



Study of seasonal incidence and impact of abiotic factors on sucking pests of brinjal

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Received: April 7, 2016; Revised received: November 2, 2016; Accepted: January 6, 2017

Abstract: The present investigation was undertaken to find the impact of abiotic factors on seasonal incidence and sucking pest complex of brinjal under field conditions during *kharif* 2015-2016. The incidence of leaf hopper population (2.80 Lh/L i.e., Leaf hopper mean population/leaf) was noticed during 34th standard week and reached peak by 40th standard week (5.00 Lh/L) (October) whereas the aphid population was noticed during the 34th standard week (3.00 Lh/L) and peak population observed during the 40th standard week (4.60 Lh/L) (October). Correlation studies showed that among the various abiotic factors, maximum temperature showed highly significant positive correlation ($r = 0.77$) and sunshine hours ($r = 0.61$) showed significant positive correlation with the leaf hopper population. In case of aphid population, maximum temperature showed significant positive correlation ($r = 0.70$), rainfall showed highly significant negative correlation ($r = -0.74$) and relative humidity evening ($r = -0.59$) showed significant negative correlation with aphid population. The present investigations will give a brief idea about how the abiotic factors influencing the sucking pests of brinjal.

Keywords: Abiotic factors, Aphids, Brinjal, Leaf hoppers

INTRODUCTION

Brinjal, *Solanum melongena* L. is one of the most important vegetables in South Asia which accounts for almost fifty percent of the world's area under cultivation. (Alam *et al.*, 2003). In India, brinjal is an important commercial vegetable crop grown throughout the year over the country (Pareet, 2009). Due to its versatility in use in Indian food, brinjal is often described as the 'King of vegetables' (Choudhary and Gaur, 2009). Based on its highest production potential and availability of the produce to consumers, it is also termed as common man's vegetable. In India brinjal is cultivated over an area of 711.3 thousand hectares with an annual production of 13557.8 thousand MT and productivity of 19.1 MT/ha.

In the brinjal field, various pests prevail during seedling to harvesting stage and the loss caused by brinjal pests vary from season to season depending upon environmental factors (Anjali *et al.*, 2012). The crop was attacked by number of sucking pests during vegetative stage. Among the sucking pests, leaf hopper (*Amrasca biguttula biguttula* Ishida), Aphid (*Aphis gossypii* Glover) and whitefly (*Bemisia tabaci* Gennaus) cause significant damage during vegetative stage. Sucking pests are highly governed by various abiotic factors and meteorological parameters play a pivotal role in the biology of sucking pest. Temperature, relative humidity, rainfall, wind speed, evaporation and sunshine

hours weather parameters that directly influence the activity of a given species of insect. Hence, it is necessary to have a thorough knowledge on seasonal incidence of different sucking pests with respect to abiotic factors, which helps in developing pest prediction models for forecasting pest incidence. The investigation was therefore, undertaken to find out the impact of the weather factors on the incidence of pest complex of brinjal.

MATERIALS AND METHODS

The experiment was carried out under field conditions at the College Farm, College of Agriculture, Professor Jayashankar Telangana State Agricultural University (PJ TSAU), Rajendranagar, Hyderabad on brinjal locally popular variety, Shyamla during *Kharif* 2015-16. For sowing the seed, nursery bed was prepared to fine tilth and raised to about 15 cm height with 1m width and convenient length. Seeds were sown during first week of July 2015 about 6 cm apart between the lines and covered with fine soil and watered regularly. The transplanting of seedlings was done during the first week of August. One month old seedlings were transplanted at two seedlings per hill in a bulk plot of 600 m² by adopting 75 cm x 60 cm spacing. The experimental field was divided into three blocks and each block was considered as a replication. All recommended agronomical practices were followed from time to time to raise the crop successfully.

The data were recorded on pest population in the field at weekly interval (Standard Week) from the initiation of the pest infestation and was continued up to crop maturity. A total of 5 plants from each replication were selected and tagged for recording the observations on sucking pests. The population of both nymphs and adults of leaf hopper and aphids were counted during early morning hours on 3 leaves (each from top, middle and bottom canopy) from each of the 5 selected and tagged plants. Weekly data on different abiotic factors was also recorded. Data so obtained was then subjected to statistical analysis for correlation, test of significance and step down multiple linear regression. Combined effect of weather parameters on pest populations were identifies by using the Multiple Linear Regression Step Down analysis. The following formulae were used to express the effect of weather parameters on pest populations.

$$Y = a + bx_1 + bx_2 + \dots + bx_n$$

RESULTS AND DISCUSSION

The observations recorded on the different sucking pests *viz.* leaf hopper and aphids during *kharif* 2015-16 were presented in the table 1. Indicated that initial incidence was observed two weeks after transplanting. Though the leaf hopper population recorded up to 45th standard week, it was found declining further from (4.60 leaf hoppers/leaf) 41st standard week to 2.40 leaf hoppers/ leaf by 45th standard week. Lowest leaf hopper population (1.40 leaf hoppers /leaf) were recorded during the 38th standard week.

Correlation studies were carried out to find out the effect of abiotic factors on the leaf hopper population. The results (Table.3, figs.1, 2) indicated that leaf hopper population has highly significant and positive correlation with the maximum temperature ($r = 0.77$), sig-

Table 1. Incidence of leaf hopper population in brinjal influenced by weather parameters for five plants/replication.

Standard weeks	Dates of standard weeks	Leaf hopper mean population/leaf	Temperature		Relative humidity		Rainfall (mm)	Wind speed (km/hr)	Sunshine (hrs.)	Evaporation (mm)
			Max. (°C)	Min. (°C)	I (%)	II (%)				
34	Agu.20-26	2.80	30.43	22.43	89.71	69.00	4.29	3.66	3.66	3.53
35	Aug.27-sep.02	3.80	31.50	22.71	90.57	64.57	7.06	3.29	6.63	5.37
36	Sept.03-09	2.60	30.07	22.14	83.29	66.71	4.09	3.63	3.90	5.17
37	Sept.10-16	4.80	33.43	22.93	88.43	59.14	4.40	1.41	7.17	5.56
38	Sept.17-23	1.40	28.36	21.93	95.86	85.71	13.14	0.80	1.67	2.50
39	Sept.24-30	3.20	30.43	22.21	89.57	61.00	6.20	1.21	4.43	3.51
40	Oct.01-07	5.00	31.93	22.29	89.43	57.57	0.29	0.20	7.16	4.33
41	Oct.08-14	4.60	31.36	21.14	96.00	55.00	4.94	0.20	5.84	3.43
42	Oct.15-21	4.20	33.36	19.57	88.43	37.43	0.00	0.13	7.89	4.50
43	Oct.22-28	3.80	32.79	19.14	91.71	42.00	0.00	0.61	8.36	4.47
44	Oct.29-Nov.04	3.20	32.43	18.14	89.29	43.57	0.00	1.80	8.94	4.69
45	Nov.05-11	2.40	31.29	20.71	91.71	50.86	2.61	1.34	7.33	3.57

Table 2. Incidence of aphid population in brinjal influenced by weather parameters for five plants/replication.

Standard weeks	Dates of standard weeks	Aphid population/leaf	Temperature		Relative humidity		Rainfall (mm)	wind speed (km/hr)	Sunshine (hrs.)	Evaporation (mm)
			Max. (°C)	Min. (°C)	I (%)	II (%)				
34	Agu.20-26	3.00	30.43	22.43	89.71	69.00	4.29	3.66	3.66	3.53
35	Aug.27-sep.02	2.60	31.50	22.71	90.57	64.57	7.06	3.29	6.63	5.37
36	Sept.03-09	2.80	30.07	22.14	83.29	66.71	4.09	3.63	3.90	5.17
37	Sept.10-16	3.40	33.43	22.93	88.43	59.14	4.40	1.41	7.17	5.56
38	Sept.17-23	0.80	28.36	21.93	95.86	85.71	13.14	0.80	1.67	2.50
39	Sept.24-30	3.00	30.43	22.21	89.57	61.00	6.20	1.21	4.43	3.51
40	Oct.01-07	4.60	31.93	22.29	89.43	57.57	0.29	0.20	7.16	4.33
41	Oct.08-14	3.40	31.36	21.14	96.00	55.00	4.94	0.20	5.84	3.43
42	Oct.15-21	4.00	33.36	19.57	88.43	37.43	0.00	0.13	7.89	4.50
43	Oct.22-28	3.60	32.79	19.14	91.71	42.00	0.00	0.61	8.36	4.47
44	Oct.29-Nov.04	2.80	32.43	18.14	89.29	43.57	0.00	1.80	8.94	4.69
45	Nov.05-11	1.80	31.29	20.71	91.71	50.86	2.61	1.34	7.33	3.57

Table 3. Correlation coefficient studies correlated between sucking pests of brinjal and weather parameters.

Insect pest of brinjal	Temperature		Relative humidity		Rainfall (mm)	Wind speed (km/hr.)	Sunshine hours (hrs.)	Evaporation (mm)
	Max. (°C)	Min. (°C)	I (%)	II (%)				
Leafhopper	0.77**	0.02	-0.10	-0.52	-0.53	-0.38	0.61*	0.51
Aphid	0.70*	0.09	-0.36	-0.59*	-0.74**	-0.28	0.54	0.46

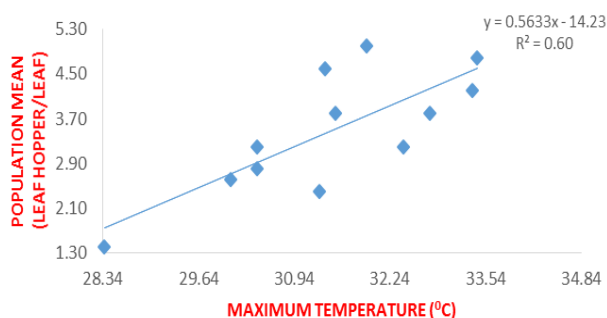


Fig.1. linear regression equation between leaf hopper population and maximum temperature in brinjal.

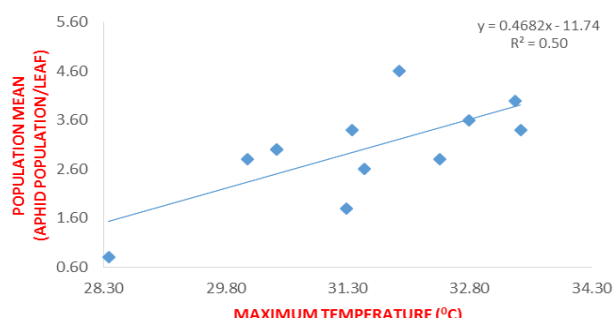


Fig.3. linear regression equation between aphid population and maximum temperature in brinjal.

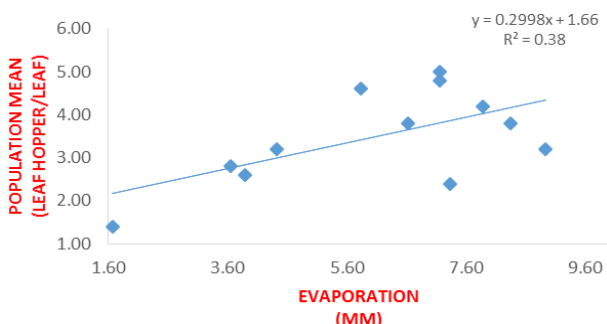


Fig.2. linear regression equation between leaf hopper population and evaporation in brinjal.

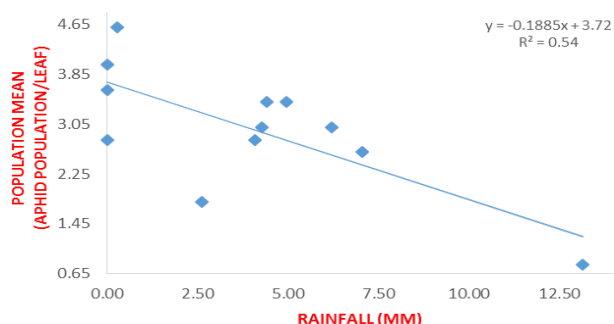


Fig.4. linear regression equation between aphid population and rainfall in brinjal.

nificant and positive correlation with the sunshine hours ($r = 0.61$). Relative humidity I ($r = -0.10$), relative humidity II ($r = -0.52$), rainfall ($r = -0.53$) and wind speed ($r = -0.38$) are showed negative but non-significant correlation with leaf hopper population, whereas minimum temperature ($r = 0.02$) and evaporation ($r = 0.51$) are showed non-significant positive correlation with leaf hopper population. The present observations are in confirmation with findings of Tiwari *et al.* (2011) where they found that maximum temperature (0.7241), minimum temperature (0.6912), sunshine hours (0.130) showed significant positive correlation with the leaf hopper population *Amrasca bigutulla bigutulla*. Similar results were obtained by Naik *et al.* (2009) and Meena *et al.* (2010) they found that the association of leaf hopper population was positive and non-significant with rainfall during 2010-11, while, it was negative and significant during 2011-12. The results of the correlation values were in close agreement with the results of Omprakash *et al.* (2013) where the maximum temperature (0.373), minimum temperature (0.214) were positively correlated; whereas rainfall (-0.483), relative humidity I (-0.421), relative humidity II (-0.228) were negatively correlated. The similar results were also reported by Patel *et al.* (2015). In their findings also, the correlation values for maximum temperature (0.5570), minimum temperature (0.3183) and wind velocity (0.1748km/hr.) have shown positive correlation with leaf hopper population, whereas relative humidity I (-0.1621), relative humidity II (-0.0593) and rainfall (-0.3746) showed the nega-

tive correlation. To find out the combined effect of weather parameters on leaf hopper populations for that Multiple Linear Regression Step Down analysis was carried out. Among all the parameters minimum temperature, RH-I, rainfall, wind speed and evaporation showed 77 per cent impact on the leaf hopper population. $Y = -23.34 + 0.45 * \text{minimum temperature} + 0.16 * \text{RH-I} - 0.21 * \text{rainfall} - 0.35 * \text{wind speed} + 0.78 * \text{evaporation}$ ($R^2 = 0.77$) The incidence of *Aphis gossypii* nymphs and adults population was observed during crop growing period *khariif* 2015-16 are presented in the table 2. Initial incidence was observed two weeks after transplanting. Though the aphid population recorded up to 45th standard week (1.80 aphids/leaf), it was found declining further from 43rd standard week i.e., 3.60 to 1.80 aphids/leaf by 45th standard week. Lowest aphid population (0.80 aphids/leaf) were recorded during the 38th standard week. To find out the effect of abiotic factors on the aphids population can be done by using the Correlation studies. The results (Table.3, figs.3&4) indicated that aphid population has highly significant and positive correlation with the maximum temperature ($r = 0.70$), highly significant and negative correlation with the rainfall ($r = -0.74$) and significant with negative correlation was showed by Relative humidity II ($r = -0.59$). Relative humidity I ($r = -0.36$) and wind speed ($r = -0.28$) showed non-significant negative correlation, whereas minimum temperature ($r = 0.09$), sunshine hours ($r =$

0.54) and evaporation ($r = 0.46$) showed non-significant positive correlation with aphid population. The correlation values of the present experiment were in close agreement with the findings of Patel *et al.* (2015) where the correlation values for maximum temperature (0.6070), minimum temperature (0.2909) and wind velocity (0.1548km/hr.) have shown positive correlation with aphid population, and relative humidity I (-0.2160), relative humidity II (-0.1207), rainfall (-0.3961) showed the negative correlation.

Multiple Linear Regression Step Down analysis was carried out to find out the combined effect of weather parameters on aphid population. Among all the parameters minimum temperature, rainfall, wind speed, sunshine hours and evaporation showed 68 per cent impact on the aphid population.

$Y = -1.76 + 0.27 * \text{minimum temperature} - 0.28 * \text{rainfall} - 0.37 * \text{wind speed} - 0.20 * \text{sunshine hours} + 0.40 * \text{evaporation}$ ($R^2 = 0.68$)

Conclusion

The present experiment provides an insight on population dynamics of insect pests of brinjal. It can be concluded that seasonal population fluctuation of major insect pests on brinjal crop is greatly influenced by abiotic factors and peak population levels were observed during September to October. Leaf hopper population (2.80) was noticed during 34th standard week and reached peak by 40th standard week (5.00) (October) whereas the aphid population was noticed during the 34th standard week (3.00) and peak population observed during the 40th standard week (4.60) (October). The statistically significant values indicated that occurrence of insect pests population were due to the prevailing ecological conditions. The management of brinjal pest complex during *kharif* sown brinjal under tropical and semi tropical zones should therefore be promoted and tailored from July/August onwards using integrated approaches.

ACKNOWLEDGEMENTS

The researcher's team is sincerely thankful to the Professor Jayashankar Telangana State Agricultural University for providing research facilities. We also thank UGC for providing financial assistance through Award of Maulana Abul Kalam Azad National Fellowship (MANF) during the research.

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