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Seasonal incidence of leafhopper (*Amrasca biguttula biguttula*) and its effect of abiotic factors on brinjal crop

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Abstract

A field trial was conducted at the Commercial Horticulture Unit of Birsa Agricultural University, Kanke, and Ranchi during *rabi* season of 2016-2017 and 2017-2018, in order to monitor the incidence and abundance of leafhopper. The activity of leafhopper started soon after the transplanting. The serious activities were noticed from 34th August 2016 to second January 2017. The highest leaf hopper number per leaf was found as (12.0/3 leaves) at maximum temperature and minimum temperature 24.6^o C and 4.8^oC, respectively. The correlation was found positive and highly significant ($r = -0.666^{**}$) with maximum temperature ($r = -0.666^{**}$) and ($r = -0.536^{*}$) minimum temperature. The maximum relative humidity and minimum relative humidity was ($r = 0.288$) and ($r = -0.096$) respectively observed the positively non-significant and positively non-significant correlation with population of leafhopper. In the year 2017-18, the peak (11.6/ 3 leaves) activity of leafhoppers was recorded at 46th SMW. The pest was active throughout the season with a fluctuation range of 0.0 to 11.6 aphid per three leaves. The abiotic factors together were able to explain up to the extent of 78-74 per cent population dynamics fluctuation in leafhopper.

Keywords: *Solanum melongena*, seasonal incidence, leafhopper, abiotic factors

Introduction

Brinjal, (*Solanum melongena* L.) is an important vegetable crop can be grown throughout the year on a wide range of soil and climatic conditions. Not only is a high yielding vegetable, brinjal also a high remunerative crop. There are various names of this crop in different parts of the world, some of which are as follows eggplant, guinea squash, aubergine, *baingan* etc. It is native of Indian sub-continent, with India as the probable centre of origin (Gleddie *et al.*, 1986) [5]. Due to its versatility in use in Indian food, brinjal is often described as the 'King of vegetables' (Choudhary and Gaur, 2009) [4]. Nayar *et al.* (1976) [9] listed 53 insects attacking on brinjal. According to Mote, 1981[8]; Tripathy, *et al.* (1997) [10] in brinjal *Leucinodes orbonalis* is considered as the most serious pest all over the world. Atwal, A.S. (1976) [1] reported the abundance of *L. orbonalis* during monsoon periods. *L. orbonalis* was observed throughout the year on the brinjal crops (Mehta *et al.*, 1980) [6]. The experiment was conducted to study the incidence and abundance of leafhopper in brinjal.

Materials and Methods

This field experiment was conducted to study the response of different entries/genotypes of little millet against leafhopper and the crop was grown without application of insecticide either in soil or as seed treatment. This was done to allow the natural population of leafhopper on crop. The experiment was done in two successive years i.e. 2016-17 and 2017-18. 21 varieties of brinjal were taken for this experiment i.e. Pusa Kranti (OP), Round Green Katedar, KUR BR-112(op), Brinjal green Round, Green long(op), F1 Hybrid PK-133, Green long F1 Hybrid, F1 Kusuma, F1 Hybrid KBRH-PK, F1 Hybrid Rajkiran, Brinjal-Sinduri F1 Hybrid, F1 Pratima, F1 Hybrid KBRH-Blue Magic, Brinjal Green Long, F1 Hybrid Super Chhaya, Swarna Pratibha palandu, Hybrid JK 8031, Swarna Shyamali Palandu, F1 Hybrid utkal Hybrid F1 Mali-128 and F1 Hybrid Brinjal No. 704. Seeds were sown in plots of 5m×2m at the Commercial Horticulture Unit with 60cm row to row and 60cm plant to plant spacing. The experiment was laid out in randomized block design with three replications. Meteorological data on temperature, rainfall, no of rainy days, relative humidity, wind speed and sun shine hours were obtained weekly, in both the years, from the meteorological observatory maintained in the Department of Agricultural Physics and Climatology, Birsa Agricultural

University, Ranchi. Randomly five plants were tagged and an observation on population of insect pests of brinjal was recorded in morning times at weekly interval from germination to harvesting of crop. Weekly observation on pest incidence were made at B.A.U., Kanke, Ranchi. Five plants were randomly tagged were counted. For leaf hopper, the number of adults and young ones on three leaves per plant, one each from top, middle and bottom portion were examined and pests counted and expressed as mean number per three leaves.

Results and Discussion

During the year 2016-17, it was found that leafhoppers were active almost throughout the crop growth period. The insect was observed on brinjal crop from 34th SMW where minimum (2.8/3 leaves) leafhoppers incidence was observed which was the lowest among all the standard weeks. During that period, the maximum and minimum temperatures, maximum and

minimum relative humidity and rainfall were recorded to be 30.6 C, 21.1 C, 82 percent, 70 per cent and 60.6mm, respectively. The insect was found to be increasing up to 37th SMW after which a sharp decline was noticed up to 47th standard week. However, the leafhoppers count once again went on increasing from 48th standard week and the peak (12.0/3 leaves) leafhoppers count was noticed at 52nd SMW when the maximum and minimum temperatures, maximum and minimum relative humidity were recorded to be 24.6 °C, 4.8 °C, 86 percent, 55 per cent and, respectively with no precipitation (Table-1, Fig-1). The correlation studies indicated that there was highly significant and negative correlation found with maximum temperature ($r = -0.666^{**}$) while it was significantly negative ($r = -0.536^*$) with minimum temperature. The pest was active throughout the crop growth. Borah (1995) [2] reported that *A. biguttula biguttula* was active on *Solanum melongena* throughout the growing season (Table-2).

Table 1: Population dynamics of leafhopper of brinjal with different weather parameters (2016 -17)

S MW	Date of Obs.	Temperature (°C)		R. H. (%)		Wind velocity Km/hr.	Sunshine hrs.	Total rainfall (mm)	Leafhopper
		Max. Temp.	Min. Temp.	Max.	Min.				
34	20.08.2016	30.6	21.1	82	70	4.1	35.4	60.6	2.8
35	27.08.2016	33.0	23.1	82	51	3.4	59.7	6.0	4.3
36	03.09.2016	27.9	21.3	85	65	5.1	6.9	85.2	11.88
37	10.09.2016	29.8	21.3	83	71	3.7	26.2	21.3	11.3
38	17.09.2016	30.9	22.1	80	61	3.1	50.6	10.4	6.3
39	24.09.2016	29.9	21.0	84	68	4.0	39.8	130.6	5.4
40	01.10.2016	30.0	20.7	84	69	2.5	57.8	0.0	4.1
41	08.10.2016	28.7	19.0	82	71	3.5	47.3	19.3	7.3
42	15.10.2016	28.2	14.6	85	59	1.5	65.5	0.0	7.2
43	22.10.2016	28.6	14.5	87	47	2.1	63.2	0.0	7.3
44	29.10.2016	28.1	14.6	86	58	2.9	60.9	0.0	7.1
45	05.11.2016	26.9	12.1	86	59	2.6	56.7	0.0	7.6
46	12.11.2016	27.0	10.9	87	49	2.2	60.5	0.0	6.5
47	19.11.2016	25.1	6.9	87	57	2.4	67.5	0.0	7.2
48	26.11.2016	25.0	7.3	87	57	2.5	60.1	0.0	8.5
49	03.12.2016	26.1	9.7	88	54	1.9	57.2	0.0	8.9
50	10.12.2016	24.3	5.2	87	63	3.3	60.6	0.0	9.2
51	17.12.2016	24.3	3.5	85	47	2.6	62.3	0.0	9.0
52	24.12.2016	24.6	4.8	86	55	1.8	62.0	0.0	12.0
01	01.01.2017	24.8	4.8	84	58	2.7	48.5	0.0	11.88
02	08.01.2017	22.9	5.0	84	61	2.8	50.5	0.0	11.2

SMW: Standard meteorological Week; RH-Relative Humidity

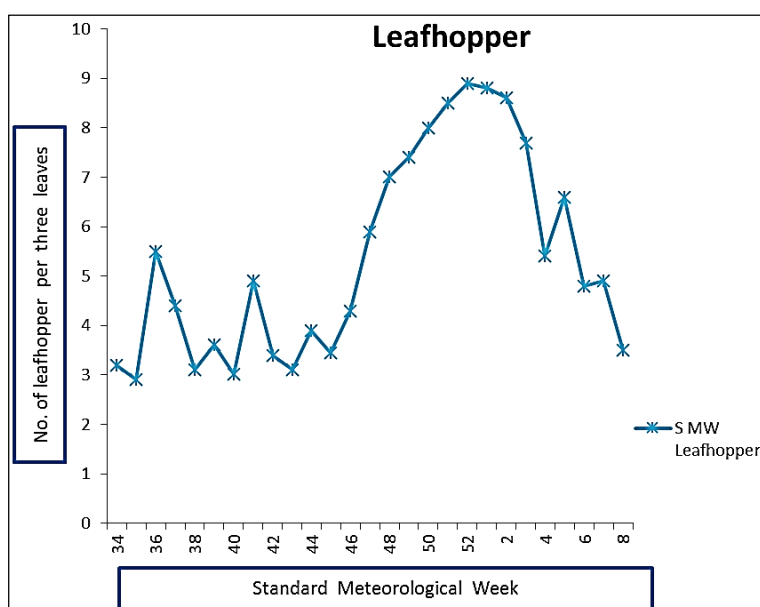


Fig 1: Population Dynamics of leafhopper in Brinjal during 2016-17

Table 2: Correlation Coefficient and regression equation for leafhopper of brinjal Vs weather parameter during (2016- 17)

Insect pest	Temperature (°C)		Relative Humidity (%)		Wind (Km/hr)	Sunshine (hrs)	Rainfall (mm)	R ²	Regression equation
	Max.	Min.	Max.	Min.					
Leafhopper	-0.666**	-0.536*	0.288	-0.096	-0.0467	-0.242	-0.159	0.781	Y=49.00 -0.553X ₁ -0.066X ₂ -0.093X ₃ - 0.059X ₄ -1.085X ₅ -0.193X ₆ -0.23 X ₇

*Significant at the 0.05 level (2 tailed).

** Significant at the 0.01 level (2 tailed)

SFB-Shoot and fruit borer

R²= Correlation coefficientX₅=Wind (km/hr)X₁ =Maximum Temperature (°C)X₂ =Minimum Temperature (°C)X₃ =Maximum Relative Humidity (%)X₄ =Minimum Relative Humidity (%)X₆ =Sunshine (Hrs)X₇ = Rainfall (mm)**Population dynamics on different insect pests during 2017-18**

In the year 2017-18, the peak (11.6/3 leaves) activity of leafhoppers was recorded at 46th SMW. The pest was active throughout the season with a fluctuation range of 0.0 to 11.6 aphid per three leaves. During peak incidence of insect, the maximum and minimum temperature and maximum and minimum relative humidity were recorded to be 24.9 °C, 12.8 °C, 84 percent and 68 per cent, respectively (Table-3, Fig-2). There was negative and highly significant correlation observed with maximum ($r = -0.717^{**}$) and minimum ($r = -0.712^{**}$) temperature, respectively (Table-4). These findings

are more or less in agreement with Mohapatra (2008) [7] who, reported that rainfall had a non-significant positive effect on population of *A. biguttula* (0.284). Who reported that the correlation between leafhoppers population and weather parameters were negatively significant. These findings are more or less in agreement with Bharadiya and Patel (2005) [3] found that the activity of the leafhopper, *Amrasca biguttula*, was at maximum during the third week of November. The multiple regression analysis revealed that weather parameters contributed for 78 per cent and 74 per cent, respectively of total variation in their population in 2016-17 and 2017-18 in Table 1 to Table 4.

Table 3: Population dynamics of leafhopper of brinjal with different weather parameters in 2017-18

S MW	Date of Obs.	Temperature(°C)		R. H.(%)		Wind velocity Km/hr.	Sunshine hrs.	Total rainfall (mm)	Leafhopper
		Max. Temp.	Min. Temp.	Max.	Min.				
29	16.07.2017	29.5	21.0	86	69	3.9	0.0	56.1	0.0
30	23.07.2017	25.9	18.0	85	71	3.9	0.0	524.6	5.0
31	30.07.2017	31.2	18.3	85	72	2.0	0.0	57.7	2.8
32	06.08.2017	31.1	20.4	87	71	3.6	0.0	94.3	2.9
33	13.08.2017	29.5	20.7	87	69	3.5	0.0	10.5	7.4
34	20.08.2017	31.5	21.6	86	70	3.8	0.0	67.3	5.5
35	27.08.2017	30.1	21.0	88	71	3.2	0.0	103.8	6.9
36	03.09.2017	30.5	21.2	84	69	2.7	0.0	0.0	6.7
37	10.09.2017	30.8	22.6	86	65	2.0	0.0	2.0	6.5
38	17.09.2017	30.3	21.2	85	67	1.9	0.0	14.2	6.8
39	24.09.2017	30.6	22.6	87	65	2.0	0.0	43.8	6.6
40	01.10.2017	29.9	21.5	86	70	1.6	0.0	53.0	7.2
41	08.10.2017	29.5	21.6	86	68	2.3	14.7	2.0	7.4
42	15.10.2017	28.5	16.7	86	70	1.5	47.6	27.6	7.9
43	22.10.2017	29.6	15.3	84	69	1.6	48.3	0.0	7.5
44	29.10.2017	27.1	13.1	84	66	2.1	59.2	0.0	8.8
45	05.11.2017	26.4	11.5	85	66	1.5	64.9	0.0	9.7
46	12.11.2017	24.9	12.8	84	68	1.7	30.4	2.0	11.6
47	19.11.2017	25.0	9.2	87	68	2.6	63.0	0.0	10.7
48	28.11.2017	24.2	5.4	85	68	2.9	64.9	0.0	11.5
49	03.12.2017	24.1	6.1	86	67	1.9	61.1	0.0	11.3

SMW: Standard meteorological Week; RH-Relative Humidity

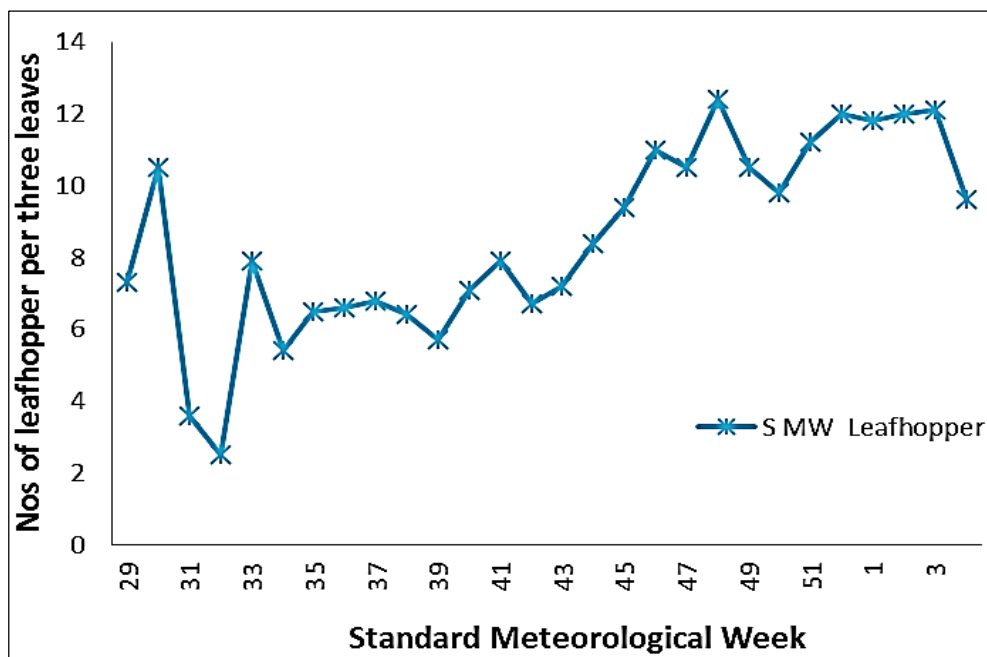


Fig 2: Population dynamics of leafhopper in brinjal during 2017-18

Table 4: Correlation Coefficient and regression equation for leafhopper of brinjal Vs weather parameter in 2017-18

Insect pests	Temperature		R.H. (%)		Wind (Km/hr)	SS (hrs)	Rainfall (mm)	R ²	Regression equation
	Max. (°C)	Min. (°C)	Max.	Min.					
	Leafhopper	-0.717**	-0.712**	0.196					

*Significant at the 0.05 level (2 tailed).

** Significant at the 0.01 level (2 tailed)

SFB- Shoot and fruit borer

R²= Correlation coefficient

X₅ = Wind (km/hr)

X₁ =Maximum Temperature (°C)

X₂ =Minimum Temperature (°C)

X₃ = Maximum Relative Humidity (%)

X₄ =Minimum Relative Humidity (%)

X₆=Sunshine (Hrs)

X₇=Rainfall-(mm)

Conclusion

The peak activity of leafhoppers was recorded at 52nd SMW and 46th SMW, during 2016-17 and 2017-18 respectively. There was negative and highly significant correlation observed with maximum, minimum temperature and sunshine hrs, and negative correlation was observed with RH (min) and wind speed in both the years. The abiotic factors are able to explain about 78-74 percent population dynamics fluctuation in leafhopper.

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