Madras Agric. J., 105 (4-6): 206-209, June 2018

# Population Dynamics of Sucking Pests on Bhendi, *Abelmoschus esculentus* L. (Moench)

**M. Kavinilavu*, R. Vishnupriya and N. Chitra**
Department of Agricultural Entomology, Tamil Nadu Agricultural University, Coimbatore-641 003

**Field investigations were made during 2017-2018 (Aug-April) in bhendi Co4 hybrid raised under organic conditions in farmer's field of Thondamuthur block, Coimbatore. The population dynamics of sucking pests in bhendi *viz*., leafhopper (*Amrasca biguttula biguttula* Ishida), aphid (*Aphis gossypii* Glover), whitefly (*Bemisia tabaci* Gennadius), thrips (*Thrips tabaci* Linnman) and mealybug (*Maconellicoccus hirsutus*) were assessed in different growth periods of the crop and correlated with weather parameters. The studies revealed that incidence of sucking pests started during August and reached its peak during October under organic conditions. Correlation studies between the sucking pest complex and weather factors revealed that there was significant positive correlation with maximum temperature and relative humidity. whereas, minimum temperature and wind velocity showed negative correlation to all above mentioned sucking pests. The rainfall favoured the activity of all the sucking pests with positive correlation except mealybug. Regression analysis revealed that for every unit increase in maximum temperature, the leafhoppers population got increased by 0.08 numbers. Similarly, for every unit increase in relative humidity the whiteflies population got increased by 0.02 numbers.**

**Key words:** Bhendi, Weather factors, Sucking pests, Seasonal incidence, Organic conditions.

Bhendi, *Abelmoschus esculentus* L. (Moench), is an economically important vegetable crop grown in tropical and sub-tropical parts of the World. In India, it is cultivated in an area of 501 thousand ha, with a production of 5972 thousand metric tonnes and productivity of 11.5 MT $ha^{-1}$ during 2016-17 (Anonymous, 2016-17). In Tamil Nadu, it is cultivated in an area of 8,000 ha, with a production and productivity of 56.67 thousand metric tonnes and 7.10 metric tonnes $ha^{-1}$, respectively. The immature pods of bhendi are consumed as vegetables (Habtamu *et al*., 2014) which contains high energy rich source of fats, carbohydrates, vitamins like A & B and minerals such as calcium, iron, magnesium and potassium (IBPGR, 1990).

Among various biotic and abiotic stresses, the insect pest damage is higher and sucking pests cause more damage in the vegetative stage of the crop. Leafhoppers, aphids, whiteflies, thrips and mealybugs are important pests of bhendi. The yield losses caused by sucking pests were attributed as 32.06 to 56.0 per cent by leafhoppers (Singh *et al*., 1994), 94.0 per cent by whiteflies (Sastry *et al.,* 1996) and 54.04 per cent by aphids (Chaudhary *et al.,* 1989). Reports indicate that the total pesticide consumption in Coimbatore district during the year of 2014- 15 was 68.00 metric tonnes and 17585.00 kilo litres in dust and liquid formulations respectively (https://www.indiastat.com). In view of this, it becomes paramount importance to monitor the population build up of sucking pests as influenced by weather factors, so that suitable management strategy could be taken up when such a favourable climatic changes occur besides forecasting the likelihood of occurrence of sucking pests incidence. With this idea, the present field investigation was conducted. It is necessary to understand the population dynamics of these pests in order to take up preventive measures. The present study, though looks simple has been scientifically carried out.

*Corresponding author's email: nilavukavi1976@gmail.com

## Material and Methods

### *Method of observation*

A study was conducted to monitor the population dynamics of sucking pests during 2017- 2018 at Thondamuthur block, Coimbatore, Tamil Nadu. The variety Co4 was selected for this study. The observations on the nymphs and adults present on the top, middle and bottom leaves of the twenty five randomly selected plants in each five quadrat and expressed in terms of number / 3 leaf. The observations were recorded at weekly intervals commencing from seedling stage to harvesting stage of the crop.

### *Interpretation of data*

The data recorded on sucking pests, natural enemies and meteorological parameters were used for statistical analysis.The simple correlation was computed between population of these pests, natural enemies and abiotic factors, *viz.,* maximum and minimum temperatures, relative humidity and rainfall.

### *Statistical analysis*

The statistical test ANOVA was used to check

whether there was any significant difference in the collections from four regions. All these statistical analyses were done using Microsoft Excel 2016 version and IBM SPSS version 20.

## Results and Discussion

### *Seasonal incidence of leafhoppers*

The incidence of leafhoppers on bhendi started during second week of August 2017, with 18.71 leafhoppers per three leaves and reached peak during third week of October 2017 (26.92 leafhoppers/ 3 leaves) (Table.1). These findings are in line with the findings of Hegde *et al.* (2004) on cotton leafhopper (*A. biguttula biguttula*), According to them, leafhopper population was noticed during second fortnight of August, reached peak during first fortnight of September and declined later. Srinivasa (1993) from Dharwad reported that September and October months were very much congenial for leafhopper population build up.

**Table 1. Seasonal occurrence of sucking pests in relation to weather parameters**

| Standard week | Maximum temperature (0c) | Minimum temperature (0c) | Rainfall (mm) | Relative humidity(%) | Wind velocity (km/hr) | No. / 3 leaves | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Jassids | Whiteflies | Aphids | Thrips | Mealybug |
| 33 | 31.29 | 23.26 | 1.74 | 85.86 | 5.97 | 18.71 | 1.58 | 13.49 | 2.97 | 3.58 |
| 34 | 31.79 | 22.97 | 0.37 | 86.57 | 8.47 | 19.72 | 1.43 | 15.93 | 3.80 | 3.95 |
| 35 | 32.77 | 23.29 | 6.63 | 86.14 | 9.10 | 19.56 | 2.30 | 14.42 | 2.53 | 4.67 |
| 36 | 32.73 | 23.07 | 16.24 | 88.86 | 4.39 | 20.20 | 2.60 | 12.46 | 0.60 | 5.19 |
| 37 | 30.46 | 24.07 | 1.20 | 86.29 | 5.64 | 20.48 | 3.70 | 21.84 | 3.16 | 5.48 |
| 38 | 29.07 | 22.43 | 8.03 | 86.86 | 8.76 | 22.04 | 3.56 | 19.64 | 4.14 | 5.87 |
| 39 | 30.53 | 23.11 | 1.83 | 89.00 | 4.79 | 23.08 | 4.89 | 26.96 | 4.90 | 6.90 |
| 40 | 31.27 | 22.80 | 0.06 | 88.71 | 4.20 | 25.96 | 4.47 | 26.66 | 3.99 | 6.76 |
| 41 | 30.24 | 23.30 | 11.93 | 87.71 | 3.84 | 26.92 | 4.08 | 27.00 | 3.80 | 0.12 |
| 42 | 30.16 | 22.60 | 5.26 | 89.14 | 3.19 | 19.48 | 4.10 | 17.18 | 3.10 | 0.94 |
| 43 | 31.87 | 21.61 | 1.70 | 90.29 | 3.21 | 10.60 | 4.38 | 11.26 | 3.70 | 1.28 |
| 44 | 30.06 | 22.37 | 0.57 | 87.43 | 4.83 | 8.12 | 4.83 | 2.34 | 2.20 | 1.56 |
| 45 | 28.53 | 21.96 | 7.11 | 90.00 | 3.70 | 9.32 | 5.26 | 10.67 | 2.68 | 2.10 |
| 46 | 31.29 | 21.47 | 0.17 | 88.29 | 2.86 | 10.68 | 5.70 | 13.85 | 1.92 | 2.45 |
| 47 | 30.79 | 23.16 | 0.00 | 88.29 | 4.64 | 16.04 | 7.06 | 18.69 | 1.59 | 2.87 |
| 48 | 29.04 | 22.57 | 3.87 | 88.29 | 7.19 | 13.16 | 8.91 | 19.92 | 1.23 | 3.17 |
| 49 | 29.96 | 21.66 | 0.17 | 88.57 | 3.09 | 14.71 | 10.58 | 19.90 | 2.97 | 3.58 |
| 50 | 30.43 | 22.11 | 0.00 | 87.57 | 3.93 | 18.72 | 11.43 | 20.93 | 1.80 | 3.95 |
| 51 | 29.07 | 19.47 | 0.00 | 85.43 | 6.56 | 19.56 | 13.30 | 21.42 | 0.53 | 2.67 |
| 52 | 29.86 | 19.46 | 0.00 | 86.57 | 5.33 | 21.80 | 14.11 | 22.89 | 1.30 | 5.74 |
| 1 | 30.56 | 18.63 | 0.00 | 86.71 | 3.54 | 25.00 | 15.34 | 24.53 | 0.50 | 2.78 |
| 2 | 31.76 | 18.99 | 0.31 | 88.29 | 4.24 | 27.46 | 13.98 | 24.00 | 1.90 | 2.39 |
| 3 | 30.81 | 18.93 | 0.00 | 86.43 | 5.16 | 30.30 | 17.76 | 25.00 | 0.54 | 3.05 |
| 4 | 30.86 | 18.39 | 0.00 | 83.86 | 3.66 | 25.90 | 18.56 | 19.14 | 1.23 | 2.10 |
| 5 | 31.11 | 16.54 | 0.00 | 81.14 | 4.84 | 21.50 | 19.46 | 17.56 | 2.29 | 5.50 |
| 6 | 31.93 | 20.39 | 0.00 | 87.43 | 4.90 | 19.88 | 21.09 | 18.87 | 2.47 | 2.90 |
| 7 | 32.03 | 20.99 | 0.00 | 85.43 | 6.74 | 16.79 | 22.12 | 19.96 | 3.20 | 3.00 |
| 8 | 33.03 | 18.67 | 0.00 | 84.00 | 5.60 | 13.30 | 23.35 | 20.60 | 1.20 | 4.60 |
| 9 | 33.64 | 20.41 | 0.00 | 82.57 | 6.96 | 8.12 | 24.12 | 1.17 | 1.09 | 0.00 |
| 10 | 35.14 | 19.74 | 0.00 | 82.57 | 5.04 | 6. 67 | 24.34 | 2.34 | 2.18 | 1.08 |
| 11 | 32.76 | 23.26 | 2.37 | 84.00 | 7.24 | 5.89 | 22.98 | 1.00 | 0.92 | 0.19 |

After that, the leafhoppers population gradually increased from first week of December 2017 with 13.16 leafhoppers /3 leaves and peak incidence was noticed during third week of January 2006 (30.30 leafhoppers /3 leaves), there after there was a gradual decline in population of leafhopper. These findings are in close agreement with Senapati and Mohanty (1980) who revealed that, there was a progressive increase in leafhopper population from the second week of December reaching a peak in the third week of January. From the second week of March the population declined gradually. Bhendi leafhoppers population showed positive significant correlation with maximum temperature (r= 0.568) and negative significant correlation with minimum temperature (r= -0.602) and non-significant correlation with rainfall (r= 0.422) and positive higher significant correlation with RH (r=0.769) and significant negative correlation with wind velocity (r= -0.747) (Table.2). The present findings are in agreement with the findings of Umar *et al*. (2003) and Bishnol *et al*. (1996) who reported that according to maximum temperature the leafhopper population increased. Anurag *et al*. (2018) reported that the leafhoppers population was positive correlation with rainfall and negative correlation with wind velocity.

### *Seasonal incidence of whiteflies*

The activity of whitefly was low during August to last week of November, which ranged from 1.58 whiteflies/3 leaves (2ndweek of August 2017) to 5.70 whiteflies/3 leaves (last week of November 2017) (Table. 1) These findings are in conformity with Obnesorge (1981) who reported that density of *B. tabaci* was lowest in *kharif* and winter crops. Whitefly population on bhendi crop started from first week of December with 7.06 whiteflies/3 leaves and there was a gradual increase in whitefly population with the increase in temperature. Peak whitefly population was noticed during first week of March 07 (24.37 whiteflies/3 leaves). Whitefly population showed positive highly significant correlation with maximum temperature (r=0.643) and negative significant correlation with minimum temperature (r= -0.572) and positive significant correlation with rainfall (r=0.524) and positive higher significant correlation with RH (r= 0.753) and significant negative correlation with wind velocity (r=0.690) (Table.3). These results are

in line with Threhan (1994), who reported that high temperature was found to favour rapid multiplication of the pest. Same results were reported by Ozgur *et al*. (1990) and Rao *et al*. (1989).

***Seasonal incidence of aphids***

The incidence of aphid on bhendi started during second week of August 2017 (13.49 aphids/3 leaves) and peak incidence was noticed both in September and October months (Table. 1). Present findings are in line with the findings of Slosser *et al.* (1998) who reported that population of *A. gossypii* increased during August and October months. Patel and Rote (1995) reported that aphid population was peak in the second fortnight of October followed by first and second fortnight of November, thereafter, the population started declining. From the first week of December 2017 onwards, there was an increasing trend in population (10.93 aphids/3 leaves), and reached peak during third week of January (25.00 aphids/3 leaves), later there was a gradual decline in aphid population. This finding is in accordance with Patel and Rote (1995) and according to them aphid population decreased in the month of December, increased in the month of January and later there was a gradual decline. Aphids population showed positive significant correlation with maximum temperature (r= 0.612) and negative significant correlation with minimum temperature (r= -0.593) and positive significant correlation with rainfall (r= 0.529) and positive higher significant correlation with RH (r= 0.753) and significant negative correlation with wind velocity (r= -0.724). Anurag *et al*. (2018) reported that the aphid population positively correlated with rainfall and negatively correlated with wind velocity (Table. 4).

**Table 2. Influence of weather parameters on sucking pests population**

| Weather parameters | Sucking pest | Maximum temperature (ºC) | Minimum temperature(ºC) | Rainfall (mm) | Relative humidity (%) | Wind velocity (km/hr) |
|---|---|---|---|---|---|---|
| Correlation coefficient | Leafhoppers | 0.568* | -0.602* | 0.422 | 0.769** | -0.747** |
| | Aphids | 0.612* | -0.593* | 0.529* | 0.783** | -0.724** |
| | Whiteflies | 0.643** | -0.572* | 0.524* | 0.753** | -0.690** |
| | Thrips | 0.648** | -0.586* | 0.507* | 0.766** | -0.695** |
| | Mealybug | 0.619* | -0.617* | -0.168 | 0.767** | -0.699** |
| **Regression Equation** | Leafhoppers | 29.816 + 0.0825x | 12.133 – 5.4297x | 6.7297- 1.2497x | 2.5952 – 0.0971x | 12.329- 1.1298x |
| | Aphids | 39.277- 0.8393x | 16.181- 0.1493x | 12.045+ 0.439x | 33.176 – 0.5327x | 12.187 + 0.1507x |
| | Whiteflies | 32.089- 0.0576x | 33.399- 0.9497x | 12.639 + 0.1682x | 6.1068 + 0.2205x | 14.258- 0.2422x |
| | Thrips | 17.797 – 0.3258x | 18.72 – 0.5182x | 7.4125 + 0.0819x | 3.7181 – 0.1305x | 9.0101 + 0.2731x |
| | Mealybug | 17.957- 0.4345x | 20.723- 0.7625x | 4.6671- 0.1546x | 18.798- 0.1669x | 3.883 + 0.0876x |
| **$R^2$** | Leafhoppers | 0.2116 | 0.9798 | 0.6397 | 0.0028 | 0.4127 |
| | Aphids | 0.0381 | 0.0015 | 0.0521 | 0.0253 | 0.0011 |
| | Whiteflies | 0.0491 | 0.0784 | 0.0096 | 0.0054 | 0.0036 |
| | Thrips | 0.0232 | 0.0755 | 0.0073 | 0.0061 | 0.0149 |
| | Mealybug | 0.619 | -0.617 | -0.168 | 0.767 | -0.699 |

**. Correlation is significant at 0.01 level (2-tailed). *. Correlation is significant at 0.05 level (2-tailed).

***Seasonal incidence of thrips***

The incidence of thrips on bhendi started during second week of August 2017 (2.97 thrips/3 leaves) and peak incidence was noticed in fourth week September months (4.90 thrips/3 leaves) (Table. 1). Bhendi thrips population showed positive highly significant correlation with maximum temperature (r= 0.648) and negative significant correlation with minimum temperature (r= -0.586) and positive significant correlation with rainfall (r= 0.507) and positive highly significant correlation with RH (r=0.766**) and significant negative correlation with wind velocity (r= -0.695**) (Table. 5). Vennila *et al*., (2007) reported that high temperature and scanty rainfall aggravate the severity of sucking pests and further reported that *Thrips tabaci* has population peaks during dry spell with high temperature which are optimum for population build up.

***Seasonal incidence of mealybug***

The incidence of mealybug on bhendi started during second week of August 2017 (3.58 mealybug/3 leaves) and peak incidence was noticed in fourth week September months (6.90 mealybug/3 leaves) (Table.1). Bhendi mealybug population showed positive significant correlation with maximum temperature (r= 0.619) and negative correlation with minimum temperature (r= -0.617) and rainfall (r= -0.168) and positive highly significant correlation

with RH (r= 0.767) and negative highly significant correlation with wind velocity (r= -0.699) (Table.6). These findings are in conformity with those of Mani and Thontadarya (1987), who reported that maximum temperature showed a positive significant correlation with the mealybug population. Mealybug population had non-significant correlation with rainfall. The present findings are in line with the findings of Patel *et al.* (1997) who reported that during high rainfall period the mealy bug population did not attain peak.

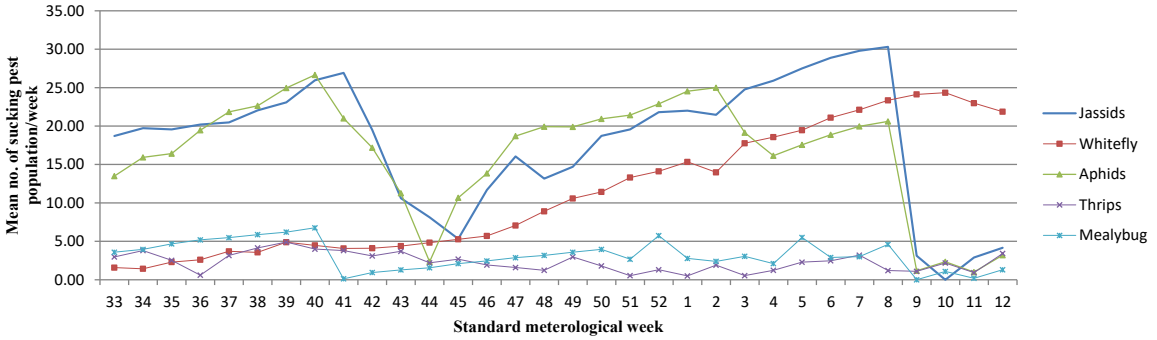


**Fig. 1. Influence of weather parameters on sucking pests**

***Regression analysis***

The regression equation indicated that an increase of 1ºC of maximum temperature increases the leafhoppers population by 0.0825 per 3 leaves per week and the population decreases by 5.4297 per 3 leaves as the 1ºC of minimum temperature increases. The increase of 1% relative humidity increase the whiteflies population by 0.2205 per 3 leaves per week. Increase in 1% maximum temperature results in decrease of whiteflies, aphids, thrips and mealybug population by 0.0576, 0.8393, 0.8393, 0.3258 and 0.4345 per 3 leaves, respectively. Similarly, due to 1% increase of relative humidity the population of leafhoppers, aphids, thrips and mealybug decrease by 0.0971, 0.5327, 0.1305 and 0.1669 per 3 leaves, respectively (Table 2).

***Conclusion***

The occurrence of sucking pests in bhendi can be forecasted with the prevailing weather parameters of the area. Continuous monitoring and forecasting will help the farmers to rely on non-chemical methods for better management of the sucking pest infestation in organic bhendi crop.

## References


Anurag, P. and G. Chandrakar. 2018. Studies on the seasonal incidence of major insect pests and its natural enemies on okra and their correlation with weather parameters. *Int.J.Curr.Microbiol.App.Sci.,* **6** : 204-210.

Gogoi, I., Dutta, C., and I. Gogoi. 2000. Seasonal abundance of cotton jassid, *Amrasca biguttula biguttula* (Ishida) on okra. *Journal of Agricultural Sciences,* **13(1)**:22-26.

IndiaAgristat, 2018. Agriculture Statistics of India. Retrieved from https://www.indiastat.com//

Kumawat, R.L., Pareek, B.L., and B. Meena. 2000. Seasonal incidence of jassid and white fly on okra and their correlation with abiotic factors. *Annals of Biology,* **16(2)**:167-169.

Lal, H., Mahal, M.S., Singh, R. and B. Singh. 1990. Influence of rainfall on population build-up of *Amrasca biguttula biguttula* (Ishida) on okra. *Journal of Insect Science,* **3(2)**:169-171.

Meena, N.K., Kanwat, P.M., Meena, A.and J.K. Sharma.2010. Seasonal incidence of leaf hoppers and whiteflies on okra, *Abelmoschus esculentus*(L.) Moench in semi-arid region of Rajasthan. *Annals of Agri Bio Research,* **15(1)**:25-29.

Patel, I. and N.B. Rote. 1995. Seasonal incidence of sucking pest complex of cotton underrainfed condition of southern Gujarat. *Gujarat Agric. Univ. Res. J*., **21(1)**: 127-129.

Sastry, K. and S. Singh. 1974. Effect of yellow vein mosaic virus infection on growth and yield of okra crop. *Indian Phyto Pathology*, **27(3)**:294-297.

Singh, G. and K.S. Brar. 1994. Effect of date of sowing on the incidence of *Amrasca biguttula biguttula* (Ishida) and *Earias spp*. on okra. *Indian Journal of Ecology*, **21(2)**:140-144.

Yadav, J.B., Singh, R. and R.Tripathi. 2007. Effect of weather parameters on incidence of pest complex of okra. *Annals of Plant Protection Sciences,* **15(2)**:477-478.


Received : May 15, 2018; Revised : June 22, 2018; Accepted : June 28, 2018