Plant Archives Vol. 19 No. 2, 2019 pp. 3351-3354 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

SEASONAL INCIDENCE OF LEAF EATING CATERPILLAR, *SPODOPTERA LITURA* (FABRICIUS) IN GROUNDNUT ECOSYSTEM DURING KHARIF SEASON

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Abstract

Field experiments were carried out to study the seasonal incidence of *S. litura* on groundnut during kharif 2010 and 2011 at Variyankaval, Ariyalur district, Tamil Nadu. The results of seasonal incidence showed that the appearance of *S. litura* was noticed on 36th MSW and the highest population observed during 41st MSW (4.54 larvae per meter row), however the highest per cent infestation of leaflets recorded during 41st MSW (68.4 %) followed by 42nd MSW (50.2 %) and 40th MSW (49.5 %). In *kharif* 2011, the per cent infestation of leaflets increased gradually reached peak during 40th MSW (72.5%) followed by 41st MSW (60.4%) and 39th MSW (54.50%). The maximum larval population of *S. litura* was noticed in 40th MSW (5.92 larvae/mrl). Correlation analysis in both seasons on groundnut revealed that R.H (r = 0.452) and (r = 0.609) showed significant positive association, while wind speed (r = - 0.540) and (r = - 0.490) exhibited negative association with mean larvae of *S. litura* per meter row during *kharif* 2010 and 2011 respectively.

Key words: Seasonal incidence, *S. litura*, *Khar*if season, *Arachis hypogaea*

Introduction

Groundnut (*Arachis hypogaea* L.) is an important oil seed crop of tropical and sub-tropical regions of the world. India ranks first in groundnut cultivation with an area of 5.53 m ha and occupies second place in production (9.67 million tonnes) with productivity of 1750 kg ha^{-1}. In India, groundnut is mostly grown in five states *viz.,* Gujarat, Andhra Pradesh, Tamil Nadu, Karnataka and Maharashtra which accounts for 80 percent of total area and 84 per cent of total production of groundnut. The national average yield of *rabi* groundnut is higher (1600kg/ha) than *kharif* (1000kg/ha) (NICRA, 2011). Among the major groundnut producing states of India, Tamil Nadu ranks fourth in acreage (0.76 m ha) with total production of 0.83 million tonnes. The reasons for low productivity may be several, of which insect pest damage is the major one. Insect pests are recognized as one of the major constraints on groundnut production causing severe losses to groundnut in India (Vikram Singh, 1980). Among these insect pests, red hairy caterpillar causes up to 75 percent, leaf miner causes up to 49 percent, jassids causes yield losses up to 17 percent, thrips causes up to 17 percent yield losses.

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Among the defoliators *Spodoptera* is one of the important pests cause yield loss. *Spodoptera litura* (Fab.) is an economically important polyphagous insect and this pest was widely distributed throughout Asia and causing considerable economic loss to many field, vegetables and fruit crops. Crop loss due to insect varies between 10 to 30 percent for major crops. In case of severe infestation, the entire crop is damaged badly, thus causing 40 percent defoliation of leaf area. It is indicated that climatic changes affect the activity of tobacco caterpillar. Therefore, knowledge of how insect pests respond to climate variation is of fundamental importance in understanding insect pest management. Keeping these in view, field experiment was conducted to address the importance and impact of weather on *S. litura* incidence on groundnut crop.

Materials and Methods

Field experiment was conducted in farmer's field, at Variyankaval village, Jayankondam, during *kharif* seasons 2010-2011 to study the seasonal incidence of *S.*

litura infesting groundnut. The popular cultivar TMV 2 was sown with a spacing of 30 × 10 cm. The plot size was 5m × 5m and replicated three times. All the recommended agronomic practices were followed in the cultivation of the crop except the plant protection measures. In each season, beginning from 30th day after sowing, observations were made on larval population, foliage damage at weekly interval. Observations were made at weekly interval on leaflet damage in a randomly selected meter row and expressed as per cent leaflet damage. Absolute larval population was also recorded from same meter row.

The natural incidences of *S.litura* were correlated with weather parameters. The data on weather parameters *viz.,* maximum, minimum temperature (C°), relative humidity (RH), wind velocity, and rain fall were recorded daily at automatic weather station Jayankondam and presented as weekly average. The mean weather data that prevailed seven days prior to each observation were calculated to work out correlation studies. The data were analyzed by multiple correlation and regression to study the relation between weather parameters and per cent incidence of larvae (Gomez and Gomez, 1984).

Results and Discussion

Seasonal incidence of *S. litura* in groundnut ecosystem during *kharif* 2010 and 2011

Field experiments were carried out to study the seasonal incidence of *S. litura* on groundnut at Variyankaval, Jayankondam, Ariyalur district, Tamil Nadu during 2010 for two seasons (*Kharif* 2010 and *Kharif* 2011) presented in table 1. The results of seasonal incidence showed that the appearance of *S. litura* was noticed on 36th MSW and the highest population observed during 41st MSW (4.54 larvae per meter row), however the per cent infestation of leaflets was observed from 36th MSW and increased trend of per cent infestation was noticed up to 41st MSW thereafter percent infestation was gradually declined during Kharif 2010. The highest per cent infestation of leaflets recorded during 41st MSW (68.4%) followed by 42nd MSW (50.2%) and 40th MSW (49.5%).

In *kharif* 2011, the percent infestation of leaflets increased gradually reached peak during 40th MSW (72.5%) followed by 41st MSW (60.4%) and 39th MSW (54.50%). The maximum larval population of *S. litura* was noticed in 40th MSW (5.92 larvae/mrl). The present observations on *S. litura* incidence are in agreement with the findings of Singh and Sachan (1993) who indicated that peak population of *S. litura* of which recorded between 40th and 43rd standard weeks. Similar observations were noticed by Gedia *et al.,* (2007) who showed that oviposition of *S. litura* on groundnut foliage was first appeared in mid July (30th standard week) and three peaks of *S. litura* egg masses were observed with highest oviposition (1.3 & 1.5/m^2) during 36th standard week in groundnut. AICRP 2013 showed the maximum incidence of *S. litura* was noticed in the all the fields (Vridhachalam taluk) during reproductive stage. Monobrullah *et al.,* (2007) reported

Table 1: Studies on incidence of *S. litura* in groundnut ecosystem during *kharif* season

Month	MSW	Seasonal incidence of *S. litura*					
		Kharif 2010				*Kharif* 2011	
		% infestation of leaflets	No. of Larvae /m row	Month	MSW	% infestation of leaflets	No. of Larvae /m row
Jan.	31	0	0	August	31	0	0
	32	0	0		32	0	0
	33	0	0		33	0	0
Feb.	34	0	0		34	0	0
	35	0	0	Sep.	35	0	0
	36	13.5	0.92		36	15.5	0.76
	37	28.8	1.26		37	31.5	2.12
Mar.	38	30.2	1.28		38	38.9	2.78
	39	38.7	1.46		39	54.5	3.16
	40	49.5	2.92	Oct.	40	72.5	5.92
	41	68.4	4.54		41	60.4	5.21
April	42	50.2	3.86		42	44.6	2.3
	43	30.8	0.84		43	52.2	3.5
	44	24.5	0.80	Nov.	44	24.2	1.1
	45	20.2	0		45	30.1	1.3
May	46	0	0		46	13.4	0.82
SEd		0.428	0.0114			0.437	0.0141
CD (0.01)		1.179	0.0313			1.204	0.0387

Mean larval population /meter row,
Date of sowing: 17.07.2010 (*Kharif* 2010) & 20.07.2011(*Kharif* 2011)
MSW- Meteorological standard week

Table 2: Correlation between weather parameters and weekly observations on larval population of *S. litura* in groundnut.

Mean *S. litura* larva/mrl	Weather parameters				
	Max. Temp.(C)	Min. Temp.(C)	RH(%)	Wind speed (kmph)	Rainfall (mm)
***Kharif* 2010**	-0.246	0.235	0.452*	-0.540*	-0.018
***Kharif* 2011**	-0.052	0.372	0.609**	-0.490*	-0.191

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

that peak larval population of *S. litura* was noticed on tomato in 25th standard week (3.5 larva/plant) the larval population attained its peak during 43rd standard week (4.3 larva/plant).

Influence of weather parameters on larval incidence of *S.litura* on groundnut during *kharif* 2010 and 2011

The results of correlation study revealed that R.H (r = 0.452) and (r = 0.609) showed significant positive association, while wind speed (r = -0.540) and (r = -0.490) exhibited negative association with mean larvae of *S. litura* per meter row during *kharif* 2010 and 2011 respectively. Whereas, mean larval population of *S. litura* per meter row was found positively correlated with minimum temperature (r = 0.235) & (r = 0.372) on groundnut during *kharif* 2010 and 2011. While the rainfall (r = -0.018) & (r = -0.191), maximum temperature (r = -0.246) & (r= -0.052) exerted negative correlation with weather parameters during *kharif* season of 2010 and 2011. These results are in agreement with the findings of Nadaf and Kulkarni (2006). They reported a significant positive association with larval population of *S. litura* and minimum temperature.

Table 3: Multiple linear regression analysis of per cent leaflet damage due to *S. litura* (Y) and weather parameters (X) in groundnut during *kharif* 2010 and 2011. (n= 16)

Variables	Partial regression coefficient	Standard error	't' value	r^2
***Kharif* 2010**				
X1=Max. Temperature	2.59	9.41	0.275 NS	
X2=Min. Temperature	13.6	11.2	- 1.21 NS	
X3=Relative Humidity	1.93	3.14	0.616 NS	0.550
X4= Wind speed	-15.0	12.2	-1.22 NS	
X5= Rainfall	-1.28	0.946	-2.35*	
Kharif 2011				
X1=Max. Temperature	3.82	3.64	1.04NS	0.761
X2=Min. Temperature	-2.13	6.32	-0.337 NS	
X3=Relative Humidity	1.50	0.579	2.59*	
X4= Wind speed	-2.92	6.51	-0.449 NS	
X5= Rainfall	-2.23	1.13	-2.17*	

NS= Non significant * Significant P = 0.05 CD (P=0.05): 2.13
** Highly significant P = 0.01 CD (P= 0.01): 2.95

Table 4: Multiple linear regression analysis of *S. litura* larval population (Y) and weather parameters (X) in groundnut during *kharif* 2010 and 2011. (n = 16)

Variables	Partial regression coefficient	Standard error	't' value	r^2
***Kharif* 2010**				
X1=Max. Temperature	-0.683	8.90	0.070 NS	
X2=Min. Temperature	0.687	13.08	- 0.052 NS	
X3=Relative Humidity	-1.15	3.16	-0.365 NS	0.355
X4= Wind speed	- 18.8	12.92	-2. 450*	
X5= Rainfall	-0.150	0.981	-0.153 NS	
Kharif 2011				
X1=Max. Temperature	0.259	0.305	0.848NS	
X2=Min. Temperature	0.171	0.529	-0.322 NS	
X3=Relative Humidity	0.121	0.048	- 2.49*	0.717
X4= Wind speed	-0.103	0.546	-0.189 NS	
X5= Rainfall	-0.129	0.094	-1.360 NS	

NS= Non significant * Significant P = 0.05 CD (P=0.05): 2.13
** Highly significant P = 0.01 CD (P= 0.01): 2.95

According to Selvaraj *et al.,* (2010) who observed that larval population built up of *S. litura* showed a positive correlation with relative humidity, sunshine hours and dewfall, whereas negatively correlated with wind velocity. Similar trend of results were noticed by Harish Kumar Netam *et al.,* (2013) who obtained the positive relation between larva of *S. litura* and R.H. The present findings are contrary to Vinothkumar *et al.,* (2009) report that the correlation and regression studies showed that during *kharif* season, the individual weather parameters have no significant correlation with the abundance of *S. litura*, but all weather parameters together showed influence upto 90% on the incidence of *S. litura* and Satyanarayana *et al.,* (2010) observed the incidence of *S. litura* in terms of larval population had non-significant relationship with maximum temperature, relative humidity and wind speed. This may be due to variation in weather parameters distribution.

The multiple regressions between mean number of *S. litura*/mrl and weather parameters in groundnut during *kharif* season of 2010 and 2011 are presented in table 3. The multiple regression analysis showed that R.H and wind speed exerted a significantly negative influence on mean number of *S. litura*/ mrl during the *kharif* 2010 and *kharif* 2011 respectively. However, maximum temperature alone showed positive influence but it was not significant. The multiple regression equation fitted with weather factors to predict the mean larva of *S. litura* per meter row length was

Season Regression equation

Kharif 2010 $Y = 197.06 + 0.07^{NS} X_1 + 0.052^{NS} X_2 - 0.365^{NS} X_3 - 2.45^{*} X_4 - 0.153^{NS} X_5$

Kharif 2011 $Y = -20.35 + 0.848^{NS} X1 - 0.322^{NS} X_2 - 2.49^{*} X_3 - 0.189^{NS} X4 - 1.36^{NS} X_5$

Influence of weather parameters on per cent leaflet damage by *S.litura* on groundnut during *kharif* 2010 and 2011

Correlation between weather parameters and per

Table 5: Correlation Coefficients between weather parameters and weekly observation on per cent leaflet damage due to *S. litura* in groundnut.

Mean *percent* leaflet damage	Weather parameters				
	Max. Temp.(C)	Min. Temp.(C)	RH(%)	Wind speed (kmph)	Rainfall (mm)
***Kharif* 2010**	-0.246	-0.235	0.352	-0.540*	-0.018
***Kharif* 2011**	-0.064	0.023	0.680**	-0.600**	-0.244

** Significant at 0.05 probability level

* Significant at 0.01 probability level

cent leaflet damage in groundnut due to *S. litura* during the *kharif* season of 2010 and 2011 are presented in table 4. The result of correlation study revealed that wind speed (r = -0.540 and r = -0.600) showed significant negative association, while R.H in *kharif* 2011 (r = 0.680) exhibited significant positive association with percent leaflet damage. However, percent leaflet damage caused by *S. litura* was found negatively correlated with rainfall (r = -0.018 & r = -0.244) and maximum temperature (r = -0.246 & r = -0.064) and they were not significant. The minimum temperature showed negative correlation with per cent leaflet damage during the season of *kharif* 2010 and it was not significant. The findings of present study are in agreement with Selvaraj *et al.,* (2010) who reported that the correlation matrix between the weather factors and *S. litura* damage per cent revealed that a significant positive correlation existed with morning relative humidity, sunshine hours and dewfall, whereas a significant negative correlation was recorded with wind speed, while non-significant and negative correlation was recorded with maximum temperature, minimum temperature and rainfall.

The multiple regressions between percent leaflet damage caused by *S. litura* and weather parameters in groundnut during *kharif* season of 2010 and 2011 are presented in table 5. The multiple regression analysis indicated that rainfall exerted a significantly negative influence on per cent incidence/mrl due to *S. litura* during *kharif* 2010 and 2011, whereas R.H in *kharif* 2011 was correlated positively significant influence on per cent incidence on groundnut due to *S. litura*. The multiple regression equation fitted with weather factors to predict the per cent leaflets damage/mrl was

Season Regression equation

Kharif 2010 $Y = -197.00 + 0.275^{NS} X1 - 1.21^{NS} X_2 + 0.616^{NS} X_3 - 1.22^{NS} X_4 - 2.35^{*} X5$

Kharif 2011 $Y = -150.49 + 1.04^{NS} X_1 - 0.337^{NS} X_2 + 2.59^{*} X_3 - 0.449^{NS} X_4 - 2.17^{*} X_5$

Conclusions

The results present studies concluded that the first appearance of *S. litura* larval population was recorded from 36th MSW to reached peak in 40th (5.92/mrl), 41st MSW (4.54/mrl) and declined after six weeks of sowing. The R.H and minimum temperature showed significant positive association, while maximum temperature, wind speed and rainfall showed negatively non significant correlation with mean larvae of *S. litura*. The minimum temperature showed significant positive association. However, wind speed exhibited significant negative association with per cent leaflet damage by *S. litura* on groundnut during *kharif* seasons of 2010 and 2011.

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