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BIO-EFFICACY OF INSECTICIDES AGAINST SAFFLOWER APHID (*UROLEUCON COMPOSITAE* THEOBALD)

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ABSTRACT

A field experiment was conducted to evaluate the bio-efficacy of six different insecticides against safflower aphids (*Uroleucon compositae* Theobald). Dimethoate (0.03%) and imidacloprid (0.004%) were most effective against safflower aphids; however, thiomethoxam (0.005%) followed by acetamiprid (0.004%), profenofos (0.05%) and acephate (0.03%) were also effective against the safflower aphids. Highest yield of safflower was observed from plots treated with dimethoate (0.03%); but, the maximum incremental cost-benefit ratio was recorded for imidacloprid (0.004%) followed by dimethoate (0.03%).

Key words: Bio-efficacy, safflower aphids

INTRODUCTION

Safflower (*Carthamus tinctorius* Linn.) is an important oilseed crop cultivated in India, with manifold use as vegetable and edible oil, as drying oil and dye for trade. The cake of decorticated seed is used as concentrated cattle feed and un-decorticated seed is used as manure. Maharashtra is the major safflower growing state in India followed by Karnataka and Andhra Pradesh. Maharashtra records the highest growth rate of area and production followed by Karnataka and is a major *rabi* oilseed crop, next to groundnut. It was cultivated over an area of 5.84 lakh hectares with an annual production of 1.97 lakh tonnes contributing 68.6 per cent of the total area and 59.2 per cent of the total production of safflower in India (Anonymous, 2010). The safflower oil contains 3 per cent minerals and 18 to 20 per cent carbohydrates; besides, it also contains vitamin A and D in sufficient quantities. The oil is low in polyunsaturated fatty acid and high in linoleic acid (75 to 78 per cent) and is therefore considered more suitable for human consumption, especially those who suffer from Cardo-Vascular diseases. Though oil is mainly used for edible purposes, but it is also used in manufacture of paints, varnishes and linoleum (Knowles, 1955).

Insect pests are one of the major factors responsible for lower yield of safflower. The crop is infested by 22 insect- pests in India (Rai, 1976). The insect-pests causing major damage include safflower seed fly (*Acanthiophilus helianthi* Rossi), safflower caterpillar (*Perigoea capensis* Guen.) and safflower aphid (*Uroleucon compositae* Theobald).

The safflower aphid (*U. compositae* Theobald) is the most serious pest and has been reported from all parts of the country wherever safflower is cultivated, causing extensive damage. In case of severe infestation plants are completely covered with aphids; both nymphs and adults suck the cell sap from plants particularly from young shoots, leaves and flowers resulting in stunted growth of the plants, in turn, considerable reduction in yield is obtained. Aphids excrete honey dew on the leaves, which promote the growth of sooty mould that hampers the photosynthetic activity of the plant. The loss in seed yield of safflower due to aphid infestation was reported to be 36.05 per cent (Bhumannavar and Thontadarya, 1979), 54.54 per cent (Suryawanshi and Pawar, 1980), and 24.20 to 67.22 per cent (Shetgar *et al*., 1993). Keeping these facts in view, a field-cum-laboratory experiment on bio-efficacy and residual toxicity of different insecticides against safflower aphids (*U. compositae* Theobald) was conducted during *rabi* 2012-13.

MATERIALS AND METHODS

The field experiment on bio-efficacy of different insecticides against safflower aphids infesting Sharda variety of safflower was conducted in a randomized block design with seven treatments including untreated control replicated thrice at the farm of College of Agriculture, Latur during *rabi* season 2012-13. The crop was sown on 08.10.2012 by dibbling in plots with a gross size of 5.0m x 4.5m. The distance between two plots was maintained as 1-metre. The row to row and plant to plant distance maintained were 45cm and 20cm,

respectively. The recommended doses of fertilizer at the rate of 40kg N, 20kg P_2O_5 and 20kg K_2O per hectare were applied at the time of sowing. Observations for aphid population were taken from 5 randomly selected plants that were labeled in each replication of the treatments. The observations on total number of aphids per 10cm apical shoot length as well as on leaf each from top, middle and bottom canopy of the observation plants were recorded at one day before and 1, 3, 7 and 14 days after first and second application of insecticides. The data on number of aphids recorded at different intervals were transformed before statistical analysis. The insecticides were applied twice as foliar spray on 28.11.2012 and 21.12.2012 when aphid infestation was the maximum. The insecticide solutions were prepared by adding required quantity of insecticides in a known quantity of water.

RESULTS AND DISCUSSION

The results on the effect of different insecticides after first spray on the population of aphids infesting 10cm apical shoot length of safflower are tabulated in Table 1. The data indicate that all the insecticides tested recorded significantly minimum population of aphids over untreated control at all the days of observations after the first application. The average number of aphids per 10cm apical shoot length of safflower ranged from 15.13 to 54.86, 11.13 to 57.13, 3.90 to 75.06 and 1.2 to 71 at 1, 3, 7 and 14 days after first application of insecticides.

The lowest population of aphids was observed from the plots treated with thiamethoxam 0.005 per cent (15.13), dimethoate 0.03 per cent (11.13), dimethoate 0.03 per cent (3.90) and thiamethoxam 0.005 per cent (1.2) at respective days of observations. It was followed by acetamiprid 0.004 per cent (15.4) and profenofos 0.05 per cent (22.13), thiamethoxam 0.005 per cent (12.6) and imidacloprid 0.004 per cent (13.13), acetamiprid 0.004 per cent (4.33) and thiamethoxam 0.005 per cent (5.13) and profenofos 0.05 per cent (1.33) and acetamiprid 0.004 per cent (1.4) at respective days of observations. The population of aphids recorded from control plots was the maximum being 54.86, 57.13, 75.06 and 71.

The data on the effect of different insecticides on the population of aphids after second spray are presented in Table 2. The results reveal that all the insecticides were superior in recording significantly minimum aphids at all the days of observations after second spray over untreated control; however, they were at par with each other at 1 and 7 days after spray. The aphid population in different treatments ranged from 11.4 per cent in acetamiprid 0.004 per cent treated plots to 75.8 per cent in untreated control plots at 1 day after second spray. The corresponding values at 3, 7 and 14 days were 3.04 per cent in acetamiprid 0.004 per cent to 69.06 per cent in untreated control, 0.78 per cent in thiamethoxam 0.005

Table 1. Effect of different insecticides on the mean population of *U. compositae* on safflower after first spray

Treatments	Mean number of aphids per 10 cm apical shoot length				
	1 day before spray	Days After Spray			
		1	3	7	14
Thiamethoxam 0.005 per cent	31.7 (5.68)	15.13 (3.95)	12.6 (3.61)	5.13 (2.37)	1.2 (1.30)
Acephate 0.03 per cent	50.0 (7.10)	30.1 (5.53)	18.3 (4.33)	7.13 (2.76)	3.06 (1.88)
Imidacloprid 0.004 per cent	56.2 (7.53)	23.3 (4.88)	13.1 (3.69)	5.2 (2.38)	1.6 (1.44)
Dimethoate 0.03 per cent	49.3 (7.06)	23.7 (4.92)	11.13 (3.41)	3.90 (2.09)	1.6 (1.44)
Profenofos 0.05 per cent	53.3 (7.34)	22.1 (4.76)	21.3 (4.66)	7.86 (2.89)	1.33 (1.35)
Acetamiprid 0.004 per cent	32.7 (5.72)	15.4 (3.99)	14.5 (3.87)	4.33 (2.19)	1.4 (1.37)
Untreated Control	48.3 (6.99)	54.86 (7.44)	57.13 (7.59)	75.06 (8.69)	71 (8.45)
S.Em. $\pm$	0.75	0.42	0.41	0.34	0.29
C.D. at 5%	N. S.	1.29	1.26	1.04	0.89
C.V. (%)	18.49	14.53	16.04	17.14	19.47

Figures in parentheses are square root transformed values; N.S. - Non-significant

Table 2. Effect of different insecticides on the mean population of *U. compositae* on safflower after second spray

Treatments	Mean number of aphids per 10 cm apical shoot length				
	1 day before spray	Days After Spray			
		1	3	7	14
Thiamethoxam 0.005 per cent	38.30 (6.22)	15.10 (3.94)	5.00 (2.34)	0.78 (1.13)	0.20 (0.83)
Acephate 0.03 per cent	50.33 (7.12)	23.33 (4.88)	8.92 (3.06)	1.70 (1.48)	0.03 (0.72)
Imidacloprid 0.004 per cent	40.4 (6.39)	14.06 (3.81)	6.13 (2.57)	1.37 (1.36)	0.04 (0.73)
Dimethoate 0.03 per cent	41.9 (6.50)	19.46 (4.46)	7.18 (2.77)	2.26 (1.66)	0.06 (0.74)
Profenofos 0.05 per cent	38.10 (6.20)	12.80 (3.64)	5.39 (2.42)	2.13 (1.62)	0.37 (0.93)
Acetamiprid 0.004 per cent	34.50 (5.91)	11.40 (3.44)	3.04 (1.88)	1.46 (1.4)	0.053 (0.74)
Untreated Control	53.50 (7.34)	75.80 (8.73)	69.10 (8.34)	64.6 (8.06)	59.33 (7.73)
S.Em. ±	0.77	0.49	0.32	0.25	0.06
C.D. at 5%	N. S	1.52	0.99	0.76	0.18
C.V. (%)	19.83	18.44	16.42	17.46	5.25

Figures in parentheses are square root transformed values; N.S. – Non-significant

Table 3. Effect of different insecticides on the pooled mean population of *U. compositae* on safflower

Treatments	Mean number of aphids per 10 cm apical shoot length of safflower				
	1 day before spray	Days After Spray			
		1	3	7	14
Thiamethoxam 0.005 per cent	35 (5.95)	15.1 (3.94)	8.59 (3.01)	3.38 (1.97)	0.55 (1.02)
Acephate 0.03 per cent	59.4 (7.73)	20.9 (4.62)	13.9 (3.79)	3.97 (2.11)	1.22 (1.31)
Imidacloprid 0.004 per cent	48.3 (6.98)	18.7 (4.38)	10.3 (3.28)	3.38 (1.97)	1.00 (1.22)
Dimethoate 0.03 per cent	45.6 (6.78)	19.8 (4.50)	9.4 (3.14)	2.90 (1.84)	1.10 (1.26)
Profenophos 0.05 per cent	45.7 (6.79)	17.5 (4.23)	13.6 (3.75)	5.06 (2.35)	0.76 (1.12)
Acetamiprid 0.004 per cent	33.9 (5.86)	13.25 (3.70)	8.82 (3.05)	2.86 (1.83)	0.66 (1.08)
Untreated Control	59.2 (7.72)	53.4 (7.34)	64.1 (8.03)	64.7 (8.07)	70.9 (8.44)
S.Em. ±	0.75	0.40	0.39	0.25	0.17
C.D. at 5%	N.S.	1.23	1.20	0.76	0.51
C.V. (%)	19.30	14.67	17.17	14.59	12.92

Figures in parentheses are square root transformed values; N.S. – Non-significant

per cent to 64.6 per cent in untreated control and 0.03 per cent in acephate 0.03 per cent to 59.33 per cent in untreated control plots. The efficacy of insecticides against aphids at second position was found to be profenofos 0.05 per cent (12.8 aphid nymphs), thiamethoxam 0.005 per cent (5 aphid nymphs),

imidacloprid 0.004 per cent (1.37 aphid nymph) and imidacloprid 0.004 per cent (0.04 aphid nymph) at 1, 3, 7 and 14 days after second spray, respectively.

Mean of first and second sprays

The pooled mean aphid population data after first and second sprays are tabulated in Table 3, from which it can be observed that all the insecticides were significantly effective for the control of safflower aphids over untreated control. The insecticides *viz*., acetamiprid 0.004 per cent, thiamethoxam 0.005 per cent, acetamiprid 0.004 per cent and thiamethoxam 0.005 per cent, recorded significantly lowest population of aphids to the extent of 13.25, 8.59, 2.86 and 0.55 per 10 cm apical shoot length of safflower at 1, 3, 7 and 14 days after spray, respectively. It becomes evident from the results that thiamethoxam 0.005 per cent, acetamiprid 0.004 per cent, dimethoate 0.03 per cent and imidacloprid 0.004 per cent recorded numerically lowest population density of *U. compositae* on the 10cm apical shoot length of safflower. Many workers *viz*., Suryawanshi and Pawar (1980), Chandrakar and Gupta (1989), Narangalkar and Shivpuje (1990), and Padiwal *et al*. (1996) also reported the effectiveness of dimethoate 0.03 per cent against safflower aphids. Among the new molecules of insecticides tested against safflower aphids, thiamethoxam and acetamiprid followed by imidacloprid were more effective and economic than dimethoate (Anonymous, 2006 and Hanumantharaya *et al*., 2007).

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