



Influence of Prevailing Weather Parameters on Population Dynamics of Leafhopper *Empoasca kerri* and Thrips *Scirtothrips dorsalis* on Groundnut in Semi Arid Ecosystem of Rajasthan

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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

The field experiment were conducted at Agronomy farm, S.K.N. College of Agriculture, Jobner during *Kharif*, 2020 and 2021 to know the population dynamics of leafhopper, *Empoasca kerri* Pruthi and thrips, *Scirtothrips dorsalis* Hood on groundnut. The primary focus of research on the effects of weather variables on insect ecology. The incidence of leafhopper, *E. kerri* and thrips *S. dorsalis* appeared in the fifth and fourth week of July in both the years and the population of leafhopper and thrips reached to its peak in the second and first week of September during *Kharif*,

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2020 and 2021 respectively. The correlation studies indicated that the leafhopper and thrips population had significant positive correlation with relative humidity ($r= 0.62$ and $r= 0.60$) and ($r= 0.77$ and $r= 0.75$) during both the *Kharif* seasons 2020 and 2021 respectively. Whereas the leafhopper and thrips population had significant positive correlation ($r= 0.59$ and $r= 0.61$) respectively at minimum temperature in *Kharif* 2021.

Keywords: Correlation; groundnut; leafhopper; thrips.

1. INTRODUCTION

“Groundnut, *Arachis hypogaea* (L.) also known as peanut belongs to family Fabaceae. In India it is an important crop and occupies second position among oilseed crops. Sucking pests are the major biotic constraints in groundnut production. Sucking pests suck the sap from tender plant parts as a result plant or parts of plant dry up. They feed on the plant sap (direct damage) and also act as vectors for plant viral diseases (indirect damage). Leafhoppers suck the sap from the leaves and petioles and mainly it prefers the first three terminal leaves and feeding symptoms induce yellowing of foliage that begins at the tip, known as hopper burn. Thrips mainly feed by lacerating and sucking the sap from leaves and the peanut stripe virus (PStV), peanut bud necrosis disease (PBNB) are transmitted by thrips. The leafhoppers can cause up to 22 per cent of yield loss in groundnut [1] while thrips up to 17 to 40 per cent” [2]. “Abiotic conditions such as temperature, relative humidity, sunlight, and rainfall have a significant impact on the population dynamics of any insect pest” [3]. “The environment, the availability of a host, and the activity of natural enemies all play a role in an insect’s survival, reproduction, and development. Weather parameters influence insect life cycles, reproduction, and outbreaks [4], and fluctuation in these abiotic factors have a negative effect on insect population dynamics” [5]. The purpose of these research is to demonstrate how interactions between individuals with specific traits give rise to population- and community-level occurrences. For a better understanding of how individual interactions with their physical surroundings and with other people translate into population and interspecific dynamics, it is highly recommended to investigate the impacts of weather on insects.

2. MATERIALS AND METHODS

The experimental study conducted at Agronomy farm, S.K.N. College of Agriculture, Jobner (Rajasthan) during *Kharif*, 2020 and 2021 to know the population dynamics of leafhopper and

thrips on groundnut. The groundnut crop, variety RG-510 was shown on 8th July 2020 and 5th July 2021 in five plots. The plot size was 3.0 m x 2.0 m with row to row and plant to plant distance of 40 cm x 15 cm, respectively.

2.1 Methods of Observations

The population of leafhopper and thrips on groundnut were recorded at weekly interval early in morning hours. The population of leafhopper and thrips were recorded on three leaves per plant from the five selected and tagged plants from each plot. The population was counted by gently holding the leaf between the two halves of a petri plate and both nymphs as well as adults were counted with in it [6].

2.2 Interpretation of Data

To interpret the results of population dynamics of leafhopper and thrips on groundnut the simple correlation was computed between pest population and abiotic factors, *i.e.* minimum & maximum temperatures, relative humidity and rainfall was worked out using following formula.

$$r = \frac{N \sum xy - (\sum x) (\sum y)}{\sqrt{N \sum x^2 - (\sum x)^2} \cdot \sqrt{N \sum y^2 - (\sum y)^2}}$$

Where,

- r = Simple correlation coefficient
- x = Independent variables *i.e.* abiotic components
- y = Dependent variables *i.e.* pests
- N = Number of observations

3. RESULTS AND DISCUSSION

The mean population of leafhopper and thrips and the standard meteorological week wise weather parameters are presented in Table 1 (*Kharif* 2020) and Table 2 (*Kharif* 2021). The findings of the present study and the related discussion are explained hereunder.

Table 1. Population dynamics of leafhopper and thrips on groundnut in relation to weather parameters in Kharif, 2020

SMW	Date of observations	Temperature (°C)		Mean relative humidity (%)	Total rainfall (mm)	Leaf hopper/three leaves	Thrips/ three leaves
		Max.	Min.				
31	29.07.20	36.00	24.20	69	0.00	1.40	0.60
32	05.08.20	32.90	23.00	83	47.40	3.00	1.28
33	12.08.20	33.10	23.50	86	57.40	3.76	2.80
34	19.08.20	30.20	22.00	87	39.40	4.20	3.40
35	26.08.20	31.10	21.50	83	27.80	4.00	3.20
36	02.09.20	31.70	21.30	84	24.40	4.16	3.60
37	09.09.20	36.30	21.10	67	0.00	5.40	4.00
38	16.09.20	37.30	21.50	63	01.30	4.00	3.08
39	23.09.20	36.90	20.80	59	03.20	3.60	2.00
40	30.09.20	37.00	14.30	47	0.00	2.40	1.20
41	07.10.20	36.60	16.50	43	0.00	1.20	0.88
42	14.10.20	35.00	20.30	44	0.00	1.00	0.80
Correlation coefficient with max. temp.						NS	NS
Correlation coefficient with min. temp.						NS	NS
Correlation coefficient with relative humidity						0.625*	0.602*
Correlation coefficient with rainfall						NS	NS

SMW = Standard meteorological weeks; * = Significant at 5 per cent level; NS = Non Significant

Table 2. Population dynamics of leafhopper and thrips on groundnut in relation to weather parameters in Kharif, 2021

SMW	Date of observations	Temperature (°C)		Mean relative humidity (%)	Total Rainfall (mm)	Leaf hopper/ three leaves	Thrips/ three leaves
		Max.	Min.				
30	26.07.21	31.80	24.30	65	55.40	2.08	1.88
31	02.08.21	30.10	22.80	89	98.90	3.00	2.20
32	09.08.21	33.50	23.20	75	02.40	2.60	2.00
33	16.08.21	35.60	22.10	65	00.00	1.20	1.80
34	23.08.21	33.60	23.80	73	10.80	3.60	2.40
35	30.08.21	32.80	22.50	75	25.40	3.88	2.48
36	06.09.21	33.00	23.60	80	07.80	5.20	3.80
37	13.09.21	32.50	22.60	78	01.60	4.00	3.40
38	20.09.21	31.60	22.30	79	38.20	4.20	3.60
39	27.09.21	31.70	22.60	77	08.20	3.40	3.20
40	04.10.21	33.40	21.50	69	33.00	2.20	1.80
41	11.10.21	35.50	16.50	50	00.00	0.60	0.40
Correlation coefficient with max. temp.						NS	NS
Correlation coefficient with min. temp.						0.590*	0.619*
Correlation coefficient with relative humidity						0.772*	0.755*
Correlation coefficient with rainfall						NS	NS

SMW = Standard Meteorological Weeks; NS = Non Significant; * = Significant at 5 per cent level

The incidence of leafhopper, *E. kerri* commenced in the fifth and fourth week of July in both the years and remained active throughout the crop season, up to second week of October during Kharif, 2020 and 2021, respectively. The peak population of 5.40 and 5.20 leafhopper per three leaves per plant was recorded in the second and first week of September during Kharif, 2020 and

2021, respectively, when the prevailing maximum temperature of 36.30°C and 33.00°C, minimum temperature of 21.10°C and 23.60°C, relative humidity of 67.00 per cent and 80.00 per cent and rainfall of 00.00 mm and 07.80 mm respectively. The correlation matrix indicated that leafhopper population had significant positive correlation (r= 0.62 and r= 0.77) with relative

humidity during both the years and minimum temperature ($r= 0.59$) only during 2021. While, non significant correlation with other abiotic factors during both the years. The present findings are in conformity with the findings of Jyothrimai et al. [7] reported that “the activity of jassid on groundnut throughout the crop season and peak activity in mid September”. Yadav et al. [8] found that “the incidence of jassid were commenced in the second week of August and touched its peak in the second week of September (13.56 jassid/ 3 leaves)”. Khanpara and Acharya [9] reported that “the incidence of the pest commenced in the 3rd week of July (1.80 jassid nymphs/ 3 leaves), which gradually increased and attained peak (4.20 jassid nymphs/ 3 leaves) in the 2nd week of September after that the population decreased and disappear in the 3rd week of October”. Similar observation work made by Harish et al. [10] and Mer et al. [11]. According to Ahir et al. [12] the “incidence of jassid started in the 2nd week of August and touched the peak in the 3rd week of September with 7.00 jassids/ 3 leaves”. Nigude et al. [13] reported that “the incidence of jassid started in 2nd week of August and later on steadily increased and reached to its peak in the 1st week of September with 3.06 jassids/ 3 leaves”. Gocher et al. [14] reported that “the leafhopper population commenced in the last week of July and reached to its peak in the second week of September”. Nayak et al. [15] reported that “the leaf hopper population appeared during 33rd standard meteorological week and attained the peak population (5.68/ top 3 leaves) in the second week of September”. The studies on correlation of leafhopper population with abiotic factors are supported by the findings of Jena and Kuila [16] reported that “the relationship between meteorological variables and per cent infestation of jassids had negative correlation with minimum temperature and positive correlation with maximum temperature, rainfall and relative humidity which is partially corroborates with present findings”. According to Yadav et al. [8] the “leafhopper population had negative non significant correlation with temperature and positive correlation with relative humidity and total rainfall the findings are in close akin with present findings”. Similar work was made by Mer et al. [11] and Saritha et al. [17]. Ahir et al. [12] reported that “the jassid population had negative correlation with temperature, whereas relative humidity and rainfall were found non significant and positive which is partially corroborates with present findings”. Nigude et al. [13] reported that “the

population of jassid was negatively non significant with temperature and rainfall and positively associated with relative humidity which is fully conformity with present findings”. According to Gocher et al. [14] “the population of leafhopper had significant negative correlation with maximum temperature and significant positive correlation with relative humidity”. Nayak et al. [15] reported that “the leaf hopper population had significant positive correlation with minimum temperature which is accordance to present findings”.

The incidence of thrips, *S. dorsalis* started in the fifth and fourth week of July in both the years and remained active throughout the crop season upto second week of October during 2020 and 2021, respectively. The peak population of thrips 4.00 and 3.80 thrips per three leaves per plant was recorded in the second and first week of September during *Kharif*, 2020 and 2021, respectively. The correlation matrix showed that thrips population had significant positive correlation with relative humidity ($r= 0.60$ and $r= 0.75$) during both the years and with minimum temperature ($r= 0.61$) only during 2021. While, non significant relationship with other weather parameters during both the years. The present results corroborates with the findings of Yadav et al. [8] reported that “the incidence of thrips were commenced in the second week of August and touched the peak (4.16 thrips/ 3 leaves) in the fourth week of September”. Similar work made by Harish et al. [10] and Naresh et al. [18]. According to Ahir et al. [12] “the incidence of thrips started in 2nd week of August and attained peak in the 2nd week of September which is partially agreement with present findings”. Nigude et al. [13] reported that “the incidence of thrips started in 1st week of August and reached to its peak in the 4th week of September with 4.20 thrips/ 3 leaves”. Nayak et al. [15] found that “thrips appeared during 33rd standard meteorological week and reached to peak (3.84/ top bud leaves) in the second week of September which is close agreement with present results”. Saritha et al. [17] reported that “the incidence of thrips has started on 27th SMW and attained peak in the 31st SMW (3.5 thrips/ plant) which is partially conformity with present findings”. Yadav et al. [8] reported that “the correlation between thrips and temperature was negative but with relative humidity and total rainfall, the correlation was positive and non significant”. Kandakoor et al. [19] reported that “the thrips population had positive correlation to maximum and minimum temperature which is

contrary to present results". Harish et al. [10] and Naresh et al. [18] have also worked. According to Ahir et al. [12] "the correlation between thrips population and temperature was negative but with total rainfall, the correlation was positive non significant and correlation with relative humidity was positively significant which is fully support with present result". Nigude et al. [13] reported that "the thrips population was negatively non significant with temperature and rainfall and positively significant correlation with relative humidity which is corroborates with present findings". Nayak et al. [15] found that "thrips population had significant positive correlation with minimum temperature which is close akin with present results". Saritha et al. [17] reported that "the thrips population had significant positive correlation with relative humidity and rainfall which is corroborate with present findings".

4. CONCLUSION

The important conclusions drawn from present investigation made on population dynamics of leafhopper and thrips on groundnut. The incidence of leafhopper, *E. kerri* and thrips *S. dorsalis* appeared in the fifth and fourth week of July in both the years. The population of leafhopper and thrips reached to its peak in the second and first week of September during *Kharif*, 2020 and 2021 respectively. The correlation studies indicated that the leafhopper and thrips population had significant positive correlation with relative humidity ($r= 0.62$ and $r= 0.60$) and ($r= 0.64$, $r= 0.77$ and $r= 0.75$) during both the *Kharif* seasons 2020 and 2021 respectively. Whereas the leafhopper and thrips population had significant positive correlation with ($r= 0.59$ and $r= 0.61$) minimum temperature in *Kharif*, 2021.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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