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Seasonal Incidence of Fruit and Shoot Borer of Okra along with Climatic Factors in Udaipur Region of India

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Abstract: The field experiment was conducted with a view to study the fluctuation of pest population of *Earias vittella* (Fab.) and their relation with prevailing weather conditions at Horticulture Farm, Rajasthan College of Agriculture, Udaipur during Kharif 2005 and 2006. The results revealed that borer incidence commenced in the 29th standard week. The peak infestation of plants (91.6%) was observed in 45th standard week. The maximum numbers of larvae (7.5 larvae/10 plants) were recorded in the 42nd standard week. The maximum quantum of damaged fruits on number basis was 54.3% and on weight basis was 54.7% when the crop was 18 weeks old in 42nd standard week. Correlation between pest population and important weather parameters showed that *Earias* population was negatively correlated with the mean temperature and mean relative humidity but non significantly and negatively correlated with rainfall in terms of larval population and percentage of infested plants.

Key words: Abundance, *Earias*, meteorological parameters, *Abelmoschus*, correlation

INTRODUCTION

The spotted bollworm of cotton or okra fruit and shoot borer, *E. vittella* (Lepidoptera: Noctuidae) is a widely distributed insect pest. This pest has been reported to infest okra (*A. esculentus*), cotton (*G.* sp.), hollyhock (*A. rosea.*), safflower (*Carthamus* sp.), Indian mallow (*Abutilon* sp.), *Corchorus* sp., *Hibiscus* sp., *Malvas* sp., *Malvastrum* sp., *Sida* sp., *Theobroma* sp. and *Urena* sp. (Khan and Verma, 1946; Pearson, 1958; Butani and Verma, 1976; Atwal, 1999; David, 2001). It is estimated about 69% loss in marketable yield due to attack of this insect on okra (Rawat and Sahu, 1973). Radke and Undirwade (1981) observed the appearance of *Earias* sp. with the initiation of fruiting. The infestation increased and reached its peak up to 100% after 12 weeks of sowing with an average larval population of 1.3 per fruit. Similarly, Agrawal (1993) recorded the incidence at first picking that remained till 5th picking (10 weeks after germination) and the resultant loss in yield was 60.0 and 63.3% during kharif 1991 and 1992, respectively. However, the peak incidence of fruit and shoot borer of okra was observed in the last week of August with a range of 34 to 45% damage to fruits (Rana, 1983); 67.7% in October (Dhawan and Sidhu, 1984) and 25.9 to 40.9%

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(Dhamdhere *et al*., 1984). Gupta *et al*. (1998) reported a positive correlation of *E. vittella* with minimum temperature, morning relative humidity and total rainfall and negative correlation with maximum temperature in okra. Pareek *et al*. (2001) observed the fruit borer incidence to start in first week of September with maximum fruit infestation in the third week of October. Yadvendu (2001) recorded the peak incidence of 86.5 and 72.5/5 plants during first and fourth week of September, respectively. Acharya (2002) and Dangi (2004) observed that the incidence of okra fruit borer commenced from the 4th week of August (6th week after sowing). Hence, an attempt has, therefore, been made to study the population dynamics of okra fruit and shoot borer in relation to prevailing weather conditions on Udaipur region of Rajasthan, so that the informations can effectively be utilized in formulating pest management programme.

MATERIALS AND METHODS

To record the population dynamics of fruit and shoot borer, the field experiment was conducted during Kharif 2005 and 2006 at Horticulture Farm, Rajasthan College of Agriculture, Udaipur. An okra variety Arka Anamika was sown on 21st July 2005 and 2006 in plots of 3×2.7 m (8.1 m^2) with six replications maintaining 45 cm row to row and 30 cm plant to plant distance. The seed rate used was 20 kg ha^{-1}. Normal agronomic procedures were followed to grow the crop. Ten plants were selected at random and tagged in each plot for the trial on population dynamics of okra fruit and shoot borer. Weekly observations were taken on the entire tagged plant throughout the crop season. The incidence of okra fruit and shoot borer was recorded in terms of percentage of infested plants, number of larvae per ten plants and percentage of damaged fruits (number and weight basis). Incidence of okra fruit and shoot borer in terms of percentage of damaged fruits on number and weight was recorded by counting and weighing healthy and damaged fruits at each picking separately. In order to study the influence of key abiotic factors on the pest incidence, simple correlations were worked out between the pest incidence and meteorological factors for the instantaneous effect of meteorological variables by using the formula:

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sqrt{\{\sum X^2 - \frac{(\sum X)^2}{N}\}\{\sum Y^2 - \frac{(\sum Y)^2}{N}\}}}$$

Where:

r = Simple linear correlation coefficient
X = Independent variable (meteorological parameter)
Y = Dependent variable (pest)
N = No. of observations

RESULTS AND DISCUSSION

Population Dynamics of Okra Fruit and Shoot Borer

The results indicated that Earias *vittella* (Fab.) infestation on okra plants commenced in the end of July (29th standard week) that continuously increased till the last picking in the mid of November (45th standard week) when 90.8 and 91.6 per cent of the plants were found to be attacked by the pest during Kharif 2005 and 2006, respectively (Table 1). Radke and Undirwade (1981) also reported infestation to the extent of 100 per cent with larval population of 1.3 per fruit.

Table 1: Seasonal incidence of shoot and fruit borer of okra during 2005-06 and 2006-07

Standard week	Mean temperature (°C)		Total Mean relative humidity (%)		No. of rainfall (mm)		Infested plants (%)		Larvae/10 plants		Damaged fruits on No. basis (%)		Damaged fruits on weight basis (%)	
	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006	2005	2006
29	23.6	24.8	87.0	91.0	70.4	118.6	17.6	22.5	0.3	0.5	-	-	-	-
30	25.7	25.8	86.5	89.0	26.3	29.9	21.2	26.1	0.6	0.8	-	-	-	-
31	22.9	26.2	83.0	82.5	41.7	34.2	26.7	30.0	1.1	1.2	7.6	9.2	9.7	9.8
32	23.8	26.4	76.0	72.0	13.7	18.8	32.8	33.3	1.3	1.5	11.7	13.4	11.9	13.0
33	27.6	28.0	72.0	70.0	67.2	63.5	35.7	36.7	1.9	1.8	11.9	13.7	12.4	13.3
34	26.5	27.3	58.0	62.0	80.4	60.3	39.6	40.0	2.3	2.0	12.8	14.7	15.4	16.0
35	27.2	27.7	44.0	46.5	76.8	80.7	51.2	50.5	2.4	2.4	14.2	15.5	16.2	16.5
36	24.3	25.9	56.5	54.0	71.5	67.4	54.8	56.7	2.7	2.9	16.8	18.7	17.6	18.0
37	27.1	26.4	51.5	49.5	22.5	23.6	63.5	67.5	3.2	3.3	19.7	23.1	20.8	23.9
38	22.8	24.4	50.5	53.5	31.6	29.4	71.9	73.7	4.2	4.1	26.2	28.3	24.7	29.7
39	22.2	23.1	52.5	53.0	18.7	21.7	74.4	74.1	4.7	4.8	33.8	34.1	30.9	35.4
40	21.7	22.6	57.0	63.0	8.2	5.6	77.6	78.0	5.4	5.5	42.6	44.4	36.8	44.9
41	23.8	21.0	61.0	63.5	4.7	0.0	81.8	83.0	5.9	6.4	47.7	53.0	41.6	52.9
42	21.7	21.1	52.0	61.5	0.0	0.0	84.9	85.4	7.3	7.5	49.3	54.3	47.2	54.7
43	20.6	18.0	54.0	50.5	0.0	0.0	87.0	88.0	6.2	5.9	47.2	45.8	45.8	46.2
44	21.8	20.2	56.5	62.0	0.0	0.0	89.2	90.8	5.7	5.5	41.6	42.1	44.1	40.8
45	18.4	17.7	59.5	55.0	0.0	0.0	90.8	91.6	4.0	4.4	35.4	37.7	43.8	37.6

It was observed that the infestation of Earias *vittella* (Fab.) on okra shoots started in the last of July (29th standard week) with an average population of 0.3 and 0.5 larvae/10 plants in Kharif 2005 and 2006, respectively. The infestation continuously increased and reached to the peak of 7.5 larvae/10 plants in 3rd week of October (43rd standard week) and thereafter, the population of larvae declined gradually. Similarly, Yadvendu (2001) reported that pest population attained its peak of 86.5 and 72.5 larvae/5 plants during first and fourth week of September, respectively. Dangi (2004) also reported peak population (10.3 larvae/5 plants) in first week of October.

The damage to fruits started in the first week of August (31st standard week). The mean fruit damage on number basis ranged from 7.6 and 9.2 per cent in the first week of August (31st standard week) to 49.3 and 54.3% in the 3rd week of October (42nd standard week) during Kharif 2005 and 2006, respectively. Dhawan and Sidhu (1984) also reported maximum fruit damage (67.7%) at the end of October. Abhisek *et al.* (1997) reported that infestation of fruit borer started at the beginning of fruiting and reached to a peak of 42.3% in the first fortnight of June while Shah *et al.* (2001) reported fruit damage ranging from 8.3 to 91.6% with peak in 13 weeks old crop. Dangi (2004) observed 71.8% fruit damage on number basis in the last week of September due to pest population.

The mean fruit damage on weight basis ranged from 9.8 to 54.7% and 9.7 to 47.2% during both the years, respectively and exactly followed the same trend as that of number of fruit damaged. Dangi (2004) also reported 70.2% fruit infestation on weight basis due to attack of *Earias vittella* (Fab.).

Correlation between Incidence of Pest Population and Abiotic Factors

It is evident from Table 2 that the incidence of fruit and shoot borer in terms of percentage of infested plants had a significant negative correlation with the mean temperature (r = -0.734 in 2005, r = -0.805 in 2006) and mean relative humidity (r = -0.213 in 2005, r = -0.285 in 2006) but non significant negative correlation with rainfall (r = -0.145 in 2005 and r = -0.242 in 2006). Kadam and Khaire (1995) also reported that high humidity had adverse effect on pest population.

Table 2: Correlation coefficient (r) of pest population with abiotic factors

	Infested plants (%)			No. of Larvae/10 plants		
Weather parameters	2005	2006	Pooled	2005	2006	Pooled
Mean temperature (°C)	-0.734	-0.805	-0.770	-0.678	-0.712	-0.695
Mean relative humidity (%)	-0.213	-0.285	-0.249	-0198	-0.241	-0.220
Total rainfall (mm)	-0.145	-0.242	-0.194	-0.175	-0.246	-0.221

Incidence of fruit borer in terms of larval population showed significant negative correlation with mean temperature (r = -0.678 in 2005 and r = -0.712 in 2006) and mean relative humidity (r = -0.198 in 2005 and r = -0.241 in 2006) but non significant negative correlation with rainfall (r = -0.175 in 2005 and r = -0.246 in 2006). Dhamdhere *et al.* (1984) found negative correlation of pest population with temperature and relative humidity. Devraj and Kumar (1987) and Pareek *et al.* (2001) observed that minimum temperature, relative humidity and rainfall had a significant negative correlation with the population build up.

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