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EFFICACY OF HORTICULTURAL MINERAL OIL TOWARDS THE MANAGEMENT OF WHITEFLY IN MULBERRY (*MORUS* SPP.) AND IT'S BIO SAFETY TO SILKWORM (*BOMBYX MORI* L.)

S.K. MUKHOPADHYAY, M.V. SANTHA KUMAR AND S. NIRMAL KUMAR
CENTRAL SERICULTURAL RESEARCH AND TRAINING INSTITUTE
BERHAMPORE -742 101, INDIA.
(e-mail : csrtiber@gmail.com)

In an attempt to study the efficacy of horticultural mineral oil for the control of whitefly in mulberry, different concentrations (0.25, 0.5, 1.0 & 1.5%) were tested along with chemical and unsprayed control for comparison. It was revealed that in all the concentrations there was reduction in whitefly population up to 91.12% till seventh day of spray. Resurgent population necessitated a second spray and it was observed that after second spray reduction of population with 0.5% was 85.59% and 31.68% with 1.0%. Treated mulberry leaves were fed to silkworm larvae immediately after spray from hatching to maturation and there was no significant difference in survival and other economic traits of silkworm. Therefore, horticultural mineral oil can control whitefly up to seven days of spray and is completely bio-safe to silkworm and no safe period is required.

Key words : whitefly, mineral oil, bio-safety, mulberry, silkworm.

INTRODUCTION

Bio-safety in insect pest management is a serious concern due to negative impact of synthetic insecticides on natural enemy complex, pollinators and non-target organisms. As a result, search for alternate bio rational compounds gained momentum in last three decades and botanicals, bio-pesticides, etc. are being recommended. It was estimated that by next decade nearly 20 - 30% synthetic insecticides will be replaced by bio-rational agents though insecticides will continue to remain as the mainstay in the insect management paradigm. Refined petroleum or mineral oil has long been an important source of insecticides, used for control of mosquito larvae, fruit trees pests like leaf hopper coding moth, red mites, etc. (Ginsberg, 1940; Smith & Pearse, 1948; Chapman *et al.*, 1952, Chapman *et.al.*, 1966) before the dawn of synthetic insecticide era. With the advent of synthetic insecticides, conventional insecticides gradually lost their importance. Due to negative documentations on the effect of chemical insecticides on environment, non-target organisms and widespread pollution; search for bio-rational compounds in insect pest management are necessitated. Several workers have again shown interest in using alternatives like mineral oil for managing insect pests (Zwick & Westigard, 1978; Willet & Westigard, 1988; Riedel, 1995; Angello *et al.,* 1994; Beers *et. al.,* 1996; Brunner, 1997; Fernandez *et al.,* 2001; Dario *et al.*, 2005; Negi & Gupta, 2007) in different crops including fruit. Horticultural mineral oil has been suggested as the only available and effective remedy to manage mites (Lauson & Wicks, 19991) due to recent loss of effective synthetic insecticides through regulatory decisions or resistance management.

Mulberry (*Morus* sp.) is a perennial plant being cultivated in *ca* 30,000 ha land in eastern & northeastern India for its foliage to feed the silkworm (*Bombyx mori* L) for production of silk. Like other crops it is prone to several insect pests and their infestation causes foliage loss up to 25%, which is a serious impediment to the production of silk in tropical condition. Among the insect pests, whitefly (Homoptera : Aleyroididae) infests mulberry garden during July-November. Several species of whiteflies were reported on mulberry in India, of which two species (*Dialeuropora decempuncta & Alleuroclava pentatuberculata*) are prevalent in the eastern part of India (David & Regupathy, 2004). Several chemical insecticides were recommended for management of whitefly (Mukhopadhyay, 2006). But in the protection of mulberry, insecticide application is of serious concern due to sensitivity of silkworms to the residual toxicity and hardly adequate safe period is available between pruning and harvesting of leaves in fixed cropping schedule. For this, alternatives, those having minimum residual toxicity and lesser safe period are preferred for protection of mulberry. Moreover, whiteflies are also reported for developing quick resistance to insecticides (Saito & Sagiyama, 2005). To address the resistance management rotational use of alternative insecticides are always suggested.

In the present study an attempt has been made to study the efficacy of horticultural mineral oil (Agrospray - S; IOC) in different concentrations for the management of whitefly in mulberry and its bio-safety to silkworms.

MATERIALS AND METHODS

A field experiment was conducted in RBD with four concentrations viz. 0.25%, 0.5%, 1.0%, & 1.5% of Agro Spray-S along with recommended chemical control (0.1% dichlorvos) and an unsprayed control each with three replications. Each plot (5.5m X 2.0 m) is having 54 mulberry (S1 cultivar) plants with 60X60 cm spacing. Recommended cultural operations and package of practices were adopted for maintenance of the plantation. Experiment was repeated in two seasons (July and October) for two years.

Recording of pest population : Four concentrations of horticultural mineral oil along with recommended insecticides were sprayed on the mulberry plants. Whitefly population was recorded from top two leaves (adult), middle two leaves (early nymphs) and two bottom leaves (late nymphs) during cooler hours of the day from ten plants randomly (Neilson *et al* 1957) in each replication. The first observation was made a day before the first spray as pretreatment population. Subsequent observations were made after 24 hours of spray, 7 days after spray (DAS) and 14 DAS. Pooled data in terms of suppression of population of whitefly were statistically analyzed.

Bioassay : Silkworm hybrid ($NxNB_4D_2$) used to test the impact of treatments on the survival and economic traits. Hatched silkworm larvae reared with standard methods for rearing (Krishnaswamy, 1986) during two seasons (November and February). Larvae were fed with leaves from the plots immediately after spray along with an unsprayed control and chemical control. Each treatment was replicated thrice with 300 larvae, maintained till spinning and mortality of larvae were recorded day wise. After harvesting, cocoons were subjected to assessment for their economic parameters adopting standard protocol (Mukhopadhyay *et al.*, 2008).

RESULTS & DISCUSSION

Whitefly population reduced significantly after 24 hrs. of spray in all the treatments and maximum reduction was recorded in 0.25% (91.12) followed by 1.0% (82.93%). Till

7th day of spray, population continues to decline and comparable to chemical control (Table I). But after that, population started increasing. Spraying of mineral oil repelled whiteflies or might have died due to blockage of spiracles etc. The result corroborated with the report of Liang & Liu (2002), where mineral oil treated leaves had fewer Silverleaf whitefly (*Bemisia argentifolii*) compared to control in melon. In another study on greenhouse whitefly *Trialeurodes vaporarium* (Westwood) infested Chrysanthemum, 2% petroleum oil repelled adult whiteflies for at least 11 days after spraying and no

Table I : Whitefly population /leaf.

Treatments	PT	1 DAS	7 DAS	14 DAS	1 DAS	7 DAS	14 DAS
Control	17.67	17.74	21.03	27.60	35.0	28.63	52.20
0.25% Agro Spray-S.	15.95	0.98 (91.12)	3.18 (74.98)	45.67	12.2 (63.56)	7.30 (77.12)	50.02
0.50% Agro Spray-S	13.83	2.28 (81.19)	2.41 (80.16)	39.07	7.0 (70.00)	4.30 (85.59)	43.43
1.0% Agro Spray-S	16.63	2.45 (82.93)	2.70 (81.90)	23.57	12.4 (43.07)	15.77 (31.8)	51.07
1.5% Agro Spray-S	13.95	1.99 (85.54)	2.14 (83.31)	18.50	12.4 (3.93)	11.70 (-2.20)	47.00
0.1% dichlorvos	19.87	1.56 (91.58)	21.03 (90.19)	18.83	4.3 (77.06)	0.60 ((96.93)	8.30
CD at 5%		**3.88**	**2.35**	**NS**	**12.79**	**11.86**	**32.22**

PT : Pretreatment population; DAS : Day after spray; Figures in parentheses indicate percent reduction.

Table II : Adjusted Mean.

Treatments	1 DAS	7 DAS	14 DAS	1 DAS	7 DAS	14 DAS
Control	17.78	21.01	28.06	35.13	28.60	51.94
0.25% Agro Spray -S.	0.97	3.18	45.54	10.46	7.69	53.42
0.50% Agro Spray -S	2.21	2.44	38.21	5.97	4.54	45.50
1.0% Agro Spray -S	2.46	2.70	23.68	12.94	15.64	49.99
1.5% Agro Spray -S	1.92	2.17	17.69	13.49	11.46	44.90
0.1% dichlorvos	1.67	1.56	20.05	5.35	0.37	6.27
CD at 5%	**3.88**	**2.35**	**NS**	**12.79**	**11.86**	**32.22**

Table III : Survival and Economic Parameters of Cocoon.

Treatments	Survival	SCW(gm)	SSW(gm)	SR%
Control	92.0	1.56	0.298	19.10
0.25% Agro Spray -S.	96.0	1.67	0.302	18.08
0.50% Agro Spray -S	96.0	1.60	0.291	18.11
1.0% Agro Spray -S	92.0	1.57	0.298	18.98
1.5% Agro Spray -S	94.0	1.62	0.300	18.85
CD at 5%	**NS**	**NS**	**NS**	**NS**

SCW :- Single cocoon weight; SSW : Single shell weight.

phytotoxicity was observed when four weekly 1% & 2% sprays were made. (Larew & Locke, 2008), the findings are in agreement with the present study. Fernandez, *et al* (2005) have observed that application of horticultural mineral oil consistently reduce population density of Rosy apple aphid (*Dysaphus plataginea* (Passerini)), white apple leaf hopper (*Typhlocyba pornaria* McAtee) nymphs and tetranychid mite population and higher levels of suppression occur with the more number of applications. Similar observations were also observed in apple rust mite [*Aculus schlechtendali* (Walepa)]. It may be non-toxic and is in conformity with the findings when no mortality was observed in silkworm larvae fed with leaves immediately after spray (Table III). In the bioassay it was revealed that in terms of survival, single cocoon weight, shell ratio (%) there is no appreciable difference among the treatments and that with control (Table III). Based on the findings, 1.5% refined mineral oils can be sprayed to control whiteflies up to seventh day of spray in mulberry and can be safely fed to silkworms immediately after spray, as those are having no impact on the economic parameters of cocoons. Products containing mineral oil do not present unacceptable risk to human health or environment when used according to label directions.

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