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Effect of Weather Parameters on Seasonal Activities of *Plutella xylostella* (L.) on Cabbage

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ABSTRACT: The field experiment was conducted at Horticulture Farm, S.K.N. College of Agriculture, Jobner, Rajasthan during two consecutive seasons *i.e. Rabi*, 2022-23 and *Rabi*, 2023-24. During investigation diamondback moth was reported as a major insect pest of cabbage crop. The infestation of diamondback moth was initiated from third week of December (51st SMW) and peaked in first week of February (6th SMW) and second week of February (7th SMW) in *Rabi*, 2022-23 and 2023-24 respectively. The correlation studies revealed that the *P. xylostella* population showed a significant positive correlation with maximum temperature (r = 0.57) and sunshine hours (r = 0.56) during *Rabi*, 2022-23. Whereas during 2023-24, it had a significant positive correlation with minimum temperature (r = 0.73).

Keywords: Diamondback moth, seasonal incidence, correlation, abiotic factors.

INTRODCTION

Cabbage [*Brassica oleracea var. capitata* (Linn.): Cruciferae] is one of most abundantly consumed cruciferous vegetable all over the world (Matharu and Mehta 2017)**.** It is an important cruciferous vegetable crop which growing mainly in *Rabi* season in India. It is cultivated extensively in the tropical and temperate regions of the world including India. It is one of the most popular and widely grown vegetable and has occupied second position in production after potato. It is a rich source of vitamin A, C and mineral including potassium, calcium, sodium and iron. It is good sources of protein (1.3 per cent) which contains all essential amino acids, particularly sulphur containing amino acids. Cabbage is commonly used as cooked vegetable. It also makes into a good salad mixed in tomato, green chillies, beet root, etc. Cabbage is used as boiled vegetable, salad, curries and pickles. The total area under cabbage cultivation in India is 432 thousand ha with an annual production of 10048.6 thousand metric tonnes, while in Rajasthan, the total area and annual production is 0.75 thousand ha and 7.48 thousand metric tonnes, respectively, (Anonymous, 2023). Cabbage crop is attacked by a number of insects *viz.*, tobacco caterpillar, *Spodoptera litura* (F.); diamondback moth, *Plutella xylostella* (L.); cabbage leaf webber, *Crocidolomia bionotalis* (Zell); aphid, *Lipaphis erysimi* (Kalt); painted bug, *Bagrada cruciferarum* (Kirk.) and flea beetle, (Goeze) Rao and Lal (2005) from sowing to harvest. Among the pest complex of cabbage, diamond back moth (Plutella xylostella Linn.) is the most destructive of cultivated cruciferous crops worldwide, Talekar and Shelton (1993). Kumar *et al.* (1983) reported 52 percent losses in marketable yield of cabbage due to the infestation of *Plutella xylostella*. Diamondback moth (DBM), *Plutella xylostella* (Lepidoptera: Plutellidae) is a serious pest and has a great economic importance worldwide. It was estimated that at least 53–80% loss in marketable yield is due to the DBM attack alone and loss could be more if the attack is severe. It has national importance on cabbage because it causes 50-80 per cent annual loss in the marketable yield. Krishnamoorthy (2004) reported 52 per cent losses in yield due to the attack of only diamondback moth. The knowledge of seasonal incidence of insect pests at different growth stages of cabbage crop will be helpful in evolving proper management schedule. The knowledge of seasonal incidence of insect pests at different growth stages of cabbage crop will be helpful in evolving proper management schedule. The information on seasonal incidence was however, generated by many workers (Sachan and Srivastava 1972; Shukla and Kumar 2004; Wagle *et al.*, 2005) from different regions of India. Hence, investigations on seasonal incidence of major pests of cabbage and their natural enemies in relation to weather parameters was undertaken and the results presented herein

MATERIALS AND METHODS

Cabbage cv. Golden Acre was transplanting in 60 × 45 cm spacing, divided into five plots each measuring 3 ×

2.25 m^2, at Horticulture Farm "S.K.N. College of Agriculture, Jobner (SKNAU, Jobner) Rajasthan, India during two consecutive years *i.e., Rabi*, 2022-23 and *Rabi*, 2023-24. The seed were sown on the seed beds on the marked lines and they were covered with the fine soil. The seed rate utilized was 600 g/ha (*i.e*., seedlings required for transplanting one hectare area field. No insecticidal treatment was applied at any stage of the crop growth. Observations on the larval population DBM was conducted on 25 randomly selected cabbage plants in an experimental field. These observations were carried out weekly, starting from the appearance of pests and continuing until the harvest of the crops. To estimate the larval population of diamondback moth, direct visual counting method was used (Lal, 1998). The observations were recorded at weekly interval throughout the crop growth on five randomly selected plants from each plot. The metrological data regarding weather parameters were collected from Metrological Observatory, Department of Agronomy (SKNAU, Jobner). The observations taken on the incidence of the pest of diamondback moth and there was correlated with weather parameters, *viz*., maximum and minimum temperature, relative humidity (morning and evening) and sunshine hours.

RESULTS AND DISCUSSION

Seasonal incidence of diamondback moth at different growth stages of the crop. The data presented in Table 1 and 2 indicate that the incidence of Diamond back moth, *P. xylostella* commenced in 3rd week of December (51th SMW) during both the years, *i.e*., *Rabi*, 2022-23 and 2023-24 with 1.24 and 1.20 larvae per plant, respectively. The incidence continued thereafter for a long period and reached to peak first week of February (6th SMW) with 4.44 and second week of February (7th SMW) with 4.84 larvae per plant during 2022-23 and 2023-24 respectively. The weather parameters indicated that the infestation of Diamond back moth on cabbage crop was started at maximum temperatures (25.5°C and 25 °C), minimum temperatures (4.6°C and 5.5°C), morning relative humidity (79 % and 68 %) evening relative humidity (37 % and 34 %) and sunshine hours (8.1 and 7 hrs. per day) during *Rabi*, 2022-23 and 2023-24, respectively. The maximum larval population of diamond back moth was recorded in first (5th SMW) and second (6th SMW) week of February (4.44 and 4.84 larvae per plant) at maximum temperature (26.9°C and 26.6°C) minimum temperatures (6.90°C and 7.2°C), morning relative humidity (82 % and 72 %), evening relative humidity (31 % and 29 %) and sunshine hours (9 and 7.2 hrs/ day) during *Rabi*, 2023-24, respectively. After reaching the peak, the population of diamond back moth started to decline and reached to low level in the 3rd week of March during both the years. The present results are in agreement with those of Jat *et al.* (2017a); Pallavi *et al.* (2023) who reported that the infestation of diamond back moth, *P. xylostella* was started in 2nd week of December during both the years and reached to its peak in the 5th and 6th SMW during both the years, respectively. The results are in agreement with those of Jat *et al.* (2017b), also reported that the population of diamond back moth peak during second week of February. Misra *et al.* (2017) ; Anitha & Kalasariya (2024) observed the incidence of *P. xylostella* was started in the 4th week of December (52nd SMW) and reached its peak in 3rd to 4th week of February (7th SMW) are in conformity of present finding. Similarly, Dhaked and Kumar (2019) reported that the diamond back moth was observed 3rd week of December (51th SMW) and 4th week of December (52nd SMW) during both the years, respectively and it's reached to peak level in 2nd week of February (7th SMW) and 3rd week of February (8th SMW) during both the years, respectively. The present findings are in similar relation with the findings of Patra *et al.* (2013); Saranya *et al.* (2017); Bhagat *et al.* (2018); Lal *et al.* (2020), reported that DBM initially appeared in the December and attained its peak in the different week of February.

Correlation study between population of diamondback moth and abiotic factors on cabbage. The larval population of *P. xylostella* showed positive significant correlation with maximum temperature (r= 0.57) and sunshine hours (r= 0.56) and non- significant correlation with minimum temperature (r= 0.46) whereas, non- significant negative correlation morning and evening relative humidity (r= -0.33, -0.41) during *Rabi*, 2022-23, whereas in 2023-24, it had significant positive correlation with minimum temperature (r= 0.73) while, non-significant positive correlation with maximum temperature (r= 0.17) and morning relative humidity (r= 0.04) and sunshine hours (r= 0.20) while, evening relative humidity showed non-significant negative correlation (r= -0.15). These findings are in close agreement with those of Venkateswarlu *et al.* (2011); Mahendran *et al.* (2017) who, observed a significant positive correlation of diamondback moth population with maximum temperature, minimum temperature and bright sunshine hours. Similarly, Jat *et al.* (2017b). The diamond back moth exhibited a positive significant correlation with temperature and negative non-significant correlation with humidity. The present findings are conformity with those of Sultana *et al*. (2019) reported that positive correlations between maximum temperature. While Gopika *et al.* (2022) reported that the diamondback moth had highly significant positive correlation with minimum temperature. Bhagat *et al.* (2018) revealed that there was no statistically significant correlation between DBM populations and various weather parameters, including maximum and minimum temperatures, relative humidity and sunshine hours. The present findings are also supported by Jat *et al.* (2017c); Anitha & Kalasariya (2024); Sharma *et al.* (2024), who reported a significant positive correlation between the diamondback moth population and bright sunshine hours.

Table 1: Seasonal incidence of diamondback moth, *Plutella xylostella* (L.) in relation to abiotic factors on cabbage *Rabi*, 2022-23.

Sr. No.	SMW*	Mean larval population of DBM/ plant	Temperature (°C)		Relative Humidity (%)		Bright Sunshine (hrs/ day)
			Max	Min.	Mor.	Eve.	
1.	51	1.24	25.5	4.6	79	37	8.1
2.	52	1.40	23.3	2.2	79	30	1.9
3.	1	1.48	20.7	-1	82	40	7.5
4.	2	1.96	24.5	4.9	75	35	7.3
5.	3	2.12	20.1	-0.5	77	33	8.3
6.	4	2.24	21.3	3.6	80	42	4.1
7.	5	3.20	22	5.2	83	54	7.3
8.	6	4.44	26.9	6.9	82	31	9
9.	7	4.24	28.4	5.8	76	26	9.4
10.	8	4.00	31.9	9.8	73	25	8.6
11.	9	3.80	32.1	12	70	28	8.8
12.	10	3.40	30.7	11.3	77	28	6.9
13.	11	2.80	32.8	13.8	79	32	6.7
14.	12	1.88	28.5	13.1	81	42	6.3
Correlation coefficient (r)			0.57*	0.46(NS)	-0.33(NS)	-0.41(NS)	0.56*

SMW- Standard metrological week; *Significant at 5% level and NS- Non significant

Table 2: Seasonal incidence of diamondback moth, *Plutella xylostella* (L.) in relation to abiotic factors on cabbage *Rabi*, 2023-24.

Sr. No.	SMW	Mean larval population of DBM/ plant	Temperature (^{0}C)		Relative Humidity (%)		Bright Sunshine (hrs/ day)
			Max	Min.	Mor.	Eve.	
1.	51	1.20	25	5.5	68	34	7
2.	52	1.60	25	4.9	79	42	6.4
3.	1	1.68	17	3.5	79	58	2.7
4.	2	1.88	21.9	3.3	76	37	5.3
5.	3	2.20	23.2	3.5	75	35	6.5
6.	4	2.44	24	4.3	73	32	7.1
7.	5	4.60	26	11.1	79	35	5.5
8.	6	4.72	22.9	6.6	73	33	7.8
9.	7	4.84	26.6	7.2	72	29	7.2
10.	8	4.44	28	10.4	73	34	8
11.	9	3.80	26.4	11.6	70	42	6.26
12.	10	3.60	28.3	8.9	68	52	8.21
13.	11	2.60	30.6	7.6	74	29	8.38
14.	12	1.80	34.07	13. 0	61.57	24.85	9.68
Correlation coefficient (r)			0.17 (NS)	0.73*	0.04 (NS)	-0.15(NS)	0.20

SMW- Standard metrological week; *Significant at 5% level and NS- Non significant

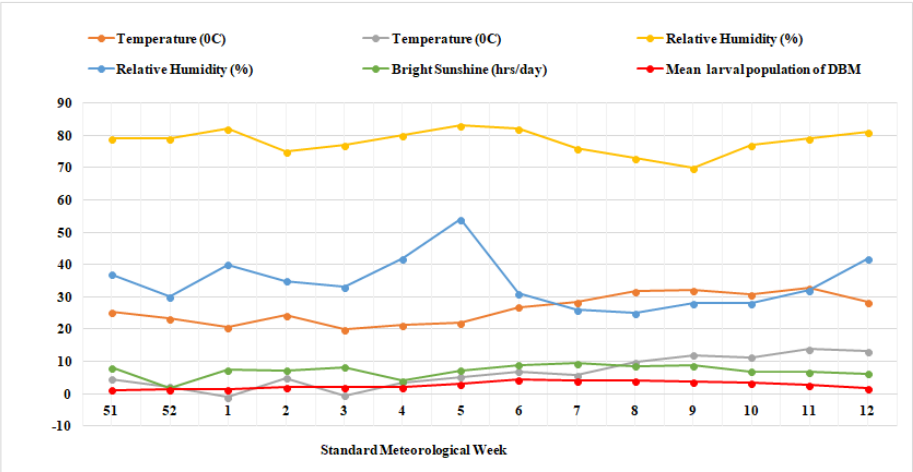

Fig. 1. Seasonal incidence of diamondback moth, *Plutella xylostella* (L.) in relation to abiotic factors on cabbage *Rabi*, 2022-23.

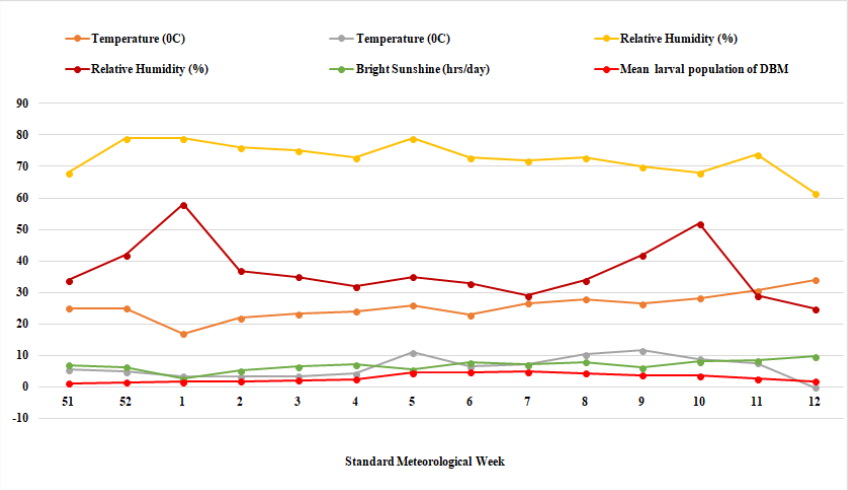

Fig. 2. Seasonal incidence of diamondback moth, *Plutella xylostella* (L.) in relation to abiotic factors on cabbage *Rabi*, 2023-24.

CONCLUSIONS

The present investigation made on seasonal incidence of diamondback moth in relation to abiotic factors on cabbage. The infestation of diamondback moth 3rd week of December (51th SMW) during both years. The population of diamondback moth gradually increased and reached to its peak in the first week of February (6th SMW) and second week of February (7th SMW) during 2022-23 and 2023-24 respectively. The population of diamondback moth was positively correlated with maximum temperature and sunshine in 2022-23 and it had also showed positively correlated with minimum temperature during 2023-24.

FUTURE SCOPE

According to the present findings of the investigation, there is a plenty of scope to build the studies that can enhance and implement proper effective management practices for the control of insect pests. This research would aid in the implementation of natural enemies and pest IPM tactics.

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