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Seasonal incidence of insect pests and their natural enemies on cabbage

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Abstract
The present study entitled "Seasonal incidence of insect pests and their natural enemies on cabbage" was conducted during *rabi* season 2024-25 at the farm of Krishi Vigyan Kendra, College of Agriculture, Dhule (Maharashtra). The study on seasonal incidence indicated that pest occurs during November to March in *rabi* 2024-25. The peak incidence of aphid was observed during fourth week of January *i.e.* 4th SMW (14.82 aphids/three leaves / plant), while, the incidence of tobacco leaf eating caterpillar and diamondback moth was at its peak during fifth week of January *i.e.* 5th SMW (4.40 larvae/plant and 9.80 larvae/plant respectively). The activity of coccinellid predator was at its peak during fourth week of January *i.e.* 4th SMW (2.80/plant). Among various climatic parameters, only evaporation showed a statistically significant positive correlation with the population of diamondback moth and ladybird beetles while, other meteorological factors showed no significant influence.

Keywords: Cabbage, aphids, diamondback moth, seasonal incidence, tobacco leaf eating caterpillar

Introduction

Cruciferous vegetables, especially cabbage (*Brassica oleracea* var. capitata), form an important component of *rabi* cropping systems in India. Cabbage, belonging to the family Brassicaceae having chromosome no 2n = 18 is known as cole crop. It is one of the most widely consumed vegetables globally. This crop is indigenous to the northern Mediterranean coast and Western Europe. A comparatively cool climate is ideal for its growth. It can withstand frost in the head stage. It can be grown in a wide range of sandy to heavy soils. It is used in multiple culinary forms, including salads, boiled dishes, curries, pickles and dehydrated products. China is the leading producer while, India ranks second in cabbage production.

Cabbage offers a nutrient-rich profile, providing vitamin A (2000 I.U.), B1 (50 I.U.) and C (124 mg/100gm), also it is low in calories 27 %, fat 0.1 % and carbohydrates 4.6 %. Additionally, it is good source of protein 1.3 % with all essential amino acids. Cabbage is an excellent source of minerals such as calcium 39 mg, iron 0.8mg, magnesium 10mg, sodium 14.1mg potassium 114mg and phosphorus 44 mg (Kumar *et al*., 2024) [7].

Cabbage cultivation faces significant challenges from insect pests and diseases, which severly impact the crop yields. The crop is attacked by a number of insects *viz*, tobacco leaf eating caterpillar (*Spodoptera litura* Fab), diamondback moth (*Plutella xylostella* Linn.), cabbage leaf webber (*Crocidolomia bionotalis*), aphids (*Brevicornye brassicae* and *Liphaphis Erysimi*), painted bug *(Bagrada cruciferarum*). The pest occurs in endemic form with high population densities on early and late sown cabbage. In case of severe infestation, the growing head are also damaged, affecting the production of marketable curds (Arora *et al.*, 2003) [1]. Constant pest monitoring is necessary to avoid unexpected outbreaks. Multiple approaches to pest management are utilized like biological, physical, mechanical, cultural and chemical control to mitigate sucking and lepidopterian pests in cabbage. Despite alternatives, chemical control is still the most commonly used method for managing cabbage pests. The excessive and irrational use of insecticides has led to several negative consequences, including pest resurgence and resistance, residues in food commodities. Given the economic importance of cabbage and the threats from insect pests, the study intends to evaluate the seasonal incidence of insect pests and their natural enemies along with their correlation with climatic factors.

Material and Methods

The investigation on seasonal incidence of insect pests and their natural enemies was carried out at the Agricultural farm of Krishi Vigyan Kendra, Dhule (Maharashtra)-424004 during *rabi* 2024-25. Dhule is situated at 20.9° North Latitude and 74.78° East Longitude and at a altitude of 787 feet (250 meters) above the mean sea level (MSL). The field was uniform with typical black cotton soil having good drainage. The cabbage crop (variety: Euro 2) was sown on 27th October 2024 and transplanted on 19th November 2024, with a spacing of 90 x 30 cm^2. The crop was cultivated following the standard agronomic practices in Maharashtra, India.

To know the seasonal incidence, the population of insect pests were recorded weekly from the beginning of transplanting up till harvest. 5 plants were tagged in each plot from compact block. The observation on aphid population were recorded on upper and lower side of the leaf surface for three leaves per plant. For lepidopteron pest *viz.*, diamondback moth and tobacco leaf eating caterpillar, the number of larvae per plant was recorded. Similarly, to record the population density of natural enemies *viz*., lady bird beetle, the counts were made on per plant basis on tagged 05 plants at weekly intervals. During the experimentation, the weather parameters *viz.*, maximum and minimum temperatures, relative humidity and sunshine hours were recorded and the pest population was correlated with the meteorological factors.

Result and Discussion

1. Seasonal incidence of insect pests and their natural enemies on cabbage

Various pests were found infesting the cabbage crop during *rabi* 2024-25 like aphid (Brevicoryne brassicae), diamondback moth (*Plutella xylostella* L.), tobacco leaf eating caterpillar (*Spodoptera litura* F.) and the natural enemies *viz.*, coccinellid beetle (Coccinella *septempunctata*). It is presented in Table 1 and depicted in Fig.1.

1.1 **Aphid (*Brevicoryne brassicae*)**

During *rabi*, aphid population were observed from the 1st week of December (49th SMW) of the year. As season progressed, it was gradually started increasing from 51th SMW and the infestation was high during the 4th week of January (4th SMW) which was 14.82 aphids/three leaves / plant. These highest population aligned with particular meterological conditions, with 31.20º and 10.70º C of maximum and minimum temperatures respectively, the morning relative humidity was 89%, evening relative humidity 37% with 7.30 hours of sunshine, 7.3 hrs sunshine hours, 7.8 mm evaporation and 1.3 km/hr of wind speed. After that, it was decreased gradually up to harvesting. The results of present observations are corroborative with Vadluri *et al*. (2023) [12] opined that peak infestation started at 2nd week of January. Garai Koushik (2024) [3] findings stated that the aphid populations gradually increased from 51st SMW.

Plate 1: Population of Aphid, *Brevicoryne brassicae*

1.2 Diamondback moth (*Plutella xylostella* L.)

During *rabi*, the larval populations of diamondback moth commenced from the 50th SMW (0.66 larvae/plant), the peak infestation was observed in the 5th SMW (9.80 larvae/plant) when the maximum and minimum temperature was 33º C and 11ºC respectively, with 88% morning relative humidity, 37% evening relative humidity, 7.8 sunshine hours, 7.7 mm of evaporation and 1.6 km/hr of wind speed. Vadluri *et al*., (2023) [12] revealed that DBM reached its peak at last week of January (4th SMW). Shyam *et al*., (2020) [11] observed that peak incidence of diamondback moth larvae was during 5th SMW. The present findings agree with above researchers.

Plate 2: Larvae of diamondback moth, *Plutella xylostella* L.

1.3 Tobacco Leaf eating Caterpillar (*Spodoptera litura* F.)

During *rabi*, the larvae of tobacco leaf eating caterpillar commenced from 52nd standard week (1.20 larvae/plant), reached its highest level in the 5th SMW (4.40 larvae/plant) when the maximum and minimum temperature was 33º C and 11ºC respectively, with 88% morning relative humidity, 37% evening relative humidity, 7.8 sunshine hours, 7.7 mm of evaporation and 1.6 km/hr of wind speed. Shigwan *et al*., (2022) [10] found that the peak incidence was during 4th SMW. These results are similar to above researchers. Pushpalatha *et al*., (2023) [8] observed that peak incidence was noticed during 3rd SMW.

Plate 3: Larvae of tobacco leaf eating caterpillar, *Spodoptera litura* FF.

1.4 Coccinellid beetle

The observations on seasonal occurance of coccinellid beetle shows that the beetle first commenced during 50th SMW (0.40/plant), attained the highest population during 4th SMW (2.80/plant), with 31.20º and 10.70º C of maximum and minimum temperature respectively, the morning relative humidity was 89%, evening relative humidity 37% with 7.30 hours of sunshine, 7.3 hrs sunshine hours, 7.8 mm evaporation and 1.3 km/hr of wind speed. Yadav and Agrawal (2019) [13] stated that the first appearance of *Coccinella septempunctata* started from 50th SMW. Sharma *et al*., (2017) [9] stated that population of coccinellids was at peak in 4th SMW.

Correlation of weather parameters with insect pests and their natural enemies on cabbage

The data on the average population of aphid, diamondback moth, tobacco leaf eating caterpillar and coccinellid

predator were noted during field conditions and correlated with abiotic factors such as minimum and maximum temperature, morning and evening relative humidity, rainfall and rainy days, evaporation, wind speed and sunshine hours. Pearson's correlation coefficient values (r) was used to determine the relation between pest populations and meteorological parameters and depicted in table 2.

The correlation study on aphid population showed positive non-significant correlation with maximum temperature (r= 0.027), morning relative humidity (r= 0.208), sunshine hours (r= 0.099) and evaporation (r= 0.191). It shown negative non-significant relationship with minimum temperature (r= -0.111), evening relative humidity (r= -0.313), rainfall (r=-0.041) and wind speed (r= -0.323). The results of present observations are corroborative with Gawali *et al*., (2023) [4] who reported that the aphid population had positive non-significant correlation with maximum temperature, morning relative humidity and sunshine hours. And negative non-significant correlation with minimum temperature. Isaq *et al*., (2023) [5] also noticed that aphid population had a significant and negatively correlated with evening relative humidity and minimum temperature.

The correlation study on average larval population of diamondback moth showed positively non-significant correlation with maximum temperature (r= 0.099), morning relative humidity (r= 0.012), sunshine hours (r= 0.032) and positive significant with evaporation (r=0.632**). It shown negatively non-significant correlation with minimum temperature (r= -0.006), evening relative humidity (r= -0.187), rainfall (r= -0.161), rainy days (r= -0.161) and wind speed (r= -0.024). The results of present observations are corroborative with Vadluri *et al*., (2023) [12] who reported that negatively non-significant correlation with minimum temperature, evening relative humidity and positively non-significant correlation with morning relative humidity. Kant *et al*., (2023) [6] also stated that significant positive correlation with morning relative humidity and significant negative correlation with wind speed.

The correlation study on average larval population of tobacco leaf eating caterpillar showed positively non-significant correlation with maximum temperature (r= 0.049), morning relative humidity (r= 0.126) and sunshine hours (r= 0.039). Also, it has positively non-significant correlation with evaporation (r= 0.355). The larval population has negatively non-significant correlation with minimum temperature (r= -0.013), evening relative humidity (r= -0.168), rainfall (r= -0.099), rainy days (r= -0.099) and wind speed (r= -0.178). The results of present observations are corroborative with Isaq *et al*., (2023) [5] who noticed that evening relative humidity and minimum temperature had negative correlation with the larvae of tobacco leaf eating caterpillar population. Gawali *et al*., (2023) [4] also opined that tobacco leaf eating caterpillar had positive non-significant correlation with maximum temperature, morning relative humidity and sunshine hours.

The correlation study on ladybird beetle population revealed positively non-significant correlation with maximum temperature (r= 0.076), morning relative humidity (r= 0.058), sunshine hours (r= 0.093) and positively significant with evaporation (r= 0.504*). However, it showed negatively non-significant correlation with minimum temperature (r= -0.061), evening relative humidity (r= -0.309), rainfall (r= -0.129), rainy days (r= -0.129) and wind speed (r= -0.043). The results of present observations are corroborative with Gaikwad *et al*., (2018) [2] also stated that lady bird beetle had positive non-significant correlation with maximum temperature, morning relative humidity, sunshine hours and negative non- significant correlation with minimum temperature.

Table 1: Seasonal incidence of insect pests and their natural enemies on cabbage during *rabi 2024*-25

Month	SMW*	Aphid/ three leaves/plant	DBM larvae/ Plant	Tobacco leaf eating caterpillar/ plant	Ladybirdbeetle Predator/plant	Temperature (ºC)		Relative Humidity (%)		Total rainfall (mm)	Rainy days	BSS (hrs)	EVP (mm)	Wind Speed (km/hr)
						Max	Min	Morning	Evening					
November	47	00	00	00	00	30.4	11	89	35	0	0	5.2	6.7	1.2
	48	00	00	00	00	28.6	8.1	89	33	0	0	6.1	6.5	1.4
December	49	1.20	00	00	00	30.1	14.3	89	46	0	0	3.6	5.9	2.1
	50	0.90	0.66	00	0.40	28	5.8	85	38	0	0	7.4	6.6	1.8
	51	7.46	2.80	00	1.20	29.9	6.2	88	32	0	0	6.2	6	3.2
	52	5.20	2.40	1.20	0.82	28.6	13.5	90	43	2.6	1	2	4.2	1.2
January	1	11.84	5.12	3.40	1.60	30.3	9.2	89	36	0	0	6.5	6.2	1.9
	2	10.00	7.22	3.80	1.80	26.9	7.4	89	36	0	0	3.1	6	2.2
	3	12.18	8.14	3.60	2.40	29.4	9.9	87	37	0	0	4.7	6.8	1.8
	4	14.82	9.10	3.50	2.80	31.2	10.7	89	37	0	0	7.3	7.8	1.3
	5	14.50	9.80	4.40	2.60	33	11	88	37	0	0	7.8	7.7	1.6
February	6	10.24	9.30	2.80	2.40	31.2	11.6	85	37	0	0	6.8	7.4	1.8
	7	2.12	7.40	1.60	1.60	28.5	10.1	89	41	0	0	1.5	7.6	3.1
	8	3.46	5.60	1.80	1.80	30.4	9.5	87	36	0	0	7.2	7.6	3.3
	9	1.96	3.90	2.40	1.40	34.3	13.7	85	39	0	0	7.9	7.5	4
March	10	0.60	1.80	1.00	0.00	34.8	12.3	83	46	0	0	8.7	6.5	3.5

Table 2: Correlation between insect pests' population on cabbage with weather parameters

Pests	Correlation coefficient values (r)								
	Temperature (oC)		Relative humidity (%)		Rainfall (mm)	Rainy days	Sunshine (hrs.)	Evaporation (mm)	Wind speed (kmp)
	Maximum	Minimum	Morning	Evening					
Aphids	0.027	-0.111	0.208	-0.313	-0.041	-0.041	0.099	0.191	-0.323
Diamondback moth	0.099	-0.006	0.012	-0.187	-0.161	-0.161	0.032	0.632**	-0.024
Tobacco leaf eating caterpillar	0.049	-0.013	0.126	-0.168	-0.099	-0.099	0.039	0.355	-0.178
Coccinelid beetle	0.076	-0.061	0.058	-0.309	-0.129	-0.129	0.093	0.504*	-0.043

*- significant at 5%

**- significant at 1%

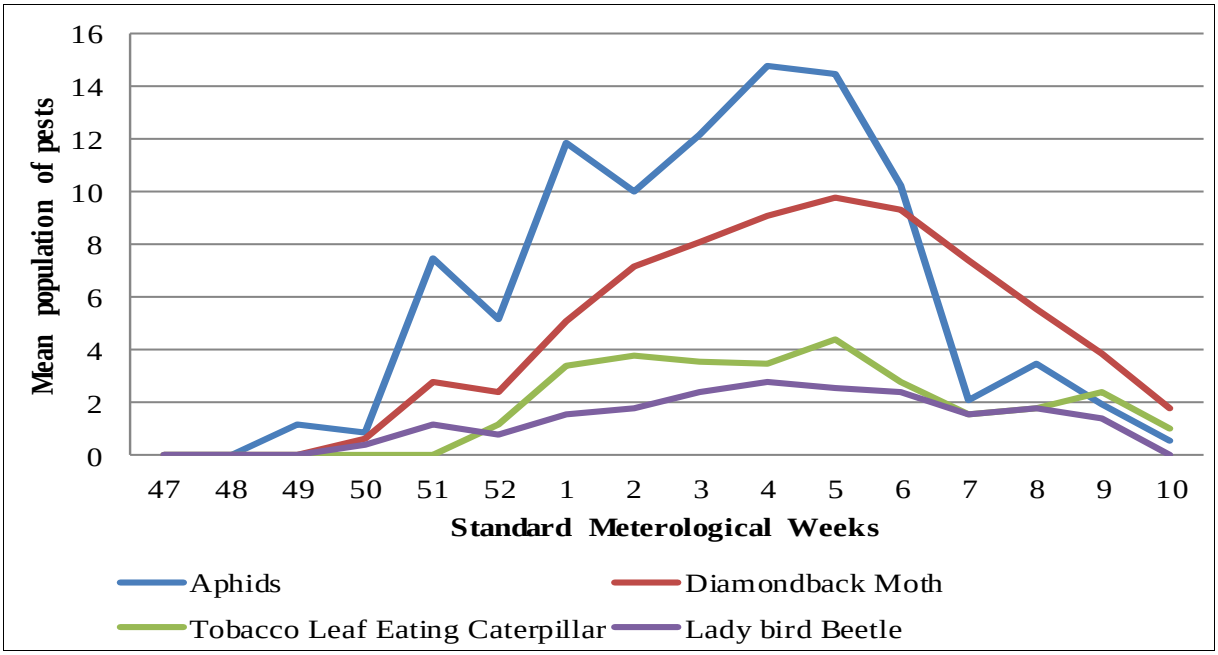

Fig 1: Seasonal incidence of insect pests and their natural enemies on cabbage during *rabi* 2024-25

Conclusion

Based on the findings of this study, the following conclusions are drawn. The major insect pests infesting cabbage crop were diamondback moth, tobacco leaf eating caterpillar, aphid with lady bird beetle observed as a potential biological control agent and commenced from 50th, 52nd, 49th and 50th SMW respectively. The highest population of diamondback moth, tobacco leaf eating caterpillar, aphid and lady bird beetle was noticed during 5th, 5th, 4th and 4th SMW respectively. At 1% significance level, diamondback moth shown significant positive correlation with evaporation. It is clear from the non-significant correlation between climatic factors and different insect pests that weather parameters did not significantly impact on cabbage pests during the *rabi* season.

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