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Influence of abiotic factors on the seasonal incidence of major insect pests on cauliflower

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Abstract
An experiment was conducted to observe the influence of abiotic factors on the incidence of insect pests *viz.*, diamond back moth, tobacco leaf eating caterpillar, aphids and painted bugs on cauliflower during late-*kharif* season, 2016 at Farm of Agricultural Entomology Section, College of Agriculture, Dhule. Major activity period of diamond back moth (*Plutella xylostella*) was observed from 35th to 39th SMW with peak incidence in 39th SMW (7.32 larvae/plant) and tobacco leaf eating caterpillar (*Spodoptera litura)* was observed from 35th to 47th SMW with peak incidence in 43rd SMW (3.12 larvae/plant) respectively while aphids (*Brevicoryne brassicae)* appeared from 35th SMW to 47th SMW with peak incidence in 43rd SMW (44.17 aphids/3 leaves/plant). Painted bugs (*Bagrada cruciferarum)* were observed from 35th to 47th SMW with peak incidence in 42nd SMW (4.23 painted bugs/3 leaves/plants). Analysis of correlation between weather (abiotic) factors and the insect pests of okra showed that population of diamond back moth had a significant positive correlation with minimum temperature (r=0.6475*) and evening RH (r=0.5578*), While tobacco leaf eating caterpillar, aphids and painted bugs showed non-significant relationship with weather parameters.

Keywords: DBM, Aphids, Coccinellids, Abiotic factors, Cauliflower

Introduction
Cole crops are one of the most abundantly consumed vegetable all over the world. They belong to genus *Brassica* of the family Brassicaceae. This group includes a wide variety of vegetable crops. The two major crops of this group are cauliflower (*Brassica oleraceae* L. var *botrytis*) and cabbage (*Brassica oleraceae* L. var *capitata*). Serving 100 g of raw cauliflower provides 25 calories of energy, 5 g of carbohydrates, 0.3 g of fats, and 1.9 g of proteins. It has a high content of vitamin C (48.2 mg), moderate levels of several B vitamins and vitamin K (15.5 µg). Cauliflower contains several phytochemicals, common in the cabbage family, that are under preliminary research for their potential properties, including isothiocyanates and glucosinolates [3].
Cauliflower crop is attacked by a number of insects *viz*, Tobacco caterpillar (*Spodoptera litura*), Diamond back Moth (*Plutella xylostella*), cabbage leaf Webber (*Crocidolomia binotalis*), aphids (*Brevicoryne brassicae*) and *Lipaphis erysimi*, painted bug (*Bagrada cruciferarum*) and flea beetle (*Phyllotreta cruciferae*) from sowing to harvest. [7]
The knowledge of the seasonal incidence of insect pests at different growth stages of cauliflower crop will be helpful in evolving proper management schedule. The information on seasonal incidence was however, generated by many workers [9, 10, 11, 12] from different regions of India. Hence, investigations on seasonal incidence of major pests of cauliflower in relation to weather parameters were undertaken and the results are presented herein.

Materials and Methods
The research work was carried out in late-*kharif* season, 2016 at the experimental farm of Entomology Section, College of Agriculture, Dhule-424004, (Maharashtra). The experiment on seasonal incidence of major pests of cauliflower in relation to weather parameters was laid in three quadrates of plot size 3.00 m x 3.00 m. Spacing adopted was 60 cm x 45 cm. Cauliflower plants of variety Rimzim were transplanted on 15th August 2016. The crop was grown under protective irrigation. Five plants were tagged from each quadrate and the observations were taken from these tagged plants. Population of sucking pests i.e. aphids and painted bugs (total nymphs + adults) were recorded on three leaves per plant *viz*., each from 1 upper, 1 middle and 1 lower plant canopy. Population of chewing pests i.e. diamond back

moth and tobacco leaf eating caterpillar were recorded as larval counts from the tagged plants. Observations of weather data (Maximum & Minimum temperature, morning & evening relative humidity and total rainfall per week) were recorded on a weekly basis from meteorological observatory.
Statistical analysis of the Correlation of the abiotic (weather) factors on major insects was worked out.

Results and Discussion

1. Seasonal incidence of insect pests of cauliflower.

Diamondback moth (*Plutella xylostella* L.)

During late-*kharif*, the larval population of diamond back moth first appeared in the 35th SMW and reached to its peak (7.32 larvae/plant) in the 39th SMW with the 32.9 ^{0}C maximum and 21.5 ^{0}C minimum temperature, 84 per cent morning and 54 per cent evening relative humidity and 23.0 mm rainfall. Thereafter the population started declining from 40th SMW.

The present findings are in confirmation with Ahmad and Ansari (2010) [1] who reported peak incidence of Diamond back moth in III week of September. Ahmad *et al.* (2015) [2] also obtained similar results.

Tobacco leaf eating caterpillar (*Spodoptera litura* F.)

The data on the seasonal incidence of Tobacco caterpillar (*Spodoptera litura*) during late-*kharif* season are presented in table 3. It is evident that the pest commenced from the 35th SMW and continued till 47th SMW which ranged from 0.38 to 3.12 larvae/plant and exist in the field with 0.38 larvae/plant during 47th SMW. However, the highest peak activity (3.12 larvae/plant) was recorded in the 43rd SMW coinciding with the fourth week of October. There was a gradual decrease in the larval population from the fifth week of October and subsidized in next three weeks.

Palande *et al.* (2004) [5] studied the seasonal incidence of cabbage pests in relation to weather and reported that the tobacco leaf eating caterpillar, *Spodoptera litura* occurred in kharif and part of rabi seasons and these results are in confirmation with present investigation.

Aphids (*Brevicoryne brassicae* L.)

The data on population of aphids are presented in table 1. It reveals that the pest commenced from last week of August 0.66 aphids/3 leaves/plant and gradually increased up to fourth week of October (i.e. 44.17 aphids/3 leaves/plant). There was a gradual decrease in population in fifth week of October and subsidized in next three weeks. The existed maximum and minimum temperature, morning and evening relative humidity and rainfall are 32.9 & 15.8 (ºC), 74.3 & 27.3(%) and 0.00 (mm) respectively in 43rd SMW.

The present findings are in confirmation with Raja *et al.* (2014) [6] who reported that the peak incidence of *Brevicoryne brassicae* was in September and also reported that the severity of aphid infestation has been reported to be inconsistent in different crop seasons on brassica. Rohilla *et al.* (1987) [8] reported peak aphid infestation in the last week of February while Aslam (2005) [4] reported peak aphid infestion in the second week of March. Palande *et al.* (2004) [5] reported from the findings that aphid infestation is location specific and governed with the seasonal effect of weather conditions.

Painted Bugs (*Bagrada cruciferarum* K.)

The data on population of painted bugs are presented in table 1. It is evident from the data that the occurrence of painted bugs commenced from 35th SMW and continued till 47th SMW which ranged from 0.53-4.23 painted bugs/ 3 leaves/plant. The incidence of painted bugs gradually increased from last week of August (0.53 painted bugs/ 3 leaves/ plant) to third week of October (4.23 painted bugs/ 3 leaves/plant). The population decreased in the next five weeks from 4.23 to 0.64 painted bugs/3 leaves/plant.

The present findings are in confirmation with Raja *et al.* (2014) [6] who reported that the maximum population of painted bugs was in the month of October-November.

2. Correlation of weather factors on population build up of pests

The data on average population of diamond back moth, *Spodoptera litura*, aphids and painted bugs recorded under field conditions were correlated with meteorological parameters such as maximum and minimum temperature, morning and evening relative humidity and rainfall. The Pearson's correlation coefficient values (r) were computed. These are narrated in table 2.

The correlation between incidence of diamondback moth (r=-0.031) were negatively, non-significant with maximum temperature (T_{max}), whereas (r=0.648*) positively significant with minimum temperature (T_{min}) at 5 per cent level of significance. The morning relative humidity shows positive and non-significant correlation with the occurrence of diamondback moth (r=0.420) and the evening relative humidity showed positive and significant correlation at 5 per cent level of significance (r=0.558*). The rainfall had positive but non-significant effect at 5 per cent and 1 per cent level of significance with diamond back moth.

The correlation between incidence of tobacco leaf eating caterpillar were positively, non-significant with both maximum temperature (T_{max}) (r=0.006) and minimum temperature (T_{min}) (r=0.122). The morning relative humidity (r=-0.124) and evening relative humidity (r=-0.122) showed negative and non-significant correlation with the occurrence of tobacco leaf eating caterpillar. The rainfall had negative but non-significant effect at 5 and 1 per cent level of significance with tobacco leaf eating caterpillar.

The correlation between incidence of aphids were negatively non-significant with both maximum temperature (T_{max}) (r=-0.179) and minimum temperature (T_{min}) (r=-0.248). The morning relative humidity (r=-0.362) and evening relative humidity (r=-0.423) showed negative and non-significant correlation with occurrences of aphids. The rainfall had negative and non-significant effect at 1 and 5 per cent level of significance with an incidence of aphids.

The correlation between incidence of painted bugs (r=-0.281) were negatively non-significant with maximum temperature (T_{max}), whereas (r=0.031) positively non-significant with minimum temperature (T_{min}). The morning relative humidity (r=-0.172) and evening relative humidity (r=-0.233) both showed negative and non-significant correlations with occurrences of painted bugs. The rainfall had negative but non-significant effect at 5 and 1 per cent level of significance with painted bugs.

Table 1: Seasonal incidence of pests on cauliflower

Month	SMW	DBM	Tobacco leaf eating caterpillar	Aphids	Painted Bugs	Temperature (^{0}C)		RH (%)		RF (mm)
						Max	Min	Mor.	Eve.	
Aug	34	0	0	0	0	0	31.3	21.3	86.9	63
	35	0.16	0.46	0.66	0.53	0	32.1	22.1	90.1	63.9
Sep	36	2.01	0.6	1.89	0.67	0	31.3	18.9	86.3	56.3
	37	4.23	1.06	5.13	1.21	1.4	33.3	22.8	82.6	55.3
	38	6.31	1.73	5.32	1.91	2.5	30.9	22.2	88.7	66.6
	39	7.32	2.06	16.3	1.95	4.2	32.9	21.5	84	54
Oct	40	5.92	1.66	25.21	2.45	5.4	30.5	20.9	90	76.3
	41	4.2	2.12	32.89	3.21	7.8	31.4	19.1	91.9	51.7
	42	3.33	2.25	38.14	4.23	15.0	29.5	17.5	75.7	25.6
	43	2.86	3.12	44.17	3.75	19.2	32.9	15.8	74.3	27.3
	44	2.14	2.42	37.6	3.26	25.0	31.9	12.3	69.4	22.7
Nov	45	1.32	1.09	19.73	1.54	14.2	31.9	11.9	60.3	16.9
	46	0.88	0.41	12.88	0.75	7.0	31.2	11.5	75.6	26.9
	47	0.32	0.38	4.21	0.64	3.5	31.9	10.1	79.1	25.6

*SMW= standard meteorological week

Table 2: Correlation between major pests of cauliflower with weather parameters

Pests	Correlation coefficient values (r)				
	Temperature (ºC)		Relative humidity (%)		Rainfall (mm)
	Maximum	Minimum	Morning	Evening	
Diamond back Moth	-0.0313	0.6475*	0.4204	0.5578*	0.1484
Spodoptera litura	0.0056	0.1229	-0.1236	-0.1219	-0.2141
Aphids	-0.1790	-0.2475	-0.362	-0.423	-0.388
Painted Bugs	-0.2184	0.0092	-0.1718	-0.2230	-0.2874

**- significant at 1%,*- significant at 5%

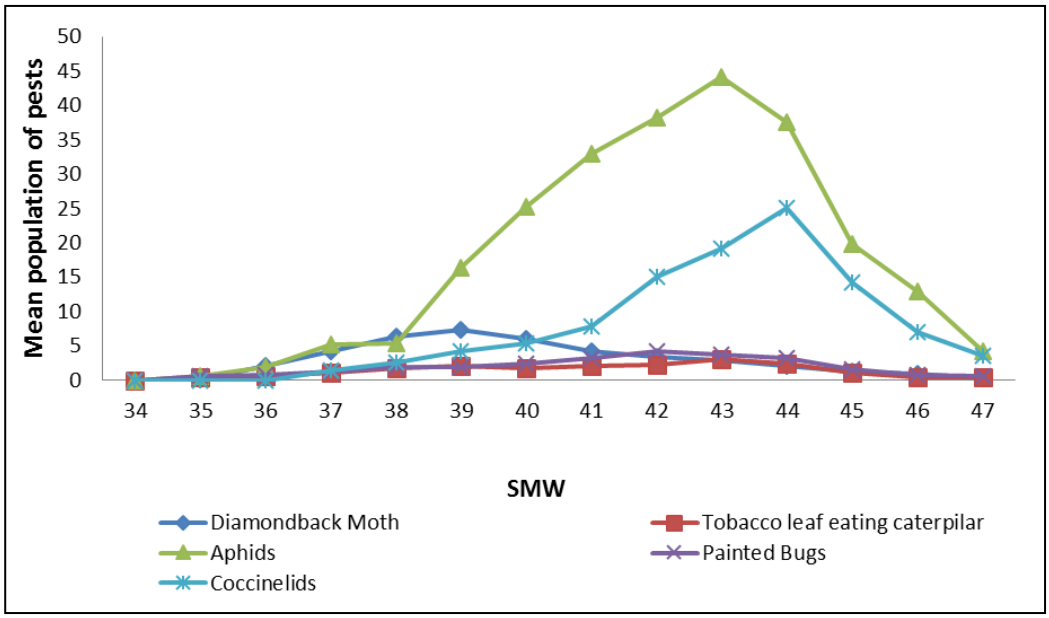

Fig 1: Seasonal incidence of insect pests on Cauliflower in Aug-Nov 2016

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