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TOMATO: *Lycopersicon esculentum* Mill., ‘Lanai’

**CONTROL OF SWEETPOTATO WHITEFLY, WITH FOLIAR APPLIED
INSECTICIDES, IN GREENHOUSE TOMATO, 2014**

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Sweetpotato Whitefly (SPW): *Bemisia tabaci* (Gennadius)

Beleaf 50 SG, Levo 2.4 SL and SuffOil-X, applied as foliar sprays, were evaluated for preventative and knock-down control of SPW on greenhouse tomato, compared to a non-treated check, at the Gulf Coast Research and Education Center, Wimauma, Fla. in Feb-Mar 2014.

'Lanai' tomato seedlings, grown in 1.25 inch Speedling® trays, were transplanted to 1-gal pots in late Jan. On 7 Feb, two pots each were placed into 'BugDorm-2120 Insect Rearing Tents' (<http://bugdorm.megaview.com.tw/index.php>), made of 96x26 mesh white polyester netting (two sides) and clear vinyl (two sides) on greenhouse benches in a RCB design. Treatments were replicated four times. Each plot consisted of two plants inside a cage. All treatments were applied to the plants, outside their cages on 25 Feb, with a hand-held sprayer with a spray wand outfitted with a nozzle containing a 45° core and a no. 4 disc. The sprayer was pressurized by CO₂ to 40 psi and calibrated to wet the leaf surfaces thoroughly without excessive run-off. The plants were returned to their cages as soon as they were dry. On 26 Feb, about 40 SPW adults, from a colony reared on cotton, were introduced into each cage. Two wks after treatments were applied (11 Mar), Levo 2.4 SL and SuffOil-X were applied a second time. Sampling was performed weekly from 3 to 24 Mar. When a sample and treatment application occurred on the same date, the sample was taken first. Samples consisted of ten, randomly selected, mature leaflets per plot, five from each plant, distributed evenly from the top to bottom strata of the foliage. Samples were transported to the laboratory where SPW were counted on the lower leaf surfaces with the aid of a stereo microscope. Data were recorded as numbers of SPW eggs, 1st, 2nd & 3rd, or 4th instars, and exuviae per ten leaflets. Only live instars were recorded. All data were transformed, $\log_{10}(x+1)$, prior to ANOVA. Means were separated by Fisher's Protected LSD test ($P \leq 0.05$) with SAS 9.2 software (SAS Institute 2008). Means are reported in the original scale.

There were no differences among treatments in SPW egg densities until 17 Mar, when densities in plots treated with Levo or SuffOil-X were lower than in the non-treated and in plots treated with the low rate of Beleaf (Table 1). One wk later, egg densities among all chemically treated

plots, except those treated with SuffOil-X, were not different from the untreated checks. On 24 Mar, first instar densities in plots treated with Levo or SuffOil-X were significantly lower than in any other chemically treated or non-treated plots (Table 2). Second and third instar densities were lowest with these same treatments on 17 Mar and in plots treated with SuffOil-X on 24 Mar (Table 3). There were no differences in fourth instar densities among treatments throughout the experiment; however, by the last sample (24 Mar) mean densities ranged from 16 per ten leaflets in the checks to 0.3 per ten leaflets in plots treated with SuffOil-X (Table 4). Densities of the sum of all instars were lowest with treatments of Levo or SuffOil-X on 17 Mar and with SuffOil-X only on 24 Mar (Table 5). No significant differences in mean densities of exuviae were detected (Table 6). Other than the presence of small white bumps on the tops of some of the young leaves, observed after the second application of SuffOil-X, no signs of phytotoxicity were observed. This research was supported by industry gift(s) of pesticide and/or research funding.

Fig 1: Whitefly eggs per 10 leaflets

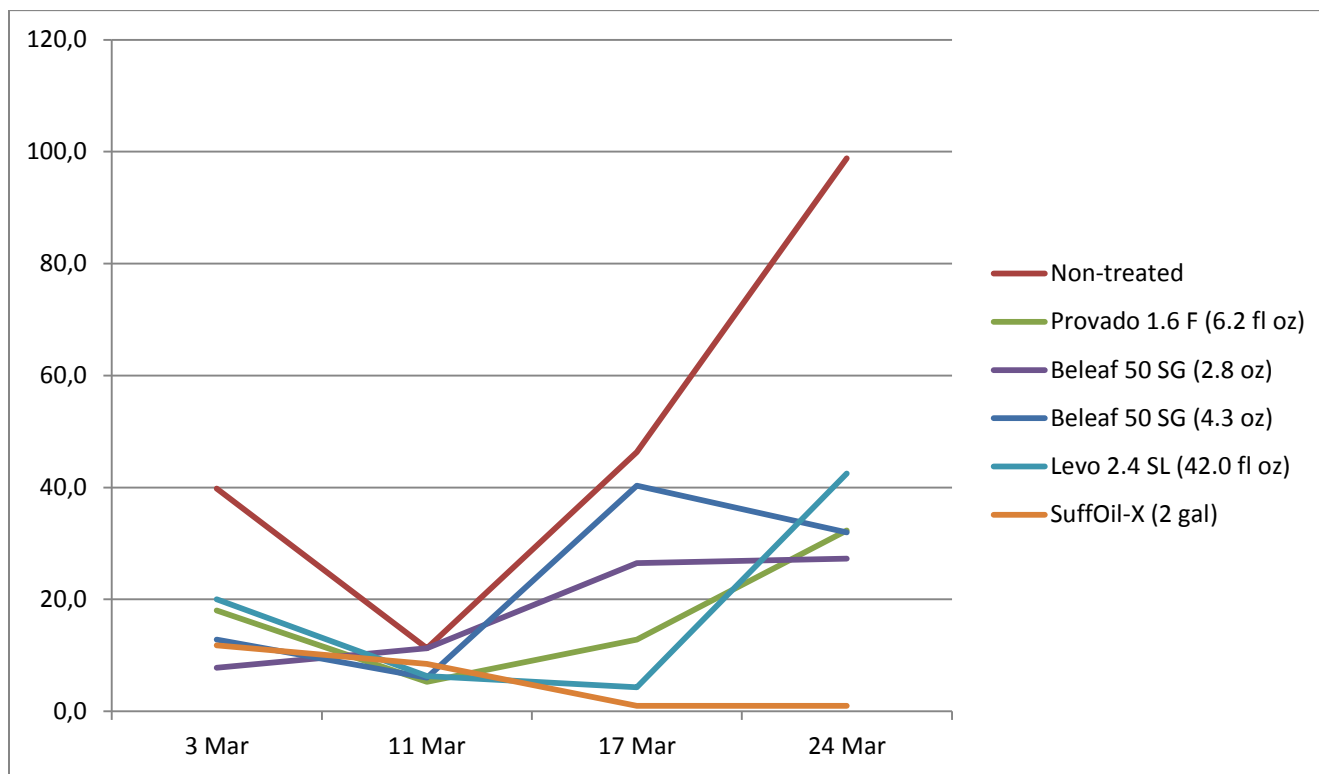


Table 1.

Treatment/ Formulation ^a	Rate amt/100 gal	No. SPW eggs (\pm SE) per 10 leaflets			
		3 Mar	11 Mar	17 Mar	24 Mar
Non-treated	--	39.8 a (11.9)	11.3 a (2.9)	46.3 a (25.1)	98.8 a (43.2)
Provado 1.6 F	6.2 fl oz	18.0 a (12.6)	5.3 a (2.7)	12.8 ab (5.8)	32.3 a (14.2)
Beleaf 50 SG	2.8 oz	7.8 a (2.3)	11.3 a (7.7)	26.5 a (10.9)	27.3 a (12.2)
Beleaf 50 SG	4.3 oz	12.8 a (8.5)	6.0 a (3.0)	40.3 ab (35.9)	32.0 a (12.5)
Levo 2.4 SL	42.0 fl oz				
+ Induce	32.0 fl oz	20.0 a (11.8)	6.3 a (3.0)	4.3 bc (2.3)	42.5 a (14.1)
SuffOil-X	2.0 gal	11.8 a (8.0)	8.5 a (5.3)	1.0 c (0.7)	1.0 b (1.0)
<i>F</i> _{5,15}		1.58	0.49	6.13	5.22
<i>P</i> -value		0.2254	0.7795	0.0028	0.0057

Means within a column followed by the same letter are not significantly different by Fisher's Protected LSD ($P \leq 0.05$). Data were transformed $\log_{10}(x+1)$ prior to ANOVA; non-transformed means are presented.

^a A '+' sign indicates the products were combined.

Fig 1: Whitefly 1st instars per 10 leaflets

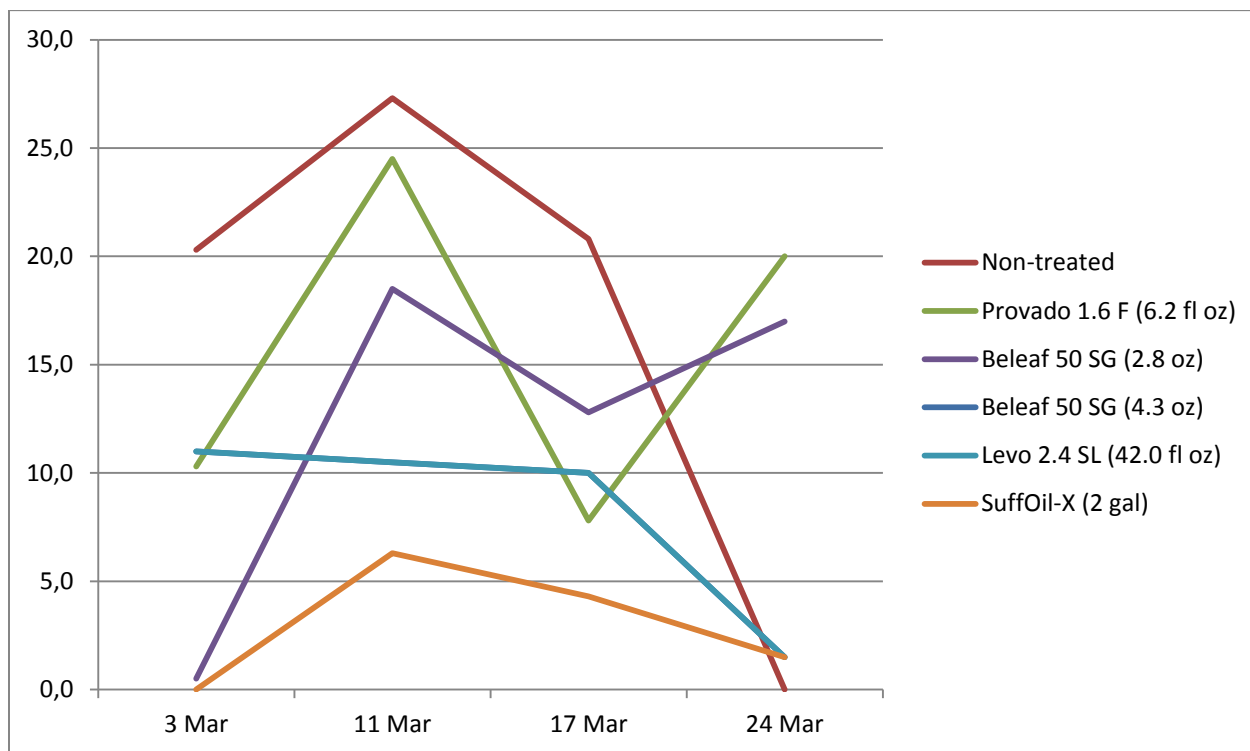


Table 2

Treatment/ Formulation ^a	Rate amt/100 gal	No. SPW 1 st instars (\pm SE) per 10 leaflets			
		3 Mar	11 Mar	17 Mar	24 Mar
Non-treated	--	20.3 a (20.3)	27.3 a (7.7)	20.8 a (4.9)	58.8 a (36.8)
Provado 1.6 F	6.2 fl oz	10.3 a (8.7)	24.5 a (8.6)	7.8 a (4.4)	20.0 a (4.6)
Beleaf 50 SG	2.8 oz	0.5 a (0.5)	18.5 a (8.5)	12.8 a (3.8)	17.0 a (4.0)
Beleaf 50 SG	4.3 oz	0.3 a (0.3)	12.5 a (2.0)	9.0 a (3.1)	16.3 a (2.2)
Levo 2.4 SL	42.0 fl oz				
+ Induce	32.0 fl oz	11.0 a (7.3)	10.5 a (7.5)	10.0 a (4.5)	1.5 b (0.6)
SuffOil-X	2.0 gal	0.0 a (0.0)	6.3 a (4.3)	4.3 a (2.9)	1.5 b (1.5)
$F_{5,15}$		1.11	2.27	2.47	7.44
P-value		0.3951	0.0998	0.0799	0.0011

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Fig 3: Whitefly 2nd & 3rd instars per 10 leaflets

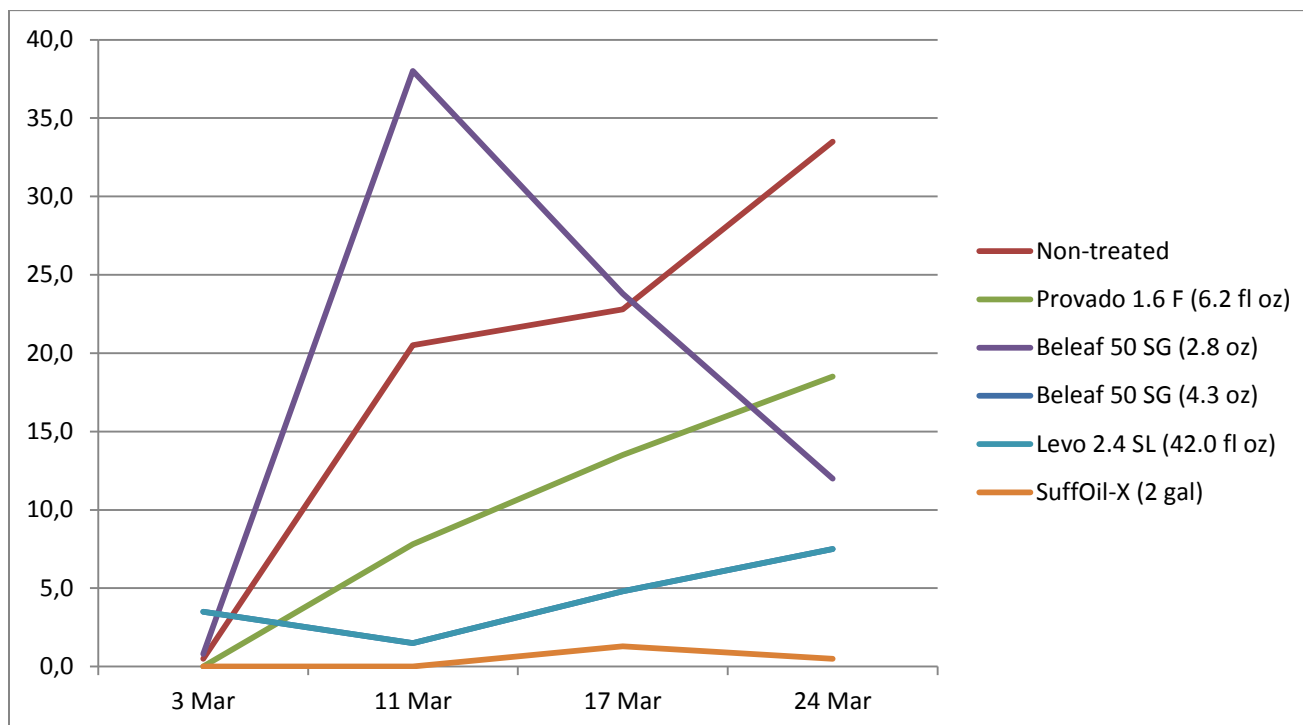


Table 3

Treatment/ Formulation ^a	Rate amt/100 gal	No. SPW 2 nd & 3 rd instars (\pm SE) per 10 leaflets			
		3 Mar	11 Mar	17 Mar	24 Mar
Non-treated	--	0.5 a (0.5)	20.5 a (10.0)	22.8 ab (13.1)	33.5 a (12.3)
Provado 1.6 F	6.2 fl oz	0.0 a (0.0)	7.8 a (7.4)	13.5 ab (4.2)	18.5 ab (5.6)
Beleaf 50 SG	2.8 oz	0.8 a (0.8)	38.0 a (26.9)	23.8 a (7.4)	12.0 ab (4.1)
Beleaf 50 SG	4.3 oz	3.5 a (2.0)	5.0 a (1.9)	7.5 ab (2.2)	14.3 ab (6.3)
Levo 2.4 SL	42.0 fl oz				
+ Induce	32.0 fl oz	3.5 a (3.5)	1.5 a (1.5)	4.8 bc (3.3)	7.5 b (3.2)
SuffOil-X	2.0 gal	0.0 a (0.0)	0.0 a (0.0)	1.3 c (1.3)	0.5 c (0.5)
<i>F</i> _{5,15}		0.93	2.21	4.19	6.65
<i>P</i> -value		0.4883	0.1076	0.0139	0.0019

Means within a column followed by the same letter are not significantly different by Fisher's Protected LSD ($P \leq 0.05$). Data were transformed $\log_{10}(x+1)$ prior to ANOVA; non-transformed means are presented.

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Fig 4: Whitefly 4th instars per 10 leaflets

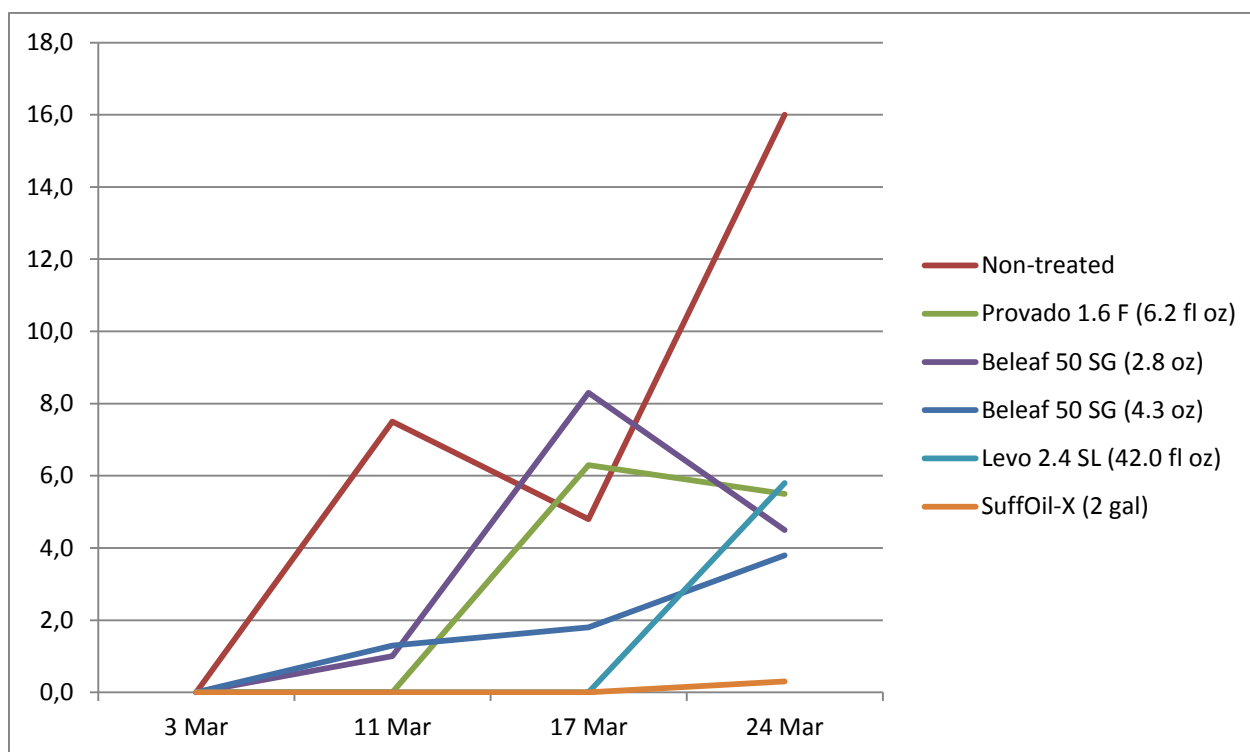


Table 4

Treatment/ Formulation ^a	Rate amt/100 gal	No. SPW 4 th instars (\pm SE) per 10 leaflets			
		3 Mar	11 Mar	17 Mar	24 Mar
Non-treated	--	0.0 (0.0)	7.5 a (5.4)	4.8 a (2.3)	16.0 a (7.7)
Provado 1.6 F	6.2 fl oz	0.0 (0.0)	0.0 a (0.0)	6.3 a (3.9)	5.5 a (3.3)
Beleaf 50 SG	2.8 oz	0.0 (0.0)	1.0 a (1.0)	8.3 a (5.7)	4.5 a (0.6)
Beleaf 50 SG	4.3 oz	0.0 (0.0)	1.3 a (0.9)	1.8 a (1.1)	3.8 a (2.5)
Levo 2.4 SL	42.0 fl oz				
+ Induce	32.0 fl oz	0.0 (0.0)	0.0 a (0.0)	0.0 a (0.0)	5.8 a (1.9)
SuffOil-X	2.0 gal	0.0 (0.0)	0.0 a (0.0)	0.0 a (0.0)	0.3 a (0.3)
<i>F</i> _{5,15}	--	--	1.70	2.00	2.39
<i>P</i> -value	--	--	0.1959	0.1373	0.0879

Means within a column followed by the same letter are not significantly different by Fisher's Protected LSD ($P \leq 0.05$). Data were transformed $\log_{10}(x+1)$ prior to ANOVA; non-transformed means are presented.

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Fig 5: Whitefly 1st – 4th instars per 10 leaflets

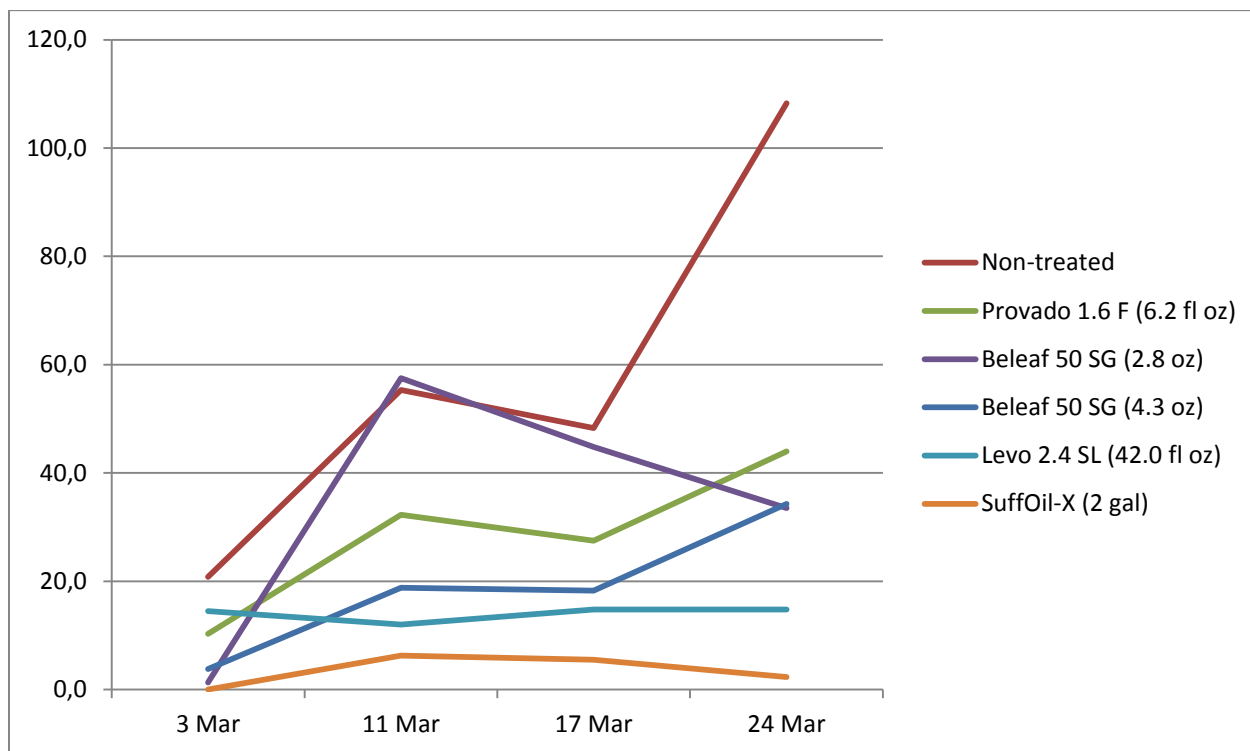


Table 5

Treatment/ Formulation ^a	Rate amt/100 gal	<u>No. SPW 1st – 4th instars (±SE) per 10 leaflets</u>			
		3 Mar	11 Mar	17 Mar	24 Mar
Non-treated	--	20.8 a (20.1)	55.3 a (18.5)	48.3 a (14.5)	108.3 a (52.6)
Provado 1.6 F	6.2 fl oz	10.3 a (8.7)	32.3 a (15.4)	27.5 ab (7.7)	44.0 ab (5.7)
Beleaf 50 SG	2.8 oz	1.3 a (0.8)	57.5 a (34.8)	44.8 a (13.7)	33.5 ab (6.0)
Beleaf 50 SG	4.3 oz	3.8 a (1.9)	18.8 a (3.4)	18.3 ab (3.9)	34.3 ab (10.0)
Levo 2.4 SL	42.0 fl oz				
+ Induce	32.0 fl oz	14.5 a (10.6)	12.0 a (7.3)	14.8 bc (7.8)	14.8 b (4.4)
SuffOil-X	2.0 gal	0.0 a (0.0)	6.3 a (4.3)	5.5 c (2.9)	2.3 c (1.4)
<i>F</i> _{5,15}		0.69	2.73	5.46	8.14
<i>P</i> -value		0.6408	0.0602	0.0047	0.0007

Means within a column followed by the same letter are not significantly different by Fisher's Protected LSD ($P \leq 0.05$). Data were transformed $\log_{10}(x+1)$ prior to ANOVA; non-transformed means are presented.

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Fig 6: Whitefly exuviae per 10 leaflets

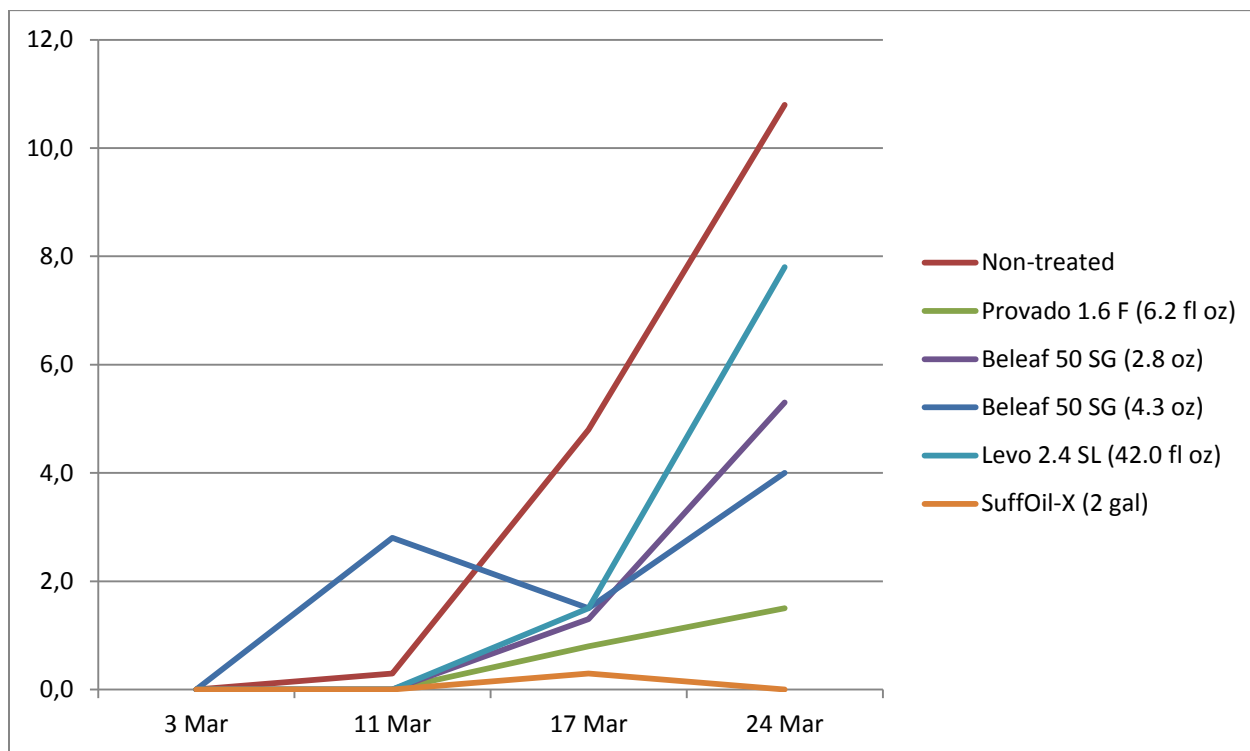


Table 6

Treatment/ Formulation ^a	Rate amt/100 gal	No. SPW exuviae (\pmSE) per 10 leaflets			
		3 Mar	11 Mar	17 Mar	24 Mar
Non-treated	--	0.0 (0.0)	0.3 a (0.3)	4.8 a (3.8)	10.8 a (7.2)
Provado 1.6 F	6.2 fl oz	0.0 (0.0)	0.0 a (0.0)	0.8 a (0.5)	1.5 a (0.9)
Beleaf 50 SG	2.8 oz	0.0 (0.0)	0.0 a (0.0)	1.3 a (1.3)	5.3 a (2.7)
Beleaf 50 SG	4.3 oz	0.0 (0.0)	2.8 a (2.4)	1.5 a (1.0)	4.0 a (2.4)
Levo 2.4 SL	42.0 fl oz				
+ Induce	32.0 fl oz	0.0 (0.0)	0.0 a (0.0)	1.5 a (1.5)	7.8 a (6.8)
SuffOil-X	2.0 gal	0.0 (0.0)	0.0 a (0.0)	0.3 a (0.3)	0.0 a (0.0)
<i>F</i> _{5,15}	--	--	1.83	0.47	1.38
<i>P</i> -value	--	--	0.1664	0.7963	0.2881

Means within a column followed by the same letter are not significantly different by Fisher's Protected LSD ($P \leq 0.05$). Data were transformed $\log_{10}(x+1)$ prior to ANOVA; non-transformed means are presented.

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Part II. Materials Tested for Arthropod Management

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CONTROL OF SWEETPOTATO WHITEFLY, WITH FOLIAR APPLIED INSECTICIDES, IN GREENHOUSE TOMATO, 2014

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Brand Name	Form-ulation	Common Name	Composition	Manufacturer
Beleaf	50 SG	flonicamid	N-(cyanomethyl)-4-(trifluoromethyl)-3-pyridinecarboxamide	FMC Corp. Philadelphia, PA
Induce	90%	non-ionic surfactant	Proprietary blend of alkyl aryl polyoxyalkane ethers, free fatty acids, and dimethyl polysiloxane	Helena Chemical Co., Memphis, TN
Levo	2.4 SL	not available	not available	Sineria Industries, Ltd.,

				Cyprus
Provado	1.6 F	imidacloprid	1-[(6-Chloro-3-pyridinyl)methyl]-N-nitro-2-imidazolidinimine	Bayer CropScience Research Triangle Park, NC
SuffOil-X	80%	petroleum horticultural oil mixture	Hydrotreated light parafinic distillate mixture	BioWorks, Inc. Victor, NY