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Population dynamics of *Earias vittella* Fab. in okra as influenced by weather parameters in north Bihar

S.K. MANDAL, ABDUS SATTAR[1] and S.C. GUPTA
Department of Entomology and Agril. Zoology, [1]Department of Agronomy
Rajendra Agricultural University, Bihar, Pusa (Samastipur) – 848 125

ABSTRACT

A field experiment was conducted during summer, 2000 and 2001 at Pusa, Bihar to evaluate the impact of weather parameters on the incidence and activity of *Earias vittella* Fab. in okra CV 'Pusa Sawani'. The analysis revealed that the pest activity started to buildup from four weeks age of the crop and remained intensified critically below a maximum temperature of 35°C and above a minimum temperature of 22°C. Significant negative correlation with maximum temperature and positive relationships with minimum temperature, relative humidity, vapour pressure and rainfall were observed. Regression models explained 93 to 95 per cent variability due to weather parameters for okra borer infestation.

Key words : Weather, infestation, okra, shoot and fruit borer.

Okra a quick growing green vegetable is grown widely under varying agro-climatic conditions in Bihar state. The shoot and fruit borer, *Earias vittella* Fab. (*Lepidoptera:Noctuidae*) is an important pest of okra {*Ablmoschus esculentus* (L.) Moench}. Larva bores the growing shoot of okra plant prior to fruit formation resulting in withering and drying of shoot. On formation, larva starts feeding on okra fruits and thus causes direct yield loss upto 49 to 79 per cent (Krishnaiah, 1980). The present studies were carried out to evaluate the population dynamics of *Earias vittella* on okra crop in relation to weather parameters.

MATERIALS AND METHODS

Study on population dynamics of *E. vittella* on okra was undertaken at the University Apiary, Rajendra Agricultural University, Pusa, Bihar during summer in the years 2000 and 2001. The okra CV 'Pusa Sawani' was sown on 16th February in both the years in sixteen random blocks of size 3m x 2m with a spacing of 0.3 x 0.3 m. Normal agronomical practices were followed to raise the crop. The borer pest incidence was recorded each season from each replicate from 11th standard meteorological week (12-18 March). The shoot damage was worked out by counting randomly selected 10 tagged plants with withered terminal shoots out of all the shoots of total tagged plants in each replicate and the per cent weekly shoot damage was worked out. The fruit damage was worked

out by counting borer infested fruits out of the total fruits harvested from each plot in each of the pickings. The per cent infested fruits on weight basis was also calculated.

The larval population per hundred fruits was taken at each picking. Larva were either crawling on the infested fruits or were present inside the infested okra fruits. The larva in infested fruits were counted by cutting the fruit longitudinally. The weekly meteorological data were collected (viz. maximum and minimum temperature, relative humidity at 700 hrs and 1400 hrs local mean time, vapour pressure and rainfall) for correlation and regression analysis.

RESULTS AND DISCUSSION

Weather parameters and Earias vittella infestation

The activity of shoot and fruit borer (*E. vittella*) on summer okra was observed from 11th standard meteorological week (12-18 March) in both the years. The infested shoots ranged between 0.5 to 2.3 per cent in 2000 and 1.8 to 4.2 per cent in 2001 and these infestations were almost negligible and no infestation on shoot was observed after fruit setting (Table 1a). The low incidence on shoot was earlier reported by Senapathy *et al.* (1982). Ahmad (1988) also recorded lower infestation on shoots than on the fruits. The damage potential of the pest based on both fruit number and weight as well as larval population per hundred fruits started to build up from 13th week (26 March – 1 April) and increased progressively upto 25th week (18-24 June) in both the years of study. The minimum incidence of 16.5 (fruit number) and 15.2 per cent (on weight basis) and the larval population of 29.2 per hundred fruits in 2000 and relatively lower larval population in 2001 (Table 1a) were recorded during 26th March to 1st April. The maximum of 48.2, 43.0 per cent on fruit number and weight basis respectively and 57.2 larval population were recorded in 22nd week (28 May – 3 June) in 2000 and in the 24th week (11-17 June) during 2001 season. The progressive increase in fruit damage and the larval population in 2000 was perhaps due to higher level of moisture in the crop environment from higher amount of rainfall in 2000 than 2001 (Table 1b). Similar trend in infestation and larval population from 24.41 to 54.25 per hundred fruits was observed in 2001. The pest activity remained intensified critically below a maximum temperature of 35°C and above a minimum temperature of 22°C.

These findings are in agreement with Dhamdhere *et al.* (1984), Ahmad (1998) and Ghosh *et al.* (1999). Balasubramanian *et al.* (1982) also reported that damage by *Earias vittella* increased correspondingly with advancing crop stage and that the maximum damage was found around the mean temperature of 30°C with lower humidity.

Correlation studies

Correlations between okra shoot and fruit borer damage percentage (fruit number and weight basis) as well as the

Table 1a. : Population dynamics of shoot and fruit borer on summer okra during 2000 and 2001.

Standard week & period	Mean percentage of withered terminal shoots		Mean percentage incidence on fruits				Mean larvae/100 fruits	
			Number basis		Weight basis		2000	2001
	2000	2001	2000	2001	2000	2001		
11 (12-18 Mar)	0.5	1.76	-	-	-	-	-	-
12 (19-25 Mar)	2.34	4.15	-	-	-	-	-	-
13 (26-01 Apr)	-	-	16.54	13.84	15.16	12.35	29.42	24.41
14 (02-08 Apr)	-	-	20.61	21.46	17.24	20.62	33.15	31.53
15 (09-15 Apr)	-	-	27.52	16.15	23.36	16.45	40.26	28.70
16 (16-22 Apr)	-	-	29.74	18.23	26.53	17.52	42.47	30.32
17 (23-29 Apr)	-	-	27.63	26.48	25.72	23.46	40.52	38.84
18 (30-06 May)	-	-	22.56	30.54	18.74	28.53	35.25	42.45
19 (07-13 May)	-	-	32.82	27.37	29.32	24.65	45.64	38.72
20 (14-20 May)	-	-	36.73	22.12	33.55	21.25	49.08	32.26
21 (21-27 May)	-	-	37.94	33.86	34.62	30.80	50.12	45.53
22 (28-03 Jun)	-	-	48.20	34.95	43.04	31.56	57.16	48.72
23 (04-10 Jun)	-	-	41.25	28.36	39.15	27.72	54.68	41.16
24 (11-17 Jun)	-	-	47.08	39.15	42.24	35.45	55.75	54.25
25 (18-24 Jun)	-	-	36.73	36.25	34.92	34.36	52.16	50.74

Table 1b : Standard weekly meteorological parameters at Pusa (Bihar) during summer, 2000 and 2001.

Standard week & period	Maximum temperature (°C)		Minimum temperature (°C)		Relative humidity (%) 700 hrs		Relative humidity (%) 1400 hrs		Vapour pressure (mm of Hg)		Rainfall (mm)	
	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001	2000	2001
11 (12-18 Mar)	31.6	33.4	14.2	16.3	78	73	36	28	11.6	11.3	0	0
12 (19-25 Mar)	34.6	33.8	15.9	17.4	81	83	30	33	12.5	13.8	0	0
13 (26-01 Apr)	38.0	35.9	17.5	16.8	54	77	21	20	9.8	10.8	0	0
14 (02-08 Apr)	36.6	37.2	20.0	21.0	70	75	37	32	14.5	14.9	0	0
15 (09-15 Apr)	35.0	34.5	22.4	19.8	83	73	49	31	19.4	14.3	21.0	7.5
16 (16-22 Apr)	45.2	37.0	22.7	27.5	86	67	51	38	19.2	16.2	18.0	0
17 (23-29 Apr)	34.9	32.9	23.9	23.1	81	77	53	59	19.7	20.1	0	80.0
18 (30-06 May)	43.7	31.5	25.6	23.8	77	84	45	57	20.5	20.6	0	11.0
19 (07-13 May)	38.8	33.2	25.5	24.8	85	80	59	57	22.5	21.6	28.0	37.0
20 (14-20 May)	31.5	35.0	24.5	24.7	86	85	69	53	22.3	22.0	74.6	50.0
21 (21-27 May)	32.5	32.4	24.7	25.5	87	86	69	65	22.9	22.5	41.0	38.5
22 (28-03 Jun)	34.1	33.1	26.3	25.6	87	85	71	67	23.0	23.5	116.0	12.5
23 (04-10 Jun)	34.8	34.1	25.8	27.1	90	82	69	59	25.5	23.5	94.0	11.0
24 (11-17 Jun)	32.4	32.0	26.1	26.0	91	92	77	75	24.9	25.3	112.0	213.5
25 (18-24 Jun)	34.3	33.8	22.0	23.1	84	86	69	68	24.8	25.6	13.7	24.0

Table 2 : Correlation coefficients between shoot and fruit borer incidence and meteorological parameters (Pooled data, 2000 and 2001)

Infestation yard sticks	Correlation coefficients					
	Max. temperature (°C)	Min. temperature (°C)	Relative humidity at 0700 hrs (%)	Relative humidity at 1400 hrs (%)	Man vapour pressure (mm of Hg)	Rainfall (mm)
Fruit number basis	-0.65*	0.77**	0.93**	0.96**	0.92**	0.75**
Fruit weight basis	-0.65*	0.76**	0.93**	0.96**	0.93**	0.73**
Larvae per 100 fruits	-0.64*	0.75**	0.92**	0.9623**	0.93**	0.71**

*Significant at 5% level
**Significant at 1% level

larval population per hundred fruits and prevailing weather parameters (Table 2) revealed significant negative relationship with maximum temperature and highly significant positive relationship with minimum temperature. Significant positive correlations of relative humidity both at 700 hrs and 1400 hrs ranging from 0.9244 to 0.9630 with pest incidence per hundred fruits were obtained. Pest incidence had highly significant positive relationship with mean vapour pressure. Rainfall too had significant positive impact on the pest infestation (Table 2). The significant negative correlation of the percentage infestation with the maximum temperature is in conformity with Grewal and Atwal (1969) who reported the maximum survival of the larvae of *Earias* spp. below 30 to 35°C. Results on the minimum temperature are also in agreement with the findings of Radake and Undirwade (1981), Gupta *et al.* (1998).

Regression models

Regression models were developed between infestation of shoot and fruit borer and prevailing meteorological parameters by pooling the data of 2000 and 2001. The weather parameters accounted for 93 to 95 per cent variation in okra borer infestation. The cumulative effects of different meteorological parameters on the incidence and activity of the pest were obtained in the regression equations as :

$$Y_1 = -3.818 + 0.430X_1 - 0.541X_2 - 0.048X_3 + 0.744X_4 - 0.692X_5 + 0.073X_6 \quad (R^2 = 0.94)$$

$$Y_2 = 4.356 + 0.301X_1 - 0.554X_2 - 0.074X_3 + 0.564X_4 - 0.012X_5 + 0.023X_6 \quad (R^2 = 0.93)$$

$$Y_3 = 9.777 + 0.616X_1 - 0.980X_2 - 0.061X_3 + 0.712X_4 - 0.046X_5 + 0.071X_6 \quad (R^2 = 0.95)$$

Where,

Y_1, Y_2, Y_3 = Infestation of shoot and fruit borer based on (1) fruit number, (2) fruit weight and (3) larval population respectively

X_1, X_2 = Maximum and minimum temperature (°C)

X_3, X_4 = Relative humidity (%) at 700 and 1400 hrs

X_5 = Mean vapour pressure (mm of Hg)

X_6 = Weekly rainfall (mm)

Information generated through this study about okra pest dynamics as affected by meteorological parameters may help in formulating agroadvisory for this region.

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