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Bio-efficacy of fenazaquin 10 EC against two spotted spider mite, *Tetranychus urticae* Koch. (Acari: Tetranychidae) in tomato

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ABSTRACT: A field trial was conducted at the Central Research Station Farm, Orissa University of Agriculture & Technology, Bhubaneswar during winter seasons of 2008-09 and 2009-10, using tomato variety "Arka Vikas" to test the bio-efficacy of fenazaquin 10EC against two spotted spider mite, *Tetranychus urticae* Koch. The results revealed that fenazaquin at 125 and 150 g a.i./ha registered significantly lowest mite population (3.5-4.8/4 cm^2 leaf area) followed by dicofol at 250g a.i./ha at 10 days after spraying (DAS) during both the years of study. The highest population reduction was achieved (90.27-92.13%) with fenazaquin at 125-150g a.i./ha followed by dicofol at 250g a.i./ha and fenazaquin at 100g a.i./ha (76.40-76.81 %) compared to control. Plots receiving fenazaquin at 125 and 150g a.i./ha treatments recorded significantly highest fruit yield (18.9-19.2 t/ha) which was 30.0-32.1per cent more than control (14.5 t/ha). The selectiveness and safety of fenazaquin to predatory phytoseiid mites was observed at all doses evaluated.

Keywords: Fenazaquin, *Tetranychus urticae*, tomato

INTRODUCTION

The two spotted spider mite, *Tetranychus urticae* Koch. (Acari: Tetranychidae), is an extremely polyphagous herbivore, feeding on a wide range of host plant species, including vegetables throughout the world (Navajas, 1998). In recent years, it has assumed the status of a major pest on almost all vegetable crops including tomato (Srinivasa *et al.*, 2003). Damage due to the pest includes reduction in crop yield as well as aesthetic injuries, because of the webbings produced by the mites. Continued and repeated use of synthetic acaricides for its control resulted in the development of resistance against commercially available chemicals in a short period of time. The wide spread acaricide resistance has been a major obstacle in the cost effective integrated mite management programme (Cho *et al*., 1995). In order to have alternative acaricide in pipeline to manage this pest effectively, in the present study, a new acaricide *viz.*, fenazaquin was evaluated.

MATERIALS AND METHODS

A field experiment was conducted at the Central Research Station Farm, Orissa University of Agriculture and Technology, Bhubaneswar during winter seasons of 2008-09 and 2009-10 to test the bio-efficacy of fenazaquin 10EC against two spotted spider mite, *Tetranychus urticae* Koch. and its natural enemies on tomato. Experiment was laid out in a randomized block design using tomato variety 'Arka Vikas' planted in plots of 5.5m x 3.6m size at a spacing of 60cm x 50cm. There were six treatments *viz.*, fenazaquin at 75, 100,125 and 150 g a.i./ha, dicofol @ 250g a.i./ha and an untreated control replicated four times. The crop was fertilized with 125:80:110 kg $N:P_2O_5:K_2O$/ha and grown with other recommended package of practices for the state except plant protection. Two sprayings were given at 15 days interval starting with the initiation of mite infestation using 500l of spray solutions per hectare by a knap sack sprayer.

Observations were recorded on the number of *T. urticae* per four square centimeter (2cm x 2cm leaf bit) from three matured tender leaves selected from apical portion of five randomly selected plants from each plot. Data were recorded one day before spraying (DBS) and at 3, 7 and 10 days after each spraying (DAS). The leaf samples were collected and observed under binocular microscope in the laboratory for different stages (egg, nymphs and adults) of phytophagous mites. Similarly, the number of predatory phytoseiid mites per leaflet was also counted from five randomly selected plants at the days mentioned above. Treatment-wise marketable fruit yield was recorded at harvest. The data were subjected to transformation before statistical analysis following Gomez and Gomez (1984) to test the significance of treatment effects.

RESULTS AND DISCUSSION

The mean spider mite population (all stages), as revealed from Table1, did not vary significantly (52.7-55.7) at one day before spraying (DBS) during winter,

Table 1. Effect of fenazaquin treatments on *Tetranychus urticae*

Treatment	Mean spider mite population/4cm² (2008-09)					Mean spider mite population/4cm² (2009-10)				
	Dose (ga.i /ha)	1 DBS	3 DAS	7 DAS	10 DAS	Reduction over control (%)	1 DBS	3 DAS	7 DAS	10 DAS	Reduction over control (%)
Fenazaquin 10EC	75	55.6 (1.75)	8.1 (0.96)[b]	9.2 (1.01)[b]	18.9 (1.30)[c]	67.64	43.2 (1.64)	8.6 (0.98)[b]	11.9 (1.11)[b]	19.1 (1.30)[c]	60.45
Fenazaquin 10EC	100	53.4 (1.73)	8.6 (0.98)[b]	9.4 (1.02)[b]	12.5 (1.13)[b]	78.59	45.7 (1.67)	8.2 (0.96)[b]	9.1 (1.00)[b]	11.4 (1.09)[b]	76.40
Fenazaquin 10EC	125	55.7 (1.75)	3.2 (0.62)[a]	4.1 (0.71)[a]	4.8 (0.76)[a]	91.78	44.6 (1.66)	3.7 (0.67)[a]	4.3 (0.72)[a]	4.7 (0.75)[a]	90.27
Fenazaquin 10EC	150	54.8 (1.75)	2.7 (0.57)[a]	3.6 (0.66)[a]	3.5 (0.65)[a]	94.00	42.5 (1.64)	2.4 (0.53)[a]	3.5 (0.65)[a]	3.8 (0.68)[a]	92.13
Dicofol 18.5EC	250	52.7 (1.73)	8.5 (0.98)[b]	8.7 (0.99)[b]	11.8 (1.11)[b]	79.79	43.8 (1.65)	8.7 (0.99)[b]	8.8 (0.99)[b]	11.2 (1.09)[b]	76.81
Untreated control	-	53.3 (1.73)	56.5 (1.76)[c]	58.8 (1.78)[c]	58.4 (1.77)[d]	-	44.1 (1.65)	45.4 (1.66)[c]	47.6 (1.69)[c]	48.3 (1.69)[d]	-
SE (m) ±	-	(0.02)	(0.03)	(0.03)	(0.04)	-	(0.02)	(0.05)	(0.04)	(0.03)	-
CD (p=0.05)	-	NS	(0.08)	(0.09)	(0.13)	-	NS	(0.16)	(0.12)	(0.09)	-

DBS = Day before spraying DAS = Days after spraying NS = Non – significant
Figures in the parentheses are Log X + 1 transformed values
Means followed by a common letter in a column are not significantly different from each other

2008-09 season indicating homogenous distribution of the pest. At 3 days after spraying (DAS) in all acaricidal treatments, the mite population was significantly low (2.7-8.6/4cm²) compared to control (56.5/4 cm² leaf area). At 7 DAS, among the acaricides, fenazaquin at 125 and 150g a.i. /ha registered lowest mite population (3.6-4.1/ 4 cm² leaf area), while fenazaquin at 75 and 100g a.i./ha remained at par with the standard check dicofol at 250g a.i./ha as regards the efficacy in keeping down the mite population (8.7-9.4/4cm² leaf area) compared to UTC (58.8/4cm² leaf area). Almost similar trend was observed with regard to efficacy of acaricides on 10 DAS compared to 7 DAS. Plots treated with fenazaquin at 125 and 150g a.i./ha had lower mite population (3.5-4.8/4 cm² leaf area) followed by dicofol at 250g a.i./ha and fenazaquin at 100g a.i./ha (11.8-12.5 mites/4 cm² leaf area) which were on par compared to UTC (58.4 mites/ 4 cm² leaf area) on 10 DAS. In terms of population reduction, highest reduction was observed with fenazaquin at 125 and 150g a.i./ha (91.78-94.00%) followed by fenazaquin at 100g a.i./ha and dicofol at 250g a.i./ha (67.64-79.79 %) over UTC. Fenazaquin at 75g a.i./ ha did not show satisfactory suppression with 67.64% reduction over control.

Although the mite population (all stages) recorded during winter, 2009-10 season was low compared to previous season there was no significant difference in their population (42.5-45.7/4 cm² leaf area) at 1 DBS indicating homogenous distribution of the pest throughout the experimental plot. Results were same as 2008-09 on 3, 7 and 10 DAS during winter, 2009-10 season as regards the efficacy in reducing mite population. On 10 DAS, the population of mites in all the acaricide treated plots remained significantly low (3.8-19.1/4cm² leaf area) compared to control (48.3/4cm² leaf area). Among the treatments, lowest mite population (3.8-4.7/4cm² leaf area) was recorded in fenazaquin at 125 and 150g a.i./ ha treated plots followed by fenazaquin at 100g a.i./ha treatment was at par with dicofol at 250g a.i./ha with 11.2-11.4 mites/4cm² leaf area. The highest mite population reduction was recorded (90.27-92.13%) with

Table 2. Effect of fenazaquin treatments on phytoseiid mite predators

Treatment	Dose (g a.i. /ha)	Mean predatory mite population/4cm² (2008-09)				Mean predatory mite population/4cm² (2009-10)			
		1 DBS	3 DAS	7 DAS	10 DAS	1 DBS	3 DAS	7 DAS	10 DAS
Fenazaquin 10EC	75	0.50 (1.00)	0.52 (1.01)	0.70 (1.09)	1.10 (1.26)	0.42 (0.96)	0.48 (0.99)	0.66 (1.08)	1.02 (1.23)
Fenazaquin 10EC	100	0.39 (0.94)	0.44 (0.97)	0.67 (1.08)	1.08 (1.26)	0.38 (0.94)	0.51 (1.00)	0.70 (1.09)	0.91 (1.19)
Fenazaquin 10EC	125	0.41 (0.95)	0.47 (0.98)	0.72 (1.10)	1.13 (1.28)	0.34 (0.92)	0.46 (0.98)	0.67 (1.08)	0.94 (1.20)
Fenazaquin 10EC	150	0.40 (0.95)	0.51 (1.00)	0.68 (1.09)	1.11 (1.27)	0.40 (0.95)	0.47 (0.98)	0.71 (1.10)	0.97 (1.21)
Dicofol 18.5EC	250	0.43 (0.96)	0.48 (0.99)	0.71 (1.10)	1.16 (1.29)	0.38 (0.94)	0.46 (0.98)	0.65 (1.07)	1.04 (1.24)
Untreated control	-	0.50 (1.00)	0.53 (1.01)	0.87 (1.17)	1.20 (1.30)	0.43 (0.96)	0.48 (0.99)	0.78 (1.13)	0.96 (1.21)
SE (m) ±	-	(0.03)	(0.02)	(0.04)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)
CD (p=0.05)	-	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)	(NS)

DBS = Day before spraying DAS = Days after spraying NS = Non – significant

Figures in the parentheses are X + 0.5 square root transformed values

Table 3. Effect of fenazaquin treatments on marketable tomato fruit yield

Treatment	Dose g a.i./ha	Pooled mean marketable tomato fruit yield (t/ha)	Increase in yield over control (%)
Fenazaquin 10%EC	75	15.4[c]	5.9
Fenazaquin 10%EC	100	16.2[b]	11.4
Fenazaquin 10%EC	125	18.9[a]	30.0
Fenazaquin 10%EC	150	19.2[a]	32.1
Dicofol 18.5%EC	250	16.4[b]	13.1
Untreated control	-	14.5[d]	-
SE (m) ±	-	0.3	-
CD (p=0.05)	-	0.8	-

Means followed by a common letter in a column are not significantly different from each other

fenazaquin at 125-150g a.i./ha followed by dicofol at 250g a.i./ha and fenazaquin at 100g a.i./ha (76.40-76.81 %) compared to control.

Although no reference is available on the efficacy of fenazaquin on *T. urticae* infesting tomato, Longhurst *et al*. (1992) reported acaricidal properties of fenazaquin against *T. urticae* in a variety of crops. Sahoo *et al*. (2003) observed that fenazaquin was second to abamectin in terms of toxicity to adult females of red spider mite, *Oligonychus coffeae* infesting tea. Bharadwaj and Sharma (2010) found that out of seven acaricides evaluated against two spotted spider mite, hexithiazox at (0.0025%), abamectin at (0.01%), fenazaquin at (0.001%) and propargite at 0.05% provided excellent control in apple. Rai (2010) recorded moderate mortality (60.88%) of *T. urticae* infesting brinjal crop with the application of fenazaquin at 100g a.i./ha. Senapati *et al*. (2010) reported that fenazaquin gave best control of yellow mite up to 14 days in chilli.

Effect on Natural Enemies

The mean number of predatory phytoseiid mite population per leaflet (Table 2) observed during 2008-

09 season did not vary (0.39-0.50) in the sub-plots indicating uniform distribution at 1 DBS. Their population also did not vary among acaricide treated plots and UTC indicating safety of tested acaricides to predatory mites at 3 (0.44-0.53), 7 (0.67-0.87) and 10 (1.08-1.20) DAS. Similar results were observed during following season indicating selectiveness and safety of fenazaquin to predatory phytoseiid mites at all doses evaluated. Mallik *et al*. (2003) reported the efficacy of predatory phytoseiid mite, *Amblyseius longispinosus* on *T urticae*. The safety of fenazaquin to predatory mite results in increased cumulative effect of chemical on *T urticae*.

Fruit Yield

The pooled mean data of marketable tomato fruit yield (Table 3) revealed that, plots treated with fenazaquin 125 and 150g a.i./ha recorded significantly highest fruit yield (18.9-19.2 t/ha), which was 30.0-32.1 per cent increase over control. Fenazaquin at 100g a.i./ha treatment recorded 16.2 t/ha, which was at par with standard check dicofol at 250g a.i./ha (16.4 t/ha). Fenazaquin at 75g a.i./ha (15.4 t/ha) though yielded significantly higher compared to UTC (14.5 t/ha), the increase in yield over control (5.9%) was not impressive.

Hence, it may be concluded from the present study that fenazaquin at 125g a.i./ha is effective for the control of phytophagous mite, *Tetranychus urticae* in tomato and also safe to predatory mite.

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