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# Effect of abiotic factors on incidence of major sucking pests on brinjal

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**Abstract**
An experiment was conducted to observe the effect of abiotic factors on seasonal incidence of major sucking insect-pests on brinjal during *kharif*-2018 at Experimental farm, Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani (M.S.). The incidence of sucking insect-pest *viz*., aphid, leaf hopper and whitefly was observed from 29$^{th}$ – 50$^{th}$ (July to December) standard meteorological week (SMW) whereas, mites 37$^{th}$ -50$^{th}$ SMW. The incidence of aphid reached to its peak (15.1 aphid/3 leaves) during 42$^{th}$ SMW (second fortnight of October) and whitefly (23.4 whitefly/3 leaves) during 43$^{th}$ SMW. While, the maximum population of leaf hopper observed during 37$^{th}$ SMW (11.8 leaf hopper/3 leaves) *i.e.* second week of September. Whereas, highest number of mites recorded during 47$^{th}$ SMW (14.1 mites/4 cm$^2$ leaves). The correlation studies between incidence of aphid and weather parameters showed significant positive correlation (r= 0.503) with Morning relative humidity. The incidence of leaf hopper showed significant positive correlation with Bright sunshine (hrs) (r= 0.508) while, whitefly showed significant positive correlation with Morning relative humidity(r= 0.687) and Bright sunshine (hrs) (r= 0.663).

**Keywords:** Seasonal incidence, abiotic factors, aphid, leaf hopper, whitefly, mite, brinjal

## Introduction
Brinjal (*Solanum melongena* L.) belongs to the family Solanaceae and is native of India. It is the third most important vegetable crop grown throughout the year in all parts of India and it's contributes 17.8 per cent to the total production of vegetables in the country.Globally, India ranks second after China in vegetable production and contribute 16.7 per cent to global area and 15.4 per cent to vegetable production (Rai *et al.*, 2014) [14]. 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) [12] 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) [17]. 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 "Effect of abiotic factors on seasonal incidence of sucking insect-pests on brinjal" were conducted during *kharif* season 2018 on brinjal variety 'Ajay' at Experimental farm, Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra. The plot size was 10 x 10 m with 90 cm x 60 cm spacing. Population of aphids, leafhoppers and whiteflies were recorded at weekly intervals on three leaves selected from top, middle and bottom canopy of 20 tagged plant commencing from ten days of transplanting and continued till harvesting. Population of red spider mites was recorded at weekly interval on three leaves per 4 $cm^2$ leaf area selected from top, middle and bottom canopy of the plant.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 aphid (*Aphis gossypii* Glover) leaf hopper (*Amrasca biguttula biguttula* Ishida), whitefly (*Bemisia tabaci* Gennadius) and mites (*Tetranychus urticae*) are presented in Table 1. During the course of investigation, jassid and whitefly were recorded as major sucking insects-pests of brinjal.

### Aphid (*Aphis gossypii* Glover)

The population of aphids' nymph and adult (0.6/plants) first appeared on brinjal crop during 29th standard meteorological week (SMW). In subsequent observations, there was an increase in its population with slight fluctuation in some observations. The highest population (15.1 aphids /plant) was noticed during 42th SMW. After this week the population was gradually decreased reaching to 6.0 aphids per plant at harvest. The population range (0.6 to 15.1 aphids /plant) was noticed during 29th to 50th SMW. In the present investigation, maximum activity (15.1/plant) of aphids' population was noticed during first week of September to last week of October.

The above results are in accordance with the results reported by Rajput *et al.* (2010) [15] who told that *A. gossypii* population showed peak activity during 30th SMW and 33rd SMW in 2001-2002 while during 33rd SMW and 35th SMW in 2002-2003. Results showed that *A. gossypii* population was at peak in 30th-34th standard week. Shaik *et al*. (2017) [18] observed aphid incidence was noticed during the 34th standard week (3.00 aphids/leaves) and peak population was observed during the 40th standard week (4.60 aphids/leaves) (October).

The data presented in (Table 2) showed that population of aphids was negatively and non-significant correlated with minimum temperature (r = -0.280), evening relative humidity (r = -0.209), wind velocity (r = -0.385), positive correlated with maximum temperature (r= 0.195) and significant positive correlation was observed between aphid population with morning relative humidity (r = 0.503*), and negatively significant with rainfall (-0.502*) and bright sunshine hours (-0.510*) during *kharif* 2018.

The present findings are conformity with the findings with Chandrakumar *et al*. (2008) [4] all the sucking pest showed negative correlation with maximum temperature and rainfall. Mohapatra (2008) [9] stated that among the weather parameters, temperature showed a positive correlation with *A. gossypii* while effect of rainfall was adverse. Ramya and Veeravel (2010) [16] documented that the rainfall and wind velocity had negative correlation with pest infestation.

### Leaf hopper (*Amrasca biguttula biguttula* Ishida)

The incidence of leaf hopper commenced in the third week of August (29th SMW) with mean population of 2.9 leaf hopper/3 leaves. Population of leaf hopper increased with the growth of the crop until it touched its peak of (11.8 leaf hopper /3 leaves) in second week of September (37th SMW) and thereafter the population decreased gradually (Table 1). The present investigation was in consonance with the earlier researchers, Kumawat *et al.* (2000) [6] recorded incidence of leafhopper on okra in the fourth week of July and reached its peak during second and fourth week of September. Meena *et al.* (2010) [8] found that the incidence of leafhoppers was started in first week of August and was being active till harvesting in both the years, its population reached to maximum (15.2 and 16.4 leafhoppers per plant) in fourth week of September in 2002 and 2003.Omprakash *et al*. (2013) [11] observed incidence was also observed during first week after transplanting in (2010-11 and 2011-12) population reached peak in fourth week of October.

The maximum activity of leafhopper was noticed during third week of September. The leafhopper population had positively non-significant relation with minimu temprature (r= 0.073) and negative non-significant correlation with relative humidity and wind velocity whereas maximum temperature (r=-0.575) and Rainfall shows negative significant correlation and bright sunshine hours shows significant positive correlation with leafhopper population. (Table 2.)

Similar findings were observed by Mahmood *et al*. (2002) [7] reported that the maximum and minimum temperature were found positive and significant correlation and relative humidity, rainfall was found negative and non-significant correlation with population fluctuation. Jain (2008) reported that leafhopper population had non-significant relationship with all the weather parameters. Chandrakumar *et al*. (2008) [4] who also reported that rainfall and maximum temperature shows negative significant correlation whereas minimum temperature and relative humidity negative non-significant correlation. Varma *et al*. (2011) [20] reported that the leafhopper incidence showed positive correlation with maximum temperature, relative humidity, rainfall, wind speed and sunshine hours.

### Whitefly (*Bemisia tabaci* Gennadius)'

Whiteflies nymph and adult population was first appeared during 29th SMW (4.80 whiteflies /plant). Thereafter, there was a progressive increase in population (23.4 whiteflies /plant) on fourth week of October there was a gradual decrease in the pest density (6.6 whiteflies /plant) at harvest.

In the present investigation, pest was active throughout the crop growth. Similarly, Borah (1995) [3] reported that *B. tabaci* was active on brinjal throughout the growing season. Anonymous (2004) reported whitefly incidence during 36th standard week in the beginning which persisted till 52nd standard week. Bharadiya and Patel (2005) [2] found that the maximum activity of whitefly, *Bemisia tabaci* was noticed during fourth week of October. According to Omprakash *et al.* (2013) [11] reported that whitefly population started from first week after transplanting in both the years and peak incidence was observed during the final week of October to first week of November and decreased gradually up to crop maturity.

Maximum activity of whitefly was noted during fourth week

of October. The whitefly population was correlated negatively significant with rainfall, maximum temperature relative humidity and wind velocity whereas positively significant with bright sunshine and positive non-significant with minimum temperature. (Table 2.)

Similar findings were observed by Vishwanathrao (2002) [21] revealed that the population of whitefly had significant negative correlationship with wind velocity and positive with sunshine hours. Chandrakumar *et al*. (2008) [4] reported that rainfall and maximum temperature shows negative significant correlation whereas minimum temperature had negative non-significant correlation.

**Table 1:** Seasonal incidence of sucking insect pest of brinjal during *kharif* 2018

| SMW | Duration | Sucking pests | | | |
|---|---|---|---|---|---|
| | | Number pests per three leaves/plant | | | No./4 Cm$^2$ |
| | | Aphids | Leafhopper | Whitefly | Mites |
| 29 | 16-22 July | 0.6 | 2.9 | 4.8 | 0.0 |
| 30 | 23-29 July | 0.9 | 4.1 | 4.9 | 0.0 |
| 31 | 30-5 Aug. | 1.8 | 5.9 | 6.4 | 0.0 |
| 32 | 6-12 Aug. | 2.8 | 6.9 | 8.9 | 0.0 |
| 33 | 13-19 Aug. | 1.4 | 2.5 | 3.0 | 0.0 |
| 34 | 20-26 Aug. | 0.9 | 3.4 | 2.4 | 0.0 |
| 35 | 27-2 Sep. | 2.5 | 9.8 | 8.4 | 0.0 |
| 36 | 3-9 Sep. | 4.6 | 10.4 | 9.5 | 0.0 |
| 37 | 10-16 Sep. | 4.8 | 11.8 | 10.4 | 0.5 |
| 38 | 17-23 Sep. | 5.9 | 9.9 | 10.9 | 0.9 |
| 39 | 24-30 Sep. | 6.4 | 9.7 | 13.7 | 1.9 |
| 40 | 1-7 Oct. | 6.9 | 9.1 | 15.9 | 2.1 |
| 41 | 8-14 Oct. | 9.6 | 8.8 | 17.5 | 4.5 |
| 42 | 15-21 Oct. | 15.1 | 8.9 | 18.3 | 5.9 |
| 43 | 22-28 Oct. | 9.8 | 8.1 | 23.4 | 8.6 |
| 44 | 29-4 Nov. | 8.3 | 7.9 | 18.6 | 9.5 |
| 45 | 5-11 Nov. | 8.2 | 7.6 | 10.9 | 11.1 |
| 46 | 12-18 Nov. | 8.0 | 6.2 | 9.6 | 13.1 |
| 47 | 19-25 Nov. | 8.5 | 6.8 | 9.0 | 14.1 |
| 48 | 26-02 Dec. | 7.9 | 5.2 | 8.6 | 8.6 |
| 49 | 3-9 Dec. | 6.6 | 5.6 | 8.0 | 7.1 |
| 50 | 10-16 Dec. | 6.0 | 5.0 | 6.6 | 6.1 |

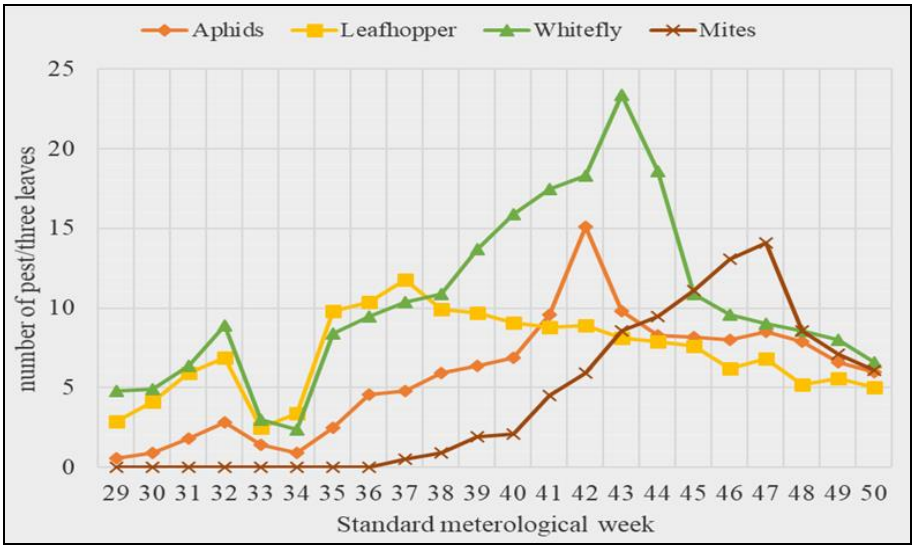


**Fig 1:** Seasonal incidence of sucking insect-pests

**1. Mite (*Tetranychus urticae*)**

The population of red spider mite (0.90 and 1.90 mites /4 cm$^2$ leaves) was initiated on brinjal in 38$^{th}$ and 39$^{th}$ SMW during *Kharif* 2019. The peak population (13.10 and 14.104 cm$^2$) was observed in 46$^{th}$ and 47$^{th}$ SMW during the experiment (Table 1.) The above results are according to the findings of Patil and Nandihalli (2009) [13] they reported that spider mites appeared much later on *Kharif* crop than Summer crop i.e. at 90 days after transplanting (1$^{st}$ week of November). The first peak incidence occurred in 46$^{th}$ standard week (November 12-18) with 28.73 individuals per 4 cm$^2$ leaf area and the second peak of 23.8 individuals per 4 cm$^2$ leaf area was attained during Jan. 2005. Ghosh (2013) [5] observed that the pest was active throughout the growing period with a peak population of 6.18 mites/leaf during 23$^{rd}$ SMW (last week of May) in the Pre-*Kharif* crop. Highest population (7.56/leaf) was found on the 42$^{nd}$ SMW (first week of October) in the Post-*Kharif* crop. Sudden fall of population was found in the last week of June because of heavy rains. The incidence of mite population always remained higher on the upper canopy of the plant.

The mites' maximum activity was found in the month of November. The data presented on (Table 2.) mites shows

positive non-significant correlation with maximum temperature (r=0.053) and morning relative humidity (r=0.284) whereas rainfall (r= -0.384), minimum temperature (r= -0.369) and bright sunshine hours (r= -0.132) shows negative non-significant correlation. Evening relative humidity (r= -0.513*) and wind velocity (r= -532*) found negative significant correlation during *kharif* 2018-19.

The findings of the present study are in conformity with the earlier studies Patil and Nandihalli (2009) [13] reported rainfall (-0.405) was highly detrimental and showed highly significant negative correlation with mite population further Tripathi *et al*. (2013) [19] reported a positive correlation between temperature and mite population and negative correlation with humidity and rainfall. Monica *et al*. (2014) [10] found a significantly positive correlation between the population of *T. urticae* and the maximum temperature and significant negative correlation with the morning relative humidity which means when the temperature increased the mite population also increased and with increasing humidity, the mite population decreased.

**Table 2:** Correlation coefficient (r) of sucking pest on brinjal with prevailing weather parameters.

| Weather parameters | Correlation coefficient ('r' value) | | | |
|---|---|---|---|---|
| | Aphid | Leafhopper | Whitefly | Mites |
| Rainfall | -0.502* | -0.643* | -0.535* | -0.384 |
| Maximum temperature ($^0$c) | 0.195 | -0.575* | -0.797* | 0.053 |
| Minimum temperature ($^0$c) | -0.280 | 0.073 | -0.290 | -0.369 |
| Morning relative humidity (%) | 0.503* | -0.299 | 0.687* | 0.284 |
| Evening relative humidity (%) | -0.209 | -0.0.081 | -0.526* | -0.513* |
| Bright sunshine (hrs) | -0.510* | 0.508* | 0.663* | -0.312 |
| Wind velocity (km/hr) | -0.385 | -0.378 | -0.488* | -0.532* |

## Conclusion

The present study revealed that aphid, leaf hopper, whitefly and mite was commenced in third week of July. Aphid touch the peak during third week of October (15.1 aphid/3 leaves), leaf hopper second week of September (11.8 leaf hopper/3 leaves) and whitefly third week of October (14.70 whiteflies/3 leaves/plant). While, mite touched peak in third week of November (14.1 mites/4 cm$^2$). This will help us in scheduling sucking pests management strategies in brinjal crop.

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