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Bio-efficacy of acaricides against two spotted spider mite, *Tetranychus urticae* Koch (Acarina: Tetranychidae) infesting carnation (cv. Beaumonde) under protected cultivation

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ABSTRACT

The acaricides tested for the bio-efficacy against *Tetranchyus urticae* under polyhouse conditions revealed that all the acaricidal treatments were significantly superior to untreated control in checking the mite population under polyhouse conditions. Among acaricides, propargite 0.05 per cent gave 69.19 per cent mite population reduction after two application. The next best treatment in order of effectiveness was abamectin 0.0025 per cent (63.34%) and it also exhibited consistent performance as second best treatment, followed by dimethoate 0.03 per cent (57.97%). However, the benefit cost ratio showed that propargite and dimethoate were most economical with net BCR of 1: 8.98 and 1: 8.93, respectively and gave effective control of *T. urticae.*

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INTRODUCTION

Flowers are the most beautiful and fascinating part of nature with power to overwhelm anybody's heart with love, happiness and joy. It is grown all over the world.

Major pests infesting carnations are mites (*Tetranychus urticae* Koch), carnation tortrix moth (*Tortrix pronubata*), thrips (*Taeniothrips dianthi*) and bud borer (*Helicoverpa armigera*). Amongst these, two spotted spider mite, *T. urticae* (Acarina: Tetranychidae) is the most serious pest of carnation in greenhouse and occurs regularly. It is being recorded worldwide infesting more than 150 different field and ornamental plants. *T. urticae* is a devastating pest in poly house cultivation (Jhansi Rani and Mohan, 1997). Both nymph and adult feed with chelicerate type mouthparts which is modified to pierce and suck the cell sap from epidermis of leaves. Large colonies of *T. urticae* produce very fine webbing around the leaves and flowers in which they feed and go toward the tops of plants where they tend to congregrate. Moreover, the small size, fast development rate and high reproductive potential make it difficult to control them. Further, major problem associated with their control is development of resistance to acaricides.

Research work on chemical control on mites has been also done by earlier research workers. As tetranychid mites are of considerable economic importance and their control on carnation continues to be a major problem, hence it was felt necessary to undertake studies on mite under polyhouse conditions.

MATERIAL AND METHODS

The present investigation on chemical control of *Tetranychus urticae* (Koch) infesting carnation in south Gujarat conditions was carried out during 2008-2009 under polyhouse conditions.

Some never acaricides along with conventional ones were tested with recommended concentration for their bioefficacy against two spotted spider mite, *T. urticae* on carnation. Their adverse effect on predatory mite was also evaluated. A polyhouse trial was laid out at Department of Floriculture and Landscaping, ASPEE Collage of Horticulture and Forestry, N.A.U., Navsari. The treatments were applied coinciding with profuse buildup of spider mite during *Rabi* 2009. The experiment was designed in Completely Randomized Design (C.R.D.) repeated thrice on variety, Beaumonde. The eight acaricides along with control (water spray) were applied on carnation on a gross plot size of 6.60×1.80 m planted on a spacing of 110×30 cm.

The treatment emulsions were sprayed on carnation plants with knapsack sprayer to the extent of slight run off. To evaluate the effect of foliar spray of various treatments, mite counts were made on ten randomly selected plants tagged from each net plot. Three random trifoliate leaves representing top, middle and lower canopy from each of the previously marked five plants per repetition were plucked and held in polyethylene bags separately and brought to the laboratory for counting mite population (live) under binocular microscope. The spider mite density (all embryonic stages together) was recorded from whole leaf. These sampled were also used to count predator. A pre-treatment counts a day before and post- treatment count 1, 3, 7 and 14 days after application of treatment (DAT) were recorded. The mites responding to touch of brush were considered alive. The data so obtained on mite counts (canopy- wise and leaf surface) were summed up and converted to per trifoliate leaf. The per cent reduction due to acaricidal treatment was calculated. The same trial was conducted under laboratory condition and observations were noted as pre-treatment and 24, 48 and 72 hr after application of treatments.

The flower yield per plot was recorded for each treatment and converted it per hectare. Benefit to cost ratio (BCR) was worked out for each treatment. For this purpose, gross realization was worked out for all the treatments including control by deducting the cost of insecticide as well as the cost of labour required for spray, from the total income of the marketable flower yield. Net gain over control was calculated by deducting realization of each treatment.

RESULTS AND DISCUSSION

The mean population reduction of *T. urticae* during November 2008 at 1, 3, 7 and 14 days after application were computed and are presented in Table 1. The mean data on

Table 1 : Efficacy of acaricides on population reduction of *T. urticae* on carnation under polyhouse condition

Treatments	Conc. (%)	Average (%) reduction under poly house condition		
		After 1st spray	After 2nd spray	Overall pooled
Abamectin 1.9 (%)	0.0025	63.39b (79.59)	63.36b (79.64)	63.34b (79.71)
Fenazaquin 10 (%)	0.01	53.02f (63.83)	50.52ef (59.57)	51.77ef (61.70)
Buprofezin 25 EC	0.030	44.81h (49.70)	42.68h (45.96)	43.75h (47.83)
Fenpyroximate 5 (%) EC	0.0025	49.09g (57.12)	48.02fg (55.26)	48.56g (56.19)
Propargite 57 (%) EC	0.05	70.11a (87.81)	68.53a (86.25)	69.19a (87.03)
Dicofol 18.5 (%) EC	0.05	55.09e (67.20)	52.23e (62.48)	53.63e (64.84)
Diafenthiuron 50 WP	0.055	57.16cd (70.54)	56.88cd (70.11)	57.01cd (70.32)
Dimethoate 30EC	0.03	58.18c (72.13)	57.79c (71.57)	57.97c (71.85)
Control (Water spray)	-	28.38i (22.79)	27.35i (21.12)	27.93i (21.96)
Mean	-	46.86 (53.25)	17.31 (61.33)	52.57 (62.38)
S.E. ±		-	-	-
Treatment (T)		0.71	1.47	1.36
(P × T)		1.55	-	-
C. D (P=0.05)		-	-	-
Treatment (T)		1.99	4.35	4.04
(P × T)		N.S.	N.S.	N.S.
C.V.		5.07	4.90	4.49

N.S. = Non –significant * indicate significance of value at P=0.05

population of *T. urticae* over different periods of observation after first spraying indicated that all the acaricidal treatments were significantly superior over control. However, significantly maximum reduction of mite population was 70.11 per cent recorded in propargite 0.05per cent and Abamectin 0.0025per cent stood next to the above treatment with 63.39per cent reduction. It was followed by the treatment of dimethoate 0.03per cent (58.18%) and was at par with diafenthiuron 0.055per cent (57.16%).

The average results of *T. urticae* population reduction over different period after second application indicated that all the acaricidal treatments were significantly superior over control. Propargite 0.05 per cent demonstrated significantly maximum mite reduction of 68.53 per cent population, followed by Abamectin 0.0025 per cent with reduction of 63.36 per cent. The next effective treatments were dimethoate 0.03 per cent (57.79%) and was found at par with diafenthiuron 0.055 per cent (56.88%).

The pooled data over two sprayings on mite population clearly indicated that all the insecticides recorded significantly highest mite reduction over untreated control. However, there was wide variation in the effectiveness due to insecticidal treatments. The treatment of propargite 0.05 per cent stood first by recording significantly highest mite reduction of 69.19 per cent over all other treatments. The next best treatment was abamectin 0.0025 per cent with 63.34 per cent reduction. The next order of efficacy of treatments were dimethoate 0.03 per cent (57.97%), diafenthiuron 0.055 per cent (57.01%), while least effective chemicals were dicofol 0.05 per cent (53.63%), fenazaquin 0.01per cent (51.77%), fenpyroximate 0.0025 per cent (48.56%) and buprofezin 0.030 per cent (43.75%). The interaction effect between treatment and period was significant indicating inconsistent performance of different treatments during different periods of observation.

Dicofol 0.05 per cent proved to be the most effective in causing 70 per cent maximum reduction of mites in bhendi and brinjal both under field and pot culture conditions in the finding of Ramaraju (2004). Whereas, Akashe *et al.* (2006) reported abamectin 0.0025 per cent as most effective in checking *T. urticae* population on rose and Singh *et al.* (2006) reported that dimethoate 0.06 per cent was found best against *T. urticae* on rose. However, Singh and Choudhary (2008) showed that abamectin 1.9 EC was most effective on okra in mite population reduction and propargite 0.05 per cent stood next to this treatment. In other findings, diafenthiuron at different formulations recorded the highest reduction of *T. urticae* population (Bhaskaran *et al.,* 2007 and Patel *et al.,* 2009).

Yield and economics:

Regarding yield of carnation, the results revealed that the gross realization of Rs. ha^{-1} was highest in propargite (Rs. 21280.5 ha^{-1}), followed by abamectin (Rs.20368.5 ha^{-1}), dimethoate (Rs. 13887 ha^{-1}) and diafenthiuron (Rs. 13521 ha^{-1}) and the corresponding figures for net profit obtained over control were 20089.5, 12788.5, 13367, 1969 and 11690.5 Rs. ha^{-1}, respectively (Table 2). Looking to net BCR, propargite (1: 8.98) stood first, followed by dimethoate (1:8.93). While, the treatments fenazaquin, diafenthiuron and abamectin showed negative BCR and were found non-profitable may due to their high cost.

It can be concluded from the present investigation that propargite and dimethoate were most economical with net BCR of 1: 8.98 and 1: 8.93, respectively and gave effective control of *T. urticae*.

Table 2 : Economics of different insecticidal treatments

Treatments	Insecticide		Labour cost (Rs. /ha)	Total cost of plant protection (Rs. /ha)	Yield (No. /ha)	Gross income (Rs. /ha)	Net gain (Rs. /ha)	Net profit over control	BCR	
	Quantity (L or kg/ha)	Cost (Rs. /ha)							Gross	Net
Abamectin 1.9 (%)	1.30	7380	200	7580	13579	20368.5	12788.5	4585	1:0.60	1:0.60
Fenazaquin 10 (%)	1.00	2320	200	2520	7923	11884.5	9364.5	1161	1:0.46	1:0.46
Buprofezin 25 EC	1.20	480	200	680	7268	10902	10222	2018.5	1:2.97	1:1.97
Fenpyroximate 5 (%) EC	0.500	600	200	800	7554	11331	10531	2327.5	1:2.91	1:1.91
Propargite 57 (%) EC	0.870	991	200	1191	14187	21280.5	20089.5	11886	1:9.98	1:8.98
Dicofol 18.5 (%) EC	2.70	1080	200	1280	8647	12970.5	11690.5	3487	1:2.72	1:1.72
Diafenthiuron 50 WP	1.10	11352	200	11552	9014	13521	1969	6234.5	-1:0.54	1:0.54
Dimethoate 30EC	1.00	320	200	520	9258	13887	13367	5163.5	1:9.93	1:8.93
Control (Water spray)	0	0	0	0	5469	8203.5	-	-	-	-

Total spray : 2 nos.

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