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Seasonal Incidence of *Spodoptera litura* (Fab.) Infesting Groundnut with Respect to Leaf Damage

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

A field experiment was conducted at Main Oilseeds Research Station, Junagadh Agricultural University, Junagadh in 2023 during the *kharif* season to investigate the seasonal incidence of *Spodoptera litura* (Fab.) infesting groundnut concerning leaf damage. The activity of the activity of *S. litura* began in the 31st standard meteorological week (SMW) in fourth week of July, with 5.53 per cent leaf damage initially. During the third week of August, the 34th SMW recorded the first peak of 12.97 per cent leaf damage. After a slight decrease in leaf damage, a second peak was seen in the 38th SMW, in third week of September, with 14.89 per cent leaf damage. In the following weeks, there was a decrease in the leaf damage, reaching its lowest during the 44th SMW, which fell on the fifth week of October, with 0.78 per cent leaf damage. The

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correlation studies showed a significant positive correlation between larval population and minimum temperature, morning relative humidity, and morning and evening vapor pressure (r = 0.613*, 0.515*, 0.637* and 0.577*, respectively).

Keywords: Seasonal incidence; groundnut; S. litura; weather parameter and leaf damage.

1. INTRODUCTION

Groundnut (*Arachis hypogaea* L.) is a leguminous oilseed crop native to South America. As the king of oilseeds, it is the fourth most important oilseed in the world. It is the largest source of edible oil and ranks 13th among food crops in the world [1]. India comes ranked second to China in terms of groundnut production. Of all the groundnut-growing states in India, Gujarat has the largest share in terms of area and production. In Gujarat, the area under groundnut cultivation is 17.09 lakh hectares, with an annual production of 28.14 lakh tonnes and a productivity of 1647 kg/ha [2].

Groundnut yield is affected by direct pest damage or by pests such as disease vectors. More than a hundred insect species have been reported on groundnuts in India [3]. Among the various insect pests infesting this crop in Gujarat, the tobacco caterpillar *S. litura* is considered the most important pest due to its polyphagous nature and prevailing favourable climate, it occurs throughout the year. The newly hatched and early instar larvae of *S. litura* feed together on the underside of the leaf, resulting in leaf skeletonization and severe leaf destruction in later stages, leaving only petioles and branches, scraping chlorophyll and causing total yield loss up to 15-30 percent [4]; more than 180 crops [5].

The study of population dynamics is useful for obtaining information about the population of *S. litura* in groundnut crops. Correlating pests with various weather parameters such as temperature, relative humidity, wind speed, bright sunshine, evaporation, rainfall and rainy days provides valuable information and based on this information, a predictive model can be developed to predict their occurrence and ultimately farmers can plan plant protection strategies.

2. MATERIALS AND METHODS

To study the seasonal incidence of *Spodoptera litura* (Fab.) infesting groundnut concerning leaf damage, the variety, GJG-9 was sown at Main Oilseeds Research Station, Junagadh Agricultural University, Junagadh during the *kharif*, 2023. The crop was grown in plot size of 20 m x 20 m with a spacing of 45 cm x 10 cm between rows and plants, respectively. Plot was divided into 30 random quadrants measuring 1 m x 1 m. Throughout the experiment, standard agronomical practices were followed and no insecticides were applied. Observations on per cent leaf damage were recorded weekly from one week after germination until harvest. This was done on three randomly selected plants from each quadrate. The mean of per cent leaf damage per plant was worked out separately. Per cent leaf damage was calculated using the following formula [6].

$$\text{Per cent leaf damage} = \frac{\text{Number of damaged leaf}}{\text{Total number of leaf}} \times 100$$

2.1 Correlation study

The weekly meteorological data was obtained from the meteorological observatory of Junagadh Agricultural University, Junagadh. A simple correlation was calculated between pest population and various abiotic factors such as temperature (maximum and minimum), relative humidity (morning and evening), bright sunshine, rainfall, wind speed and vapour pressure (morning and evening), as well as rainy days to assess their impact.

3. RESULTS AND DISCUSSION

The data on the leaf damage by *S. litura* (Table-1 and illustrated in Fig.-1) indicate that the activity of *S. litura* started in the 31st SMW, the 4th week of July, with 5.53 per cent leaf damage. The first peak of 12.97 per cent leaf damage occurred in the 34th SMW, coinciding with the 3rd week of August. There was a slight reduction to 10.87 and 10.35 per cent leaf damage in the following weeks (35th and 36th SMW, respectively). The leaf damage increased again in the 37th SMW, the 2nd week of September, to 11.12 per cent and reached a second peak of 14.89 per cent leaf damage in the 38th SMW coinciding with the 3rd week of September. After that, the leaf damage by *S. litura* continued to decline each week, reaching a minimum of 0.78 per cent leaf damage in the 44th SMW *i.e.*, the 5th week of October.

Table 1. Per cent leaf damage by *S. litura* infesting groundnut during *kharif*, 2023

WAS	SMW	Month	Per cent leaf damage by *S. litura*	Temperature (°C)			Relative humidity (%)			BSS (hr)	RF (mm)	WS (km/h)	VP		Rainy days
				Max.	Min.	Mean	Mor.	Eve.	Mean				Mor.	Eve.	
3	30	July	0.00	30.1	25.3	27.7	93	84	89	1.1	343.2	7.1	25.0	25.1	7
4	31		5.53	29.9	25.3	27.6	91	81	86	0.0	26.0	8.2	24.5	24.1	3
5	32	August	9.10	30.3	25.5	27.9	89	76	83	0.3	8.1	8.5	23.7	23.1	1
6	33		10.33	30.3	25.4	27.9	90	73	82	0.5	0.9	7.8	24.0	22.9	0
7	34		12.97	30.8	25.2	28.0	89	74	82	0.8	6.8	6.7	24.0	23.3	1
8	35		10.87	32.8	24.6	28.7	84	62	73	4.1	0.0	5.7	23.4	22.3	0
9	36	September	10.35	34.4	25.1	29.8	81	57	69	6.8	0.0	5.0	23.2	22.2	0
10	37		11.12	34.0	25.3	29.7	85	56	71	6.1	0.0	5.9	24.1	20.9	0
11	38		14.89	31.2	24.8	28.0	91	77	84	2.5	199.6	5.5	24.8	24.0	3
12	39		10.65	33.7	25.3	29.5	83	63	73	4.1	16.1	4.1	23.3	23.6	1
13	40	October	8.23	35.5	23.0	29.3	84	41	63	9.7	0.0	3.9	21.8	16.9	0
14	41		5.51	34.7	23.0	28.9	79	46	63	9.3	53.4	3.7	21.8	18.7	1
15	42		2.02	35.1	23.1	29.1	74	39	57	9.1	0.0	3.6	19.0	16.0	0
16	43		1.14	36.6	21.8	29.2	70	31	51	8.6	0.0	2.6	18.1	13.8	0
17	44		0.78	36.3	19.7	28.0	72	28	50	8.7	0.0	2.0	16.3	12.0	0

WAS: Week After Sowing
SMW: Standard Meteorological Week
BSS: Bright Sunshine Hours
RF: Rainfall
WS: Wind Speed
VP: Vapour Pressure

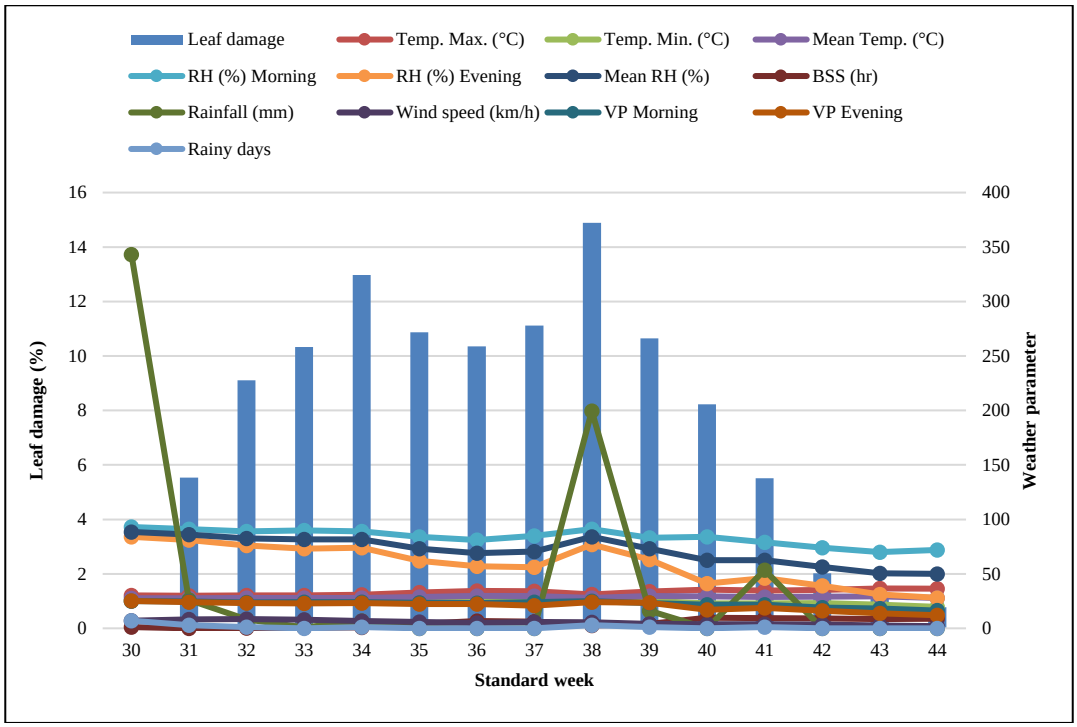

Fig. 1. Per cent leaf damage due to *S. litura* in relation to weather parameters during *kharif*, 2023

Similarly, Dodiya et al. [7] observed that the infestation of *S. litura* in groundnut begun during the third week of July (29th SMW) and reached at peak level (2.50 larvae/plant) during the 3rd week of September (37th SMW) with 90.33 per cent damaged plant. Kumar et al. [8] reported that the maximum larval population of tobacco caterpillar was appeared in 40th SMW (6.7 larvae/plant) and 41st SMW (9.3 larvae/plant) with 34.9 and 34.1 per cent foliage damage by *S. litura*. Priyanka et al. [9] reported that peak increase in the population during the 48th SMW with 11.2 per cent damage. Pazhanisamy et al. [10] reported that the per cent infestation of leaflets reached peak during 40th SMW (72.5%).

3.1 Correlation Studies Between Per Cent Leaf Damage by *S. litura* and Weather Parameters

A study on effect of various weather parameters on fluctuation of per cent leaf damage by *S. litura* infesting groundnut (Table 2) indicated that minimum temperature (r = 0.613*), morning relative humidity (r = 0.515*), morning (r = 0.637*) and evening vapour pressure (r = 0.577*) had a significantly positive correlation with leaf damage by *S. litura*. Additionally, Mean temperature (r = 0.106), evening (r = 0.457) and mean relative humidity (r = 0.479) and wind speed (r = 0.382) was positively correlated with leaf damage by *S. litura* but non-significant. While, maximum temperature (r = -0.363), bright sunshine hours (r = -0.379), rain fall (r = -0.184) and rainy days (r = -0.227) showed statistically non-significant negative correlation with leaf damage by *S. litura*.

Dodiya et al. [7] revealed that larval population of *S. litura* had a significant positive correlation with morning relative humidity (r = 0.694) as well as morning and evening vapour pressure (r = 0.512 and 0.576). Priyanka et al. [9] reported that the *S. litura* larval population showed a non-significant negative correlation with the Tmax ºC (r = -0.233) and a significant positive correlation with Tmin ºC (r = 0.370). Pazhanisamy et al. [10] reported a negative correlation between the temperature maximum during the *kharif* 2010 and 2011 on *S. litura* of groundnut. Kumar et al. [8] exhibited that tobacco caterpillar larvae had negative non-significant correlation with rainfall (r = -0.075). Satyanarayana et al. [11] revealed that *S. litura* during the rainy season on groundnut had a non-significant relationship with maximum temperature, relative humidity and wind speed, while, it showed a significant correlation with minimum temperature.

Table 2. Correlation matrix of weather parameters and per cent leaf damage by *S. litura*

Weather parameter	Per cent leaf damage by *S. litura*
Maximum Temperature (°C)	-0.363
Minimum Temperature (°C)	0.613*
Mean Temperature (°C)	0.106
Morning Relative humidity (%)	0.515*
Evening Relative humidity (%)	0.457
Mean Relative humidity (%)	0.479
Bright Sunshine hours (hr)	-0.379
Rainfall (mm)	-0.184
Wind speed (km/hr)	0.382
Morning Vapour Pressure (mm in Hg)	0.637*
Evening Vapour Pressure (mm in Hg)	0.577*
Rainy days	-0.227

**Significant at 5% (r = ±0.514)* ***Significant at 1% (r = ±0.642)* *N = 15*

4. CONCLUSION

The maximum leaf damage by *S. litura* (12.97% and 14.89%) was observed in 34th and 38th SMW (3rd week of August and 3rd week of September), respectively. The correlation matrix exhibited that the per cent leaf damage by *S. litura* had a significant positive correlation with minimum temperature, morning relative humidity and vapour pressure. However, there was a non-significant negative correlation found with maximum temperature, bright sunshine hours, rainfall and rainy days, while non-significant positive correlation with evening relative humidity and wind speed.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Option 1:
Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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