



## REGULAR ARTICLE

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

K. ARCHUNAN\*, M. PAZHANISAMY, S. SATHYA

Department of Entomology, Faculty of Agriculture, Annamalai University,  
Annamalai Nagar 608 002, Tamil Nadu, India

### 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 13<sup>th</sup> and 15<sup>th</sup> MSW in rabi season, whereas 43<sup>rd</sup> and 42<sup>nd</sup> 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, meteorological standard weeks, correlation, regression.

### INTRODUCTION

Bhendi *Abelmoschus esculentus* L. (Moench) (Family: Malvaceae), 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<sup>-1</sup> 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 execute 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 20<sup>th</sup> Jan (rabi 2017) and 25<sup>th</sup> Aug (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 7<sup>th</sup> MSW (meteorological standard week) to 17<sup>th</sup> MSW ranging from 19.64–42.27% and also fruit damage noticed from 8<sup>th</sup> and 17<sup>th</sup> MSW. The highest per cent shoot damage was recorded at 13<sup>th</sup> MSW (42.27%) followed by 14<sup>th</sup> MSW (38.66%) and 10<sup>th</sup> MSW (37.10%) and fruit damage was recorded 15<sup>th</sup> MSW (44.47%) followed by 11<sup>th</sup> MSW (43.33%).

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

Received 11 March 2018; Accepted 1 May 2018

\*Corresponding Author

K. Archunan

Department of Entomology, Faculty of Agriculture, Annamalai University, Annamalai Nagar 608 002, Tamil Nadu, India

Email: greenwld115@gmail.com

©This article is open access and licensed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0/>) which permits unrestricted, use, distribution and reproduction in any medium, or format for any purpose, even commercially provided the work is properly cited. Attribution — You must give appropriate credit, provide a link to the license, and indicate if changes were made.

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

In kharif season per cent of shoot damage (table 1 and fig. 2) *E. vittella* on bhendi observed on 38<sup>th</sup> to 48<sup>th</sup> MSW which ranged from 12.5 to 33.98% and the maximum shoot damage recorded 43<sup>rd</sup> MSW (2.7 larvae/plant). The fruit damage noticed on 39<sup>th</sup> to 48<sup>th</sup> MSW that ranged from 19.33 to 42.1% and maximum fruit damage (fig. 2) noticed 43<sup>rd</sup> followed by 42<sup>nd</sup> and 44<sup>th</sup> MSW. There is no damage on occur on 36<sup>th</sup> and 37<sup>th</sup> 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 45<sup>th</sup> standard week. The maximum number of larvae (7.5 larvae per plant) recorded in 42<sup>nd</sup> 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<sub>1</sub>–Maximum temperature X<sub>2</sub>–Minimum temperature

X<sub>3</sub>–Relative humidity X<sub>4</sub>–Sunshine hours X<sub>5</sub>–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<sup>2</sup>) 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) exerted 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.

#### **Particular Regression 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<sup>2</sup>) 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 <i>E. vittella</i> during 2017					
		Rabi		Month	Std week	Kharif	
		% of shoot damage	% of fruit damage			% 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

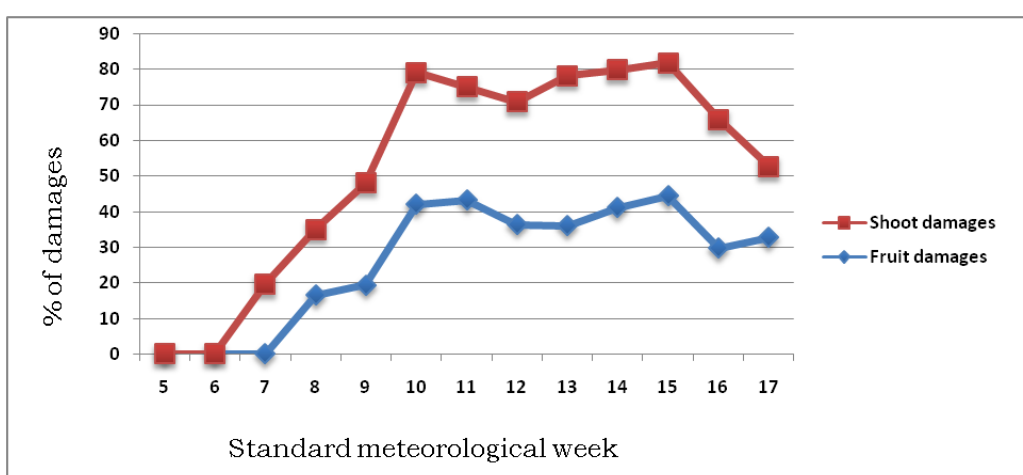
**Table 3: Multiple linear regression analysis of *E. vittella* shoot damages (Y) and weather parameters (X) in bhendi during rabi season 2017. (n=13)**

Variables	Partial regression coefficient	Standard error	't' value	r <sup>2</sup>
<b>Shoot damage</b>				
X1= Max. Temperature	4.272	2.36	1.81*	0.68
X2= Mini. Temperature	-0.230	2.59	-0.08 <sup>NS</sup>	
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*	
<b>Fruit damage</b>				
X1= Max. Temperature	6.561	0.98	6.64*	0.96
X2= Mini. Temperature	0.344	1.08	0.32 <sup>NS</sup>	
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 <sup>NS</sup>	

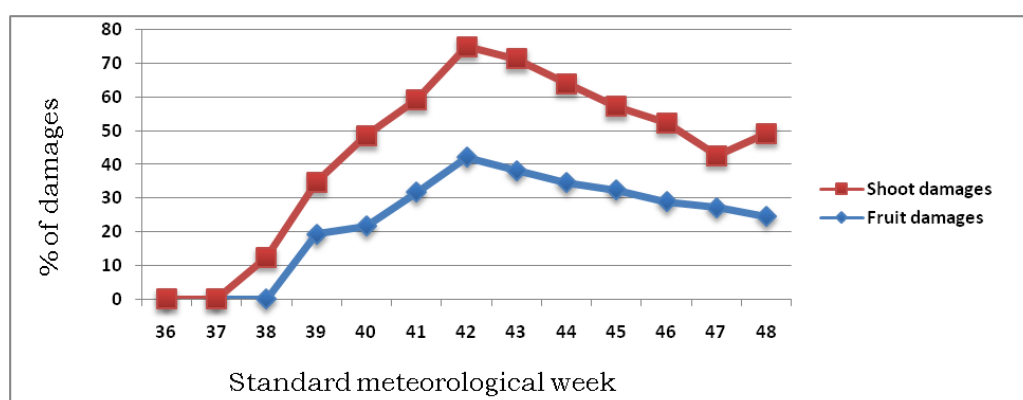
**Table 4: Multiple linear regression analysis of *E. vittella* fruit damages (Y) and weather parameters (X) in bhendi during kharif season 2017. (n=13)**

Variables	Partial regression coefficient	Standard error	't' value	r <sup>2</sup>
<b>Shoot damage</b>				
X1= Max. Temperature	3.271	3.68	0.88*	0.48
X2= Mini. Temperature	-15.373	7.17	-2.14**	
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*	
<b>Fruit damage</b>				
X1= Max. Temperature	-2.903	4.52	-0.64*	0.429
X2= Mini. Temperature	-14.772	8.80	-1.67*	
X3= Relative Humidity	3.150	2.07	1.52*	
X4= Wind speed	-0.188	3.29	-0.06 <sup>NS</sup>	
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**

**REFERENCES**

1. Benchasri S. Okra (*Abelmoschus esculentus* (L.) Moench) as a valuable vegetable of the world. Ratarstvo i povrtarstvo. 2012;49:105-12.
2. FAO. Statistical Database. 2015. Retrieved from <http://www.faostat.fao.org>.
3. Anonymous. 2016. Horticulture-Statistical Year Book India 2016. Available at: <http://www.mospi.gov.in/statistical-year-book-india/2016/178>.

4. Singh Y, Jha A, Verma S, Mishra VK, Singh SS. Population dynamics of sucking insect pests and its natural enemies on okra agro-ecosystem in Chitrakoot region. *African Journal of Agricultural Research*. 2013;8:3814-9.
5. Rai, A. B., Swamy, T. M. S., Kodandaram, M. H. and H. Jaideep. 2010. Integrated Pest Management of Vegetable Crops: Potential and Prospects. *In: Souvenir of National Symposium on Conservation Horticulture* held at Dehradun, Uttarakhand from 21-23 March, 2010, pp. 246-261.
6. Malaichattiwar, Meena, R. S., Singh, P. S. and N. K. Yadav, 2014. Seasonal incidence of shoot and fruit borer (*E. vittella*) of Okra (*Abelmoschus esculantus*) in the Gangetic plains of Uttar Pradesh. *Current Advances in Agricultural Sciences* 6: 205-206.
7. Gomez, K. A. and Gomez, A. A. 1976. Statistical procedure for agricultural research, 2nd edition, *John Wiley and Sons. Inc. New York*.
8. Chouhan, S., Chandrakar, G., Nirala, Y. S. and N. Rana. 2016. Seasonal Incidence of Shoot and Fruit Borer, *Earias vittella* Fab. on Okra and their Correlation with Weather Parameters. *Advances in Life Sciences* 5: 419-421.
9. Shivashankara, T. N., 2012. Studies on bioecology and management of Okra fruit borers in the hill zone of Karnataka. *M. Sc. (Hort.) Thesis*, Univ. Hort. Sci., Bagalkot, Karnataka (India). 232p.
10. Sharma, R. P., Swaminathan, R. and Bhati, K. K., 2010. Seasonal incidence of fruit and shoot borer of Okra along with climatic factors of Udaipur Region. *Asian Journal of Agricultural Research*, 4: 232-236.
11. Rajput, G. S. and Tayde, A. 2017. Population dynamics and comparative efficacy of certain novel insecticides, botanicals and bioagents, against shoot and fruit borer (*Earias vittella* Fabricius) of Okra crop. *Journal of Entomology and Zoology Studies*, 5: 1667-1670.
12. Pazhanisamy, M. 2015. Influence of certain ecofriendly approaches against *Aproaerema modicella* (Devender) and *Spodoptera litura* (Fabricius) on groundnut. *Ph. D (Agri. Entomology) Thesis*, Annamalai University, chidambaram. 275p.
13. Raju A, Reddy CN, Kumari DA. 2017. Seasonal incidence and correlation of abiotic factors against okra shoot and fruit borer. *Contemporary Research in India* 7:246-251
14. Sreedevi, K. V. 2011. Studies on insect pests of Okra, *Abelmoschus esculentus* (L.) with special reference to fruit borers and their management. *M. Sc (Agri.) Thesis*. University of Agricultural Sciences, Bangalore. 133p.