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Baldev Ram
Department of Entomology, S. K. N. College of Agriculture, Sri Karan Narendra Agriculture University, Jobner, Rajasthan, India

Akhter Hussain
Department of Entomology, S. K. N. College of Agriculture, Sri Karan Narendra Agriculture University, Jobner, Rajasthan, India

SL Sharma
Department of Entomology, S. K. N. College of Agriculture, Sri Karan Narendra Agriculture University, Jobner, Rajasthan, India

BL Jat
Department of Entomology, S. K. N. College of Agriculture, Sri Karan Narendra Agriculture University, Jobner, Rajasthan, India

Corresponding Author:
Baldev Ram
Department of Entomology, S. K. N. College of Agriculture, Sri Karan Narendra Agriculture University, Jobner, Rajasthan, India

Seasonal incidence of okra shoot and fruit borer in relation to meteorological parameters

Baldev Ram, Akhter Hussain, SL Sharma and BL Jat

Abstract
Okra (*Abelmoschus esculentus* (L.) Moench) commonly known as Bhindi or lady's finger, is a popular vegetable crop due to its high nutritional and medicinal values. Okra crop, right from germination to harvesting is attacked by about 72 species of insect pests. The main cause of low yield in okra is phytophagous insect pests, diseases and mites but the shoot and fruit borers (*Earis insulana* Boisduval and *E. vittella* Fab.) are one of the most serious pests of okra (Singh *et al.*, 2014). The larvae bore into the terminal growing shoots, floral buds, flowers and fruits of okra, resulting in cessation, withering and drying of infested shoots, tender leaves and heavy shedding of floral buds and flowers. The borer has been reported to cause 24.6 to 26.0 per cent damage to okra shoots (Pareek *et al*., 1986) and 40 to 100 per cent loss to fruits (Shinde *et al*., 2007). A field experiment was carried out in *kharif*, 2020 at SKN College of Agriculture, Jobner to evaluate the seasonal incidence of okra shoot and fruit borer (*Earias* sp.) in relation to meteorological parameters. Okra variety, selectiaon-999 was sown in individual five plot of size 2.25 x 1.8 m^2. The data on shoot and fruit borer, *Earias* spp. were recorded on five randomly selected and tagged plants throughout the crop period by visual count of the plant in which the top portion was infested. The infestation of shoot and fruit borer on shoot was recorded in 33rd SMW (Standard Meteorological Week), which reached its peak in 40th SMW (11.20 per cent). The shoot infestation had non-significant relation with minimum temperature (r= 0.37), and rainfall (r= -0.28), whereas, significant positive correlation with maximum temperature (r= 0.86*) and significant negative correlation with relative humidity (r= -0.58*). Infestation of fruits had negative significant correlation with maximum temperature (r = -0.77 on number basis and -0.80 on weight basis), minimum temperature (r = - 0.86 on number basis and r = -0.87 on weight basis) and rainfall (r = -0.59 on number basis and r = -0.56 on weight basis) but non-significant with relative humidity.

Keywords: *Earias vittella,* seasonal incidence, temperature, relative humidity and Standard Meteorological Week

Introduction
Vegetables are the substantial part of human diet. Vegetables contain almost all nutritional requirements that our body needs. The health benefits of vegetable nutrition are enormous. They are the affluent and cheaper source of vitamins, minerals, antioxidants, dietary fibres and trace elements. As vegetables contain these health benefitting phyto-chemical compounds, they not only protect the human body from oxidant stress, diseases, and cancers, but also help our body in developing the capacity to fight against these diseases by boosting its immunity. Among the divergent group of vegetables, Okra *Abelmoschus esculentus* L. (Moench) is the second largest cultivated crop, a potential export earner and accounting for about 60 percent of export of the total fresh vegetables (Peirce, 1987) [6].

Among the biotic factors insect-pests are predominant and occur regularly at different stages of crop growth. Among other various factors responsible for lower yield of Okra, insect pests *viz*., the fruit borer, *Helicoverpa armigera* (Hubner), Okra shoot and fruit borer, *Earias vittella* (Fabricius) and sucking insect pests *viz*., whitefly *Bemesia tabaci* (Gennadius)., Jassids, *Amrasca biguttulla biguttula* (Ishida) and thrips *Thrips tabaci* (Lind) are highly destructive causing serious damage and are responsible for lowering the yield of Okra crop (Lal *et al*., 1990) [4].

The important limiting factor in the successful cultivation of Okra is the damage caused by insect-pests, mainly fruit borers and sucking insects. The important species of fruit borers are *Earias vittella* (Fabricius) (Krishnaiah *et al*. 1980, Rawat and Sahu, 1973) [3, 7], *E. insulana* (Bioduval) (Tripathi and Singh, 1990) and *Helicoverpa armigera* (Hubner) (Rawat and Sahu, 1973) [7].

The larvae of Okra shoot and fruit borer, *E. vittella* (Fab.) are the major constraint in maximizing production in summer grown okra. Damage due to the borer pests in summer season has been reported to range from 4.65 to 17.15 per cent (Dhamdhre *et al*., 1984) [1]. It causes up to 41.60 per cent cop loss in different parts of India (Srinivasan and Krishnakumar, 1988). However, according to Hiremath and Thontadarya (1984) [2] the damage caused by *Earias* spp. may reach as high as 60.68 per cent. Besides the fruits, it also damages growing shoots which adversely affects the overall health of plants and yield. In the light of above facts this experiment was carried out to determination of population dynamics of okra shoot and fruit borer and impact of weathers parameters on them.

Material and Methods

Layout of experiment

For studying the effect of abiotic factors on the incidence of major insect pests of okra, the variety selection – 999 was sown on third week of July 2020 in five plots of 2.25 X 1.8 m^2 sizes keeping row to row and plant to plant distance of 45 cm and 30 cm, respectively. All five plots of okra were not sprayed with any of the insecticides.

Methods of observation

For recording the observations, the crop was left for natural infestation. The observations of shoot infestation by *Earias* spp. were recorded at weekly interval and fruit infestation at each picking and converted into weekly basis. The observations on shoot and fruit borer, *Earias* spp. were recorded on five randomly selected and tagged plants throughout the crop period by visual count of the plant in which the top portion was infested, started after two week of sowing to last picking of the fruits. The per cent shoot infestation was calculated by counting the total number of shoots and the number of infested shoots. In case of fruit borer, the observations were recorded on infestation of fruits both on number and weight basis at each picking starting from initiation of fruit infestation to till last picking of fruits. The per cent infestation of fruits on number basis was calculated by counting the infested and healthy fruits separately from selected tagged plants. The weight of both healthy and infested fruits was taken separately and level of infestation was worked out in per cent.

The data recorded on infestation of shoot and fruit borer and meteorological parameters was used for statistical analysis. To infer the results of seasonal incidence, simple correlation was worked out between per cent shoot and fruit infestation by okra and abiotic parameters, *viz*; maximum and minimum temperatures, relative humidity and rainfall.

Interpretation of data

To interpret the results of seasonal incidence of okra shoot and fruit borer, the simple correlation was computed between per cent shoot and fruit infestation by okra and abiotic factors (maximum and minimum temperature, relative humidity and rainfall). The following formula was used for calculating correlation coefficient.

$$r = \frac{N\sum xy - (\sum x)(\sum y)}{N\sum x2 - (\sum x)2.N\sum y2 - (\sum y)2}$$

Where,

r = Simple correlation coefficient

x = Independent variables *i.e*. abiotic components

y = Dependent variables *i.e*. pests

N = Number of observations

Results and Discussion

The mean shoot and fruit infestation (number and weight basis) was recorded to observe the incidence of shoot and fruit borer, *Earias vittella* (Fab.) in Okra. The data revealed (Table 1) that the shoot damage initiated in the 33rd standard mean week with shoot damage of 1.80 per cent. Initially, the infestation was low, gradually increased and reached to its peak *i.e*., 11.20 per cent in the fourth week of September (40th SMW). The shoot infestation gradually decreased after the peak infestation. Regarding mean infestation of fruits, the infestation started during the fourth week of August (35th SMW) and recorded 5.93 per cent infestation in number basis and 5.18 per cent infestation in weight basis. The mean fruit infestation gradually increased and reached its peak 30.92 per cent (number basis) and 28.90 per cent (weight basis) during the second week of November (47th SMW).

The infestation of *E. vittella* on shoot of okra crop started at maximum temperature of 33.10 °C, minimum temperature of 23.50 °C while the relative humidity of 86 per cent and total rainfall of 57.40. During maximum shoot infestation the maximum temperature, minimum temperature and relative humidity recorded were 37, 14.30 and 47 per cent respectively. No rainfall was recorded during the same. The mean fruit infestation peaked (both number and weight basis) when maximum temperature of 25.20 °C, minimum temperature of 7.70 °C and relative humidity of 72 per cent was recorded.

The shoot infestation had non-significant correlation with minimum temperature and rainfall while it had positive significant correlation with maximum temperature (r= 0.86) and negative significant correlation with relative humidity (r= 0.58). The mean fruit infestation on number basis had non-significant correlation with relative humidity and negative significant correlation with maximum temperature (r= 0.77), minimum temperature (r= 0.86) and rainfall (r= 0.59). Regarding weight basis it had non-significant correlation with relative humidity, negative significant correlation with maximum temperature (r= 0.80), minimum temperature (r= 0.87) and rainfall (r= 0.56).

The infestation of *Earias sp*., on the shoots of okra commenced in the second week of August with mean shoot damage of 1.80 per cent. Initially the infestation was low increased gradually and reached to its peak (11.20 percent) during last week of September. The incidence decreased gradually and disappeared from shoots during first week of November. The results were in accordance with Sharma and Jat (2010) [8] whom reported that the infestation initiated during the second week of August and reached its peak during the last week of September.

Table 1: Seasonal incidence of okra shoot and fruit borer in relation to meteorological parameters

SMW	Date of observation	Maximum temp.	Minimum temp.	R.H	Total rain fall	Mean Shoot infestation	Mean infestation of fruit (%)	
							Number basis	Weight basis
33	12-08-2020	33.10	23.50	86	57.40	1.80	-	-
34	19-08-2020	30.20	22.00	87	39.40	2.40	-	-
35	26-08-2020	31.10	21.50	83	27.80	3.40	5.93	5.18
36	02-09-2020	36.70	21.30	84	24.40	5.60	6.38	5.44
37	09-09-2020	36.30	21.10	67	0.000	5.60	7.31	7.00
38	16-09-2020	37.30	21.50	63	1.300	6.40	10.37	8.20
39	23-09-2020	36.90	20.80	59	3.200	8.60	11.38	9.70
40	30-09-2020	37.00	14.30	47	00.00	11.20	13.36	10.90
41	07-10-2020	36.60	16.50	43	00.00	9.20	15.60	12.90
42	14-10-2020	35.00	20.30	44	00.00	7.80	18.08	15.40
43	21-10-2020	33.30	17.60	43	00.00	5.60	20.39	19.60
44	28-10-2020	31.00	10.50	48	00.00	3.0	21.37	21.30
45	04-11-2020	30.90	08.90	65	00.00	0.00	23.90	22.90
46	11-11-2020	27.40	12.70	71	00.00	0.00	27.04	25.60
47	18-11-2020	25.20	07.70	72	00.00	0.00	30.92	28.90
Max. temp. (r)						0.86**	-0.77**	-0.80**
Min. temp. (r)						0.37 (NS)	-0.86**	-0.87**
R.H. (r)						-0.58*	-0.23 (NS)	-0.19 (NS)
Rainfall (r)						-0.28 (NS)	-0.59*	-0.56*

SMW = Standard meteorological week | *Significant at 5 percent level **Significant at 1 percent level | NS: Non significant

Conclusion

The data on seasonal abundance of *E. vittella* on okra showed that, the shoot damage of this noctuid commenced from 33rd standard mean week (1.80% shoot damage) and reached its peak during 40th SMW (11.20% shoot damage). The correlation study revealed that mean shoot infestation was positively correlated with maximum temperature (r= 0.86) and negatively correlated with relative humidity (r= -0.28). Mean fruit infestation on number basis was negatively correlated with maximum temperature (r= -0.77), minimum temperature (r= -0.86) and rainfall (r=-0.59). The same trend was followed in case fruit infestation on weight basis, it was negatively correlated with all the parameters recorded such as maximum temperature (r= -0.80), minimum temperature (r= -0.87) and rainfall (r=-0.56).

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