Efficacy of Miticides Against Two-Spotted Spider Mite, *Tetranychus urticae*, Infesting Three Almond Varieties

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Abstract.- The efficacy of three miticides *viz*. Pyrida, Ethion and Agrifol was tested against two-spotted spider mite, *Tetranychus urticae* Koch (Acari: Tetranychidae) on three almond (*Prunus dulcis*) cultivars *viz*. Ferraster, Karishma and Lajawab. All the three miticides significantly reduced the mite populations on all the tested cultivars as compared to the check. Pyrida was the most effective miticide, followed by Ethion and Agrifol. Mean mite populations after three cumulative sprays on these varieties recorded per leaf after 1, 3, 7, 10 and 15 days was 0.52, 0.22, 2.44, 3.19 and 3.85, respectively, with Pyrida; 2.04, 0.96, 3.70, 5.04 and 6.22, respectively, with Ethion; and 3.93, 2.63, 6.07, 8.74 and 10.55, respectively with Agrifol, as compared with 42.22, 47.37, 46.52, 54.15 and 57.18 for the check. Overall mean mite population after three spays on three varieties, Ferraster Karishma and Lajawab was noted as 4.87, 1.91 and 2.60 for Pyrida, 2.82, 3.09 and 4.86 for Ethion, and 5.00, 5.62 and 8.54 for Agrifol as compared to 48.24, 48.56 and 56.71 mite per leaf on untreated trees, respectively. It is concluded from these results that Pyrida was the best insecticide followed by Ethion and Agrifol for the control of *T. urticae* on the basis of their performance; three sprays are recommended. Variety Lajawab was more susceptible to *T. urticae* than Ferraster and Karishma.

Key words: Almond varieties, miticides, two-spotted spider mite.

INTRODUCTION

Almond (Prunus dulcis) is the most important stone fruit grown in Pakistan. It is very delicious with high nutritional value (Agunbiade and Olanlokun, 2006). Almond is attacked by a number of insect pests. Some of major pests are ants, oriental fruit moth, peach twig borer, tree borer, brown mites and two spotted spider mites. Among spider mites, Tetranychus urticae is of immense importance as it causes serious damage in almond growing regions of the world (Helle and Sabelis, 1985). It occurs on a wide range of host plants especially in warm and dry climates. T. *urticae* feed by penetrating the plant tissues with its mouthparts and is found on the under side of leaf. It spins fine strands of webbing on the host plant. It is estimated that 18-22 cells are destroyed/min (Bunescu et al., 1995). If feeding is continued, it causes a stippled blanched effect and later the leaves turn yellow, grey or bronze. Complete defoliation may occur if the mites are not controlled

(Tuttle and Barker, 1968). In addition to apple, pear, peach, plum and almond, many shade trees and weeds are also attacked by this pest (Khan *et al.*, 2003).

In spite of the immense importance of almond, no attention has so far been paid to the losses caused by *T. urticae*. These losses cause reduction in production and affect the quality of the almond. Keeping in view the economic importance of spider mites, this study was initiated with the objectives to evaluate the efficacy of various miticides against this mite on three almond varieties and to determine the number of sprays required to suppress this noxious pest.

MATERIALS AND METHODS

Efficacy of three miticides namely, Pyrida, Ethion and Agrifol was studied on three cultivars of almond *viz.*, Ferraster, Karishma and Lajawab against two-spotted spider mite, *Tetranychus urticae*.

The orchard selected for the trial comprised 96, 22 year-old trees, with 16 trees in each row and a total of 6 rows. Two adjacent rows, having 16 tree each, belonged to each variety. In this way the total number of trees in each variety was 32. Plant to

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plant and row-to-row distance was 6.5 x 6.5 m, respectively. The experiment was designated as three factorial (miticides x varieties x days) in a Randomized Complete Block Design (RCBD). Factor one was comprised of four treatments: three miticides, Agrifol (Dicofol) 20EC, Ethion (Ethion) 45.5EC, and Pyrida (Pyridaben) 15EC, plus a check. Factor two was 3 almond varieties, viz., Ferraster, Karishma and Lajawab, while factor three was (five) time intervals (Days 1, 3, 7, 10 and 15 after spray application). Two trees of each variety were randomly assigned to each treatment. One tree was left untreated as buffer zone between each treatment. A total of 72 trees were used for the experiment. In this way each treatment was replicated three times. The orchard was monitored regularly at an interval of seven days from the beginning of spring (N h) te etect the appearance of spider mites.

Miticides applications were initiated on May 21, June 06 and June 23 2002, respectively. Trees were sprayed with the miticides Agrifol, Ethion and Pyrida @ 200 mL, 200 mL and 100 mL 100 L⁻¹ water, respectively, by using knapsack sprayer when mite populatie reached the EIL of 6-8 mites per leaf (Hadi, 1992). Population densities (number of spider mites/leaf) were recorded at an interval of 1, 3, 7, 10 and 15 days after each spray. Fifteen leaves were randomly sampled from each top, bottom, inner and outer portions. Therefore 60 leaves were sampled from each tree; while 120 total leaves were collected from two trees i.e. each treatment. The leaves were brought to the laboratory for counting the number of spider mites (T. urticae) under binocular microscope. Population densities of spider mites were estimated from eac = the t = rees oftotal 30 leaves per treatment. Data obtained was statistically analyzed using factorial model for RCBD in Statistical Analysis Software (SAS Institute, 1995) and mean each factor and their interactions were compared for significance, using LSD test.

RESULTS

Population density of spider mites after first spray

The results of three miticides on the population density of two-spotted spider mites. $T_{\rm c}$

urticae are presented in Table I. All the three miticides were found significantly effective in reducing the spider mite population on all the three almond cultivars than untreated trees. Pyrida was found to be highly significantly superior to Ethion and Agrifol. It reduced populations to 0.00 mite/leaf on varieties Ferraster and Karishma and 0.67 mites/ leaf on Lajawab on the day following spray application. Ethion lowered populations to 0.33 mites/leaf on Ferraster and Karishma, and 2.33 mite/leaf on Lajawab while Agrifol reduced population density to 1.33 mite/leaf on Ferraster and Karishma and 5.67 mites/ leaf on Lajawab. On the other hand population density was 21.33, 23.67, 23.67 mites/ leaf in the checks, with respect to each treatment.

On three days after treatment (3DAT1) the efficacy of Pyrida and Ethion was 0.00 mites/ leaf on Ferraster and Karishma and 0.33 and 1.33 mites/ leaf on Lajawab, respectively. Population densities recorded on Agrifol-treated trees were 1.00 on Ferraster and Karishma and 3.67 on Lajawab, and 26.33, 29.67 and 29.33 mites/ leaf, respectively, on untreated trees.

The number of spider mites on each of the respective almond varieties gradually increased to 2.33 n leaf on Ferraster and Karishma and 4.00 mites/ leaf on Lajawab in Pyrida treated trees on 7DAT1. This was followed by Ethion where the mite populations were 3.67, 5.00 and 6.00, while 6.33, 7.67 and 9.33 mites/ leaf, respectively, for Agrifol, as compared with 20.67, 21.33 and 37.67 mites/ leaf, respectively, in untreated trees. Population densities on 10th day of the first spray was 3.33, 3.67 and 4.33, respectively, in Pyrida, 5.00, 6.00, 6.33, respectively, in Ethion, and 9.33, 12.33 and 11.67 mites/ leaf on Agrifol as compared with 37, 36 and 39.67 mites/ leaf, respectively, on eated trees.

Data recorded on 15DAT1 for the population of mite per leaf was 4.00 on Ferraster, 5.00 on Karishma and Lajawab on Pyrida treated trees. This number increased to 6.33, 7.67 and 8.67 on Ethion and 12.67, 14.00, and 15.00 on Agrifol treated trees as compared with 43.33, 39.00 and 44.67 mite/leaf on untreated trees in all three cultivars.

The interaction of miticides and time interval was significant on mite populations in all three

Days	Variety		Μ	liticides		Means
-	•	Agrifol	Ethion	Pyrida	Control	D x V
			D	x V x T		
			Mean n	o. mites/ leaf		
1DAT1*	Ferraster	1.33	0.33	0.00	21.33	5.75
	Karishma	1.367	0.33	0.00	23.67	6.42
	Lajawab	5.67	2.33	0.67	23.67	8.08
3DAT1	Ferraster	1.00	0.00	0.00	26.33	6.83
	Karishma	1.00	0.00	0.00	29.67	7.67
	Lajawab	3.67	1.33	0.33	29.33	8.67
7DAT1	Ferraster	6.33	3.67	2.33	20.67	8.15
	Karishma	7.67	5.00	2.33	21.33	9.08
	Lajawab	9.33	6.00	4.00	37.67	14.25
10DAT1	Ferraster	9.33	5.00	3.33	37.00	13.67
	Karishma	12.33	6.00	3.67	36.00	14.50
	Lajawab	11.67	6.33	4.33	39.67	15.50
15DAT1	Ferraster	12.67	6.33	4.00	43.33	16.58
	Karishma	14.00	7.67	5.00	39.00	16.42
	Lajawab	15.00	8.67	5.00	44.67	18.33
				D x T		
1DAT1		2.89	1.00	0.22	22.89	6.75
3DAT1		1.89	0.44	0.11	28.44	7.72
7DAT1		7.78	4.89	2.89	26.56	10.53
10DAT1		11.11	5.78	3.78	37.56	14.56
15DAT1		13.89	7.56	4.67	42.33	17.11
				V x T		
	Ferraster	6.13	3.07	1.93	29.73	10.22
	Karishma	7.33	3.80	2.20	29.93	10.82
	Lajawab	9.07	4.93	2.87	35.00	12.97
Means		7.51	3.93	2.33	31.56	11.33

 Table I.
 Effect of three miticides, time interval and their interaction on the population density of *T. urticae* per leaf on three almond cultivars after 1st spray.

almond varieties. The least number of mites per leaf (0.11) was recorded on day 3^{rd} in Pyrida treated trees. In contrast, the highest population (13.89) was noted on 15DAT1 for Agrifol treated trees, as compared to 42.33 mites/ leaf on untreated trees.

T interaction of almond varieties and miticides was also significant for population density of spider mites. Minimum mite populations per leaf (1.93) was observed on Pyrida treated trees of Ferraster, while the maximum number of mites per leaf (9.07) was recorded on Agrifol treated trees of Lajawab In contrast, mite population ranged from 29.73 to 35.00 per leaf on untreated trees of all the three cultivars. Miticides Pyrida and Ethion appear to have similar efficacy against mite as compared with Agrifol. Almond variety Lajawab showed susceptibility to mite population as compared with Ferraster and Karishma.

Population density of spider mites after second spray

Results of the second spray are presented in Table II. Highest control of spider mites per leaf was obtained in case of Pyrida, which reduced the mite densities to 1.00, 0.00 and 2.33, respectively, followed by Ethion at 3.00, 3.33, 5.67. Agrifol reduced the population to 3.67, 6.00 and 10.33, respectively, as compared with 48.00, 41.33 and 35.00 on untreated trees of Ferraster, Karishma and Lajawab, respectively, one day after application.

^{*}Day After Treatment (DAT)

LSD $_{(0.05)}$ for D x V x T = 5.11

D x T = 2.95

V x T = 2.28D x V = 2.26

Days	Variety		Means			
•		Agrifol	Ethion	Pyrida	Control	D x V
				D x V x T		
			Ne	o. mites/ leaf		
1DAT2*	Ferraster	3.67	3.00	1.00	48.00	13.91
	Karishma	6.00	3.33	0.00	41.33	12.67
	Lajawab	10.33	5.67	2.33	35.00	13.33
3DAT2	Ferraster	2.67	1.00	0.00	52.33	14.00
	Karishma	3.00	0.00	0.00	42.67	11.42
	Lajawab	7.00	3.67	1.33	55.33	16.83
7DAT2	Ferraster	4.00	3.67	1.67	53.67	15.75
	Karishma	4.67	3.00	3.00	46.33	14.25
	Lajawab	9.67	5.33	4.67	54.67	18.58
10DAT2	Ferraster	8.00	4.67	3.00	58.67	18.58
	Karishma	6.00	4.33	3.00	53.33	16.67
	Lajawab	12.33	7.00	3.33	59.33	20.50
15DAT2	Ferraster	8.67	4.67	3.67	60.00	19.25
	Karishma	7.00	5.33	4.33	62.67	19.83
	Lajawab	16.00	9.00	5.00	58.33	22.08
				D x T		
1DAT2		6.67	4.00	1.11	41.44	13.31
3DAT2		4.22	1.56	0.44	50.11	14.08
7DAT2		6.11	4.00	3.11	51.56	16.19
10DAT2		8.78	5.33	3.11	57.11	18.58
15DAT2		10.56	6.33	4.33	60.33	20.39
				V x T		
	Ferraster	5.40	3.40	1.87	54.53	16.31
	Karishma	5.33	3.20	2.07	49.27	14.97
	Lajawab	11.07	6.13	3.33	52.53	18.27
Means		7.27	4.24	2.42	52.11	16.52

 Table II. Effect of three miticides, time interval and their interaction on the population density of *T. urticae* per leaf on three almond cultivars after 2nd spray.

*Day After Treatment (DAT)

LSD $_{(0,05)}$ for D x V x T = 6.43

D x T = 5.39

V x T = 4.17D x V = 4.67

Data recorded 3DAT2 of application showed reduction in mite population. Pyrida provided 100% control in Ferraster and Karishma. In Lajawab, the population of mites was 1.33 per leaf. Ethion reduced the mite populations to 1.00, 0.00 and 3.67, respectively, and Agrifol reduced them to 2.67, 3.00 and 7.00 as compared with 52.33, 42.67 and 55.33 mites/leaf on untreated trees of Ferraster, Karishma and Lajawab, respectively.

Results recorded on 7DAT2 showed that Pyrida was still more effective than Ethion and Agrifol. The populations of mites per leaf were 1.67, 3.00 and 4.67, respectively, followed by Ethion with 3.67, 3.00 and 5.33 and Agrifol with 4.00, 4.67 and 9.67 on Ferraster, Karishma and Lajawab, respectively, as compared with 53.67, 46.33 and 54.67 on untreated trees. Good control of mites was observed even on 10DAT2 for Pyrida, which kept the population as low as 3.00, 3.00 and 3.33 mites/leaf, respectively, while the number of mites per leaf was 4.67, 4.33 and 7.00 for Ethion, and 8.00, 6.00 and 12.33 for Agrifol. These compared with 58.67, 53.33 and 59.33, respectively, on untreated trees. On 15DAT2 mite populations per leaf were 3.67, 4.33 and 5.00 for Pyrida, 4.67, 5.33 and 9.00 for Ethion and 8.67, 7.00 and 16.00 for Agrifol as compared with 60.00, 62.67, and 58.33 on untreated trees of Ferraster, Karishma and Lajawab, respectively.

As with the first spray application, there was

Days	Variety		Means			
-	·	Agrifol	Ethion	Pyrida	Control	D x V
			D	x V x T		
			Mean n	o. mites/ leaf		
1DAT3*	Ferraster	0.67	0.33	0.00	58.00	14.75
	Karishma	3.67	1.67	0.33	64.00	17.42
	Lajawab	2.33	1.33	0.33	65.00	17.25
3DAT3	Ferraster	0.67	0.33	0.00	62.33	15.83
	Karishma	2.00	0.33	0.00	63.33	16.42
	Lajawab	2.67	2.00	0.33	65.00	17.50
7DAT3	Ferraster	4.00	2.00	1.33	56.33	15.92
	Karishma	4.67	2.00	1.67	64.67	18.25
	Lajawab	4.33	2.67	1.00	63.83	17.83
10DAT3	Ferraster	4.67	2.67	1.67	61.33	17.58
	Karishma	5.33	3.67	2.67	70.67	20.58
	Lajawab	9.00	5.67	3.67	71.33	22.42
15DAT3	Ferraster	7.33	4.67	2.33	64.33	19.67
	Karishma	5.33	3.67	2.67	69.67	20.33
	Lajawab	9.00	6.00	2.67	72.67	22.58
				D x T		
1DAT3		2.22	1.11	0.22	62.33	16.47
3DAT3		1.78	0.89	0.11	63.56	16.58
7DAT3		4.33	2.22	1.33	61.44	17.33
10DAT3		6.33	4.00	2.67	67.78	20.19
15DAT3		7.22	4.78	2.56	68.89	20.86
				V x T		
	Ferraster	3.47	2.00	1.07	60.47	16.75
	Karishma	4.20	2.27	1.47	66.47	18.60
	Lajawab	5.47	3.53	1.60	67.47	19.52
Means	·	7.27	4.24	2.42	52.11	18.29

 Table III. Effect of three miticides, time interval and their interaction on the Population density of *T. urticae* per leaf on three almond cultivars after 3rd spray.

*Day After Treatment (DAT)

LSD $_{(0.05)}$ for D x V x T = 8.27

D x T = 4.77

V x T = 3.70D x V = 4.14

a significant interaction between miticides and time interval with respect to mite populations. The minimum number of mites per leaf (0.44) was noted for Pyrida on 3DAT2. The maximum mite population (10.56) was recorded for Agrifol on 15DAT, compared with 60.33 mites/ leaf on untreated trees on the same day.

A significant interaction also occurred between almond varieties and miticides was with respect to population density of mites. Population density was lower (1.87 mites/ leaf) for Pyrida treated trees of Ferraster, while higher (11.07 mites/ leaf) for Agrifol on Lajawab, as compared with untreated trees (54.53 mites/ leaf) of Ferraster during 2^{nd} spray.

Population density of spider mites after third spray

Results of the 3^{rd} spray are presented in Table III. The greatest suppression of mite populations was observed after third spray application, as compared with 1^{st} and 2^{nd} spray. No mites were observed on 1DAT3 on trees treated with Pyrida on Ferraster. The population was higher on these varieties at the same time. Data recorded for Ethion was 0.33, 1.67 and 1.33 and Agrifol 0.67, 3.67 and 2.33 as compared with 58.00, 64.00 and 65.00 mites/leaf on untreated trees of Ferraster, Karishma and Lajawab, respectively, for 1 DAT3. The mite population per leaf was 0.00, 0.00 and 0.33 for Pyrida, 0.33, 0.33 and 2.00 for Ethion and 0.67, 2.00 and 2.67 for Agrifol as compared with 62.33, 63.33



Days	Variety		Means			
-	·	Agrifol	Ethion	Pyrida	Control	DxV
]	DxVxT		
1DAT4*	Ferraster	1.89	1.22	0.33	42.44	11.47
	Karishma	3.68	1.78	0.11	43.00	12.14
	Lajawab	6.11	3.11	1.11	41.20	12.88
3DAT4	Ferraster	1.45	0.44	0.00	47.00	12.22
	Karishma	2.00	0.11	0.00	45.22	11.83
	Lajawab	13.34	2.33	0.66	49.89	16.56
7DAT4	Ferraster	4.78	3.11	1.78	43.56	13.31
	Karishma	5.67	3.33	2.33	44.11	13.86
	Lajawab	7.78	4.67	3.22	52.06	16.93
10DAT4	Ferraster	7.33	4.11	2.67	52.33	16.61
	Karishma	7.89	4.67	3.11	53.33	17.25
	Lajawab	11.00	6.33	3.78	56.77	19.47
15DAT4	Ferraster	9.56	5.22	3.33	55.89	18.50
	Karishma	8.78	5.56	4.00	57.11	18.86
	Lajawab	13.33	7.89	4.22	58.56	21.00
				D x T		
1DAT4		3.93	2.04	0.52	42.22	12.18
3DAT4		2.63	0.96	0.22	47.37	12.79
7DAT4		6.07	3.70	2.44	46.52	14.6 8
10DAT4		8.74	5.04	3.19	54.15	17.78
15DAT4		10.55	6.22	3.85	57.18	19.45
				V x T		
	Ferraster	5.00	2.82	4.87	48.24	15.23
	Karishma	5.62	3.09	1.91	48.56	14.79
	Lajawab	8.54	4.86	2.60	56.71	18.18
Means	5	6.39	3.59	3.13	51.17	16.07

 Table IV. Effect of three miticides, time interval and their interaction on the population density of *T. urticae* per leaf on three almond cultivars (over all spray). This table shows average of the data given in Tables I-III.

*Day After Treatment (DAT)

LSD $_{(0.05)}$ for D x V x T = 2.01

 $D \ge T = 1.17$

V x T = 1.00D x V = 1.01

and 65.00 on untreated trees of Ferraster, Karishma and Lajawab, on 1DAT3, respectively.

Mites population on 7DAT3 increased to 1.33, 1.67 and 1.00 on Pyrida, 2.00, 2.00 and 2.67 on Ethion and 4.00, 4.67 and 4.33 on Agrifol as compared with 56.33, 64.67 and 63.83 mites/ leaf on untreated trees of Ferraster, Karishma and Lajawab, respectively, after 7 days. The population density of mites/ leaf on 10DAT3 was 1.67, 2.67 and 3.67 in Pyrida, 2.67, 3.67 and 5.67 in Ethion, 4.67, 5.33 and 9.00 in Agrifol, compared with 61.33, 70.67 and 71.33 mites/ leaf untreated trees of Ferraster, Karishma and Lajawab spectively. An examination of the data suggests there was only a slight increase in mite density between 10 and

15DAT3 in the untreated and control trees. The population density of mites per leaf on Ferraster, Karishma and Lajawab was noted to be 2.33, 2.67 and 2.67 on Pyrida, 4.67, 3.67 and 6.00 on Ethion and 7.33, 5.33 and 9.00 on Agrifol as compared with 64.33, 69.67 and 72.67 mites/ leaf respectively on untreated trees.

There was no significant interaction between the parameters miticides and time interval in any of the three almond varieties. Minimum population density of mite/ leaf (0.22) was observed for Pyrida one day after the third spray. In contrast maximum mite density in the miticide treatments (7.22) was recorded for Agrifol, as compared with 68.89 mite/ leaf on untreated trees after 15 days.



There was no interaction between almond varieties and miticides with respect to spider mites density.. Minimum density (1.07 mites/ leaf) was noted for Pyrida on Ferraster and maximum density (5.47 mite/ leaf) was recorded for Agrifol on Lajawab

Overall effect of three sprays on spider mite population

Overall results of the three sprays have been summarized in Table IV. Pyrida, Ethion and Agrifol were all effective in controlling spider mites as compared with untreated trees, where the mite pop[ulations rapidly increased from mid May to mid July. Pyrida was the most effective of all the miticides, reducing mites density to 0.33, 0.11 and 1.11/ leaf, followed by Ethion 1.22, 1.78 and 3.11 and Agrifol 1.89, 3.68 and 6.11 as compared with 42.44, 43.00 and 41.2 on untreated trees of Ferraster, Karishma and Lajawab, respectively, after 1 day of spray. Average effect of three sprays after 3 days of spray showed the effectiveness of Pyrida on Ferraster, Karishma and Lajawab where it controlled 100% of mite populations on Ferraster and Karishma and reduced populations to 0.66/ leaf on Lajawab. Ethion reduced the number of mites per leaf to 0.44, 0.11 and 2.33 and Agrifol to 1.45, 2.00 and 13.34 as compared with 47.00, 45.22 and 49.89 on untreated trees of Ferraster, Karishma and Lajawab, respectively.

Spider mite density on 7DAT3 on Ferraster, Karishma and Lajawab for three miticides was 1.78, 2.33, 3.22/ leaf in Pyrida, 3.11, 3.33 and 4.67 in Ethion and 4.78, 5.67 and 7.78 in Agrifol as compared with 43.56, 44.11 and 52.06 on untreated trees of Ferraster, Karishma and Lajawab, respectively. Mite density noted on 10DAT3 on Ferraster, Karishma and Lajawab was 2.67, 3.11 and 3.78/ leaf in Pyrida, 4.11, 4.67, 6.33 in Ethion and 7.33, 7.89 and 11.00 in Agrifol, as compared with 52.33, 3 and 56.77 mites/leaf on untreated trees.

The number of Spider mites recorded per leaf on 15DAT3 on Ferraster, Karishma and Lajawab for the three miticides was 3.33, 4.00 and 4.22, respectively, in Pyrida, 5.22, 5.56 and 7.89 in Ethion and 9.56, 8.78 and 13.33 in Agrifol as compared with 55.89, 57 and 58.56 on untreated trees.

In the interaction among the almond varieties

and miticides the number of mites per leaf was founded to be lowest in case of Ethion (*i.e.* 0.96) on 2DAT3, while it was lowered for Agrifol on 15DAT3 (10.55). It was recorded as high as 57.18 on untreated trees on the same day.

In the interaction of varieties and miticides the lowest population density (1.91) was found on Karishma for Pyrida and highest (8.54) on Lajawab for Agrifol. Lajawab was observed highly susceptible to spider mites and 56.71 mites were recorded on untreated trees.

DISCUSSION

Overall results showed that all three miticides *i.e.* Pyrida, Ethion and Agrifol had significantly reduced mite population on all the three cultivars of almond. However, results varied between the miticides, the number of sprays applied and the variety.

In all three sprays, Pyrida proved to be the best miticide in reducing the mite population on all the three cultivars. This was followed by Ethion and Agrifol. Pyrida showed high to moderate toxicity to mite population up to 10 days after application. However, mite populations reached economic threshold level (ETL) after 15 days in all the three cultivars of almond. Meurrens (1993) also demonstrated that Pyrida was effective against *T. urticae* for more than 15 days. Khan *et al.* (2003) also reported these miticides to be effective against this noxious pest up to 14 days in a field trial. Legrand *et al.* (1999) observed the effectiveness of these miticides for more than one month after application in apple crop.

Ethion was running parallel with Pyrida in all the three sprays on all the three almond cultivars. It suppressed mite density up to 3 days; however, mite population increased on 3DAT1 but remained low in third spray up D days after application in all the three cultivars. Sekulic (1994) also reported that Ethion was very toxic to *T. urticae*, while Akbar (1992) graded it as a moderately toxic to this destructive pest.

Agrifol had a moderate to fair level of effectiveness against T. *urticae* as compared with Pyrida and Ethion. Population of mites was low up to three days after application on all the three



cultivars, except in Lajawab in 2^{nd} spray. Mite population gradually increased on all the three cultivars with passage of time until the maximum was recorded on 15DAT. Bunescu *et al.* (1995) also reported the effectiveness of Agrifol against *T. urticae*, while Cho *et al.* (1995) recorded both resistant and susceptible strains of this mite to Agrifol. The possible reason for this response could be both genetic and environmental factors.

It can be concluded from the present study that Pyrida was the most effective miticide followed by Ethion and Agrifol. In the past, studies on toxicity and effectiveness of various insecticides against *T. urticae* relation to different host plants have been undertaken by many workers (Estrada *et al.*, 1989; Li and Harmsen, 1993; Cheng and Pan 1994; Sekulic *et al.*, 1994; Park *et* 1996; Chen, 1999; Jacon *et al.*, 1999; Legrand *et al.*, 1999; Piao *et al.*, 1999; Sing *et al.*, 1999; Szwejda, 1999).

Apart from toxicity, another important global issue which gained great attention is pesticide resistance. Very limited in nation is available on two-spotted spider mite in this connection (Cho *et al.*, 1995; Kim and Lee, 1995; Funayama and Takahashi, 1995; Beer *et al.*, 1998; Nauen *et al.*, 2000). So far our findings are concerned, we did not notice anything which might suggest resistance in *T. urticae*, as the efficacy of all the test miticides was quite high.

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