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Bioefficacy of acaricides against two spotted spider mites infesting rose under polyhouse condition

SS Tilekar, UB Hole, AS Bagde and SN Tawate

Abstract
An experiment entitled “Bioefficacy of acaricides against two spotted spider mites infesting rose under polyhouse condition” was conducted during 2021 with six treatments, replicated thrice, in the polyhouse of horticulture section, college of Agriculture Phaltan, (Maharashtra).
The treatments comprised of six acaricides buprofezin 25 EC, propargite 57 EC, fenpyroximate 5 EC, flufenoxuron 10 DC, difenthiuron 50 WP, dimethoate 30 EC and untreated control, respectively. All the acaricidal treatments found superior over untreated control for management of rose mites. The treatment with fenpyroximate 5 EC found most superior for the management of rose mites and the efficacy of acaricides for the management of rose mites was as follows flufenoxuron 10 DC, propargite 57 EC, buprofezin 25 EC, diafenthiuron 50 WP and dimethoate 30 EC, respectively.

Keywords: Rose, acaricides, rose mites, efficacy

Introduction
India is gracefully paving its path to emerge as a significant player of the world floriculture trade and a New Floral Super Power of the future. India currently has one of the largest consumer bases and fastest-growing retail markets in the world, with annual growth in flower consumption over 20%. One of nature's most magnificent creations, the rose (*Rosa sp.*), is referred to as the "queen of flowers." The name "Erose," which means "the god of love," is the origin of the word "rose." The words for rose in Sanskrit literature include "Tarunipushpa," "Atimanjula," and "Semantika." Rosaceae is the family that comprises rose. Only eight of the 120 species in the genus Rosa the *Rosa chinensis* (Jacq), *Rosa damascene* (Mill), *Rosa foetida*, *Rosa gallica*, *Rosa gigantea*, *Rosa moschara*, *Rosa multiflora*and *Rosa wischuriana*are grown as ornamentals. In and around the cities of Delhi, Pune, Bangalore and Chandigarh, it is widely grown (Norboo *et al.*, 2017) [1]. Among various factors affecting the ornamental production, pest and diseases pose serious threat. Many insect and non-insect pests in India affect ornamental crops that are grown in protected environments. The mites are one of these that are common and result in significant losses. Technically, mites are arthropods; they are minuscule, with the majority being 1/8 of an inch or less in length, and some, like the eriophyid mite, are invisible to the naked eye. They lack wings and typically have an oblong or an oval-shaped body. Their mouthparts are of the chelicerate type (Shukla., 2013) [2].
The production of rose is high, but productivity and marketability are decreasing considerably due to pest damage. Hence, it is necessary to manage mite pest under protected cultivation by employing the various methods of control.
Keeping above facts in mind, the present study will be initiated to obtain the precise information on the status and incidence of mites on rose

Material and Methods
The experiment was laid out in randomized block design with ten treatments and three replications. The plot size was 25×1.5 m and plant spacing was 30×30 cm. The well established pre-planted popular variety of rose ‘Top Secret’ was selected for conduct of an experiment. All the recommended agronomic practices were followed from time to time to raise good crop. By spraying water alone on the control plot, the amount of spray fluid required for each plot was estimated. The amount of acaricide needed to prepare spray fluid with the desired concentration was calculated for each acaricide. While making the spray fluid, the necessary amount of water was taken in a bucket and measured amounts of an acaricide were added to the water. With the use of a long wooden stick, it was thoroughly swirled to ensure even mixing of the acaricide and water.

To record the pre and post treatment observations, five plants from each treatment were randomly selected and tagged. Observations were recorded in the morning hours. Post treatment counts were recorded on One, third, seventh and tenth day after each spraying.

Three leaves each from lower, middle and upper part of each randomly selected and tagged plants were selected. The surviving mites population was recorded with the help of magnifying lens 10_x as per the methodology adopted by Hole and Salunkhe (2005) [3].

Table 1: Treatment details

Sr. No	Common Name	Trade name	Formulation used	Source/ manufacturer	Dose (g a.i./ha)	Formulation
1	Buprofezin	Applaud	25 EC	M/s. Tata Rallis India Pvt. Ltd., Mumbai (ms)	150	600
2	Propargite	Omite	57 EC	M/s. Dhanuka Agritech Ltd., Gulberga (ms)	570	1000
3	Fenpyroximate	Sedna	5 EC	M/s. Biostand India Ltd., Mumbai (ms)	15	300
4	Flufenoxuron	Cascade	10 DC	M/s. Crystal Crop Protection Pvt. Ltd., Nagpur (ms)	50	500
5	Diafenthiuron	Pegasus	50 WP	Joshi Agrochem Pharma Pvt Ltd, (ms)	300	600
6	Dimethoate	Rogor	30 EC	M/s. Tata Rallis India Pvt. Ltd., Mumbai (ms)	300	990
7	Untreated control					

Result and Discussion

The results obtained during the course of investigations are presented under the following heads.

1. Bioefficacy of different acaricides against red spider mite, *T. urticae* on Rose

Studies were undertaken to find out efficacy of different acaricides against *Tetranychus urticae* Koch. on rose buprofezin 25 EC, propargite 57 EC, fenpyroximate 5 EC, flufenoxuron 10 DC, difenthiuron 50WP, dimethoate 30EC were tested for their efficacy *Tetranychus urticae* Koch.

First Spray

1.1 Incidence of mites before spraying

The data on average number of surviving population of mites per plant prior to acaricide application ranged from 47.11 to 49.45. These observations were statistically non – significant, there by indicating the mites population to be uniformly distributed in the experimental plot prior to the application of insecticides.

Table 2: Efficacy of acaricide treatments against rose mites after first spray

Sr. No.	Name of acaricide	Conc. (%)	Survival population under poly house condition						% reduction over untreated control
			First Application						
			Pre count	1 DAS	3 DAS	7 DAS	10 DAS	Mean	
1	Buprofezin 25 EC	0.03	48.67 (6.91)	43.99 (6.57)	41.32 (6.40)	37.44 (6.10)	36.46 (6.07)	39.80 (6.28)	34.33
2	Propargite 57 EC	0.11	47.75 (6.79)	43.93 (6.54)	40.60 (6.33)	36.90 (5.86)	34.41 (5.85)	38.96 (6.14)	35.71
3	Flufenoxuron 10 DC	0.01	48.85 (6.88)	42.64 (6.54)	36.98 (6.12)	33.51 (5.75)	32.53 (5.73)	36.41 (6.13)	39.92
4	Fenpyroximate 5 EC	0.005	47.11 (6.74)	41.43 (6.45)	34.77 (5.73)	30.79 (5.54)	31.46 (5.62)	34.61 (5.83)	42.89
5	Difenthiuron 50WP	0.06	49.45 (6.65)	45.08 (6.70)	43.75 (6.61)	40.27 (6.19)	37.72 (6.11)	41.70 (6.40)	31.19
6	Dimethoate 30EC	0.06	48.52 (6.86)	48.13 (6.91)	46.13 (6.79)	43.72 (6.48)	38.44 (6.22)	44.10 (6.6)	27.23
7	Untreated control	--	48.45 (6.84)	51.57 (7.02)	56.57 (7.47)	64.21 (7.91)	70.08 (8.35)	60.60 (7.68)	
	SE+		0.029	0.03	0.13	0.10	0.14		
	CD at 5% level	--	NS	0.09	0.39	0.30	0.42		
	CV%	--	1.69	12.94	11.27	11.73	12.39		

DAS= Days after spraying, N.S. – Non-significant

*Figures in parentheses are $\sqrt{x+0.5}$ values.

1.2 One day after spraying

The data on average survival of mite population recorded revealed that the average number of mite population ranged from 41.43 to 48.13 mites per leaf in treated plots as against higher number of 51.57 mites per leaf in untreated plot.

Amongst the acaricide evaluated, fenpyroximate 5 EC proved to be most promising acaricide, recorded least of 41.43 mites per three leaves and it was superiorly significant over all other acaricides. Flufenoxuron 10 DC was the next best treatment with population of 42.64 followed by propargite 57 EC with population 43.93 mites per three leaves. Buprofezin 25 EC and diafenthiuron 50 WP with an efficacy 43.99, 45.08 respectively. Dimethoate 30 EC having population 48.13 mites per three leaves did not prove much effective in controlling mites. 1 DAS it is observed that flufenoxuron 10 DC is at par with fenpyroximate 5 EC.

1.3 Three days after spraying

Amongst the acaricide evaluated, fenpyroximate 5 EC proved to be most promising acaricide, recorded least of 34.77 mites per three leaves and it was superiorly significant over all other acaricides. Flufenoxuron 10 DC was the next best treatment with population of 36.98 followed by propargite 57 EC with population 40.60 mites per three leaves. Buprofezin 25 EC and diafenthiuron 50 WP with an efficacy 41.32, 43.75 respectively. Dimethoate 30 EC having population 46.13 mites per three leaves did not prove much effective in controlling mites. 3 DAS it is observed that flufenoxuron 10 DC is at par with fenpyroximate 5 EC.

1.4 Seven days after spraying

Amongst the acaricide evaluated, fenpyroximate 5 EC proved to be most promising acaricide, recorded least of 30.79 mites per three leaves and it was superiorly significant over all other acaricides. Flufenoxuron 10 DC was the next best treatment with population of 33.51 followed by propargite 57 EC with population 36.90 mites per three leaves. Buprofezin 25 EC and diafenthiuron 50 WP with an efficacy 37.44, 40.27 respectively. Dimethoate 30 EC having population 43.72 mites per three leaves did not prove much effective in

controlling mites. 7 DAS it is observed that flufenoxuron 10 DC is at par with fenpyroximate 5 EC.

1.5 Ten days after spraying

Amongst the acaricide evaluated, fenpyroximate 5 EC proved to be most promising acaricide, recorded least of 31.46 mites per three leaves and it was superiorly significant over all other acaricides. Flufenoxuron 10 DC was the next best treatment with population of 32.53 followed by propargite 57 EC with population 34.41 mites per three leaves. Buprofezin 25 EC and diafenthiuron 50 WP with an efficacy 36.46, 37.72 respectively. Dimethoate 30 EC having population 38.44 mites per three leaves did not prove much effective in controlling mites. 7 DAS it is observed that flufenoxuron 10 DC and propargite 57 EC are at par with fenpyroximate 5 EC. The overall result showed that the treatment with fenpyroximate 5 EC found most effective with highest reduction over untreated control (42.89%) which is followed by flufenoxuron 10 DC (39.92%) reduction over untreated control, propargite 57 EC (35.71%) reduction over untreated control. The insecticidal treatment followed order of reduction over untreated control was reduction over untreated control were buprofezin 25 EC and diafenthiuron 50 WP with (34.33%) and (31.19%) reduction over untreated control and dimethoate 30 EC (27.23%) reduction over untreated control found less effective for rose mites population control.

2. Second spray

Table 3: Efficacy of acaricide treatments against rose mites after second spray

Tr. No.	Treatments	Conc. (%)	Survival population under poly house condition						% reduction over untreated control
			Second application						
			Pre count	1 DAS	3 DAS	7 DAS	10 DAS	Mean	
1	Buprofezin 25 EC	0.03	37.38 (6.04)	34.71 (5.79)	32.77 (5.67)	28.28 (5.12)	27.51 (5.12)	30.81 (5.42)	61.89
2	Propargite 57 EC	0.11	34.33 (5.85)	34.00 (5.76)	31.02 (5.48)	27.32 (5.03)	26.88 (5.16)	29.95 (5.35)	62.96
3	Flufenoxuron 10 DC	0.01	32.46 (5.72)	31.57 (5.69)	29.53 (5.32)	24.35 (4.85)	23.68 (4.90)	27.28 (5.19)	66.26
4	Fenpyroximate 5 EC	0.005	31.61 (5.61)	30.78 (5.69)	27.26 (5.12)	21.31 (4.31)	22.27 (4.73)	25.40 (4.96)	68.58
5	Difenthiuron 50WP	0.06	37.77 (6.05)	35.19 (5.85)	34.50 (5.65)	29.67 (5.33)	28.34 (5.28)	31.92 (5.52)	60.52
6	Dimethoate 30EC	0.06	38.03 (6.15)	37.08 (6.08)	34.82 (5.70)	33.33 (5.74)	31.63 (5.60)	34.21 (5.78)	57.69
7	Untreated control	--	71.38 (8.41)	73.35 (8.51)	76.05 (8.67)	81.42 (8.94)	92.57 (9.62)	80.84 (8.9)	
	SE+		0.75	0.03	0.07	0.05	0.06		
	CD (p=0.05)	--	NS	0.09	0.21	0.15	0.18		
	CV%	--	12.11	10.93	16.25	15.97	14.38		

DAS= Days after spraying, N.S. – Non-significant

*Figures in parentheses are $\sqrt{x + 0.5}$ values.

2.1 Incidence of mites before spraying

The data of observations on mites recorded one day before spraying are given in the table 4.4 and are ranging from 31.61 to 38.03 mites per leaf in different treatment and were found statistically non-significant indicating uniform population of mites.

2.2 One day after spraying

The data on average survival of mite population recorded revealed that the average number of mite population ranged from 30.78 to 37.08 mites per leaf in treated plots as against higher number of 73.35 mites per leaf in untreated plot.

At 1 DAS, data on average number of mites per three leaves revealed that all the treatments differed significantly over untreated control. The average of mites in treated plot ranged from 30.78 to 37.08 in treated plot as against 73.35 mites per three leaves in untreated plot. The treatment with fenpyroximate 5 EC was most effective and recorded 30.78 mites per three leaves Flufenoxuron 10 DC was the next best treatment with population of 31.57 followed by propargite 57 EC with population 34.00 mites per three leaves. Buprofezin 25 EC and diafenthiuron 50 WP with an efficacy 34.71, 35.19 respectively. Dimethoate 30 EC was the least effective and recorded the highest surviving population of mites, i.e 37.08 per three leaves of plant, on an average. 1 DAS it is observed that flufenoxuron 10 DC and propargite 57 EC are at par with fenpyroximate 5 EC.

2.3 Three days after spraying

At 3 DAS, data on average number of mites per three leaves revealed that all the treatments differed significantly over untreated control. The average of mites in treated plot ranged from 27.26 to 34.82 in treated plot as against 76.05 mites per three leaves in untreated plot. The treatment with fenpyroximate 5 EC was most effective and recorded 27.26 mites per three leaves Flufenoxuron 10 DC was the next best treatment with population of 29.53 followed by propargite 57 EC with population 31.02 mites per three leaves. Buprofezin 25 EC and diafenthiuron 50 WP with an efficacy 32.77, 34.82 respectively. Dimethoate 30 EC was the least effective and recorded the highest surviving population of mites, i.e 34.82 perthree leaves of plant, on an average. 3 DAS it is observed that flufenoxuron 10 DC is at par with fenpyroximate 5 EC.

2.4 Seven days after spraying

At 7 DAS, data on average number of mites per three leaves revealed that all the treatments differed significantly over untreated control. The average of mites in treated plot ranged from 21.31 to 33.33 in treated plot as against 81.42 mites per three leaves in untreated plot. The treatment with fenpyroximate 5 EC was most effective and recorded 21.31 mites per three leaves Flufenoxuron 10 DC was the next best treatment with population of 24.35 followed by propargite 57 EC with population 27.32 mites per three leaves. Buprofezin 25 EC and diafenthiuron 50 WP with an efficacy 28.28, 29.67 respectively. Dimethoate 30 EC was the least effective and recorded the highest surviving population of mites, i.e 33.33 per three leaves of plant, on an average.

2.5 Ten days after spraying

10 DAS, data on average number of mites per three leaves revealed that all the treatments differed significantly over untreated control. The average of mites in treated plot ranged from 22.27 to 31.63 in treated plot as against 81.42 mites per

three leaves in untreated plot. The treatment with fenpyroximate 5 EC was most effective and recorded 22.27 mites per three leaves Flufenoxuron 10 DC was the next best treatment with population of 23.68 followed by propargite 57 EC with population 26.88 mites per three leaves. Buprofezin 25 EC and diafenthiuron 50 WP with an efficacy 27.51, 31.63 respectively. Dimethoate 30 EC was the least effective and recorded the highest surviving population of mites, i.e 34.21 per three leaves of the plant, on an average. 10 DAS it is observed that flufenoxuron 10 DC is at par with fenpyroximate 5 EC.

The overall result showed that the treatment with fenpyroximate 5 EC found most effective with highest reduction over untreated control (68.58%) which is followed by flufenoxuron 10 DC (66.26%) reduction over untreated control, propargite 57 EC (62.96%) reduction over untreated control. The insecticidal treatment followed order of reduction over untreated control were reduction over untreated control, buprofezin 25 EC and diafenthiuron 50 WP with (61.89%) and (60.52%) reduction over untreated control and dimethoate 30 EC (57.69%) reduction over untreated control found less effective for rose mites population control.

Table 4: Efficacy of acaricide treatments against rose mites after third spray

Tr. No.	Treatments	Conc. (%)	Survival population under poly house condition						% reduction over untreated control
			Third Application						
			Pre count	1 DAS	3 DAS	7 DAS	10 DAS	Mean	
1	Buprofezin 25 EC	0.03	27.44 (5.02)	26.08 (5.07)	23.46 (4.80)	20.26 (4.48)	19.75 (4.35)	22.38 (4.67)	76.69
2	Propargite 57 EC	0.11	26.37 (5.05)	25.73 (5.10)	20.22 (4.51)	17.88 (4.20)	16.51 (4.12)	20.08 (4.27)	79.08
3	Flufenoxuron 10 DC	0.01	23.51 (4.79)	23.02 (4.84)	19.02 (4.34)	15.66 (4.01)	12.66 (3.50)	17.59 (4.17)	81.68
4	Fenpyroximate 5 EC	0.005	22.44 (4.67)	21.32 (4.65)	17.90 (4.25)	12.35 (3.37)	8.06 (2.83)	14.90 (3.77)	84.48
5	Difenthiuron 50WP	0.06	28.37 (5.26)	26.42 (5.16)	25.62 (4.99)	24.15 (4.88)	21.79 (4.60)	24.49 (4.90)	74.49
6	Dimethoate 30EC	0.06	30.35 (5.31)	29.17 (5.21)	27.17 (5.21)	25.60 (5.02)	24.40 (4.90)	26.58 (5.08)	72.19
7	Untreated control	--	91.35 (9.51)	92.29 (9.59)	95.84 (9.76)	96.10 s(9.76)	99.66 (9.55)	95.97 (9.66)	
	SE+		0.58	0.07	0.08	0.06	0.05		
	CD (p=0.05)	--	NS	0.21	0.24	0.18	0.15		
	CV%	--	14.36	11.25	15.38	16.47	14.37		

DAS= Days after spraying, N.S. – Non-significant

*Figures in parentheses are $\sqrt{x+0.5}$ values.

3. Third spray

3.1 Incidence of mites before spraying

The data of observations on mites recorded one day before spraying are given in the table 4.5 and are ranging from 22.44 to 30.35 mites per leaf in different treatment and were found statistically non-significant indicating uniform population of mites

3.2 One day after spraying

The data on average survival of mite population recorded revealed that the average number of mite population ranged from 21.32 to 29.17 mites per leaf in treated plots as against higher number of 92.29 mites per leaf in untreated plot.

Amongst the acaricide evaluated, fenpyroximate 5 EC proved to be most promising acaricide, recorded least of 21.32 mites per three leaves and it was superiorly significant over all other acaricides. Flufenoxuron 10 DC was the next best treatment with population of 23.02 followed by propargite 57 EC with population 25.73 mites per three leaves. Buprofezin 25 EC and diafenthiuron 50 WP with an efficacy 26.08, 26.42 respectively. Dimethoate 30 EC having population 29.17 mites per three leaves did not prove much effective in controlling mites. 1 DAS it is observed that flufenoxuron 10 DC is at par with fenpyroximate 5 EC.

3.3 Three days after spraying

Amongst the acaricide evaluated, fenpyroximate 5 EC proved to be most promising acaricide, recorded least of 17.90 mites per three leaves and it was superiorly significant over all other acaricides. Flufenoxuron 10 DC was the next best treatment with population of 19.02 followed by propargite 57 EC with population 20.22 mites per three leaves. Buprofezin 25 EC and diafenthiuron 50 WP with an efficacy 23.46, 25.62 respectively. Dimethoate 30 EC having population 27.17 mites per three leaves did not prove much effective in controlling mites. 3 DAS it is observed that flufenoxuron 10 DC is at par with fenpyroximate 5 EC.

3.4 Seven days after spraying

Amongst the acaricide evaluated, fenpyroximate 5 EC proved to be most promising acaricide, recorded least of 12.35 mites per three leaves and it was superiorly significant over all other acaricides. Flufenoxuron 10 DC was the next best treatment with population of 15.66 followed by propargite 57 EC with population 17.88 mites per three leaves. Buprofezin 25 EC and diafenthiuron 50 WP with an efficacy 20.26, 21.79 respectively. Dimethoate 30 EC having population 25.60 mites per three leaves did not prove much effective in controlling mites.

3.5 Ten days after spraying

Amongst the acaricide evaluated, fenpyroximate 5 EC proved to be most promising acaricide, recorded least of 8.06 mites per three leaves and it was superiorly significant over all other acaricides. Flufenoxuron 10 DC was the next best treatment with population of 12.66 followed by propargite 57 EC with population 16.51 mites per three leaves. Buprofezin 25 EC and diafenthiuron 50 WP with an efficacy 19.75, 21.79 respectively. Dimethoate 30 EC having population 24.40 mites per three leaves did not prove much effective in controlling mites.

The overall result showed that the treatment with fenpyroximate 5 EC found most effective with highest reduction over untreated control (84.48%) which is followed by flufenoxuron 10 DC (81.68%) reduction over untreated control, propargite 57 EC (79.08%) reduction over untreated control. The insecticidal treatment followed order of reduction over untreated control was reduction over untreated control were buprofezin 25 EC and diafenthiuron 50 WP with (76.69%) and (74.49%) reduction over untreated control and

dimethoate 30 EC (72.19%) reduction over untreated control found less effective for rose mites population control.

The result of present findings are in conformity with Vinoth Kumar *et al*., (2009) [4] who evaluated the efficacy of acaricide molecules and resulted that fenpyroximate 5 EC @ 0.8 ml/l which recorded the per cent reduction of mites (60.30 and 78.73) foliar application of propargite 57 EC @ 3 ml/l and diafenthiuron 50 WP @ 1 g/l also proved to be successful in suppressing *T. urticae* population on brinjal. Reddy (2014) [5] studied *Tetranychus urticae* (Koch) on chrysanthemum cultivated under protected conditions and their results showed that at 5, 10, and 15 days after treatment, fenpyroximate indicated 100% mortality.

Shukla (2018) [6] also assessed the effectiveness of fenpyroximate, 5 EC @ 25 g a.i /ha against red spider mites, *T. urticae*, on okra at various dosages and came to know that it was the most successful treatment, while propargite, 57 EC @ 850 g a.i /ha was also demonstrated to be effective treatment in the majority of observations, according to the data.

The results are agreement with Sandeepa *et al*., (2017) [7] who demonstrated that the propargite 57 EC treatment significantly decreased the number of mites when compared to the other treatments. The next-best treatment was diafenthiuron 50 WP.

Kaur *et al*., (2006) [8] observed that propargite, for their efficacy against eggs of the two-spotted spider mite at 27 ± l°e. In terms of ovicide, propargite (0.05%) were determined to be the most effective insecticides. Jadhav *et al*., (2016) [9] also obtained bio-efficacy results and indicated that propargite @ 1500ml a.i /ha confirmed to be the most effective treatment evidenced considerable decrease of mites in 6.25 cm^2 leaf area/ 3 leaves.

Patil *et al*., (2014) [10] evaluated the acaricides *Tetranchyus urticae* Koch. indicated that after two applications, the acaricide propargite (0.05%) decreased the mite population by 69.19%. The second-best treatment in terms of effectiveness was abamectin 0.0025 percent. The third-best treatment was dimethoate 0.03% (57.97%).

Conclusion

The three sprays of treatment with diafenthiuron 50WP were found to be most effective against rose mites.

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