



SEASONAL INCIDENCE OF MAJOR INSECT PESTS OF CAULIFLOWER (VAR. SNOW BALL - 16)

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ABSTRACT

Investigation on the seasonal incidence of major insect pests of cauliflower, was carried out in the Department of Entomology, Rajasthan College of Agriculture, MPUAT, Udaipur, during two crop seasons i.e., *rabi*, 2015 – 2016 and *rabi*, 2016 – 2017. Diamondback moth (*Plutella xylostella* Linnaeus), aphids (viz., *Lipaphis erysimi* Kaltenbach, *Brevicoryne brassicae* Linnaeus and *Myzus persicae* Sulzer), flea beetle (*Phyllotreta chotanica* Duvivier) and painted bug (*Bagrada hilaris* Burmeister) were recorded as the major insect pests of cauliflower. Infestation by aphids and DBM, initiated in December and that of flea beetles and painted bug initiated in the month of January. The major insect pests reached their peak mean populations during February-March. The population of the major insect pests was positively correlated with the mean atmospheric temperature, wind velocity and sunshine hours; and negatively correlated with relative humidity and rainfall during both the years.

Key words: Incidence, major insect pests, correlation, cauliflower.

INTRODUCTION

Cauliflower (*Brassica oleracea* L. var. *botrytis*: Cruciferae), is an important winter vegetable cultivated extensively in India. India is the second largest producer of vegetables (12.6%) and also one of the largest producers of cauliflower in the world. In 2015 – 2016, the area under cauliflower cultivation in India was 4,26,000 ha with a production of 80,90,000 mt and productivity of 19.10 mt/ ha. West Bengal, Bihar, Madhya Pradesh, Odisha, Gujarat, Haryana, Assam and Rajasthan are the major cauliflower growing states in India (Indian Horticulture Database, 2016). One of the major limiting factors in the production of vegetables is the extensive crop devastations caused due to increased pest menace. Vegetables are more prone to insect pests and diseases mainly due to their tenderness and softness as compared to other crops and virtual absence of resistance characters, because of intensive hybrid cultivation.

Cauliflower, one of the abundantly consumed vegetables of India, is also infested by numerous pests that act as major constraints in its production. Diamondback moth (DBM), *Plutella xylostella* (L.), tobacco caterpillar, *Spodoptera litura* (F.), leaf webber, *Crociodolomia binotalis* (Z.), stem borer, *Hellula undalis* (F.), aphid, *Brevicoryne brassicae* (L.), mustard aphid,

Lipaphis erysimi (K.), and painted bug, *Bagrada cruciferarum* (L.) are the main insect pests infesting cauliflower. The seasonal incidence of any insect pest varies from region to region due to variation in cropping season and climatic conditions. Hence, it was considered imperative to find out the impact of environmental factors on incidence of these important insect pests of cauliflower, in order to find out the seasonal pattern of their incidence for a better monitoring and management of these pests.

MATERIAL AND METHODS

Field experiment to find out the seasonal incidence of major insect pests of cauliflower and their associated natural enemies was conducted in the Horticulture Farm and Department of Entomology, Rajasthan College of Agriculture, MPUAT, Udaipur during *rabi*, 2015 – 2016 and 2016 – 2017. The seedlings of the late season cauliflower variety Snowball-16, were raised on well prepared nursery beds during the last week of September 2015 and 2016. The experimental field was laid out with uniform sized plots of 4.8 X 4.05 m² (19.44 m²) in Randomized Block Design (RBD). The seedlings of cauliflower were transplanted in the last week of October, 2015 and 2016 at a spacing of 60 cm x 45 cm. Weekly meteorological data on maximum and minimum temperature (°C), morning and evening relative humidity

(%), wind velocity (kmph), sunshine (hrs) and rainfall (mm) were obtained from the meteorological unit of the Instructional Farm, Rajasthan College of Agriculture, Udaipur. Populations of the major insect pests were recorded at weekly intervals during morning hours, between 7.00 A.M. to 10.00 A.M, from ten randomly selected and tagged plants in each replication. The population of aphids (both nymphs and adults; alate and apterous) was recorded by visual counting method using a magnifying lens on each of the three marked leaves of each tagged plant. The population of diamondback moth (DBM), flea beetles and painted bugs were recorded by visually counting the number of larvae and adults on the whole tagged plants, respectively (Lal, 1998) on each tagged plant. Simple correlation was worked out between the population of major insect pests and abiotic factors. The coefficient of correlation was worked out using the following formula.

$$r_{xy} = \frac{\sum XY - \frac{(\sum X)(\sum Y)}{n}}{\sqrt{\left[\sum X^2 - \frac{(\sum X)^2}{n}\right] \left[\sum Y^2 - \frac{(\sum Y)^2}{n}\right]}}$$

Where,

r_{xy} = Simple correlation coefficient

X = Variable *i.e.*, abiotic component

Y = Variable *i.e.*, mean number of insect pests

n = Number of paired observations

The correlation coefficient values were subjected to test of significance (t-test) and the calculated t-values obtained were compared with t- table value at 5% level of significance.

$$t = \frac{1}{\sqrt{1-r^2}} \times \sqrt{n-2}$$

RESULTS AND DISCUSSION

Seasonal incidence of major insect pests of cauliflower during *rabi*, 2015-16 and 2016-17:

Aphids: The infestation of aphids initiated in the 3rd week of December (50th SMW, 2015) and then gradually increased, reaching a peak mean population of 207.53 aphids/ 3 leaves/ plant during the 1st week of March (10th SMW, 2016) during which the mean temperature, mean relative humidity, wind velocity and sunshine were 22.91°C, 47.57 per cent, 3.57 kmph and 8.43 hrs respectively. Aphid population exhibited a significant positive correlation with mean atmospheric temperature and wind velocity ($r = 0.74$ and 0.73 respectively), while with mean relative humidity and sunshine hours, it exhibited a non-significant negative relationship ($r = -0.49$) and a non-significant positive relationship ($r =$

0.31) respectively (Table 1). No rainfall was recorded during this entire period. Similarly, during the second season of the experiment, the incidence of aphids began from the 2nd week of December (49th SMW, 2016), reaching its peak population of 217.50 aphids/ 3 leaves/ plant in the 1st week of March (9th SMW, 2017) and remained in the field till the third week of March (11th SMW, 2017). At the time of peak incidence of the pest, the mean temperature, mean relative humidity, wind velocity and sunshine were 21.11°C, 48.50 per cent, 2.49 kmph and 9.11 hrs respectively. Mean atmospheric temperature and sunshine hours had a non-significant positive correlation ($r = 0.41$ and 0.21 respectively) with the aphid population, whereas, mean relative humidity and total rainfall had a non-significant negative correlation ($r = -0.51$ and -0.08 respectively). Similar to the first season, wind velocity had a significant positive correlation ($r = 0.73$) with the incidence of aphids even in the second season (Table 2). Badjena and Mandal (2005) have also reported the incidence of three species of aphids *viz.*, *M. persicae* (major one) followed by *B. brassicae* and *L. erysimi* in the cauliflower fields starting from the second week of November reaching their peak of 216.3 aphids/ 3 leaves in their study. According to the findings of Mandal and Patnaik (2008), the aphid, *B. brassicae* commenced its activity from mid-December and lingered on the crop till harvest during March end, similar to the present findings. Similarly, Meenakshi *et al.* (2014) who, during their experiments on cauliflower and cabbage in different locations, recorded the peak population of aphids in the month of March. With regards to weather parameters, similar to the present findings, Zag (2001) and Meenakshi *et al.* (2014) under their study, observed a positive correlation of aphid population with temperature and a negative correlation with relative humidity and rainfall under their study.

Diamondback moth: The diamondback moth started appearing from the 1st week of January (1st SMW, 2016), reaching its peak of 30.93 larvae/ plant during the 1st week of March (9th SMW, 2017) and remained until the end of the crop season. At the time of peak incidence, the mean temperature, mean relative humidity, wind velocity and sunshine were 22.91°C, 47.57 per cent, 3.57 kmph and 8.43 hrs respectively. The DBM incidence had a significant positive correlation ($r = 0.66$ and 0.60 respectively) with mean atmospheric temperature and wind velocity and a non-significant positive correlation ($r = 0.31$) with sunshine hours, whereas, with mean relative humidity it had a significant negative correlation ($r = -0.76$) (Table 1). No rainfall was recorded during this period. The observations recorded during the second crop season revealed that the incidence of DBM began during the last week of December (52nd SMW, 2016) reached its peak in the 1st week of March (9th SMW,

Table 1. Seasonal incidence of major insect pests in cauliflower during *rabi* 2015-16

Date of observation	Atm. Temp. (°C)	R.H. (%)	Wind velocity (Kmph)	Sunshine (Hrs)	Mean number of insects/ plant			
					Aphids/ 3 leaves	DBM larvae	Flea beetle	Painted bug
14-12-2015	17.50	52.93	1.66	8.07	1.20	-	-	-
21-12-2015	14.17	49.36	1.70	8.23	1.40	-	-	-
28-12-2015	14.30	48.07	1.83	6.54	2.50	-	-	-
04-01-2016	20.00	52.36	1.96	7.39	7.23	0.07	-	-
11-01-2016	18.55	54.64	2.00	7.36	16.70	0.13	0.03	-
18-01-2016	17.19	58.07	2.46	7.07	38.40	0.20	0.10	-
25-01-2016	14.51	52.07	2.00	6.34	50.87	0.73	0.17	0.03
01-02-2016	19.33	54.57	2.39	8.49	47.60	3.33	0.40	0.10
08-02-2016	16.60	47.21	2.74	8.60	52.87	8.50	0.37	0.90
15-02-2016	17.95	49.00	3.61	8.94	83.00	13.57	3.27	3.07
22-02-2016	21.26	46.50	4.19	6.73	113.80	18.30	6.77	6.07
29-02-2016	20.09	38.64	2.44	9.36	124.23	25.77	12.03	5.83
07-03-2016	22.91	47.57	3.57	8.43	207.53	30.93	13.57	5.57
14-03-2016	22.89	50.57	3.93	7.99	148.47	21.03	12.07	4.17
21-03-2016	23.75	46.36	5.01	7.20	99.23	14.37	11.87	3.77
Coefficient of correlation (r) for population and atm. temp.			0.74*	0.66*	0.86*	0.71*		
Coefficient of correlation (r) for population and relative humidity			-0.49	-0.76*	-0.67*	-0.69*		
Coefficient of correlation (r) for population and wind velocity			0.73*	0.60*	0.66*	0.56		
Coefficient of correlation (r) for population and sunshine			0.31	0.49	0.27	0.14		

*Significant at 5%

2017) with a mean population of 21.50 larvae/ plant and remained until the end of the crop season. At the time of peak incidence of the pest, the mean temperature, mean relative humidity, wind velocity and sunshine were 21.11°C, 48.50 per cent, 2.49 kmph and 9.11 hrs respectively. Similar to the first season, the DBM larval population had a significant positive correlation with mean atmospheric temperature and wind velocity ($r = 0.74$ and 0.74 respectively) and a non-significant positive correlation with sunshine hours ($r = 0.50$). Similarly, with mean relative humidity it had a significant negative correlation ($r = -0.73$) and a non-significant negative relationship ($r = -0.27$) was recorded with the total rainfall (Table 2).

Flea beetle: Flea beetle infestation initiated in the 2nd week of January (2nd SMW, 2016) and continued until the end of the crop season reaching to its highest mean population of 13.57 beetles/ plant in the 1st week of March (10th SMW, 2016) during which the mean temperature, mean relative humidity, wind velocity and sunshine were 22.91°C, 47.57 per cent, 3.57 kmph and 8.43 hrs respectively. The mean atmospheric temperature and wind velocity had a significant positive correlation ($r = 0.86$ and 0.66 respectively) with the flea beetle incidence, whereas, sunshine hours had a non-significant positive correlation ($r = 0.27$). With the mean relative humidity their population had a significant negative correlation ($r = -0.76$) (Table 1). No rainfall was

recorded during this period. During the second season of the experiment, it was found that the incidence of flea beetle began during the 1st week of January (1st SMW, 2017) and remained until the end of the crop season *i.e.*, 3rd week of March (11th SMW, 2017), reaching to its highest mean population of 7.30 beetles/ plant during the 4th week of February (8th SMW, 2017). At the time of peak incidence, the mean temperature, mean relative humidity, wind velocity and sunshine were 21.61°C, 49.79 per cent, 3.34 kmph and 8.36 hrs respectively. Among the different abiotic factors, mean atmospheric temperature and wind velocity had significant positive correlation ($r = 0.80$ and 0.75 respectively) and sunshine hours had a non-significant positive correlation ($r = 0.52$) with the mean population of flea beetles. On the contrary, the mean relative humidity and total rainfall had a significant and non-significant negative correlation respectively ($r = -0.82$ and -0.30), with the population of flea beetles (Table 2). Chaudhari *et al.* (2001) reported that population of flea beetle reached its maximum during last week of March in cabbage crop, similar to our observations. Zhang *et al.* (2000) revealed that, the beetle population showed a close positive correlation with mean day temperature.

Painted bug: The incidence of painted bug began in the last week of January (4th SMW, 2016) and continued till the 3rd week of March (12th SMW, 2016). The peak mean population of 6.07 bugs/ plant was recorded in the last

Table 2. Seasonal incidence of major insect pests in cauliflower during rabi 2016-17

Date of observation	Atm. Temp. (°C)	R.H. (%)	Wind velocity (Kmph)	Sunshine (Hrs)	Total Rainfall (mm)	Mean number of insects/ plant			
						Aphids/ 3 leaves	DBM larvae	Flea beetle	Painted bug
14-12-2015	17.50	52.93	1.66	8.07	1.20	-	-	-	-
21-12-2015	14.17	49.36	1.70	8.23	1.40	-	-	-	-
28-12-2015	14.30	48.07	1.83	6.54	2.50	-	-	-	-
08-12-2016	18.41	57.36	1.87	8.54	0.00	1.13	-	-	-
15-12-2016	19.57	60.57	1.66	8.79	0.00	3.70	-	-	-
22-12-2016	17.84	60.29	1.73	8.59	0.00	5.87	-	-	-
29-12-2016	18.37	55.36	1.76	8.56	0.00	12.23	0.03	-	-
05-01-2017	18.49	60.21	1.83	8.33	0.00	24.73	0.07	0.17	-
12-01-2017	15.16	67.00	2.60	5.30	0.00	31.77	0.10	0.20	-
19-01-2017	13.41	62.43	2.37	8.26	0.00	72.97	0.27	0.40	-
26-01-2017	18.16	66.29	2.16	4.20	1.40	55.60	0.93	0.40	0.07
02-02-2017	16.51	65.36	2.27	8.20	0.00	71.80	3.27	0.97	0.07
09-02-2017	17.54	58.00	2.93	8.26	0.00	109.03	9.83	2.33	1.20
16-02-2017	17.10	62.00	3.07	8.41	0.00	134.90	12.80	3.20	2.27
23-02-2017	21.61	49.79	3.34	8.36	0.00	175.90	17.43	7.30	3.40
02-03-2017	21.11	48.50	2.49	9.11	0.00	217.50	21.50	5.23	4.47
09-03-2017	20.93	48.07	3.63	8.91	0.00	120.83	17.87	4.60	3.47
16-03-2017	18.81	42.07	3.30	7.76	0.00	95.57	11.67	4.17	1.90
Coefficient of correlation (r) for population and atm. temp.						0.41	0.74*	0.80*	0.84*
Coefficient of correlation (r) for population and relative humidity						-0.51	-0.73*	-0.82*	-0.73*
Coefficient of correlation (r) for population and wind velocity						0.73*	0.74*	0.75*	0.54
Coefficient of correlation (r) for population and sunshine						0.21	0.50	0.52	0.66
Coefficient of correlation (r) for population and total rainfall						-0.08	-0.27	-0.30	-

*Significant at 5%

week of February (8th SMW, 2016) during which the mean temperature, mean relative humidity, wind velocity and sunshine were 21.26°C, 46.50 per cent, 4.19 kmph and 6.73 hrs respectively (Table 1). The incidence of painted bug, had a significant positive relationship with mean atmospheric temperature ($r = 0.71$), whereas, with mean relative humidity it had a significant negative relationship ($r = -0.69$). Wind velocity and sunshine hours on the other hand, had a non-significant positive correlation ($r = 0.56$ and 0.14 respectively) with the infestation of painted bugs. No rainfall was recorded during this period. The incidence of painted bug initiated in the last week of January (4th SMW, 2017) and continued to remain until the 3rd week of March (11th SMW, 2017) reaching a peak mean population of 4.47 bugs/ plant in the 1st week of March (9th SMW, 2017) during the second year of the experiment. The mean atmospheric temperature, mean relative humidity, wind velocity and sunshine at the time of peak incidence of the pest, were found to be 21.11°C, 48.50 per cent, 2.49 kmph and 9.11 hrs respectively. The incidence of painted bug had a significant positive relationship with mean atmospheric temperature ($r = 0.84$), whereas, with the mean relative humidity and total rainfall, it had a significant negative and non-significant negative

relationship respectively ($r = -0.73$ and -0.51) with the painted bug population. Wind velocity and sunshine hours on the other hand, had a non-significant positive correlation ($r = 0.54$ and 0.66 respectively) with the infestation of painted bugs (Table 2). Bhati *et al.* (2015) recorded the peak infestation of painted bugs from the last week of February to mid March, similar to our findings. Similarly, Nagar *et al.* (2011) also observed the peak activity of this pest in 1st week of March. Similar to the present findings, earlier Nagar *et al.* (2011) and Bhawaskar (2015) have also reported a significant positive correlation between the incidence of painted bug and atmospheric temperature and negative correlation between the incidence of painted bug and relative humidity.

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