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## Seasonal incidence of diamondback moth (*Plutella xylostella* L.) on cabbage (*Brassica oleracea* var. *capitata* L.) under Allahabad condition

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**Abstract**

Studies on seasonal incidence of diamondback moth *Plutella xylostella*. Infesting cabbage (*Brassica oleracea* var. *capitata* L.) work were carried out at the college of Shiats, Allahabad during 2015-2016. The *P. xylostella* damage was active throughout the year with a varying degree of infestation. It was recorded from a minimum of 0.32 per cent (second fortnight of February) to maximum of 5.98 per cent (third fortnight of March). A study on the correlation studies indicated a significant positive correlation between larval population of diamondback moth and the relative humidity (R.H), total rainfall and sunshine hours (SSH) had negative correlation with the larval population of diamondback moth.

**Keywords:** *Plutella xylostella*, weather parameters, cabbage.

**Introduction**

Cabbage, *Brassica oleracea* var. *capitata* L. is one of the important cruciferous vegetable crops grown in India. It is grown more or less in all the states. The nutritional value/ 100 g of cabbage consists of carbohydrates 5.8 g, fat 0.1 g, protein 1.28 g, vitamins (thiamine or vitamin B1 0.061 mg, riboflavin or B2 0.040 mg, niacin or vitamin B3 0.234 mg, pantothenic acid or vitamin B5 0.212 mg, folate or vitamin B9 43 mg, vitamin C 36.6 mg, and vitamin K 76mg), minerals (Ca 40 mg, Fe 0.47 mg, Mg 12 mg, Mn 0.16 mg, P 26 mg, K 170 mg, Na 18mg, Zn 0.18 mg). (Sharma *et al.*, 2017) [8]

India is the second largest producer of cabbage in the world after china. India producing 8534.2 million tones (5.3 percent of total vegetable production) in an area of 372.4 hactares (4 percent of total vegetable area) with a productivity of 22.9MT/ha. Highest production of cabbage in India is found in West bengal. Highest Cabbage producing states of India, west Bengal, orissa and Bihar, 2179.20 tones, 1148.21 tones and 778.55 tones respectively. Major cabbage growing states in the country are West Bengal, Orissa, Bihar, Uttar Pradesh, Assam, Karnataka, Maharashtra, Madhya Pradesh and Tamil Nadu (Anonymous, 2013) [2]

Cabbage has an anti-cancer property, it protects against bowel cancer due to the presence of indole-3-carbinol. Cabbage juice was used as a remedy against poisonous mushrooms and as a gargle against hoarseness. It is generally used as cooked vegetables either alone or is mixed with potato, peas or other vegetable as fried or in curry form. (Hazra *et al.* 2011) [6].

The cabbage crop is attacked by a number of different insect pests and among them Cabbage caterpillar, *Pieris brassicae* Linnaeus; diamondback moth, *Plutella xylostella* Linnaeus; Cabbage semi-looper, *Thysanoplusia orichalcea* Fabricius and *Autographa nigrisigna* Walker; tobacco caterpillar, *Spodoptera litura* Fabricius; Cabbage leaf webber, *Crocodolomia binotalis* Zeller; cabbage borer, *Hellula undalis* Fabricius and cabbage flea beetles, *Phyllotreta cruciferae* Goeze.; *P. chotanica* Duviv; *P. birmanica* Harold., *P. oncera* Maulik and *P. downesi* Baly are the pests of major importance Among these, *P. xylostella* is a major and regular pest causing damage to the cabbage crop under Allahabad. (Ayalew, 2006) [1]

Diamond back moth (*Plutella xylostella* L.) is the most destructive insect pest attacking cruciferous plants throughout the world. the pest was first recorded in 1746 in Europe and since then it has been reported is about 128 countries, with varied levels of infestation ranging from moderate is Asian region than the Mediterranean regions to high in South and Southeast Asians countries. (Harcourt, 1963) [5]

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Diamondback moth causes significant yield losses in cruciferous vegetables that including cabbage and broccoli by First instar larvae begin feeding by boring through the cuticle of the leaf and mining in the tissue beneath. Depending on the larval infestation the yield loss can range from up to 60 to 100% (Shelton *et al.*, 1993)<sup>[9, 10]</sup> and the annual, global cost for managing the first is estimated at US \$ 1 billion (Talekar and Shelton 1993)<sup>[9, 10]</sup>.

Excessive use of chemicals to control this pest not only causes the economical restraint on farmers but also produces the harmful side effects on the environment as well as human being. The best way to overcome this situation is to destroy the pest at its initial stage of the life cycle. This is possible if timely prediction of the occurrence of the pest can be made. Hence, an investigation on seasonal incidence of the *P.xylostella* on Cabbage in relation with different meteorological parameters was carried out.

## Materials and Methods

### Site and location of experiments

The present investigations were conducted at the departmental farm at Shiats, Allahabad during *rabi*, 2015-2016. Geographically, Allahabad is located at longitude of 25.4358° North, latitude of 81.8463° East and at an altitude of 92 metres above mean sea level (MSL) in Allahabad district of UP.

### Climatic and weather conditions of location:

The climate of the region which is characterized by extremes of the temperature during summer and winter. During the summer, temperature may rise as high as 42 °C and in winter, it may fall as low as 8-6 °C. The total rainfall is 0.5 mm/per hour which is mostly received from last week of June to September. This region provides a safe long growing season for most of the crops.

### Lay out

The seedlings were transplanted. The plot size was 2x1m and spacing was maintained at 40x50cm. The experiment was laid out in randomized block design (RBD) with three replications.

### Observation

To estimate the larval population of diamondback moth, direct visual counting method was used (Meena, *et al.*, 2012)<sup>[7]</sup>. The observations were recorded at weekly interval throughout the crop growth on five (5) randomly selected plants from each plot. The weather data viz., maximum and minimum temperature, relative humidity, rainfall and bright sunshine hours recorded in the Shiats, Allahabad was collected for correlating with the population fluctuation phenomena of diamondback moth.

### Meteorological data

Weekly data of temperature (maximum and minimum), relative humidity and sunshine hours were obtained from the Meteorological Department of Shiats Allahabad UP.

## Results and Discussion

### Seasonal incidence of diamondback moth (*Plutella xylostella* L.) on cabbage during 2015-2016.

The data on the seasonal abundance of diamondback moth recorded on cabbage (Table 1) revealed that during 2015-2016, the infestation of diamondback moth larva was first recorded on 2<sup>nd</sup> week of Feb with an initial population of 0.32 larvae/plant. The population increased gradually in successive weekly count and reached a peak of 6.15 larvae/plant on 24<sup>th</sup> March and thereafter, declined population with 1.26/plant on 14<sup>th</sup> April. A simple correlation coefficient was worked out between the number of larvae and the weather factors viz., temperature (max. and min.), relative humidity, rainfall and wind velocity sunshine hours. That the maximum temperature had a positive effect in ( $r=0.63$  and  $r=0.61$ , respectively), the relative humidity had the negative and positive relation with the larval population of diamondback moth in two seasons ( $r=-0.10$  and  $r=-0.40$  respectively), it had non-significant effect with the pest population. The correlation studies also revealed that rain fall had negative but non-significant ( $r=-0.85$ ). However sunshine hours (SSH) had negative non-significant relation ( $r=-0.61$ ) wind velocity had negative but non-significant (-0.50) during 2015-2016.

The maximum temperature during the month of February to April (period of high activity of pest) ranged between 30 to 40 °C, whereas, minimum and average temperature ranged between 18 to 28 °C and 27 to 32.5 °C, respectively. The minimum relative humidity at that period was 40 to 90 per cent. While during the month of December and January (the period of low activity of pest) maximum and minimum temperature ranged between 30 to 34 °C and 10 to 17 °C, respectively and minimum relative humidity ranged between 31 to 50 per cent. Thus, it can be concluded that diamondback moth population was relatively higher when maximum, minimum, average temperature and minimum relative humidity were higher were found to be lower population of diamondback moth. Rest of the parameters viz., average relative humidity and rainfall, sunshine hours, wind velocity, did not show effect on the diamondback population. They negative but non-significant correlation with diamondback moth population. The present findings of the significant positive correlation of diamondback moth population with the maximum and minimum temperature was also reported by (Venkateswarlu *et al.* 2011) but the findings of the same author that significant negative relation with the relative humidity and significant positive with sunshine hours is in contrast with the present findings as it has been observed that the relative humidity has no significant effect and SSH has negative and non-significant relation with the population fluctuation of diamondback moth the findings of (Goudegnon *et al.*, 1999)<sup>[4]</sup> observed that diamondback moth population attained its peak during February and March The present results supported the work of (Vanlaldiki, *et al.*, 2013, Viraktamath *et al.*, 1994)<sup>[11, 12]</sup> observed significant positive correlation of diamondback moth infestation with maximum and minimum temperature on cabbage crop

**Table 1:** Seasonal incidence of diamondback moth (*Plutella xylostella* L.) on cabbage during 2015-2016.

Date of Observation	Standard week	No. of larva /plant	Temperature		Humidity %		Rainfall (mm)	Wind Velocity	Sunshine (hr/day)
			Max.	Min.	Morning	Evening			
26/11/15	47 <sup>th</sup>	0	30.02	1188	82.71	44.57	0.00	0.64	7.8
2/12/15	48 <sup>th</sup>	0	31.05	11.62	82.71	41.85	0.00	0.52	8.44
9/12/15	49 <sup>th</sup>	0	29.54	10.37	84.28	45.14	0.00	0.69	8.28
16/12/15	50 <sup>th</sup>	0	27.51	9.54	87	56.42	1.20	0.73	6.22

23/12/15	51 <sup>st</sup>	0	22.25	7.84	91.28	58.57	0.00	1.77	3.51
30/1/16	52 <sup>nd</sup>	0	17.20	8.2	93.42	62.57	0.00	0.83	1.10
6/01/16	1 <sup>st</sup>	0	20.65	12.74	92.28	56.42	4.71	1.46	0.00
13/01/16	2 <sup>nd</sup>	0	19.71	9.65	91.28	68.57	0.00	1.40	0.00
20/01/16	3 <sup>rd</sup>	0	15.71	7.92	94.57	67.14	0.00	1.29	0.00
27/01/16	4 <sup>th</sup>	0	18.62	11.64	93.42	69.14	3.28	1.25	0.00
03/02/16	5 <sup>th</sup>	0	23.62	12.90	92.28	51.57	1.51	1.43	2.65
10/02/16	6 <sup>th</sup>	0.25	27.08	11.17	91.28	54.42	0.74	2.10	3.08
17/02/16	7 <sup>th</sup>	0.65	28.20	11.94	94.57	48.14	0.00	0.79	6.45
24/02/16	8 <sup>th</sup>	1.01	30.85	13.34	93.42	49.42	0.00	1.68	15.68
03/03/16	9 <sup>th</sup>	1.25	29.58	14.71	89.57	60.57	9.62	2.16	13.35
10/03/16	10 <sup>th</sup>	3.2	33.20	15.11	89.85	50.42	0.00	1.73	12.20
17/03/16	11 <sup>th</sup>	4.55	33.37	15.02	86.71	45.14	0.02	1.78	11.25
24/03/16	12 <sup>th</sup>	5.7	34.31	16.45	87.57	45.71	0.00	2.66	13.25
31/03/16	13 <sup>th</sup>	6.15	34.14	18.37	91.14	44.14	1.20	3.09	10.32
7/04/16	14 <sup>th</sup>	2.15	38.76	20.24	89	40.23	0.00	5.23	9.73
14/04/16	15 <sup>th</sup>	1.26	39.25	21.00	87	38.74	0.00	4.02	9.32
		r=	0.601	0.660	-0.108	-0.448	-0.085	-0.502	0.614
			S	S	NS	S	NS	NS	NS

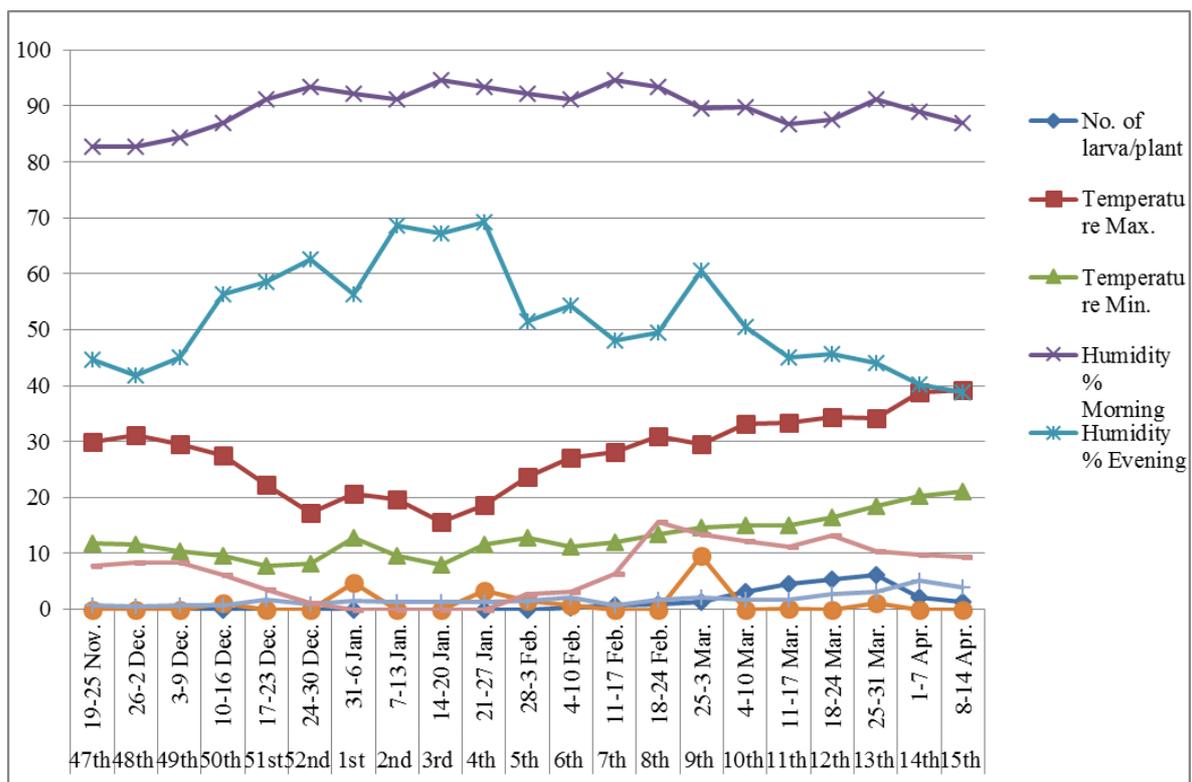


Fig 1: seasonal incidence of diamondback moth (*P. xylostella*) on cabbage.

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