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The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; SP-12(11): 798-800

www.thepharmajournal.com
Received: 22-08-2023
Accepted: 26-09-2023

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Evaluation of different insecticides against red spider mite, *Tetranychus urticae* Koch infesting rose

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Abstract
Investigation on evaluation of insecticides against red spider mite, *Tetranychus urticae* Koch was carried out at Karnataka State Department of Horticulture, Shivamogga during 2017-2018 under open field conditions. For this study seven insecticides (acetamiprid 20 SP, imidacloprid 30.5 SC, thiamethoxam 25 WG, dinutefuron 20 SG , diafenthiuron 50 WP, chlorfenapyr 10 EC and dichlorvos 76 EC) including untreated control were tested for recording observation. Result showed that, out of seven chemical insecticides tested against mites, diafenthiuron 50 WP was found most promising in controlling mite population. It was followed by chlorfenapyr 10 EC, imidacloprid 30.5 SC and thiamethoxam 25 WG.

Keywords: Red spider mite, *Tetranychus urticae* Koch, rose, management and open field conditions

Introduction

Rose (*Rosa* spp.) is a popular flowering shrub in India and other parts of the world. Roses have been cultivated in gardens for centuries as vines, shrubs, specimen plants, ground-covers, and container plants because of their beautiful and often fragrant blooms. Commercial rose cultivation in open-field and protected structures is gaining popularity, with the area under cultivation growing by the day. Pests are one of the most important factors influencing flower production and quality. The year-round uniformity of environmental conditions favours the multiplication of insect pests and is ideal for the rapid proliferation of unwanted insects, which pose an ever-present threat to the quality of flowers. Among the non-insect pests, Mites are the most well-known non-insect pests, and they have grown in importance in recent years due to their destructive nature and damage potential. Tetranychidae (spider mites), Tenuipalpidae (false spider mites), Eriophyiidae (gall mites), and Tarsonemidae (broad/yellow mites) are the four major families of phytophagous mites (Anonymous, 1991) [1]. Spider mites typically feed on the lower surface of the leaves, causing speckling and eventually turning yellowish, leading to defoliation. The mites spread to all parts of the plant as the population grows, especially during the day, and produce webbing all over the plant. A moderate population can have a significant impact on crop yield, and a heavy infestation can cause plant death (Jeppson *et al.*, 1975) [3]. These mites extensively web the top, new growth of leaves, and unopened flower buds. The infested leaves appear burnt and have a lot of leaf fall. Flower buds partially open due to mite infestation. Infested flower petals lose their radiance, resulting in a direct loss for the grower. Mites cause approximately 53% of the damage to webbed top canopy rose plants (Dhooria, 1999) [2]. As a result, the current study has been proposed, given the crop's economic importance and the magnitude of the damage caused by insect pests.

Materials and Methods

The experiment was carried out in the Karnataka State Department of Horticulture, Shivamogga, during 2017-2018 under open field conditions to evaluate insecticides against red spider mite infested rose. The variety Dutch was chosen for this experiment. In a randomised block design with three replications, the bed was divided into 10 plants per treatment, with 90 cm and 90 cm spacing between plants and rows, respectively.

The sample procedure

Eight insecticides, including an untreated control, were tested for recording observations (Table 1). Five plants were chosen at random from each plot, and red spider mites were counted one day before, three, five, ten, and fourteen days after each spray. The mites were counted on three leaves, one from the top, one from the middle, and one from the bottom.

Statistical analysis

The statistical analysis of the data obtained from management trails was done by analysis of variance (ANOVA) using Web Agri Stat Package (WASP-2) developed by Indian Council of Agricultural Research, research complex, Goa. After analysis, data was accommodated in the table as per the needs of objectives for interpretation of results. The interpretation of data was done by using the critical difference value calculated at 0.05 probability level. The level of significance was expressed at 0.05 probability.

Results and Discussion

Effect of insecticides against rose mite after first spray

Table 2 indicates the data on the average number of mites per leaf recorded during pre and post counts. According to the data, the pre-count in various treatments ranged from 19.15 to 24.77 per leaf. These incidence observations were statistically insignificant, implying a uniform incidence of mites in rose plots.

The mite population ranged between 7.18 and 17.09 per leaf, according to data collected on three DAS. In terms of pest population reduction, all treatments outperformed the untreated control. The diafenthiuron 50 WP treatment had significantly fewer mites per leaf (7.18) and was found to be the most superior treatment. It was, however, comparable to chlorfenapyr 10 EC and imidacloprid 30.5 SC (Table 2).

The observations on mite survival population observed 5 DAS were 5.21 to 16.66 per leaf and 25.9 in untreated plots. The superiority of diafenthiuron 50 WP (5.21 per leaf) over the other treatments was discovered. The dinotefuron 20 SG treatment was the least effective in controlling the pest (16.66 mites per leaf).

At 10 DAS, the diafenthiuron 50 WP treated plots had the lowest mite population (8.34 mites per leaf), which was significantly superior to other treatments and comparable to chlorfenapyr 10 EC (10.1 mites per leaf). Dinotefuron 20 SG had a low efficacy, with a mite population of 18.02 per leaf, but it was significantly better than the control (27.57 per leaf).

In 14 DAS, a similar trend of efficacy of these insecticides was observed; diafenthiuron 50 WP was found to be most effective, with a minimum mite population of 11.77 per leaf, and it was comparable to chlorfenapyr 10 EC (Table 2).

In terms of overall mean efficacy, diafenthiuron 50 WP (8.13 mites per leaf) was the most promising insecticide in reducing mite population, followed by chlorfenapyr 10 EC (10.15 mites per leaf).

Percent reduction over untreated control

Diafenthiuon 50 WP was found to be the most effective treatment, with a 69.81 percent reduction in mite population, followed by chlorfenapyr 10 EC (62.28%) and imidacloprid 30.5 SC (53.11%). Dinotefuron 20 SG demonstrated the lowest percentage reduction (31.68%) (Table 2).

Effect of insecticides against rose mite after second spray

Table 3 displays the pre and post count observations. According to the data collected on three DAS, the mite population per leaf ranged from 5.18 to 7.59 in different treatments. The diafenthiuron 50 WP treatment outperformed all others, with a significantly lower number of mites (5.18 per leaf) and was comparable to chlorfenapyr 10 EC (7.59 per leaf). The other treatments in order of merit of control were: imidacloprid 30.5 SC, thiamethoxam 25 WG, acetamiprid 20 SP, dichlorvos 76 EC and dinotefuron 20 SG.

On 5 DAS, a wide range of mite survival population was observed (3.91 to 12.92 mites per leaf). When compared to other treatments, the diafenthiuron 50 WP treatment performed best (3.91 mites per leaf).

The survival mite population recorded on 10 DAS was found to exist in a wide range (5.67 to 15.25 mites per leaf), with diafenthiuron 50 WP showing a significant reduction (5.67 mites per leaf) over the other treatments. Chlorfenapyr 10 EC and imidacloprid 30.5 SC were on par with each other (Table 3).

At 14 DAS, diafenthiuron 50 WP (8.86 per leaf) and chlorfenapyr 10 EC (9.11 per leaf) had the lowest mite population, followed by imidacloprid 30.5 SC (10.65 per leaf) and thiamethoxam 25 WG (11.94 mites per leaf). Acetamiprid 20 SP showed a moderate level of reduction (14.50 mites per leaf).

The mean mite population after spraying insecticides across treatments revealed that diafenthiuron 50 WP had the lowest population of mites (5.91 per leaf), followed by chlorfenapyr 10 EC, which had a population of 7.03 mites per leaf. Untreated controls had the highest population of 31.71 mites per leaf (Table 3).

Percent reduction over untreated control

When compared to the untreated control, diafenthiuron 50 EC had the highest percent reduction of 82.48, followed by chlorfenapyr 10 EC (79.16%) and imidacloprid 30.5 SC (74.03%) (Table 3).

In the present study out of seven chemical insecticides tested against mites diafenthiuron 50 WP was found most promising in controlling mite population. It was followed by chlorfenapyr 10 EC, imidacloprid 30.5 SC and thiamethoxam 25 WG.

The present findings are in association with Aguir *et al.* (1993) [1] who reported that diafenthiuron was highly effective against mites. Valunj *et al.* (1999) [6] revealed that chlorfenapyr at 500 ml/ha was the more effective treatment. Norboo *et al.* (2017) [5] reported that imidacloprid 200 SL was the most effective in reducing the mite population.

Table 1: Treatment details for testing the efficacy of insecticides against sucking pest of rose

Treatments	Chemicals	Dosage (gm or ml/lit)	Trade name
T_1	Acetamiprid 20 SP	0.30	Pride
T_2	Imidacloprid 30.5 SC	0.50	Confidor
T_3	Thiamethoxam 25 WG	0.20	Actra
T_4	Dichlorvos 76 EC	1.60	Nuvan
T_5	Chlorefenapyr 10 EC	1.60	Interprid
T_6	Difenthiuron 50 WP	1.20	Pegasus
T_7	Dinotefuron 20 SG	0.20	Osheen
T_8	Untreated control		

Table 2: Evaluation of insecticidal sprays against mite *Tetranychus urticae* Koch during 2017-2018 as assumed by mean number of mites recorded following first spray

Sl. No.	Treatments	Dose (ml or g/lit)	Mean no. of mites per leaf					Overall mean no. of mites per leaf	Percent reduction over untreated control
			1 DBS	3 DAS	5 DAS	10 DAS	14 DAS		
1	Acetamiprid 20 SP	0.30	21.01 (4.62)	14.83 $(3.89)^{bc}$	13.50 $(3.71)^{bc}$	15.13 $(3.95)^{bcd}$	19.01 $(4.41)^{bc}$	15.62±2.05	42.00
2	Imidacloprid 30.5 SC	0.50	20.98 (4.62)	12.17 $(3.52)^{bcd}$	11.17 $(3.36)^{cd}$	12.05 $(3.49)^{cde}$	15.11 $(3.95)^{bcd}$	12.63±1.48	53.11
3	Thiamethoxam 25 WG	0.20	19.15 (4.42)	13.94 $(3.78)^{bc}$	12.11 $(3.52)^{bcd}$	13.72 $(3.75)^{bcd}$	18.10 $(4.31)^{bc}$	14.47±2.21	46.26
4	Chlorfenapyr 10 EC	1.60	20.22 (4.55)	9.77 $(3.2)^{cd}$	7.49 $(2.82)^{de}$	10.10 $(3.23)^{de}$	13.26 $(3.65)^{b}$	10.15±2.05	62.28
5	Diafenthiuron 50 WP	1.20	19.99 (4.52)	7.18 $(2.75)^{d}$	5.21 $(2.35)^{e}$	8.34 $(2.97)^{e}$	11.77 $(3.47)^{d}$	8.13±2.38	69.81
6	Dinotefuron 20 SG	0.20	24.77 (5.02)	17.09 $(4.19)^{b}$	16.66 $(4.14)^{b}$	18.02 $(4.30)^{b}$	21.80 $(4.72)^{b}$	18.39±2.02	31.68
7	Dichlorvos 76 EC	1.60	23.49 (4.87)	16.06 $(4.06)^{b}$	15.02 $(3.94)^{bc}$	16.35 $(4.08)^{bc}$	20.50 $(4.57)^{b}$	16.98±2.09	36.92
8	Untreated control	-	20.38 (4.57)	24.39 $(4.99)^{a}$	25.90 $(5.13)^{a}$	27.57 $(5.30)^{a}$	29.84 $(5.51)^{a}$	26.93±2.02	-
	SEm±	-	NS	0.25	0.25	0.25	0.26	-	-
	CD (P = 0.05)	-	NS	0.77	0.76	0.76	0.77	-	-
	CV%	-	-	11.53	11.72	11.17	10.22	-	-

Figures in parentheses are √x + 0.5 transformed values; Means in the columns followed by the same alphabet do not differ significantly by DMRT (P = 0.05); DBS-Day before spray; DAS-Days after spray

Table 3: Evaluation of insecticidal sprays against mite *Tetranychus urticae* Koch during 2017-2018 as assumed by mean number of mites recorded following second spray

Sl. No.	Treatments	Dose (ml or g/lit)	Mean no. of mites per leaf					Overall mean no. of mites per leaf	Percent reduction over untreated control
			1 DBS	3 DAS	5 DAS	10 DAS	14 DAS		
1	Acetamiprid 20 SP	0.30	19.01 $(4.41)^{bc}$	13.13 $(3.69)^{bc}$	10.17 $(3.24)^{bcd}$	12.50 $(3.56)^{bc}$	14.50 $(3.87)^{bc}$	12.58±1.56	62.69
2	Imidacloprid 30.5 SC	0.50	15.11 $(3.95)^{bcd}$	9.39 $(3.14)^{cd}$	6.93 $(2.71)^{de}$	8.05 $(2.91)^{cde}$	10.65 $(3.33)^{cd}$	8.75±1.39	74.03
3	Thiamethoxam 25 WG	0.20	18.10 $(4.31)^{bc}$	11.75 $(3.50)^{bcd}$	9.08 $(3.09)^{cd}$	10.57 $(3.31)^{bcd}$	11.94 $(3.52)^{bcd}$	10.83±1.14	67.87
4	Chlorfenapyr 10 EC	1.60	13.26 $(3.65)^{b}$	7.59 $(2.8)^{de}$	4.84 $(2.31)^{ef}$	6.57 $(2.58)^{de}$	9.11 $(3.09)^{d}$	7.03±1.55	79.16
5	Diafenthiuron 50 WP	1.20	11.77 $(3.47)^{d}$	5.18 $(2.30)^{e}$	3.91 $(2.01)^{f}$	5.67 $(2.48)^{e}$	8.86 $(3.05)^{d}$	5.91±1.82	82.48
6	Dinotefuron 20 SG	0.20	21.80 $(4.72)^{b}$	16.65 $(4.14)^{b}$	12.92 $(3.64)^{b}$	15.25 $(3.95)^{b}$	16.29 $(4.06)^{b}$	15.28±1.45	54.68
7	Dichlorvos 76 EC	1.60	20.50 $(4.57)^{b}$	14.58 $(3.86)^{b}$	12.50 $(3.60)^{bc}$	13.67 $(3.76)^{b}$	15.10 $(3.93)^{bc}$	13.96±0.98	58.58
8	Untreated control	-	29.84 $(5.51)^{a}$	32.38 $(5.73)^{a}$	33.04 $(5.79)^{a}$	34.21 $(5.89)^{a}$	35.21 $(5.97)^{a}$	31.71±1.25	-
	SEm±	-	0.26	0.23	0.18	0.24	0.22	-	-
	CD (P = 0.05)	-	0.77	0.71	0.53	0.73	0.66	-	-
	CV%	-	10.22	11.14	9.20	11.70	9.75	-	-

Figures in parentheses are √x + 0.5 transformed values; Means in the columns followed by the same alphabet do not differ significantly by DMRT (P= 0.05); DBS-Day before spray; DAS-Days after spray

Conclusion

Overall results of the study conclude as diafenthiuron 50 WP was found effective in controlling the red spider mite followed by chlorfenapyr 10 EC, imidacloprid 30.5 SC and thiamethoxam 25 WG.

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