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EVALUATION OF DIRECT AND INDIRECT ACTION OF INSECTICIDES AND ACARICIDES FOR CONTROL OF LIME AND AVOCADO PESTS

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Abstract. **Several insect and mite pests i.e., *Panonychus citri, Unaspis citri, Toxoptera citricida, Oligonychus yothersi, Frankliniella* spp., *Diaprepes abbreviatus* continue to be the most costly expense threatening the economic viability of avocado, and lime in Florida. We tested the efficacy of several pesticides against diverse pests (insects and mites) affecting these crops in Florida. The trials were conducted in growers' orchards or at the UF-TREC campus. The data generated during this study provides support of the efficacy of the compounds against pests of the crops mentioned above. The effectiveness of each pesticide is discussed and compared with results from untreated controls.**

Introduction and Review of Literature

Several insects and mite pests continue to be the most costly expense threatening the economic viability of lime (*Citrus latifolia*) and avocado (*Persea americana*) in Florida. Most of these pests, i.e., *Panonychus citri, Unaspis citri, Toxoptera citricida, Oligonychus yothersi, Frankliniella* spp., have been controlled with different chemical compounds, and they are part of a pest management program for both crops (Peña and Johnson, 1999; Knapp, 1998). However, many of the currently registered pesticides for avocados and limes will be lost with in the next 3 years (J. Crane, personal communication). Fortunately, there appears to be a good number of "new generation of pesticides" with potential for replacing pesticides currently used for both crops. The objective of this study is to 1) elucidate efficacy of several compounds against pests of avocado and lime in Florida. 2) Determine the effect of chemicals on biocontrol agents.

Materials and Methods

Citrus red mite, Panonychus citri. Experiments to elucidate the effectiveness of acaricides for control of citrus red mite were conducted from 22 April 1999 through 21 May 1999 in a glasshouse at the University of Florida, Tropical Research and Education Center, Homestead, FL. Red mite infested 4 feet lime trees growing in 1 gal containers were used for the experiment. Treatments consisted of three plants replicated seven times in a CRD. All applications were foliar and applied to first run-off with a manual sprayer at approximately 25 PSI. A pre-treatment count of motile stages (adults and nymphs) and eggs found per leaf was taken one day before spray. Post-treatment counts were taken 4, 7, 14 and 21 days following treatment. An ANOVA was performed and data separated by Waller-Duncan K-ratio test for each variable.

Citrus Psyllid, Diaphorina citrii. The trial was conducted in a two acre block of 6-year-old lime trees located at the University of Florida Tropical Research and Education Center. One application of insecticides was made on April 21, 1999 between 8 AM and 10 AM at a rate of 200 gal per acre with a hand-gun sprayer, 350 PSI, directed to the leaves and new leaf flush. Treatments were arranged in a completely randomized design of 16 trees per treatment; psyllid infestation was evaluated by collecting from each tree three leaf flushes and counting the number of eggs, nymphs and adults per flush.

Snow scale, Unaspis citri. The trial was conducted in a two acre block of six-year-old lime trees located at the University of Florida Tropical Research and Education Center. One application of insecticide was made on 16 July, 1998 between 1 PM and 4:30 PM at a rate of 200 gal per acre with a hand-gun sprayer, 350 PSI, directed to the trunk and main branches. Treatments were arranged in a completely randomized design of eight trees per treatment; scale infestation was evaluated by counting the number of main branches per tree, and by visually rating the percent scale infestation per trunk and branches. At the same time, the infestation per tree was graded as light (=1), medium (=2) or high (=3); scale infestation was evaluated one week before treatment and 2, 4, 8 and 12 weeks after treatment.

Brown citrus aphid, Toxoptera citricida. Experiment 1. Foliar treatments of Ethion and Lorsban, without surfactant were compared to an untreated control. All treatments were randomized and replicated four times on plots of four trees each in a 4 year old lime block on 20 × 20 ft spacing. Spray treatments were applied using a hand-gun sprayer with speed, nozzling and pressure adjusted at 200 gpa. All treatments were applied on October 15, 1998 with brown citrus aphid and coccinellid larvae counts made 1 day before spray and 2, 6 and 10 days after. At each sample, 5-10 cm long flushes were collected per tree (80 flushes per replicated plot) and examined for brown citrus aphid in the laboratory.

Brown citrus aphid, Toxoptera citricida. Experiment 2. Foliar treatments of Provado and 1% Citrus oil, and Lorsban without surfactant were compared to an untreated control. All treatments were randomized and replicated four times on plots of four trees each in a 4 year old lime block on 20 × 20 ft spacing. Spray treatments were applied using a hand-gun sprayer with speed, nozzling and pressure adjusted at 100 gpa. All treatments were applied on October 15, 1998 with brown citrus aphid and coccinellid larvae counts made 1 day before spray and 2, 5, 10, and 15 days after. At each sample, 5-10 cm long flushes were collected per tree (80 flushes per replicated plot) and examined for brown citrus aphid in the laboratory.

Indirect effects of chemicals on natural enemies on lime. Two chemicals, Agrimek and Nexter, were evaluated for indirect effects on the lady beetle, *Coccinella sanguinea sanguinea* which is a common aphid predator in *Citrus* and other crops grown in southern Florida. The coccinellids were hand collected

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and reared in the laboratory, until egg deposition. Egg batches were kept at 24° ± 2°C and 75-80% RH and 12:12 L:D, and larvae fed *Aphis* spp. until they were 4 days-old.

The test unit consisted of a bottom plexiglass plate (30.5 cm × 12.5 cm × 2 mm high) to which the product was applied and a safety Plexiglass plate of the same size with 10 recesses (d = 3.2 cm; 1.3 cm high) which was placed on the bottom of the Plexiglas plate 5 hours after the spray deposit dried. Each plate received approximately 1.6 ml of the mixture. Safety Plexiglas cylinders were placed into each recess as a confinement of the ladybug larvae during the test. The cylinders were sealed in the top with screen (52 × 52 mesh) to prevent aphids and ladybugs from escape. Individual larvae were daily fed 60 wingless aphids which were collected from *Parthenium histerophorus*. Each test include a control, the test substance (Nexter) and a reference treatment (Agrimek). Each treatment was replicated three times. The test and the reference product were diluted using distilled water. The spray apparatus was calibrated until it delivered an application rate equivalent to 100 l/ha. The condition of the larvae were recorded daily after introduction. After adult beetles emerged from the pupae, they were classified as healthy or malformed and sexed. A single male and a female were the transferred to 12.5 cm in diameter petri dishes to examine their reproductive performance. Beetles were fed daily an abundant (ca. 60-70) number of *Aphis* spp. The breeding cages were maintained under the same conditions as the test.

Effect of chemicals on parasitoids of citrus leafminer. To assess the relative impact of "Sevin" and competitive products on beneficial parasitoids of citrus leafminer on citrus, we evaluated for direct toxicity and effects of field-aged residues on females of the parasitoid *Pnigalio minio* (Hymenoptera: Eulophidae) using a glass vial bioassay. Eighty microliters of insecticide solutions were applied to 2 ml glass. Treated vials were vortexed and allowed to dry for 2 h. A single 8 d-old adult parasitoid was introduced into the vial 2 h after treatment and mortality observed 2, 4, 6, 24 and 48 hours thereafter. Parasitoids were removed from the vials 48 h after exposure. A different set of parasitoids was added 3, 5 and 10 days after treatment to the treated vials following the same procedure as explained above.

Citrus root weevil, Diaprepes abbreviatus. Two rates of the nematode, *Steinernema riobravis*, a sublethal dose of the insecticide, imidacloprid, and the fungus, *Beauveria bassiana* were tested for control of citrus weevil larvae in Marl soil. Treatments were assigned to 3 feet tall Tahiti lime trees replicated 10 times. Neonates less than 48 h old were used to infest each tree before treatment. Larvae were collected from eggs laid by field-collected adult females of citrus root weevil. The first nematode treatment was made at a rate of two million nematodes per tree, injected into the root system, using a tractor mounted sprayer, at which a # 1 multihole nozzle was added and the nozzle injected at a depth of 2-3 feet into the ground. A flow meter was attached to the spray hose. The second nematode treatment consisted of an application of two million nematodes per tree (~ 1 gallon /tree) applied to the soil surface as a drench using a watering can. The third treatment consisted on the application of a sublethal dose of imidacloprid (Admire [BAY NTN 33893] 1.6 F 17.4% a.i. and the fungus *B. bassiana* [Mycotrol ES 9601, log 5 dose per gram soil = 0.1 ml/gal] applied together as a drench using a 2 gallon watering can and the untreated control. The test was carried during three consecutive months, when trees were removed and the soil around the root system sifted for larvae. Fresh and dry weight of the root system of treated and untreated trees was taken. Soil was collected before treatment and bioassays were conducted to determine the presence of entomopathogenic nematodes and fungi. To determine the presence of resident nematodes, two soil samples were taken per tree to a depth of 6 inches at least 2 weeks before treatment. The samples were mixed and a sub-sample placed in a petri dish (24.5 cm in diameter), where 5 *Galleria* larvae were added. Fate of the larvae was determined 5 through 7 days after. Test to determine presence of entomopathogenic fungi, followed the same steps as mentioned above. Bioassay columns made of polystyrene tubes (10.5 cm high, 5 cm diameter with screen on bottom) were used. Two inches of soil were added per column. Tube was placed in container with a piece of carrot in bottom and 1.5 mm diameter moist filter paper. Soil up to 10 cc line and tapped 5 times on the table. Ten neonates, less than 48 h old were placed on top of the soil column. Seven days after, larvae were recovered and their fate evaluated. Dead larvae were held in a 1.5 mm in diameter petri dish lined with a moist filter paper to confirm mycosis caused by fungi. Propagules per g soil bioassay -PDA + Dodine petri plates (per liter water: 39 g PDA., o.4 g dodine, 0.1 streptomycin sulfate and 0.05 g chlortetracycline hydrochloride). Serial dilutions were made and plated by placing 5 g soil into 20 ml sterile distilled water with Tween and vortexed for 10 sec. Dilutions were made by placing 100 µl of the stock solution into 900 µl of distilled water (10^{-1}) and continuing to yield the desired solution. 100 µl of the dilution was spread on ½ of each plate to give two replications of the dilution. Plates were incubated for 10 days at 27-28°C and the number of fungal propagules determined microscopically.

Avocado mite, Oligonychus yothersi. This study was conducted in a 20 year-old Monroe avocado orchard in Homestead, FL that had experienced high damage of avocado mite in previous years. Four treatments were replicated 10 times in a RCB design. Each replicate consisted of an individual tree. Treatments were applied with a hand-held sprayer operating at 200 PSI and delivering 200 gal/acre. We evaluated eggs, adults and nymphs 2 day before treatment and 3, 7, 14 and 21 days after treatment, by collecting two leaves per treatment per replication.

Flower thrips, Frankliniella spp. Fifteen year-old avocado trees located at the Tropical Research and education Center in Homestead, FL were treated with experimental insecticides for control of flower thrips. The test was a RCB design consisting of 20 replicates. Applications were made using a backpack air-blast sprayer calibrated to deliver 100 gpa. Applications were initiated when different flower stages were present per panicle. Treatments were applied on 6 April, 1999 and evaluations were made on 7 and 9 April 1999. Infested panicles were evaluated by sampling one panicle using a beat-cloth and counting thrips that fell into the cloth. Differences among treatments were separated using ANOVA and data separated by Waller-Duncan K-ratio test.

Results

Citrus Red Mite. An average of 18-31 mite adults and nymphs and 51-73 eggs were observed per leaf in test trees when the spray trial was initiated (Tables 1 and 2). All treatments provided knockdown and residual red mite control compared to the untreated control. Floramite WP was not as effective as Agrimek and Sanmite, 7 and 21 days after treatment.

Table 1. Effect of acaricides on densities of citrus red mite on lime.

Treatment	Dose/ 100 gal	Number of adults and nymphs/leaf				
		1DBT	4DAT	7DAT	14DAT	21DAT
Floramite WP	2 oz	21.20 a	6.62 b	5.29 b	1.54 b	1.25 b
Agrimek 0.15EC	4 oz	18.39 a	0.88 bc	0.39 bc	0.17 bc	0.16 bc
Sanmite 75W	4 oz	30.70 a	0.21 cb	0.08 c	0.00 c	0.04 c
Untreated		24.76 a	45.60 a	24.70 a	10.41 a	2.95 a

DBT = Days before treatment.
DAT = Days after treatment.
Means in columns followed by the same letter are not significantly different (Duncan, $P > 0.05$).

Table 2. Effect of acaricides on densities of eggs of citrus red mite on lime.

Treatment	Dose/ 100 gal	Mean eggs per leaf at				
		1DBT	4DAT	7DAT	14DAT	21DAT
Floramite WP	2 oz	73.58 a	28.46 b	18.25 ab	4.79 b	1.58 ab
Agrimek 0.15EC	4 oz	52.43 a	23.92 b	8.04 b	4.21 b	0.56 b
Sanmite 75W	4 oz	51.75 a	19.67 b	11.04 b	3.28 b	0.40 b
Untreated		61.88 a	77.43 a	30.50 a	8.79 a	2.37 a

DBT = Days before treatment.
DAT = Days after treatment.
Means within a column followed by the same letter do not differ significantly (Duncan; $P > 0.05$).

Citrus Psyllid. Citrus psyllid egg densities were reduced between seven and 14 days after treatment on treated trees (Table 3). A reduction of psyllid nymphs was observed seven days after treatment for all treatments, but this reduction was only observed on the Lorsban treated trees 14 days after spray (Table 4). Nexter treatments and Lorsban maintained a similar psyllid adult infestation during the first 2 weeks following treatment (Table 5).

Table 3. Insecticides used against citrus psyllid on lime.

Treatment	Dose/Acre	Number of psyllid eggs/apical bud			
		1DBT	3DAT	7DAT	14DAT
Untreated		3.41 a	2.95 a	2.39 a	3.22 a
Nexter	6.6 oz	1.43 a	1.62 a	0.83 b	0.39 b
Nexter	5.2 oz	2.43 a	2.33 a	0.50 b	1.04 b
Lorsban 4EC	2.5 pts	2.29 a	0.31 a	0.02 b	0.58 b

Numbers within a column followed by the same letter were not significantly different (ANOVA; DMRT; $P < 0.05$).
DBT = days before treatment.
DAT = days after treatment.

Table 4. Insecticides used against citrus psyllid on lime.

Treatment	Number of psyllid nymphs/upper leaf			
	1DBT	3DAT	7DAT	14DAT
Untreated	2.56 a	5.66 a	1.29 a	1.93 a
Nexter 6.6 oz	1.37 a	2.12 b	0.41 a	0.93 ab
Nexter 5.2 oz	2.65 a	0.70 b	0.93 a	1.37 ab
Lorsban 4EC	2.20 a	0.68 b	0.68 a	0.02 b

Numbers within a column followed by the same letter were not significantly different (ANOVA; DMRT; $P < 0.05$).
DBT = days before treatment.
DAT = days after treatment.

Table 5. Effect of insecticides used against citrus psyllid on lime.

Treatment	Number of psyllid adults/flush			
	1DBT	3DAT	7DAT	14DAT
Untreated	0.12 a	0.06 a	0.17 a	0.10 a
Nexter 6.6 oz	0.35 a	0.02 a	0.02 b	0.00 b
Nexter 5.2 oz	0.11 a	0.01 a	0.02 b	0.00 b
Lorsban 4EC	0.25 a	0.00 a	0.00 b	0.00 b

Numbers within a column followed by the same letter were not significantly different (ANOVA; DMRT; $P < 0.05$).
DBT = days before treatment.
DAT = days after treatment.

The efficacy of these insecticides should be tested in combination with adjuvants, such as NR435 Oil and kinetic.

Citrus snow scale, Unaspis citri. The only treatment that caused a reduction on percentage of snow scale infestation was Applaud. Knack maintained a similar percent twig infestation during the first four weeks following treatment. Applaud treated trees maintained similar scale grade density (i.e., light) during 28 days following treatment (Tables 6-8).

The efficacy of the most promising insecticides should be tested in combination with adjuvants, such as NR435 Oil and kinetic.

Brown Citrus Aphid. Experiment 1. All treatments gave good knockdown of the aphid population, with treatments remaining efficient 10 days after treatment (Table 9). The flushes did not have any aphid population in either the check or treatment plots 15 days after treatment. No phytotoxicity was observed following any of the spray treatments. All treat-

Table 6. Insecticides used against snow scale on lime.

Treatment		Dose
1. Applaud 70WP	Buprofezin	0.25 lbs ai/A to 0.38 lbs ai/A = 0.77 lb/A = 0.77lb/100 gall **= 0.077 lb/10 gall water = 32 g/10 gall water**
2. Fulfill 50WP	Pymetrozyne	0.178 lbs ai/A = 0.36 lbs/A = 0.36 lbs/ 100 gall water = 0.0178 lb/10 gall water = **8 g product/10 gall water**
3. Knack 0.86EC	Pyriproxifen	0.02 lbs ai/A to 0.11 lbs ai/A = 0.13 gall/A = 0.13 gall/100 gall water **= 0.013 gall/10 gall water = 13 ml product/10 gall water**
4. Admire 1.6F	Imidachloprid	0.044 lbs ai/A = 0.028 gall/A = 0.028 gall/100 gall water = 0.0028 gall/10 gall water **= 2.8 ml/10 gall water**
5. Untreated	—	—

Table 7. Effect of insecticides on infestation of snow scale on lime.

Treatment	% twig infestation				
	1DBT	14DAT	28DAT	56DAT	82DAT
Applaud	31.25 a	31.25 b	58.75 a	57.50 a	30.00 b
Fulfill	41.25 a	43.75 ab	48.75 a	61.25 a	51.25 ab
Knack	31.12 a	40.00 ab	38.75 a	52.50 a	26.25 b
Admire	40.00 a	38.75 ab	42.50 a	56.25 a	61.25 a
Untreated	50.00 a	52.50 a	46.25 a	65.00 a	47.50 ab

Numbers within a column followed by the same letter were not significantly different (ANOVA; DMRT; $P < 0.05$).
DBT = days before treatment.
DAT = days after treatment.

Table 8. Effect of insecticides on infestation of snow scale on lime.

Treatment	Twig infestation grade				
	1DBT	14DAT	28DAT	56DAT	82DAT
Applaud	1.25 a	1.00 b	1.00 b	1.25 a	1.38 a
Fulfill	1.88 a	2.14 a	1.62 ab	2.12 a	2.12 a
Knack	1.62 a	1.62 a	1.62 ab	1.75 a	1.38 a
Admire	1.50 a	1.62 a	1.50 ab	1.75 a	1.88 a
Untreated	2.00 a	1.62 ab	1.88 a	2.12 a	1.88 a

Numbers within a column followed by the same letter were not significantly different (ANOVA; DMRT; $P < 0.05$).
DBT = days before treatment.
DAT = days after treatment.

Table 9. Effect of insecticides applied for control of brown citrus aphid on lime.

Treatment	Dose	No. brown citrus aphids/10 cm shoot			
		1DBT	2	6	10 DAT
Ethion 4MI	5 pts/A	132.62 a	10.88 b	8.00 b	23.00 b
Ethion 4MI	2.5 pts/A	98.0 a	16.25 b	10.25 b	n/a
Lorsban 4E	2.5 pts/A	88.0 a	7.71 b	23.67 b	13.50 b
Check	water	57.0 a	86.62 a	78.50 a	166.43 a

Treatment means within columns not showing a common letter are significantly different as separated by DMRT ($P = 0.05$).
DBT = days before treatment.
DAT = Days after Treatment.

ments reduced the coccinellid larval density up to 6 days after treatment (Table 10).

Experiment 2. All treatments gave good knockdown of the aphid population compared with the untreated control, with treatments remaining efficient 10 days after treatment. The Provado treatment lost its efficacy 15 days after (Table 11). Flushes did not have an aphid population in the Lorsban plots 15 days after treatment. No phytotoxicity was observed following any of the spray treatments.

All treatments reduced the coccinellid larval density up to 10 days after treatment (Table 12).

Indirect effect of pesticides on lady bugs on lime. Agrimek and Nexter caused higher mortality to lady bugs than the natural mortality observed in the control. Agrimek caused a higher mortality to lady bugs compared with Nexter 13 days after treatment (Table 13).

Table 10. Effect of insecticides applied for control of brown citrus aphid on lime.

Treatment	Dose	No. Coccinellid larvae/10 cm shoot			
		1DBT	2	6	10 DAT
Ethion 4MI	5 pts/A	0.00 a	0.00 b	0.00 b	0.50 a
Ethion 4MI	2.5 pts/A	0.38 ab	0.00 b	0.00 b	n/a
Lorsban4E	2.5 pts/A	0.50 ab	0.00 b	0.00 b	0.00 a
Check	water	0.75 a	0.38 a	0.75 a	0.72 a

Treatment means within columns not showing a common letter are significantly different as separated by DMRT ($P = 0.05$).
DBT = Days before Treatment.
DAT = Days after Treatment.

Table 11. Effect of insecticides applied for control of brown citrus aphid on lime.

Treatment	Dose/ 100 gal	No. brown citrus aphids/10 cm shoot				
		1DBT	2	5	10	15DAT
Provado 1.6F+	3.5 fl oz					
oil	1%	383.50 a	1.25 b	0.00 b	0.00 b	23.0
Check	water	380.50 a	297.00 a	78.00 a	84.25 a	30.0
Lorsban 4E	2.5 pts/A	388.0 a	7.71 b	23.67 b	13.50 b	n/a

Treatment means within columns not showing a common letter are significantly different as separated by DMRT ($P = 0.05$).

Table 12. Effect of insecticides applied for control of brown citrus aphid on lime.

Treatment	Dose/ 100 gal	No. Coccinellid larvae/10 cm shoot				
		1DBT	2	5	10	15DAT
Provado 1.6F+	3.5 fl oz					
oil	1%	0.50 a	0.25 b	0.00 a	0.00 a	0.00 a
Lorsban 4E	2.5 pts/A	0.50 a	0.00 b	0.00 b	0.00 a	n/a
Check	water	1.50 a	2.25 a	1.75 b	0.25 a	0.00 a

Treatment means within columns not showing a common letter are significantly different as separated by DMRT ($P = 0.05$).
DBT = Days before Treatment.
DAT = Days after Treatment.

Indirect effect of pesticides on Pnigalio minio. The organophosphate and carbamate insecticide were highly toxic to *P. minio* during the same day of treatment. These pesticides were also

Table 13. Indirect effect of insecticides applied on lime on lady bugs.

Treatment	Rate form	% Mortality of larvae *C. sanguinea sanguinea*					
		24 hr	48 hr	72 hr	4d	5d	6d Post-Trt
Control	no chemical	0 ± 0 b	4 ± 4 b	8 ± 5 b	11 ± 5 b	11 ± 5 b	14 ± 7 b
Agrimek 0.15EC	2.49 ml/gall	51 ± 10	86 ± 5 a	90 ± 4 a	100 ± 0 a	100 ± 0 a	100 ± 0 a
Nexter 75 WP	4.3 oz/gall	0 ± 0 b	7 ± 4 b	17 ± 6 b	20 ± 5 b	20 ± 5 b	27 ± 4 b

Treatment	% Mortality of larvae *C. sanguinea sanguinea*							
	7d	8d	9d	10d	11d	12d	13d	14 d Post-Trt
Control	18 ± 6 b	18 ± 6 b	18 ± 6 c	18 ± 6 c	23 ± 8 c	23 ± 8 c	23 ± 8 c	23 ± 8 c
Agrimek	100 ± 0 a	100 ± 0 a	100 ± 0 a	100 ± 0	100 ± 0 a	100 ± 0 a	100 ± 0 a	100 ± 0 a
Nexter	37 ± 10 b	40 ± 13 b	47 ± 11 b	48 ± 11 b	48 ± 11 b	48 ± 11 b	48 ± 11 b	52 ± 10 b

Means ± SEM within a column followed by the same letter are not significantly different ($P > 0.05$ Duncan).
Hr = hours after treatment.
D Post-Treatment = Days after treatment.

Table 14. Indirect effect of insecticides applied to control the citrus leafminer on its parasitoid, *Pnigalio minio.*

Treatments	Dose	Initial % mortality after 2 h contact with treated vial			
		Days after treatment			
		0	3	6	10
Check	water alone	0 b	0 b	0 b	0 b
Sevin XLR	3 lb ai/A	100 a	100 a	100 a	93 a
Agrimek	6 oz/A	57 b	0 b	0 b	0 b
Lorsban 4E	2.5 pts/A	100 a	100 a	100 a	98 a

Means in the same column followed by the same letter not significantly different (P = 0.05, Fisher's Protected LSD).

highly toxic as residues for up to 10 days. Agrimek was less toxic to the parasitoid during the same day of treatment, but was not toxic 10 days after treatment (Tables 14 and 15).

Avocado Mite. Reduction of motile avocado mites was observed 21 days after treatment. Egg density was reduced on Floramite and Agrimek treated trees, during 3 and 14 days after treatment (Tables 16 and 17).

Avocado Flower thrips. A high rate of spinosad provided a significant reduction of flower thrips in avocado during three days after application of the pesticide. Thrips densities were not suppressed eight days after treatment (Table 18).

Table 15. Effect of entomopathogenic nematodes, *Beauveria bassiana* and Admire against larvae of *Diaprepes abbreviatus.*

Treatment	Small larvae/ tree	Large larvae/ tree	Dried root mass (g)/tree
Untreated	1.1 a	1.2 a	5.9 a
Biovector (injected)	0.6 a	0.4 a	8.8 a
Biovector (drench)	0.8 a	1.1 a	9.0 a
Beauveria + Admire	0.8 a	0.4 a	10.6 a

Means ± SEM within a column followed by the same letter are not significantly different (P > 0.05 Duncan).

Table 16. Efficacy of acaricides against avocado red mite.

Treatment	Mean adults + nymphs per leaf				
	1DBT	3	7	14	21DAT
Floramite	2.45 a	1.42 a	1.63 ab	2.29 ab	2.55 a
Agrimek	2.12 a	0.72 a	2.35 a	3.68 a	1.02 b
Sanmite	2.90 a	1.22 a	1.84 b	0.87 b	0.50 b
Control	3.22 a	2.32 a	0.48 b	2.08 ab	0.25 b

Means ± SEM within a column followed by the same letter are not significantly different (P > 0.05 Duncan).

Table 17. Efficacy of acaricides against avocado red mite.

Treatment	Day 0	Mean mite eggs per leaf			
		3DAT	7DAT	14DAT	21DAT
Floramite	1.85 a	2.30 b	3.41 a	1.74 b	0.89 a
Agrimek	1.32 a	1.52 b	1.75 a	2.00 b	2.55 a
Sanmite	1.85 a	3.70 ab	2.42 a	1.76 b	1.64 a
Control	1.20 a	5.82 a	2.75 a	4.48 a	1/12 a

Means ± SEM within a column followed by the same letter are not significantly different (P > 0.05 Duncan).

Table 18. Efficacy of insecticide against flower thrips on avocado.

Treatment	Thrips/Panicle			
	1DBT	1DAT	3DAT	8DAT
Spinosad 12ml/gallon	64.75 a	6.75 b	12.15 b	28.40 a
Untreated	67.80 a	53.55 a	34.00 a	57.15 a

Means ± SEM within a column followed by the same letter are not significantly different (P > 0.05 Duncan).

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