



[Environmental Horticulture Program Research Summaries](#)

IR-4 Environmental Horticulture Program Mealybug Efficacy

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Abstract

Managing mealybugs and scale 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 often targeting stems or leaf petioles not readily accessible due to dense foliage. 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 insecticides for mealybugs to add additional species to existing registrations and screen new active ingredients. Over time, mealybug efficacy has been re-established as high priority at subsequent workshops (2019, 2021). This research was conducted between 2004 and 2022. This summary contains outcomes from 32 experiments established to screen new active ingredients for impact on mealybugs.

Across crop and mealybug species, the products with the most impact on populations include ISM-555, TriStar, Orthene, Pradia, Safari, Talus, Flagship, Rycar, A169018, Aria, Kontos, and Ventigra. MBI 205, TetraCURB Concentrate, and SP3014 also provided acceptable reductions in populations. Seven different mode of action groups are represented. There is the opportunity to include mealybugs on active ingredients that are not yet registered for mealybugs and expand currently registered labels with additional mealybug species.

Introduction

Managing mealybugs and scale 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 often targeting stems or leaf petioles not readily accessible due to dense foliage. 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 insecticides for mealybugs to add additional species to existing registrations and screen new active ingredients. Over time, mealybug efficacy has been re-established as high priority at subsequent workshops (2019, 2021). This research was conducted between 2004 and 2022. This summary contains outcomes from 32 experiments established to screen new active ingredients for impact on mealybugs.

Materials and Methods

Fifty-four products or numbered compounds representing 43 actives were screened for efficacy on seven species of mealybugs on 13 different host crops (not all products tested on all mealybugs or crops). Most products were applied twice as foliar sprays approximately 14 days apart. Flagship, Kontos, Mainspring, Merit (Marathon), and Safari were also applied as container drench, in-ground drench, trunk spray, soil broadcast, or media mix for foliar mealybugs. 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: 05-010, 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, 20-004, 21-004 and 22-005. 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 2022

Product Trade Name	Manufacturer	Active Ingredients	Code Numbers	MOA Class	Application Method	Rate (per 100 gal)	# Exp.
A16901B 45WG **	Syngenta Crop Protection	Thiamethoxam + cyantraniliprole	A16901B	IRAC 4A + IRAC 28	Drench	10 oz	5
					Foliar	6.7 oz	3
Acelepryn	Syngenta Crop Protection (former Dupont Crop Protection) product	Chlorantraniliprole	DPX-E2Y45	IRAC 28	Drench	0.8 fl oz	1
Altus	Envu (formerly Bayer)	Flupyradifurone	BYI-2960	IRAC 4D	Foliar	14 fl oz	6
Aria 50SG	FMC	Fonicamid		IRAC 29	Foliar	60 g	4
					Foliar	120 g	4
					Drench	120 g	1
AzaGuard	BioSafe Systems	Azadirachtin		IRAC UN	Foliar	16 fl oz	3
					Foliar	32 fl oz	2
Bountify	Pro Farm Group (formerly Marrone Bio Innovations)	Burkholderia rinojensis strain A396	MBI 306		Foliar	5 fl oz	4
					Foliar	10 fl oz	2
					Foliar	20 fl oz	4
BW133 **	Bioworks	BW133	BW133	FRAC NC	Foliar	5 lb	2
BW238 ES **	Bioworks	BW238 ES	BW149, BW238		Foliar	64 fl oz	1
BW238 WP **	Bioworks	BW238 WP	BW149, BW238		Foliar	2 lb	1
BW279N **	Bioworks	BW279N	BW279N		Foliar	150 fl oz	1
					Foliar	300 fl oz	1
Chlorpyrifos 2.32%	MicroFlo	Chlorpyrifos		IRAC 1B	Foliar	32 oz	1
Distance	Valent USA	Pyriproxyfen		IRAC 7C	Foliar	8 fl oz	2
					Foliar	12 fl oz	7
					Foliar	16 fl oz	2
					Foliar	32 fl oz	2
DuraGuard	Whitmire	Chlorpyrifos		IRAC 1B	Foliar	7 fl oz	1
Flagship 0.22G	Syngenta Crop Protection	Thiamethoxam		IRAC 4A	Broadcast	6 g per gal media or per 6-in pot	3
Flagship 25WG	Syngenta Crop Protection	Thiamethoxam	CGA 293343	IRAC 4A	Drench	8.0 oz	2
					Foliar	2.0 oz	7
					Foliar	4.0 oz	7
					Foliar	8.0 oz	4
Fulcrum	OHP	Pyriproxyfen		IRAC 7C	Foliar	12 fl oz	1
Hachi-Hachi EC	SePRO Corporation	Tolfenpyrad	NAI-2302	IRAC 21A	Foliar	32 fl oz	1

Product Trade Name	Manufacturer	Active Ingredients	Code Numbers	MOA Class	Application Method	Rate (per 100 gal)	# Exp.
ISM-555 **	Syngenta Crop Protection	ISM-555, A21377X	ISM-555		Foliar	3.84 fl oz	9
					Foliar	5.76 fl oz	8
KOC22018-8 **	Kemin Crop Technologies	Botanical Oil Blend			Foliar	128 fl oz	4
Kontos 240SC	OHP	Spirotetramat	BYI 8330	IRAC 23	Drench	3.4 fl oz	5
					Foliar	3.4 fl oz	3
Mainspring GNL 200SC	Syngenta Crop Protection	Cyantraniliprole	A20520A	IRAC 28	Drench	12 fl oz	1
Marathon II	OHP	Imidacloprid		IRAC 4A	Foliar	1.7 fl oz	2
MBI 203 SC2 **	Pro Farm Group (formerly Marrone Bio Innovations)	MBI 203	MBI 203		Drench	2 qt	1
					Foliar	2 qt	1
					Foliar	1 gal	9
					Foliar	2 gal	2
MBI 205 **	Pro Farm Group (formerly Marrone Bio Innovations)	MBI 205	MBI 205		Drench	4 qt	1
					Foliar	3 gal	2
Merit 75WP	Envu (formerly Bayer)	Imidacloprid		IRAC 4A	Foliar	20 g per 1250 pots	1
Mesurool 75-W	Gowan	Methicarb		IRAC 1A	Foliar	0.5 lb	1
Natural Solutions - V. lecanii	Natural Solutions	Verticillium lecanii			Foliar	1:1000	1
NI02ES-1 **	Bioworks	NI02ES-1	NI02ES-1, BW400				
Orthene 75S					Foliar	10.5 oz	1
Orthene TTO 97 (Valent)	Valent USA	Acephate		IRAC 1B	Foliar	8 oz	2
					Foliar	10.7 oz	1
					Foliar	16 oz	1
Pradia SL	OHP	Cyclaniliprole + Flonicamid	IKI-3326	IRAC 28 + IRAC 29	Foliar	12 fl oz	2
					Foliar	16.5 fl oz	3
Precise Acephate	Agrium Advanced Technologies	Acephate		IRAC 1B	Broadcast	2 tbs per pot	1
QRD 400 (also known as Facin) **	AgraQuest	Extract of Chenopodium ambrosioides	QRD 400	IRAC UNE	Foliar	4 oz	1
					Foliar	0.25% w ai:v	2
					Foliar	0.5% w ai:v	2
RTSA 721 **	Rainbow Treecare Scientific	RTSA 721	RTSA 721		Basal Spray	17 fl oz	2
					Basal Spray	34 fl oz	2
					Drench	4 gal	2
					Drench	8 gal	2
Rycar	SePRO Corporation	Pyrifluquinazon	SP3009, NNI-0101	IRAC UN	Foliar	8.6 fl oz	1
					Foliar	18 fl oz	2

Product Trade Name	Manufacturer	Active Ingredients	Code Numbers	MOA Class	Application Method	Rate (per 100 gal)	# Exp.
Safari 20SG	Valent USA	Dinotefuran		IRAC 4A	Drench	12 oz	6
					Drench	24 oz	10
					Drench	48 oz	2
					Drench	6 g per DBH	1
					Foliar	8 oz	7
Safari 2G	Valent USA	Dinotefuran	V-10112 2G	IRAC 4A	Broadcast	1 g per 6-in pot	1
					Media mix	2.6 g per gal media	1
Sarisa 50SL	OHP	Cyclaniliprole	IKI-3106	IRAC 28	Foliar	22 fl oz	2
					Foliar	28 fl oz	5
SP3014 **	SePRO Corporation	SP3014	SP3014		Foliar	13 fl oz	4
					Foliar	16 fl oz	6
					Foliar	32 fl oz	4
SuffOil X (Synergy)	Bioworks	Petroleum Oil	BW280	FRAC NC	Foliar	2 gal	1
Talstar NF	FMC	Bifenthrin		IRAC 3A	Foliar	20 fl oz	2
Talus 40SC	SePRO Corporation	Buprofezin		IRAC 16	Foliar	18 fl oz	2
					Foliar	21.5 fl oz	4
					Foliar	43 fl oz	4
					Foliar	86 fl oz	2
Talus 70DF	SePRO Corporation	Buprofezin		IRAC 16	Foliar	12 oz	1
					Foliar	14 oz	4
Talus WP	SePRO Corporation	Buprofezin		IRAC 16			
TetraCURB Concentrate	Kemin Crop Technologies	Rosemary Oil		IRAC UNE	Foliar	128 fl oz	4
TetraCURB Max	Kemin Crop Technologies	castor oil + rosemary oil + clove oil + peppermint oil		IRAC UNE	Foliar	256 fl oz	4
TetraCURB Organic	Kemin Crop Technologies	Rosemary Oil		IRAC UNE	Foliar	128 fl oz	4
TriStar 30SG	NuFarm	Acetamiprid		IRAC 4A	Foliar	1.7 oz	1
					Foliar	3.4 oz	1
					Foliar	4 oz (112 g)	1
					Foliar	8 oz (224 g)	2
TriStar 70WSP	Cleary	Acetamiprid		IRAC 4A	Foliar	1.1 oz (32 g)	2
					Foliar	1.7 oz (48 g)	2
					Foliar	2.3 oz (64 g)	2
					Foliar	3.3 oz (96 g)	2
					Foliar	4 oz (112 g)	1
				Foliar	4.5 oz (128 g)	2	

Product Trade Name	Manufacturer	Active Ingredients	Code Numbers	MOA Class	Application Method	Rate (per 100 gal)	# Exp.
					Foliar	8 oz (224 g)	1
Ultra Pure Oil (BASF)	BASF Corporation	Petroleum Oil		FRAC NC	Foliar	2 gal	2
V-10433	Valent USA	V-10433	V-10433		Foliar	11 fl oz	9
Velifer	BASF Corporation	Beauveria bassiana Strain PPRI 5339		IRAC UNF	Foliar	13 oz	2
Ventigra Insecticide	BASF Corporation	Afidopyropen	BAS 440 00I	IRAC 9D	Foliar	4.8 fl oz	4
					Foliar	7 fl oz	7

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

Results and Summary

Comparative Efficacy on Mealybugs

Mealybugs are closely related to scale insects but are soft, oval insects covered in wax. They feed on phloem of many different plants in residential and commercial landscapes and in greenhouses and interiorscapes. In addition to reducing plant vigor and quality, mealybugs secrete honeydew in which sooty mold grows further marring plant quality and photosynthetic potential.

Mealybugs are difficult to manage because contact materials may not penetrate dense foliar or undersides of leaf and systemic materials move throughout plants primarily in xylem, not phloem.

Since 2005, IR-4 has screened products against Citrus Mealybug, Madeira Mealybug, Stiped Mealybug, Mexican Mealybug, Phormium Mealybug, and two species of root mealybugs. Across all species tested, the best products were ISM-555, TriStar, Orthene, Pradia, Safari, Talus, Flagship. Rycar, Aria, Kontos, Ventigra, SP3014, TetraCURB Concentrate also performed well and can be included into an overall program to manage mealybugs and other insect pests.

For citrus mealybug, TriStar, ISM-555, Flaship 25WG, Talus, Safari, and SP3014 provided acceptable reduction in populations in at least 3 experiments.

For madeira mealybug, Orthene, Ventigra, Pradia, Talus, Kontos, Safari 20SG, Safari 2G, Flagship, and Rycar provided good to excellent reduction in populations in at least 3 experiments.

These products also tended to provide good to excellent management of striped, Mexican, and phormium mealybugs, but too few experiments have been conducted on these species so far.

For root mealybugs, Kontos was the only product tested in more than 3 experiments and it provided good to excellent efficacy. Safari 20SG, Grandevo, and Aria have potential.

Product_Actives	MOA	Citrus Mealybug (Planococcus citri)	Madeira Mealybug (Phenacoccus madeirensis)	Mealybug, Striped (Ferrisia virgata)	Mexican Mealybug (Phenacoccus gossypii)	Phormium Mealybug (Balanococcus diminutus)	Root Mealybug, Hibiscus (Ripersiella hibisci)	Root Mealybug, (Rhizoecus sp.)
A16901B 45WG (Thiamethoxam + cyantraniliprole)	IRAC 4A + IRAC 28	4.5 (4 - 5) n2 Labeled	3.0 (1 - 5) n6 Labeled				5.0 (5 - 5) n1 Labeled	
Acelepryn (Dupont) (Chlorantraniliprole)	IRAC 28						1.0 (1 - 1) n1	
Altus (Flupyradifurone)	IRAC 4D	2.0 (1 - 3) n2 Labeled	2.0 (1 - 3) n3 Labeled					
Aria 50SG (Flonicamid)	IRAC 29	3.0 (1 - 5) n3 Labeled			5.0 (5 - 5) n1 Labeled		4.0 (4 - 4) n1 Labeled	
AzaGuard (Azadirachtin)	IRAC UN	1.5 (1 - 2) n2	2.0 (1 - 3) n2					
Bountify (MBI 306) (Burkholderia rinojensis strain A396)	unknown	2.0 (1 - 5) n5	1.0 (1 - 1) n1	1.0 (1 - 1) n1				
BW133 (BW133)	FRAC NC	4.0 (3 - 5) n2						
BW238 ES (BW238 ES)	unknown	1.0 (1 - 1) n1						
BW238 WP (BW238 WP)	unknown	1.0 (1 - 1) n1						
BW279N (BW279N)	unknown		1.0 (1 - 1) n1					
Cygon 2E (Dimethoate)	IRAC 1B							5.0 (5 - 5) n1
Distance (Pyriproxyfen)	IRAC 7C	2.7 (1 - 5) n6 Labeled	2.7 (1 - 4) n3 Labeled	2.0 (2 - 2) n1 Labeled				
DuraGuard (Chlorpyrifos)	IRAC 1B	1.0 (1 - 1) n1						
Flagship 0.22G (Thiamethoxam)	IRAC 4A		2.5 (1 - 3) n4 Labeled					
Flagship 25WG (Thiamethoxam)	IRAC 4A	4.4 (4 - 5) n5 Labeled	3.6 (2 - 5) n5 Labeled		4.0 (4 - 4) n1 Labeled	4.0 (4 - 4) n1 Labeled		
Hachi-Hachi EC (Tolfenpyrad)	IRAC 21A		5.0 (5 - 5) n1					
Horticultural Oil (Horticultural Oil)	FRAC NC		5.0 (5 - 5) n1					
ISM-555 (ISM-555, A21377X)	unknown	4.8 (4 - 5) n5	5.0 (5 - 5) n1	5.0 (5 - 5) n1				

Product_Actives	MOA	Citrus Mealybug (Planococcus citri)	Madeira Mealybug (Phenacoccus madeirensis)	Mealybug, Striped (Ferrisia virgata)	Mexican Mealybug (Phenacoccus gossypii)	Phormium Mealybug (Balanococcus diminutus)	Root Mealybug, Hibiscus (Ripersiella hibisci)	Root Mealybug, (Rhizoecus sp_)
KOC22018-8 (Botanical Oil Blend)	unknown	3.0 (3 - 3) n1	2.0 (1 - 3) n2					
Kontos 240SC (Spirotetramat)	IRAC 23	1.5 (1 - 2) n2 Labeled	4.3 (2 - 5) n4 Labeled				3.8 (3 - 5) n4 Labeled	
Mainspring GNL 200SC (Cyantraniliprole)	IRAC 28		1.0 (1 - 1) n1					
Marathon II (Imidacloprid)	IRAC 4A	1.0 (1 - 1) n2 Labeled						
MBI 203 SC2 (MBI 203)	unknown	1.3 (1 - 2) n6	1.0 (1 - 1) n2	1.0 (1 - 1) n1			4.0 (4 - 4) n1	
MBI 205 (MBI 205)	unknown	2.0 (2 - 2) n1	5.0 (5 - 5) n1				2.0 (2 - 2) n1	
Merit 75WP (Imidacloprid)	IRAC 4A		1.0 (1 - 1) n1					
Mesurool 75-W (Methicarb)	IRAC 1A	3.0 (3 - 3) n1						
Natural Solutions - V. lecanii (Verticillium lecanii)	unknown	3.0 (3 - 3) n1						
Orthene TTO 97 (Valent) (Acephate)	IRAC 1B	5.0 (5 - 5) n1 Labeled	5.0 (5 - 5) n4 Labeled		5.0 (5 - 5) n1 Labeled		1.0 (1 - 1) n1 Labeled	
Pradia (Cyclaniliprole + Flonicamid)	IRAC 28 + IRAC 29	3.5 (2 - 5) n2	4.7 (4 - 5) n3					
Precise Acephate (Acephate)	IRAC 1B					1.0 (1 - 1) n1 Labeled		
QRD 400 (Extract of Chenopodium ambrosioides)	IRAC UNE	1.5 (1 - 2) n2	3.0 (3 - 3) n1					
RTSA 721 (RTSA 721)	unknown	1.7 (1 - 2) n3						
Rycar (Pyrifluquinazon)	IRAC UN	5.0 (5 - 5) n1 Labeled	3.3 (2 - 5) n3 Labeled					
Safari 20SG (Dinotefuran)	IRAC 4A	3.8 (1 - 5) n8 Labeled	4.1 (2 - 5) n7 Labeled		5.0 (5 - 5) n1 Labeled	5.0 (5 - 5) n2 Labeled	4.5 (4 - 5) n2 Labeled	
Safari 2G (Dinotefuran)	IRAC 4A		4.0 (2 - 5) n3 Labeled					

Product_Actives	MOA	Citrus Mealybug (Planococcus citri)	Madeira Mealybug (Phenacoccus madeirensis)	Mealybug, Striped (Ferrisia virgata)	Mexican Mealybug (Phenacoccus gossypii)	Phormium Mealybug (Balanococcus diminutus)	Root Mealybug, Hibiscus (Ripersiella hibisci)	Root Mealybug, (Rhizoecus sp_)
Sarisa 50SL (Cyclaniliprole)	IRAC 28	1.5 (1 - 2) n2 Labeled	1.0 (1 - 1) n3 Labeled					
SP3014 (SP3014)	unknown	3.2 (2 - 4) n5	4.0 (4 - 4) n1	1.0 (1 - 1) n1				
SuffOil X (Synergy) (Petroleum Oil)	FRAC NC		3.0 (3 - 3) n1 Labeled					
Talstar NF (Bifenthrin)	IRAC 3A	3.0 (3 - 3) n2 Labeled						
Talus 40SC (Buprofezin)	IRAC 16	3.8 (3 - 4) n5 Labeled	5.0 (5 - 5) n1 Labeled		5.0 (5 - 5) n1 Labeled			
Talus 70DF (Buprofezin)	IRAC 16	3.3 (2 - 5) n3 Labeled	4.5 (4 - 5) n4 Labeled					
TetraCURB Concentrate (Rosemary Oil)	IRAC UNE	5.0 (5 - 5) n1	2.0 (1 - 3) n2					
TetraCURB Max (castor oil + rosemary oil + clove oil + peppermint oil)	unknown	2.0 (2 - 2) n1	3.0 (3 - 3) n1	3.0 (3 - 3) n1				
TetraCURB Organic (Rosemary Oil)	IRAC UNE	1.0 (1 - 1) n1	2.0 (1 - 3) n2					
TriStar 30SG (Acetamiprid)	IRAC 4A	5.0 (5 - 5) n1 Labeled	4.5 (4 - 5) n2 Labeled		5.0 (5 - 5) n1 Labeled			
TriStar 70WSP (Acetamiprid)	IRAC 4A	5.0 (5 - 5) n4 Labeled	4.0 (4 - 4) n1 Labeled			4.0 (4 - 4) n1 Labeled		
Ultra Pure Oil (BASF) (Petroleum Oil)	FRAC NC	1.5 (1 - 2) n2						
V-10433 (V-10433)	unknown	1.8 (1 - 3) n5	2.0 (2 - 2) n1	1.0 (1 - 1) n1				
Velifer (Beauveria bassiana Strain PPRI 5339)	IRAC UNF	1.0 (1 - 1) n1 Labeled		2.0 (2 - 2) n1 Labeled				
Ventigra Insecticide (Afidopyropen)	IRAC 9D	2.0 (2 - 2) n2 Labeled	4.7 (4 - 5) n3 Labeled	2.0 (2 - 2) n1 Labeled				

Average rating on a scale of 1 – 5 with 1 = 0 to about 70% efficacy and 5 = 100 efficacy or equivalent to non-inoculated control; minimum to maximum rating; number of trials. A rating of 2 or lower is considered unacceptable. A rating of 3 or higher is considered commercially acceptable. For insect/product combinations that are blank, IR-4 has not screened this combination.

Citrus Mealybug

Ludwig 2004. In the first of two experiments conducted by Ludwig on citrus mealybug (*Planococcus citri*) in 2004, five pesticides were evaluated 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 2). 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 3). 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 2005. 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 4). 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 2005. Parella conducted studies for control of citrus mealybug on coleus (*Solenostemon x hybridus*) in 2005. 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.

Parella 2009. Parella conducted studies for control of citrus mealybug on zinnia (*Zinnia elegans*) 'Sunny Time' in 2009. In the 2009 experiment, all pesticides except the low rate of Aria provided some degree of citrus mealybug control (Table 5). 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.

Parella 2011. Parella conducted studies for control of citrus mealybug on rose (*Rosa* sp) 'Akita' in 2011. In this experiment of chemical and biorational products, 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 (Table 6). 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 (Table 7).

Joseph 2018. 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 8).

Nansen 2019. Nansen studied 10 active ingredients to manage 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 highly effective treatments included Pradia, Talus and TetraCURB Concentrate (Table 9). 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).

Nansen 2020. Nansen studied 8 active ingredients to manage citrus mealybug on miniature rose (*Rosa* sp.) in 2020. 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 most effective treatments were BW-133, ISM-555, and SP3014 for both crawlers and mobile adults (). Suppression of populations occurred with RTSA at the higher rate. The number of egg masses declined in these same treatments (data not shown, refer to researcher report). None of the treatments caused phytotoxicity or impacted plant growth.

Chong 2020. In an experiment conducted on new actives to manage citrus mealybug on coleus, ISM 555 and UltraPure Oil provided the most effective control (Table 11). 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 Bountify 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.

Villanassery Joseph 2021. In an experiment conducted on new actives to manage citrus mealybug on coleus, none of the treatments were statistically significantly different than the nontreated control including the standard (ISM 555 , MBI 203 SC2, Bountify, RTSA-721,

SP3014, V-10433, and Fulcrum) (Table 12). No phytotoxicity was observed on the treated plants at any time during this experiment.

Chong 2021. In an experiment conducted with new active ingredients to manage citrus mealybug on marigold ‘Yellow Hero’, ISM 555 and SP3014 provided excellent efficacy of immature and non-bearing adults through 56 days after first treatment (Table 13), equivalent to Distance, the standard treatment. MBI 203 SC2, Bountify, and V-10433 significantly reduced populations compared to the nontreated control. No phytotoxicity or residue was observed on the treated plants at anytime during this experiment with the exception of RTSA-721 which caused foliar necrosis on the edges of young and old leaves starting within 3 days after application.

Nansen 2021. Nansen studied 7 active ingredients to manage citrus mealybug on miniature rose (*Rosa* sp.). Count data were collected pretreatment and 3, 7, 14, 28 and 42 days 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 most effective treatments were ISM-555, Bountify, and the high rate of SP3014 for both crawlers and mobile adults. V-10433 reduced populations; Distance, RTSA 721 and MBI 203 SC2 provided suppression. By the end of the experiment, the number of egg masses declined in all treatments compared to the nontreated control (data not shown, refer to researcher report). None of the treatments caused phytotoxicity on foliage or flower or impacted plant growth.

Nansen 2022. Nansen studied 7 active ingredients to manage citrus mealybug on coleus (*Plectranthus scutellarioides*) in 2022. Count data were collected pretreatment and 3, 7, 10, 14 and 28 days after the first applications. One fully matured leaf was selected per plant. Crawlers, mobiles (immatures larger than crawlers + adults), and egg masses were counted on both sides of the leaf. All treatments reduced populations of egg masses, crawlers and mobile adults, but the most effective treatments were Distance and ISM-555 (Table 15). Suppression of crawlers and mobile adults occurred with SP3014 and TetraCurb Max. Bountify (MBI 306), MBI 203, SP3014, TetraCURB Max and B-10433 provided suppression to good to reduction of egg masses (data not shown, refer to researcher report). None of the treatments caused phytotoxicity on foliage or flowers or impacted plant growth.

Table 2. 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)
Nontreated	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 3. 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)
Nontreated	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 4. 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 20SC (buprofezin)	21.5 fl oz	3.7 bcde	67 bcde	83 bcdef	95 def	98 f	99 e
Talus 20SC (buprofezin)	43 fl oz	2.1 e	49 bcde	80 cdef	84 cdef	95 f	97 e
TriStar 75WSP (acetamiprid)	48 g	5.9 ab	86 bcde	95 def	95 cdef	98 ef	97 e
TriStar 75WSP (acetamiprid)	96 g	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
Nontreated	-	2.1 e	0 a	0 a	0 a	0 a	0 a
Nontreated (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 5. 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	4.7 a	4.4 a (0)	10.4 ab (57)	2.9 b (95)	43.0 ab (53)
Aria (flonicamid)	4.3 oz	5.1 a	3.0 a (9)	4.3 b (83)	0.3 b (100)	2.2 b (98)
Flagship (thiamethoxam)	2 oz	8.1 a	3.1 a (41)	0.4 b (99)	0.4 b (100)	2.7 b (98)
Flagship (thiamethoxam)	4 oz	3.3 a	4.2 a (0)	2.3 b (86)	0.1 b (100)	1.9 b (97)
Mesurool (methiocarb)	0.5 lb	4.3 a	5.0 a (0)	9.1 ab (59)	7.4 b (87)	14.4 b (83)
Natural Solutions (<i>Verticillium lecanii</i>)	1:1000	5.1 a	0.0 a (100)	0.7 b (97)	2.3 b (96)	12.6 b (87)
Safari (dinotefuran) - drench	12 oz	2.5 a	5.8 a (0)	6.0 b (53)	4.1 b (87)	13.9 b (71)
Safari (dinotefuran) - drench	24 oz	6.2 a	5.4 a (0)	2.0 b (94)	3.8 b (95)	23.7 ab (80)
Safari (dinotefuran)	0.2 oz	4.8 a	0.5 a (85)	0.4 b (98)	0.2 b (100)	0.0 c (100)
Safari (dinotefuran)	0.4 oz	2.8 a	0.5 a (73)	0.3 b (98)	0.1 b (100)	0.1 b (100)
Talus (buprofezin)	12 oz	2.1 a	0.4 a (71)	3.3 b (68)	4.1 b (84)	5.6 b (86)
Tristar 30SG (acetamiprid)	2.7 oz	6.0 a	0.1 a (98)	1.6 b (95)	0.4 b (99)	0.1 b (100)
Tristar 30SG (acetamiprid)	5.3 oz	3.2 a	0.0 a (100)	0.1 b (99)	0.1 b (100)	0.0 c (100)
Nontreated	-	4.0 a	2.6 a (0)	20.5 a (0)	51.1 a (0)	77.2 a (0)

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

Table 6. Efficacy on Citrus Mealybug on Rosa sp. ‘Akita’, Parella, CA, 2011a.

Treatment	Rate Per 100 Gal	Population Averages (Henderson’s Percent Control)				
		Pre-Treat	10 DAIT	17 DAIT	31 DAIT	52 DAIT
A16901B drench	10 oz	226.7	88.2 abc (85)	23.8 bc (94)	20.0 c (97)	17.0 b (97)
A16901B foliar	6.7 oz	140.2	10.3 d (97)	7.0 c (97)	2.0 d (99)	2.0 b (99)
Kontos drench	3.4 fl oz	197.8	184.5 ab (65)	127.7 a (62)	284.3 a (43)	455.8 a (12)
Kontos foliar	3.4 fl oz	138.3	88.2 abc (76)	64.7 ab (73)	71.5 b (80)	158.8 ab (56)
Rycar	8.6 fl oz	163.8	78.5 bc (82)	29.7 bc (89)	26.8 bc (94)	1.7 b (100)
Safari drench	24 oz	190.5	110.8 abc (78)	26.5 bc (92)	56.8 bc (88)	57.7 b (88)
Talstar	20 oz	124.7	35.3 cd (89)	13.5 c (94)	21.3 c (93)	33.2 b (90)
Nontreated	-	129.5	345.0 a (0)	220.5 a (0)	328.3 a (0)	340.2 ab (0)

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

Table 7. Efficacy on Citrus Mealybug on Rosa sp. ‘Akita’, Parella, CA, 2011b.

Treatment	Rate Per 100 Gal	Population Averages (Henderson’s Percent Control)				
		1 DAIT	9 DAIT	16 DAIT	30 DAIT	68 DAIT
Distance	12 oz	477.5 a (5)	234.7 a (42)	473.7 ab (22)	427.0 ab (32)	622.2 a (0)
MBI 203 SC	2 gal	491.0 a (2)	360.5 a (11)	501.4 ab (17)	304.8 ab (52)	467.5 a (24)
MBI 205	3 gal	506.5 a (0)	381.3 a (6)	433.5 ab (29)	102.8 b (84)	593.5 a (3)
Talstar	20 oz	496.8 a (1)	64.0 b (84)	95.3 b (84)	107.8 b (83)	297.7 a (51)
Talus 70DF	12 oz	406.8 a (19)	195.2 b (52)	267.3 ab (56)	148.5 b (76)	70.2 b (89)
Nontreated	-	503.0 a (0)	404.7 a (0)	606.7 a (0)	629.5 a (0)	613.7 a (0)

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

Table 8. 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)
Azanguard (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)
Nontreated	-	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)
	<i>F</i> 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 9. 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	64 fl oz	70.1 ab	42.9 (29)	42.3 (21)	16.7 (39)	18.7 (26)	b
KOC22018 (botanical oil blend)	128 fl oz	82.7 ab	37.3 (19)	18.9 (54)	4.7 (78)	7.1 (63)	bcd
Pradia SL (cyclaniliprole + flonicamid)	16.5 fl oz	49.1 b	22.9 (58)	9.7 (80)	1.6 (93)	0.4 (98)	d
Sarisa (cyclaniliprole)	28 fl oz	92.3 ab	43.4 (0)	43.6 (0)	13.3 (9)	10.6 (21)	bc
Talus 70DF	14 oz	70.7 ab	44.1 (34)	14.7 (75)	7.3 (76)	1.4 (95)	bcd
TetraCURB Concentrate	128 fl 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)	7 fl oz	72.6 ab	23.7 (48)	14.1 (65)	3.0 (86)	8.3 (57)	cd
Nontreated	-	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 fl oz	78.0 ab	41.6 (13)	24.3 (42)	10.4 (57)	8.3 (57)	d
Duraguard ME	64 fl oz	80.6 ab	43.4 (13)	42.7 (1)	14.3 (42)	28.6 (0)	b
KOC22018 (botanical oil blend)	128 fl oz	95.7 ab	38.9 (34)	19.0 (63)	4.7 (84)	7.1 (70)	bcd
Pradia SL (cyclaniliprole + flonicamid)	16.5 fl oz	59.0 b	23.4 (36)	9.9 (69)	1.6 (91)	0.4 (97)	bcd
Sarisa (cyclaniliprole)	28 fl oz	105.9 ab	44.7 (31)	43.9 (22)	19.0 (42)	10.9 (58)	bc
Talus 70DF	14 oz	80.9 ab	44.7 (10)	15.1 (65)	7.3 (71)	1.4 (93)	bcd
TetraCURB Concentrate	128 fl 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)	7 fl oz	82.0 ab	24.4 (52)	14.3 (67)	4.3 (83)	8.3 (59)	cd
Nontreated (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 10. Efficacy on Citrus Mealybug on Rose ‘Salmon Sunblaze’, Nansen, CA, 2020.

Treatment	RatePer 100 Gal	Pretreat	3 DAIT	7 DAIT	14 DAIT	28 DAIT	42 DAIT
Number of Citrus Mealybug Mobiles Per Leaf (Henderson’s Percent Control) ^x							
Bountify	5 fl oz	88.1 a	60.9 a (11)	62.0 ab (24)	52.9 ab (26)	65.0 c (38)	94.2 bc (32)
BW133	5 lb	91.4 a	44.0 a (38)	33.9 ab (60)	14.0 ab (81)	4.0 a (96)	4.7 a (97)
Distance	12 fl oz	78.3 a	63.4 a (0)	44.1 ab (39)	43.6 ab (32)	49.3 bc (47)	69.7 b (43)
ISM 555	3.84 fl oz	68.4 a	34.6 a (35)	18.9 a (70)	10.6 a (81)	3.0 a (96)	0.4 a (100)
	5.76 fl oz	82.6 a	44.4 a (31)	27.3 ab (64)	13.1 ab (80)	4.1 a (96)	0.7 a (99)
MBI203	128 fl oz	66.0 a	27.9 a (46)	34.4 ab (43)	30.0 ab (44)	45.0 bc (43)	65.6 b (36)
RTSA	17 fl oz	59.1 a	44.1 a (4)	48.3 ab (11)	46.7 ab (3)	62.9 c (11)	81.6 bc (12)
	34 fl oz	59.1 a	52.6 a (0)	53.1 ab (2)	57.3 ab (0)	41.0 c (42)	26.1 a (72)
SP3014	13 fl oz	72.6 a	42.9 a (24)	36.3 ab (46)	24.4 ab (59)	14.9 ab (83)	6.0 a (95)
V-10433	11 fl oz	72.0 a	68.3 a (0)	60.7 ab (8)	38.3 ab (35)	57.0 c (34)	80.4 bc (28)
Nontreated	-	73.1 a	57.0 a (0)	67.3 b (0)	59.4 b (0)	87.3 c (0)	114.1 c (0)
Total Number of Citrus Mealybug Crawlers Per Leaf (Henderson’s Percent Control) ^x							
Bountify	5 fl oz	16.6 b	7.0 a (31)	8.7 ab (45)	6.0 ab (43)	12.1 b (40)	13.3 b (44)
BW133	5 lb	13.0 ab	6.3 a (22)	3.3 ab (74)	0.0 a (100)	0.0 a (100)	0.0 a (100)
Distance	12 fl oz	13.6 ab	9.1 a (0)	2.9 ab (78)	6.0 ab (30)	7.6 ab (55)	10.9 ab (44)
ISM 555	3.84 fl oz	12.0 ab	4.1 a (44)	1.4 a (88)	0.3 ab (96)	0.0 a (100)	0.0 a (100)
	5.76 fl oz	13.4 ab	4.4 a (46)	3.9 ab (70)	0.6 ab (93)	0.0 a (100)	0.0 a (100)
MBI203	128 fl oz	8.6 ab	1.0 a (81)	1.9 ab (77)	2.0 ab (63)	8.9 b (16)	10.9 b (11)
RTSA	17 fl oz	6.9 ab	5.9 a (0)	8.7 ab (0)	5.4 ab (0)	7.7 ab (8)	15.1 ab (0)
	34 fl oz	6.3 a	6.0 a (0)	6.4 ab (0)	6.7 b (0)	8.0 b (0)	5.3 a (41)
SP3014	13 fl oz	12.4 ab	4.7 a (39)	2.9 ab (76)	1.9 ab (76)	1.0 a (93)	1.4 a (92)
V-10433	11 fl oz	11.3 ab	10.9 a (0)	5.7 ab (47)	2.4 ab (66)	9.9 b (29)	15.0 b (7)
Nontreated	-	10.4 ab	6.4 a (0)	10.0 b (0)	6.6 ab (0)	12.8 b (0)	14.9 b (0)

* Based on pairwise tukey comparisons, we present the combinations of dosage and product at time points after first spray applications. As is standard in presentation of results in scientific literature, statistical differences are highlighted with letters.

Table 11. 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						
Bountify	5 fl oz	11.2 a	10.4 a (54)	51.8 abc (54)	82.8 ab (34)	142.8 ab (54)
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)
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 (<i>Beauveria bassiana</i> 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)
Nontreated	-	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						
Bountify	5 fl oz	13.0 a	14.0 a (38)	89.8 ab (13)	140.6 a (2)	223.3 abc (22)
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)
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 (<i>Beauveria bassiana</i> 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)
Nontreated	-	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).

Table 12. Efficacy on Citrus Mealybug on Coleus (*Solenostemon scutellarioides*), ‘Wizard Jade’, Villanassery Joseph, GA, 2021.

Treatment	Rate	Pretreat	3 DAFA	7 DAFA	14 DAFA	28 DAFA
Bountify	2.5 fl oz	25.3 a	72.2 a (0)	84.5 a (0)	361.3 a (0)	421.3 a (0)
Bountify	5 fl oz	11.6 a	42.5 a (0)	53.0 a (0)	148.2 a (0)	463.0 a (0)
ISM-555 + Capsil	3.84 fl oz	20.0 a	29.2 a (9)	53.5 a (0)	369.7 a (0)	376.0 a (0)
ISM-555 + Capsil	5.76 fl oz	35.3 a	29.3 a (49)	114.5 a (0)	241.8 a (0)	316.5 a (5)
MBI 203 SC2	128 fl oz	11.2 a	26.6 a (0)	30.8 a (0)	100.8 a (0)	473.2 a (0)
MBI 203 SC2	64 fl oz	18.0 a	54.6 a (0)	47.3 a (0)	248.3 a (0)	464.7 a (0)
RTSA721	17 fl oz	20.3 a	55.0 a (0)	51.5 a (0)	158.8 a (0)	435.7 a (0)
RTSA721	34 fl oz	12.5 a	88.8 a (0)	92.8 a (0)	345.3 a (0)	548.0 a (0)
SP3014+ Capsil	13 fl oz	17.6 a	40.8 a (0)	46.2 a (0)	125.3 a (0)	188.2 a (0)
SP3014+ Capsil	26 fl oz	22.2 a	119.3 a (0)	52.2 a (1)	302.5 a (0)	309.7 a (0)
V-10433	11 fl oz	27.8 a	96.6 a (0)	98.8 a (0)	256.8 a (0)	414.3 a (0)
Fulcrum	12 fl oz	11.5 a	90.5 a (0)	65.0 a (0)	127.7 a (0)	365.2 a (0)
Nontreated	-	33.0 a	53.2 a (0)	78.6 a (0)	107.8 a (0)	311.0 a (0)

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

Table 13. Efficacy on Citrus Mealybug on Marigold (*Tagetes patula*), ‘Yellow Hero’, Chong, SC, 2021.

Treatment	Rate	Pretreat	7 DAIT	14 DAIT	28 DAIT	42 DAIT	56 DAIT
Number of immature and non-reproducing adult citrus mealybugs counted in 2 minutes ^x							
Bountify	5 fl oz	0.3	0.3 (0)	7.5 a (0)	6.7 b (39)	3.5 b (44)	3.2 b (62)
ISM-555 + Capsil	3.84 + 6 fl oz	0.5	0.2 (60)	0.0 d (100)	0.0 d (100)	0.0 d (100)	0.3 b (98)
ISM-555 + Capsil	5.76 + 6 fl oz	0.5	0.7 (0)	0.2 cd (98)	0.0 d (100)	0.2 d (98)	0.0 b (100)
MBI 203 SC2	128 fl oz	0.2	0.0 (100)	5.0 ab (0)	4.5 bc (39)	2.8 bc (33)	1.7 b (70)
RTSA-721 (drench)	4 gal	0.5	0.2 (60)	4.0 abc (63)	3.7 bcd (80)	2.7 bc (74)	3.8 ab (73)
RTSA-721 (drench)	8 gal	0.5	0.7 (0)	7.5 a (31)	5.0 bc (73)	3.5 b (67)	3.8 ab (73)
SP3014 + Capsil	13 + 6 fl oz	0.8	0.3 (63)	1.0 cd (94)	0.3 d (99)	0.3 d (98)	0.0 b (100)
SP3014 + Capsil	16 + 6 fl oz	1.0	0.2 (80)	1.2 bcd (94)	0.7 d (98)	0.5 d (98)	1.8 b (94)
V-10433	11 fl oz	0.2	0.2 (0)	1.5 bcd (65)	1.7 cd (77)	1.2 cd (71)	1.5 b (74)
Distance IGR	12 fl oz	0.7	0.5 (29)	3.7 abcd (76)	5.8 b (77)	2.0 bcd (86)	1.3 b (93)
Nontreated		0.3	0.3 (0)	6.5 a (0)	11.0 a (0)	6.3 a (0)	8.5 a (0)
Total number of citrus mealybugs counted in 2 minutes ^x							
Bountify	5 fl oz	0.0	0.0	0.3	2.5 bcd	5.7 ab	5.8 abc
ISM-555 + Capsil	3.84 + 6 fl oz	0.0	0.0	0.5	7.7 a	8.8 a	9.3 a
ISM-555 + Capsil	5.76 + 6 fl oz	0.0	0.0	0.2	0.0 d	0.0 d	0.2 d
MBI 203 SC2	128 fl oz	0.0	0.0	0.0	0.0 d	0.2 d	0.2 d
RTSA-721 (drench)	4 gal	0.0	0.0	0.2	4.7 b	7.7 a	7.7 ab
RTSA-721 (drench)	8 gal	0.0	0.0	0.0	2.5 bcd	5.3 abc	6.0 abc
SP3014 + Capsil	13 + 6 fl oz	0.0	0.0	0.0	3.0 bc	8.2 a	9.8 a
SP3014 + Capsil	16 + 6 fl oz	0.0	0.0	0.0	0.8 cd	1.3 bcd	1.3 d
V-10433	11 fl oz	0.0	0.0	0.2	0.5 cd	0.8 cd	1.5 d
Distance IGR	12 fl oz	0.0	0.0	0.0	0.7 cd	2.2 bcd	3.3 cd
Nontreated	-	0.0	0.0	0.2	2.2 bcd	5.5 abc	4.3 bcd

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

Table 14. Efficacy on Citrus Mealybug on Rose ‘Mandarin Sunblaze’, Nansen, CA, 2021.

Treatment	Rate	Pretreat	3 DAIT	7 DAIT	14 DAIT	28 DAIT	42 DAIT
Number of citrus mealybug crawlers counted on one leaf ^x							
Bountify	5 fl oz	4.1 b	5.6 ab (12)	4.9 bc (16)	1.3 b (78)	0.4 b (92)	0.0 c (100)
ISM-555 + Capsil	3.84 + 6 fl oz	4.0 b	3.6 b (41)	1.1 c (80)	0.7 b (88)	0.0 b (100)	0.0 c (100)
ISM-555 + Capsil	5.76 + 6 fl oz	6.4 ab	8.9 ab (9)	2.5 c (73)	2.7 b (71)	0.0 b (100)	0.0 c (100)
MBI 203 SC2	128 fl oz	7.0 ab	7.5 ab (30)	6.1 ab (37)	3.4 b (66)	3.9 ab (58)	2.8 bc (74)
RTSA-721 (drench)	4 gal	9.7 ab	8.6 ab (42)	8.3 ab (39)	8.0 a (43)	6.3 ab (50)	5.9 b (60)
RTSA-721 (drench)	8 gal	9.5 ab	9.5 ab (34)	7.2 ab (46)	5.5 ab (60)	5.7 ab (54)	4.0 bc (72)
SP3014 + Capsil	13 + 6 fl oz	7.1 ab	7.0 ab (36)	4.6 bc (54)	5.0 ab (51)	3.1 ab (66)	2.4 bc (78)
SP3014 + Capsil	16 + 6 fl oz	6.9 ab	4.7 ab (55)	4.6 bc (52)	4.3 ab (56)	0.9 b (90)	0.0 c (100)
V-10433	11 fl oz	7.1 ab	8.6 ab (21)	7.3 ab (27)	6.7 a (35)	3.6 ab (62)	1.7 c (84)
Distance IGR	12 fl oz	6.4 ab	7.3 ab (26)	4.4 c (50)	4.4 ab (52)	3.9 ab (54)	2.9 bc (71)
Nontreated		6.6 ab	10.0 a (0)	9.1 a (0)	9.4 a (0)	8.6 a (0)	10.0 a (0)
Number of citrus mealybug mobiles counted on one leaf ^x							
Bountify	5 fl oz	39.0 b	36.7 (13)	23.4 b (42)	11.9 b (67)	5.0 c (86)	1.3 c (97)
ISM-555 + Capsil	3.84 + 6 fl oz	63.1 ab	37.1 (46)	14.0 b (79)	8.1 b (86)	0.0 c (100)	0.0 c (100)
ISM-555 + Capsil	5.76 + 6 fl oz	58.7 ab	44.4 (30)	20.9 b (66)	9.3 b (83)	1.3 c (98)	0.0 c (100)
MBI 203 SC2	128 fl oz	78.0 a	65.8 (22)	37.5 b (54)	25.1 b (65)	20.9 b (70)	19.0 c (77)
RTSA-721 (drench)	4 gal	72.9 a	71.4 (9)	64.4 b (15)	56.1 a (17)	38.7 b (40)	42.0 b (46)
RTSA-721 (drench)	8 gal	60.5 ab	64.2 (2)	55.5 a (12)	43.3 ab (23)	37.6 b (30)	16.7 c (74)
SP3014 + Capsil	13 + 6 fl oz	51.7 ab	49.7 (11)	38.0 b (29)	24.2 b (50)	15.4 c (66)	12.0 c (78)
SP3014 + Capsil	16 + 6 fl oz	56.4 ab	36.9 (40)	31.1 b (47)	26.6 b (49)	7.0 c (86)	1.9 c (97)
V-10433	11 fl oz	60.3 ab	57.1 (12)	51.6 ab (18)	39.9 ab (29)	22.9 b (57)	11.9 c (82)
Distance IGR	12 fl oz	72.9 a	60.7 (23)	39.4 ab (48)	27.1 b (60)	17.9 bc (72)	15.7 c (80)
Nontreated	-	64.7 ab	70.0 (0)	67.3 a (0)	60.0 a (0)	57.4 a (0)	69.0 a (0)

* Based on pairwise tukey comparisons, we present the combinations of dosage and product at time points after first spray applications. As is standard in presentation of results in scientific literature, statistical differences are highlighted with letters.

Table 15. Efficacy on Citrus Mealybug on Coleus, Nansen, CA, 2022.

Treatment	Rate	Pretreat	3 DAIT	7 DAIT	10 DAIT	14 DAIT	28 DAIT
Number of citrus mealybug crawlers counted on one leaf ^x							
Bountify	10 fl oz	14.4	13.1 ab (25)	9.4 (36)	10.6 b (42)	14.1 a (23)	14.3 b (35)
Bountify	20 fl oz	14.9	11.7 ab (36)	10.7 (30)	13.7 ab (28)	17.7 a (7)	16.4 b (28)
Distance IGR	12 fl oz	14.3	11.3 ab (35)	7.4 (49)	4.4 b (76)	0.7 c (96)	0.0 c (100)
ISM-555 + Capsil	3.84 + 6 fl oz	18.4	15.0 ab (33)	9.3 (51)	8.7 b (63)	1.1 c (95)	0.0 c (100)
ISM-555 + Capsil	5.76 + 6 fl oz	18.6	14.9 ab (34)	8.4 (56)	8.3 b (65)	1.1 c (95)	0.0 c (100)
MBI 203 SC2	128 fl oz	13.1	11.4 ab (29)	11.0 (18)	9.4 b (44)	9.3 bc (44)	10.4 b (48)
SP3014 + Capsil	16 + 6 fl oz	14.6	11.6 ab (35)	9.4 (37)	7.3 b (61)	10.4 ab (44)	7.3 b (67)
SP3014 + Capsil	32 + 6 fl oz	14.0	12.9 ab (24)	11.9 (17)	8.1 b (55)	15.4 a (13)	13.6 b (36)
TetraCURB Maxx	256 fl oz	12.9	9.4 b (40)	6.7 (49)	4.7 b (71)	11.3 bc (31)	4.1 bc (79)
V-10433	11 fl oz	11.9	8.6 b (41)	7.6 (38)	7.1 b (53)	8.6 bc (43)	7.7 b (58)
Nontreated		17.0	20.7 a (0)	17.4 (0)	21.7 a (0)	21.6 a (0)	25.9 a (0)
Number of citrus mealybug mobiles counted on one leaf ^x							
Distance IGR	12 fl oz	71.7	57.9 (24)	30.4 b (58)	19.6 b (77)	6.7 b (94)	1.4 c (99)
Bountify	10 fl oz	77.6	66.3 (20)	48.3 ab (38)	42.3 b (54)	55.0 b (51)	59.7 b (54)
Bountify	20 fl oz	71.6	65.7 (14)	48.6 ab (33)	57.0 ab (33)	70.9 ab (31)	65.6 b (46)
ISM-555 + Capsil	3.84 + 6 fl oz	77.0	66.1 (20)	39.0 ab (50)	23.3 b (75)	8.0 b (93)	2.1 c (98)
ISM-555 + Capsil	5.76 + 6 fl oz	79.6	65.3 (23)	34.9 ab (57)	21.1 b (78)	9.0 b (92)	1.6 c (99)
MBI 203 SC2	128 fl oz	64.0	54.7 (20)	52.9 ab (18)	46.1 b (40)	40.7 b (56)	41.6 bc (62)
SP3014 + Capsil	16 + 6 fl oz	79.1	70.4 (17)	56.4 ab (29)	35.3 b (63)	46.0 b (60)	35.9 bc (73)
SP3014 + Capsil	32 + 6 fl oz	83.4	73.9 (17)	65.4 ab (22)	47.6 b (52)	56.4 b (53)	50.9 b (64)
TetraCURB Maxx	256 fl oz	60.3	44.0 (32)	29.9 b (51)	29.1 b (60)	40.6 b (53)	26.3 bc (74)
V-10433	11 fl oz	61.4	47.6 (28)	43.0 ab (31)	34.4 b (53)	33.1 b (63)	33.3 bc (68)
Nontreated	-	73.3	78.4 (0)	74.1 a (0)	87.4 a (0)	105.6 a (0)	123.9 a (0)

* Based on pairwise tukey comparisons, we present the combinations of dosage and product at time points after first spray applications. As is standard in presentation of results in scientific literature, statistical differences are highlighted with letters.

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 16). 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 17). 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 18). 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 19).

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 21. 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 greatly reduced starting 28 DAT as assessed by counting populations on 3 randomly selected leaves for 30 seconds. (Table 22). In addition, both products effectively reduced the formation of male pupae by 49 DAT (Table 23). 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.

Gilrein 2022. Gilrein assessed the impact of 8 active ingredients against Madeira mealybug infesting coleus (*Plectranthus scutellarioides*), ISM-555 and Safari provided reductions in mealybug populations starting at 3 days after first application, with Safari reductions becoming statistically different from the nontreated control 14 DAIA (Table 24). By 28 DAIA, SP3014 at the high rate and TetraCURB Max provided effective reduction in populations. ISM-555, SP3014, TetraCURB Max, and Safari efficacy continued through 42 DAIA; egg masses were also significantly less with applications of these 4 active ingredients. V-10433 suppressed populations by 42 DAIA. No significant phytotoxicity was observed for the duration of the trial.

Table 16. 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 40SC (buprofezin)	21.5 oz	13.5 a	29 bcd	90 d	95 d	98 f	98 d
Talus 40SC (buprofezin)	43 oz	8.7 bcd	62 bcd	82 cd	97 d	96 ef	98 d
TriStar 70WSP (acetamiprid)	48 g	7.0 cd	55 abc	34 a	49 a	57 ab	57 ab
TriStar 70 WSP (acetamiprid)	96 g	6.0 cd	19 a	42 bc	57 bc	58 bc	42 ab
TriStar 70WSP (acetamiprid) +Capsil	48 g+6 fl oz	7.4 cd	53 cd	77 cd	61 cd	95 ef	93 d
Nontreated	-	6.4 cd	0 a	0 a	0 a	0 a	0 a
Nontreated (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 17. 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±0.1 e (78)	0.0±0.0 e (100)	0.0±0.0 d (100)	0.0±0.0 d (100)
Nontreated	-	-	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)
Nontreated	-	-	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)
Nontreated	-	-	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 18. 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)
Nontreated			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 19. 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)
Nontreated			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 20. 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
Pradia 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
Sarisa(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
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
Nontreated		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 21. 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)
Azanguard (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)
Nontreated	-	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
Azanguard (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
Nontreated	-	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 22. Efficacy on Immature and Mature Madeira Mealybug on Coleus (*Plectranthus scutellarioides*), ‘Premium Sun Chocolate Mint’, Vafae, 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)
Nontreated	-	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)
Nontreated	-	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 23. 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
Nontreated	-	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.

Table 24. Efficacy on Madeira Mealybug on Coleus (*Plectranthus scutellarioides*), ‘Wizard Red Velvet’, Gilrein, NY, 2022.

Treatment	Rate Per 100 Gal	Average total mealybug population						Egg Sacs
		Pretreat	3 dat	7 dat	14 dat	28 dat	42 dat	
Bountify	20 fl oz	67.0 ns	112.5 ab (0)	129.3 ab (0)	166.9 a (0)	123.8 ab (0)	390.9 a (0)	33.00a
ISM-555 + Capsil @ 0.05%	3.84 fl oz	53.3 ns	21.3 b (70)	9.0 c (87)	9.9 c (87)	2.8 c (96)	11.9 cd (95)	1.88b
ISM-555 + Capsil @ 0.05%	5.76 fl oz	105.8 ns	24.0 ab (83)	8.0 c (94)	14.8 c (90)	3.6 c (98)	12.9 cd (97)	1.50b
MBI-203 SC2	128 fl oz	91.8 ns	60.8 ab (50)	84.5 ab (32)	100.9 ab (25)	83.9 ab (38)	351.8 a (15)	29.63a
SP3014 + Capsil @ 0.05%	16 fl oz	87.9 ns	161.1 a (0)	175.8 a (0)	181.3 ab (0)	55.1 abc (57)	120.5 ab (70)	4.13b
SP3014 + Capsil @ 0.05%	32 fl oz	74.3 ns	54.0 ab (46)	65.1 ab (35)	47.0 abc (57)	14.9 abc (86)	34.6 bc (90)	1.00b
TetraCURB MAX	256 fl oz	66.4 ns	48.1 ab (46)	50.6 abc (43)	28.0 abc (71)	12.6 bc (87)	52.1 bc (83)	1.43b
V-10433	11 fl oz	79.1 ns	54.3 ab (49)	52.1 ab (51)	61.4 bc (47)	52.8 abc (54)	92.0 ab (74)	13.38a
BW279N	300 fl oz	93.0 ns	86.1 ab (31)	96.8 ab (23)	81.1 ab (40)	144.8 ab (0)	231.1 a (45)	14.38a
BW279N	150 fl oz	86.9 ns	50.3 ab (57)	112.5 ab (4)	143.6 ab (0)	94.4 ab (26)	253.1 a (35)	14.00a
Safari	8 fl oz	81.6 ns	32.3 ab (70)	27.0 bc (75)	20.0 c (83)	11.3 c (91)	3.1 d (99)	1.13b
Nontreated control		86.6 ns	115.8 ab (0)	116.5 ab (0)	126.5 ab (0)	126.9 a (0)	391.1 a (0)	36.50a

Means within columns 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 $\log(y+1)$.

ANOVA (D00) $F_{11,84} = 0.3473$, $P = 0.9718$; ANOVA (D03) $F_{11,84} = 2.7700$, $P = 0.0041$; ANOVA (D07) $F_{11,84} = 8.4227$, $P < 0.0001$; ANOVA (D14) $F_{11,84} = 8.1204$, $P < 0.0001$; ANOVA (D28) $F_{11,83} = 8.1104$, $P < 0.0001$; ANOVA (D42) $F_{11,83} = 20.4652$, $P < 0.0001$.

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 25).

Table 25. 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
Nontreated	-	20.5	0	0	0	0	0
Nontreated (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.

Miscanthus Mealybug

In a single experiment with Miscanthus Mealybug (*Balanococcus diminutus*) on miscanthus (*Miscanthus purpurascens*, *Miscanthus sinensis*), six insecticides were screened for efficacy. While reductions in populations were observed with some treatments only data collected at 28 DAT were statistically significant (Table 26). Best treatments managing nymphs were Sarissa at 22 fl oz per 100 gal, Altus at 5.4 fl oz gal and Mainspring at 12 fl oz per 100 gal.

Table 26. Efficacy on Miscanthus Mealybug on Miscanthus, Kunkel, DE, 2015.

Stage	Treatment	Rate per 100 gal	Population Averages (Henderson's Percent Control)				
			Pre-Treatment	7 DAT	14 DAT	28 DAT	123 DAT
Live Adults	Altus	2.7 oz	7.2 a	4.0 a (0)	2.0 a (4)	2.5 a (30)	0.2 a (45)
	Altus	5.4 oz	4.2 a	1.2 a (0)	1.2 a (1)	0.3 a (86)	0.0 a (100)
	Chlorpyrifos	32 oz	6.2 a	5.3 a (0)	0.2 a (89)	1.5 a (51)	4.0 a (0)
	Mainspring	8 oz	13.7 a	7.3 a (0)	2.0 a (49)	2.0 a (71)	3.7 a (0)
	Mainspring	12 oz	11.2 a	0.5 a (41)	3.2 a (1)	0.0 a (100)	2.2 a (0)
	Sarisa	22 oz	4.3 a	5.0 a (0)	2.7 a (0)	0.2 a (91)	2.8 a (0)
	Sarisa	28 oz	8.8 a	4.0 a (0)	3.0 a (0)	3.3 a (24)	5.2 a (0)
	Talus	14 oz	7.3 a	3.8 a (0)	4.5 a (0)	0.5 a (86)	4.2 a (0)
	Ventigra	7 oz	6.7 a	5.0 a (0)	2.5 a (0)	2.3 a (31)	0.3 a (11)
	Nontreated	-	19.8 a	1.5 a (0)	5.7 a (0)	9.8 a (0)	1.0 a (0)
Live Nymphs	Altus	2.7 fl oz	33.8 a	8.0 a (27)	9.0 a (45)	13.7 abc (74)	0.2 a (94)
	Altus	5.4 fl oz	21.7 a	5.8 a (18)	11.3 a (0)	5.3 bc (84)	0.3 a (87)
	Chlorpyrifos	32 oz	24.3 a	16.2 a (0)	6.0 a (49)	15.3 abc (60)	3.0 a (0)
	Mainspring	8 fl oz	30.0 a	18.5 a (0)	28.7 a (0)	25.5 ab (45)	2.2 a (30)
	Mainspring	12 fl oz	31.2 a	11.3 a (0)	4.0 a (74)	9.2 abc (81)	2.3 a (29)
	Sarisa	22 fl oz	26.0 a	8.2 a (3)	17.2 a (0)	1.8 c (96)	3.7 a (0)
	Sarisa	28 fl oz	24.2 a	19.2 a (0)	7.7 a (35)	32.3 a (14)	6.2 a (0)
	Talus	14 oz	27.8 a	24.5 a (0)	19.3 a (0)	11.2 abc (74)	7.2 a (0)
	Ventigra	7 fl oz	10.3 a	28.7 a (0)	10.0 a (0)	14.0 abc (13)	0.7 a (35)
	Nontreated	-	38.3 a	12.5 a (0)	18.7 a (0)	59.7 a (0)	4.0 a (0)
Total Live	Altus	2.7 oz	41.0 a	12.0 a (0)	11.0 a (36)	16.2 abc (67)	0.3 a (91)
	Altus	5.4 oz	25.8 a	7.0 a (0)	12.5 a (0)	5.7 bc (81)	0.3 a (86)
	Chlorpyrifos	32 oz	30.5 a	21.5 a (0)	6.2 a (51)	16.8 abc (54)	7.0 a (0)
	Mainspring	8 oz	43.7 a	25.8 a (0)	30.7 a (0)	27.5 ab (47)	5.8 a (0)
	Mainspring	12 oz	42.3 a	11.8 a (0)	7.2 a (59)	9.2 abc (82)	4.5 a (0)
	Sarisa	22 oz	30.3 a	13.2 a (0)	19.8 a (0)	2.0 c (94)	6.5 a (0)
	Sarisa	28 oz	33.0 a	23.2 a (0)	10.7 a (22)	35.7 ab (9)	11.3 a (0)
	Talus	14 oz	35.2 a	28.3 a (0)	23.8 a (0)	11.7 abc (72)	11.3 a (0)
	Ventigra	7 oz	17.0 a	33.7 a (0)	12.5 a (0)	16.3 abc (20)	1.0 a (32)
	Nontreated	-	58.2 a	14.0 a (0)	24.3 a (0)	69.5 a (0)	5.0 a (0)

Sarris was applied with the nonionic surfactant Turbo

* Transformed data analyzed: Adults, Nymphs, Total Combined – log transformed; Nymph and Total Combined Percent mortality variables were arcsine square root transformed (Jump Pro v12). Treatments with different letters in a column are significantly different at $\alpha = 0.05$ (Tukey HSD)

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 27).

Table 27. 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)
	Nontreated	-	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)
	Nontreated	-	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)
	Nontreated	-	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 Rhaps palm (*Rhapis robusta*). Products were applied once as drench; in addition, Kontos was applied as foliar spray in two weekly applications (Table 28). 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 29). All treatments except Orthene provided good to excellent control of root mealybug.

No phytotoxicity was observed on any of the treated plants.

Table 28. Efficacy on Rhizoecus Root Mealybug on Rhaps 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
Nontreated	-	-	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 29. 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	Drench 4/11,4/25	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)
Nontreated	-	-	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.

Striped Mealybug

In 2022, Chong studied the impact of 8 active ingredients on stiped mealybug (*Ferrisia virgata*) on azalea (*Rhododendron* sp. 'Encore Autumn royalty'). The most effective treatments

throughout the experiment were ISM-555 at both rates. By 28 days after initial applications, all other treatments reduced populations in comparison to the water treated control with TetraCURB Max, Ventigra, and Velifer and Distance statistically lower. Distance, the positive control standard, however, was only applied once whereas all other treatments were applied a minimum of twice. No phytotoxicity or residues were observed on any of the treated plants.

Table 30. Efficacy on Striped Mealybug on Azalea, Chong, SC, 2022.

Treatment	Rate Per 100 Gal	Population Averages (Henderson's Percent Control)							
		Pretreat	3 dat	7 dat	14 dat	21 dat	28 dat	42 dat	56 dat
Bountify	20 fl oz	25.6	29.6 a (0)	23.8 a (0)	21.4 a (0)	13.6 ab (0)	9.4 ab (63)	296.4 ab (23)	
Distance IGR	12 fl oz	25.4	14.2 bc (29)	11.2 bc (19)	15.0 ab (0)	10.2 ab (20)	6.0 b (76)	145.4 bcde (62)	
ISM-555 + Capsil	3.84 fl oz + 0.05%	25.6	8.0 bc (60)	2.4 c (83)	3.0 d (79)	1.8 de (86)	2.0 b (92)	41.4 de (89)	110.0 b (77)
ISM-555 + Capsil	5.76 fl oz + 0.05%	25.2	4.2 c (79)	2.2 c (84)	2.4 d (83)	0.2 e (98)	0.4 b (98)	20.8 e (94)	164.2 b (64)
MBI 203 SC2	128 fl oz	26.4	20.2 ab (2)	13.0 b (10)	14.8 ab (2)	14.8 a (0)	9.2 ab (65)	243.4 abc (38)	
SP3014 + Capsil	16 fl oz + 0.05%	25.2	14.8 bc (25)	12.2 bc (11)	8.8 bcd (39)	7.2 bcd (43)	8.6 b (66)	166.0 bcde (56)	
SP3014 + Capsil	32 fl oz + 0.05%	26.0	22.4 ab (0)	13.6 b (4)	13.2 abc (11)	10.8 ab (17)	14.8 ab (43)	225.2 abc (42)	
TetraCURB Max	256 fl oz	25.6	11.0 bc (45)	6.2 bc (56)	4.4 cd (70)	3.2 cde (75)	3.4 b (87)	110.4 cde (71)	285.2 b (39)
V-10433	11 fl oz	25.4	16.0 abc (20)	11.4 bc (18)	9.8 bcd (32)	9.4 abc (26)	8.8 b (65)	206.4 bcd (46)	
Ventigra	7 fl oz	25.6	18.4 abc (8)	13.4 b (4)	15.8 ab (0)	8.0 abcd (38)	5.6 b (78)	198.0 bcd (48)	
Velifer	13 fl oz	25.2	17.2 abc (13)	13.0 b (6)	11.8 bcd (18)	10.2 ab (19)	5.6 b (78)	188.4 bcde (50)	
Nontreated		26.0	20.4 ab (0)	14.2 ab (0)	14.8 ab (0)	13.0 ab (0)	26.0 a (0)	389.2 a (0)	476.6 a (0)

¹Only treatments suppressing mealybug populations at around the average of 100 mealybugs per plant at 42 DAT were assessed at 56 DAT.

²Data were $\log_{10}(x+0.1)$ -transformed before ANOVA under RCBD at $\alpha = 0.05$. Means within a column followed by the same letters are not significantly different among treatments according to Fisher's LSD test at $\alpha = 0.05$.

Efficacy Summary by Active Ingredient

A16901B 45WG. 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. On rhizoecus root mealybug, it provided excellent control in one experiment. Although registered, this product has not been commercialized.

Acelepryn. Poor control was observed in a single experiment for root mealybug.

Altus 200 SL. It provided poor to good control of citrus mealybug in 2 trials and of Madeira mealybug in three coleus experiments.

Aria 50SG. Aria foliar provided variable but generally 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.

Azaguard. It provided poor to fair control of citrus mealybug in two trials and of Madeira mealybug in three coleus experiments.

Bountify. Foliar applications provided poor to excellent efficacy of citrus mealybug in five trials but little efficacy for madeira and stiped mealybugs in single experiments.

BW133. This product provided good to excellent control of citrus mealybug in two experiments.

BW238. Both formulations (ES and WP) of this product provided poor control of citrus mealybug in a single experiment on coleus.

Distance 0.86E. Mixed results were obtained with citrus and Madeira mealybugs, with poor control in one experiment and good control in another.

Flagship 0.22G/25WG. Flagship at both rates applied as foliar treatment provided great to excellent control of citrus mealybug, Mexican mealybug and phormium mealybug. Mixed efficacy on Madeira mealybug (poor to excellent) was obtained in 9 trials, with foliar generally superior to drench or broadcast treatment.

Grandevo. Grandevo 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.

Hachi-Hachi. Hachi-Hachi demonstrated excellent control of Madeira mealybug in a single experiment.

ISM-555. This active ingredient provided excellent control of citrus mealybug in five experiments and Maderia and striped mealybugs in single experiments.

KOC22018-8. 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.

Kontos/Movento 240SC. Control of Madeira mealybug was variable – fair to excellent population reductions. For citrus mealybug, observed efficacy was poor to fair. It provided good to excellent control of rhizoecus root mealybug applied as foliar spray or media drench in two

experiments.

Mainspring 200SC. It provided poor control of Madeira mealybug in a coleus trial.

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.

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

Orthene. Orthene provided excellent control of Madeira mealybug in 4 trials and for citrus and Mexican mealybug in single experiments..

Pradia. In an experiment for control of citrus mealybug, Pradia 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.

QRD 400. QRD 400 provided good control of Madeira mealybug and poor to fair control of citrus mealybug at 0.25 and 0.5 % rates.

Rycar/Rycar20SC. Control of citrus mealybug was excellent in a rose experiment and provided fair to excellent efficacy for madeira mealybug.

Safari 2G/20SG/Transect 70WSP. 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. In an experiment for control of citrus mealybug, IKI-3106/Sarisa provided poor control on coleus and fair control on rose in single trials. It provided poor control of Madeira mealybug in 2 coleus trials.

SP3014. SP3014 foliar provided fair to great control of citrus mealybug in a four experiments and great efficacy for madeira mealybug in a single experiment. Little efficacy was observed for stiped mealybug in a single experiment.

Talus 40SC/70DF. Talus provided excellent control of Madeira mealybug and Mexican mealybug, and mediocre to excellent control of citrus mealybug.

TetraCURB. 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. TetraCURB Max provided fair to good control of citrus, Madeira and striped mealybugs in single experiments.

TriStar 30SG/70WSP. TriStar regardless of formulation provided great to excellent efficacy for citrus, madeira, Mexican and Phormium mealybugs.

V-10433. V-10433 foliar provided poor to fair efficacy across mealybug species.

Velifer. Velifer foliar provided poor to fair control of citrus and striped mealybugs in single experiments.

Ventigra. Ventigra provided excellent control of Madeira mealybug in three coleus trials, but it

was not as effective for citrus or striped mealybug.

Please see Table 31 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 31. Summary of Efficacy by Product for Mealybug

Note: Table entries are sorted by crop Latin name. Only those experiments received by 4/7/23 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.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
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.
29369	Acelepryn (Dupont) (Chlorantraniliprole)	IRAC 28	Root Mealybug, Hibiscus (Ripersiella hibisci)	Palm, Guangxi Lady (Rhapis robusta)	Greenhouse	Hara	HI	2009	Drench	Poor control of rhizoeucus 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) '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.
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.
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 29	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

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
25083	Aria 50SG (Flonicamid)	IRAC 29	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides) 'Kong Scarlet'	Greenhouse	Oetting	GA	2005	foliar	Excellent efficacy at 120 g per 100 gal
25083	Aria 50SG (Flonicamid)	IRAC 29	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.
28059	Aria 50SG (Flonicamid)	IRAC 29	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 29	Root Mealybug, Hibiscus (Ripersiella hibisci)	Palm, Guangxi Lady (Rhapis robusta)	Greenhouse	Hara	HI	2009	Drench	Good control of rhizococcus root and pineapple mealybugs at 120 g per 100 gal.
33868	AzaGuard (Azadirachtin)	IRAC UN	Madeira Mealybug (Phenacoccus madeirensis)	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 madeirensis)	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.
35274	Bountify (MBI 306) (Burkholderia rinojensis strain A396)		Mealybug, Striped (Ferrisia virgata)	Azalea (Rhododendron sp.) 'Encore Autumn Royalty'	Greenhouse	Chong	SC	2022	Foliar	Some reduction when applied 3 times every 7 days at 20 fl oz per 100 gallons. Phytotoxicity was not observed.
35072	Bountify (MBI 306) (Burkholderia rinojensis strain A396)		Madeira Mealybug (Phenacoccus madeirensis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Red Velvet'	Greenhouse	Gilrein	NY	2022	Foliar	Some reduction of nymphs and adults when applied 3 times every 7 days at 20 fl oz per 100 gallons.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
34408	Bountify (MBI 306) (Burkholderia rinojensis strain A396)		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.
34408	Bountify (MBI 306) (Burkholderia rinojensis strain A396)		Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Nansen	CA	2022	Foliar	Some reduction of crawlers and mobiles when applied 3 times every 7 days at 20 and 10 fl oz per 100 gallons. Mediocre control of eggs.
34408	Bountify (MBI 306) (Burkholderia rinojensis strain A396)		Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Villanassery Joseph	GA	2021	Foliar	Efficacy unknown. Trial results showed no significant differences among treatments.
34284	Bountify (MBI 306) (Burkholderia rinojensis strain A396)		Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Salmon Sunblaze'	Greenhouse	Nansen	CA	2020	Foliar	Poor efficacy with 5 fl oz per 100 gal applied twice weekly.
34284	Bountify (MBI 306) (Burkholderia rinojensis strain A396)		Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Mandarin Sunblaze'	Greenhouse	Nansen	CA	2021	Foliar	Excellent efficacy. 100% reduction in egg masses and crawlers; greater than 95% reduction of mobiles when applied at 5 fl oz per 100 gal rate.
34978	Bountify (MBI 306) (Burkholderia rinojensis strain A396)		Citrus Mealybug (Planococcus citri)	Marigold, French (Tagetes patula)	Greenhouse	Chong	SC	2021	Foliar	Mediocre efficacy when applied twice at 5 fl oz per 100 gal rate.
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.
33920	BW133 (BW133)	FRAC NC	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Salmon Sunblaze'	Greenhouse	Nansen	CA	2020	Foliar	Excellent efficacy with 5 lb per 100 gal applied 3 times weekly.
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.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
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.
35076	BW279N (BW279N)		Madeira Mealybug (Phenacoccus madeirensis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Red Velvet'	Greenhouse	Gilrein	NY	2022	Foliar	Some reduction of nymphs and adults when applied 3 times every 7 days at 300 and 150 fl oz per 100 gallons.
33141	Chlorpyrifos 2.32% (Chlorpyrifos)	IRAC 1B	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.
30590	Cygon 2E (Dimethoate)	IRAC 1B	Root Mealybug, Rhizoecus sp. (Rhizoecus sp.)	Malpighia (Malpighia sp.) M. prostrata	TBD	Reinert	FL	1974	Drench	Excellent efficacy with two drenches 1 week apart using 0.5 lb ai per 100 gal.
35280	Distance (Pyriproxyfen)	IRAC 7C	Mealybug, Striped (Ferrisia virgata)	Azalea (Rhododendron sp.) 'Encore Autumn Royalty'	Greenhouse	Chong	SC	2022	Foliar	Some reduction when applied once at 12 fl oz per 100 gallons. Phytotoxicity was not observed.
29619	Distance (Pyriproxyfen)	IRAC 7C	Madeira Mealybug (Phenacoccus madeirensis)	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.
29619	Distance (Pyriproxyfen)	IRAC 7C	Madeira Mealybug (Phenacoccus madeirensis)	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 madeirensis)	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.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
29844	Distance (Pyriproxyfen)	IRAC 7C	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Nansen	CA	2022	Foliar	Excellent efficacy of crawlers and mobiles when applied once at 12 fl oz per 100 gallons. Excellent control of eggs.
30290	Distance (Pyriproxyfen)	IRAC 7C	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Mandarin Sunblaze'	Greenhouse	Nansen	CA	2021	Foliar	Mediocre efficacy. About 50% reduction in egg masses, crawlers and mobiles, 14 and 28 DAIT with 12 fl oz per 100 gal.
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.
34982	Distance (Pyriproxyfen)	IRAC 7C	Citrus Mealybug (Planococcus citri)	Marigold, French (Tagetes patula)	Greenhouse	Chong	SC	2021	Foliar	Mediocre efficacy between 0-42 days DAT, good efficacy following 42 DAT when applied once at 12 fl oz per 100 gal rate.
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 madeirensis)	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 madeirensis)	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 madeirensis)	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 madeirensis)	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 madeirensis)	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 madeirensis)	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 madeirensis)	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 madeirensis)	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 madeirensis)	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) '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
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.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
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.
34975	Fulcrum (Pyriproxyfen)	IRAC 7C	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Villanassery Joseph	GA	2021	Foliar	Efficacy unknown. Trial results showed no significant differences among treatments.
30277	Grandevo (MBI 203 DF) (Chromobacterium subtsugae NRRL B-30655)	FRAC NC	Madeira Mealybug (Phenacoccus madeirensis)	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 madeirensis)	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 madeirensis)	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.
35272	ISM-555 (ISM-555, A21377X)		Mealybug, Striped (Ferrisia virgata)	Azalea (Rhododendron sp.) 'Encore Autumn Royalty'	Greenhouse	Chong	SC	2022	Foliar	Excellent efficacy when applied 2 times every 14 days at 3.84 fl oz and 5.76 fl oz + 0.05% Capsil per 100 gallons. Phytotoxicity was not observed.
35070	ISM-555 (ISM-555, A21377X)		Madeira Mealybug (Phenacoccus madeirensis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Red Velvet'	Greenhouse	Gilrein	NY	2022	Foliar	Great to excellent efficacy on nymphs and adults when applied twice every 14 days at 3.84 and 5.76 fl oz per 100 gallons respectively.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
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.
34406	ISM-555 (ISM-555, A21377X)		Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Nansen	CA	2022	Foliar	Excellent efficacy of crawlers and mobiles when applied 2 times every 14 days at 3.84 fl oz and 5.76 fl oz per 100 gal + 0.05% v/v Capsil. Excellent control of eggs.
34406	ISM-555 (ISM-555, A21377X)		Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Villanassery Joseph	GA	2021	Foliar	Efficacy unknown. Trial results showed no significant differences among treatments.
34282	ISM-555 (ISM-555, A21377X)		Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Salmon Sunblaze'	Greenhouse	Nansen	CA	2020	Foliar	Excellent efficacy with 3.84 and 5.76 fl oz per 100 gal + Capsil applied twice biweekly. Best treatment.
34282	ISM-555 (ISM-555, A21377X)		Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Mandarin Sunblaze'	Greenhouse	Nansen	CA	2021	Foliar	Excellent efficacy. 100% reduction in egg masses, crawlers and mobiles with 3.84 fl oz per 100 gal and in egg masses and crawlers with 5.76 fl oz per 100 gal. Greater than 95% reduction of mobiles with 5.76 fl oz per 100 gal.
34976	ISM-555 (ISM-555, A21377X)		Citrus Mealybug (Planococcus citri)	Marigold, French (Tagetes patula)	Greenhouse	Chong	SC	2021	Foliar	Excellent efficacy when applied at 3.84 and 5.76 fl oz per 100 gal.
33928	KOC22018-8 (Botanical Oil Blend)		Madeira Mealybug (Phenacoccus madeirensis)	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
33928	KOC22018-8 (Botanical Oil Blend)		Madeira Mealybug (Phenacoccus madeirensis)	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.
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 madeirensis)	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 madeirensis)	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 madeirensis)	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 madeirensis)	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.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
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.
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 rhizococcus 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 rhizococcus 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 madeirensis)	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.
35273	MBI 203 SC2 (MBI 203)		Mealybug, Striped (Ferrisia virgata)	Azalea (Rhododendron sp.) 'Encore Autumn Royalty'	Greenhouse	Chong	SC	2022	Foliar	Some reduction when applied 3 times every 7 days at 128 fl oz per 100 gallons. Phytotoxicity was not observed.
35071	MBI 203 SC2 (MBI 203)		Madeira Mealybug (Phenacoccus madeirensis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Red Velvet'	Greenhouse	Gilrein	NY	2022	Foliar	Some reduction of nymphs and adults when applied 3 times every 7 days at 128 fl oz per 100 gallons.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
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.
34407	MBI 203 SC2 (MBI 203)		Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Nansen	CA	2022	Foliar	Some reduction of crawlers and mobiles when applied 3 times every 7 days at 128 fl oz per 100 gallons. Mediocre control of eggs.
34407	MBI 203 SC2 (MBI 203)		Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Villanassery Joseph	GA	2021	Foliar	Efficacy unknown. Trial results showed no significant differences among treatments.
34283	MBI 203 SC2 (MBI 203)		Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Salmon Sunblaze'	Greenhouse	Nansen	CA	2020	Foliar	Poor efficacy with 128 fl oz per 100 gal applied twice weekly.
34283	MBI 203 SC2 (MBI 203)		Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Mandarin Sunblaze'	Greenhouse	Nansen	CA	2021	Foliar	Mediocre control of egg masses, crawlers and mobiles when applied at 128 fl oz per 100 gal.
34977	MBI 203 SC2 (MBI 203)		Citrus Mealybug (Planococcus citri)	Marigold, French (Tagetes patula)	Greenhouse	Chong	SC	2021	Foliar	Mediocre efficacy between 0-42 days DAT, good efficacy following 42 DAT when applied twice at 128 fl oz per 100 gal rate.
30278	MBI 205 (MBI 205)		Madeira Mealybug (Phenacoccus madeirensis)	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 (MBI 205)		Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Akita'	Greenhouse	Parrella	CA	2011	Foliar	Experiment 2: Poor control initially 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.
31351	MBI 205 (MBI 205)		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.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
30493	Merit 75WP (Imidacloprid)	IRAC 4A	Madeira Mealybug (Phenacoccus madeirensis)	Marigold, French (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Drench	No significant reduction with 20 g per 1250 pots applied once.
29761	Mesurool 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 madeirensis)	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 madeirensis)	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 madeirensis)	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 madeirensis)	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.
25148	Orthene TTO 97 (Valent) (Acephate)	IRAC 1B	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides) 'Kong Scarlet'	Greenhouse	Oetting	GA	2005	Foliar	Excellent efficacy with 10.5 oz per 100 gal.
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 29	Madeira Mealybug (Phenacoccus madeirensis)	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 29	Madeira Mealybug (Phenacoccus madeirensis)	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).
33870	Pradia (Cyclaniliprole + Flonicamid)	IRAC 28 + IRAC 29	Madeira Mealybug (Phenacoccus madeirensis)	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.
33614	Pradia (Cyclaniliprole + Flonicamid)	IRAC 28 + IRAC 29	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 29	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	Foliar	50% control 4 and 6 WAT
25068	QRD 400 (Extract of Chenopodium ambrosioides)	IRAC UNE	Madeira Mealybug (Phenacoccus madeirensis)	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)	IRAC UNE	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
25085	QRD 400 (Extract of Chenopodium ambrosioides)	IRAC UNE	Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Parrella	CA	2005	Foliar	Experiment 2: No control at 4 oz per 100 gal.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
34590	RTSA 721 (RTSA 721)		Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Villanassery Joseph	GA	2021	Drench	Efficacy unknown. Trial results showed no significant differences among treatments.
34285	RTSA 721 (RTSA 721)		Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.)	Greenhouse	Nansen	CA	2020	Basal spray	
34285	RTSA 721 (RTSA 721)		Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Salmon Sunblaze'	Greenhouse	Nansen	CA	2020	Drench	Poor and mediocre efficacy with 17 and 34 fl oz per 100 gal.
34285	RTSA 721 (RTSA 721)		Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Mandarin Sunblaze'	Greenhouse	Nansen	CA	2021	Drench	Poor efficacy when applied at 17 and 34 fl oz per 100 gal
34979	RTSA 721 (RTSA 721)		Citrus Mealybug (Planococcus citri)	Marigold, French (Tagetes patula)	Greenhouse	Chong	SC	2021	Drench	Mediocre efficacy when applied at 4 and 8 gal per 100 gal rates.
29622	Rycar (Pyrifluquinazon)	IRAC UN	Madeira Mealybug (Phenacoccus madeirensis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Scarlet'	Greenhouse	Chong	SC	2011	Foliar	Mediocre control of nymphs with 18 fl oz per 100 gal applied once.
29622	Rycar (Pyrifluquinazon)	IRAC UN	Madeira Mealybug (Phenacoccus madeirensis)	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 madeirensis)	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

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
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 madeirensis)	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 madeirensis)	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 madeirensis)	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.
25065	Safari 20SG (Dinotefuran)	IRAC 4A	Madeira Mealybug (Phenacoccus madeirensis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Red Velvet'	Greenhouse	Gilrein	NY	2022	Foliar	Excellent efficacy on nymphs and adults when applied 3 times every 7 days at 8 fl oz per 100 gallons.
25065	Safari 20SG (Dinotefuran)	IRAC 4A	Madeira Mealybug (Phenacoccus madeirensis)	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 madeirensis)	Common Coleus (Plectranthus scutellarioides) 'Kong Scarlet'	Greenhouse	Oetting	GA	2005	Foliar	With and without Capsil, provided good efficacy
30490	Safari 20SG (Dinotefuran)	IRAC 4A	Madeira Mealybug (Phenacoccus madeirensis)	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).

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
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) 'Wizard King'	Greenhouse	Oetting	GA	2005	Foliar	Safari drenches provided better control (mostly >95% throughout experiment) than foliar sprays (between 43 and 85% control)
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.
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.
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.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
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 madeirensis)	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 madeirensis)	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).
33869	Sarisa 50SL (Cyclaniliprole)	IRAC 28	Madeira Mealybug (Phenacoccus madeirensis)	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.
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.
35275	SP3014 (SP3014)		Mealybug, Striped (Ferrisia virgata)	Azalea (Rhododendron sp.) 'Encore Autumn Royalty'	Greenhouse	Chong	SC	2022	Foliar	Some reduction when applied 3 times every 7 days at 16 fl oz and 32 fl oz + 0.05% Capsil per 100 gallons. Phytotoxicity was not observed.
35073	SP3014 (SP3014)		Madeira Mealybug (Phenacoccus madeirensis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Red Velvet'	Greenhouse	Gilrein	NY	2022	Foliar	Mediocre to great efficacy on nymphs and adults when applied 3 times every 7 days at 16 and 32 fl oz per 100 gallons respectively.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
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.
34409	SP3014 (SP3014)		Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Nansen	CA	2022	Foliar	Some reduction of crawlers and mobiles when applied 3 times every 7 days at 16 and 32 fl oz per 100 gallons. Great control of eggs.
34409	SP3014 (SP3014)		Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Villanassery Joseph	GA	2021	Foliar	Efficacy unknown. Trial results showed no significant differences among treatments.
34286	SP3014 (SP3014)		Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Salmon Sunblaze'	Greenhouse	Nansen	CA	2020	Foliar	Good efficacy with 13 fl oz per 100 gal + Capsil applied 3 times weekly.
34286	SP3014 (SP3014)		Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Mandarin Sunblaze'	Greenhouse	Nansen	CA	2021	Foliar	Great control of egg masses and crawlers, good control of mobiles when applied at 13 and 26 fl oz per 100 gal
34980	SP3014 (SP3014)		Citrus Mealybug (Planococcus citri)	Marigold, French (Tagetes patula)	Greenhouse	Chong	SC	2021	Foliar	Great efficacy when applied at 13 and 26 fl oz per 100 gal
30494	SuffOil X (Synergy) (Petroleum Oil)	FRAC NC	Madeira Mealybug (Phenacoccus madeirensis)	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

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
25064	Talus 40SC (Buprofezin)	IRAC 16	Madeira Mealybug (Phenacoccus madeirensis)	Common Coleus (Plectranthus scutellarioides) 'King Scarlet'	Greenhouse	Oetting	GA	2005	Foliar	Both 21.5 and 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.
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) 'Jade Wizard'	Greenhouse	Oetting	GA	2005	Foliar	Excellent efficacy from 4 weeks on until the end of the experiment
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.
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 madeirensis)	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 madeirensis)	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 madeirensis)	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 madeirensis)	Marigold, French (Tagetes patula) 'Yellow Boy'	Greenhouse	Davis	MI	2010	Foliar	About 95-98 % control with 14 oz per 100 gal applied twice.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
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.) 'Salmon Sunblaze'	Greenhouse	Nansen	CA	2019	Foliar	Excellent efficacy with 14 oz per 100 gal applied twice biweekly. Minor phytotoxicity.
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.
33929	TetraCURB Concentrate (Rosemary Oil)	IRAC UNE	Madeira Mealybug (Phenacoccus madeirensis)	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).
33929	TetraCURB Concentrate (Rosemary Oil)	IRAC UNE	Madeira Mealybug (Phenacoccus madeirensis)	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.
33925	TetraCURB Concentrate (Rosemary Oil)	IRAC UNE	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.
35276	TetraCURB Max (castor oil + rosemary oil + clove oil + peppermint oil)		Mealybug, Striped (Ferrisia virgata)	Azalea (Rhododendron sp.) 'Encore Autumn Royalty'	Greenhouse	Chong	SC	2022	Foliar	Good efficacy when applied 3 times every 7 days at 256 fl oz per 100 gallons. Phytotoxicity was not observed.
35074	TetraCURB Max (castor oil + rosemary oil + clove oil + peppermint oil)		Madeira Mealybug (Phenacoccus madeirensis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Red Velvet'	Greenhouse	Gilrein	NY	2022	Foliar	Good efficacy on nymphs and adults when applied 3 times every 7 days at 256 fl oz per 100 gallons.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
35069	TetraCURB Max (castor oil + rosemary oil + clove oil + peppermint oil)		Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Nansen	CA	2022	Foliar	Some reduction of crawlers and mobiles when applied 3 times every 7 days at 256 fl oz per 100 gallons. Good control of eggs.
33930	TetraCURB Organic (Rosemary Oil)	IRAC UNE	Madeira Mealybug (Phenacoccus madeirensis)	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).
33930	TetraCURB Organic (Rosemary Oil)	IRAC UNE	Madeira Mealybug (Phenacoccus madeirensis)	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.
33926	TetraCURB Organic (Rosemary Oil)	IRAC UNE	Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Salmon Sunblaze'	Greenhouse	Nansen	CA	2019	Foliar	Some population suppression at 2 weeks after application 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 madeirensis)	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.
30484	TriStar 30SG (Acetamiprid)	IRAC 4A	Madeira Mealybug (Phenacoccus madeirensis)	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	Foliar	Good to excellent control throughout this experiment

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
25063	TriStar 70WSP (Acetamiprid)	IRAC 4A	Madeira Mealybug (Phenacoccus madeirensis)	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	Excellent 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) 'Jade Wizard'	Greenhouse	Oetting	GA	2005	Foliar	Excellent efficacy
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.
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.
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.
35277	V-10433 (V-10433)		Mealybug, Striped (Ferrisia virgata)	Azalea (Rhododendron sp.) 'Encore Autumn Royalty'	Greenhouse	Chong	SC	2022	Foliar	Some reduction when applied 5 times every 3 days at 11 fl oz per 100 gallons. Phytotoxicity was not observed.
35075	V-10433 (V-10433)		Madeira Mealybug (Phenacoccus madeirensis)	Common Coleus (Plectranthus scutellarioides) 'Wizard Red Velvet'	Greenhouse	Gilrein	NY	2022	Foliar	Some reduction of nymphs and adults when applied 5 times every 3-4 days at 11 fl oz per 100 gallons.
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
34410	V-10433 (V-10433)		Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Nansen	CA	2022	Foliar	Some reduction of crawlers and mobiles when applied 5 times every 3 days at 11 fl oz per 100 gallons. Good control of eggs.
34410	V-10433 (V-10433)		Citrus Mealybug (Planococcus citri)	Common Coleus (Plectranthus scutellarioides)	Greenhouse	Villanassery Joseph	GA	2021	Foliar	Efficacy unknown. Trial results showed no significant differences among treatments.
34287	V-10433 (V-10433)		Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Salmon Sunblaze'	Greenhouse	Nansen	CA	2020	Foliar	Poor efficacy with 11 fl oz per 100 gal applied 5 times at 3-4 days interval.
34287	V-10433 (V-10433)		Citrus Mealybug (Planococcus citri)	Rose (Rosa sp.) 'Mandarin Sunblaze'	Greenhouse	Nansen	CA	2021	Foliar	Good control of egg masses, mediocre control of crawlers and mobiles when applied at 11 fl oz per 100 gal.
34981	V-10433 (V-10433)		Citrus Mealybug (Planococcus citri)	Marigold, French (Tagetes patula)	Greenhouse	Chong	SC	2021	Foliar	Good efficacy when applied at 11 fl oz per 100 gal.
35279	Velifer (Beauveria bassiana Strain PPRI 5339)	IRAC UNF	Mealybug, Striped (Ferrisia virgata)	Azalea (Rhododendron sp.) 'Encore Autumn Royalty'	Greenhouse	Chong	SC	2022	Foliar	Some reduction when applied 3 times every 7 days at 13 fl oz per 100 gallons. Phytotoxicity was not observed.
34412	Velifer (Beauveria bassiana Strain PPRI 5339)	IRAC UNF	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.
35278	Ventigra Insecticide (Afidopyropen)	IRAC 9D	Mealybug, Striped (Ferrisia virgata)	Azalea (Rhododendron sp.) 'Encore Autumn Royalty'	Greenhouse	Chong	SC	2022	Foliar	Some reduction when applied 2 times every 14 days at 7 fl oz per 100 gallons. Phytotoxicity was not observed.
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.

PR#	Product (Active Ingredients)	MOA Class	Target	Crop	Production Site	Researcher	Trial State	Trial Year	Application Type	Results
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.
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.
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 include citrus mealybug on the ISM-555 label when registered. Similarly, we suggest that SePRO include this pest on the first label for SP3014. The Pradia label can be amended to specifically include madeira mealybug.

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