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RESEARCH ARTICLE

Seasonal abundance of mustard aphid (*Lipaphis erysimi* Kalt.) on cauliflower (*Brassica oleracea* var. *botrytis*) and its management

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ABSTRACT

The experiment was conducted to study the seasonal abundance of mustard aphid (*Lipaphis erysimi* Kalt.) on cauliflower (*Brassica oleracea* var.*botrytis* Linn.) and its eco-friendly management through insecticides and bio-pesticides. Aphids appeared on cauliflower during 1st week of January, reached its peak (275.12 aphids plant^{-1}with 100% infestation) during 2nd week of February and continued till end of March. Its abundance and infestation had significant positive association with environmental factors(R=0.928 and 0.909). Increase in humidity increased aphid population and infestation. Aphids were most effectively controlled with imidacloprid @0.01% spray during 2nd week of February. The cost benefit ratio varied from 1:8.98 to 1: 67.12 in different insecticidal treatments, the highest in imidacloprid with a record of maximum monetary benefit of Rs.35810.00 closely followed by malathion with its net profit of Rs. 28794.00 ha^{-1}.

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INTRODUCTION

Cauliflower, *Brassica oleracea* var.*botrytis* Linn. is one of the most important cruciferous vegetable crops of India. It is attacked by various insect pests which act as limiting factor in the profitable cultivation of this crop. The important insects include aphid(*Lipaphis erysimi* Kalt.), diamond back moth(*Plutella xylostella* Linn.),cabbage semilooper (*Trichoplu siani* Hb.)and painted bug(*Bagrada cruciferarum* Linn.)and are distributed throughout the country. The aphid (*L. erysimi*) is emerging as a serious pest of *Brassica* oilseed and cole crops in eastern Uttar Pradesh and other parts of India. This has threatened the cultivation of these crops causing severe damage during *Rabi* season. In places where the production is in large scale, it is dried and preserved for use in the off season. It is imperative to find out the impact of environmental factors on incidence of important insect pests of cauliflower and extent of losses through their desirable suppression with effective and economically insecticides. The present investigation was undertaken to study the seasonal abundance of aphid on cauliflower and its eco-friendly management through insecticides and bio-pesticides.

MATERIALS AND METHODS

A field experiment was carried out at Vegetable Research Farm of C.S. Azad University of Agriculture and Technology, Kanpur during *Rabi* 2004-05. The meteorological observations (temperature, relative humidity, wind velocity and rainfall) for the crop period were obtained from the Department of Agronomy of the University. The experiment consisted of nine treatments *viz.*,endosulfan 35EC (0.05 and 0.07%), malathion 50EC (0.03 and 0.05%), imidacloprid17.8SL(0.07and 0.01%), nimbicidin 1500 ppm (0.75and 1.00%) and control were assigned in randomized block design with three replications. All the treatments were allocated in each plot in each replication randomly with the help of random number. The seed of cauliflower variety Pusa snow ball-1 was sown on 5

October 2004 and seedling of 4-5 leaves transplanted on 9th November 2004 at 45 cm x45 cm between row to row and plant to plant distance. Two sprayings of each insecticide were applied with hand compressor @700 litres of the spray solution.

The population of aphids was estimated by counting the total aphid leaf^{-1}. The aphids were counted on 10 randomly selected plants of middle leaf in three replications noticed any one lower, middle and upper leaf from each plant during early hours of the day. The total aphids on upper surface of leaves were counted first and then on the lower by gentle turning taking all possible care not to disturb them. Finally, the average number of aphids per leaf was calculated. The observations on damage and mortality were first converted into percentage and thus were transformed into angular transformation for statistical analysis to work out the standard error and significant differences among the treatments. The mean original data of percentage damage was calculated as percentage reduction over control with following formula (Abbots, 1925) :

$$\frac{C-T}{C} x100$$

where,

C= Percentage damage of control

T=Percentage damage of treatment plot

RESULTS AND DISCUSSION

The experimental findings of the present study have been presented in the following sub heads:

Seasonal abundance of mustard aphid *(Lipaphis erysimi* Kalt.*)* and its correlation with environmental factors :

Aphid appeared on cauliflower during 1st week of January and reached at its peak to 275.12 aphids plant^{-1} with 100 per cent infestation during 2nd week of February and continued till the end of March(Table1). Aphid population and infestation had positive correlation(R=0.928 and R=0.909) with environmental factors (Table 2).Increased temperature decreased, the aphid infestation while increased relative humidity increased the infestation. The population of aphids had significant correlation with minimum, maximum and average temperature *viz.*, -0.164, -0.237 and -0.190, respectively. The observations on correlation showed that increase in temperature decreased the aphid population and *vice-versa*. The percentage infestation of aphid also provided significantly negative correlation with minimum temperature which means that the increase in minimum temperature decreases the percentage infestation, while maximum and average temperature showed non- significant correlation with the infestation of aphid. The highly significant positive correlation was recorded between aphid population and minimum , maximum and average relative humidity (RH) *viz.*, 0.441,0.553 and 0.525,respectively, while infestation of aphid also provided significant positive correlation with minimum and average relative humidity which increased percentage infestation of aphid and *vice-versa*. Rainfall has non-significant positive relation with aphid population and infestation.

Table 1: Abundance of aphid population on cauliflower

Standard metrological week	Mean number of aphid plant^{-1}	Per cent infestation
1st week(1-7 January)	11.40	30
2nd week(8-14 January)	39.30	45
3rd week(15-21 January)	86.30	55
4th week(22-28 January)	107.34	60
5th week (29January-4 February)	200.00	76
6th week (5-11 February)	275.12	100
7th week (12-18 February)	211.00	74
8th week (19-25 February)	174.00	72
9thweek (26February- 4March)	156.00	64
10th week (5-11March)	155.00	60
11th week (12-18 March)	146.00	32
12th week (19-25 March)	82.30	16
13th week (26 March-1 April)	22.00	10
14th week (2-8 April)	0.00	00

Table 2 : Correlation coefficient of aphid population and infestation percentage with environmental factors

Pooled effect of environmental factor on	R=0.928***	R=0.909***
Temperature (^{O}C)		
Minimum	-0.164	-0.553*
Maximum	-0.237	-0.619*
Average	-0.190	-0.584*
Relative humidity		
Minimum	0.441	0.693**
Maximum	0.553*	0.722**
Average	0.525*	0.708**
Rainfall (mm)	0.135	0.287

*, ** and *** Indicate significance of value at P= 0.05, 0.01 and 0.1, respectively

Control of mustard aphid :

Mustard aphid on cauliflower was most effectively controlled with use of imidacloprid @0.01per cent spray during IInd week of February, providing 97.07,97.46 and 97.76 per cent while 98.94, 97.97 and 99.05 per cent mortality after 3,7 and 10 days of first and second sprayings, respectively(Table 3). Endosulfan @ 0.07 per cent created 92.64, 92.80 and 92.80 per cent while 93.04,96.52 and 97.17 per cent mortality after 3,7 and 10 days after first and second sprayings which closely related to malathion. The present finding is supported by the

work of Meena and Lal (2004) who recorded imidacloprid 0.01 per cent spray effective > endosulfan (0.07 per cent) > ethofenprox (0.1 per cent) lambdaclorothrin (0.01 per cent) > cartaphidrocloride (0.05 per cent > betacyfluthrin (0.00125 per cent). Imidacloprid proved most effective against *L. erysimi* Kalt. Steeknath *et al*. (1998) also found that imidacloprid @ 0.02 per cent spray was adjudged as the best effective treatment in suppressing a population of *L. erysimi*. These results are also supported by Dwivedi *et al*. (2011) who reported effectively suppression of the population of mustard aphid by using methylchlorpyriphos @0.04%, endosulfan 0.07%, malathion 50 EC @0.05%, nimbicidine @1%, neemtop @0.6% and dipel 0.1% on cabbage (*B. oleracea* var. *capitata*).

Yield of cauliflower and economics of insecticidal treatment:

The production of cauliflower was found to be significantly enhanced with use of insecticides which was highest 334.07 q/ha in imidacloprid @ 0.01 per cent treated plot followed by 309.26 q/ha in malathion @ 0.05 per cent and endosulfan @0.07 per cent and endosulfan @0.05 per cent treated plots provided 309.26 and 301.11q/ha yield. Cost benefit ratio was highest, 1:67.12 in case of malathion @0.05 per cent followed by1:61.17 in malathion @0.03 per cent but imidacloprid 0.01 per cent provided 1:41.83 cost benefit ratio (Table 4).These findings regarding high production in imidacloprid treated plots but malathion treated plot having best cost benefit ratio are supported by finding of Meena and Lal (2004) and Steeknath *et al*.(1998)who obtained the highest

Table 3 : Bio efficacy of insecticides and bio pesticides against mustard aphid

Treatments	Dose (%)	Per cent mean mortality after					
		First spray			Second spray		
		3 day	7 day	10 day	3 day	7 day	10 day
Endosulfan 35EC	0.05	79.53 (63.08)	80.10 (63.51)	80.10 (63.51)	81.94 (64.82)	87.07 (68.95)	87.90 (69.64)
Endosulfan 35EC	0.07	92.64 (74.21)	92.80 (74.44)	92.80 (72.34)	93.04 (74.66)	96.52 (79.22)	97.17 (80.37)
Malathion 50 EC	0.03	82.99 (65.65)	83.34 (65.88)	83.34 (65.88)	86.67 (68.61)	90.87 (72.44)	97.42 (80.72)
Malathion 50EC	0.05	94.90 (76.96)	95.26 (77.48)	95.26 (77.48)	95.97 (78.46)	98.32 (82.51)	98.86 (83.98)
Imidacloprid 17.85 SL	0.07	87.42 (69.21)	87.85 (69.64)	87.56 (69.64)	88.01 (69.73)	94.09 (75.94)	95.81 (78.17)
Imidacloprid 17.85 SL	0.01	97.07 (80.19)	97.46 (81.47)	97.76 (81.47)	98.94 (81.80)	97.97 (83.98)	99.05 (89.50)
Nimbicidin 1500 ppm	0.75	69.01 (56.17)	71.94 (57.99)	72.17 (58.18)	70.17 (56.91)	72.17 (58.18)	74.16 (59.47)
Nimbicidin 1500 ppm	1.00	72.01 (58.05)	73.17 (58.82)	74.62 (59.74)	72.41 (58.31)	74.62 (59.74)	77.19 (61.48)
Control	-	2.01 (8.13)	1.90 (7.92)	4.15 (1.83)	3.87 (11.39)	4.15 (11.83)	4.93 (12.79)
S.E.±	-	2.24	3.94	2.56	1.92	1.50	1.46
C.D.@5%		4.74	8.31	5.44	4.06	3.19	3.09

Figures in parenthes represent angular transformed values

Table 4: Economic analysis of insecticidal application on cauliflower

Name of insecticide	Dose (%)	Yield q ha^{1}	Cost input				Returns			
			Amount of insecticide lit. ha^{1}	Rate of insecticide Rs. ha^{1}	Spraying cost labour + Machine charge	Total Rs.	Increase yield over control (q ha^{1})	Cost of increase is Rs. ha^{1}@ 300 q^{1}	Net return (Rs.)	Cost benefit ratio
Endosulfan35EC	0.05	301.11	1.00	225.00	310.00	535.00	89.26	26778.00	26778.00	1:49.05
Endosulfan35EC	0.07	309.26	1.40	225.00	310.00	625.00	97.41	29223.00	28598.00	1:45.76
Malathion50EC	0.03	290.81	0.42	170.00	310.00	381.00	78.96	23688.00	23307.00	1:61.17
Malathion50EC	0.05	309.26	0.70	170.00	310.00	429.00	97.41	29223.00	28794.00	1:67.12
Imidacloprid17.85SL	0.007	392.78	0.28	1400.00	310.00	702.00	80.93	24279.00	23577.00	1:33.59
Imidacloprid17.85SL	0.01	334.07	0.39	1400.00	310.00	856.00	122.22	36666.00	35810.00	1:41.83
Nimbicidin1500ppm	0.75	267.78	5.25	290.00	310.00	1522.00	55.93	16779.00	15256.00	1:10.02
Nimbicidin1500ppm	1.00	289.73	7.00	290.00	310.00	234.00	77.88	23364.00	21024.00	1:8.98
Control	-	211.85	-	-	-	-	-	-	63555.00	-

N.B. : Cost of insecticide were obtained from the plant protection officer, Kanpur and market rate of cauliflower were collected from the Sr. Agri. Marketing Inspector, Kanpur for collecting cost benefit ratio

economic return with use of imidacloprid.

It may be concluded from the study that the mustard aphid (*Lipaphis erysimi* Kalt.) was effectively controlled with spraying of imidacloprid @0.01 per cent during second week of February in cauliflower.

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