Horticultural Biotechnology Research 2018, 4: 30-34
doi: 10.25081/hbr.2018.v4.3491
http://updatepublishing.com/journal/index.php/hbr/

ISSN: 2455-460X

REGULAR ARTICLE

INFLUENCE OF WEATHER FACTORS ON INCIDENCE OF SHOOT AND FRUIT BORER (*EARIAS VITTELLA* FABIRICUS) ON BHENDI

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ABSTRACT

The field experiments were carried out in the farmer field at C. Mutlur near Chidambaram during rabi and kharif 2017. The results of experiments revealed that the per cent shoot damage and fruit damage by *E. vittella* on bhendi reached peak on 13th and 15th MSW in rabi season, whereas 43rd and 42nd MSW in kharif season. The per cent shoot damage and fruit damage by *E. vittella* were exerted significantly positively correlated with minimum (0.552 and 0.698) and maximum temperature (0.629 and 0.748), whereas rainfall positively correlated with per cent shoot and fruit damage but it was non significant (0.111 and 0.297), however relative humidity (-0.178 and-0.210) and sunshine hours were exerted negatively correlated with per cent shoot damage and fruit damage by *E. vittella* during rabi 2017. The kharif season 2017 indicated that per cent shoot damage and fruit damage of bhendi was positively non significant association with RH and rain fall, while negatively non significant correlation with minimum temperature (-0.43 and-0.309) and sunshine hours (-0.265 and-0.283) was recorded.

Keywords*:* Shoot damage and fruit damage, *E. vittella*, weather parameter, meterological standard weeks, correlation, regression.

INTRODUCTION

Bhendi *Abelmoschus esculentus* L. (Moench) (Family: Malvaceae0, is an economically significant crop cultivated in India and is used all over the world as vegetable [1]. It is commonly known as okra or lady's finger and the origin of bhendi is Africa. In India ranks first in the world with 5,784.0 thousand tones (72% of the total world production) of bhendi [2]. In Tamilnadu the crop occupies 11000 ha with the productivity of 75.4 thousand tones mt ha^{-1}in the state [3]. It being a short duration crop and though bhendi is widely cultivated season such as February-March, June-July and October-November. The major insect pests known to attack bhendi in India are leaf hopper, aphid, white fly, spider mite and fruit borer, which are importance in bhendi [4]. Among them, shoot and fruit borer, *Earias vittella* (Fabricius) considered major pest which cause severe damage to crop and causing more than 50% loss in cotton and 69% on bhendi alone in various parts of India. The *E. vittella* alone cause upto 41.6 per cent net yield loss in bhendi [5]. The aim of this study was to determine the role of meteorological factors on incidence of *E. vittella* on bhendi. This will facilitate to excute proper time of application of insecticides and other control strategies for the *E. vittella* on Bhendi.

MATERIALS AND METHODS

The field experiments were carried out in farmer field at C. Mutlur near Chidambaram during 2017. The popular cultivar of Arka anamika seeds were sown in 45×30 cm spacing and 4×5m plot size during 20th Jan (rabi 2017) and 25thAug (kharif 2017). Normal agronomic procedures were taken on the entire crop throughout season without plant protection measures. The pest population *E. vittella* was recorded on Bhendi in terms of per cent of damage randomly selected five plants in each replication [6]. Weather parameters like Temperature, Relative humidity, Rainfall and Sunshine hour were recorded from meteorological observatory at Annamalai University and correlated with incidence of *E. vittella*. Correlation analysis was carried out as per Gomez and Gomez [7].

RESULTS AND DISCUSSION

Studies on incidence of *E. vittella* in bhendi ecosystem during rabi and kharif season 2017

In rabi season studies on pest incidence (table 1 and Fig.1) revealed that shoot damage of *E. vittella* on bhendi was noticed from 7th MSW (meteorological standard week) to 17th MSW ranging from 19.64–42.27% and also fruit damage noticed from 8th and 17th MSW. The highest per cent shoot damage was recorded at 13th MSW (42.27%) followed by 14th MSW (38.66%) and 10th MSW (37.10%) and fruit damage was recorded 15th MSW (44.47%) followed by 11th MSW (43.33%).

The present finding is in concordance to Chouhan *et al.* [8] who showed that the incidence of *E. vittella* was observed 7th to 16th MSW reached peak on last week of March

Received 11 March 2018; Accepted 1 May 2018

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(12th MSW) with 2 larvae/plant and the seasonal mean was 1.44 larvae/plant followed by 13th MSW with 1.5 larvae/plant and Shivashankara [9] observed incidence commenced from 5th MSW and increased at fruit maturity stage and mean incidence peak (3.20 larvae/plant) was during 14th MSW.

In kharif season per cent of shoot damage (table 1 and fig. 2) *E. vittella* on bhendi observed on 38th to 48th MSW which ranged from 12.5 to 33.98% and the maximum shoot damage recorded 43rd MSW (2.7 larvae/plant). The fruit damage noticed on 39th to 48th MSW that ranged from 19.33 to 42.1% and maximum fruit damage (fig. 2) noticed 43rd followed by 42nd and 44th MSW. There is no damage on occur on 36th and 37th during kharif season 2017. The present finding is in concordance to Sharma *et al.* [10], who reported the peak infestation of *E. vittella* on bhendi was observed in 45th standard week. The maximum number of larvae (7.5 larvae per plant) recorded in 42nd standard week.

Influence of weather parameters on per cent shoot and fruit damage by *E. vittella* on bhendi during rabi 2017

Correlation between weather parameters and shoot damage and fruit damage of *E. vittella* in bhendi during rabi 2017 are presented in table. 2. The studies indicated that R. H (r =-0.178 and-0.210) exerted non significant negative association with per cent shoot damage and fruit damage of *E. vittella* respectively. The present finding is in concordance to Sharma *et al.* [10], in which it was observed that relative humidity was negatively correlated. Whereas sunshine hour (r=-0.566 and-0.641) positively correlated with shoot and fruit but it was significant. However maximum temperature (r = 0.552 and 0.698) and minimum temperature (r= 0.629 and 0.748) exhibited significant positive association with shoot damage and fruit damage by *E. vittella* respectively. Where rainfall (r = 0.111 and 0.074) exhibited positive association with shoot damage and fruit damage but it was non significant. Rajput and Tayde [11] showed that positively correlated with maximum temperature.

Multiple regression equations were fitted for regression analysis between the weather parameter (X) and both the shoot damage and fruit damage on *E. vittella* in bhendi during the rabi season 2017.

Particular regression equation

Shoot damage Y =-310.75+4.27 X_1-0.23 X_2+3.034 X_3–7.06 X_4–1.11 X_5

Fruit damage Y =-568.99+6.56 X_1+0.33 X_2+4.9 X_3–6.04 X_4–0.21 X_5

X_1–Maximum temperature X_2–Minimum temperature

X_3–Relative humidity X_4–Sunshine hours X_5–Rainfall

The regression equation indicated that an increase in 1 % R. H. increased to range 3.03 and 4.9 of shoot damage and fruit damage per five plant. An increase of 1°C of maximum temperature would be lead to an increase of 4.27 and 6.56 of shoot damage and fruit damage/five plant/week. However, 1°C increase minimum temperature decreased the shoot damage of *E. vittella* by 0.23/plant/week during rabi season.

Further, the values of coefficient of determination (R^2) indicated that there were 67.6 % and 96.2 % variation in *E. vittella* shoot damage and fruit damage was caused due to meteorological factors during the rabi 2017. These studies were in accordance with report of Pazhanisamy [12] in *Spodoptera litura* on groundnut.

Influence of weather parameters on per cent of shoot and fruit damage by *E. vittella* on bhendi during kharif 2017

Correlation between weather parameters and shoot and fruit damage of *E. vittella* in bhendi during kharif 2017 are presented in table 4. The studies indicated that R. H (r = 0.231 and 0.241) excerted non significant negative association with per cent shoot damage and fruit damage of *E. vittella* respectively. Whereas rainfall (r = 0.169 and 0.074) exhibited positive association with per cent of shoot damage and fruit damage. However minimum temperature (r =-0.430 and-0.309) showed negatively correlated with per cent of shoot damage and fruit damage and also sunshine hours negatively correlated with both shoot damage and fruit damage of *E. vittella* in bhendi during kharif 2017.

Similarly, Raju *et al.* [13] showed that fruit damage on number and weight basis were significantly negatively correlated with maximum temperature. The positive correlation was observed with morning and evening RH (0.88) and rainfall (0.82) [14].

Multiple regression equations were fitted for regression analysis between the weather parameter (X) and both the shoot damage and fruit damage on *E. vittella* in bhendi during the kharif season 2017.

ParticularRegression equation

Shoot damage Y = 167.9+3.27 X_1–1.53 X_2+1.69 X_3–2.50 X_4–0.07 X_5

Fruit damage Y = 226.9-2.90 X_1–1.47 X_2+3.15 X_3–0.188 X_4–0.135 X_5

The regression equation indicated that an increase in 1 % R. H. increased to range 1.69 and 3.15 of shoot damage and fruit damage per five plants. However 1°C increases minimum temperature decreased the shoot damage and fruit damage of *E. vittella* by 1.53 and 1.47/five plants/week, whereas increases of 1°C of maximum temperature would be lead to an increase of 3.27 shoot damage/five plants/week, whereas decreased 2.29 fruit damage/five plants/week during kharif season 2017. Further, the values of coefficient of determination (R^2) indicated that there were 48.15% and 42.92 % variation in *E. vittella* shoot damage and fruit damage was caused due to meteorological factors during the kharif 2017, respectively. These studies were in accordance with report of Pazhanisamy [12] in *Spodoptera litura* on groundnut.

Table 1: Studies on incidence of *E. vittella* in bhendi ecosystem during rabi and kharif 2017

Month	Std week	Seasonal incidence of *E. vittella* during 2017					
		Rabi				Kharif	
		% of shoot damage	% of fruit damage	Month	Std week	% of shoot damage	% of fruit damage
Feb	5	0	0	Sep	36	0	0
	6	0	0		37	0	0
	7	19.64	0		38	12.5	0
	8	18.33	16.67		39	15.4	19.33
Mar	9	28.63	19.44	Oct	40	26.85	21.75
	10	37.1	42.04		41	27.6	31.72
	11	31.67	43.33		42	32.98	42.1
	12	34.27	36.48		43	33.09	38.27
	13	42.27	35.95		44	29.52	34.56
April	14	38.66	41.11	Nov	45	24.76	32.47
	15	37.3	44.47		46	23.48	28.96
	16	36.03	29.83		47	15.4	27.3
	17	19.84	32.78		48	24.76	24.52
SEd		0.09	0.79			0.61	1.30
CD (0.01)		0.27	2.23			1.68	3.62

Mean of three replications, Date of sowing: 025.01.2017 (summer) and 05.09.2017, MSW-Meteorological Standard Week

Table 2: Correlation coefficients between weather parameters and weekly observed damage of *E. vittella* on bhendi during rabi season 2017

Season	% of shoot and fruit damages	Weather parameter				
		Max. temp. °C	Min. Temp. °C	RH (%)	Sunshine h	Rainfall (mm)
Rabi 2017	Shoot damage	0.552*	0.629*	-0.178	-0.566*	0.111
	Fruit damage	0.698*	0.748*	-0.210	-0.641*	0.297
Kharif 2017	Shoot damage	-0.259	-0.430	0.243	-0.265	0.169
	Fruit damage	0.027	-0.309	0.231	-0.283	0.074

**Significant at 0.05 probability level, **Significant at 0.01 probability level

Table 3: Multiple linear regression analysis of *E. vittella* shoot damages (Y) and weather parameters (X) in bhendi during rabi season 2017. (n=13)

Variables	Partial regression coefficient	Standard error	't' value	r^2
Shoot damage				
X1= Max. Temperature	4.272	2.36	1.81*	
X2= Mini. Temperature	-0.230	2.59	-0.08^{NS}	0.68
X3= Relative Humidity	3.036	1.85	1.64*	
X4= Wind speed	-7.060	4.93	-1.43*	
X5= Rainfall	-1.105	1.10	-1.01*	
Fruit damage				
X1= Max. Temperature	6.561	0.98	6.64*	
X2= Mini. Temperature	0.344	1.08	0.32^{NS}	0.96
X3= Relative Humidity	4.902	0.77	6.35*	
X4= Wind speed	-6.041	2.06	-2.93*	
X5= Rainfall	-0.213	0.46	-0.46^{NS}	

Table 4: Multiple linear regression analysis of *E. vittella* fruit damages (Y) and weather parameters (X) in bhendi during kharif season 2017. (n=13)

Variables	Partial regression coefficient	Standard error	't' value	r^2
Shoot damage				
X1= Max. Temperature	3.271	3.68	0.88*	
X2= Mini. Temperature	-15.373	7.17	-2.14**	0.48
X3= Relative Humidity	1.695	1.68	1.01*	
X4= Wind speed	-2.502	2.68	-0.93*	
X5= Rainfall	-0.067	0.06	-1.04*	
Fruit damage				
X1= Max. Temperature	-2.903	4.52	-0.64*	
X2= Mini. Temperature	-14.772	8.80	-1.67*	0.429
X3= Relative Humidity	3.150	2.07	1.52*	
X4= Wind speed	-0.188	3.29	-0.06^{NS}	
X5= Rainfall	-0.135	0.08	-1.68*	

NS= Non significant, *significant P = 0.05CD (P= 0.05): 0.514

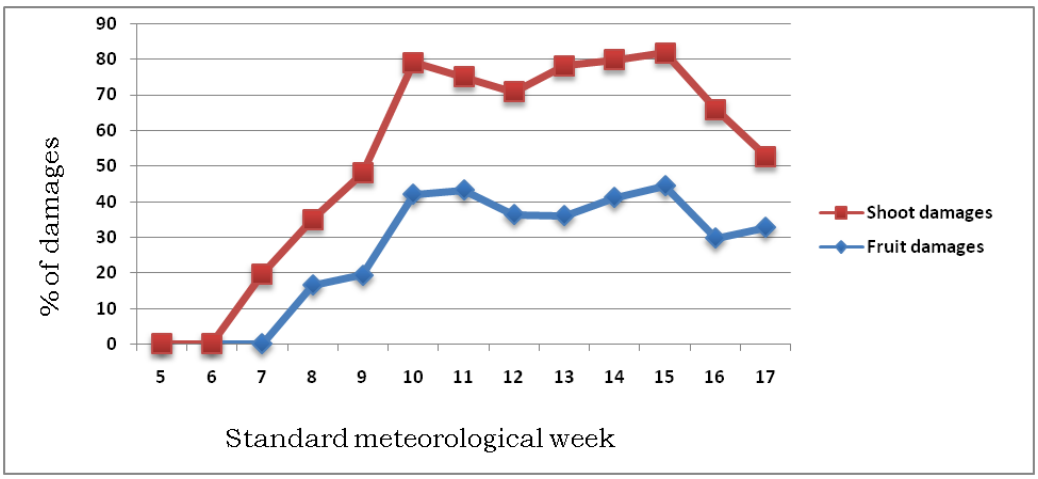

Fig. 1: Seasonal incidence of *E. vittella* on bhendi ecosystem during rabi season–2017

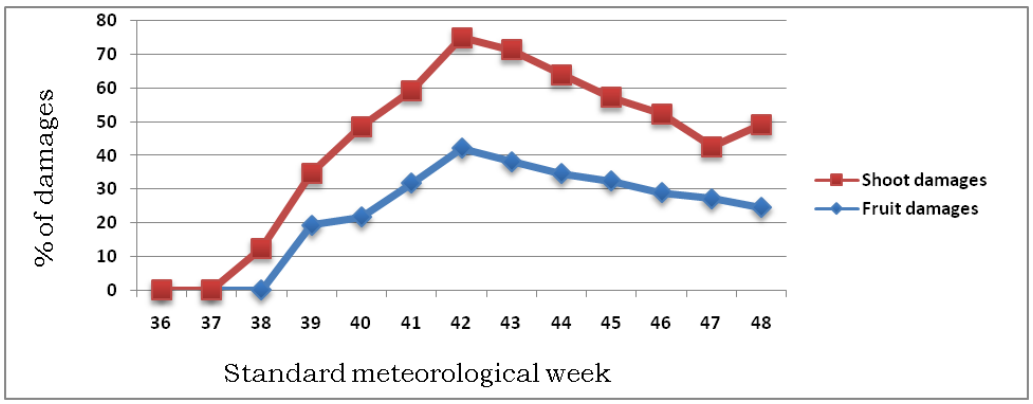

Fig. 2: Seasonal incidence of *E. vittella* on bhendi ecosystem during kharif season–2017

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