

# STUDY THE SEASONAL INCIDENCE OF DIAMONDBACK MOTH, *PLUTELLA XYLOSTELLA* (LINN.) ON CABBAGE

## Abstract

The present investigation entitled 'Study the seasonal incidence of diamondback moth, *Plutella xylostella* (Linn.) on cabbage' was carried out on variety 'Golden Acre' during *Rabi*, 2021 and 2022. At Crop Research Centre, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (UP). The data were recorded on five randomly selected plants once in a standard week. Diamondback moth population reached a maximum level of 9.67 and 9.33 larvae/five plants during 3<sup>rd</sup> week of January in *Rabi* 2021 and 4<sup>th</sup> week of January in *Rabi* 2022. The *P. xylostella* was active throughout the year with a varying degree of infestation.

Key words: *Plutella xylostella*, Crop Research, Cabbage production

## Introduction

Cabbage, *Brassica oleracea* var. *capitata* (Linn.) is a member of the "Cruciferous" family along with other vegetables such as broccoli, cauliflower and Brussels sprouts. Its numerous varieties including green cabbage, red cabbage and savoy cabbage offer versatility in cooking, making it a staple in many cuisines. The genus cabbage is a cole crop vegetable, it is considered as one of the exotic vegetables. It is one of the most popular winter season leafy vegetables widely consumed globally and overall in India. The Head of cabbage may reach 0.5 to 1.5 kilograms. In India, cabbage is cultivated in a wide range of tropical and temperate regions. Many researchers have observed that *Brassica oleracea* (Linn.), with a chromosome number of  $n=9$  and  $2n=18$ , exhibits distinct characters. It is believed to have originated from the coastal regions of Northern Europe or the Mediterranean region. **Snogerup (1980).**

In India, the crop is cultivated in almost all the states. Annual production of Cabbage in West Bengal in 2021-22, ranked first, the state accounted for 24.38 per cent of total production. The cultivated area and average productivity of cabbage were 22.18 tonnes/ha. Cabbage seeds germinate properly at 12.7°C to 15.5°C temperatures. The major cabbage-growing states in the country are West Bengal (24.38 per cent), Odisha (11.77 per cent), Gujrat (8.29 per cent), Madhya Pradesh (8.29 per cent), Assam (7.75 per

cent), Bihar (7.52 per cent), Chhattisgarh (4.38 per cent) Uttar Pradesh (3.63 per cent), followed by Haryana, Karnataka and Maharashtra. In Uttar Pradesh, the area under cultivation of cabbage is about 9.06 thousand hectares with a production of about 302.97 thousand tonnes **Anonymous (2022)**.

Cabbage is a low-calorie vegetable that is rich in nutritional value per 100 g of cabbage consists of carbohydrates 5.8 g, fat 0.1 g, protein 1.28 g, vitamins (thiamine or vitamin B<sub>1</sub> 0.061 mg, riboflavin or B<sub>2</sub> 0.040 mg, niacin or vitamin B<sub>3</sub> 0.234 mg, pantothenic acid or vitamin B<sub>5</sub> 0.212 mg, folate or vitamin B<sub>9</sub> 43 mg, vitamin C 36.6 mg and vitamin K 76 mg) and minerals Ca 40 mg, Fe 0.47 mg, Mg 12 mg, Mn 0.16 mg, P 26 mg, K 170 mg, Na 18 mg and Zn 0.18 mg, **Sharma et al. (2017)**. Besides its culinary uses, cabbage has traditionally been used for its medicinal properties. Se-enriched sauerkraut extracts exhibit high antioxidant and anti-inflammatory properties. **Penas et al. (2012)**. 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 **Keck et al. (2004)**.

## **Materials and Methods**

### **Experimental site**

The present investigation entitled 'Study the seasonal incidence of diamondback moth, *Plutella xylostella* (Linn.) on cabbage' was carried out on variety 'Golden Acre' during *Rabi*, 2021 and 2022. At Crop Research Centre, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (UP). The district Meerut is situated at a 28°57' to 29°02' North latitude and 77°40' to 77°45' East longitude North latitude of 237 meters above mean sea level. The district Meerut falls under the north-western plains sub-region of the upper Gangetic plain zone. The district is spread over a geographical area of 2522 km<sup>2</sup>. The general climate of the Meerut district is semi-arid and sub-tropical characterized by very hot summers and cold winters. The maximum temperature shoots up to 45°C during summer whereas the minimum temperature is 4-5°C and below during the winter season. The average annual rainfall is about 886mm, of which about 75-80 per cent is received through the southwest monsoon during the month of July to September. Few rain showers occasionally occur in the winter and summer seasons. The meteorological information of Modipuram, Meerut was obtained from the meteorological laboratory of the IIFSR-Indian Institute of Farming System Research Modipuram

(Meerut).

### **Experimental Layout**

The experiments were laid out in Randomized Block Design (RBD). 35 days old seedling were transplanted in the main field of cabbage variety Golden Acre was planted in eight plots with a plot size 4.0 x 3.0 m and spacing 60 x 50 cm on the 8<sup>th</sup> of November 2021 and 7<sup>th</sup> of November 2022.

### **Observations recorded**

To estimate the larval population of the diamondback moth, *Plutella xylostella* (Linn.) on cabbage by direct visual counting method was recommended by (Meena *et al.*, 2012). The observations were recorded at weekly intervals throughout the crop growth on five randomly selected plants from each plot. The weather data viz., maximum and minimum temperature (<sup>0</sup>C) relative humidity (per cent), rainfall (mm), sunshine hours (hrs./day) and wind velocity (km/hrs.) was collected from the meteorological observatory of the IIFSR for correlating with the population fluctuation phenomena of diamondback moth.

### **Result and Discussion**

#### **Rabi, Year 2021-22**

The seasonal incidence of *Plutella xylostella* (Linn.) was observed throughout the cropping season. The data were presented in (Table no.- 1 and depicted in (Figure no.- 1). The first incidence of *Plutella xylostella* (Linn.) was observed on 21<sup>st</sup>, November 2021 in the 4<sup>th</sup> week of November (46<sup>th</sup> standard meteorological week) with a mean number of larvae 0.67 larvae per five plants. The maximum, minimum and average temperatures that prevailed during the initial infestation were 29.01 °C, 13.86°C and 21.43°C respectively. Maximum, minimum and average relative humidity were 76.43, 49.71 and 63.07 per cent respectively. The rainfall was 0.00 mm. and the wind speed prevailing during this week was 6.71 km/h. The sunshine was 6.50 hrs./day during this period. The head damage reached its peak on 16<sup>th</sup>, January 2022, during the 3<sup>rd</sup> week of January (2<sup>nd</sup> standard week) with a mean larval population of 9.67 diamondback moths per five plants recorded. The maximum, minimum and average temperatures that prevailed during its peak infestation were 17.70°C, 5.30°C and 11.50°C respectively and the maximum, minimum and average relative humidity were 91.90, 80.60 and 86.25 per cent respectively. The rainfall was 67.50 mm., wind speed 6.20 km/h. and sunshine hours were 1.20 hrs/ day during that

period.

The correlation with weather parameter shows the strong significant negative correlation between the larval population of *Plutella xylostella* (Linn.) with maximum temperature ( $r = -0.778$ ), minimum temperature ( $r = -0.720$ ), and average temperature ( $r = -0.767$ ) but the morning relative humidity ( $= 0.703$ ) shows the strong significant positive correlation. While sunshine ( $= -0.586$ ) shows significant negative correlation and wind velocity ( $= -0.706$ ) shows the negatively non-significant correlation whereas evening relative humidity ( $r = 0.294$ ) average relative humidity ( $r = 0.435$ ) and rainfall ( $0.4125$ ) shows the non-significant positive correlation between the larval population of *Plutella xylostella* (Linn.).

### **Rabi, Year 2022-23**

The seasonal incidence of *Plutella xylostella* (Linn.) was observed throughout the cropping season. The data were presented in **(Table no.-2)** and depicted in **(Figure no.-2)**. The first incidence of *Plutella xylostella* (Linn.) was observed on November 27, 2022 in the 4<sup>th</sup> week of November (47<sup>th</sup> standard week) with a mean number of larvae 0.67 larvae per five plants. The maximum, minimum and average temperatures that prevailed during the initial infestation were 27.40°C, 12.10°C and 19.75°C respectively. Maximum, minimum and average relative humidity were 77.00, 64.70 and 70.85 per cent respectively. The rainfall was 0.00 mm., wind speed prevailing during this week was 4.90 km/h. and sunshine hours were 3.80 hrs/day during that period. The head damage reached to its peak by January 22, 2023 during the 4<sup>th</sup> week of January (3<sup>rd</sup> standard week) with a mean larval population of 9.33 *Plutella xylostella* (Linn.) per five plants. The maximum, minimum and average temperatures prevailed during its peak infestation were 17.40°C, 5.10°C and 11.025°C respectively and the maximum, minimum and average relative humidity ranged from 92.00, 71.90 and 81.95 per cent respectively. The rainfall was 0.00 mm., wind speed 8.00 km/h. and sunshine hours were 02.40 hrs./day during that period.

The correlation with weather parameter shows the strong significant negative correlation between the larval population of *Plutella xylostella* (Linn.) with maximum temperature ( $r = -0.961$ ), minimum temperature ( $r = -0.962$ ), and average temperature ( $r = -0.977$ ) but the morning relative humidity ( $= 0.845$ ), evening relative humidity ( $r = 0.657$ ) and average relative humidity ( $r = 0.798$ ) shows the strong significant positive correlation. While sunshine ( $= -0.769$ ) shows strong significant negative correlation.

Whereas wind velocity (= 0.247) and rainfall (0.051) show the positively non-significant correlation between the larval population of *Plutella xylostella* (Linn.).

The results of the present investigation are similar to the results of **Shyam et al. (2020)** reported the correlation studies revealed that maximum ( $r = -0.496$ ), minimum ( $r = -0.484$ ), and average ( $r = -0.534$ ) temperature had significant negative correlation, while the other weather parameters showed non-significant correlation with larval population of diamond back moth. Whereas **Bana (2012)** observed that the infestation of diamondback moth started in the third week of November and reached peak in the first week of January. **Kawsar et al. (2021)** shows the similar results the correlation with maximum temperature the correlation studies revealed that maximum ( $r = -0.496$ ), minimum ( $r = -0.484$ ), and average ( $r = -0.534$ ) temperature had significant negative correlation, while the other weather parameters showed non-significant correlation with larval population of diamond back moth.

### **Conclusion**

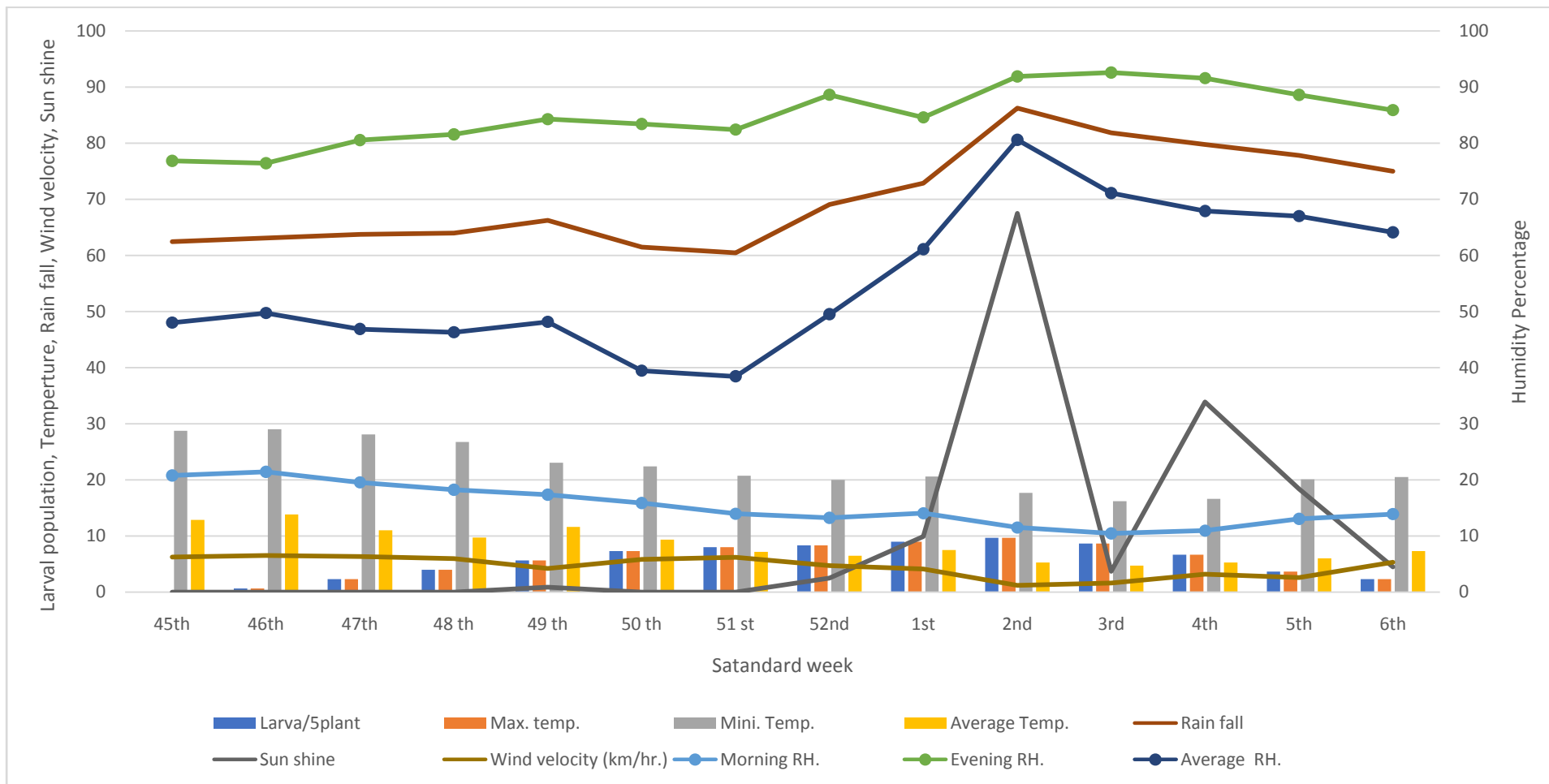
It may be concluded from the present study that infestation of *P. xylostella* started from the end of November in 2021-2022 and last week of November in 2022-2023 and reached peak in the month of January in both years in Meerut district. The correlation with weather parameter shows the strong significant negative correlation between the larval population of *P. xylostella* (Linn.) with maximum temperature. These findings can be used by the farmers for developing a sound programme to counter the attack of *P. xylostella* in cabbage crop to minimize losses.

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**Table no.-1. Larval population of DBM, *Plutella xylostella* (Linn.) on cabbage during Rabi, 2021-22.**

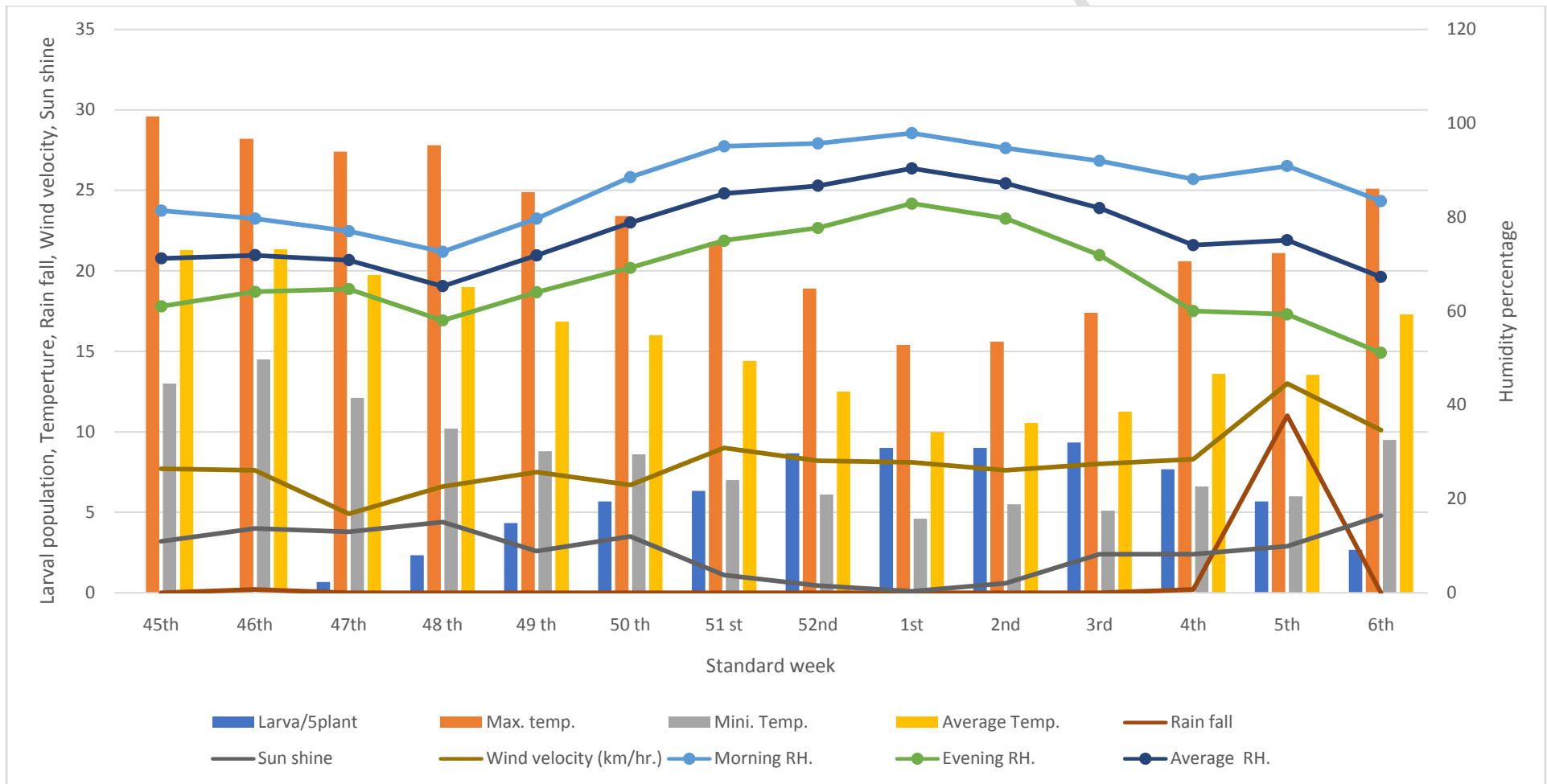
Standard Meteorological Week (SMW)	Date of Observation	Average Population Larvae/ 5Plants	Meteorological Parameters								
			Temperature (°C)			Relative humidity (%)			Rainfall (mm)	Sun shine hrs./day	Wind Velocity (km/hr.)
			Max.	Min.	Average (X <sub>1</sub> )	Morning	Evening	Average (X <sub>2</sub> )			
45 <sup>th</sup>	14/11/2021	0.00	28.73	12.86	20.79	76.86	48.00	62.43	00.00	06.21	07.07
46 <sup>th</sup>	21/11/2021	0.67	29.01	13.86	21.43	76.43	49.71	63.07	00.00	06.50	06.71
47 <sup>th</sup>	28/11/2021	2.33	28.11	11.00	19.55	80.57	46.86	63.71	00.00	06.31	03.54
48 <sup>th</sup>	05/12/2021	4.00	26.76	9.71	18.23	81.57	46.29	63.93	00.00	05.96	04.27
49 <sup>th</sup>	12/12/2021	5.67	23.07	11.64	17.35	84.29	48.14	66.21	00.90	04.21	05.33
50 <sup>th</sup>	19/12/2021	7.33	22.40	09.36	15.88	83.43	39.43	61.43	00.00	05.80	06.10
51 <sup>st</sup>	26/12/2021	8.00	20.74	07.17	13.95	82.43	38.43	60.43	00.00	06.20	05.06
52 <sup>nd</sup>	02/01/2022	8.33	20.00	06.49	13.24	88.63	49.50	69.06	02.50	04.69	05.33
1 <sup>st</sup>	09/01/2022	9.00	20.60	07.50	14.05	84.60	61.10	72.85	09.90	04.10	04.70
2 <sup>nd</sup>	16/01/2022	9.67	17.70	05.30	11.50	91.90	80.60	86.25	67.50	01.20	06.20
3 <sup>rd</sup>	23/01/2022	8.67	16.20	04.70	10.45	92.60	71.10	81.85	03.70	01.60	06.80
4 <sup>th</sup>	30/01/2022	6.67	16.60	05.30	10.95	91.60	67.90	79.75	33.90	03.20	04.60
5 <sup>th</sup>	06/02/2022	3.67	20.10	06.00	13.05	88.60	67.00	77.80	18.40	02.60	05.40
6 <sup>th</sup>	13/02/2022	2.33	20.50	07.30	13.90	85.90	64.10	75.00	04.50	05.30	05.40



**Figure no.-1. Larval population of DBM *Plutella xylostella* (Linn.) on cabbage during Rabi, 2021-22**

**Table no.-2. Larval population of DBM, *Plutella xylostella* (Linn.) on cabbage during Rabi, 2022-23**

Standard Meteorological Week (SMW)	Date of Observation	Average Population Larvae/5 Plants	Meteorological Parameters								
			Temperature (°C)			Relative Humidity (%)			Rainfall (mm)	Sun Shine hrs./day	Wind Velocity (km/hr.)
			Max	Min	Average (X <sub>1</sub> )	Morning	Evening	Average (X <sub>2</sub> )			
45 <sup>th</sup>	13/11/2022	0.00	29.6	13.0	21.30	81.40	61.00	71.20	00.00	03.20	07.70
46 <sup>th</sup>	20/11/2022	0.00	28.2	14.5	21.35	79.70	64.10	71.90	00.20	04.00	07.60
47 <sup>th</sup>	27/11/2022	0.67	27.4	12.1	19.75	77.00	64.70	70.85	00.00	03.80	04.90
48 <sup>th</sup>	04/12/2022	2.33	27.8	10.2	19.00	72.60	58.00	65.30	00.00	04.40	06.60
49 <sup>th</sup>	11/12/2022	4.33	24.9	08.8	16.85	79.70	64.00	71.85	00.00	02.60	07.50
50 <sup>th</sup>	18/12/2022	5.67	23.4	08.6	16.00	88.50	69.20	78.85	00.00	03.50	06.70
51 <sup>st</sup>	25/12/2022	6.33	21.8	07.0	14.40	95.10	75.00	85.05	00.00	01.10	09.00
52 <sup>nd</sup>	01/01/2023	8.00	18.9	06.1	12.50	95.70	77.70	86.70	00.00	00.45	08.20
1 <sup>st</sup>	08/01/2023	8.67	15.4	04.6	10.00	97.90	82.90	90.40	00.00	00.10	08.10
2 <sup>nd</sup>	15/01/2023	9.00	15.6	05.5	10.55	94.70	79.70	87.20	00.00	00.60	07.60
3 <sup>rd</sup>	22/01/2023	9.33	17.4	05.1	11.25	92.00	71.90	81.95	00.00	02.40	08.00
4 <sup>th</sup>	29/01/2023	7.67	20.6	06.6	13.60	88.10	60.00	74.05	00.20	02.40	08.30
5 <sup>th</sup>	05/02/2023	5.67	21.1	06.0	13.55	90.90	59.30	75.10	11.00	02.90	13.00
6 <sup>th</sup>	12/02/2023	2.67	25.1	09.5	17.30	83.40	51.10	67.25	00.00	04.80	10.10



**Figure no.-2. Larval population of DBM, *Plutella xylostella* (Linn.) on cabbage during Rabi, 2022-23**

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