

Project Name: Scale & Mealybug Efficacy

Dates Active: 2004-'05; 2008-'12; 2018-'23; 2024-'25

Project Description:

During the 2003 IR-4 Environmental Horticulture Workshop certain studies were designated "Super A" to start devoting time and resources to groups of studies with the same general goal. Researching new and existing pest management tools for mealybugs was one set. This concept then morphed into high priority projects. Mealybugs, particularly newly invasive species, present difficulties for growers and landscape managers. While there are several tools in different classes, product efficacy is often unknown for newly invasive species or on mealybugs of new ornamental horticulture crops. Screening for mealybug efficacy initially occurred in 2004 and 2005 and then began again in 2008 with experiments continuing through 2012. At the 2017 Workshop, mealybugs and scale once again became a high priority project.

Research Project Abstract:

Abstract from 2023 Mealybug Efficacy Summary

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.

Target Species (Phytotoxicity, or common and Latin name of arthropod, pathogen, weed):
Citrus Mealybug (<i>Planococcus citri</i>) Madeira Mealybug (<i>Phenacoccus madeirensis</i>) Mealybug, Cotton (<i>Phenacoccus solenopsis</i>) Mealybug, Striped (<i>Ferrisia virgata</i>) Mealybug, Taxus (<i>Dysmicoccus wistariae</i>) Mexican Mealybug (<i>Phenacoccus gossypii</i>) Miscanthus Mealybug (<i>Miscanthiococcus miscanthi</i>) Phormium Mealybug (<i>Balanococcus diminutus</i>) Root Mealybug, Hibiscus (<i>Ripersiella hibisci</i>) Root Mealybug, Rhizoecus sp. (<i>Rhizoecus</i> sp.)

Target Crops (list tested crops if ongoing or completed project)
Aglaonema (<i>Aglaonema</i> sp.) Gardenia (<i>Gardenia</i> sp.) Malpighia (<i>Malpighia</i> sp.) <i>M. prostrata</i> Silvergrass, Japanese (<i>Miscanthus sinensis</i>) Flax, New Zealand (<i>Phormium tenax</i>) Australian Catchbird Tree (<i>Pisonia brunoniana</i>) Common Coleus (<i>Plectranthus scutellarioides</i>) Palm, Guangxi Lady (<i>Rhapis robusta</i>) Azalea (<i>Rhododendron</i> sp.) 'Encore Autumn Royalty' Rose (<i>Rosa</i> sp.) Sage (<i>Salvia daghestanica</i>) Coleus (<i>Solenostemon</i> sp.) Marigold, French (<i>Tagetes patula</i>) Marigold (<i>Tagetes</i> sp.) Zinnia (<i>Zinnia</i> sp.) 'Sunny Time'

Target Product(s)(list tested products or numbered compounds if ongoing or completed project)	
A16901B 45WG (Thiamethoxam + cyantraniliprole)	Rycar (Pyrifluquinazon)
Acelepryn (Chlorantraniliprole)	Safari 20SG (Dinotefuran)
Acelepryn (Dupont) (Chlorantraniliprole)	Safari 2G (Dinotefuran)
Altus (Flupyradifurone)	Sarisa 50SL (Cyclaniliprole)
Aria 50SG (Flonicamid)	SP3014 (SP3014)
AzaGuard (Azadirachtin)	SuffOil X (Synergy) (Mineral oil)
Bountify (MBI 306) (Burkholderia rinojensis strain A396)	Talstar NF (Bifenthrin)
BW133 (BW133)	Talus 40SC (Buprofezin)
BW238 ES (BW238 ES)	Talus 70DF (Buprofezin)
BW238 WP (BW238 WP)	Talus WP (Buprofezin)
BW279N (BW279N)	TetraCURB Concentrate (Rosemary Oil)
Chlorpyrifos 2.32% (Chlorpyrifos)	TetraCURB Max (castor oil + rosemary oil + clove oil + peppermint oil)
Cygon 2E (Dimethoate)	TetraCURB Organic (Rosemary Oil)
Distance (Pyriproxyfen)	TriStar 30SG (Acetamiprid)
DuraGuard (Chlorpyrifos)	TriStar 70WSP (Acetamiprid)
EpiShield (Peppermint oil, clove oil, and sodium lauryl sulfate)	Ultra Pure Oil (BASF) (Mineral oil)
Flagship 0.22G (Thiamethoxam)	V-10433 (V-10433)
Flagship 25WG (Thiamethoxam)	Velifer (Beauveria bassiana Strain PPRI 5339)
Fulcrum (Pyriproxyfen)	Ventigra Insecticide (Afidopyropen)
Hachi-Hachi EC (Tolfenpyrad)	
Horticultural Oil (Mineral oil)	
ISM-555 (ISM-555, A21377X)	
KOC22018-8 (Botanical Oil Blend)	
Kontos 240SC (Spirotetramat)	
Mainspring GNL 200SC (Cyantraniliprole)	
Marathon II (Imidacloprid)	
MBI 203 SC2 (MBI 203)	
MBI 205 (MBI 205)	
Merit 75WP (Imidacloprid)	
Mesurool 75-W (Methicarb)	
Natural Solutions - V. lecanii (Verticillium lecanii)	
Orthene TTO 97 (Valent) (Acephate)	
Pradia (Cyclaniliprole + Flonicamid)	
Precise Acephate (Acephate)	
QRD 400 (Extract of Chenopodium ambrosioides)	
RTSA 721 (RTSA 721)	

Product Registration and Research Status			
	Fully Screened (also includes standards)	Partially Screened through IR-4 ¹	Need Data for Additional Species ?
Labeled for Mealybugs Generally & Commercialized	Flagship 25WG Onyx Orthene TTO Precise Acephate Scimitar CS Sun Spray Ultra-Fine oil Talstar NF Talus 40SC Talus 70DF Ultra Pure Oil	Aria 20SG Distance Flagship 0.22G Grandevo (MBI203) DF Kontos Pradia Safari 20SG * Sarisa	Arena 50WDG Botanigard 22WP BotaniGard MAXX EcoTrol Marathon II M-Pede Naturalis L Preferal Rycar * Safari 2G SuffOil X TriStar 30SG Xxpire
Labeled for Mealybugs Generally But NOT Commercialized			
Labeled for Specific Mealybugs & Commercialized			
Labeled for Specific Mealybugs but NOT Commercialized			
Not yet registered or labeled for Mealybugs		A16901B ISM-555 MBI-203 NI02ES-1 SP3014 TetraCurb Maxx	Hachi-Hachi <i>Verticillium lecanii</i>
No longer available for development for Mealybugs	Acelepryn QRD 400		
* IR-4 Data contributed to registration decision – either adding pest to label or not pursuing further research 1 At least one species screened fully 2 Product not available for production ornamentals			

IR-4 Efficacy Trials to Date
Average rating on a scale of 1 – 5 where 1 = <60% Control (not effective), 2 = 60-79% control, 3 = 80-89% control, 4 = 90-94% control and 5 = 95-100% control; minimum to maximum rating; number of trials (See table on next page). For product/pest combinations that are blank, IR-4 has not screened this combination. A rating of 3 or higher is considered commercially acceptable. 'Labeled' indicates that this pest species or genera is listed on the label.

Environmental Horticulture Program Research Project Sheet

<https://www.ir4project.org/ehc/ehc-registration-support-research/env-hort-extension-resources/>

MOA	Product (Actives)	Citrus Mealybug (<i>Planococcus citri</i>)	Madeira Mealybug (<i>Phenacoccus madeirensis</i>)	Mealybug, Cotton (<i>Phenacoccus solenopsis</i>)	Mealybug, Striped (<i>Ferrisia virgata</i>)	Mexican Mealybug (<i>Phenacoccus gossypii</i>)	Phormium Mealybug (<i>Balanococcus diminutus</i>)	Root Mealybug, Hibiscus (<i>Riparsiella hibisci</i>)	Root Mealybug, <i>Rhizoecus</i> sp.
FRAC BM02	Natural Solutions - V. lecanii (<i>Verticillium lecanii</i>)	3.0 (3 - 3) n1							
FRAC NC	BW133 (BW133)	4.0 (3 - 5) n2							
FRAC NC	Horticultural Oil (Mineral oil)		5.0 (5 - 5) n1						
FRAC NC	SuffOil X (Synergy) (Mineral oil)		3.0 (3 - 3) n1 Labeled						
FRAC NC	Ultra Pure Oil (BASF) (Mineral oil)	1.5 (1 - 2) n2							
FRAC NC & IRAC UNB	Bountify (MBI 306) (<i>Burkholderia rinojensis</i> strain A396)	1.8 (1 - 5) n6	1.0 (1 - 1) n1	4.0 (4 - 4) n1	1.5 (1 - 2) n2				
IRAC 16	Talus 40SC (Buprofezin)	3.8 (3 - 4) n5 Labeled	5.0 (5 - 5) n1 Labeled			5.0 (5 - 5) n1 Labeled			
IRAC 16	Talus 70DF (Buprofezin)	3.3 (2 - 5) n3 Labeled	4.5 (4 - 5) n4 Labeled						

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IRAC 1A	MesuroI 75-W (Methicarb)	3.0 (3 - 3) n1							
IRAC 1B	Cygon 2E (Dimethoate)								5.0 (5 - 5) n1
IRAC 1B	DuraGuard (Chlorpyrifos)	1.0 (1 - 1) n1							
IRAC 1B	Orthene TTO 97 (Valent) (Acephate)	5.0 (5 - 5) n1 Labeled	5.0 (5 - 5) n4 Labeled			5.0 (5 - 5) n1 Labeled		1.0 (1 - 1) n1 Labeled	
IRAC 1B	Precise Acephate (Acephate)						1.0 (1 - 1) n1 Labeled		
IRAC 21A	Hachi-Hachi EC (Tolfenpyrad)		5.0 (5 - 5) n1						
IRAC 23	Kontos 240SC (Spirotetramat)	1.5 (1 - 2) n2 Labeled	4.3 (2 - 5) n4 Labeled					3.8 (3 - 5) n4 Labeled	
IRAC 28	Acelepryn (Dupont) (Chlorantraniliprole)							1.0 (1 - 1) n1	

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IRAC 28	Mainspring GNL 200SC (Cyantraniliprole)		1.0 (1 - 1) n1						
IRAC 28	Sarisa 50SL (Cyclaniliprole)	1.5 (1 - 2) n2 Labeled	1.0 (1 - 1) n3 Labeled						
IRAC 28 + IRAC 29	Pradia (Cyclaniliprole + Flonicamid)	3.5 (2 - 5) n2	4.7 (4 - 5) n3						
IRAC 29	Aria 50SG (Flonicamid)	3.0 (1 - 5) n3 Labeled				5.0 (5 - 5) n1 Labeled		4.0 (4 - 4) n1 Labeled	
IRAC 3A	Talstar NF (Bifenthrin)	3.0 (3 - 3) n2 Labeled							
IRAC 4A	Flagship 0.22G (Thiamethoxam)		2.5 (1 - 3) n4 Labeled						
IRAC 4A	Flagship 25WG (Thiamethoxam)	4.4 (4 - 5) n5 Labeled	3.6 (2 - 5) n5 Labeled			4.0 (4 - 4) n1 Labeled	4.0 (4 - 4) n1 Labeled		
IRAC 4A	Marathon II (Imidacloprid)	1.0 (1 - 1) n2 Labeled							

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IRAC 4A	Merit 75WP (Imidacloprid)		1.0 (1 - 1) n1						
IRAC 4A	Safari 20SG (Dinotefuran)	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	
IRAC 4A	Safari 2G (Dinotefuran)		4.0 (2 - 5) n3 Labeled						
IRAC 4A	TriStar 30SG (Acetamiprid)	5.0 (5 - 5) n1 Labeled	4.5 (4 - 5) n2 Labeled			5.0 (5 - 5) n1 Labeled			
IRAC 4A	TriStar 70WSP (Acetamiprid)	5.0 (5 - 5) n4 Labeled	4.0 (4 - 4) n1 Labeled				4.0 (4 - 4) n1 Labeled		
IRAC 4A + IRAC 28	A16901B 45WG (Thiamethoxam + cyantraniliprole)	4.5 (4 - 5) n2 Labeled	3.0 (1 - 5) n6 Labeled					5.0 (5 - 5) n1 Labeled	
IRAC 4D	Altus (Flupyradifurone)	2.0 (1 - 3) n2 Labeled	2.0 (1 - 3) n3 Labeled						
IRAC 7C	Distance (Pyriproxyfen)	2.4 (1 - 5) n7 Labeled	2.7 (1 - 4) n3 Labeled	2.0 (2 - 2) n1 Labeled	2.0 (2 - 2) n1 Labeled				

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IRAC 7C	Fulcrum (Pyriproxyfen)				1.0 (1 - 1) n1				
IRAC 9D	Ventigra Insecticide (Afidopyropen)	2.0 (2 - 2) n2 Labeled	4.7 (4 - 5) n3 Labeled		2.0 (2 - 2) n1 Labeled				
IRAC UN	AzaGuard (Azadirachtin)	1.5 (1 - 2) n2	2.0 (1 - 3) n2						
IRAC UN	Rycar (Pyrifluquinazon)	5.0 (5 - 5) n1 Labeled	3.3 (2 - 5) n3 Labeled	1.0 (1 - 1) n1 Labeled					
IRAC UNE	QRD 400 (Extract of <i>Chenopodium ambrosioides</i>)	1.5 (1 - 2) n2	3.0 (3 - 3) n1						
IRAC UNE	TetraCURB Concentrate (Rosemary Oil)	5.0 (5 - 5) n1	2.0 (1 - 3) n2						
IRAC UNE	TetraCURB Organic (Rosemary Oil)	1.0 (1 - 1) n1	2.0 (1 - 3) n2						

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IRAC UNF	Velifer (Beauveria bassiana Strain PPRI 5339)	1.0 (1 - 1) n1 Labeled		1.0 (1 - 1) n1 Labeled	2.0 (2 - 2) n1 Labeled				
unknown	BW238 ES (BW238 ES)	1.0 (1 - 1) n1							
unknown	BW238 WP (BW238 WP)	1.0 (1 - 1) n1							
unknown	BW279N (BW279N)		1.0 (1 - 1) n1						
unknown	EpiShield (Peppermint oil, clove oil, and sodium lauryl sulfate)	3.0 (3 - 3) n1 Labeled		1.0 (1 - 1) n1 Labeled	1.0 (1 - 1) n1 Labeled				
unknown	ISM-555 (ISM-555, A21377X)	4.8 (4 - 5) n6	5.0 (5 - 5) n1	1.0 (1 - 1) n1	3.0 (1 - 5) n2				
unknown	KOC22018-8 (Botanical Oil Blend)	3.0 (3 - 3) n1	2.0 (1 - 3) n2						

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unknown	MBI 203 SC2 (MBI 203)	1.3 (1 - 2) n7	1.0 (1 - 1) n2	1.0 (1 - 1) n1	1.0 (1 - 1) n2			4.0 (4 - 4) n1	
unknown	MBI 205 (MBI 205)	2.0 (2 - 2) n1	5.0 (5 - 5) n1					2.0 (2 - 2) n1	
unknown	RTSA 721 (RTSA 721)	1.7 (1 - 2) n3							
unknown	SP3014 (SP3014)	3.0 (2 - 4) n6	4.0 (4 - 4) n1	1.0 (1 - 1) n1	1.0 (1 - 1) n2				
unknown	TetraCURB Max (castor oil + rosemary oil + clove oil + peppermint oil)	2.5 (2 - 3) n2	3.0 (3 - 3) n1	2.0 (2 - 2) n1	2.5 (2 - 3) n2				
unknown	V-10433 (V-10433)	1.7 (1 - 3) n6	2.0 (2 - 2) n1	1.0 (1 - 1) n1	1.0 (1 - 1) n2				