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Insect Pest Control Potentiality of some Commercially Available Detergents

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ABSTRACT

Pest control potentiality of four commercial detergents namely, Surf Excel, Sunlight, Rin Advanced and Ezee, each at three concentrations (1.0, 0.5 and 0.1%), against citrus psylla (*Diaphorina citri* Kaw.), taro aphid (*Aphis gossypii* Glov.) and black ant (*Camponotus compressus* Fabr.) was studied in the department of Agril. Entomology, Bidhan Chandra Krishi Viswavidyalaya. All the treatments with the detergents except 0.1% concentration of Surf Excel and Rin Advanced provided 84.80 – 98.23% reduction in psyllid population up to 7 days after treatment. Ezee and Surf Excel @ 1.0 and 0.5%, Sunlight @ 1.0 and 0.1% and Rin Advanced @ 1.0% resulted in 79.31 – 97.40% population reduction of the aphid up to the same period. The detergents caused total mortality of the ant within 1 hr of treatment. Surf Excel @ 1.0% and sunlight @ 1.0 and 0.5% caused mild to moderate level of burning on swamp taro leaves after 48 – 72 hr of treatment.

Key words : Detergents, Pest, Potentiality.

Soaps and detergents are used to control insects over centuries. Recently there has been renewed interest in using these products in many countries as soaps containing potassium salts can be used in organic farming (Anon, 2005). Though the soaps and detergents are relatively safer to the natural enemy fauna with the possible exception of predatory mites, one of the most serious draw back of using these in agricultural pest control is the risk of phytotoxicity (Butler and Hennberry, 1990b). To overcome this problem, insecticidal soaps have been formulated which have high insect killing properties vis-à-vis safe to plants (Weinzeierl and Henn, 1994). However even the commercial detergents and soaps can be used in pest control with reasonable safety (Puri *et al.,* 1994). In general, soaps and detergents are highly effective against most soft bodied arthropods such as, aphids, psyllids, young scales, white flies, mealy bugs and spider mites (Moore *et al.*, 1979; Butler and Hennberry, 1990a and Anonymous, 2001). Keeping this in mind, an attempt was made to evaluate the bio-efficacy of four commercial detergents in controlling two important crop pests namely, the citrus psylla, *Diaphorina citri* and taro aphid, *Aphis gossypii*; and one house hold pest, the black ant, *Camponotus compressus*.

MATERIAL AND METHODS

The experiment was conducted at the University Horticulture Farm at Mondouri during June, 2005. There were altogether thirteen treatments including four commercial detergents namely, Surf Excel, Sunlight, Rin Advanced and Ezee, each at three concentrations (0.1, 0.5 and 1.0 %) and untreated control. To study the bio-efficacy of the detergents against *D. citri*, thirty nine numbers of five year old lemon (*Citrus limon* Burm) trees were selected and fixed for spray. Each treatment was sprayed on three trees @ 1litre / tree considering each individual tree as a replication. In untreated control, trees were sprayed with same quantity of water. The population of nymphs and adults was counted from 15 cm terminal shoot of ten twigs per plant, before and 1, 3, 7 and 15 days after spraying (DAS). To study the bio-efficacy of these detergent sprays against the aphid, *A. gossypii*, Swamp taro (BCST – 1) was grown in plots measuring 3x3m^2 at a spacing of 75 x 75 cm^2 following usual practices. One hundred twenty days old plants were sprayed with the above treatments @ 750 L ha^{-1}. Aphid populations were recorded just before and 1, 3, 7, and 15 DAS from three leaves (one tender, one moderately old and one old) of each of the three plants, selected for this purpose, per plot using the following score: up to 100 - direct count; 101 - 300 - A; 301 - 500 - B; 501 - 1000 - D and so on. The aphid population against a particular score was determined from the mean value of the lower and upper limits of that score. To study the effect of detergents on the mortality of the ant, *C. compressus*, these were attracted to Petri plates (15 cm diameter) lined with filter paper by providing biscuit dusts. Afterwards the Petri plates were

sprayed with 2 ml detergent solution with the help of a hand atomizer and immediately covered with the lid to trap the ants. In control treatment water was used. Mortality was recorded after one hour. No further observation was taken as all the insects died within one hr of treatment. Per cent population reduction of the test insects over control was calculated from the observed data which were utilized to work out test of significance following RBD. The treated citrus trees or swamp taro plants were examined daily for consecutive seven days after spraying to record phytotoxicity symptoms like leaf injury, wilting, vein clearing, necrosis etc., if any, due to treatment with detergents.

RESULTS AND DISCUSSION

Efficacy of detergents in controlling *D. citri*:

Before the spraying, the treatments harboured 3.0 - 11.3 adults and nymphs per 15 cm twig on an average and there was significant difference among the treatments in respect of psyllid population. One day after the spraying, different concentrations of detergents resulted in 14.0 - 90.9% reduction in population over control. Rin Advanced at 1.0% gave maximum reduction in population (90.9%) and was statistically at par with all the three dosages of Surf Excel ((90.80 - 82.20% reduction), and Ezee (84.13 - 58.75% reduction) and Sunlight @ 1.0 and 0.5% (79.90 and 74.60% reduction, respectively). Sunlight @ 0.1% and Rin Advanced @ 0.5 and 0.1% produced 36.40, 35.50 and 14.00% population reduction, respectively.

After three days of spraying, Ezee @ 1.0% showed total reduction of psyllid population and this treatment did not differ significantly from other treatments except 0.5 and 0.1% concentration of Rin Advanced (60.30 and 6.10%) and 0.1% Sunlight (66.70%).

After 7 days of treatment, however, there was slight increase in psyllid population in some of the treatments and Rin Advanced @ 0.1% was inferior to all other treatments (38.03% reduction). Sunlight @ 0.1% showed 69.80% reduction in population and this treatment was on a par with Surf Excel @ 1.0% (87.50%), Ezee @ 0.1% (88.20%) and Rin Advanced @ 0.5% (84.80%). Ezee @ 0.5% gave maximum population reduction over control (98.23%) and was at par with all the treatments except the lowest dosages (0.1%) of Sunlight and Rin Advanced. The number of psyllids recorded in different treatments after 15 days of treatment was erratic and scanty which could not be used in analyzing the data.

Efficacy of detergents in controlling *A. gossypii*:

The commercial detergents at different dosages caused 48.92 - 97.80% reduction of aphids within 24 h of treatment. Ezee @ 1.0% showed maximum reduction ((97.80%) and was at par with all other treatments except 0.5 and 0.1% concentration of Surf Excel (55.80 and 48.90% population reduction, respectively) and 0.5% Rin Advanced (50.00% reduction).

After 3 days of treatment, Surf Excel @ 1.0% gave maximum population reduction of aphids (97.64%) followed by Sunlight @ 1.0% (97.33%), Ezee @ 0.5% (95.60%) and 1.0% (94.13%), Rin Advanced @ 1.0% (89.60%), Surf Excel @ 0.5% (80.00%), Sunlight @ 0.1% (76.9%) and Ezee @ 0.1% (69.40%) and these treatments did not show any significant difference among themselves. Rin Advanced @ 0.5% was the least effective causing 50.00% reduction in aphid population. This treatment, however, did not differ significantly from Sunlight @ 0.5% (57.80%), Surf Excel @ 0.1% (57.80%), Rin Advanced @ 0.1% (69. 04%) and Ezee @ 0.1% (69.40%) in performance.

After 7 days of treatment, Ezee @ 1.0% caused total reduction in aphid population and was found to be superior to rest of the treatments except Ezee @ 0.5% (97.25%), Surf Excel @ 1.0% (97.40%), Sunlight @ 1.0% (95.64%) and Rin Advanced @ 1.0% (90.90%). Rin Advanced @ 0.5%, Ezee @ 0.1%, Sunlight @ 0.5% and Surf Excel @ 0.1% were the poor performers in which the per cent population reduction was 50.33, 66.78, 63.31 and 68.03% respectively.

After 15 days of spray, however, population decreased to negligible level in most of the treatments and some of the treatments harboured even slightly higher aphid population than the control.

Bio-efficacy of detergents against *C. compressus*:

The different dosages of detergents caused total mortality of the ants within one h of treatment.

Phytotoxicity of detergents on plants:

The treatments did not produce any kind of phyto-toxicity on lemon trees. Surf Excel @ 1.0% produced burning symptoms on about 50% leaf area on an average after 48 h. Sunlight @ 1.0 and 0.5% caused mild burning and yellowing of leaves after 72 h of treatment that spread over 20 - 25% leaf area on an average.

Soaps dissolved in water have been used for pest control since 1786 (Nair *et al.,* 1976). During

Table 1. Population reduction of *D. citri* due to treatment with different detergents

Treatments	Number / 15 cm shoot (PT)	% population reduction over control		
		1DAS	3DAS	7DAS
Surf Excel 1.0%	2.49	82.20 (70.10)	95.90 (81.90)	87.50 (69.40)
Surf Excel 0.5%	2.96	90.80 (72.50)	85.40 (69.50)	93.00 (74.70)
Surf Excel 0.1%	2.75	89.20 (71.10)	79.40 (66.40)	94.13 (78.30)
Sunlight 1.0%	2.56	79.90 (64.60)	98.60 (84.60)	94.10 (77.90)
Sunlight 0.5%	2.95	74.60 (60.90)	94.50 (78.50)	94.20 (76.30)
Sunlight 0.1%	3.26	36.40 (36.60)	66.70 (55.90)	69.80 (57.00)
Rin Advanced 1.0%	3.04	90.90 (72.80)	89.90 (74.30)	93.30 (78.10)
Rin Advanced 0.5%	2.27	35.50 (34.50)	60.30 (43.30)	84.80 (71.20)
Rin Advanced 0.1%	2.21	14.00 (13.40)	67.10 (55.50)	38.03 (37.00)
Ezee 1.0%	1.87	84.13 (70.10)	100.00 (88.20)	89.90 (74.50)
Ezee 0.5%	2.47	58.75 (50.20)	75.20 (61.70)	98.23 (84.40)
Ezee 0.1%	2.69	76.80 (61.80)	96.50 (80.60)	88.17 (69.90)
Control	2.79	-	-	-
CD (p =0.05)	0.48	28.96	28.62	15.50

Table 2. Population reduction of *A. gossypii* due to treatment with different detergents

Treatments	Number / leaf (PT)	% population reduction over control		
		1DAS	1DAS	1DAS
Surf Excel 1.0%	16.46	95.80 (78.50)	97.60 (81.80)	97.40 (80.90)
Surf Excel 0.5%	13.49	55.80 (48.40)	80.00 (63.50)	79.31 (63.30)
Surf Excel 0.1%	22.46	48.90 (44.40)	57.80 (49.60)	68.03 (55.90)
Sunlight 1.0%	35.36	91.20 (73.40)	97.30 (80.80)	95.64 (78.10)
Sunlight 0.5%	22.46	74.40 (64.00)	57.80 (49.60)	63.31 (53.70)
Sunlight 0.1%	30.05	72.90 (61.40)	76.90 (61.40)	80.20 (64.50)
Rin Advanced 1.0%	20.51	85.90 (71.20)	89.60 (73.50)	90.90 (73.00)
Rin Advanced 0.5%	20.00	50.00 (45.00)	50.00 (45.00)	50.30 (45.20)
Rin Advanced 0.1%	12.33	80.60 (67.70)	69.00 (56.40)	73.84 (60.50)
Ezee 1.0%	4.76	97.80 (83.80)	94.10 (73.50)	100.00 (88.20)
Ezee 0.5%	20.51	92.40 (74.50)	95.60 (79.50)	97.30 (81.50)
Ezee 0.1%	10.38	78.40 (64.50)	69.40 (57.50)	63.78 (53.00)
Control	22.97	-	-	-
CD (p =0.05)	7.95	14.87	13.56	13.25

Table 3. Percent corrected mortality of *C. compressus* after 1h of spraying with detergents

Treatments	Number (PT)	% mortality
Surf Excel 1.0%	47	100.00
Surf Excel 0.5%	45	100.00
Surf Excel 0.1%	50	100.00
Sunlight 1.0%	51	100.00
Sunlight 0.5%	56	100.00
Sunlight 0.1%	54	100.00
Rin Advanced 1.0%	49	100.00
Rin Advanced 0.5%	54	100.00
Rin Advanced 0.1%	57	100.00
Ezee 1.0%	52	100.00
Ezee 0.5%	48	100.00
Ezee 0.1%	55	100.00
Control	57	0.00

the present investigation, all the three concentrations of Surf Excel and Ezee and Sunlight and Rin Advanced @ 1.0 and 0.5% effectively controlled citrus psylla (*D. citri*) up to 7 days after the treatment. Ezee @ 1.0 and 0.5% and Surf Excel, Sunlight and Rin Advanced @ 1.0% resulted in more than 90% reduction of *A. gossypii* population up to 7 days. Sunlight @ 0.1% and Surf Excel @ 0.5% even caused 80.20 and 79.31% reduction of aphid population. Earlier, Rumakom (1986) controlled the psyllid, *Heteropsylla cubana* infesting acacia by water soap spray. Buttler and Hennberry (1990a) reported that, liquid detergents controlled *Myzus persicae* on cotton and brinjal and *Brevicoryne brassicae* on cauliflower. Puri *et al.,* (1994) found 0.5 – 1.0% concentration of Nirma and Surf and 1.0% concentration of Wheel as effective as 0.05% triazophos in controlling *Bemisia tabaci*. The results of the present investigation are in clear agreement with the present investigation.

All the detergents at different dosages caused total mortality of the ant, *C. compressus* within 1 h. Abbasi *et al*. (1984) reported detergents as environmentally safe pesticide for the control of household insects.

One of the limitations of using soaps and detergents in crop pest control is the phytotoxicity caused by some of these (Butler and Hennberry, 1990b), though Nielson (1990) did not found any phytotoxicity of detergent sprays on test plants. During the present investigation, Surf Excel @ 1.0% and Sunlight @ 1.0 and 0.5% caused phytotoxicity to swamp taro plants among the two plant species sprayed with detergents. The two dosages of Ezee and Rin Advanced and Surf Excel @ 0.5 and 0.1 and Sunlight @ 0.1% did not produce any phytotoxicity on this crop. The phytotoxicity caused by these detergents may be attributed to the length of carbon based fatty acid chains as shorter chain fatty acids (9-carbon chain or less) are known to have herbicidal properties. Wax layer present on swamp taro leaves may also contribute towards the development of phytotoxicity symptoms.

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