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SEASONAL INCIDENCE OF INSECT PESTS IN CAULIFLOWER (*Brassica oleraceae* L VAR. *BOTRYTIS*)

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ABSTRACT

Studies were undertaken to establish the seasonal incidence insect pests in cauliflower during *rabi*, 2018-19 and 2019-20 at College Farm, College of Agriculture, Rajendranagar. During both these years, the population of aphids and leaf webber was high while the incidence of other pests viz., diamondback moth, painted bug and tobacco caterpillar was very low. The incidence of aphids was noticed during 47th SMW during both the years. In the first year, there was a gradual increase in aphid population peaking during 1st SMW (115/3leaves/plant) while in the second year, there was a sudden increase in population peaking early i.e.; by 51st SMW (122.2/3leaves/plant) with a slight decline before reaching the second peak (142.6/3 leaves/plant) during 2nd SMW. Leaf webber incidence was noticed in the 48th SMW during both the years. However, in 2018-19 single peak occurred during 52nd SMW while in 2019-20, two peaks were noticed, the first during 51st SMW and the second during 2nd SMW. The head borer damage was noticed during 2nd SMW during both the years. The peak damage was attained by the end of 6th SMW recording 30 per cent damage during 2018-19 and 38 per cent damage during 2019-20. The natural enemy population was also recorded simultaneously during both the years. Aphids and leaf webber showed a negative correlation with temperature, windspeed and evaporation and positive correlation with morning RH and sunshine. The predators viz., coccinellids and syrphids exhibited a negative correlation with maximum and minimum temperatures and windspeed while showing positive correlation with morning RH and evaporation. The predators were found to be dependent on the density of aphids and showed positive correlation with aphid population.

Key words : Leaf webber, Aphids, Cauliflower (*Brassica oleraceae* L var. *botrytis*), Coccinellids, Syrphids.

Introduction

Cauliflower (*Brassica oleraceae* L var. *botrytis*) is one of the most important winter vegetables. It is a source of vitamins (A, B and C) and minerals, low in fat and rich in dietary fibre. It is consumed as vegetable in curries, soups and pickles. In 2017-18, India produced about 86,68,220 mt of cauliflower from 4,52,590 ha area with an average productivity of 19.15 mt ha⁻¹. Bihar, Uttar Pradesh, West Bengal, Orissa, Assam, Haryana, Rajasthan and Maharashtra are the major cauliflower growing states. In Telangana, the area under cauliflower is 1.58 thousand ha with a total production of 3.18 thousand mt and average productivity of 20.21 mt ha⁻¹ (<https://www.indiastat.com>). Insect pests such as diamond back moth (DBM) *Plutella xylostella*

(Linnaeus), tobacco caterpillar *Spodoptera litura* (Fabricius), leaf webber *Crocicidolomia binotalis* (Zeller), head borer *Hellula undalis* (Fabricius), aphid *Brevicoryne brassicae* (Linnaeus), mustard aphid *Lipaphis erysimi* (Kaltenbach) (Yadav and Malik, 2014) cause serious economic damage to the crop. Studies on the seasonal incidence pattern and population dynamics of major pests and their natural enemies is crucial for developing a successful and effective management of insects in cauliflower. Hence, the present study was carried out.

Materials and Methods

Field trials were taken up during *rabi*, 2018-19 and 2019-20 at College Farm (17.32' N, 78.40' E), College of Agriculture, Rajendranagar. The nursery of cauliflower

var. Dhaval F₁ 043 was sown in the second fortnight of September during both the years, and after one month, the seedlings were transplanted in the main field at 60 cm × 45 cm spacing in 200 sq m. plot on ridges and furrows. All the recommended package of practices (Vyavasaya Panchangam, 2018) for raising the healthy crop were followed except insecticidal sprays. Fifty plants were randomly selected and observations on incidence of insect pests and their natural enemies at weekly intervals were recorded as follows.

Number/3 Leaves/plant (aphids); Number of larvae/plant (leaf webber, diamondback moth and tobacco caterpillar); Number of grubs or adults/ plant (coccinellids and syrphids). The data obtained in the seasonal incidence of insect pests of cauliflower and their natural enemies were subjected to correlation and multiple regression with various weather parameters viz., maximum and minimum temperature (°C), maximum and minimum relative humidity (%), rainfall (mm) and sunshine (hrs), which prevailed during the crop growth period of 2018-19 and 2019-20 by following the technique suggested by Panse and Sukhatme (1978).

Results and Discussion

During both the years, the population of aphids and leaf webber was high while the incidence of other pests viz., diamondback moth, painted bug and tobacco caterpillar was very low. The aphids infestation was recorded during 47th SMW during both these years. A single peak was noticed in the 1st SMW (115/3leaves/plant) during 2018-19, while two peaks were recorded during 2019-20, the first in the 51st SMW (122.2/3leaves/plant) and the second in the 2nd SMW (142.6/3leaves/

plant). The leaf webber incidence was recorded in the 48th SMW during both the years (Table 1). However, in 2018-19, a single peak was noticed in the 52nd SMW (4.8 larvae/plant) while in 2019-20, two peaks were observed, the first during 51st SMW (5.4 larvae/plant) and the second during 2nd SMW (6.4 larvae/plant), similar to aphids. The head borer damage was noticed in the 2nd SMW during both the years recording 30 and 38 per cent damage during 2018-19 and 2019-20, respectively. The natural enemy population was also recorded simultaneously during both the years. In 2018-19, coccinellids were observed in the 50th SMW with the population reaching its peak in the 2nd SMW (1.20/plant) while in 2019-20, it peaked during 1st SMW (1.40/plant). The incidence of syrphids initiated during 49th SMW and the population peaked in the 2nd SMW (2.40 and 2.90/plant) during both the years (Table 1).

Similar to our findings, Bhede *et al.* (2018) reported that the incidence of aphid *B. brassicae* initiated from 48th SMW and reached its peak in 52nd SMW (114.35/leaf) during 2015-16, while in 2016-17, the aphid was first noticed during 50th SMW and reached its first peak (84.70/leaf) during 1st SMW and second peak (126.10/leaf) during 6th SMW. Aishwarya *et al.* (2018) reported that leaf webber larvae appeared in the last week of November (47th SMW) and reached peak of 7 larvae per plant in 48th SMW although the temperatures were relatively slightly higher (31.5°C and 10.1°C) than observed in our study. They also observed head borer incidence from 47th SMW, it reached peak during 3rd SMW. The maximum and minimum temperatures during the peak period of incidence were 28.9°C and 11.5°C, respectively.

Table 1 : Seasonal incidence of insect pests and natural enemies in cauliflower during *rabi*, 2018-19.

Standard Meteorological Week (SMW)	Aphids (no./3 leaves/ plant)		Leafwebber (no./plant)		Head borer (% damage)		Coccinellids no./plant)		Syrphids (no./plant)	
	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20	2018-19	2019-20
46	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
47	2.60	5.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
48	10.60	26.8	0.08	0.46	0.00	0.00	0.00	0.00	0.00	0.00
49	49.72	59.4	0.66	0.80	0.00	0.00	0.00	0.04	0.06	0.06
50	51.80	98.8	1.20	2.80	0.00	0.00	0.02	0.16	0.20	0.20
51	68.00	122.2	2.60	5.40	0.00	0.00	0.14	0.40	0.78	0.50
52	89.80	109.2	4.80	5.20	0.00	0.00	0.48	1.10	1.60	1.20
1	115.00	102.4	4.20	5.00	0.00	0.00	0.74	1.40	2.00	2.40
2	109.20	142.6	3.40	6.40	2.00	4.00	1.20	1.20	2.40	2.90
3	102.60	118.0	3.20	5.60	4.00	12.00	0.92	1.08	1.30	2.60
4	98.40	114.4	0.96	4.80	10.00	18.00	0.68	0.80	0.64	2.05
5	56.60	60.8	0.40	2.00	20.00	26.00	0.30	0.30	0.22	1.50
6	38.80	40.2	0.06	0.60	30.00	38.00	0.10	0.26	0.18	0.40

Table 2 : Correlation of insect pests in cauliflower with abiotic parameters and natural enemies with abiotic and biotic parameters.

Abiotic/biotic parameters											
	Maximum temperature (°C)	Minimum temperature (°C)	Mean temperature (°C)	Morning relative humidity (RH I) (%)	Evening relative humidity (RH II) (%)	Rainfall (mm)	Rainy days (R.D.)	Sunshine (hrs)	Wind speed (Km/hr)	Evaporation (E.pan) (mm)	Aphids
Aphids	-0.353	-0.227	-0.338	0.269	0.033	0.103	0.064	0.039	-0.354	-0.217	-
Leaf webber	-0.276	-0.114	-0.210	0.170	-0.046	-0.129	-0.158	0.086	-0.448*	-0.258	-
Coccinellids	-0.140	-0.159	0.199	0.055	0.014	0.099	0.077	0.119	-0.366	-0.045	0.816***
Syrphids	-0.074	-0.186	-0.198	0.003	-0.129	-0.058	-0.080	0.186	-0.266	0.013	0.785***

* Significant at 5% level

** Significant at 1% level

*** Significant at 0.5% level

Aphids and leaf webber showed a negative correlation with temperature, wind speed and evaporation and positive correlation with morning RH and sunshine. The predators viz., coccinellids and syrphids exhibited a negative correlation with maximum and minimum temperatures and wind speed while showing positive correlation with morning RH and evaporation. The predators were found to be dependent on the density of aphids and showed positive correlation with aphid population (Table 2). Also, Bhagat *et al.* (2018) reported that maximum, minimum and average temperature showed negative non-significant correlation with aphids in cabbage. Bhede (2017) also reported non-significant negative correlation of minimum temperature with leaf webber. However, Gaikwad *et al.* (2018) reported that leaf webber exhibited significant negative correlation with minimum temperature while it showed non-significant positive correlation with morning RH and sunshine. They also reported syrphid that maggots appeared during 48th SMW, reached peak (4.52/plant) during 52nd SMW and were significantly negatively correlated with minimum temperature.

Multiple linear regression equation was developed for aphids and leaf webber (Table 3). The abiotic factors contributed for 29.77 and 27.27 per cent of total variation in the population of aphids and leaf webber in cauliflower. Similarly, multiple linear regression equation was developed for coccinellids and syrphids with abiotic and biotic factors (aphids). The abiotic factors and biotic factors (aphids) contributed to 79.47 and 80.30 per cent of total variation in the population of coccinellids and syrphids on cauliflower.

Thus, it can be summarized that the aphids and leaf webber occurred early in late October transplanted cauliflower while other lepidopteran pests (diamondback moth and tobacco caterpillar) and bugs during mid growth stage, while head borer damage occurred at later stages i.e.; curd formation stage. However, the incidence of aphids and leaf webber was high while that of other pests was low. Aphids and leaf webber showed a negative correlation with temperature, wind speed and evaporation and positive correlation with morning RH and sunshine. The predators viz., coccinellids and syrphids exhibited a negative correlation with maximum and minimum temperatures and windspeed while showing positive correlation with morning RH and evaporation. The predators were found to be dependent on the density of aphids and showed positive correlation with aphid population.

Table 3 : Multiple linear regression of insect pests with abiotic and natural enemies with abiotic and biotic parameters.

Insects	Regression equation	R ² value
Aphids	$Y=128.76 + (-4.32) X_1 + 2.72 X_2 + (-9.37) X_3 + 2.17 X_4 + (-0.11) X_5 + 1.12 X_6 + 2.34 X_7 + (-0.81) X_8 + (-10.47) X_9 + 17.91 X_{10}$	0.2977
Leaf webber	$Y=21.97 + 0.75 X_1 + 1.56 X_2 + (-2.86) X_3 + 0.03 X_4 + (-0.10) X_5 + 0.007 X_6 + (-0.183) X_7 + (-0.05) X_8 + (-0.48) X_9 + 0.46 X_{10}$	0.2727
Coccinellids	$Y=-1.61 + 2.08 X_1 + 1.93 X_2 + (-3.94) X_3 + (-0.01) X_4 + 0.01 X_5 + (-0.04) X_6 + 0.44 X_7 + (-0.04) X_8 + (-0.02) X_9 + (-0.01) X_{10} + 0.008 X_{11*}$	0.7947
Syrphids	$Y=2.82 + 6.26 X_1 + 6.28 X_2 + (-12.49) X_3 + (-0.03) X_4 + (-0.02) X_5 + (-0.07) X_6 + 0.60 X_7 + (-0.1) X_8 + 0.10 X_9 + 0.068 X_{10} + 0.02 X_{11*}$	0.8030

Y=Dependent variable, X_1 = Max. Temp.(°C), X_2 = Min. Temp.(°C), X_3 = Mean Temp.(°C), X_4 = Morning RH (%), X_5 = Evening RH (%), X_6 = Rainfall(mm), X_7 = Rainy days, X_8 = Sunshine (hours), X_9 = Wind speed (Kmph) , X_{10} = Evaporation(mm) and X_{11*} = Aphids.

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