Project Name: Mite Efficacy

New		Ongoing		Completed	X	Duration if ongoing or completed:	2009 – 2011, 2014 - 2015

Project Description:

Mite species can be very difficult to manage because of their often cryptic nature and ability to rapidly reproduce. The key to management is a combination of excellent product application techniques for optimal plant coverage and a good rotational program among different IRAC mode of action classes to reduce resistance development. Spider mites, often the most prevalent mite group, are well studied during the development process for new miticides. However, other species may not be screened including broad mites and eriophyid mites. This project started as a regional issue in 2009screening currently registered products as well as new materials.

Research Project Abstract (if available):

Abstract from 2019 Mite Efficacy: A Literature Review
From 1999 to 2016, 34 active ingredients were tested mainly as foliar applications against several genera and species of mite pests on ornamentals and vegetables. Mite species tested included: broad mite, *Polyphagotarsonemus latus*, Eriophyid mites including *Aceria* sp., *Aculops lycopersici, Aculus ligustri, Aculus schlechtendali, Epitrimerus pyri,* spider mites including *Tetranychus urticae, Oligonychus ilicis* and *Panonychus citri,* and the red palm mite *Raoeilla indica.* Although there were insufficient data for definitive conclusions, Akari/Fujimite (fenpyroximate), Magus (fenazaquin) and Pylon (chlorfenaphyr), generally performed well on various species. Kontos/Movento/BYI 08330 (spirotetramat) looked promising on the Eriophyds *Aceria* sp. and *Aculus ligustri* and on the spider mites *P. citri* and *T. urticae*. Proclaim (emamectin benzoate) was promising on the Eriophyds *Aceria* sp. and *Aculus ligustri* and on *P. latus*. Mesa/Ultiflora (milbemectin) looked promising on the Eriophyds *A. ligustri, Aculus schlechtendali, Epitrimerus pyri* and *Aculops lycopersici*, and on the spider mites *T. urticae.* Shuttle (acequinocyl) looked promising on Southern red mite. On red palm mite, limited data indicated that Forbid/Judo (spiromesifen), Pylon, Sanmite (pyridaben), Shuttle (acequinocyl) and Sulfur/Thiolux (sulfur) performed well while Avid (abamectin), Hexygon (hexythiazox) and Tetrasan (etoxazole) were less effective. Tank-mix combination with oils generally improved mite control.

Research Target (Crop Safety, or common and Latin name of arthropod, pathogen, weed):

Broad Mite (*Polyphagotarsonemus latus*)
ForestieraEriophyid Mite (*Aceriasp*)
Hedge Privet Rust Mite (*Aculusligustri*)
Southern Red Mite (*Oligonychusilicis*)
Red Palm Mite (*Raoiellaindica*)

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

Holly (*Ilex sp.*)
New Guinea Impatiens (*Impatiens sp.*)
New Mexican Privet (*Forestieraneomexicana*)
Palm, Coconut (*Cocos sp.*)
Variegated Privet (*Ligustrumsinense*)

Target Product(s)(list tested products or numbered compounds if ongoing or completed project)

Akari 5SC (Fenpyroximate)
Avid 0.15EC (Abamectin)
Emamectin Benzoate
Floramite (Bifenazate)
Grandevo (*Chromobacteriumsubtsugae* NRRL B-30655)
Hexygon (Hexythiazox)
Judo 2SC (Spiromesifen)
Kontos (Spirotetramat)
Magus (Fenazaquin)
Ovation SC (Clofentezine)
Proclaim 5SG (Emamectin benzoate)
Pylon (Chlorfenapyr)
Sanmite (BASF) (Pyridaben)
Shuttle 15SC (Acequinocyl)
SuffOil X (Synergy) (Petroleum Oil)
Tetrasan (Etoxazole)
Thiolux 80DF (Sulfur)
TickEx EC (*Metarhiziumanisophliae*)
Ultiflora (Milbemectin)

Product Registration and Research Status				
	Fully Screened (also includes standards)	**Partially Screened through IR-4[1]**	**Need Data for AdditionalSpecies ?**	
Labeled for Mites Generally & Commercialized	Akari Avid, Minx Dursban Horticultural Oil Scimitar		BotaniGard MAXX Floramite Grandevo Judo Kontos Magus	Met-52, Tick-Ex Pylon Tetrasan Ultiflora Xpectro OD
Labeled for Mites Generally But NOT Commercialized				
Labeled for Specific Mites& Commercialized		Hexygon Ovation Sanmite	Kelthane ProMITE	Sirocco Tame
Labeled for Specific Mites but NOT Commercialized				
Not yet registered or labeled for Mites		Emamectin benzoate MBI-203	Sultan Venerate (MBI 206 F)	
No longer available for development for Mites				

* 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

Area	**Characteristic**	**Pro**	**Con**
Availability & effectiveness of alternative management tools	Little efficacy data available for non-spider-mite mites	x	
	Several IRAC classes are available for resistance management		x
	Rose Rosette Disease (eriophyid mite)	x	
	New tools may be available for screening	x	
	Need new systemic tools	x	
	Penetration to reach mite species is critical		x
	Spider mites tend to be managed well with a few exceptions		x
Damage potential of target			
Performance and crop safety of proposed products (from other systems)			
Compatibility with IPM, resistance management programs			
Economics			
Geographic distribution			
Manufacturer interest in labeling products			
Other			
Damage potential of target			

IR-4 Efficacy Trials to Date

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.

'Labeled' indicates that this disease species or genera is listed on the label. A rating of 2 or lower is considered unacceptable efficacy (*red text*). A rating of 3 or higher is considered commercially acceptable (black text). Non-labeled, completed product/disease combinations (3 or more trials) with an average rating of 3 or higher are highlighted with **green text**. For disease/product combinations that are blank, IR-4 has not screened this combination.

Product (ActiveIngredients)	Broad Mite (Polyphagotarsonemus latus)	Eriophyid Mite, Forestiera (Aceria sp_)	Hedge privet rust mite (Aculus ligustri)	Mite, Southern red (Oligonychus ilicis)	Red Palm Mite (Raoiella indica)
Akari 5SC (Fenpyroximate)		*2.0 (2 - 2) n1*	**5.0 (5 - 5) n1**		
Avid 0.15EC (Abamectin)	**5.0 (5 - 5) n1**		**5.0 (5 - 5) n1**		*2.3 (1 - 5) n3*
Enfold (Emamectin benzoate)		**4.0 (4 - 4) n1**			
Floramite (Bifenazate)				**5.0 (5 - 5) n1**	
Grandevo (MBI 203 DF) (Chromobacterium subtsugae NRRL B-30655)	*1.0 (1 - 1) n1 Labeled*				
Hexygon (Hexythiazox)		*1.0 (1 - 1) n1*	*1.0 (1 - 1) n1*		*1.0 (1 - 1) n1*
Judo 2SC (Spiromesifen)					5.0 (5 - 5) n1 Labeled
Kontos (BYI 8330 240SC) (Spirotetramat)	*2.0 (2 - 2) n2*	**3.0 (3 - 3) n1**	**5.0 (5 - 5) n1**		**5.0 (5 - 5) n1**
Magus (Fenazaquin)	3.0 (3 - 3) n1 Labeled	4.0 (4 - 4) n1 Labeled	5.0 (5 - 5) n1 Labeled		
Ovation SC (Clofentezine)				**5.0 (5 - 5) n1**	*2.0 (2 - 2) n1*
Proclaim 5SG (Emamectin benzoate)	**5.0 (5 - 5) n1**		**5.0 (5 - 5) n1**		
Pylon (Chlorfenapyr)	5.0 (5 - 5) n1 Labeled		5.0 (5 - 5) n1 Labeled		*2.0 (2 - 2) n1*
Sanmite (BASF) (Pyridaben)				5.0 (5 - 5) n1 Labeled	**5.0 (5 - 5) n1**
Shuttle 15SC (Acequinocyl)				**5.0 (5 - 5) n1**	**3.0 (3 - 3) n1**
SuffOil X (Synergy) (Petroleum Oil)	3.0 (3 - 3) n1 Labeled				
Tank Mix: Avid 2EC + Oil (Abamectin + Oil)		**4.0 (4 - 4) n1**			
Tank Mix: Pylon + Horticultural Oil (Chlorfenapyr + horticultural oil)	**5.0 (5 - 5) n1**				
Tank Mix: Pylon + SuffOil X (Chlorfenapyr + Paraffinic oil)	**5.0 (5 - 5) n1**				
Tetrasan (Etoxazole)					*1.7 (1 - 3) n3*
Thiolux 80DF (Sulfur)					**3.0 (3 - 3) n1**
TickEx EC (Metarhizium anisophliae)			3.0 (3 - 3) n1 Labeled		
Ultiflora (Milbemectin)		*1.0 (1 - 1) n1*	**5.0 (5 - 5) n1**		*2.0 (2 - 2) n1*

Registered and Experimental Products for Mite Management

IRAC Class	Foliar Applied Insecticides (active ingredients)	Registered Use Site(s)	Knock Down	Residual Control (days)	REI	Mite Efficacy				Life Stages			Treatment Program			
													A	B	C	D
						Broad Mites	Eriophyid Mites	Spider Mites	Red Palm Mites	Eggs	Immatures	Adults	Aggressive	Maintenance w/out biologicals	Maintenance with Biologicals	Maintenance prior to biologicals
Registered Products																
1B	Duraguard, Dursban (chlorpyrifos)	G, N	F	5-7	24 h	-	-	-	-	-	x	x	-	B	NO	NO
	Malathion	G, N	F	5-7	12 h	-	-	-	-	-	x	x	-	B	NO	NO
	Orthene T&O, Acephate 97 UP (acephate)	G, N	F	7	24 h	-	-	-	-	-	x	x	A	B	NO	NO
3A	Decathlon (cyfluthrin)	G, I, N	F	7	12 h	-	-	-	-	-	x	x	-	B	NO	NO
	Mavrik (fluvalinate)	G, I, N	F	14	12 h	-	-	-	-	-	x	x	-	B	NO	NO
	Scimitar GC (lambda-cyhalothrin)	G, N, S	F	7	24 h	-	-	-	-	-	x	x	-	B	NO	NO
	Talstar (bifenthrin)	G, I, N	F	7	12 h	-	-	-	-	-	x	x	-	B	NO	NO
	Tame (fenpropathrin)	G, I, L, N, S	F	7	24 h	-	-	-	-	-	x	x	-	B	NO	NO
3A +	Prentox Pyronyl Crop Spray, Pyrenone Crop Spray, etc. (pyrethrins + PBO)	G, N	F	Contact	12 h	-	-	-	-	-	x	x	-	B	NO	NO
5	Conserve SC, Entrust (spinosad)	G, L, N, S	F	5	4 h	-	-	-	-	-	x	x	A	B	C **	D
6	Avid EC (abamectin)	G, N, S	F	7-14	12 h	E	P-E	G-E	P-G	-	x	x	A	B	C **	D
	Ultiflora (milbemectin)	N	F	Contact	12 h	E	P-E	-	P	x	x	x	A	B	NO	D **
10A	Hexygon (hexythiazox)	G, L, N, S	S	30	12 h	-	P	-	-	x	x	-	A	B	C	D
	Ovation (clofentezine)	G, N, S	S	≤ 45	12 h	-	-	E	-	x	x	-				
10B	Tetrasan (etoxazole)	G, I, L, N, S		14	12 h	-	-	-	P	x	x	x	A	B	-	-
12B	ProMITE (fenbutatin-oxide)	G, N	M	-	48 h	-	-	-	-	-	x	x	A	B	C	D
13	Pylon 2SC (chlorfenapyr)	G	M	5-7	12 h	E	E	E	G	NO	x	x	A	B	NO [b]	NO
18B	Aza-Direct. Molt-X, (azadirachtin)	G, I, N, S	S	7	4 h	-	-	-	-	x	x	x	-	-	C	D
20B	Shuttle (acequinocyl)	G, I, L, N, S	F	14	12 h	-	P-E	G-E	E	x	x	x	A	B	C	D
20D	Floramite (bifenazate)	G, I, N, S	F	21	4 h	P-E	-	E	-	x	x	x	A	B	C	D
20D + 6	Sirocco (bifenazate+abamectin)	G, I, N, S	F	21	12 h	-	-	-	-	x	x	x	A	B	C**	D
21A	Akari (fenpyroximate)	G, L, I, N, S	F	14-21	12 h	E	P-E	F-G	P-E	x	x	x	A	B	C *	D
	Magus (fenazaquin)	G, I, N, S	F	Contact	12 h	G	G-E	-	-	-	x	x	-	B	C**	D
	Sanmite (pyridaben)	G	F	Contact	12 h	-	-	G-E	E	-	x	x	A	B	NO	NO
23	Forbid, Judo (spiromesifen)	G, N, S	M	7	12 h	E	P-G	E	?	x	x	x	A	B	?	?
	Kontos, BYI-8330 (spirotetramat)	G, I, N	S	7-14	24 h	F-E	F-E	E	-	-	x	x	A	B	-	-
25	Sultan Miticide (cyflumetofen) [c]	G, I, L, N, S	F	Contact	14 h	P	-	G-E	?	x	x	x	A	B	C	D
UN	Kelthane (dicofol)	G, N	-	5-7	48 h	-	-	-	-	x	x	x	-	B	NO	NO
UNB	Venerate, MBI-206 (*Burkholderia* sp. strain A396)	G, N	S	3-10	4h	-	-	-	-	-	x	-	-	-	-	-
UNE	Ecotrol (rosemary and peppermint oils)	G, N	-	-	-	-	-	-	-	x	x	x	-	-	-	-
	M-Pede, Safer Soap (potassium salts of fatty acids)	G, I, N	F	Contact	12 h	G	-	-	-	-	x	x	A	B	C **	D
	Proud 3 (thyme oil)	-	-	5-7	0 h	-	-	-	-	-	x	x	-	-	-	-

Registered and Experimental Products for Mite Management

IRAC Class	Foliar Applied Insecticides (active ingredients)	Registered Use Site(s)	Knock Down	Residual Control (days)	REI	Mite Efficacy				Life Stages			Treatment Program			
													A	B	C	D
						Broad Mites	Eriophyid Mites	Spider Mites	Red Palm Mites	Eggs	Immatures	Adults	Aggressive	Maintenance w/out biologicals	Maintenance with Biologicals	Maintenance prior to biologicals
UNE	Triact, Trilogy Neem Oil (extract of neem oil)	G, N	S	7	4 h	-	-	-	-	x	x	x	-	-	C	D
UNF	BotaniGard, Naturalis L (*Beauveria bassiana*)	G, I, N, S	M	3	4 h	-	-	G	-	-	x	x	A	B	C *	D
	Met 52, Tick Ex (*Metarhizium anisopliae* F52)	G, N	M	5-7	4 h	-	E	-	-	-	x	x	-	-	-	-
	NoFly WP (*Paecilomyces fumosoroseus* strain FE 9901)	G	M	3-7	4 h	-	-	-	-	-	-	-	-	-	-	-
	Preferal, PFR-97 (*Isaria fumosoroseus)*	G, L, N, S	S	Contact	4 h	-	-	-	-	-	x	x	A	B	C	D
UNM	Milstop [a] (potassium bicarbonate)	G, I, L, N, S	-	-	4 h	-	-	-	-	x	-	-	-	-	-	-
	Sulfur	-	-	3-5	24 h	-	-	-	G	-	x	x	A	B	-	-
	Ultra Pure oil, SuffOil-X, etc. (paraffinic oil)	G, N	F	Contact	4 h	G	-	-	-	x	x	x	A	B	C**	D
-	Cinnacure (cinnamaldehyde)	G, N	F	-	4 h	-	-	-	-	-	-	-	-	-	C	D
-	Grandevo, MBI-203 DF (*Chromobacterium subtsugae* strain PRAA4-1^T)	G, N	S	-	4 h	P	-	-	-	-	x	x	-	-	-	-
-	Sorbishield 90 (sorbitol octanoate)	G, N	-	Contact	24 h	-	-	-	-	-	x	x	-	B	-	-
-	Sucrashield (sucrose octanoate)	G, N	-	Contact	48 h	-	-	-	-	-	x	x	-	B	-	-
Experimental Products																
6	Emamectin benzoate	TBD	F	-	-	P-E	F-E	P	-	-	x	x	-	-	-	-
UNE	Trabon (soybean oil)	TBD	-	-	-	-	-	F	-	-	-	-	-	-	-	-
-	RM1963K	TBD	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Registered Use Sites: G = Greenhouse; L = Lath House; I = Indoors; N = Nursery; S = Shade House; TBD = To Be Determined
Knockdown: Fast (< 1 day), Medium (1-7 days), Slow (>7 days).
Efficacy: P = Poor (< 70% control); F = Fair (70% to 85% control); G = Good (85% to 95% control), E = Excellent (>95% control) on immatures and/or adults 1 to 3 weeks after first app.

Residual Control taken from product technical and label info, recommendations on earliest application intervals; Mite Efficacy taken from the 2019 IR-4 mite efficacy summary draft and 6 AMT reports. Effect on biological control agents for mites taken from Koppert , Biobest and some extension publications/recommendations.

* Results of efficacy trials have been variable for entomopathogens and impact on beneficial organisms is presumed to be less than that of traditional pesticide chemistries but the data are sparse.
** This insecticide is toxic to many BCA's but has a short residual and may be suitable for treating hot spots and re-introducing BCA's soon thereafter.
[b] NO because of residue on leaves.
[c] Sultan Miticide has a PRIA date of 1Q 2014. It is safe on beneficials. It has long residual and is a new mode of action group for miticides. It controls very distinct group of mites. It is active on all life stages of the mite. Controls or data supports right now citrus red mite; European red mite; Carmine mite; Glover mite; Pacific spider mite; two spotted mite.

Updated 9/10/21