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Population dynamics of shoot and fruit borer, *Earias* spp. infesting Okra

Sumitra Choudhary and Ashok Sharma

Abstract
A field study was conducted during Rainy season 2015-16 to observe the population dynamics of shoot and fruit borer, *Earias* spp. infesting okra under field conditions. The infestation of shoot and fruit borer on shoots of okra commenced in the 2nd week of August (2.10%) which gradually increased and reached to peak (15.50%) in the last week of September. The maximum temperature had significant positive correlation, while remaining abiotic factors showed non significant correlation with shoot infestation. The infestation of pest on fruits started in the last week of August *i.e.* 35 SMW (4.70%) which gradually increased and reached to peak (22.40%) in the 4th week of October *i.e.* 43 SMW. The infestation of *Earias* spp. on fruits of okra showed significant negative correlation with minimum temperature and relative humidity while, maximum temperature and rainfall had non-significant correlation.

Keywords: *Earias*, okra, population dynamics, shoot and fruit borer

1. Introduction
Vegetables play an important role in nutritional security, economic viability and fit well into the predominant intensive cropping systems prevailing in different parts of our country. Among different vegetable crops, Okra, *Abelmoschus esculentus* (L.) Moench occupies an important position and is grown extensively throughout India mainly for its immature fruits. It plays an important role in the human diet and is a good source of protein, carbohydrates, vitamins, calcium, potassium, enzymes, and total minerals which are often lacking in the diet of developing country. Its medicinal value has also been reported in curing ulcers and relief from hemorrhoids. Okra has found medical application as a plasma replacement or blood volume expander and also useful in genito-urinary disorders, spermatorrhoea and chronic dysentery. The fruits of okra have reawakened beneficial interest in bringing this crop into commercial production.

Okra is a better source of livelihood to the farmers but the attack of different insect pests at various stages of its growth act as limiting factor in its successful cultivation and yield. In India, about 13 pests are reported from okra [3]. Among them, two species of shoot and fruit borer, *Earias insulana* (Boisd.) and *E. vittella* (Fab.) are the most destructive pest of okra as young larva bores into tender shoot in early vegetative growth of plants and grown up larva damages many fruits resulting in serious loss in yield. The affected fruits are rendered unfit for human consumption, as well as for procurement of seed. The borer has been reported to cause 24.6 to 26.0 per cent damage to okra shoots [8, 16] and 40 to 100 per cent loss to fruits [10, 7, 13, 9]. In order to prevent the infestation of the pests and to produce a quality crop, it is essential to manage the pest population at appropriate time with suitable measures. Pest behaviour and population dynamics in relation to weather parameter is an essential pre-requisite for formulation of an effective pest management programme [13]. In the present scenario of climate change, the insect pest situation is also being changed with the variation in abiotic factors. The weather conditions prevailing in a region play an important role in the occurence and subsequent buildup of pest's population similarly the study was undertaken to find out the correlation between pests population and weather parameters to know the most favourable condition for buildup of pest population which is helpful in developing pest management strategies.

2. Materials and Methods
The field experiment was conducted on the Horticulture farm, S.K.N. College of Agriculture, Jobner (SKNAU, Jobner) Jaipur-Rajasthan.

Geographically, Jobner is situated at 75^0 28' East longitude, 26^0 05' North latitude and at an altitude of 427 meters above Mean Sea Level. The climate of this region is typically semi-arid, characterized by extremes of temperature both during the summer and winter with low rainfall and moderate humidity. Maximum temperature in summer reaches as high as 47 ^{0}C and minimum temperature in winter falls down below 0 ^{0}C. The average annual rainfall of locality varies from 400-500 mm occurring mostly from the last week of June to September. To study the seasonal incidence of shoot and fruit borer infesting okra in relation to key abiotic factors, Arka anamika a commonly grown and recommended variety in this area was sown on first week of July, 2015 in five separate plots of 3.0 X 2.25 m^2 size keeping row to row and plant to plant distance of 30 and 45 cm, respectively.

2.1 Observations
For recording the observations, the crop was left for having the natural infestation. 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 damaged, 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 damaged shoots. The per cent infestation of fruits on number basis was calculated by counting the infested and healthy fruits separately from selected tagged plants at each picking till last picking of fruits.

2.2 Analysis of data
The data recorded on shoot and fruit damage and meteorological parameters were used for statistical analysis [6]. The simple correlation was computed between shoot and fruit damage and abiotic factors, *viz.;* maximum and minimum temperature, relative humidity and rainfall. The following formula was used for calculating correlation coefficient [2].

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

Where
r = Simple correlation coefficient
x = Independent variable *i.e.* abiotic component
y = Dependent variable *i.e.* pest
N = Number of observations

3. Results and Discussion
The data on seasonal incidence of a pest provide useful information on the population buildup of pest in relation to the abiotic factors of environment. Such information can effectively be utilized in predicting the buildup of pest population and thus helpful in integrated pest management programme.

In the present study the shoot damage was observed when the crop was in vegetative stage. The data presented in table 1 showed that the infestation of shoot and fruit borer on shoots of okra started in the 2nd week of August (2.10%) *i.e.* four weeks after sowing which gradually increased and reached to peak (15.50%) in the last week of September when maximum temperature (34.6 ^{0}C), minimum temperatures (19.8 ^{0}C), mean relative humidity (53.00%) and no rainfall were observed. The correlation study revealed that the maximum temperature had significant positive correlation (r= 0.650), while remaining abiotic factors showed non significant correlation with shoot infestation. As soon as the fruiting started, the incidence of this insect pest on the shoots started to decline and disappeared from shoots during 43 SMW. The present study get fully support from the observations of Sharma and Jat (2010) [11] and Yadav (2015) [15] who reported that infestation of this pest on shoots of okra started in the second week of August and reached to its peak in the last week of September. Similarly, the findings of Meena and Kanwat (2005) [4], Meena *et al.* (2010) [5] and Aziz *et al.* (2011) [1] also support the present findings.

The infestation of pest (4.70%) on fruits started in the last week of August *i.e.* 35 SMW which gradually increased and reached to peak (22.40%) in the 4th week of October *i.e.* 43 SMW at 33.9 ^{0}C maximum temperature and 15.2 ^{0}C minimum temperature, 51.00 per cent relative humidity and no rainfall were observed. The infestation of *Earias* spp. on fruits of okra showed significant negetive correlation with minimum temperature and relative humidity while, maximum temperature and rainfall had non-significant correlation with fruit infestation. The present findings are in close conformity with the observations of Shah *et al.* (2001) [10], Yadav *et al.* (2007) [14], Meena *et al.* (2010) [5], Sharma and Jat (2010) [11], Sharma *et al.* (2010) [12] and Yadav (2015) [15].

Table 1: Seasonal incidence of shoot and fruit borer, *Earias* spp. infesting okra in relation to key abiotic factors

SMW	Date of observation	Temperature (°C)		Mean Relative Humidity (%)	Total Rainfall (mm)	Shoot damage (%)	Mean infestation of fruits (%) Number basis
		Max.	Min.				
32	10.08.2015	32.6	25.8	77.00	-	2.10	-
33	17.08.2015	32.4	24.4	79.00	012.0	3.00	-
34	23.08.2015	32.9	24.3	69.00	-	4.40	-
35	30.08.2015	35.6	23.4	63.00	-	6.70	4.70
36	06.09.2015	36.1	21.7	60.00	-	9.10	9.10
37	13.09.2015	37.9	21.9	54.00	-	11.20	11.00
38	20.09.2015	35.7	24.3	67.00	010.0	12.70	12.70
39	27.09.2015	34.6	19.8	53.00	-	15.50	13.90
40	04.10.2015	37.2	17.2	41.00	-	13.20	15.30
41	11.10.2015	36.8	16.3	43.00	-	9.30	18.00
42	18.10.2015	36.4	19.1	51.00	-	6.00	19.80
43	25.10.2015	33.9	15.2	51.00	-	0.00	22.40
Max. temperature (r)						0.650*	NS
Min. temperature (r)						NS	-0.886**
R.H. (r)						NS	-0.853**
Rainfall (r)						NS	NS

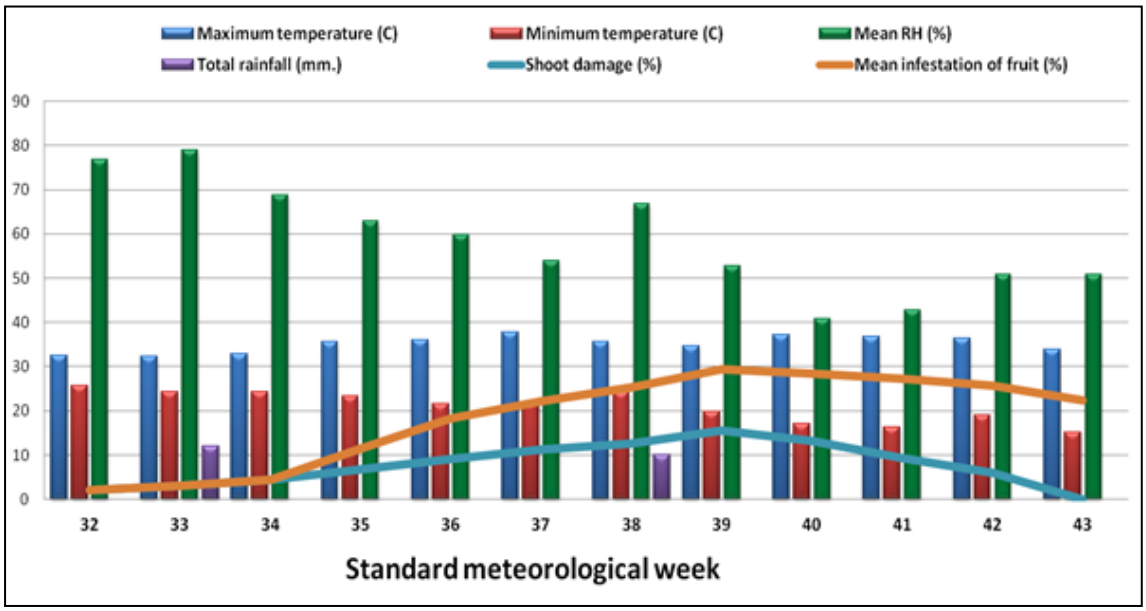

Fig 1: Seasonal incidence of shoot and fruit borer, *Earias* spp. infesting okra in relation to key abiotic factors

4. Conclusion

From the present study it can be concluded that the peak infestation of shoot and fruit borer on shoots (15.50%) was observed in the last week of September while on fruit it was observed (22.40%) in the 4th week of October (43 SMW). The maximum temperature had significant positive correlation, while remaining abiotic factors showed non significant correlation with shoot infestation. The infestation of *Earias* spp. on fruits of okra showed significant negative correlation with minimum temperature and relative humidity while, maximum temperature and rainfall had non-significant correlation.

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