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Influence of Temperature and Humidity on the Incidence of Certain Pests of Cauliflower

G Sheshagirirao, P V Krishnayya, M S V Chalam and V Srinivas Rao
Department of Entomology, Agricultural College, Bapatla 522 101 A P

ABSTRACT

A field experiment was conducted to study the seasonal incidence of tobacco caterpillar, *Spodoptera litura* (Fab.), diamondback moth, *Plutella xylostella* (Linn.) and aphid *Brevicoryne brassicae* (Linn.) on cauliflower at Agricultural College Farm, Bapatla during *rabi,* 2008-09. The incidence was recorded at weekly intervals from a total of fourty plants from four different locations in the field. The peak incidence of *S. litura* (21.0 larvae/10 plants) on cauliflower was noticed during the last week of December, 2008, while in case of *P. xylostella* (17.2 larvae/10 plants) it was during the first week of January, 2009 and *B. brassicae* (18.3 aphids/10 plants) was during the first week of January, 2009. The relationship between the populations of *S. litura larvae* and the aphids, and the morning relative humidity was negative but significant. Where as the relationship between the *P. xylostella* larval population and, the morning relative humidity and maximum temperature was significantly positive and negative, respectively.

Key words : *Brevicoryne brassicae*, Cauliflowe, *Plutella xylostella, Spodoptera litura*.

Cauliflower *(Brassica oleracea* var.*botrytis* Linn.*)* is one of the highly nutritive and economically important vegetable crops of India. In the world, India ranks first in the production of cauliflower. In India it is cultivated in an area of 0.29 m.ha with a production of 5.26 m.t (http:// www. Indiastat.com).

Cauliflower requires a cool, moist growing season. It cannot withstand low temperatures, or too much heat, dry weather and low humidity. However, the crop suffers severely by insect pests like, diamondback moth (DBM), *Plutella xylostella* Linn, tobacco caterpillar, *Spodoptera litura* (Fabricius) and aphids, *Brevicoryne brassicae* Linn (Srinivasan, 1994). Among these pests, DBM is a serious pest which infests the crop from seedling to harvest stages of the crop. The damage caused by this pest is severe in place where Cole crops are grown round the year on extensive scale. The pest causes damage worth one million rupees all over the world (Gujar, 1999).The incidence and damage of DBM is now found to be the most devastating in all cole crops growing areas causing 50-80 per cent loss in yield thus enjoying the pest status of national importance (Srinivasan and Krishnakumar, 1982). Equally, *S. litura* is also notorious polyphagous pest. Hence, the present investigation is made to understand the influence of weather factors on the incidence of these insect pests on cauliflower.

MATERIAL AND METHODS

The present investigation was conducted under field conditions at Agriculture College Farm, Bapatla, during *rabi,* 2008-2009. The pest population was counted at weekly intervals from 40 randomly selected plants each from four different locations in the bulk plantation starting from their incidence. The larvae of *S. litura* and *P. xylostella* per plant, and the nymphs and adults of *B. brassicae* from three leaves one each from bottom, middle and top of ten randomly tagged plants were counted (Church and Strickland, 1954).

The meteorological data on maximum and minimum temperatures, and morning and evening relative humidity was recorded to correlate with the incidence of the pests. The correlation and simple linear regression analysis was adopted to know the relationship between weather parameters and pest incidence.

RESULTS AND DISCUSSION

Spodoptera litura **:**

The data indicated that the initial occurrence of *S. litura* (Table 1) was during the first week of December, 2008 (49th Std. week) *i.e.,* at 25 days after transplanting (DAT) with 9.9 larvae per 10 plants. The prevailing average maximum and minimum temperatures during the period were 30.4 and 19.6^{0}C,

Table 1. Influence of weather parameters on the incidence of certain insect pests on cauliflower during *rabi*, 2008-2009

Standard Week.	Date of observation	Mean temperature(°C)		Mean relative humidity (%)		S. litura	P. xylostella	B. brassicae
		Maximum	Minimum	Morning	Evening	Mean larval population/ 10 plants	Mean larval population/ 10 plants	Mean population/ 10 plants
49	07thDec.,2008	30.4	19.6	92.1	72.9	9.9	0.0	8.0
50	14thDec.,2008	30.5	18.7	92.1	61.9	13.2	6.0	12.4
51	21thDec.,2008	30.6	18.3	91.1	74.3	17.0	8.4	14.7
52	28thDec.,2008	29.9	17.4	90.3	66.0	21.0	13.0	15.2
01	04thJan.,2009	29.7	18.2	88.1	63.9	18.9	17.2	18.3
02	11thJan.,2009	30.2	17.0	91.6	55.4	14.5	13.6	16.6
03	18thJan.,2009	30.0	16.7	91.9	72.3	10.8	10.2	13.5
04	25thJan.,2009	30.4	17.0	92.6	71.3	7.3	7.6	10.7

respectively. While the average morning and evening relative humidities were 92.1% and 72.9%, respectively. Thereafter the population gradually increased and reached the peak during the last week of December,2008 (52nd Std. week) *i.e.,* at 46 DAT with 21.0 larvae/10 plants. During the period of peak incidence the average maximum and minimum temperatures were 29.9^{0}C and 17.4^{0}C, respectively. While the average morning and evening relative humidities were 90.3% and 66.0%, respectively. There after incidence of pest gradually declined and reached at minimum level of 7.3 larvae/10 plants by the last week of January, 2009 (4th Std. week) *i.e.,* 74 DAT, a few days prior to final curd harvest. The prevailing average maximum and minimum temperatures during this period were 30.4^{0}C and 17.0^{0}C, respectively and the average morning and evening relative humidities were 92.6% and 71.3%, respectively. The present findings are in conformity with the studies of Arati *et al*. (2008) who reported that peak incidence of *S. litura* (15 larvae/ plant) during the month of January with 29.5^0 and 15.7^{0}C maximum and minimum temperatures, respectively.

Correlation studies between the larval population and the major weather parameters indicated negative and non-significant relation between the larval population and maximum and minimum temperatures (r = -0.4282 and -0.0282 respectively), and evening relative humidity (r = -0.3298), whereas the relationship between the larval population and the morning relative humidity was negative but significant (r = -0.7887) at 5 per cent level (Table 2). The results of the present study are in close agreement with findings of Murthy (1994) who reported negative association between the larval population and the maximum, minimum temperatures, and evening relative humidity.

***Plutella xylostella* :**

The initial incidence of *P. xylostella* (Table 1) was during the second week of December, 2008 (50th Std. week) *i.e.,* at 32 DAT with mean number of 6.0 larvae per 10 plants. The prevailing average maximum and minimum temperatures during the period were 30.5 and 18.7^{0}C, respectively. While, the average morning and evening relative humidities were 92.1% and 61.9%, respectively. Thereafter the population gradually increased and reached the peak during the first week of January, 2009 (1st Std. week) *i.e.,* 53 DAT with 17.2 larvae/10 plants. During the

Table 2. Simple correlation and Multiple linear regression between larval population of *S. litura* on cauliflower and weather parameters during *rabi*, 2008-2009

Variable	Weather parameters	Correlation coefficient (*r*)	Partial regression coefficient	Standard error	t-value
X_1	Maximum temperature (^{0}C)	-0.4282NS	5.6695795	9.2174244	0.6150937NS
X_2	Minimum temperature (^{0}C)	-0.0282NS	-0.6423742	1.9565662	0.3283171NS
X_3	Morning relative humidity (%)	-0.7887*	-3.3606830	1.8372854	0.8291568NS
X_4	Evening relative humidity (%)	-0.3298NS	-0.1323104	0.2452439	0.5395052NS

$Y = 169.6587 + 5.6695795\ X_1 - 0.6423742\ X_2 - 3.3606830\ X_3 - 0.1323104\ X_4$

Intercept (a) = 169.6587, per cent of variation attributed to the regression (R^2) = 0.6839671
NS: Non significant, * Significant at 5% leve

Table 3. Simple correlation and Multiple linear regression between larval population of *P. xylostella* on cauliflower and weather parameters during *rabi*, 2008-2009

Variable	Weather parameters	Correlation coefficient (*r*)	Partial regression coefficient	Standard error	t-value
X_1	Maximum temperature (^{0}C)	-0.7693*	3.6319170	0.8870894	4.0941954*
X_2	Minimum temperature (^{0}C)	-0.5807NS	-3.4389334	0.1883009	18.2629700*
X_3	Morning relative humidity (%)	0.7450*	-3.2127445	0.1768212	18.1694489*
X_4	Evening relative humidity (%)	-0.5136NS	-0.2039489	0.0236024	8.6410275*

$Y = 267.9764 + 3.6379170^*\ X_1 - 3.438934^*\ X_2 - 3.2127445^*\ X_3 - 0.2039489^*\ X_4$

Intercept (a) = 267.9764, per cent of variation attributed to the regression (R^2) = 0.9976932
NS: Non significant, * Significant at 5% level

period of peak incidence the average maximum and minimum temperatures were 29.7 and 18.2^{0}C, respectively and the average morning and evening relative humidities were 88.1% and 63.9, respectively. There after the incidence of *P. xylostella* gradually declined and reached minimum level of 7.6 larvae/ 10 plants by the last week of January, 2009 (4th Std. week) *i.e.,* 74 DAT a few days prior to final curd harvest. The prevailing average maximum and minimum temperatures during this period were 30.4^{0}C and 17.0^{0}C, respectively and the average morning and evening relative humidities were 92.6% and 71.3%, respectively. The present findings are in conformity with the studies of Varalakshmi (2004) reported that the incidence (2.6 larvae / plant) of *P. xylostella* commenced during the first week of December, 2003 and reached its peak (9.6 larvae / plant) during the second week of January, 2004.

Correlation studies between the larval population and the maximum temperature indicated that the relation was negative but significant, while the relation between the larval population and, the minimum temperature and evening relative humidity were negative and non significant (r = -0.580 and -0.5136 respectively), where as the relationship between the larval population and the morning relative humidity

Table 4. Simple correlation and Multiple linear regression between larval population of *B. brassicae* on cauliflower and weather parameters during *rabi*, 2008-2009

Variable	Weather parameters	Correlation coefficient (*r*)	Partial regression coefficient	Standard error	t-value
X_1	Maximum temperature (^{0}C)	-0.6311NS	5.3747644	2.8207374	1.9054466NS
X_2	Minimum temperature (^{0}C)	-0.4094NS	-1.9531416	0.5987529	3.2620164*
X_3	Morning relative humidity (%)	-0.7642*	-2.4826865	0.5622503	4.4156256*
X_4	Evening relative humidity (%)	-0.5464NS	-0.1727651	0.0750501	2.3019974NS

$Y = 124.2226 + 5.3747644\ X_1 - 1.9531416^*\ X_2 - 2.4826865^*\ X_3 - 0.1727651\ X_{4-}$

Intercept (a) = 124.2226, per cent of variation attributed to the regression (R^2) = 0.9396358
NS: Non significant, * Significant at 5% level

was positive and significant (r = 0.7450) at 5 per cent level (Table 3). The results of the present study are in close agreement with findings of Soujanya (2003) who reported negative association between the larval population and the maximum temperature, minimum temperature and evening relative humidity but positive correlation with the morning relative humidity.

***Brevicoryne brassicae* :**

The incidence of *B. brassicae* (Table 1) was during the first week of December, 2008) (49th Std. week) *i.e.,* at 25 (DAT) with 8.0 aphids per 10 plants. The prevailing average maximum and minimum temperatures during the period were 30.4 and 19.6^{0}C, respectively. While the average morning and evening relative humidities were 92.1% and 72.9%, respectively. Thereafter the population gradually increased and reached the peak during the first week of January, 2009. (1st Std. week) *i.e.,* at 53 DAT with 18.3 aphids /10 plants. During the period of peak incidence the average maximum and minimum temperatures were 29.7^{0}C and 18.2^{0}C, respectively, and average morning and evening relative humidities were 88.1% and 63.9%, respectively. Then gradual decline in the population of aphids was observed and reached a minimum level of 10.7 aphids/10 plants by the last week of January, 2009) (4th Std. week) *i.e.,*75 DAT, a few days prior to final curd harvest. The prevailing average maximum and minimum temperatures during the period were 30.4^{0}C and 17.0^{0}C, respectively and the average morning and evening relative humidities were 92.6% and 71.3%, respectively. The present findings are in conformity with the studies of Ghosh and Ghosh (1981) and Saharia (1984) who, reported that the peak level of pest incidence in the second week of January (2.63 aphids/ plant).

The results indicated negative and non significant relation between the larval population and maximum temperature, minimum temperature (r = -0.6311 and -0.4094, respectively) and evening relative humidity (r = -0.5464). Whereas the relationship between the aphid population and the morning relative humidity was negative but significant (r = -0.7642) at 5 per cent level (Table 4). The results of the present study are in close agreement with findings of Mulik *et al.* (2000) who reported that negative association between the aphid population and maximum, minimum temperatures.

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