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SEASONAL INCIDENCE OF PLUME MOTH, *EXELASTIS ATOMOSA* (LEPIDOPTERA: PTEROPHORIDAE) ON LONG DURATION PIGEONPEA, *CAJANUS CAJAN*

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ABSTRACT

The present research was aimed to study the incidence pattern of plume moth, *Exelastis atomosa* during *Kharif* 2015-16 and 2016-17 for long duration on pigeonpea cv. Bahar. The results revealed that the incidence of pod bug started from the 5th standard week during 2015-16 and from 6th standard week during 2016-17 and it remained active up to 15thstandard week of both the years. The *E. atomosa* population attained its peak level during 11th standard week of both the years i.e., 1.73 larvae/ plant and 1.6 larvae/ plant respectively. Correlation studies indicated that population of *E. atomosa* exhibited a significant positive correlation with maximum and minimum temperatures and wind velocity whereas a significant negative correlation was established with average relative humidity. Other abiotic factors had no significant effect on this insect pest population. The regression equation revealed that variations of different weather variables caused approximately 85.3 and 75.9 per cent variations in *E. atomosa* population during both years, respectively.

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KEY WORDS : *Exelastis atomosa,* Incidence, Pigeonpea, Plume moth.

Introduction

Pigeonpea, *Cajanus cajan* Millsp. is a perennial legume belonging to family Fabaceae[3]. It is the second most important pulse crop grown in India after chickpea[15]. Though, India accounts for more than 90 per cent of the world's pigeonpea production and area[13], the productivity has always been a concern[8]. Among the various reasons attributing to low production and productivity the insect pests continue to be one of the most important constraints to pigeonpea production throughout its distribution[14,18]. More than 200 species of insect pests are found to be attacking pigeonpea, of which the pod borer complex, feeding on flowers, pods and seeds is of key concern in the pigeonpea growing countries[4,5].

The plume moth along with the other members of the pod borer complex comprising of gram pod borer, *Helicoverpa armigera*, pod fly *Melanagromyza obtusa*, legume pod borer, *Maruca vitrata*, pod sucking bug *Clavigralla gibbosa* and blue butterfly *Lampides boeticus* significantly reduces the crop yield to an extent of 60 to 90 percent[21,24]. Particularly, *E. atomosa* often assume greater significance and are recognized as the major constraints in productivity[17]. The plume moth has been more commonly found on medium to long duration genotypes of pigeonpea causing economic damage and warrants management strategies utilized in those areas[9,19]. The larva of *E. atomosa* is green or greenish brown with spines radiating all over the body from tubercles and feeds on flower buds and seeds of pods by remaining outside and small holes are seen in the buds and tender pods. The extent of yield loss induced by

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TABLE-1: Correlation between weather parameters and *E. atomosa* population during *Kharif* 2015-17.

Weather Parameters	*E. atomosa* populations	
	2015-16	2016-17
Maximum temperature (ºC)	0.726**	0.626*
Minimum temperature (ºC)	0.669**	0.686**
Average relative humidity (%)	- 0.691**	- 0.608*
Rainfall (mm)	- 0.188 ns	- 0.462 ns
Sunshine (hours)	0.376 ns	0.212 ns
Wind velocity (km/hr)	0.676**	0.645**

*Correlation is significant at the 0.05 level (Two-tailed), ** Correlation is significant at 0.01 level (Two-tailed), ns = non significant

TABLE- 2: Multiple regressions of *E. atomosa* population with weather parameters during *Kharif* 2015-16.

Multiple regression	Temperature (ºC)		Average Relative humidity (%) (X_3)	Rainfall (mm) (X_4)	Sunshine hours (X_5)	Wind Velocity (km/hr) (X_6)
	Maximum (X_1)	Minimum (X_2)				
Coefficient	0.074	0.138	0.091	-0.056	0.618	0.156
Standard Error	0.168	0.166	0.038	0.015	0.249	0.151
T value	0.437	0.830	2.380	-3.838	2.485	1.030
F value	7.742					
R^2	0.853					
Regression equation	$Y_1 = -11.615 + 0.074 (X_1) + 0.138 (X_2) + 0.091 (X_3) – 0.056 (X_4) + 0.618 (X_5) +0.156 (X_6)$					

Y_1 = *E. atomosa* population (2015-16), X_1= Maximum temperature (ºC), X_2 = Minimum temperature (ºC), X_3 = Average relative humidity (%), X_4 = Rainfall (mm), X_5 = Sunshine (hours), X_6 = Wind velocity (km/hr)

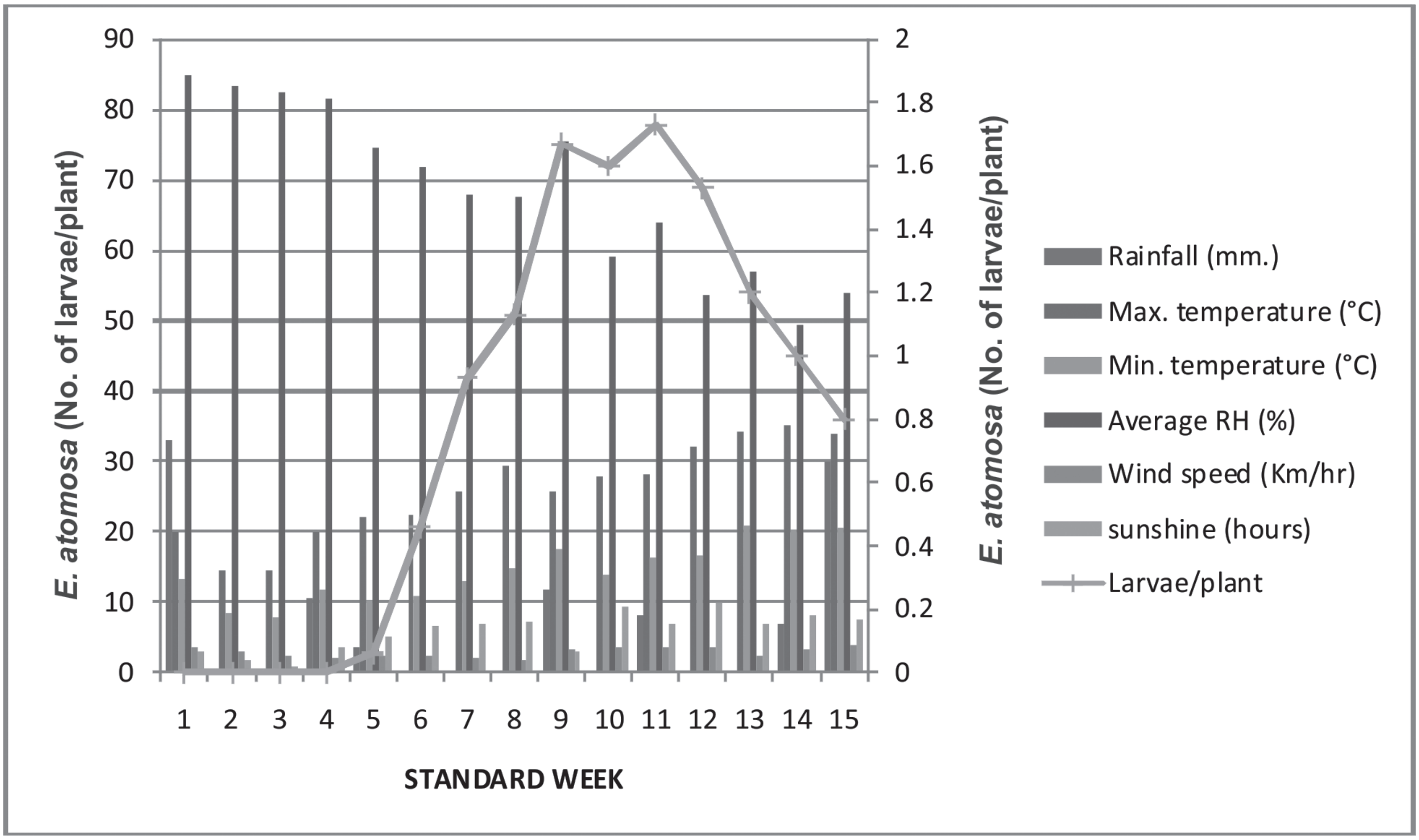

Fig. 1 : ***E. atomosa*** **population fluctuation in relation to meteorological parameters during 2015-16**

plume moth has been found to be ranging from 5%-10% in pigeonpea[21]. It has been reported to be an important pest in Varanasi region of Uttar Pradesh along with the other three lepidopteran pigeonpea pod borers i.e. *H. armigera, L. boeticus* and *Pammene critica*[22].

The main reasons for its prevalence in this region can be attributed to the indiscriminate use of insecticides, monocropping, introduction of early maturing pigeonpea cultivars and presence of favourable temperature and humidity conditions during reproductive stage of the crop. So, an appropriate management strategy has to be prepared to combat against this pest. Moreover, for development of successful pest management strategies, detailed information on the population build up, in particular the influence of weather factors on the population dynamics is of great significance[12]. Hence, an attempt has been made to investigate the effect of abiotic factors on the population buildup of *E. atomosa* on long duration pigeonpea in Varanasi region of India.

Materials and Methods

To study the seasonal incidence of *E. atomosa* on pigeonpea, field experiments were conducted at Agriculture Research Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi during *Kharif* 2015-16 and 2016-17. Long duration pigeonpea cultivar Bahar was used for the study and the crop field was kept free from pesticide sprays. The population of *E. atomosa* was recorded on five randomly selected plants from three middle rows of the plot at weekly intervals starting from 50 per cent flowering stage of the crop for studying the incidence pattern of the pest. The influence of weather parameters on population of *E. atomosa* was also worked out. For this, the data was subjected to correlation and regression analysis with weather parameters *viz*., rainfall, maximum and minimum temperatures, average relative humidity, sunshine hours and wind velocity in respect of the corresponding standard week. The meteorological data for the above analysis were obtained from the meteorological observatory of the university. The significance of simple correlation was estimated by using *t*-test[20] and the regression equations were derived by using the formula[16].

Results and Discussion

The results obtained from the present study along with the relevant discussions have been provided under the following heads:

Incidence pattern of plume moth, *E. atomosa*

During 2015-16, the first incidence of *E. atomosa* was recorded in 5th standard week. The population persisted in the field from 5th to 15th standard week. The population of plume moth attained its peak level during 11th standard week (1.73 larvae/ plant) followed by 9th standard week (1.67 larvae/ plant). The lowest mean population of plume moth was recorded on 5th standard week (0.06 larvae/ plant) (Fig. 1). Similarly, during 2016-17 the first incidence of *E. atomosa* was observed in 6th standard week. The population persisted in the field from 6th to 15th standard week. The population of plume moth attained its peak level during 11th standard week (1.6 larvae/ plant) followed by 10th standard week (1.53 larvae/ plant). The lowest mean population of plume moth was recorded on 6th standard week (0.26 larvae/ plant) (Fig. 2).

The present results are in accordance with the findings[7] who claimed that the larval population of plume moth was highest in 12th standard week (0.13 larvae/plant) followed by 11th standard week (0.11 larvae/plant) while there was no infestation during 4th to 8th standard weeks in 2007-08. Workers[17] also reported that the first incidence of plume moth was observed in 4th and 5th standard week in all genotypes and the peak of population of *E. atomosa* was recorded from 11th to 12th standard week. *E. atomosa* has been found to be most active from the 2nd week of November to 2nd week of February with peak during last week of December and thus these findings partially supports the findings of the present investigation[1]. Similar trends were also observed for other lepidopteran borers on pigeonpea[6,10].

Influence of weather parameters on population buildup of plume moth, *E. atomosa*

Simple correlation was worked out between the meteorological parameters and *E. atomosa* population in order to ascertain the influence of different abiotic factors on the population buildup of this insect pest. The analytical data on correlation coefficient during 2015-16 indicated that population of *E. atomosa* exhibited a highly significant positive correlation with maximum temperature (r = 0.726**), minimum temperature (r = 0.669**) and wind velocity (r = 0.676**) whereas a highly significant negative relationship was found with average relative humidity (r = - 0.691**). The other abiotic factors did

TABLE 3: Multiple regressions of *E. atomosa* population with weather parameters during *Kharif* 2016-17.

Multiple regression	Temperature (ºC)		Average Relative humidity (%) (X_3)	Rainfall (mm) (X_4)	Sunshine hours (X_5)	Wind Velocity (km/hr) (X_6)
	Maximum (X_1)	Minimum (X_2)				
Coefficient	0.005	0.046	0.009	-0.050	0.004	0.153
Standard Error	0.104	0.097	0.019	0.025	0.120	0.085
T value	0.047	0.475	0.490	-2.034	0.031	1.795
F value	4.205					
R^2	0.759					
Regression equation	Y_2 =-1.822 + 0.005 (X_1) + 0.046 (X_2) + 0.009 (X_3) – 0.050 (X_4) + 0.004 (X_5) + 0.153 (X_6)					

Y_2 = *E. atomosa* population (2016-17), **X_1**= Maximum temperature (ºC), **X_2** = Minimum temperature (ºC), **X_3** = Average relative humidity (%), **X_4** = Rainfall (mm), **X_5** = Sunshine (hours), **X_6** = Wind velocity (km/hr)

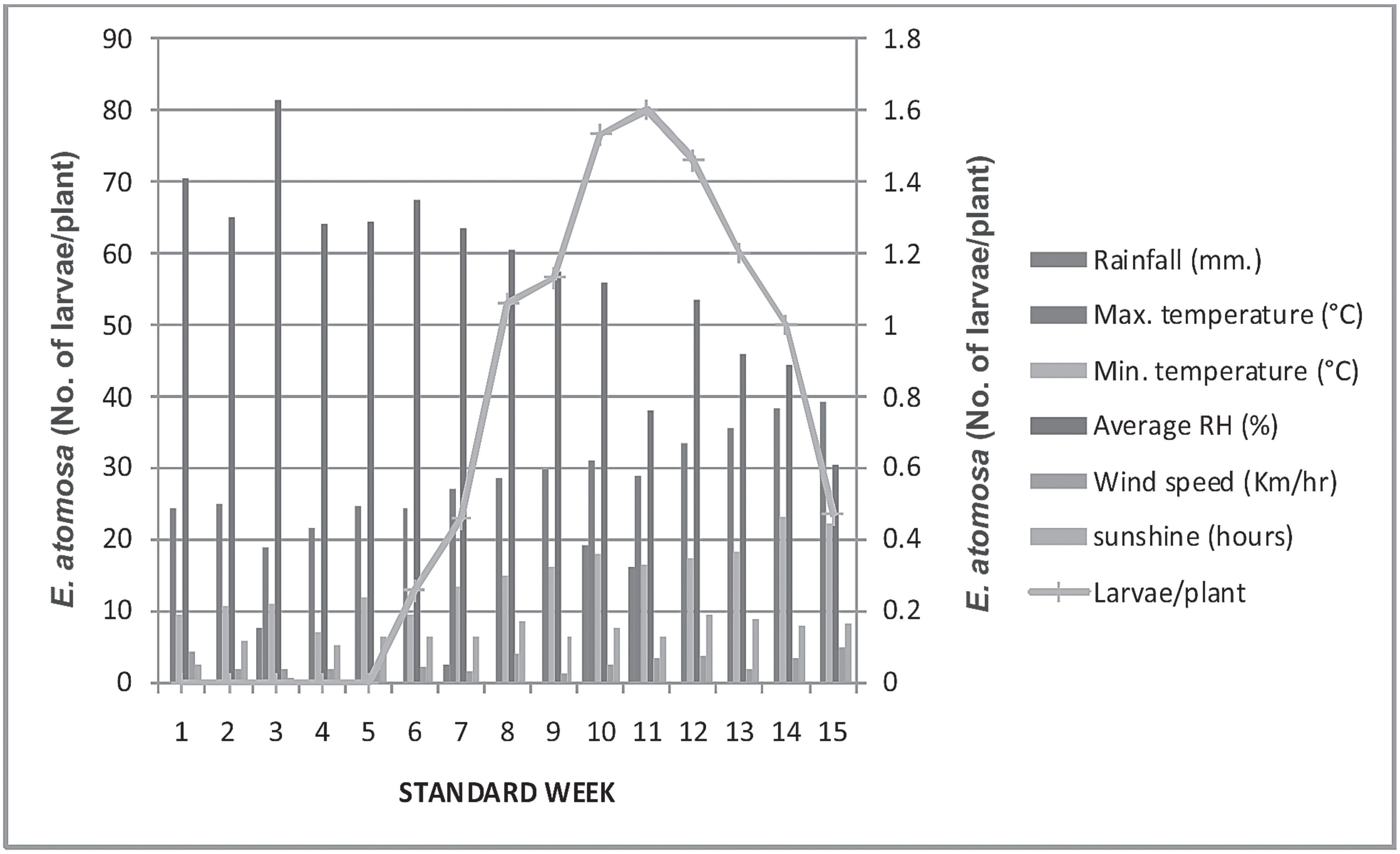

Fig. 2: ***E. atomosa*** **population fluctuation in relation to meteorological parameters during 2016-17**

not show any significant impact on incidence of the pest (Table-1). Similarly during 2016-17, the results showed that there was a positive significant association of the pest population with maximum temperature (r = 0.626*) and highly positive association with minimum temperature (r = 0.686**) and wind velocity (r = 0.645**) while a significant negative relationship was exhibited with average relative humidity (r = - 0.608*). Correlation coefficient with other abiotic factors was found to be non-significant (Table-1).

The regression coefficient revealed that the various abiotic factors were found to be most influencing factor, which contributed (R^2= 0.853 and 0.759) 85.3 and 75.9 per cent variation in *E. atomosa* population during both the years, respectively. The regression equation was fitted to study the effectiveness of weather parameters of 2015-16 and indicated that for increase in every 1°C of maximum and minimum temperature, one per cent of relative humidity, one hour of sunshine and one km/hr of wind velocity there would be an increase of 0.074, 0.138, 0.091, 0.618 and 0.156 numbers of *E. atomosa* population, while for every 1 mm increase in rainfall there would be a decrease of 0.056 numbers of *E. atomosa* population (Table-2). Similarly during 2016-17, for increase in every 1°C of maximum and minimum temperature, one per cent of relative humidity, one hour of sunshine and one km/hr of wind velocity there would be an increase of 0.005, 0.046, 0.009, 0.004 and 0.153 numbers of *E. atomosa* population, while for every 1 mm increase in rainfall there would be a decrease of 0.050 numbers of *E. atomosa* population (Table-3).

The present findings are in accordance with the findings[2], which reported that the pupal counts of *E. atomosa* were significantly correlated with maximum temperature. Moreover, Others[11] also found that the maximum, minimum and average temperatures, minimum relative humidity, water evaporation and sunshine hours had positive effects on the population build-up of the plume moth, while the rainfall, wind velocity, and maximum and average relative humidity showed negative effects. These findings strongly support the results of the present study. On the other hand the population of *E. atomosa* in pigeonpea showed a negative correlation with maximum and minimum temperature and positive correlation with morning relative humidity at Akola[1]. In an another attempt. Workers[23] noticed that the pod borers, *C. ptychora*, *E. atomosa*, *L. boeticus* and *M. obtusa* in pigeonpea showed negative correlation with temperature, relative humidity, rainfall and wind speed except in few cases; however, a positive correlation was established sunshine hours. These results partially support the present findings.

From the present study it can be concluded that *E. atomosa* is emerging as an important insect pest of pigeonpea in Varanasi region during reproductive stage of pigeonpea crop and its activity increased with increasing maximum and minimum temperature, relative humidity, sunshine and wind velocity and decreased with increase in amount of rainfall. From the present findings, it can also be inferred that there was only single peak without any multiple peaks of *E. atomosa* on pigeonpea. Hence the farmers can be alerted during the months of February and March to take up appropriate management strategies for efficient management of plume moth on long duration pigeonpea. Such studies on population build up of insect pests and their relationship with weather parameters provide a clue to improve the IPM strategy against insect pests' infestation and also help in making timely prediction of the occurrence of the pest.

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