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Effect of Some Bases Individually and Their Synergists with Dimethoate and Dichlorvos (DDVP) on the Mulberry Whitefly, *Aleuroclava* sp. Singh

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Field experiments were conducted to find out the effective control measures with some bases alone and in combination with Dichlorvos and Dimethoate for the whitefly *Aleuroclava* sp. Singh in the mulberry garden. Four common bases marketed in India Soda, Sunlight, Nirma and Surf at 1% concentration and their synergists with 0.02% Dichlorvos and 0.03% Dimethoate applied to mulberry plants reduced the whitefly by 46 - 95% (adults) 50 - 90% (nymphs) upto 15 days of application. Amongst the bases 1% Soda is more effective but, the mixing of 0.02% Dichlorvos with 1% Surf found more effective than 0.02% Dichlorvos with 1% Soda solution. As Surf and Dichlorvos mixture is costly for the control of whitely, Soda was found better (in combination with Dichlorvos) as it is cheaper and easily available to the farmers.

Key words : Whitely, Soda, Surf, Sunlight, Nirma, Dimethoate, Dichlorvos

Introduction

The mulberry whitefly, *Aleuroclava* sp. Singh (Bandyopadhyay *et al.*, 2000) has become a threat to mulberry cultivation in West Bengal. Pesticides are generally used for pest control because they are cheap, effective and successfully control different target organism. But now a days it has been commonly observed that besides their usefulness there are certain drawbacks like residual effect, development of pest resistance as in whitefly *Bemisia tabaci* (Prabhakar *et al.*, 1985; Omer *et al.*, 1993) and in green house whitefly by synthetic pyrethroid (Dittrich *et al.*, 1990), environmental pollution and toxic for nontarget organisms (Paul and Thyagarajan, 1992).

Keeping this in view the efficacy of commercially available bases like Soda, Nirma, Surf and Sunlight and effective insecticides with contact and systemic action like Dimethoate and Dichlorvos (DDVP) were selected to test their efficacy alone and also in combination with each other against the whitefly, *Aleuroclava* sp., a pest of mulberry. Bandyopadhyay *et al.* (2000) has shown the effect of soda solution on other whitefly, *Dialeuropora decempuncta*. Insecticidal soaps can also be effective to control the hatching eggs. Hence in the present study, two such insecticides and four bases were evaluated alone and in combination with each other against the whitefly, *Aleuroclava* sp. infesting mulberry. The use of pesticides mixture was adopted to decrease the cost of control and broaden the spectrum of activity. A classical example is the DDT / Dimethoate mixture (Balle, 1971) which was effective to control cotton whitefly on cotton in Sudan, Gezire.

The severity of whitefly infestation which is causing extensive leaf loss is not being regulated by routine pesticides. The present study was undertaken to evaluate the synergistic effect of dimethoate and dichlorvos with the bases like Soda, Surf, Nirma and Sunlight against the whitefly *Aleuroclava* sp. (Homoptera : Aleyrodidae).

Materials and Methods

The experiment was laid out following Randomized Block Design (RBD) with 13 treatments including the control each replicated thrice (39 sub plots). Each plot measured 4.8 m × 3.0 m with 40 mulberry plants (S1 variety) having 60 cm × 60 cm spacing was selected for the study. The treatments included 4 commercially available bases namely 1% of Soda, Sunlight, Nirma and Surf and combination of each of these bases (media) with two com-

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mercially available insecticides Dichlorvos (DDVP - 0.02%) and Dimethoate (0.03%). The mulberry plot sprayed only with water is treated as control. All these alkaliting agent and their synergistic solution were sprayed so as to cover entire area as the test insects feeds mostly from under surface of leaf.

The first application of the treatments was made 30 days after pruning when 15 - 20 adult flies / leaf were observed in the field while the subsequent application is repeated 15 days after the first application by a Knap sack sprayer. Observations were recorded one day just as the preceding day of first application (Pre-treatment population) and subsequently 5 days, 10 days and 15 days after spraying. For evaluating the bioefficacy of various bases (alone) and their synergistic action with insecticides, the counts of population of eggs, nymphs and adults were made. Early morning hours were choosen for this purpose as temperature remains comparatively low at that period. Five mulberry plants were selected randomly from each plot. According to the egg laying nature of the insect two, leaves from top were selected for collecting data on eggs and adult population. Similarly 2 leaves each from middle and also from bottom portion were selected randomly for data on early and late nymphs. Thus the population counts of eggs, nymphs and adults were made on 30 leaves in each replication. If fluid oozes out from egg and nymph after pricking with a pin, they were considered as living otherwise dead. Stereoscopic Binocular Microscope was used for above observations. Counting was made carefully by turning the top two leaf blades (Naik and Lingappa, 1992).

Population of whitefly after certain days of application of treatments depends upon its original (pre-treatment) population as well as due to the effect of treatments applied. That is why adjusted mean population was calculated and analysis of co-variance technique (Snedecor and Cochran, 1967) was extensively used to test the variation in efficacy of the bases individually as well as with different synergists.

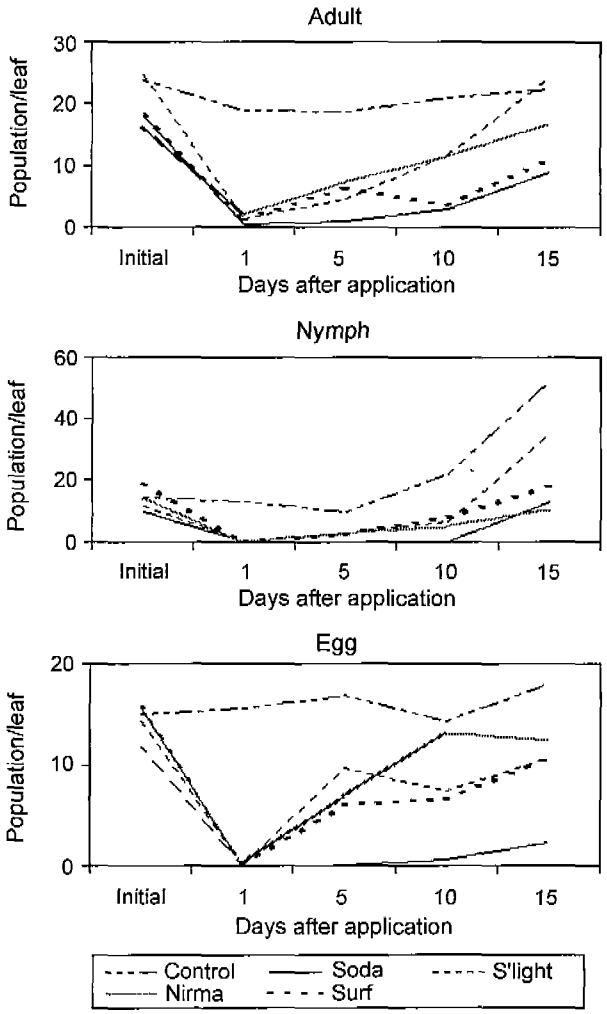

Fig. 1. Effect of different bases on controlling whitefly.

Results and Discussion

The population of whitefly eggs, nymphs and adults reduced abruptly within a day after spray in 1% Soda, 1% Sunlight,1% Nirma and 1% Surf solution. The application drastically effected eggs and nymphs (Fig. 1). Similar type of observations were made by Bandyopadhyay *et al.* (2000) with the spray of 0.05% Soda solution on mulberry whitefly *Dialeuropora decempuncta* with a reduction of 71.62% in adult stages and by Puri *et al.* (1994) with the spray of Nirma, Rin, Surf and Wheel on sweet potato whitefly, *Bemisia tabasi* on cotton plants with a reduction of 69-91% adults and 97-99% nymphal population. The rapid depletion of whitefly population within 24 hrs of treatment can be attributed to the blockage of spiracle openings and the (alkaloidal) caustic properties of free bases and the soaps (Sree Ramalu, 1985). There after there is a slow build up of the population upto 10 days of applying the treatments, in general and it took about 15 days (after spray) to reach at par with that of initial population in all the bases except Soda (Fig. 1).

The lowest population of eggs, nymphs and adult flies was recorded upto 15 days after spraying Soda solution and percent reduction of pest population was selectively more in plots treated with 1% Soda solution than other treatments like Sunlight, Nirma and Surf solution (Fig. 1). Most of the soaps when dissolved in water acts as contact insecticide. They are usually sodium salts of fatty acids (Singh, 1984).

The analysis of covariance has suggested that there is no significant difference in between the alkaline solutions

Table 1. Mean (adjusted) whitefly population (adults per leaf) in different days after application of various bases and their synergists with Dimethoate (0.03%) and DDVP (0.02%)

Treatment	Initial population	Adjusted Mean population after			
		1 days	5 days	10 days	15 days
Control	23.67	19.55	18.87	20.20	21.34
1% Soda Solution.	18.00	0.42	1.11	2.95	9.64
1% Sunlight Solution.	24.67	2.12	4.77	10.70	23.01
1% Nirma Solution.	16.33	1.91	7.62	11.68	17.97
1% Surf Solution.	18.00	1.08	6.78	3.29	11.54
1%Soda + 0.02% DDVP	30.33	0.59	0.53	1.95	5.98
1%Sunlight + 0.02% DDVP	22.67	0.98	4.64	6.37	12.67
1% Nirma + 0.02% DDVP	21.00	1.80	2.48	2.10	8.33
1% Surf + 0.02% DDVP	28.00	0.00	1.10	2.24	0.03
1%Soda + 0.03% Dimethoate	24.00	0.00	0.51	0.92	5.01
1%Sunlight + 0.03% Date	22.33	0.67	1.67	3.32	11.67
1% Nirma + 0.03% Date	22.33	0.34	4.01	4.32	8.33
1%Surf + 0.03% Dimethoate	20.00	1.23	0.91	4.94	9.65
CD at 5%		5.73	4.51	6.53	10.58

Table 2. Mean (adjusted) whitefly population (nymphs per leaf) in different days after application of different bases and their synergists with Dimethoate (0.03%) and DDVP (0.02%)

Treatment	Initial Pop.	Adjusted Mean population after			
		1 days	5 days	10 days	15 days
Control	14.67	12.93	9.87	21.57	53.23
1% Soda Solution.	10.00	0.21	0.36	1.20	10.82
1% Sunlight Solution.	11.67	0.11	0.19	7.29	33.71
1% Nirma Solution.	14.33	0.00	0.00	4.69	11.32
1% Surf Solution.	19.33	0.00	0.00	5.93	22.31
1%Soda + 0.02% DDVP	15.67	0.00	0.43	1.22	15.30
1%Sunlight + 0.02% DDVP	11.67	1.44	1.19	7.29	17.37
1% Nirma + 0.02% DDVP	12.67	1.71	1.75	5.94	13.10
1% Surf + 0.02% DDVP	11.00	0.15	0.26	0.85	0.89
1%Soda + 0.03% Dimethoate	16.00	0.18	0.00	0.43	6.87
1%Sunlight + 0.03% Date	14.67	1.26	2.20	5.90	11.57
1% Nirma + 0.03% Date	12.00	0.75	1.82	8.84	13.28
1%Surf + 0.03% Dimethoate	11.00	1.15	1.26	9.19	6.22
CD at 5%		2.71	2.62	8.33	14.97

under study in all the stages of development (i.e., adult, nymph and egg) of whitefly. But, 1% Soda solution is found to be comparatively more effective as it was being able to suppress the whitefly population level at abysmally low level even after its first application (Table 1, 2 and 3). Further on economical front 1% Soda is more cheaper than other commercial alkaline solutions.

When combined, though both Soda (with DDVP and Dimethoate) and Surf (with DDVP and Dimethoate) are found to be comparatively more effective in drastically reducing (and also for a longer span) the whitefly population, Surf has got slight edge (Table 1, 2 and 3). Again, the peculiarity in mode of action shows that Soda performs relatively better when combined with Dimethoate but, the reverse is true for Surf solution i.e., its efficacy increases in combination with DDVP. Soda solution and dimethoate together acts as a contact insecticide with a prolonged systemic action for 15 to 20 days (Singh, 1984) which has been reflected in the present experiment too. Reddy *et al.* (1988) and Patel *et al.* (1990) showed the drastic reduction of cotton whitefly, *Bemisia tabaci* on cotton and sugarcane whitefly, *Aleurolobus barodencis* on sugarcane after application of dimethoate with same dose i.e., 0.03%. Because in general dimethoate in low doses

Table 3. Mean (adjusted) whitefly population (eggs per leaf) in different days after application of various alkalis and their synergists with Dimethoate (0.03%) and DDVP (0.02%)

Treatment	Initial Population	Adjusted Mean Population after			
		1 days	5 days	10 days	15 days
Control	15.00	15.64	17.11	14.33	18.17
1% Soda Solution.	15.67	0.00	0.19	0.67	2.64
1% Sunlight Solution.	14.33	0.00	9.69	7.33	10.70
1% Nirma Solution.	11.67	0.09	6.35	13.00	11.83
1% Surf Solution.	15.67	0.00	6.19	6.67	10.97
1%Soda + 0.02% DDVP	12.00	0.08	0.00	1.66	3.89
1%Sunlight + 0.02% DDVP	13.67	0.02	0.00	4.33	9.57
1% Nirma + 0.02% DDVP	14.67	0.00	0.06	2.67	9.77
1% Surf + 0.02% DDVP	12.00	0.08	0.39	2.33	1.56
1%Soda+0.03% Dimethoate	14.67	0.00	0.06	2.00	0.77
1%Sunlight + 0.03% Date	17.33	0.00	2.74	4.00	9.31
1% Nirma +0.03% Date	14.67	0.00	3.06	3.33	9.10
1%Surf +0.03% Dimethoate	12.67	0.06	1.81	3.33	7.36
CD at 5%		0.99	10.16	3.61	2.96

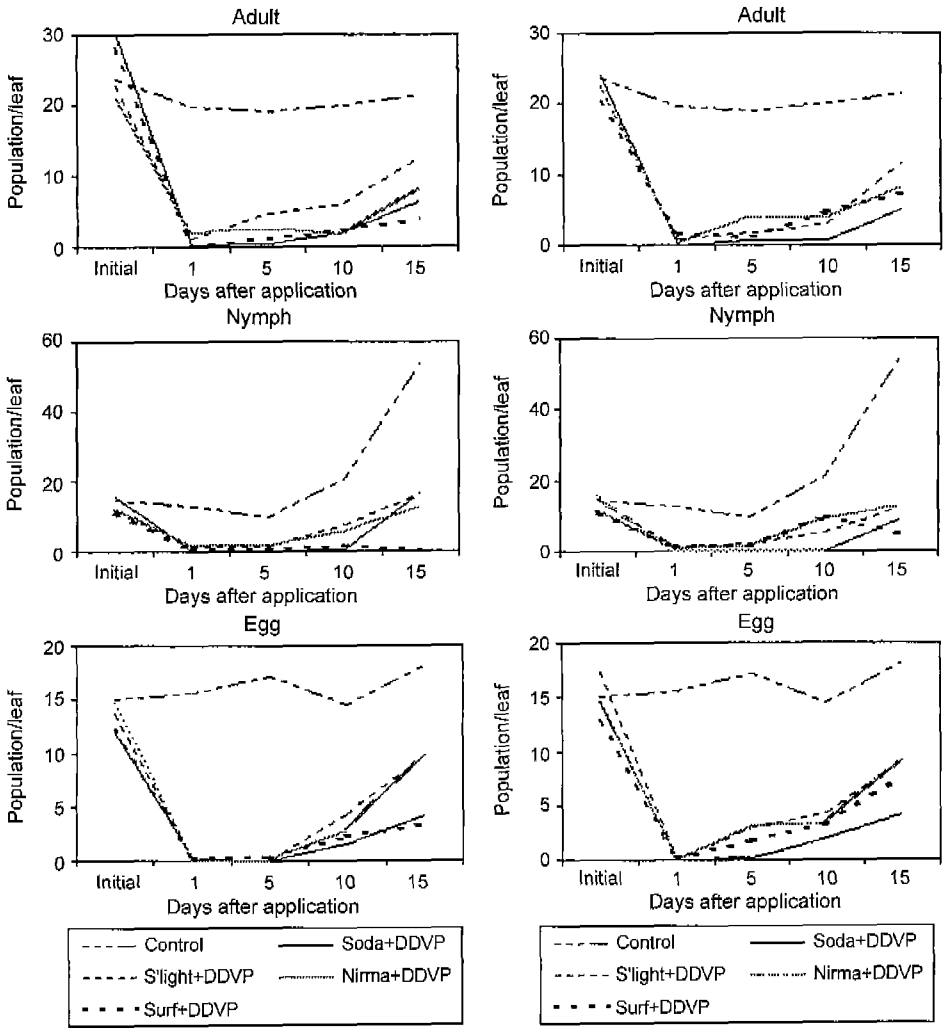

Fig. 2. Efficacy of DDVP and Dimethoate as synergist with different alkalis on whitefly.

persisted on leaf for 10 - 12 days (Chandrika and Das, 1972; Soni and Nandagopal, 1993). The effective result of dimethoate (0.03%) to control whitefly *Bemisia tabaci* and its inpact on yellow mosaic virus (YMV) in green gram *Vigna radiata* (L) Wilezek showed by Vadodaria and Vyas (1987) and in moth bean *Vigna aconitifolia* showed by Rathore and Agnihotri (1985). For that reason initially, eggs and adult population quickly destroyed by its contact action (Bose *et al.*, 1999) and regained the adult population after 15 days of application. But, due to its systemic action and phytotoxicity occurred in plants, the eggs and nymphal population not raised upto the mark (Price and Schuster, 1991). Ovicidal action of dimethoate has been established on the eggs of whitefly, *Aleurolobus barodens* (Maskell) on sugarcane at 0.08% (Patil *et al.*, 1989). However the farming community may tend towards solution of Soda and Dimethoate because it is cheaper than the other solutions. The surf solution when mixed with dichlorvos its toxocity was more effective for nymphal population than soda and dimethoate mixture (Fig. 2).

When compared separately the bases with their synergists it was observed that synergists like 1% surf with dichlorvos (DDVP) is significantly effective over synergists with dimethoate to control the population of adults, nymphs and eggs (Table 1, 2 and 3). But their effect lasts for long time to check the increase of egg and nymphal population than changing of adult population. Douressamy *et al.* (1997) showed that DDVP (EC 76) at the rate of 2 ml / litre in the early morning would minimize incidence of spiralling whitefly, *Aleurodicus dispersus.* After synergists the second best one is the soda. It significantly reduced the population in all stages upto 15 days. Hence for effective control the individual spraying of bases like commercial available soda would be better than mixing up with insecticides like dimethoate and dichlorvos to check the whitefly population in the mulberry garden.

However for residual toxicity point of view lower concentration of soda solution serves better, hence 1% concentration will be more economical for field use.

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