

Efficacy of Pesticides Against Mites and Leaf Roller Pests in Mulberry

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ABSTRACT: Field experiments were conducted at College of Agriculture, Chamarajanagara during 2022-23 to evaluate the efficacy of pesticides viz., Chlorfenapyr 10 % SC @ 1.5 ml/l, Wettable Sulphur 80 WP @ 2 g/l, Orgomite @ 2.5 ml/l, Era Safeguard @ 2.5 ml/l and Azadirachtin 1 % @ 2 ml/l along with water spray and untreated control against mites and mulberry leaf roller. The study revealed that the maximum mortality of mites was observed in Chlorfenapyr 10 % SC @ 1.5 ml/l (100 %) followed by Orgomite @ 2.5 ml/l (81.38 %), Wettable Sulphur 80 WP @ 2 g/l (67.78 %), Era Safeguard @ 2.5 ml/l (37.45 %) and Azadirachtin 1 % @ 2 ml/l (29.80 %) in the decreasing order of their efficacy at 3 DAS. The maximum mortality of leaf roller was observed in Chlorfenapyr 10 % SC @ 1.5 ml/l (100 %) followed by Era Safeguard @ 2.5 ml/l (99.10 %), Orgomite @ 2.5 ml/l (96.41 %), Azadirachtin 1 % @ 2 ml/l (93.00 %) and Wettable Sulphur 80 WP @ 2 g/l (49.36 %) at 7 DAS. Chlorfenapyr 10 % SC @ 1.5 ml/l and Orgomite @ 2.5 ml/l were found effective against both mites (*Polyphagotarsonemus latus*) and leaf roller (*Diaphania pulverulentalis*) without any phytotoxic effect on mulberry.

Keywords: Mulberry, Pesticides, Silkworm, Mites, Leaf roller.

INTRODUCTION

Mulberry is a perennial crop which can be cultivated on both rainfed and irrigated land and maintained for more than 15- 20 years. Leaf is the only food for mulberry silkworm (*Bombyx mori*) due to the presence of morin, β sitosterol and swallowing factors (Narayanawamy *et al.*, 1996). Mulberry leaf production is decreasing due to the attack of various insect and non-insect pests. Being a perennial and high biomass producing plant with luxuriant growth under irrigated condition of recommended package of practices often leading to the breeding and multiplication of various pests. This condition leads to rapid pest proliferation resulted in qualitative and quantitative loss of mulberry leaf leading to low productivity in sericulture (Rahmathulla *et al.*, 2012). Though the number of pests attacking mulberry crop worldwide is more than 300 insect and non-insect pests have been reported (Srinivasa Gowda, 2004). but, In the recent days mulberry leaf roller (*Diaphania pulverulentalis*) and mites (*Tetranychus* sp. and *Polyphagotarsonemus latus*) have becomes more serious and draw more attention in mulberry cultivation. So far, insecticide used for controlling sucking pests in mulberry was Dichlorvos (Murugana, 2022). However, for managing both insect and non-insect pests in field crops new chemicals are available in the market which are quite effective. In order to select the best insecticides including new as well as old

one requires assessing their efficiency against pests of mulberry. Keeping this in view, the present study was taken up to find out the field efficacy of pesticides for the management of mites and leaf roller in mulberry.

MATERIAL AND METHODS

Field experiments against mites and mulberry leaf roller was conducted at College of Agriculture, Chamarajanagara during 2022-23. Two year old established tree type mulberry of V-1 variety with spacing of 6*6 feet was considered with recommended agronomic practices. The experiment was laid out in a Randomized Block Design (RBD) with seven treatments including water spray and untreated control replicated four times. The experimental treatments included five insecticides viz., Chlorfenapyr 10 % SC @ 1.5 ml/l, Wettable Sulphur 80 WP @ 2 g/l, Orgomite @ 2.5 ml/l, Era Safeguard @ 2.5 ml/l and Azadirachtin 1 % @ 2 ml/l along with water spray and untreated control. Treatments were imposed using knapsack sprayer at 30 days after pruning which was coincided with pest incidence. Observations on leaf roller (*Diaphania pulverulentalis*) were recorded from five randomly selected plants per plot a day before and 1st, 3rd and 7th days after spraying of the chemicals by visual scoring (counting the number of larvae per plant) method. The population of active stages of mites (*Polyphagotarsonemus latus*) comprised of nymphs and

adults which were recorded a before and 1st, 3rd and 7th days after spraying of the chemicals using three windows of 1 cm² leaf area each from the leaf samples representing the top, middle and bottom canopy by visual scoring under the stereo microscope. Per cent mortality of both pests was calculated by following formula;

Mortality of mites (%) =

$$\frac{\text{Population before spray} - \text{Population after spray}}{\text{Population before spray}} \times 100$$

RESULTS AND DISCUSSION

Efficacy of pesticides against Yellow Mite, *Polyphagotarsonemus latus*. The data on mean number of mites/cm² and corresponding mortality percentage on 1st, 3rd and 7th day after first spray are presented in Table 1.

There was no significant difference in the pre-spray count observations among all treatments which showed that there was uniform distribution of mites on the plants. The results revealed that all the treatments were significantly found superior over the water spray and control. Among the insecticides, on one day after spray least number of mites (2.65) and maximum per cent mortality (52.99 %) was seen in Chlorfenapyr 10 % SC followed by Orgomite (3.19 & 44.55 %), Wettable Sulphur 80 WP (2.99 & 44.46 %), Era Safeguard (3.72 & 26.72 %) whereas, more number (4.48) and minimum mortality percentage (20.43 %) was observed in Azadirachtin 1 per cent. Three days after spray, the lowest mean number of mites (zero) and maximum mortality percentage (100 %) was recorded in Chlorfenapyr 10 % SC followed by Orgomite (1.09 & 81.38 %), Wettable Sulphur 80 WP (1.70 & 67.78 %), Era Safeguard (3.16 & 37.45 %) whereas, more number (3.96) and minimum mortality percentage (29.80 %) was observed in Azadirachtin 1 per cent. The data pertaining to mean mite population on seventh day after first spray revealed that the treatment of both Chlorfenapyr 10 % SC and Orgomite recorded minimum mite population (zero) and maximum mortality percentage (100 %). The next best treatment was Wettable Sulphur 80 WP (0.84 & 83.32 %) followed by Era Safeguard (2.07 & 58.72 %). The least effective insecticide treatment was Azadirachtin 1 per cent which recorded maximum number of mites (3.91) and least mortality percentage (30.70 %).

The results obtained with respect to Chlorfenapyr are in accordance with the findings of Sarkar *et al.* (2013) (Chlorfenapyr 10 SC 100 g a.i. ha⁻¹) who reported 89.32 % reduction after 3rd day of application in chilli. Chlorfenapyr is an acaricidal pyrrole, and the primary mode of action is to affect oxidative phosphorylation in the mitochondria, which results in the death of the cell through inhibition of ATP synthesis and eventual death of the pest (Arthur 2009; McLeod *et al.* 2002). The mechanism of action of Chlorfenapyr differs from that

of conventional neurotoxins, and mortality of the pest as a result of exposure to Chlorfenapyr is not immediate but takes several days after the initial exposure (Arthur, 2008). Therefore, the results of this study showed that Chlorfenapyr caused rapid mortality of spider mites were unexpected. Leonard (2000) found that Chlorfenapyr was primarily active through ingestion with considerable contact activity indicating that active life stages of spider mites can therefore acquire the lethal concentrations through both feeding and contact with the acaricide material as they move and forage on the plant.

Efficacy of Pesticides against mulberry leaf roller (*Diaphania pulverulentalis*). One day after spraying the insecticides, all the treatments were remained significantly superior over water spray and untreated control. Least number of leaf roller per plant (3.54) and the maximum mortality (43.34 %) was noticed in the treatment where Chlorfenapyr 10 % SC was sprayed followed by Era Safeguard (3.82 & 35.91 %), Orgomite (3.96 & 34.50 %), Azadirachtin 1 % (4.25 & 29.89 %) whereas, more number (5.00) and minimum mortality percentage (17.90 %) was observed in Wettable Sulphur 80 WP. Three days after spray, the lowest mean number of mites (0.31) and maximum mortality percentage (94.88 %) was recorded in Chlorfenapyr 10 % SC followed by Era Safeguard (0.31 & 93.94 %), Orgomite 80 WP (0.50 & 92.17 %), Azadirachtin 1 % (0.63 & 90.01 %) whereas, more number (4.63) and minimum mortality percentage (23.86 %) was observed in Wettable Sulphur 80 WP. On seventh day after spray, the least number of leaf roller (zero) and maximum mortality (100 %) of leaf roller was noticed in the treatment Chlorfenapyr 10 % SC and the next best treatment was Era Safeguard (0.05 & 99.10 %), Orgomite 80 WP (0.25 & 96.41 %), Azadirachtin 1 % (0.45 & 93.00 %). Higher number of leaf roller (3.05) and minimum mortality percentage (49.36 %) was observed in Wettable Sulphur 80 WP (Table 2). Similar observation has been reported in mulberry by Zhao *et al.* (2017) who studied the toxicity of Chlorfenapyr to different developmental stages of *B. odoriphaga* and reported that the Chlorfenapyr caused 50 per cent mortality of 1st, 2nd and 3rd instar *B. odoriphaga* larvae after 72 h at concentrations of 3.94, 4.12 and 10.11 mg (a.i.) L⁻¹, respectively. This consistency is explained by the fact that Chlorfenapyr has a site of action outside the insect nervous system. Instead, Chlorfenapyr disrupts the respiratory chain and proto gradients by uncoupling oxidative phosphorylation in mitochondria (Black *et al.*, 1994). Similarly, Kumar *et al.* (2019) recorded the leaf roller mortality rate of 82.51, 83.00, 81.66, 82.34, 81.36, 78.46, 79.57 and 77.37 per cent in Chlorfenapyr, Emamectin benzoate, Azadirachtin, Fipronil, Dichlorvos, Novaluron, Lambda- cyhalothrin and Profenofos at 9 days after treatment, respectively.

Table 1: Efficacy of pesticides against mites, *P. latus* infesting mulberry.

Treatment details	Number of mites/cm ² leaf area					Mortality (%)			
	1 DBS	1 DAS	3 DAS	7 DAS	Mean	1 DAS	3 DAS	7 DAS	Mean
T ₁ : Chlorfenapyr 10 % SC @ 1.5 ml/l	5.65 (2.48)	2.65 (1.78)	0.00 (0.71)	0.00 (0.71)	0.88	52.99 (46.72)	100.00 (90.00)	100.00 (90.00)	84.33
T ₂ : Wettable Sulphur 80 WP @ 2 g/l	5.45 (2.44)	2.99 (1.87)	1.70 (1.48)	0.84 (1.16)	1.84	44.46 (41.82)	67.78 (55.45)	83.32 (66.13)	65.19
T ₃ : Orgomite @ 2.5 ml/l	5.73 (2.49)	3.19 (1.92)	1.09 (1.26)	0.00 (0.71)	1.43	44.55 (41.87)	81.38 (64.60)	100.00 (90.00)	75.31
T ₄ : Era Safeguard @ 2.5 ml/l	5.08 (2.36)	3.72 (2.05)	3.16 (1.91)	2.07 (1.60)	2.98	26.72 (31.11)	37.45 (37.73)	58.72 (50.03)	40.96
T ₅ : Azadirachtin 1 % @ 2 ml/l	5.63 (2.47)	4.48 (2.23)	3.96 (2.11)	3.91 (2.10)	4.12	20.43 (26.86)	29.80 (33.08)	30.70 (33.63)	26.98
T ₆ : Water spray	5.35 (2.42)	5.32 (2.41)	5.28 (2.40)	5.24 (2.40)	5.28	0.55 (4.25)	1.28 (6.50)	2.10 (8.32)	1.31
T ₇ : Untreated control	5.26 (2.40)	5.21 (2.39)	5.17 (2.38)	5.13 (2.37)	5.17	0.93 (5.52)	1.67 (7.42)	2.41 (8.93)	1.67
F-test	NS	**	**	**	-	**	**	**	-
S. Em±	-	0.03	0.03	0.02	-	0.69	1.03	0.92	-
CD @ 5%	-	0.09	0.08	0.069	-	2.05	3.05	2.74	-

Figures in the parenthesis are transformed value; ** Significant at 1 %, NS- Non significant; DAS - Days after spraying; DBS- Days before spraying.

Table 2: Efficacy of insecticides against mulberry leaf roller, *D. pulverulentalis*.

Treatment details	Number of leaf roller/plant					Mortality (%)			
	1 DBS	1 DAS	3 DAS	7 DAS	Mean	1 DAS	3 DAS	7 DAS	Mean
T ₁ : Chlorfenapyr 10 % SC @ 1.5 ml/l	6.26 (2.60)	3.54 (2.00)	0.31 (0.90)	0.00 (0.71)	1.28	43.34 (41.17)	94.88 (79.43)	100 (90.00)	79.41
T ₂ : Wettable Sulphur 80 WP @ 2 g/l	6.11 (2.57)	5.00 (2.34)	4.63 (2.26)	3.05 (1.88)	4.23	17.90 (25.02)	23.86 (29.23)	49.36 (44.63)	30.37
T ₃ : Orgomite @ 2.5 ml/l	6.03 (2.55)	3.96 (2.11)	0.50 (1.00)	0.25 (0.85)	1.57	34.50 (35.96)	92.17 (74.69)	96.41 (82.31)	74.36
T ₄ : Era Safeguard @ 2.5 ml/l	5.96 (2.54)	3.82 (2.08)	0.31 (0.90)	0.05 (0.71)	1.38	35.91 (36.81)	93.94 (77.75)	99.10 (86.25)	76.32
T ₅ : Azadirachtin 1 % @ 2 ml/l	6.05 (2.56)	4.25 (2.17)	0.63 (1.06)	0.45 (0.97)	1.78	29.89 (33.13)	90.01 (72.30)	93.00 (76.65)	70.97
T ₆ : Water spray	5.95 (2.54)	5.58 (2.47)	5.13 (2.37)	4.04 (2.13)	4.92	6.23 (14.44)	13.78 (21.77)	31.45 (34.10)	17.15
T ₇ : Untreated control	5.99 (2.55)	5.76 (2.50)	5.31 (2.41)	4.18 (2.16)	5.08	3.84 (11.28)	11.08 (19.44)	29.48 (32.88)	14.80
F-test	NS	**	**	**	-	**	**	**	-
S.Em±	-	0.06	0.06	0.05	-	0.53	2.93	2.57	-
CD @ 5%	-	0.18	0.16	0.144	-	1.58	8.71	7.65	-

Figures in the parenthesis are transformed value; ** Significant at 1 %, NS- Non significant; DAS - Days after spraying; DBS- Days before spraying.

CONCLUSIONS

The present findings suggest that spraying of Chlorfenapyr 10 % SC @ 1.5 ml/l was found effective in controlling both mites and leaf roller in mulberry followed by Orgomite @ 2.5 ml/l which helps in the production of good quality and quantity of mulberry leaf.

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