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MANAGEMENT OF CORIANDER APHID *HYADAPHIS CORIANDRI* (DAS) WITH SAFER INSECTICIDES

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ABSTRACT

A field experiment on the relative efficacy of botanicals, biopesticides and insecticides against aphid *Hyadaphis coriandri* (Das) on coriander was conducted in 2015-16 and 2016-17. The results revealed that dimethoate 30EC was the most effective followed by acephate 75SP and cartap hydrochloride 50SP. The dhatura leaf and karanj seed extracts were found to be the least effective. The biopesticides *Beauveria bassiana*, *Verticillium lecanii*, *Metarhizium anisopliae*, azadirachtin 20EC, NSE and neem oil were found moderately effective.

Key words: *Hyadaphis coriandri*, coriander, botanicals, biopesticides, dimethoate, acephate, cartap hydrochloride, dhatura leaf extract, karanj seed extract, azadirachtin

Coriander (*Coriandrum sativum* L.) is one of the important seed spice and winter crop in India, with Rajasthan and Gujarat states together contributing >80% of production (Anonymous, 2016). Insect pests are one of the major limiting factors for higher quality production of coriander. Among the various insect pests, the coriander aphid *Hyadaphis coriandri* (Das) had been reported as a regular and major pest in Rajasthan and other parts of the country (Pareek et al., 2013; Meena et al., 2017). The safer insecticides mainly botanicals, microbials and pro-insecticides, overcome the problems like insecticide resistance, environmental pollution and insecticide residues. A pro-insecticide is a substance which is inactive in its original form but is transformed into an active state by a plant, animal or microorganism. Classical pesticides can be modified to yield pro-pesticides retaining their insecticidal activity but lowering mammalian toxicity and acquiring plant-systemic properties (Fukuto, 2004). The application of fungal pathogens like *Verticillium lecanii*, *Beauveria bassiana* and *Metarhizium anisopliae* and botanicals like *Azadirachta indica* oil and *Pongmia pinnata* karanj oil effectively control aphids (Kant et al., 2013; Chaudhary et al., 2015; Meena et al., 2016). The present study evaluates such safer insecticides against *H. coriandri*.

MATERIALS AND METHODS

The field experiment was laid out in a randomized block design (RBD) with twelve treatments and replicated thrice. The coriander variety RCr-41 recommended for this region was used and the plot size was 3.0 x 2.0 m, keeping row to row and plant to plant spacing of 30 and 10 cm, respectively. The crop was sown on 30th October and 2nd November in 2015-16 and 2016-17, respectively. The treatments included were azadirachtin 1500 ppm (5ml/ l), Neem Seed Kernel Extract (NSKE- 5.0%), neem oil (1.0%), Karanj Seed Extract (KSE- 5.0%), dhatura leaf extract (DLE- 5.0%), *Beauveria bassiana* 1.15 WP (1g/ l), *Verticillium lecanii* 1.15 WP (1g/ l), *Metarhizium anisopliae* 1.15 WP (1g/ l), acephate 75SP (0.05%), cartap hydrochloride 50SP (0.03%), dimethoate 30EC (0.03%) and untreated control. To prepare 5% NSKE and KSE, coarse powder of 30 kg seeds of neem and karanj were tied in a muslin cloth separately and immersed in 50 l of water overnight and the complete extract was separated by squeezing the cloth containing the crushed seeds. The cloth containing the crushed seed was again dipped in 50 l of water and squeezed again. In this way 100 l of solution was obtained, and to this 500 l of water was added to prepare 5% solution. Before using the solution, 200 gm khadi soap was added and the fresh material was used. To prepare dhatura leaf extract, 100 g fresh leaves of dhatura was washed with sterilized with distilled water and ground/ minced/ powdered in 100 ml distilled water. The macerate was filtered through double layered cheese cloth and centrifuged at 3500 rpm for 20 min. The supernatant was filtered through Whatman's filter paper No. 42. The extract (100%) thus obtained was

utilized (Jayadevi et al. 2003). Two foliar sprays of all the insecticides were given at an interval of 15 days, with spraying done using knapsack sprayer. First spray was done when the pest incidence crossed ETL and second was done at 15 days interval. The aphids on three inflorescence/ umbels from each tagged plants were counted. Pretreatment count was recorded one day before the application of insecticides, and post treatment data after 1, 3, 7 and 15 days. Similar observations were made after the second application. The data obtained were used to estimate the % reduction in incidence following Henderson and Tilton (1955). The data were statistically analysed by transforming the % reduction into angular transformation values (Bliss, 1937). To determine the most effective and economical treatment, the net profit and benefit cost ratio was worked out by taking the expenditure on the individual insecticidal treatment and the corresponding yield into account.

RESULTS AND DISCUSSION

The pooled data as given in Table 1 indicate that diamethoate 30EC proved to be the most effective insecticidal treatment against aphid *H. coriandri* (96.07 and 94.28% reduction after three days in first and second insecticidal application, respectively); these were at par with acephate 75SP and cartap hydrochloride 50SP. The findings of Sachan et al. (2010) support the present findings on dimethoate 30EC and acephate 75SP as highly effective. Gupta and Pathak (2009) reported cartap hydrochloride (0.1%) as highly effective. The entomopathogenic fungi and neem products viz., *M.anisopliae*, *B.bassiana, V. lecanii,* azadiractin 20EC, NSKE and neem oil were moderately effective (66.93-53.93% reduction in first, and 79.98- 57.86% reduction in second application, respectively), after three days of insecticide application. Kant et al. (2013) observed that *M. anisopliae*, *B. bassiana* and *V. lecanii* are effective. Meena et al. (2016) found that biopesticides and Choudhary et al. (2015) the neem oil, azadirachtin and NSKE as moderately effective. The karanj seed and dhatura leaf extracts stood at the lower order of efficacy, with 37.15 and 37.68% reduction in incidence after three days of application after first and 47.02 and 43.64% in second sprays, respectively. Meena et al. (2016)

Table 1. Efficacy of insecticides against *H. coriandri* on coriander (Pooled, 2015-16, 2016-17)

Insecticides	Conc. (%)/ dosage	% reduction in aphid population days after spray									
		First spray					Second spray				
		One	Three	Seven	Fifteen	Mean	One	Three	Seven	Fifteen	Mean
Azadirachtin 20 EC	5 ml/l	50.02*	60.45	60.28	19.28	47.51	46.30	61.18	62.98	87.57	64.51
		(45.01)**	(50.03)	(50.93)	(26.05)	(43.57)	(42.88)	(51.46)	(52.52)	(69.38)	(53.43)
Neem seed extract	5.0%	46.39	55.93	59.19	18.28	44.95	46.50	60.39	58.43	84.58	62.47
		(42.93)	(48.41)	(50.30)	(25.31)	(42.10)	(42.99)	(51.00)	(49.85)	(66.88)	(52.22)
Neem oil	1.0%	44.45	53.93	55.58	14.64	42.15	44.04	57.86	56.09	84.28	60.57
		(41.81)	(47.25)	(48.20)	(22.50)	(40.48)	(41.58)	(49.52)	(48.50)	(66.64)	(51.10)
Karanj seed extract	5.0%	28.03	37.15	44.86	12.15	30.55	27.09	47.02	44.90	73.28	48.08
		(31.97)	(37.55)	(42..05)	(20.40)	(33.55)	(31.36)	(43.29)	(42.07)	(58.87)	(43.90)
Dhatura leaf extract	5.0%	24.75	37.68	42.85	10.86	29.04	26.65	43.64	41.60	73.60	46.37
		(29.83)	(37.87)	(40.89)	(19.24)	(32.61)	(31.08)	(41.35)	(40.16)	(59.08)	(42.92)
Beauveria bassiana	1g/l	52.26	63.01	81.67	46.40	60.84	50.50	75.46	83.90	91.83	75.42
		(46.30)	(52.54)	(64.65)	(42.94)	(51.26)	(45.29)	(60.31)	(66.34)	(73.39)	(60.28)
Verticillium lecanii	1g/l	47.23	62.30	79.77	48.13	59.36	51.70	76.34	83.45	91.69	75.79
		(43.41)	(52.12)	(63.27)	(43.93)	(50.39)	(45.97)	(60.89)	(65.99)	(73.25)	(60.53)
Metarhizium anisopliae	1g/l	50.95	66.93	84.83	56.02	64.69	51.35	79.98	85.13	93.57	77.51
		(45.54)	(54.90)	(67.08)	(48.46)	(53.54)	(45.77)	(63.42)	(67.32)	(75.31)	(61.69)
Acephate 75 SP	0.05%	72.38	94.00	81.80	75.43	80.90	70.90	90.06	93.63	98.36	88.24
		(58.29)	(75.82)	(64.75)	(60.29)	(64.09)	(57.35)	(71.62)	(75.38)	(82.64)	(69.94)
Cartap hydrochloride 50 SP	0.03%	70.61	89.81	74.12	71.46	76.50	66.16	88.22	93.73	96.49	86.15
		(57.17)	(71.38)	(59.42)	(57.71)	(61.00)	(54.43)	(69.93)	(75.50)	(79.20)	(68.15)
Dimethoate 30 EC	0.03%	77.90	96.07	87.07	78.00	84.76	78.76	94.28	96.81	98.73	92.15
		(61.96)	(78.57)	(68.93)	(62.03)	(67.02)	(62.56)	(76.16)	(79.71)	(83.53)	(73.73)
Untreated control	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
		(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
SEm±		1.36	2.07	1.21	1.29	1.30	1.65	2.31	1.27	1.23	1.95
CD (p= 0.05%)		4.95	5.90	4.58	4.78	4.76	5.31	6.26	4.69	4.63	5.66

*Mean of three replications, **figures in parentheses angular transformed values.

Table 2. Economics of insecticides on coriander (Pooled 2015-16, 2016-17)

S.No.	Insecticides	Conc. (%) / dosage (ml or g)	Yield (q ha^{-1})	Increase in yield over control (q ha^{-1})	Return of increase yield (Rs ha^{-1})*	Total cost of expenditure (Rs ha^{-1})**	Net profit (Rs ha^{-1})	Benefit cost ratio
1.	Azadirachtin 20EC	5 ml/l	9.65	2.45	12862	4284	8578	2.00
2.	Neem seed extract	5.0%	9.35	2.15	11287	1636	9651	5.90
3.	Neem oil	1.0%	9.25	2.05	10762	1707	9055	5.30
4.	Karanj seed extract	5.0%	9.05	1.85	9712	1636	8076	4.94
5.	Dhatura leaf extract	5.0%	8.90	1.70	8925	1636	7289	4.46
6.	*Beauveria bassiana*	1g/l	10.00	2.80	14700	2637	12063	4.57
7.	*Verticillium lecanii*	1g/l	10.25	3.05	16012	2997	13015	4.34
8.	*Metarhizium anisopliae*	1g/l	10.40	3.20	16800	2097	14703	7.01
9.	Acephate 75SP	0.05%	12.45	5.25	27562	1727	25835	14.96
10.	Cartap hydrochloride 50SP	0.03%	11.65	4.45	23362	2091	21271	10.17
11.	Dimethoate 30EC	0.03%	12.85	5.65	29662	1857	27805	14.97
12.	Untreated control	-	7.20	-	-	-	-	-

*Cost of coriander seed calculated at Rs. 5250.00 q^{-1}; **It includes cost of insecticides and labour charges

evaluated the relative efficacy of botanicals and found that the karanj seed (10ml/ l) and dhatura leaf extracts (10 ml/ l) were the least effective. These observations corroborate with the present findings.

Table 2 reveals that the maximum net profit of Rs. 27805 was obtained with dimethoate 30EC followed by acephate 75SP (Rs.25835) and cartap hydrochloride 50SP (Rs. 21271). The minimum net profit of Rs.7289 was observed in plots treated with dhatura leaf extract followed by karanj seed extract (Rs. 8076), azadirachtin 20 EC (Rs. 8578) and neem oil (Rs. 9055). These results corroborate with those of Pareek (2009) with net profit obtained with dimethoate 30EC and acephate 75SP. The maximum benefit cost ratio (14.97) was obtained with dimethoate 30EC followed by acephate 50SP (14.96), and it was less with azadirachtin 20EC, *V. lecanii* and dhatura leaf extract. The present findings also confirm with those of Lekha and Jat (2004) who reported the highest benefit cost ratio with phosphamidon 85SL followed by dimethoate 30EC and acephate 75SP. Jat et al. (2009) recorded the maximum benefit cost ratio with dimethoate 30EC followed by acephate 75SP and the least with NSKE and neem oil.

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