

**Project Name:** Mealybug Efficacy

New	Ongoing	X	Completed	Duration if ongoing or completed:	2004, 2005 2008 – 2012, 2018 -2023
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**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 (if available):**

*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> )	Miscanthus Mealybug ( <i>Miscanthiococcus miscanthi</i> )
Madeira Mealybug ( <i>Phenacoccus madeirensis</i> )	Phormium Mealybug ( <i>Balanococcus diminutus</i> )
Mealybug, Striped ( <i>Ferrisia virgata</i> )	Root Mealybug, Hibiscus ( <i>Ripersiella hibisci</i> )
Melybug, Taxus ( <i>Dysmicoccus wistariae</i> )	Root Mealybug, Rhizoecus sp. ( <i>Rhizoecus sp.</i> )
Mexican Mealybug ( <i>Phenacoccus gossypii</i> )	

**Target Crops (list tested crops if ongoing or completed project)**

<i>Aglaonema sp.</i>	<i>Rhododendron sp.</i>
<i>Gardenia sp.</i>	<i>Rosa sp.</i>
<i>Malpighia sp.</i>	<i>Salvia daghestanica</i>
<i>Miscanthus sinensis</i>	<i>Tagetes patula</i>
<i>Phormium tenax</i>	<i>Tagetes patula</i>
<i>Pisonia brunoniana</i>	<i>Tagetes sp.</i>
<i>Plectranthus scutellarioides</i>	<i>Tagetes sp.</i>
<i>Rhapis robusta</i>	<i>Zinnia sp.</i>

Target Product(s)(list tested products or numbered compounds if ongoing or completed project)	
A16901B 45WG (Thiamethoxam + cyantraniliprole)	Mesurool 75-W (Methicarb)
Acelepryn (Chlorantraniliprole)	Natural Solutions - V. lecanii (Verticillium lecanii)
Acelepryn (Dupont) (Chlorantraniliprole)	NI02ES-1 (NI02ES-1)
Altus (Flupyradifurone)	Orthene TTO 97 (Valent) (Acephate)
Aria 50SG (Flonicamid)	Pradia (Cyclaniliprole + Flonicamid)
AzaGuard (Azadirachtin)	Precise Acephate (Acephate)
Bountify (MBI 306) (Burkholderia rinojensis strain A396)	QRD 400 (Extract of Chenopodium ambrosioides)
BW133 (BW133)	RTSA 721 (RTSA 721)
BW238 ES (BW238 ES)	Rycar (Pyrifluquinazon)
BW238 WP (BW238 WP)	Safari 20SG (Dinotefuran)
BW279N (BW279N)	Safari 2G (Dinotefuran)
Chlorpyrifos 2.32% (Chlorpyrifos)	Sarisa 50SL (Cyclaniliprole)
Cygon 2E (Dimethoate)	SP3014 (SP3014)
Distance (Pyriproxyfen)	SuffOil X (Synergy) (Mineral oil)
DuraGuard (Chlorpyrifos)	Talstar NF (Bifenthrin)
Flagship 0.22G (Thiamethoxam)	Talus 40SC (Buprofezin)
Flagship 25WG (Thiamethoxam)	Talus 70DF (Buprofezin)
Fulcrum (Pyriproxyfen)	Talus WP (Buprofezin)
Hachi-Hachi EC (Tolfenpyrad)	TetraCURB Concentrate (Rosemary Oil)
Horticultural Oil (Mineral oil)	TetraCURB Max (castor oil + rosemary oil + clove oil + peppermint oil)
ISM-555 (ISM-555, A21377X)	TetraCURB Organic (Rosemary Oil)
KOC22018-8 (Botanical Oil Blend)	TriStar 30SG (Acetamiprid)
Kontos 240SC (Spirotetramat)	TriStar 70WSP (Acetamiprid)
Mainspring GNL 200SC (Cyantraniliprole)	Ultra Pure Oil (BASF) (Mineral oil)
Marathon II (Imidacloprid)	V-10433 (V-10433)
MBI 203 SC2 (MBI 203)	Velifer (Beauveria bassiana Strain PPRI 5339)
MBI 205 (MBI 205)	Ventigra Insecticide (Afidopyropen)
Merit 75WP (Imidacloprid)	

Product Registration and Research Status			
	Fully Screened (also includes standards)	Partially Screened through IR-4 <sup>1</sup>	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 <b>Safari 20SG *</b> <b>Sarisa</b>	Arena 50WDG Botanigard 22WP BotaniGard MAXX EcoTrol Marathon II M-Pede Naturalis L Preferal <b>Rycar *</b> Safari 2G SuffOil X TriStar 30SG Xpire



# Environmental Horticulture Program Research Project Sheet

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

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			

PROS	CONS
Efficacy is not necessarily the same for all mealybugs	Very few new tools for screening
Efficacy data on Marone products? Root mealybugs (container ornamental), herbaceous crops, foliar. Succulents in the west	Mealybugs tend to be managed well with a few exceptions
Vestaron – Spear for scales and mealybugs	Several IRAC classes are available for resistance management
Comments: Five of the seven products in the current protocol have sufficient data for registrations decisions related to Citrus Mealybug on the prospective labels, but data are needed on other species.	

<p><b>IR-4 Efficacy Trials to Date</b></p> <p>Average rating on a scale of 1 – 5 with 1 = 0 to about 50% efficacy (not effective) and 5 = 95 to 100 efficacy (very effective); minimum to maximum rating; number of trials (See table on next page). For product/insect combinations that are blank, IR-4 has not screened this combination.</p> <p>‘Labeled’ indicates that this insect species or genera is listed on the label. A rating of 2 or lower is considered unacceptable efficacy (<i>red text</i>). A rating of 3 or higher is considered commercially acceptable (black text). Non-labeled, completed product/insect combinations (3 or more trials) with an average rating of 3 or higher are highlighted with <b>green text</b>. For insect/product combinations that are blank, IR-4 has not screened this combination.</p>
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Table 1. Mealybugs feeding above ground

MOA	Product (Active Ingredients)	Phormium Mealybug ( <i>Balanococcus diminutus</i> )	Citrus Mealybug ( <i>Planococcus citri</i> )	Madeira Mealybug ( <i>Phenacoccus madeirensis</i> )	Mealybug, Striped ( <i>Ferrisia virgata</i> )	Mexican Mealybug ( <i>Phenacoccus gossypii</i> )
FRAC BM02	Natural Solutions - V. lecanii (Verticillium lecanii)		<b>3.0 (3 - 3) n1</b>			
FRAC NC	BW133 (BW133)		<b>4.0 (3 - 5) n2</b>			
FRAC NC	Horticultural Oil (Mineral oil)			<b>5.0 (5 - 5) n1</b>		
FRAC NC	SuffOil X (Synergy) (Mineral oil)			3.0 (3 - 3) n1 Labeled		
FRAC NC	Ultra Pure Oil (BASF) (Mineral oil)		<i>1.5 (1 - 2) n2</i>			
FRAC NC & IRAC UNB	Bountify (Burkholderia rinojensis strain A396)		<i>2.0 (1 - 5) n5</i>	<i>1.0 (1 - 1) n1</i>	<i>1.0 (1 - 1) n1</i>	
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		
IRAC 1A	Mesuro 75-W (Methicarb)		<b>3.0 (3 - 3) n1</b>			
IRAC 1B	DuraGuard (Chlorpyrifos)		<i>1.0 (1 - 1) n1</i>			
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
IRAC 1B	Precise Acephate (Acephate)	<i>1.0 (1 - 1) n1 Labeled</i>				
IRAC 21A	Hachi-Hachi EC (Tolfenpyrad)			<b>5.0 (5 - 5) n1</b>		
IRAC 23	Kontos 240SC (Spirotetramat)		<i>1.5 (1 - 2) n2 Labeled</i>	4.3 (2 - 5) n4 Labeled		
IRAC 28	Mainspring GNL 200SC (Cyantraniliprole)			<i>1.0 (1 - 1) n1</i>		
IRAC 28	Sarisa 50SL (Cyclaniliprole)		<i>1.5 (1 - 2) n2 Labeled</i>	<i>1.0 (1 - 1) n3 Labeled</i>		
IRAC 28 + IRAC 29	Pradia (Cyclaniliprole + Flonicamid)		<b>3.5 (2 - 5) n2</b>	<b>4.7 (4 - 5) n3</b>		
IRAC 29	Aria 50SG (Flonicamid)		3.0 (1 - 5) n3 Labeled			5.0 (5 - 5) n1 Labeled
IRAC 3A	Talstar NF (Bifenthrin)		3.0 (3 - 3) n2 Labeled			
IRAC 4A	Flagship 0.22G (Thiamethoxam)			<i>2.5 (1 - 3) n4 Labeled</i>		
IRAC 4A	Flagship 25WG (Thiamethoxam)	4.0 (4 - 4) n1 Labeled	4.4 (4 - 5) n5 Labeled	3.6 (2 - 5) n5 Labeled		4.0 (4 - 4) n1 Labeled
IRAC 4A	Marathon II (Imidacloprid)		<i>1.0 (1 - 1) n2 Labeled</i>			
IRAC 4A	Merit 75WP (Imidacloprid)			<i>1.0 (1 - 1) n1</i>		

MOA	Product (Active Ingredients)	Phormium Mealybug ( <i>Balanococcus diminutus</i> )	Citrus Mealybug ( <i>Planococcus citri</i> )	Madeira Mealybug ( <i>Phenacoccus madeirensis</i> )	Mealybug, Striped ( <i>Ferrisia virgata</i> )	Mexican Mealybug ( <i>Phenacoccus gossypii</i> )
IRAC 4A	Safari 20SG (Dinotefuran)	5.0 (5 - 5) n2 Labeled	3.8 (1 - 5) n8 Labeled	4.1 (2 - 5) n7 Labeled		5.0 (5 - 5) n1 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)	4.0 (4 - 4) n1 Labeled	5.0 (5 - 5) n4 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		
IRAC 4D	Altus (Flupyradifurone)		2.0 (1 - 3) n2 Labeled	2.0 (1 - 3) n3 Labeled		
IRAC 7C	Distance (Pyriproxyfen)		2.7 (1 - 5) n6 Labeled	2.7 (1 - 4) n3 Labeled	2.0 (2 - 2) n1 Labeled	
IRAC 9D	Ventgra 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		
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		
IRAC UNF	Velifer ( <i>Beauveria bassiana</i> Strain PPRI 5339)		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	ISM-555 (ISM-555, A21377X)		4.8 (4 - 5) n5	5.0 (5 - 5) n1	5.0 (5 - 5) n1	
unknown	KOC22018-8 (Botanical Oil Blend)		3.0 (3 - 3) n1	2.0 (1 - 3) n2		
unknown	MBI 203 SC2 (MBI 203)		1.3 (1 - 2) n6	1.0 (1 - 1) n2	1.0 (1 - 1) n1	
unknown	MBI 205 (MBI 205)		2.0 (2 - 2) n1	5.0 (5 - 5) n1		
unknown	RTSA 721 (RTSA 721)		1.7 (1 - 2) n3			
unknown	SP3014 (SP3014)		3.2 (2 - 4) n5	4.0 (4 - 4) n1	1.0 (1 - 1) n1	
unknown	TetraCURB Max (castor oil + rosemary oil + clove oil + peppermint oil)		2.0 (2 - 2) n1	3.0 (3 - 3) n1	3.0 (3 - 3) n1	
unknown	V-10433 (V-10433)		1.8 (1 - 3) n5	2.0 (2 - 2) n1	1.0 (1 - 1) n1	

**Table 2. Root mealybugs**

MOA	Product (Active Ingredients)	<i>Rhizoecus hibisci</i>	Root Mealybug, ( <i>Rhizoecus sp</i> )
IRAC 1B	Cygon 2E (Dimethoate)		<b>5.0 (5 - 5) n1</b>
IRAC 1B	Orthene TTO 97 (Valent) (Acephate)	<i>1.0 (1 - 1) n1 Labeled</i>	
IRAC 23	Kontos 240SC (Spirotetramat)	3.8 (3 - 5) n4 Labeled	
IRAC 28	Acelepryn (Dupont) (Chlorantraniliprole)	<i>1.0 (1 - 1) n1</i>	
IRAC 29	Aria 50SG (Flonicamid)	4.0 (4 - 4) n1 Labeled	
IRAC 4A	Safari 20SG (Dinotefuran)	4.5 (4 - 5) n2 Labeled	
IRAC 4A + IRAC 28	A16901B 45WG (Thiamethoxam + cyantraniliprole)	5.0 (5 - 5) n1 Labeled	
unknown	MBI 203 SC2 (MBI 203)	<b>4.0 (4 - 4) n1</b>	
unknown	MBI 205 (MBI 205)	<i>2.0 (2 - 2) n1</i>	