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Seasonal Incidence of Insect Pests of Groundnut in Southern Telangana Zone

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ABSTRACT

This study was conducted during the Rabi season (November 2023 to March 2024) at two locations IIOR-Rajendranagar and Narkhoda farms in Telangana, India. To assess the incidence and population dynamics of major insect pests and their correlation with weather parameters. Weekly pest monitoring included observations of leaf miners, leafhoppers, aphids, and Spodoptera litura across different crop growth stages. The results revealed distinct pest trends influenced by climatic factors. Leafhopper populations peaked during the 52nd standard meteorological week (SMW) with correlations varying across farms. At Rajendranagar, leafhopper population dynamics were negatively correlated with minimum temperature (-0.436) but positively correlated with morning relative humidity (0.387NS). Similar trends were noted for aphids, which showed significant positive correlations with maximum temperature (0.484*) and sunshine hours (0.641**). Spodoptera litura recorded its highest damage percentage (20%) by the 2nd SMW at Rajendranagar, showing a significant negative correlation with minimum temperature (-0.602*). Leaf miner damage peaked at 6% during the 51st SMW, demonstrating largely non-significant weather correlations. This study highlights the influence of environmental factors on pest dynamics in groundnut cultivation and underscores the need for location-specific pest management strategies. These findings offer critical insights for optimizing pest control measures and improving groundnut productivity in semi-arid regions.*

Keywords: *Groundnut, insect pests, abiotic factors, correlation.*

Introduction

Groundnut (*Arachis hypogaea* L.) is an important oilseed crop in India and is known as peanut, earthnut, monkey nut, and goobers (3). It contains about (35%-54%) oil, (6%-24%) carbohydrates, and (21%-36%) proteins and forms a high-energy source (2). The area, production, and productivity of groundnut in India in 2022-2023 is 44.31 lakh ha, 10289 tonnes, 2322.05 kg ha$^{-1,}$ and in Telangana is 1.55 lakh hectares, 349840 tonnes, 2257 kg ha^{-1} respectively (5) making it one of the major crops of the state. It is widely grown in Mahbubnagar, Nalgonda, Warangal and Karimnagar districts (4). Low productivity in groundnut is attributed to several constraints (11). Over one hundred insect species have been reported on groundnut in India (8). Studies revealed that (15%-20%) of the total oilseed production is lost directly or indirectly by the attack of insect and mite pests every year (1).

Materials and Methods

The study was conducted during the *Rabi* season from November 2023 to March 2024 at two locations under the ICAR-Indian Institute of Oilseeds Research (IIOR): the Rajendranagar Farm (17°19'13.3" N, 78°24'41.8" E, 542.6 m MSL) and the Narkhoda Farm, Shamshabad Mandal (17°15'30.1608" N, 78°19'11.1324" E, 569 m MSL). These sites are part of the semi-arid Southern Telangana Agro-Climatic Zone, characterized by a dry tropical climate with an average annual rainfall of 931.9 mm and a maximum average temperature of 32.4°C. Groundnut crops were cultivated following standard agronomic practices. The incidence of major insect pests was monitored weekly from one week after germination until harvest. Ten randomly selected and tagged plants at each site were observed to assess pest presence across different crop growth stages. Weather parameters such as temperature, humidity, and rainfall were recorded from meteorological stations at both farms. Data on pest incidence were analyzed using correlation and regression techniques to examine the influence of environmental factors on pest dynamics, providing insights for effective pest management strategies in groundnut cultivation.

The major insect pests in groundnuts that were assessed are leaf miners, leaf hoppers, aphids, and *Spodoptera litura*.

1. Leaf miner: Number of webs per plant
2. Leaf hoppers: Number of leaf hoppers on 3 leaves (upper, middle, bottom) per plant
3. Aphids: The aphids were counted on the entire plant
4. Tobacco caterpillar *(Spodoptera litura)*

The per cent damage by *S. litura* was calculated by the formula

$$\text{Percent damage} = \frac{\text{Number of leaves damaged}}{\text{Total number of leaves}} \times 100$$

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Results and Discussion

Based on the observations made on weekly intervals from the meteorological station and compiled to standard week wise for analyzing the data. The data was statistically analyzed by correlation analysis between weather parameters and insect pests.

Correlation with weather parameters

The correlation was observed between the incidence of insect pests and weather parameters like temperature, relative humidity, sunshine hours, wind speed, evaporation, and rainfall.

Incidence of Leaf Hopper

During the *Rabi* 2023-2024 season, the incidence of the leafhopper population was carefully monitored at the IIOR-Rajendranagar farm. Observations revealed an initial average population of 0.6 leaf hoppers per 3 leaves per plant during the 49th SMW, which peaked at 4.8 leaf hoppers per 3 leaves per plant by the 52nd SMW before declining to 0.2 leaf hoppers per 3 leaves per plant by the 6th SMW (Table 1 and Fig 1). The population dynamics showed a positively non-significant correlation with morning relative humidity (0.387NS) and sunshine hours (0.054NS), while a negatively significant correlation was observed with minimum temperature (-0.436*). Other factors, including maximum temperature (-0.436NS), evening relative humidity (-0.097NS), wind speed (-0.094NS), evaporation (-0.384NS), and rainfall (-0.202NS), displayed non-significant correlations (Table 2). These results aligned with Saritha *et al*. (2020) regarding relative humidity but differed in terms of temperature correlations.

At the IIOR-Narkhoda farm, the leafhopper population started at 5.2 leaf hoppers per 3 leaves per plant during the 49th SMW, peaking at the 52nd SMW before declining to 0.5 by the 6th SMW (Table 3 and Fig 2). Correlation analysis indicated positively non-significant correlations with maximum temperature (0.749**), minimum temperature (0.201NS), sunshine hours (0.676**), wind speed (0.533*), and evaporation (0.674**). Rainfall (-0.319NS) showed a positive but non-significant correlation, while morning and evening relative humidity displayed significant negative correlations (-0.627** and -0.851**, respectively) (Table 4). These findings affirmed earlier research by Sarita *et al*. (2020) on temperature but highlighted differences in relative humidity trends.

Incidence of Leaf Miner

At the IIOR-Rajendranagar farm, leaf miner damage was first detected during the 47th SMW, with a damage percentage of 0.2%. Damage escalated to 6% by the 51st SMW and declined to 0.4% by the 4th SMW (Table 1 and Fig 1). Correlations revealed positively non-significant relationships with morning relative humidity (0.363NS) and evening relative humidity (0.045NS), alongside negatively non-significant correlations with maximum temperature (-0.472NS), minimum temperature (-0.459NS), sunshine hours (-0.107NS), wind speed (-0.083NS), evaporation (-0.440NS), and rainfall (-0.198NS) (Table 2). These results contrasted with Sangeetha *et al*. (2023).

At the IIOR-Narkhoda farm, leaf miner damage was first noted at 0.4% during the 47th SMW, peaking at 5.2% during the 52nd SMW, before dropping to 0.6% by the 4th SMW (Table 3 and Fig 2). The population trends displayed a positively significant correlation with evening relative humidity (0.484*) and non-significant correlations with other weather parameters, including maximum temperature (0.234NS), minimum temperature (0.148NS), morning relative humidity (0.378NS), wind speed (0.238NS), sunshine hours (0.215NS), and evaporation (0.194NS). Rainfall (-0.113NS) had a negative but non-significant correlation (Table 4). These observations collaborated with Sangeetha *et al*. (2023) on temperature but differed regarding evening relative humidity.

Damage by *Spodoptera litura*

At the IIOR-Rajendranagar farm, *Spodoptera litura* damage initiated at 1.8% during the 48thSMW, peaking at 20% during the 2nd SMW, and reducing to 0.2% by the 7th SMW (Table 1 and Fig 1). Correlation analysis demonstrated positive but non-significant relationships with morning relative humidity (0.390NS) and sunshine hours (0.011NS), while a negative significant correlation was observed with minimum temperature (-0.602*). Other weather parameters, including maximum temperature (-0.461NS), evening relative humidity (-0.098NS), wind speed (-0.091NS), evaporation (-0.433NS), and rainfall (-0.215NS), exhibited negative but non-significant correlations (Table 2). These findings, aside from rainfall and sunshine hours, diverged from those of Mishra *et al*. (2023).

At the IIOR-Narkhoda farm, damage initiated at 1.5% during the 48th SMW, peaking at 22.4% during the 2nd SMW, and decreasing to 0.8% by the 8th SMW (Table 3 and Fig 2). Correlation patterns indicated positive but non-significant associations with maximum temperature (0.303NS), minimum temperature (0.215NS), morning relative humidity (0.394NS), evening relative humidity (0.241NS), sunshine hours (0.291NS), wind speed (0.303NS), and evaporation (0.177NS), while rainfall (-0.162NS) showed a negative but non-significant correlation (Table 4). These findings were consistent with Mishra *et al*. (2023) except for maximum relative humidity.

Aphid Incidence

At the IIOR-Rajendranagar farm, aphid populations started at 0.4 aphids per plant during the 48th SMW, peaking at 15.4 aphids per plant by the 3rd SMW, and then reducing to 4.6 aphids per plant (Table 1 and Fig 1). Positively significant correlations were found with maximum temperature (0.484*), morning relative humidity (0.453*), sunshine hours (0.641**), wind speed (0.456*), and evaporation (0.526*). Minimum temperature (0.341NS) and evening relative humidity (0.138NS) displayed positive but non-significant correlations, while rainfall (-0.212NS) exhibited a negative but non-significant correlation (Table 2).

Similarly, at the IIOR-Narkhoda farm, aphid populations began at 0.8 aphids per plant during the 48th SMW, peaking at 16.2 aphids per plant by the 3rd SMW, and decreasing to 6.4 aphids per plant (Table 3 and Fig 2). Correlation analyses revealed positively significant associations with maximum temperature (0.527*), morning relative humidity (0.456*), sunshine hours (0.656**), wind speed (0.466*), and evaporation (0.503*). Positive but non-significant correlations were observed with minimum temperature (0.397NS) and evening relative humidity (0.073NS), while rainfall (-0.220NS) exhibited a negative but non-significant correlation (Table 4). These findings supported Sarita *et al*. (2020) concerning maximum temperature but diverged from Kumar *et al*. (2023) regarding relative humidity correlations.

Table 1. Seasonal incidence of insect pests observed on groundnut during rabi 2023- 2024 at IIOR-Rajendranagar

SMW	Age of crop (DAS)	Leaf hopper (No./3 leaves /plant)	Leaf miner (Number of webs/plant)	*Spodoptera litura* (% damage)	Aphids number/plant
45	4	0.0	0.0	0.0	0.0
46	11	0.0	0.0	0.0	0.0
47	18	0.0	0.2	0.0	0.0
48	25	0.0	1.2	1.8	0.4
49	32	0.6	2.4	3.6	1.2
50	39	1.8	3.6	5.2	2.4
51	46	2.0	6.0	6.8	3.2
52	53	4.8	5.8	16.4	4.6
1	60	3.4	4.6	19.2	8.6
2	67	2.6	3.0	20.0	9.8
3	74	1.6	1.0	15.4	15.8
4	81	1.2	0.4	8.2	14.2
5	88	0.8	0.0	4.4	12.6
6	95	0.2	0.0	1.4	10.8
7	102	0.0	0.0	0.2	8.4
8	109	0.0	0.0	0.0	6.2
9	116	0.0	0.0	0.0	4.6

Table 2. The correlation coefficient of insect pests of groundnut with weather parameters during rabi 2023-2024 at IIOR-Rajendranagar

Pests	Tmax	Tmin	RH I	RH II	Sunshine	Wind speed	Evaporation	Rainfall
Leafhoppers	-0.436^{NS}	-0.620**	0.387^{NS}	-0.097^{NS}	0.054^{NS}	-0.094^{NS}	-0.384^{NS}	-0.202^{NS}
Leaf miner	-0.472^{NS}	-0.459^{NS}	0.363^{NS}	0.045^{NS}	-0.107^{NS}	-0.083^{NS}	-0.440^{NS}	-0.198^{NS}
Spodoptera litura	-0.461^{NS}	-0.602*	0.390^{NS}	-0.098^{NS}	0.011^{NS}	-0.091^{NS}	-0.433^{NS}	-0.215^{NS}
Aphids	0.484*	0.341^{NS}	0.453*	0.138^{NS}	0.641**	0.456*	0.526*	-0.212^{NS}

Table 3. Seasonal incidence of insect pests observed on groundnut during rabi 2023- 2024 at IIOR-Narkhoda

SMW	Age of crop (DAS)	Leaf hoppers (No./3 leaves /plant)	Leaf miner (Number of webs/plant)	*Spodoptera litura* (% damage)	Aphids number/plant
45	4	0.0	0.0	0.0	0.0
46	11	0.0	0.0	0.0	0.0
47	18	0.0	0.4	0.0	0.0
48	25	0.0	1.6	1.5	0.8
49	32	0.6	2.2	2.8	1.4
50	39	1.8	3.8	4.6	2.2
51	46	2.8	6.4	6.2	3.6
52	53	5.2	5.2	14.8	5.8
1	60	3.6	4.8	17.6	8.2
2	67	2.8	2.8	22.4	12.6
3	74	2.2	1.6	16.2	16.4
4	81	1.8	0.6	8.6	14.8
5	88	0.6	0.0	5.2	13.2
6	95	0.5	0.0	2.6	11.6
7	102	0	0.0	0.8	9.5
8	109	0	0.0	0.0	8.4
9	116	0	0	0	6.4

Table 4. Correlation coefficient of insect pests of groundnut with weather parameters during Rabi 2023-2024 at IIOR-Narkhoda

Pests	Tmax	Tmin	RH I	RH II	Rainfall	Sunshine	Wind speed	Evaporation
Leafhoppers	0.272^{NS}	0.140^{NS}	0.390^{NS}	0.349^{NS}	-0.159^{NS}	0.307^{NS}	0.245^{NS}	0.205^{NS}
Leaf miner	0.234^{NS}	0.148^{NS}	0.378^{NS}	0.484*	-0.113^{NS}	0.215^{NS}	0.238^{NS}	0.194^{NS}
Spodoptera litura	0.303^{NS}	0.215^{NS}	0.394^{NS}	0.241^{NS}	-0.162^{NS}	0.291^{NS}	0.303^{NS}	0.177^{NS}
Aphids	0.527*	0.397^{NS}	0.456*	0.073^{NS}	-0.220^{NS}	0.656**	0.466*	0.503*

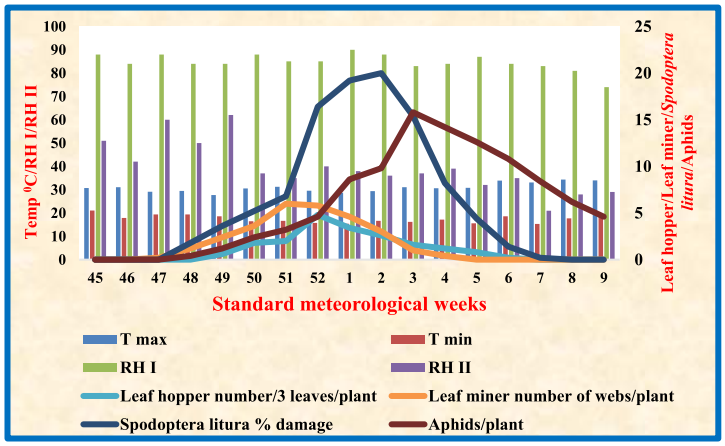

Fig 1. Correlation of groundnut insect pests with weather parameters at IIOR-Rajendranagar

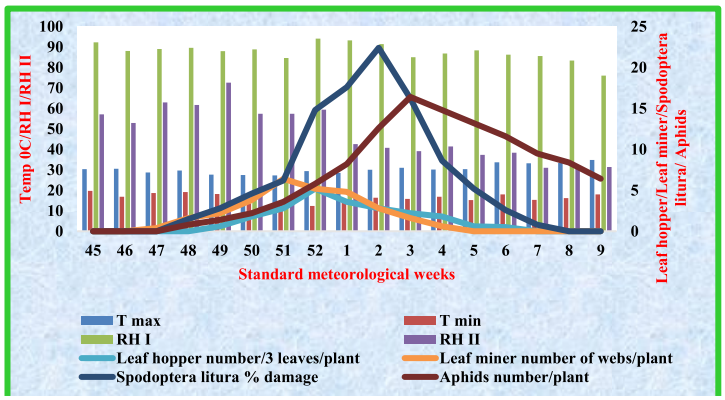

Fig 2. Correlation of groundnut insect pests with weather parameters at IIOR-Narkhoda

Conclusion

Overall, these findings provide valuable insights into the complex interactions between weather parameters and pest dynamics, offering critical data for improving pest management strategies in groundnut cultivation.

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