45WG (Thiamethoxam + cyantraniliprole)	IRAC 4A + IRAC 28	Root Mealybug, Hibiscus (Ripersiella hibisci)	Australian Catchbird Tree (Pisonia brunoniana)	Field Container	Hara	HI	2012	Drench	Significantly reduced adults and nymphs with 10 oz per 100 gal applied once; better than Orthene.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
29369	Acelepryn (Dupont) (Chlorantraniliprole)	IRAC 28	Root Mealybug, Hibiscus (Ripersiella hibisci)	Palm, Guangxi Lady (Rhapis robusta)	Greenhouse	Hara	HI	2009	Drench	Poor control of rhizoecus root and pineapple mealybugs at 0.8 fl oz per 100 gal.
32335	Altus (Flupyradifurone)	IRAC 4d	Miscanthus Mealybug (Miscanthiococcus miscanthi)	Silvergrass, Japanese (Miscanthus sinensis)	Field Container	Kunkel	DE	2015	Foliar	5.4 fl oz per 100 gal may have provided some control; high variability between the 6 replicates made detecting significant differences between treatments difficult.
33872	Altus (Flupyradifurone)	IRAC 4d	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Velvet Red'	Greenhouse	Gilrein	NY	2018	Foliar	Mediocre control of nymphs with 14 fl oz per 100 gal applied twice weekly; inferior to Safari.
33872	Altus (Flupyradifurone)	IRAC 4d	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Premium Sun Chocolate Mint'	Greenhouse	Vafaie	TX	2019	Foliar	Poor control with 14 fl oz per 100 gal applied twice biweekly.
33872	Altus (Flupyradifurone)	IRAC 4d	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Velvet Red'	Greenhouse	Gilrein	NY	2019	Foliar	Mediocre control of nymphs with 14 fl oz per 100 gal applied twice biweekly; inferior to Safari.
33616	Altus (Flupyradifurone)	IRAC 4d	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Villanassery Joseph	GA	2018	Foliar	Poor efficacy with 14 fl oz per acre; inferior to the standard Ultra Pure Oil.
30286	Altus (Flupyradifurone)	IRAC 4d	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Salmon Sunblaze'	Greenhouse	Nansen	CA	2019	Foliar	Good efficacy with 14 fl oz per 100 gal applied twice weekly.
24898	Aria 50SG (Flonicamid)	IRAC 9C	Mexican Mealybug (Phenacoccus gossypii)	Marigold (Tagetes sp.) 'Queen Sophia'	Greenhouse	Davis	MI	2005	Foliar	Excellent efficacy at 60 g and 120 g per 100 gal
25083	Aria 50SG (Flonicamid)	IRAC 9C	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Parrella	CA	2005	Foliar	Experiment 2: Good control at 60 and 120 g per 100 gal + Silwet; better than Marathon.
25083	Aria 50SG (Flonicamid)	IRAC 9C	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides) 'Kong Scarlet'	Greenhouse	Oetting	GA	2005	foliar	Excellent efficacy at 120 g per 100 gal

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
28059	Aria 50SG (Flonicamid)	IRAC 9C	Citrus Mealybug (Planococcus citri)	Zinnia (Zinnia sp.) 'Sunny Time'	Greenhouse	Parrella	CA	2008	Foliar	No significant control at 2.1. good to excellent control at 4.3 oz per 100 gal.
29370	Aria 50SG (Flonicamid)	IRAC 9C	Root Mealybug, Hibiscus (Ripersiella hibisci)	Palm, Guangxi Lady (Rhapis robusta)	Greenhouse	Hara	HI	2009	Drench	Good control of rhizoecus root and pineapple mealybugs at 120 g per 100 gal.
33868	AzaGuard (Azadirachtin)	IRAC UN	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Velvet Red'	Greenhouse	Gilrein	NY	2018	Foliar	Mediocre and good control of nymphs with 16 and 32 fl oz per 100 gal applied 3 times weekly; inferior to Safari.
33868	AzaGuard (Azadirachtin)	IRAC UN	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Velvet Red'	Greenhouse	Gilrein	NY	2019	Foliar	Mediocre control of nymphs with 16 fl oz per 100 gal applied 5 times weekly; inferior to Safari.
33612	AzaGuard (Azadirachtin)	IRAC UN	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Villanassery Joseph	GA	2018	Foliar	Poor efficacy with 32 fl oz per acre; inferior to the standard Ultra Pure Oil.
33921	AzaGuard (Azadirachtin)	IRAC UN	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Salmon Sunblaze'	Greenhouse	Nansen	CA	2019	Foliar	Some population suppression with 16 fl oz per 100 gal applied 5 times weekly.
34403	BW133 (BW133)	FRAC NC	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides) 'Wizard Jade'	Greenhouse	Chong	SC	2020	Foliar	Great initial efficacy against an excessive citrus mealybug infestation with 5 lb per 100 gal. No phytotoxicity.
34404	BW238 ES (BW238 ES)		Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides) 'Wizard Jade'	Greenhouse	Chong	SC	2020	Foliar	Poor efficacy against an excessive citrus mealybug infestation with 2 qt per 100 gal. No phytotoxicity.
34405	BW238 WP (BW238 WP)		Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides) 'Wizard Jade'	Greenhouse	Chong	SC	2020	Foliar	Poor efficacy against an excessive citrus mealybug infestation with 2 lb per 100 gal. No phytotoxicity.
33141	Chlorpyrifos 2.32% (Chlorpyrifos)	IRAC1B	Miscanthus Mealybug (Miscanthiococcus miscanthi)	Silvergrass, Japanese (Miscanthus sinensis)	Field Container	Kunkel	DE	2015	Foliar	High variability between the 6 replicates made detecting significant differences between treatments difficult.
29619	Distance (Pyriproxyfen)	IRAC 7C	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Scarlet'	Greenhouse	Chong	SC	2011	Foliar	Great control of nymphs with 12 fl oz per 100 gal applied twice at 21-day interval.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
29619	Distance (Pyriproxyfen)	IRAC 7C	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Foliar	Significantly reduced number of nymphs with 12 fl oz per 100 gal applied twice.
30486	Distance (Pyriproxyfen)	IRAC 7C	Madeira Mealybug (Phenacoccus madeiresis)	Marigold, French (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Foliar	About 77-86 % control with 12 oz per 100 gal applied twice.
29844	Distance (Pyriproxyfen)	IRAC 7C	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Ludwig	TX	2004	Foliar	Great control at 17 DAT with 16 and 32 oz per 100 gal and by 28 DAT the 8 oz rate also provided good control.
29844	Distance (Pyriproxyfen)	IRAC 7C	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Ludwig	TX	2004	Foliar	Poor efficacy using 8 and 16 oz per 100 gal, but excellent at 32 oz per 100 gal starting at 21 DAT.
30290	Distance (Pyriproxyfen)	IRAC 7C	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Akita'	Greenhouse	Parrella	CA	2011	Foliar	Experiment 2: Poor control of a very high infestation with 12 fl oz per 100 gal applied twice; inferior to Talstar applied once.
34518	DuraGuard (Chlorpyrifos)	IRAC 1B	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Salmon Sunblaze'	Greenhouse	Nansen	CA	2019	Foliar	Virtually no efficacy with single initial application of 2 quarts per 100 gal.
29620	Flagship 0.22G (Thiamethoxam)	IRAC 4A	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Scarlet'	Greenhouse	Chong	SC	2011	Broadcast	Good control of nymphs with 6 g per 6-inch container applied once.
29620	Flagship 0.22G (Thiamethoxam)	IRAC 4A	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Broadcast	No significant reduction of nymphs with 6 g per pot applied once.
30488	Flagship 0.22G (Thiamethoxam)	IRAC 4A	Madeira Mealybug (Phenacoccus madeiresis)	Marigold, French (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Broadcast	About 60-80 % control with 6 g per 6" pot applied once.
30488	Flagship 0.22G (Thiamethoxam)	IRAC 4A	Madeira Mealybug (Phenacoccus madeiresis)	Marigold, French (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2011	Broadcast	About 51-91 % control of a high infestation with 6 g per 6" pot applied once;some tip burn on foliage a week after application.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
25135	Flagship 25WG (Thiamethoxam)	IRAC 4A	Phormium Mealybug (Balanococcus diminutus)	Flax, New Zealand (Phormium tenax) 'Dazler'	Field Container	Bethke	CA	2005	Foliar	Good to great control from 8 DAT to 43 DAT
24897	Flagship 25WG (Thiamethoxam)	IRAC 4A	Mexican Mealybug (Phenacoccus gossypii)	Marigold (Tagetes sp.) 'Queen Sophia'	Greenhouse	Davis	MI	2005	Foliar	Good to excellent efficacy by 17 DAT
25067	Flagship 25WG (Thiamethoxam)	IRAC 4A	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Scarlet'	Greenhouse	Chong	SC	2011	Foliar	Excellent control of nymphs with 8 oz per 100 gal + Capsil applied twice at 14-day interval.
25067	Flagship 25WG (Thiamethoxam)	IRAC 4A	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Foliar	Good control of nymphs with 8 oz per 100 gal applied twice.
30489	Flagship 25WG (Thiamethoxam)	IRAC 4A	Madeira Mealybug (Phenacoccus madeiresis)	Marigold, French (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Drench	About 45 % control with 8 oz per 100 gal applied once.
30489	Flagship 25WG (Thiamethoxam)	IRAC 4A	Madeira Mealybug (Phenacoccus madeiresis)	Marigold, French (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2011	Drench	About 44-92% control with 8 oz per 100 gal applied once.
30489	Flagship 25WG (Thiamethoxam)	IRAC 4A	Madeira Mealybug (Phenacoccus madeiresis)	Marigold, French (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2011	Foliar	About 84-100 % control of a high infestation with 8 oz per 100 gal + Dynamic applied twice.
25084	Flagship 25WG (Thiamethoxam)	IRAC 4A	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Ludwig	TX	2004	Foliar	Excellent efficacy at 2, 4, and 8 oz per 100 gal starting at 21 DAT.
25084	Flagship 25WG (Thiamethoxam)	IRAC 4A	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Ludwig	TX	2004	Foliar	Good to excellent control starting at 17 DAT (2, 4, 8 oz per 100 gal).
25084	Flagship 25WG (Thiamethoxam)	IRAC 4A	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Parrella	CA	2005	Foliar	Experiment 2: Excellent control at 2 and 4 oz per 100 gal + Silwet; better than Marathon.
25084	Flagship 25WG (Thiamethoxam)	IRAC 4A	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides) 'Wizard Jade'	Greenhouse	Oetting	GA	2005	Foliar	Good to excellent efficacy at both 2 oz and 4 oz per 100 gal from 3 weeks after treatment
28058	Flagship 25WG (Thiamethoxam)	IRAC 4A	Citrus Mealybug (Planococcus citri)	Zinnia (Zinnia sp.) 'Sunny Time'	Greenhouse	Parrella	CA	2008	Foliar	Good to excellent control at 2 and 4 oz per 100 gal.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
30277	Grandevo (MBI 203 DF) (Chromobacterium subtsugae NRRL B-30655)	FRAC NC	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Foliar	No significant reduction of nymphs with 2 gal per 100 gal applied twice.
30287	Grandevo (MBI 203 DF) (Chromobacterium subtsugae NRRL B-30655)	FRAC NC	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Akita'	Greenhouse	Parrella	CA	2011	Foliar	Experiment 2: Poor control of a very high infestation with 2 gal per 100 gal applied twice; inferior to Talstar applied once.
31350	Grandevo (MBI 203 DF) (Chromobacterium subtsugae NRRL B-30655)	FRAC NC	Root Mealybug, Hibiscus (Ripersiella hibisci)	Australian Catchbird Tree (Pisonia brunoniana)	Field Container	Hara	HI	2012	Drench	Significantly reduced adults and nymphs with 2 qt per 100 gal applied twice; better than Orthene.
30495	Hachi-Hachi EC (Tolfenpyrad)	IRAC 21A	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Foliar	Good control of nymphs with 32 fl oz per 100 gal applied twice.
31421	Horticultural Oil (Horticultural Oil)	FRAC NC	Madeira Mealybug (Phenacoccus madeiresis)	Marigold, French (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2011	Foliar	About 81-100 % control of a high infestation with 2% solution applied twice; slight leaf burn a few days after applications.
34406	ISM-555 (ISM-555, A21377X)		Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides) 'Wizard Jade'	Greenhouse	Chong	SC	2020	Foliar	Great initial efficacy against an excessive citrus mealybug infestation with 3.82 fl oz per 100 gal + Capsil. No phytotoxicity.
33928	KOC22018-8 (Botanical Oil Blend)		Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Premium Sun Chocolate Mint'	Greenhouse	Vafaie	TX	2019	Foliar	Poor control with 128 fl oz per 100 gal applied 5 times weekly.
33928	KOC22018-8 (Botanical Oil Blend)		Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Velvet Red'	Greenhouse	Gilrein	NY	2019	Foliar	Good control of nymphs with 128 fl oz per 100 gal applied 5 times weekly; inferior to Safari. Moderate phytotoxicity (leaf necrotic spots and edge burn).

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
33922	KOC22018-8 (Botanical Oil Blend)		Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Salmon Sunblaze'	Greenhouse	Nansen	CA	2019	Foliar	Good efficacy with 128 oz per 100 gal applied 5 times weekly, but moderate levels of phytotoxicity were observed by the end of the experiment.
29621	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Scarlet'	Greenhouse	Chong	SC	2011	Foliar	Excellent control of nymphs with 3.4 fl oz per 100 gal applied once.
29621	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Drench	Significantly reduced number of nymphs with 3.4 fl oz per 100 gal applied once.
29621	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Foliar	Significantly reduced number of nymphs with 3.4 fl oz per 100 gal applied once.
30492	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	Madeira Mealybug (Phenacoccus madeiresis)	Marigold, French (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Drench	About 45 % control with 3.4 fl oz per 100 gal applied once.
30291	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Akita'	Greenhouse	Parrella	CA	2011	Drench	Experiment 1: Good initial control through 3 WAT, then poor control of a very high infestation with 3.4 oz per 100 gal; inferior to Talstar.
30291	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Akita'	Greenhouse	Parrella	CA	2011	Foliar	Experiment 1: Good initial control through 3 WAT then mediocre control of a very high infestation with 3.4 oz per 100 gal applied once; inferior to Talstar.
31348	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	Root Mealybug, Hibiscus (Ripersiella hibisci)	Australian Catchbird Tree (Pisonia brunoniana)	Field Container	Hara	HI	2012	Drench	Significantly reduced adults and nymphs with 3.4 fl oz per 100 gal applied twice; better than Orthene.
31348	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	Root Mealybug, Hibiscus (Ripersiella hibisci)	Australian Catchbird Tree (Pisonia brunoniana)	Field Container	Hara	HI	2012	Foliar	Significantly reduced adults and nymphs with 3.4 fl oz per 100 gal applied twice; better than Orthene.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
29364	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	Root Mealybug, Hibiscus (Ripersiella hibisci)	Palm, Guangxi Lady (Rhapis robusta)	Greenhouse	Hara	HI	2009	Drench	Virtually 100 % control of rhizoecus root and pineapple mealybugs at 3.4 fl oz per 100 gal.
29364	Kontos (BYI 8330 240SC) (Spirotetramat)	IRAC 23	Root Mealybug, Hibiscus (Ripersiella hibisci)	Palm, Guangxi Lady (Rhapis robusta)	Greenhouse	Hara	HI	2009	Foliar	Good control of rhizoecus root and pineapple mealybugs at 3.4 fl oz per 100 gal + Silwet applied twice.
32337	Mainspring GNL 200SC (Cyantraniliprole)	IRAC 28	Miscanthus Mealybug (Miscanthiococcus miscanthi)	Silvergrass, Japanese (Miscanthus sinensis)	Field Container	Kunkel	DE	2015	Drench	12 fl oz per 100 gal may have provided some control; high variability between the 6 replicates made detecting significant differences between treatments difficult.
34327	Mainspring GNL 200SC (Cyantraniliprole)	IRAC 28	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Velvet Red'	Greenhouse	Gilrein	NY	2019	Foliar	Poor control of nymphs with 16 fl oz per 100 gal applied twice weekly; inferior to Safari.
26477	Marathon II (Imidacloprid)	IRAC 4A	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Parrella	CA	2005	Foliar	Experiment 1: Fair control at 1.7 oz per 100 gal.
26477	Marathon II (Imidacloprid)	IRAC 4A	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Parrella	CA	2005	Foliar	Experiment 2: Poor control at 1.7 oz per 100 gal.
34407	MBI 203 SC2 (MBI 203)		Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides) 'Wizard Jade'	Greenhouse	Chong	SC	2020	Foliar	No significant efficacy against an excessive citrus mealybug infestation with 128 fl oz per 100 gal. No phytotoxicity.
30278	MBI 205 (MBI205)	FRAC NC	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Foliar	Significantly reduced number of nymphs with 3 gal per 100 gal applied twice.
30288	MBI 205 (MBI205)	FRAC NC	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Akita'	Greenhouse	Parrella	CA	2011	Foliar	Experiment 2: Poor control initally of a very high infestation with 3 gal per 100 gal applied twice; inferior to Talstar applied once; however 3 WAT good control was achieved.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
31351	MBI 205 (MBI205)	FRAC NC	Root Mealybug, Hibiscus (Ripersiella hibisci)	Australian Catchbird Tree (Pisonia brunoniana)	Field Container	Hara	HI	2012	Drench	Significantly reduced adults and nymphs with 4 qt per 100 gal applied twice; better than Orthene.
34408	MBI 306 (MBI 306)		Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides) 'Wizard Jade'	Greenhouse	Chong	SC	2020	Foliar	No significant efficacy against an excessive citrus mealybug infestation with 5 fl oz per 100 gal. No phytotoxicity.
30493	Merit 75WP (Imidacloprid)	IRAC 4A	Madeira Mealybug (Phenacoccus madeiresis)	Marigold, French (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Drench	No significant reduction with 20 g per 1250 pots applied once.
29761	Mesurol 75-W (Methicarb)	IRAC 1A	Citrus Mealybug (Planococcus citri)	Zinnia (Zinnia sp.) 'Sunny Time'	Greenhouse	Parrella	CA	2008	Foliar	Fair to good control at 0.5 lb per 100 gal.
29760	Natural Solutions - V. lecanii (Verticillium lecanii)		Citrus Mealybug (Planococcus citri)	Zinnia (Zinnia sp.) 'Sunny Time'	Greenhouse	Parrella	CA	2008	Foliar	Good initial control at 1:1000 dilution; comparable to registered products but may have shorter residual activity.
25450	Orthene TTO 97 (Valent) (Acephate)	IRAC 1B	Mexican Mealybug (Phenacoccus gossypii)	Marigold (Tagetes sp.) 'Queen Sophia'	Greenhouse	Davis	MI	2005	Foliar	Excellent efficacy with 1 lb per 100 gal.
26035	Orthene TTO 97 (Valent) (Acephate)	IRAC 1B	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) ‘Wizard Scarlet’	Greenhouse	Chong	SC	2011	Foliar	Excellent control of nymphs with 8 oz per 100 gal applied once.
26035	Orthene TTO 97 (Valent) (Acephate)	IRAC 1B	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Kong Scarlet'	Greenhouse	Oetting	GA	2005	Foliar	Excellent efficacy with 10.5 oz per 100 gal.
30482	Orthene TTO 97 (Valent) (Acephate)	IRAC 1B	Madeira Mealybug (Phenacoccus madeiresis)	Marigold, French (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Foliar	About 99 % control with 8 oz per 100 gal applied twice; best treatment.
30482	Orthene TTO 97 (Valent) (Acephate)	IRAC 1B	Madeira Mealybug (Phenacoccus madeiresis)	Marigold, French (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2011	Foliar	About 97-100 % control of a high infestation with 8 oz per 100 gal applied twice.
31349	Orthene TTO 97 (Valent) (Acephate)	IRAC 1B	Root Mealybug, Hibiscus (Ripersiella hibisci)	Australian Catchbird Tree (Pisonia brunoniana)	Field Container	Hara	HI	2012	Drench	No significant reduction of adults and nymphs with 0.67 lb per 100 gal applied once.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
33870	Pradia (Cyclaniliprole + Flonicamid)	IRAC 28 + IRAC 9C	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Velvet Red'	Greenhouse	Gilrein	NY	2018	Foliar	Great control of nymphs with 14 fl oz per 100 gal applied twice weekly; almost comparable to Safari.
33870	Pradia (Cyclaniliprole + Flonicamid)	IRAC 28 + IRAC 9C	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Premium Sun Chocolate Mint'	Greenhouse	Vafaie	TX	2019	Foliar	Excellent control with 16.5 fl oz per 100 gal applied 3 times biweekly.
33870	Pradia (Cyclaniliprole + Flonicamid)	IRAC 28 + IRAC 9C	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Velvet Red'	Greenhouse	Gilrein	NY	2019	Foliar	Excellent control of nymphs with 16.5 fl oz per 100 gal applied 3 times biweekly; comparable to Safari. Minor phytotoxicity (leaf necrotic spots and edge burn).
33614	Pradia (Cyclaniliprole + Flonicamid)	IRAC 28 + IRAC 9C	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Villanassery Joseph	GA	2018	Foliar	Efficacy with 12 and 16.5 fl oz per acre comparable to the standard Ultra Pure Oil.
33923	Pradia (Cyclaniliprole + Flonicamid)	IRAC 28 + IRAC 9C	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Salmon Sunblaze'	Greenhouse	Nansen	CA	2019	Foliar	Excellent efficacy with 14 oz per 100 gal applied 3 times biweekly.
25832	Precise Acephate (Acephate)	IRAC 1B	Phormium Mealybug (Balanococcus diminutus)	Flax, New Zealand (Phormium tenax) 'Dazler'	Field Container	Bethke	CA	2005		50% control 4 and 6 WAT
25068	QRD 400 (Extract of Chenopodium ambrosioides)		Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Kong Scarlet'	Greenhouse	Oetting	GA	2005	Foliar	At 0.5% rate good efficacy, but not as good as standards
25085	QRD 400 (Extract of Chenopodium ambrosioides)		Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Parrella	CA	2005	Foliar	Experiment 2: No control at 4 oz per 100 gal.
25085	QRD 400 (Extract of Chenopodium ambrosioides)		Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides) 'Wizard Jade'	Greenhouse	Oetting	GA	2005	Foliar	Mediocre efficacy at both 0.25% and 0.5% rates
29622	Rycar (Pyrifluquinazon)	IRAC UN	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Scarlet'	Greenhouse	Chong	SC	2011	Foliar	Mediocre control of nymphs with 18 fl oz per 100 gal applied once.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
29622	Rycar (Pyrifluquinazon)	IRAC UN	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Foliar	Excellent control of nymphs with 18 fl oz per 100 gal applied twice.
30485	Rycar (Pyrifluquinazon)	IRAC UN	Madeira Mealybug (Phenacoccus madeiresis)	Marigold, French (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Foliar	About 74-82 % control with 18 fl oz per 100 gal applied twice.
30292	Rycar (Pyrifluquinazon)	IRAC UN	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Akita'	Greenhouse	Parrella	CA	2011	Foliar	Experiment 1: Excellent control of a very high infestation with 8.6 fl oz per 100 gal applied twice; comparable to Talstar applied once.
25138	Safari 20SG (Dinotefuran)	IRAC 4A	Phormium Mealybug (Balanococcus diminutus)	Flax, New Zealand (Phormium tenax)	Field Container	Bethke	CA	2005	Drench	Provided excellent control at 4 and 6 weeks after treatment
25138	Safari 20SG (Dinotefuran)	IRAC 4A	Phormium Mealybug (Balanococcus diminutus)	Flax, New Zealand (Phormium tenax)	Field Container	Bethke	CA	2005	Foliar	Provided excellent control at 4 and 6 weeks after treatment
25137	Safari 20SG (Dinotefuran)	IRAC 4A	Mexican Mealybug (Phenacoccus gossypii)	Marigold (Tagetes sp.) 'Queen Sophia'	Greenhouse	Davis	MI	2005	Drench	Excellent efficacy by 17 DAT with foliar, by 25 DAT with drench applications
25065	Safari 20SG (Dinotefuran)	IRAC 4A	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) ‘Wizard Scarlet’	Greenhouse	Chong	SC	2011	Foliar	Great control of nymphs with 24 oz per 100 gal applied once.
25065	Safari 20SG (Dinotefuran)	IRAC 4A	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Drench	Excellent control of nymphs with 24 oz per 100 gal applied once.
25065	Safari 20SG (Dinotefuran)	IRAC 4A	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Kong Scarlet'	Greenhouse	Oetting	GA	2005	Foliar	With and without Capsil, provided good efficacy

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
25065	Safari 20SG (Dinotefuran)	IRAC 4A	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) Plectranthus scutellarioides, 'Wizard Velvet Red'	Greenhouse	Gilrein	NY	2018	Foliar	Excellent control of nymphs with 8 oz per 100 gal applied twice biweekly.
25065	Safari 20SG (Dinotefuran)	IRAC 4A	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Velvet Red'	Greenhouse	Gilrein	NY	2019	Foliar	Excellent control of nymphs with 8 oz per 100 gal applied twice every 3 weeks.
30490	Safari 20SG (Dinotefuran)	IRAC 4A	Madeira Mealybug (Phenacoccus madeiresis)	Marigold, French (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Drench	About 60-80 % control with 24 oz per 100 gal applied once.
25071	Safari 20SG (Dinotefuran)	IRAC 4A	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Ludwig	TX	2004	Drench	Excellent control starting at 17 DAT (12, 24, and 48 oz per 100 gal).
25071	Safari 20SG (Dinotefuran)	IRAC 4A	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Ludwig	TX	2004	Drench	Excellent efficacy at 12, 24, and 48 oz per 100 gal starting at 21 DAT.
25071	Safari 20SG (Dinotefuran)	IRAC 4A	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Parrella	CA	2005	Drench	Experiment 1: Poor control at 12 and 24 oz per 100 gal.
25071	Safari 20SG (Dinotefuran)	IRAC 4A	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Parrella	CA	2005	Foliar	Experiment 1: Good control at 4 and 8 oz per 100 gal + Silwet; better than Marathon.
25071	Safari 20SG (Dinotefuran)	IRAC 4A	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides) 'Wizard King'	Greenhouse	Oetting	GA	2005	Foliar	Safari drenches provided better control (mostly >95% throughout experiment) than foliar sprays (between 43 and 85% control)
30295	Safari 20SG (Dinotefuran)	IRAC 4A	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Akita'	Greenhouse	Parrella	CA	2011	Drench	Experiment 1: Good control of a very high infestation with 24 oz per 100 gal; comparable to Talstar.
28055	Safari 20SG (Dinotefuran)	IRAC 4A	Citrus Mealybug (Planococcus citri)	Zinnia (Zinnia sp.) 'Sunny Time'	Greenhouse	Parrella	CA	2008	Drench	Good to excellent control at 12 and 24 oz per 100 gal.
28055	Safari 20SG (Dinotefuran)	IRAC 4A	Citrus Mealybug (Planococcus citri)	Zinnia (Zinnia sp.) 'Sunny Time'	Greenhouse	Parrella	CA	2008	Foliar	Excellent control at 0.2 and 0.4 oz per 100 gal.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
31352	Safari 20SG (Dinotefuran)	IRAC 4A	Root Mealybug, Hibiscus (Ripersiella hibisci)	Australian Catchbird Tree (Pisonia brunoniana)	Field Container	Hara	HI	2012	Foliar	Significantly reduced adults and nymphs with 24 oz per 100 gal applied once; better than Orthene.
29367	Safari 20SG (Dinotefuran)	IRAC 4A	Root Mealybug, Hibiscus (Ripersiella hibisci)	Palm, Guangxi Lady (Rhapis robusta)	Greenhouse	Hara	HI	2009	Drench	100 % control of rhizoecus root and pineapple mealybugs at 6 g per ft plant height.
29623	Safari 2G (Dinotefuran)	IRAC 4A	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) ‘Wizard Scarlet’	Greenhouse	Chong	SC	2010	Broadcast	Excellent control of nymphs with 2.6 g per gal applied once.
29623	Safari 2G (Dinotefuran)	IRAC 4A	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Broadcast	Excellent control of nymphs with 2.6 g per gal potting media applied once.
30491	Safari 2G (Dinotefuran)	IRAC 4A	Madeira Mealybug (Phenacoccus madeiresis)	Marigold, French (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Broadcast	About 60-80 % control with 2.6 g per gal media applied once.
32336	Sarisa 50SL (Cyclaniliprole)	IRAC 28	Miscanthus Mealybug (Miscanthiococcus miscanthi)	Silvergrass, Japanese (Miscanthus sinensis)	Field Container	Kunkel	DE	2015	Foliar	28 fl oz per 100 gal may have provided some control; high variability between the 6 replicates made detecting significant differences between treatments difficult.
33869	Sarisa 50SL (Cyclaniliprole)	IRAC 28	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) Plectranthus scutellarioides, ‘Wizard Velvet Red’	Greenhouse	Gilrein	NY	2018	Foliar	No control of nymphs with 22 and 28 fl oz per 100 gal applied twice biweekly.
33869	Sarisa 50SL (Cyclaniliprole)	IRAC 28	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Premium Sun Chocolate Mint'	Greenhouse	Vafaie	TX	2019	Foliar	Poor control with 28 fl oz per 100 gal + Capsil applied 3 times biweekly.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
33869	Sarisa 50SL (Cyclaniliprole)	IRAC 28	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Velvet Red'	Greenhouse	Gilrein	NY	2019	Foliar	Poor control of nymphs with 28 fl oz per 100 gal applied 3 times biweekly; inferior to Safari. Minor phytotoxicity (leaf necrosis spots and edge burn).
33613	Sarisa 50SL (Cyclaniliprole)	IRAC 28	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Villanassery Joseph	GA	2018	Foliar	Poor efficacy with 22 and 28 fl oz per acre; inferior to the standard Ultra Pure Oil.
33924	Sarisa 50SL (Cyclaniliprole)	IRAC 28	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Salmon Sunblaze'	Greenhouse	Nansen	CA	2019	Foliar	Some population suppression with 28 fl oz + Capsil per 100 gal applied 3 times biweekly.
34409	SP3014 (SP3014)		Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides) 'Wizard Jade'	Greenhouse	Chong	SC	2020	Foliar	Great initial efficacy against an excessive citrus mealybug infestation with 13 fl oz per 100 gal + Capsil. No phytotoxicity.
30494	SuffOil X (Synergy) (Petroleum Oil)	FRAC NC	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Foliar	Excellent control of nymphs with 2 gal per 100 gal applied twice.
30294	Talstar NF (Bifenthrin)	IRAC 3A	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Akita'	Greenhouse	Parrella	CA	2011	Foliar	Experiment 1: Good control of a very high infestation with 20 oz per 100 gal.
30294	Talstar NF (Bifenthrin)	IRAC 3A	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Akita'	Greenhouse	Parrella	CA	2011	Foliar	Experiment 2:Good initial control through 3 WAT; by 2 MAT poor control of a very high infestation with 20 oz per 100 gal.
25142	Talus 40SC (Buprofezin)	IRAC 16	Mexican Mealybug (Phenacoccus gossypii)	Marigold (Tagetes sp.) 'Queen Sophia'	Greenhouse	Davis	MI	2005	Foliar	Excellent efficacy by 25 DAT
25064	Talus 40SC (Buprofezin)	IRAC 16	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'King Scarlet'	Greenhouse	Oetting	GA	2005	Foliar	Both 21.5 an 43 oz per 100 gal provided excellent control
25070	Talus 40SC (Buprofezin)	IRAC 16	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Ludwig	TX	2004	Foliar	Great efficacy starting at 21 DAT with 21.5, 43, and 86 fl oz per 100 gal.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
25070	Talus 40SC (Buprofezin)	IRAC 16	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Ludwig	TX	2004	Foliar	Great to excellent control starting at 17 DAT (21.5, 43, and 86 fl oz per 100 gal).
25070	Talus 40SC (Buprofezin)	IRAC 16	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Parrella	CA	2005	Foliar	Experiment 2: Good control at 18 oz per 100 gal + Silwet; better than Marathon.
25070	Talus 40SC (Buprofezin)	IRAC 16	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides) 'Jade Wizard'	Greenhouse	Oetting	GA	2005	Foliar	Excellent efficacy from 4 weeks on until the end of the experiment
28056	Talus 40SC (Buprofezin)	IRAC 16	Citrus Mealybug (Planococcus citri)	Zinnia (Zinnia sp.) 'Sunny Time'	Greenhouse	Parrella	CA	2008	Foliar	Good to excellent control at 12 oz per 100 gal.
32338	Talus 70DF (Buprofezin)	IRAC 16	Miscanthus Mealybug (Miscanthiococcus miscanthi)	Silvergrass, Japanese (Miscanthus sinensis)	Field Container	Kunkel	DE	2015	Foliar	High variability between the 6 replicates made detecting significant differences between treatments difficult.
29759	Talus 70DF (Buprofezin)	IRAC 16	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Scarlet'	Greenhouse	Chong	SC	2010	Foliar	Excellent control of nymphs with 14 oz per 100 gal applied once.
29759	Talus 70DF (Buprofezin)	IRAC 16	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Velvet Red'	Greenhouse	Gilrein	NY	2018	Foliar	Great control of nymphs with 14 oz per 100 gal applied twice weekly; almost comparable to Safari.
29759	Talus 70DF (Buprofezin)	IRAC 16	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'King Salmon Pink'	Greenhouse	Ludwig	TX	2011	Foliar	Excellent control of nymphs with 12 oz per 100 gal applied twice.
30483	Talus 70DF (Buprofezin)	IRAC 16	Madeira Mealybug (Phenacoccus madeiresis)	Marigold, French (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Foliar	About 95-98 % control with 14 oz per 100 gal applied twice.
33617	Talus 70DF (Buprofezin)	IRAC 16	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Villanassery Joseph	GA	2018	Foliar	Efficacy with 14 oz per acre comparable to the standard Ultra Pure Oil.
30293	Talus 70DF (Buprofezin)	IRAC 16	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Akita'	Greenhouse	Parrella	CA	2011	Foliar	Experiment 2: Good control of a very high infestation by 3 WAT with 12 oz per 100 gal applied once; this was only treatment to persist with good efficacy at 2 MAT.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
30293	Talus 70DF (Buprofezin)	IRAC 16	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Salmon Sunblaze'	Greenhouse	Nansen	CA	2019	Foliar	Excellent efficacy with 14 oz per 100 gal applied twice biweekly. Minor phytotoxicity.
33929	TetraCURB Concentrate (Rosemary Oil)		Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Premium Sun Chocolate Mint'	Greenhouse	Vafaie	TX	2019	Foliar	Poor control with 128 fl oz per 100 gal applied 5 times weekly.
33929	TetraCURB Concentrate (Rosemary Oil)		Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Velvet Red'	Greenhouse	Gilrein	NY	2019	Foliar	Good control of nymphs with 128 fl oz per 100 gal applied 5 times weekly; inferior to Safari. Minor phytotoxicity (leaf necrotic spots and edge burn).
33925	TetraCURB Concentrate (Rosemary Oil)		Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Salmon Sunblaze'	Greenhouse	Nansen	CA	2019	Foliar	Excellent efficacy with 128 fl oz per 100 gal applied 5 times weekly. Minor phytotoxicity.
33930	TetraCURB Organic (Rosemary Oil)		Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Premium Sun Chocolate Mint'	Greenhouse	Vafaie	TX	2019	Foliar	Poor control with 128 fl oz per 100 gal applied 5 times weekly.
33930	TetraCURB Organic (Rosemary Oil)		Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Velvet Red'	Greenhouse	Gilrein	NY	2019	Foliar	Good control of nymphs with 128 fl oz per 100 gal applied 5 times weekly; inferior to Safari. Minor phytotoxicity (leaf necrotic spots and edge burn).
33926	TetraCURB Organic (Rosemary Oil)		Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Salmon Sunblaze'	Greenhouse	Nansen	CA	2019	Foliar	Some population suppression at 2 weeks after applicationl with 128 fl oz per 100 gal applied 5 times weekly but by end of the experiment this level of impact had dissipated.
25205	TriStar 30SG (Acetamiprid)	IRAC 4A	Mexican Mealybug (Phenacoccus gossypii)	Marigold (Tagetes sp.) 'Queen Sophia'	Greenhouse	Davis	MI	2005	Foliar	Excellent efficacy by 25 DAT
29624	TriStar 30SG (Acetamiprid)	IRAC 4A	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) ‘Wizard Scarlet’	Greenhouse	Chong	SC	2011	Foliar	Excellent control of nymphs with 8 oz per 100 gal + Capsil applied twice at 14-day interval.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
30484	TriStar 30SG (Acetamiprid)	IRAC 4A	Madeira Mealybug (Phenacoccus madeiresis)	Marigold, French (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Foliar	About 90-92 % control with 8 oz per 100 gal applied twice.
28057	TriStar 30SG (Acetamiprid)	IRAC 4A	Citrus Mealybug (Planococcus citri)	Zinnia (Zinnia sp.) 'Sunny Time'	Greenhouse	Parrella	CA	2008	Foliar	Excellent control at 2.7 and 5.3 oz per 100 gal.
25081	TriStar 70WSP (Acetamiprid)	IRAC 4A	Phormium Mealybug (Balanococcus diminutus)	Flax, New Zealand (Phormium tenax)	Field Container	Bethke	CA	2005		Good to excellent control throughout this experiment
25063	TriStar 70WSP (Acetamiprid)	IRAC 4A	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Kong Scarlet'	Greenhouse	Oetting	GA	2005	Foliar	Without Capsil poor efficacy; with Capsil provided great efficacy
25069	TriStar 70WSP (Acetamiprid)	IRAC 4A	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Ludwig	TX	2004	Foliar	Excellenct control starting at 17 DAT (32, 64, 128 g per 100 gal).
25069	TriStar 70WSP (Acetamiprid)	IRAC 4A	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Ludwig	TX	2004	Foliar	Excellent efficacy using 32, 64, and 128 g per 100 gal starting at 21 DAT.
25069	TriStar 70WSP (Acetamiprid)	IRAC 4A	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Parrella	CA	2005	Foliar	Experiment 1: Excellent control at 1.7 and 3.4 oz per 100 gal + Silwet; better than Marathon.
25069	TriStar 70WSP (Acetamiprid)	IRAC 4A	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides) 'Jade Wizard'	Greenhouse	Oetting	GA	2005	Foliar	Excellent efficacy
33618	Ultra Pure Oil (BASF) (Petroleum Oil)	FRAC NC	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Villanassery Joseph	GA	2018	Foliar	Mediocre efficacy with 2 gal per acre.
33618	Ultra Pure Oil (BASF) (Petroleum Oil)	FRAC NC	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides) 'Wizard Jade'	Greenhouse	Chong	SC	2020	Foliar	No significant efficacy against an excessive citrus mealybug infestation with 2 gal per 100 gal. No phytotoxicity.
34410	V-10433 (V-10433)		Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides) 'Wizard Jade'	Greenhouse	Chong	SC	2020	Foliar	No significant efficacy against an excessive citrus mealybug infestation with 11 fl oz per 100 gal. No phytotoxicity.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
34412	Velifer (Beauveria bassiana strain PPRI 5339)		Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides) 'Wizard Jade'	Greenhouse	Chong	SC	2020	Foliar	Some initial efficacy against an excessive citrus mealybug infestation with 13 fl oz per 100 gal + Capsil. No phytotoxicity.
32334	Ventigra Insecticide (Afidopyropen)	IRAC 9D	Miscanthus Mealybug (Miscanthiococcus miscanthi)	Silvergrass, Japanese (Miscanthus sinensis)	Field Container	Kunkel	DE	2015	Foliar	High variability between the 6 replicates made detecting significant differences between treatments difficult.
33871	Ventigra Insecticide (Afidopyropen)	IRAC 9D	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Velvet Red'	Greenhouse	Gilrein	NY	2018	Foliar	Great control of nymphs with 4.8 an 7 fl oz per 100 gal applied twice weekly; almost comparable to Safari.
33871	Ventigra Insecticide (Afidopyropen)	IRAC 9D	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Premium Sun Chocolate Mint'	Greenhouse	Vafaie	TX	2019	Foliar	Excellent control with 4.8 and 7 fl oz per 100 gal applied twice biweekly.
33871	Ventigra Insecticide (Afidopyropen)	IRAC 9D	Madeira Mealybug (Phenacoccus madeiresis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Velvet Red'	Greenhouse	Gilrein	NY	2019	Foliar	Excellent control of nymphs with 7 fl oz per 100 gal applied twice biweekly; comparable to Safari.
33615	Ventigra Insecticide (Afidopyropen)	IRAC 9D	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Villanassery Joseph	GA	2018	Foliar	Efficacy with 7 fl oz per acre comparable to the standard Ultra Pure Oil; lower rate inferior.
33927	Ventigra Insecticide (Afidopyropen)	IRAC 9D	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Salmon Sunblaze'	Greenhouse	Nansen	CA	2019	Foliar	Some population suppression with 7 fl oz + Capsil per 100 gal applied twice biweekly.

Label Suggestions

Based upon data contained within this summary, we suggest that Syngenta consider adding tea scale (*Fiorinia theae*) to the Mainspring label. Similarly, we suggest that Dow consider adding this pest to the XXpire label. BASF may consider adding Madeira mealybug to the Ventigra label.

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