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Bio-efficacy of different acaricides and biopesticides against two spotted spider mite, *Tetranychus urticae* Koch infesting okra under laboratory conditions

SS Gamit, CB Varma and MR Dabhi

Abstract

The laboratory experiment was conducted at Entomology laboratory, Department of Entomology, BACA, AAU, Anand during *summer* and *kharif*, 2021 to determine the bio-efficacy of different acaricides and biopesticides against two spotted spider mite, *T. urticae* by using Completely Randomized Design (CRD) with three replications. And the result of bio-efficacy of different acaricides revealed that the highest mite mortality (99.97%) with treatment spiromesifen 22.9 SC @ 0.02% and it was at par with abamectin 1.9 EC @ 0.00057%, fenazaquin 10 EC @ 0.012%, propergite 57 EC @ 0.014%, ethion 10 SC @ 0.05%, diafenthiuron 10 SC @ 0.06% and etoxazole 10 SC @ 0.008% which caused 99.97% mortality after 24 hr of treatment. Whereas, the lowest mite mortality observed with treatment chlorfenapyr 10 SC 0.015% (56.80%) and dimethoate 30 EC 0.03% (56.66%) after 24 hr of treatment. While, among nine biopesticides evaluated, the highest mortality was found with treatments *Lecanicillium lecanii* (89.97%) followed by garlic bulb extract 10% (79.97%) and eucalyptus leaf extract 10% (79.97%) after 72 hr of treatment.

Keywords: Two spotted spider mite, *T. urticae*, bio-efficacy, acaricides, biopesticides

Introduction

Okra (*Abelmoschus esculentus* L.) is one of the most important vegetable of India. It is a member of family Malvaceae. In India, okra crop is subjected to attack by a number of insect-pests. Among non-insect pests, two spotted spider mites are considerable notorious pests. The feeding behaviour of this mites leads to the specklings on leaves, photosynthesis declines, stomata remains closed and transpiration decreases, finally affecting the quality and quantitative yield of okra crop. These mites can cause considerable crop yield and quality losses, because they have short life span and under favorable conditions their populations quickly reach high abundance. There is a continual need for application of new acaricides with novel biochemical modes of action, but their use to be optimized in order to prevent or delay the evolution of resistance and prolong their life span. Hence in this regard, study was initiated to understand the efficacy of different acaricides against *T. urticae* in laboratory condition. Furthermore, Now-a-days, numbers of new molecules are available in the market for pest management in different crops. Besides chemical insecticides, some botanicals, their readymade products and entomopathogenic fungus are available in the market. Bio-pesticides are also found effective for the management of mites. So, there is a need to study the bio-efficacy of different bio-pesticides for the effective and economical control of okra mites. Therefore, the present study was carried out to insight the knowledge on this aspect.

Materials and Methods

a) Bio-efficacy of different acaricides against two spotted spider mite, *T. urticae* infesting okra under laboratory conditions

The experiment was conducted under laboratory conditions in the department of Entomology, B. A. College of Agriculture, AAU, Anand during *summer*, 2021 in Completely Randomized Design with ten treatments and three replications with a view to evaluate efficacy of different acaricides against two spotted spider mite, *T. urticae* infesting okra infesting under laboratory condition. For this purpose, ten adults of *T. urticae* were released on leaf, keeping on a wad of wet cotton in Petri plate of the 9 cm diameter. The treatments of acaricides *viz.*, Chlorfenapyr 10 SC 0.015%, Propergite 57 EC 0.014%, Ethion 50 EC 0.05%, Diafenthiuron 50 WP 0.06%, Spiromesifen 22.9 SC 0.02%, Etoxazole 10 SC 0.008%, Dimethoate 30 EC 0.03%, Abamectin

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1.9 EC 0.00057% and Fenazaquin 10 EC 0.012% were given with the help of hand sprayer. The number of live mites/ leaf was observed at 24, 48 and 72 h after acaricidal treatments with the help of stereo binocular microscope to calculate corrected mortality.

b) Bio-efficacy of different biopesticides against two spotted spider mite, *T. urticae* infesting okra under laboratory condition

The experiment was conducted under laboratory conditions in the Department of Entomology, B. A. College of Agriculture, AAU, Anand during *kharif* 2021, for the evaluation of bio-efficacy of different biopesticides against okra mite, *T. urticae* on leaves in completely randomized design with ten treatments including control and three repetitions. The bio-efficacy was carried out by leaf disc method (Siegler, 1947). Matured okra leaves were collected from the field and leaf discs of 6 cm diameter cut from whole leaves. The fresh cut leaves were dipped in the treatments *viz.*, Cow urine 5%, Neem oil 0.5%, Aqueous marigold leaf extract 10%, Aqueous tulsi leaf extract 10%, Aqueous garlic bulb extract 10%, Aqueous eucalyptus leaf extract 10%, *Lecanicillium lecanii* (2×10^8 cfu/g) (NBAIR VI-8), *Metarhizium anisopliae* (2×10^8 cfu/g) (NBAIR Ma-4) and *Beauveria bassiana* (2×10^8 cfu/g) (NBAIR Bb-5a) were tested for their efficacy against mite. The leaf-discs of 6 cm diameter were immersed in the desired concentration of the extracts for 1 minute and then were taken out and kept for drying. Thereafter, petroleum jelly was applied on the edges of leaves to restrict the movement of mites. After that, leaves were kept on wet cotton pads in Petri plates (9 cm diameter). Ten adult mites were released on each disc with a brush and allowed to settle in the disc. Three replicates were maintained for each treatment and untreated control. Individual Petri plate was examined and observed number of live mites/leaf under a stereo binocular after 24, 48 and 72 hours of treatment.

The per cent reduction in mite population over control was worked out by using Henderson and Tilton formula (1955) ^[1]

for both experiments.

- Corrected per cent reduction in mite population

$$1 - \frac{n \text{ in Co before treatment} \times n \text{ in T after treatment}}{n \text{ in Co after treatment} \times n \text{ in T before treatment}} \times 100$$

Where, n = mite population; T = Treatment; Co = Control
Data thus obtained were statistically analysed by using arc-sine transformation and subjected to ANOVA.

Preparation of Plant Extracts

Aqueous extraction was carried out by infusion method. Ten percent aqueous extract of botanicals (eucalyptus, marigold, tulsi leaves and garlic bulb) were prepared by soaking 100 g of the crushed plant parts for in 1 litre of distilled water and left to stand for 12 h, and then filtered through muslin cloth. Then the filtrates were used for conducting bio-efficacy. Then after, all the extracts were mixed with sticker (detergent powder) at the rate of 2 gm /lit. to facilitate adherence of the extracts to the leaf surface.

Results and Discussions

a) Bio-efficacy of different acaricides against two spotted spider mite, *T. urticae* infesting okra under laboratory conditions

To determine the bio-efficacy of different acaricides against two spotted spider mite, *T. urticae* under laboratory experiment was conducted during *summer*, 2021. The data obtained on per cent mite mortality recorded at 24, 48 and 72 hours after imposition of treatment against two spotted spider mite were analyzed statistically and tabulated. The results pertaining to the bio-efficacy of different insecticides against two spotted spider mite, *T. urticae* are presented in the Table 1.

Table 1: Evaluation of different acaricides against two spotted spider mite, *T. urticae* infesting okra under laboratory condition

Tr. No.	Treatments	Corrected mortality (%) at Indicated intervals (hrs.)		
		24	48	72
T ₁	Chlorfenapyr 10 SC	48.91b (56.80)	61.69b (77.51)	77.38b (95.23)
T ₂	Propargite 57 EC	89.06a (99.97)	89.06a (99.97)	89.06a (99.97)
T ₃	Ethion 50 EC	89.06a (99.97)	89.06a (99.97)	89.06a (99.97)
T ₄	Diafenturon 50 WP	89.06a (99.97)	89.06a (99.97)	89.06a (99.97)
T ₅	Spiromesifen 22.9 SC	89.06a (99.97)	89.06a (99.97)	89.06a (99.97)
T ₆	Etoxazole 10 SC	89.06a (99.97)	89.06a (99.97)	89.06a (99.97)
T ₇	Dimethoate 30 EC	48.83b (56.66)	61.19b (71.54)	71.54c (89.97)
T ₈	Abamectin 1.9 EC	89.06a (99.97)	89.06a (99.97)	89.06a (99.97)
T ₉	Fenazaquin 10 EC	89.06a (99.97)	89.06a (99.97)	89.06a (99.97)
T ₁₀	Untreated control	0.91c (0.03)	0.91c (0.03)	0.91d (0.03)
	S.Em. ±	1.38	1.70	1.85
	Ftest (T)	Sig.	Sig.	Sig.
	C.V. (%)	3.32	3.96	4.14

Notes: 1) Treatment means with common letter(s) are/is not significant at 5% level of significance by DNMRT

2) Figures in the parentheses are re-transformed values and those outside are arc-sin transformed values

After 24 hours

The data on two spotted spider mite mortality presented in Table 1 revealed that the highest mite mortality was observed in the treatment of spiromesifen 22.9 SC 0.02% (99.97%) after 24 hrs, which was at par with abamectin 1.9 EC 0.00057% (99.97%), fenazaquin 10 EC 0.012% (99.97%), propergite 57 EC 0.014% (99.97%), ethion 50 EC 0.05% (99.97%), diafenthiuron 50 WP 0.06% (99.97%) and etoxazole 10 SC 0.008% (99.97%) mortality. Whereas, the lowest mite mortality was observed in treatment of chlorfenapyr 10 SC 0.015% (56.80%) and dimethoate 30 EC 0.03% (56.66%).

After 48 & 72 hours

Significantly the highest mite mortality was observed in the treatments of spiromesifen 22.9 SC 0.02% (99.97%) after 48 hrs. However, it was at par with abamectin 1.9 EC 0.00057%, fenazaquin 10 EC 0.012%, propergite 57 EC 0.014%, ethion 50 EC 0.05%, diafenthiuron 50 WP 0.06% and etoxazole 10 SC 0.008% which caused 99.97% mortality after 48 and 72 hrs after treatment. While, the Chlorfenapyr 10 SC 0.015% and dimethoate 30 EC 0.03% caused 77.51%, 95.23% and

71.54%, 89.97% mortality 48 hrs and 72 hrs after treatment, respectively.

The above results were more or less in agreement with those of Patil *et al.* (2013) [3] who showed that propergite 0.05%, abamectin 0.0025%, dimethoate 0.03% and diafenthiuron 0.055% were more effective which caused 50% and 70% mortality of mite at 24 h of treatment and 72 h of treatment, respectively. Similar results were confirmed by Reddy and Latha (2016) [4] who reported abamectin, fenazaquin, spiromesifen and propergite were more effective against mite.

b) Bio-efficacy of different biopesticides against two spotted spider mite, *T. urticae* infesting okra under laboratory condition

To determine the bio-efficacy of different insecticides against two spotted spider mite, *T. urticae* under laboratory experiment was conducted during *Kharif*, 2021. The data obtained on per cent mite mortality recorded at 24, 48 and 72 hours after imposition of treatment against two spotted spider mite, *T. urticae* were analyzed statistically and tabulated. The results pertaining to the bio-efficacy of different insecticides against mite is presented in the Table 2.

Table 2: Evaluation of biopesticides against two spotted spider mite, *T. urticae* under laboratory condition

Tr. No.	Treatments	Corrected mortality (%) at Indicated intervals (hrs.)		
		24	48	72
T ₁	Cow urine 5%	18.43d (9.99)	30.98ef (26.50)	35.20de (33.23)
T ₂	Neem oil 0.5%	18.43d (9.99)	26.55f (19.98)	30.98e (26.50)
T ₃	Aqueous marigold leaf extract 10%	26.55c (19.98)	35.20e (33.23)	39.22d (39.98)
T ₄	Aqueous tulsi leaf extract 10%	50.75b (59.97)	54.76cd (66.71)	58.98bc (73.44)
T ₅	Aqueous garlic bulb extract 10%	58.98a (73.44)	63.41ab (79.97)	63.41b (79.97)
T ₆	Aqueous eucalyptus leaf extract 10%	56.77a (69.97)	58.98bc (73.44)	63.41b (79.97)
T ₇	<i>Lecanicillium lecanii</i>	61.19a (76.78)	66.12a (83.61)	71.54a (89.97)
T ₈	<i>Metarhizium anisopliae</i>	48.83b (56.66)	50.75d (59.97)	54.76c (66.71)
T ₉	<i>Beauveria bassiana</i>	23.85c (16.35)	33.19e (29.97)	37.21d (36.57)
T ₁₀	Untreated control	0.91e (0.03)	0.91g (0.03)	0.91f (0.03)
S.Em. ± Treatment (T)		1.44	1.59	1.47
Ftest (T)		Sig.	Sig.	Sig.
C.V. (%)		6.86	6.53	5.62

Notes: 1) Treatment means with common letter (s) are/is not significant at 5% level of significance by DNMRT

2) Figures in the parentheses are re-transformed values and those outside are arc-sin transformed value

After 24 hours

The data on mite mortality presented in Table 2 revealed that the highest mite mortality was observed in the treatment of *Lecanicillium lecanii* 0.4% (2×10^8 cfu/g) (76.78%) which was at par with treatments garlic bulb extract 10% (73.44%), eucalyptus leaf extract 10% (69.97%). The treatments viz., tulsi leaf extract 10% (59.97%) and *Metarhizium anisopliae* 0.4% (2×10^8 cfu/g) (56.66%) were found second best treatments and found at par with each other followed by the treatment of marigold leaf extract 10% (19.98%) and *Beauveria bassiana* 0.4% (2×10^8 cfu/g) (16.35%) moderately effective in their efficacy. While, the lowest mite mortality was observed in treatment of cow urine 5% (9.99%) and remained at par with neem oil 0.5% (9.99%).

After 48 hours

Significantly the highest mite mortality was observed in the treatments of *Lecanicillium lecanii* 0.4% (83.61%) after 48 hrs, which was remained at par with garlic bulb extract 10% (79.97%) followed by eucalyptus leaf extract 10% (73.44%), tulsi leaf extract 10% (66.71%) and *Metarhizium anisopliae* 0.4% (2×10^8 cfu/g) (59.97%). Whereas, the treatment of marigold leaf extract 10% (33.23%) at par with *Beauveria bassiana* 0.4% (2×10^8 cfu/g) (29.97%) and they found moderately effective treatments in their efficacy followed by cow urine 5% (26.50%) and neem oil 0.5% (19.98%) are least effective.

After 72 hours

After 72 hr observations revealed that significantly the highest

mite mortality was observed in the treatments of *Lecanicillium lecanii* 0.4% (89.97%) after 72 hrs. Garlic bulb extract 10% (79.97%) and eucalyptus leaf extract 10% (73.44%) found at par with each other and second-best treatment against *T. urticae* followed by tulsi leaf extract 10% (73.44%) and *Metarhizium anisopliae* 0.4% (2×10^8 cfu/g) (66.71%). Whereas, the treatment of marigold leaf extract 10% (39.98%) and *Beauveria bassiana* 0.4% (2×10^8 cfu/g) (36.57%) and cow urine 5% (33.23%) at par with each other. While, the lowest mite mortality was observed with neem oil 0.5% (26.50%) which is at par with cow urine 5%.

The present findings are similar with those of Wekesa *et al.* (2006) [9] and Vignesh *et al.* (2019) [8] who revealed that *Beauveria bassiana*, *Metarhizium anisopliae* and *Lecanicillium lecanii* was most efficient entomopathogenic fungi against the two spotted spider mite respectively. Similar results are confirmed by Mitra *et al.* (2015) [2] who observed that marigold gave good result with 82.63% mortality followed by tulsi (65.00%). Whereas, Sharma *et al.* (2013) [6] found that neem oil and cow urine were least effective which showed 35.03% and 30.67% mortality respectively and Sathyaseelan *et al.* (2020) [5] confirmed that eucalyptus leaf extract gave moderate efficacy against mite.

Conclusion

Conclusion The present conducted study showed that, highest mortality was found with treatment spiromesifen 22.9 SC 0.02%, abamectin 1.9 EC 0.00057%, fenazaquin 10 EC 0.012%, propergite 57 EC 0.014%, ethion 10 SC 0.05%, diafenthiuron 10 SC 0.06% and etoxazole 10 SC 0.008% 24 hr after treatment. While, among nine biopesticides, the highest mortality was found with treatments *Lecanicillium lecanii* followed by garlic bulb extract 10% and eucalyptus leaf extract 10% after 72 hr of treatment.

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