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 2009 screening currently registered products as well as new materials.

Research Project Abstract (if available):

Abstract from 2012 Mite Efficacy: A Literature Review

At the IR-4 Ornamental Horticulture Program Workshop in 2009, Mite Efficacy was selected as a high priority project to obtain data supporting current and future registrations was discussed. There are many different species of mites causing injuries on ornamental horticulture crops, and an extensive project may be required to generate sufficient efficacy data to substantially impact product registrations. This summary contains efficacy on mite species collected through the IR-4 Project and data published in Arthropod Management Tests on fruit and vegetable crops. From 1999 to 2011, 26 active ingredients were tested mainly as foliar applications against several genera and species of mite pests. 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.* 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*)
Forestiera Eriophyid Mite (*Aceria sp*)
Hedge Privet Rust Mite (*Aculus ligustri*)
Southern Red Mite (*Oligonychus ilicis*)
Red Palm Mite (*Raoiella indica*)

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

Holly (*Ilex sp.*)
New Guinea Impatiens (*Impatiens sp.*)
New Mexican Privet (*Forestiera neomexicana*)
Palm, Coconut (*Cocos sp.*)
Variegated Privet (*Ligustrum sinense*)

Target Product(s) (list tested products or numbered compounds if ongoing or completed project)		
Akari 5SC (Fenpyroximate)	Judo 2SC (Spiromesifen)	Shuttle 15SC (Acequinocyl)
Avid 0.15EC (Abamectin)	Kontos (Spirotetramat)	SuffOil X (Synergy) (Petroleum Oil)
Emamectin Benzoate	Magus (Fenazaquin)	Tetrasan (Etoxazole)
Floramite (Bifenazate)	Ovation SC (Clofentezine)	Thiolux 80DF (Sulfur)
Grandevo (*Chromobacterium subtsugae* NRRL B-30655)	Proclaim 5SG (Emamectin benzoate)	TickEx EC (*Metarhizium anisophliae*)
Hexygon (Hexythiazox)	Pylon (Chlorfenapyr)	Ultiflora (Milbemectin)
	Sanmite (BASF) (Pyridaben)	

Product Registration and Research Status				
	Fully Screened (also includes standards)	**Partially Screened through IR-4 [1]**	**Need Data for Additional Species ?**	
Labeled for Mites Generally & Commercialized	Akari Avid, Minx Dursban Horticultural Oil Scimitar		Floramite Grandevo Judo Kontos Magus	Met-52, Tick-Ex Pylon Tetrasan Ultiflora
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

Project Pros	Project Cons
1 Little efficacy data available for non-spider-mite mites	1 Several IRAC classes are available for resistance management
2 Rose Rosette Disease (Eriophyid mite)	2 Very few new tools for screening
3 New tool available (BASF)	3 Spider mites tend to be managed well with a few exceptions
4 Need new systemic tools (emamectin benzoate, tree injection, unsure of soil systemicity, translaminar foliar)	4 RUP, on shelf for foliar production ornamental horticulture at the moment – need justification for manufacturer support
5 New Bayer Biologics product for mite evaluation (EPA submission for Food Use already made)	

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 (Active Ingredients)	Broad Mite (*Polyphagotarsonemus latus*)	Forestiera Eriophyid Mite (*Aceria sp*)	Hedge Privet Rust Mite (*Aculus ligustri*)	Southern Red Mite (*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*
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*				
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	4.0 (4 - 4) n1	5.0 (5 - 5) n1		
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		5.0 (5 - 5) n1		*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				
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

Foliar Applied Insecticides (active ingredients)	IRAC Class	Registered Use Site(s)	Knock Down	Residual Control (days)	REI	Mite Efficacy				Life Stages			Treatment Program			
						Broad Mites	Eriophyid Mites	Spider Mites	Red Palm Mites	Eggs	Immatures	Adults	A Aggressive	B Maintenance w/out biologicals	C Maintenance with Biologicals	D Maintenance prior to biologicals
Akari (fenpyroximate)	21A	G, L, I, N, S	F	14-21	12 h	?	P-E	F	P-E	x	x	x	A	B	C *	D
Avid EC (abamectin)	6	G, N, S	F	7-14	12 h	E	P-E	G-E	P-G	?	x	x	A	B	C **	D
Aza-Direct. Molt-X, (azadirachtin)	18B	G, I, N, S	S	7	4 h	?	?	?	?	x	x	x	?	?	C	D
Cinnacure (cinnamaldehyde)	-	G, N	F	?	4 h	?	?	?	?	?	?	?	?	?	C	D
Conserve SC, Entrust (spinosad)	5	G, L, N, S	F	5	4 h	?	?	?	?	?	x	x	A	B	C **	D
Decathlon (cyfluthrin)	3A	G, I, N	F	7	12 h	?	?	?	?	?	x	x	?	B	NO	NO
Duraguard, Dursban (chlorpyrifos)	1B	G, N	F	5-7	24 h	?	?	?	?	?	x	x	?	B	NO	NO
Ecotrol (rosemary and peppermint oils)	-	G, N	?	?	?	?	?	?	?	x	x	x	?	?	?	?
Floramite (bifenazate)	UN	G, I, N, S	F	21	4 h	P	?	E	?	x	x	x	A	B	C	D
Grandevo, MBI-203 DF (*Chromobacterium subtsugae* strain PRAA4-1^{T})	-	G, N	S	?	4 h	P	?	?	?	?	x	x	?	?	?	?
Hexygon (hexythiazox)	10A	G, L, N, S	S	30	12 h	?	P	?	?	x	x	-	A	B	C	D
Judo (spiromesifen)	23	G, N, S	M	7	12 h	E	P-G	?	?	x	x	x	A	B	?	?
Kelthane (dicofol)	UN	G, N	?	5-7	48 h	?	?	?	?	x	x	x	?	B	NO	NO
Kontos, BYI-8330 (spirotetramat)	23	G, I, N	S	7-14	24 h	F	F-E	E	?	?	x	x	A	B	?	?
Magus (fenazaquin)	21	G, I, N, S	F	Contact	12 h	G	G-E	?	?	?	x	x	?	B	C**	D
Malathion	1B	G, N	F	5-7	12 h	?	?	?	?	?	x	x	?	B	NO	NO
Mavrik (fluvalinate)	3A	G, I, N	F	14	12 h	?	?	?	?	?	x	x	?	B	NO	NO
Met 52, Tick Ex (*Metarhizium anisopliae* F52)	-	G, N	M	5-7	4 h	?	E	?	?	?	x	x	?	?	?	?
Milstop [a] (potassium bicarbonate)	NC	G, I, L, N, S	?	?	4 h	?	?	?	?	x	?	?	?	?	?	?
M-Pede, Safer Soap (potassium salts of fatty acids)	-	G, I, N	F	Contact	12 h	?	?	?	?	?	x	x	A	B	C **	D
Naturalis L (*Beauveria bassiana*)	M	G, I, N, S	M	3	4 h	?	?	?	?	?	x	x	A	B	C *	D
NoFly WP (*Paecilomyces fumosoroseus* strain FE 9901)	-	G	M	3-7	4 h	?	?	?	?	?	?	?	?	?	?	?
Orthene T&O, Acephate 97 UP (acephate)	1B	G, N	F	7	24 h	?	?	?	?	?	x	x	A	B	NO	NO
Ovation (clofentezine)	10A	G, N, S	S	≤ 45	12 h	?	?	E	?	x	x	?				
Preferal, PFR-97 (*Isaria fumosoroseus)*	-	G, L, N, S	S	Contact	4 h	?	?	?	?	?	x	x	A	B	C	D
Prentox Pyronyl Crop Spray, Pyrenone Crop Spray, etc. (pyrethrins + PBO)	3A +	G, N	F	Contact	12 h	?	?	?	?	?	x	x	?	B	NO	NO
ProMITE (fenbutatin-oxide)	12B	G, N	M	?	48 h	?	?	?	?	?	x	x	A	B	C	D
Proud 3 (thyme oil)	-	?	?	5-7	0 h	?	?	?	?	?	x	x	?	?	?	?
Pylon 2SC (chlorfenapyr)	13	G	M	5-7	12 h	E	E	E	G	NO	x	x	A	B	NO [b]	NO
Sanmite (pyridaben)	21	G	F	Contact	12 h	?	?	G-E	E	?	x	x	A	B	NO	NO
Scimitar GC (lambda-cyhalothrin)	3A	G, N, S	F	7	24 h	?	?	?	?	?	x	x	?	B	NO	NO

Information presented is based on the best data available on *July 21, 2015*.

Registered and Experimental Products for Mite Management

Foliar Applied Insecticides (active ingredients)	IRAC Class	Registered Use Site(s)	Knock Down	Residual Control (days)	REI	Mite Efficacy				Life Stages			Treatment Program			
						Broad Mites	Eriophyid Mites	Spider Mites	Red Palm Mites	Eggs	Immatures	Adults	A Aggressive	B Maintenance w/out biologicals	C Maintenance with Biologicals	D Maintenance prior to biologicals
Shuttle (acequinocyl)	20B	G, I, L, N, S	F	14	12 h	?	P-E	G-E	E	x	x	x	A	B	C	D
Sirocco (bifenazate+abamectin)	UN + 6	G, I, N, S	F	21	12 h	?	?	?	?	x	x	x	A	B	C**	D
Sorbishield 90 (sorbitol octanoate)	-	G, N	?	Contact	24 h	?	?	?	?	?	x	x	?	B	?	?
Sucrashield (sucrose octanoate)	-	G, N	?	Contact	48 h	?	?	?	?	?	x	x	?	B	?	?
Sulfur	-	?	?	3-5	24 h	?	?	?	G	?	x	x	A	B	?	?
Sultan Miticide (cylfumetofen) [c]	25	G, I, L, N, S	F	Contact	14 h	P	?	E	?	x	x	x	A	B	C	D
Talstar (bifenthrin)	3A	G, I, N	F	7	12 h	?	?	?	?	?	x	x	?	B	NO	NO
Tame (fenpropathrin)	3A	G, I, L, N, S	F	7	24 h	?	?	?	?	?	x	x	?	B	NO	NO
Tetrasan (etoxazole)	10B	G, I, L, N, S		14	12 h	?	?	?	P	x	x	x	A	B	?	?
Triact, Trilogy Neem Oil (extract of neem oil)	-	G, N	S	7	4 h	?	?	?	?	x	x	x	?	?	C	D
Ultra Pure oil, SuffOil-X, etc. (paraffinic oil)	-	G, N	F	Contact	4 h	G	?	?	?	x	x	x	A	B	C**	D
Ultiflora (milbemectin)	6	N	F	Contact	12 h	E	P-E	?	P	x	x	x	A	B	NO	D **
Experimental Products																
Emamectin benzoate	6	TBD	F	?	?	P-E	F-E	P	?	?	x	x	?	?	?	?
Venerate, MBI-206 (*Burkholderia* sp. strain A396)	-	G, N	S	?	4 h	?	?	?	?	?	x	?	?	?	?	?

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 latest IR-4 mite efficacy summary draft; 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.
[a] Milstop has a New York 2ee recommendation to control spider mites, aphids, mealybugs, stink bugs and whiteflies.
[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 mticides. 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.