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Influence of abiotic factors on seasonal abundance of sucking insect-pests on brinjal during *kharif* season

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Abstract
An experiment was conducted to observe the "Influence of abiotic factors on seasonal abundance of sucking insect-pests on brinjal" during *kharif*-2017 at Oilseed Research Station, Latur, Maharashtra. The incidence of sucking insect-pest *viz*., jassids and whitefly was observed from 31st – 52nd (July to December) standard meteorological week (SMW). The incidence of jassid reached to its peak (12.46 jassids/3 leaves) during 39th SMW (second fortnight of September). While, the maximum population of whitefly observed during 40th SMW (14.70 jassids/3 leaves) *i.e.* first week of October. The correlation studies between incidence of jassid and weather parameters showed significant positive correlation (r= 0.472) with maximum temperature while other parameters were found non-significant correlation with jassid. The incidence of whitefly showed significant positive correlation (r= 0.344) with maximum temperature, mean temperature and evening relative humidity.

Keywords: Seasonal incidence, Abiotic factors, Jassid, Whitefly, brinjal

Introduction
Brinjal (*Solanum melongena* L.) is known as king of vegetables. It is one of the prominent vegetable crop in India. It is also known as eggplant and referred with various local names in different countries such as *aubergine* (English & French), *quezi* (Chinese), *eirfruchi* (German), *Melonzana pectonciano* (Italian), *nasu* (Japanese), *baklazan* (Russian), *Barenjena* (Spanish), *baingan* (Hindi), *vangi* (Marathi) belonging to the family "Solanaceae".Globally, India ranks second in vegetable production and contribute 16.7 per cent to global area and 15.4 per cent to vegetable production (Rai *et al.*, 2014) [6]. The area under cultivation of vegetables was 10290 thousand hectare with production of 175008 thousand MT and productivity 17.01 MT per ha during 2016-17 (Anon., 2017) [1]. In India, brinjal was grown in an area of 669 thousand hectare with production of 12400 thousand MT and productivity of 18.53 MT per ha during 2016-17 (Anon., 2017) [1]. The major brinjal growing states in India are West Bengal, Orissa, Bihar, Madhya Pradesh, Chhattisgarh, Karnataka, Maharashtra, Andhra Pradesh, Haryana, Assam and Uttar Pradesh. Among these, the contribution of Maharashtra in brinjal production was 438.28 thousand MT with area occupied of 22.14 thousand ha during 2016-2017 (Anon., 2017) [1]. The biggest threat to brinjal cultivation is the vulnerable and wide spread attack by more than 30 insect-pests right from nursery stage till harvesting. According to, Patel *et al.* (1970) [3] reported 16 pest species attacking brinjal of which shoot and fruit borer, *Leucinodes orbonalis* Guenee; Jassid, *Amrasca biguttula biguttula* (Ishida); whitefly, *Bemisia tabaci* Gennadius and aphid, *Aphis gossypii* Glover are the major and important insect pests. Infestation due to jassid, whitefly and shoot and fruit borer results in about 70-92 per cent loss in yield of brinjal (Rosaiah, 2001) [7]. Information on seasonal incidence of the insect pests in brinjal ecosystem and their management, particularly in this agro-climatic situation is meagre. As the meteorological parameters play a vital role in the biology of any pest, the interaction between pest activity and abiotic factors will help in developing predictive models that aids in forecast of pest incidence. Any pest management programme will require the use of monitoring practices to be effective. It is therefore, imperative to study the population fluctuation of the crop pest in relation to weather parameters that largely direct the activity of a given species of insect pest.

Materials and Methods
The studies on "Influence of abiotic factors on seasonal abundance of sucking insect-pests on brinjal" were conducted during *kharif* season 2017 on brinjal variety 'Mauli' at Oilseed Research Station, Latur, Maharashtra

The plot size was 400 m^2 with 90 cm x 60 cm spacing. The incidence of jassids (*Amrasca biguttula biguttula* Ishida) and whitefly (*Bemisia tabaci* Gennadius) was recorded at weekly interval for recording the observation three leaves each from top, middle and bottom of thirty selected plants. Weekly data on different abiotic parameters were also recorded. Data so obtained were then subjected to statistical analysis for correlation and test of significance.

Results and Discussion

The mean population of jassids (*Amrasca biguttula biguttula* Ishida) and whitefly (*Bemisia tabaci* Gennadius) are presented in Table 1. During the course of investigation, jassid and whitefly were recorded as major sucking insects-pests of brinjal.

Jassid (*Amrasca biguttula biguttula* Ishida)

The incidence of jassids commenced in the first week of August (31st SMW) with mean population of 1.16 jassids/3 leaves. Population of jassids increased with the growth of the crop until it touched its peak of (12.46 jassids/3 leaves) in fourth week of September (39th SMW) and thereafter the population decreased gradually (Table 1). In earlier findings peak incidence of jassids was reported during 40th SMW in September (Shalini *et al*., 2017) [9] at Rohtak, moreover Saini *et al*. (2017) [8] also reported the jassids was active and maximum during September at Udaipur as well as Potai and Chandrakar (2018) [5] during September at Raipur are matched with seasonal incidence data of present experimentation which is in close conformity with the findings came out from present study of the jassids incidence.

The relationship between weather parameters and jassid population indicated highly significant positive correlation of jassid with maximum temperature (r= 0.610). While, minimum temperature (r= 0.174), mean temperature (r= 0.313), morning relative humidity (r= 0.094), evening relative humidity (r= 0.271) and mean relative humidity (r= 0.214) were positively correlated but found non–significant. Whereas, rainfall (r= -0.053) showed non-significantly negative correlation (Table 2). In previous study significantly positive correlation of jassid and weather parameters (maximum temperature) are reported by Patel *et al*. (2015) [4] at Navasari, as well as Shalini *et al*. (2017) [9] at Rohtak which are match with the correlation data of present investigation. The other factors found positively or negatively non-significant in other reports of various researchers. It might be due to the incidence in locations or climatic conditions.

Whitefly (*Bemisia tabaci* Gennadius)'

The incidence of whiteflies initiated from first week of August (31st SMW) with mean population of 0.76 whiteflies/3 leaves/plant. The whiteflies peak activity was observed during 40th SMW (14.70 whiteflies/3 leaves/plant) during the month of October, which declines onwards week till 52th SMW in last week of December The peak seasonal incidence of whitefly recorded in present trial is found similar with the results of Saini *et al*. (2017) [8] at Udaipur and Potai and Chandrakar (2018) [5] at Raipur during the periods of September. The above report gave close conformity to present findings.

The relationship between whitefly population indicated significant positive correlation at 1% level with maximum temperature (r= 0.568) and mean temperature (r= 0.358), evening relative humidity (r= 353) at 5% level. Whereas, minimum temperature (r= 0.240), morning relative humidity (r= 0.183), mean relative humidity (r= 0.302) and rainfall (r= 0.057) had non-significant positively correlated. In previous investigation significantly positive correlation of weather parameters (maximum temperature) is reported by Patel *et al*. (2015) [4] at Navasari and Indirakumar *et al*. (2016) [2] at Coimbatore which are in agreement with the present results. With regards to mean temperature significantly positive correlation is reported by Tiwari *et al*. (2012) [10] at Meerut and which is similar with present findings. In continuation to this significantly positively correlation of evening relative humidity and whitefly population are reported by Potai and Chandrakar (2018) [5] which is match with current data of correlation of whitefly population. The other parameters were not influence the whitefly population. Hence the above reports strongly supported the present findings.

Table 1: Incidence of sucking insect pests and their natural enemies in brinjal

Standard Meteorological Week (SMW)	Period (Date)	Average No. of sucking pests / 3 leaves/plant		Weekly Meteorological data						
		Jassid	Whitefly	Total Rainfall (mm)	Temperature (^{0}C)			Relative Humidity (%)		
					Max.	Min.	Mean	Max.	Min.	Mean
29	16-22 Jul.	0.00	0.00	34.00	28.60	22.50	25.55	97.00	55.00	76.00
30	23-29 Jul.	0.00	0.00	3.00	30.00	22.00	26.00	95.00	56.00	75.50
31	30-05 Aug.	1.16	0.76	0.00	30.90	22.30	26.60	92.00	51.00	71.50
32	06-12 Aug.	2.50	4.60	4.00	29.70	22.80	26.25	94.00	54.00	74.00
33	13-19 Aug.	3.50	5.10	21.00	28.30	22.10	25.20	98.00	58.00	78.00
34	20-26 Aug.	3.00	6.40	184.00	27.90	21.50	24.70	100.00	74.00	87.00
35	27-02 Sep.	4.30	7.06	22.00	29.50	21.70	25.60	97.00	74.00	85.50
36	03-09 Sep.	6.30	9.30	4.00	30.90	22.80	26.85	98.00	61.00	79.50
37	10-16 Sep.	5.10	6.80	137.00	30.30	22.00	26.15	100.00	70.00	85.00
38	17-23 Sep.	8.40	10.10	20.00	28.60	21.60	25.10	100.00	74.00	87.00
39	24-30 Sep.	12.46	14.10	8.00	31.70	21.90	26.80	100.00	82.00	91.00
40	01-07 Oct.	12.10	14.70	0.00	31.50	21.60	26.55	90.00	74.00	82.00
41	08-14 Oct.	9.40	12.30	101.00	30.50	22.60	26.55	100.00	66.00	83.00
42	15-21 Oct.	11.10	13.00	13.00	31.20	21.10	26.15	89.00	52.00	70.50
43	22-28 Oct.	11.36	13.16	0.00	31.30	19.60	25.45	88.00	41.00	64.50
44	29-04 Nov.	10.26	12.30	0.00	29.30	15.90	22.60	85.00	33.00	59.00
45	05-11 Nov.	8.33	10.13	0.00	29.30	15.70	22.50	79.00	35.00	57.00
46	12-18 Nov.	6.66	7.36	0.00	29.70	16.00	22.85	73.00	37.00	55.00
47	19-25 Nov.	5.33	6.56	0.00	30.50	19.70	25.10	86.00	46.00	66.00
48	26-02 Dec.	4.10	4.76	0.00	29.20	14.30	21.75	75.00	30.00	52.50
49	03-09 Dec.	3.13	3.96	0.00	28.90	16.80	22.85	88.00	47.00	67.50
50	10-16 Dec.	2.23	2.60	0.00	29.60	15.50	22.55	80.00	35.00	57.50
51	17-23 Dec.	1.46	1.93	0.00	27.80	11.70	19.75	80.00	30.00	55.00
52	24-31 Dec.	0.76	1.13	0.00	27.90	11.60	19.75	76.00	29.00	52.50

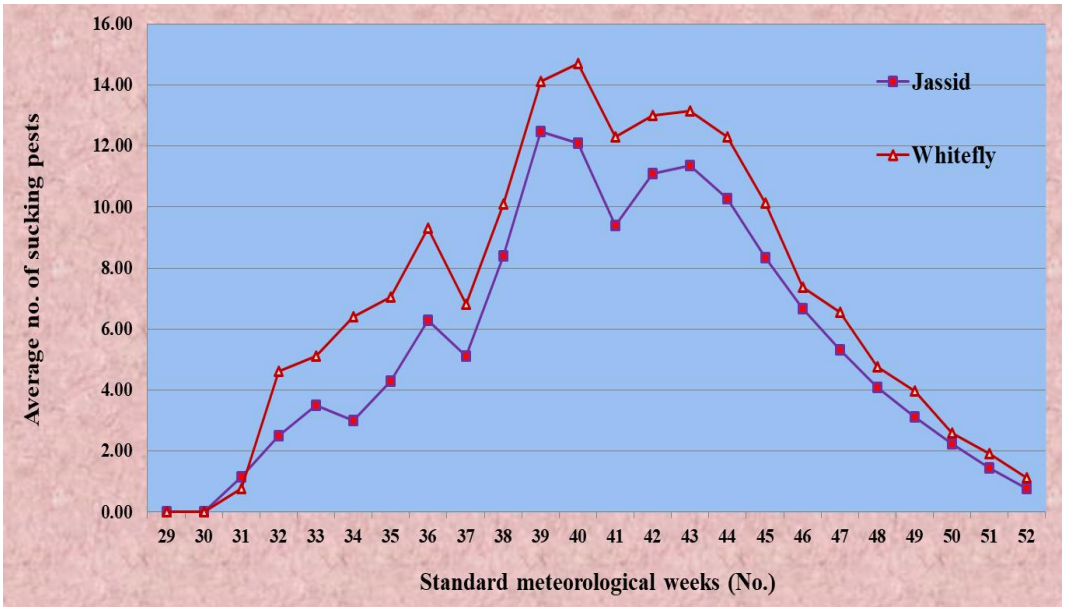

Fig 1: Incidence of sucking pests in brinjal

Table 2: Correlation coefficient (r) of sucking pest and there natural enemies on brinjal with prevailing weather parameters.

Insect pests	Temperature (ºC)			Relative humidity (%)			Rain fall (mm)
	Max.	Min.	Avg.	Morning	Evening	Average	
Jassid	0.610**	0.174	0.313	0.094	0.271	0.214	-0.053
Whitefly	0.568**	0.240	0.358*	0.183	0.353*	0.302	0.057
*Significant at 5% level (r=± 0.344)							
** Significant at 1% level (r=±0.472)							

Conclusion

The present study revealed that jassid and whitefly was commenced in first week of August. Jassid touch the peak during fourth week of September (12.46 jassids/3 leaves). While, whitefly touched peak in first week of October (14.70 whiteflies/3 leaves/plant). This will help us in scheduling sucking pests management strategies in brinjal crop.

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