**Studies on seasonal incidence of major sucking pests of groundnut (*Arachis hypogea* L.) under rainfed conditions in Tamil Nadu**

V.Abarna\*1,2, P.Manikandan3, and D.S.Rajavel1

1Department of Entomology, Tamil Nadu Agriculture University, Tamil Nadu, India

2School of Agriculture, Bharath Institute of Higher Education and Research, Tamil Nadu, India

 3Division of Ecotechnology, M S Swaminathan Research Foundation, Tamil Nadu, India

\*Email- abarnavenkat22@gmail.com

**ABSTRACT**

The survey was conducted to record the population dynamics of major sucking pests of groundnut such as Aphid, *Aphis craccivora*, Thrips, *Scirtothrips dorsalis* and Leafhopper, *Empoasca kerri* during *Rabi*, 2019- *Summer*, 2020 and *Kharif*, 2020. Incidence of aphids was observed from the 52nd SMW but a considerable population was recorded from the 06th SMW to the 18th SMW. Thrips were high during the 4th SMW to the 18th SMW but the peak incidence of thrips was observed 16th to 18th SMW. The infestation of leafhoppers was observed from the 2nd SMW and the incidence increased and reached a peak during the 8th SMW. A considerable level of incidence was observed from the 6th SMW to the 17th SMW during *Rabi*, 2019- *Summer*, 2020. The relationship between the weather factors and major sucking pests during *Rabi-Summer* and *Kharif* seasons revealed the positive relationship between aphids and thrips with maximum temperature, minimum temperature and mean temperature and the negative relationship with maximum humidity, minimum humidity, mean humidity and rainfall. Leafhoppers had a non-significant relationship with weather factors but had a significant negative relationship with rainfall.

**KEYWORD:** Groundnut, Sucking pest, Aphid, Thrips, Leafhopper, Incidence

**INTRODUCTION:**

Groundnut, *Arachis hypogea* L., one of the most important oilseed crops is known as “King of oilseeds” It is grown in many tropical and sub-tropical countries of the world under both rainfed and irrigation conditions (Doyle and Luckow, 2003; Heywood *et al.,* 2007). India ranks second with the production of 10.24 million tonnes in 2020-2021 which accounting 19 per cent of total world production. Among the Indian states, Karnataka stood first in area coverage with 1.65 lakh ha followed by Odisha (1.10 lakh ha), Tamil Nadu (0.94 lakh ha), Telangana (0.93 lakh ha) and Andhra Pradesh (0.81 lakh ha). Regarding production, Gujarat is leading with 36.76 lakh tonnes followed by Rajasthan (18.95 lakh tonnes), Madhya Pradesh (9.61 lakh tonnes), Tamil Nadu (4.47 lakh tonnes), Karnataka (2.57 lakh tonnes) and Telangana (0.10 lakh tonnes) (www.agricoop.gov.in). Groundnut production is affected by various factors. Among them, insect pests are the major biotic factor which causes loss in groundnut production. hampered by many biotic and abiotic factors. Insect pests including root feeders, sucking pests and defoliators are the major biotic constraints which cause up to 50 per cent yield loss by direct damage as well as by vectoring diseases. In India following are the major sucking pests *viz*., Aphid, *Aphis craccivora* Koch, Thrips, *Scirtothrips dorsalis* Hood and Leafhopper, *Empoasca kerri* Pruthi both the nymph and adults can cause damage to the plants. The aphid sucking the sap from the tender shoots of the crop act as a vector of rosette viral diseases. Thrips damage plants by sucking their juices and scraping at fruits, flowers and leaves and also act as vectors of the bud necrosis virus disease. The leafhopper/jassids nymphs and adults suck sap from the young leaves. The typical “V” shaped yellow patches appear and dry in a later stage producing the hopper burn appearance (Atwal and Dhaliwal, 2008). Infestation of these pests was recorded throughout India but occurrence varied in different geographical conditions. The pest infestation may vary from season to season on groundnut (Kandakoor *et al.,* 2012; Harish *et al.,* 2015; Saritha *et al.,* 2020; Manikandan and Selvanarayanan, 2020). Understanding pest population dynamics is very important to make decisions on their timely management to avoid economic losses. In this view, the experiment was conducted to understand the population dynamics of these important pests on groundnut.

**MATERIALS AND METHODS**

The survey was conducted in the major groundnut-growing villages of the Aruppukottai block of the Virudhunagar district of Tamil Nadu. Ten villages *viz.,* Aruppukottai, Narikudi, Thiruchuli, Kariapatti, Kovilangulam, Kattangudi, Mangulam, Puliyooran, Viracholan and Vadathakulam one field from each village were selected to study the seasonal incidence of major sucking pests of groundnut during *Rabi* 2019, Summer and *Kharif*, 2020.

The survey was conducted on the selected fields of all the ten villages. The twenty-five random plants per location representing North, South, East and West of the groundnut fields were selected and the selected plants were examined for pest incidence. All the data was collected during the morning hours. The incidence of aphids was recorded on all the selected plants by counting the number of nymphs and adults of the aphids per 2.5 cm shoot length per plant. To assess the leaf hoppers, the number of nymphs and adults of leafhoppers settled per plant was recorded and Thrips incidence was recorded by counting the nymphs and adults of thrips present in the top three open leaves of the plants. All the observed data was pooled together, averaged and expressed as the number of aphids / 2.5 cm shoot length in five plants, the number of leafhoppers/five plants and the number of thrips in the top three open leaves/five plants. The incidence of the above pests was plotted in Randomized Block Design (RBD). The weather information was collected from the Meteorological Observation Unit, Regional Research Station, Aruppukottai. The relationship between the pests and weather factors was estimated by Pearson correlation coefficient, and regression using IBM SPSS (IBM SPSS, 2022).

**RESULTS AND DISCUSSION**

The incidence of pests on the crops may not be similar throughout the year. It varies from season to season (Manikandan *et al.* 2019; Manikandan *et al.* 2021). The major reason behind the difference in pest incidence from season to season was the weather conditions of the particular season. One to a few or more weather parameters may affect the pest population by directly affecting its life cycle or by changing the constituents in the crop plants. This research investigated the seasonal incidence of major sucking pests on groundnut and the role of weather parameters on the pest incidence.

The result of the survey conducted during the *Rabi* 2019-*Summer* 2020 season showed that incidence of aphids was recorded throughout the season, the infestation observed from the first week of observation (52nd SMW) but a considerable population was recorded from the 06th SMW to the 18th SMW with the range of 21.61 to 47.34 aphids/ 2.5 cm shoots of five plants (Table-1). Arunbabu *et al.* (2020) also reported the considerable aphid infestation during February to March in Green gram. The correlation between the aphid population and weather parameters during the *Rabi* 2019-*Summer* 2020 season revealed that maximum temperature (0.837\*\*), minimum temperature (0.692\*\*) and mean temperature (0.782\*\*) had a significant strong positive correlation whereas maximum relative humidity (-0.778\*\*), minimum relative humidity (-0.674\*\*), mean relative humidity (-0.771\*\*), had a significant negative correlation and the rainfall showed the non-significant negative correlation (-0.172NS). Javed *et al.* (2014) and Ahir *et al.* (2017) also reported a negative correlation between the aphid incidence and rainfall. Kataria and Kumar (2015) also reported a negative correlation of aphid incidence with relative humidity and rainfall.

The incidence of thrips was observed from the first week of observation (52nd SMW) but the population was very low. Incidence showed an increasing trend from the 4th SMW to the 18th SMW. The peak incidence of thrips was observed 16th to 18th SMW. The correlation between the thrips population and weather parameters during the *Rabi* 2019-*Summer* 2020 season revealed that maximum temperature (0.943\*\*), minimum temperature (0.845\*\*) and mean temperature (0.919\*\*) had a significant strong positive correlation whereas maximum relative humidity (-0.798\*\*), minimum relative humidity (-0.649\*\*), mean relative humidity (-0.764\*\*), had a significant negative correlation and the rainfall showed the non-significant negative correlation (-0.154NS). This result is supported by Vijayalakshmi *et al.* (2017) who also reported considerable thrips infestation started in February to March in the Coimbatore district of Tamil Nadu and reported the negative correlation of thrips population relative humidity and positive correlation with maximum and minimum temperature. Naresh *et al.* (2018) also reported the thrips incidence started from the 52nd SMW to the 17th SMW and reported a positive relationship between the thrips incidence and maximum and minimum temperature and a negative relationship with relative humidity. Findings supported by Kandakoor *et al.* (2012) who also reported a positive relationship between the maximum and minimum temperature with thrips incidence.

The infestation of leafhoppers was observed from the 2nd SMW and the incidence increased and reached a peak during the 8th SMW. A considerable level of incidence was observed from the 6th SMW to the 17th SMW. Unlike aphids and thrips the fluctuation in incidence of leafhopper is observed throughout the season. The incidence of leafhoppers was positively correlated with maximum, minimum and mean temperatures and negatively correlated with maximum, minimum, and mean relative humidity and rainfall but all the above correlations were statistically non-significant. Findings supported by Kandakoor *et al.* (2012) who also reported a positive relationship between the maximum temperature with leafhopper incidence. The influence of weather parameters on leafhoppers was reported by many earlier researchers (Manikandan *et al.,* 2020; Saravanaraman *et al.,* 2020; Reddy *et al.,* 2022).

There was no strong population fluctuation observed in all three pests during the “*Rabi* 2019 – *Summer* 2020”. The results of seasonal incidence of major sucking pests of groundnut concerning weather parameters in “*Kharif* 2020 showed that the initial and the maximum incidence of aphids observed in 36th SMW. The result of the incidence is supported by the findings of Nayak *et al.* (2019) who reported the peak incidence of aphids during September in the *Kharif* season.Throughout the study period, the fluctuation in the aphid infestation was observed during *Kharif* 2020. A considerable aphid population was not observed throughout the season some weeks of observation showed that there was no aphid incidence on the crops. These results agree with the findings of Kandakoor *et al.* (2012) who also reported that the population of aphids was very low throughout the *Kharif* season and did not cause considerable damage to the plants.

The correlation between the aphid population and weather parameters during the *Kharif* 2020 season revealed that maximum temperature (0.627\*), and mean temperature (0.613\*) had a significant strong positive correlation whereas maximum relative humidity (-0.624\*), minimum relative humidity (-0.704\*), mean relative humidity (-0.707\*\*) and rainfall (-0.629\*) had a significant negative correlation and non-significant negative correlation with minimum temperature (-0.028NS). Rao *et al.* (1991), Javed *et al.* (2014) and Ahir *et al.* (2017) also reported a negative correlation between rainfall and aphid incidence. Kataria and Kumar (2015) also reported a negative correlation of aphid incidence with relative humidity and rainfall.

Thrips incidence fluctuated throughout the season and the population of thrips was negligible during *Kharif* 2020. The infestation started from the 36th SMW and the maximum was in the 38th SMW. The range of thrips population is between 0.00 to 5.76/ three top leaves of five plants. The correlation between the thrips population and weather parameters during the *Kharif* 2020 season revealed that mean temperature (0.607\*) had a significant strong positive correlation whereas minimum relative humidity (-0.626\*), mean relative humidity (-0.595\*) and rainfall (-0.759\*\*) had a significant negative correlation. These findings are supported by Vijayalakshmi *et al.* (2017) who also reported considerable thrips infestation started in 2nd week of August and reached the peak at the end of September. Choudhary *et al.* (2015) also reported a negative correlation between the thrips incidence, maximum and minimum relative humidity, and rainfall. Selvam *et al.* (2022) also reported the negative effect of rainfall on smaller-sized sucking pests.

The increase and decrease of leafhopper incidence observed throughout the season of the population ranged between 8.92 to 49.41/ five plants during *Kharif* 2020. The correlation between the leafhopper population and weather parameters during the *Kharif* 2020 season revealed that the rainfall had a strong negative relationship with leafhopper incidence (-0.933\*\*) whereas maximum and minimum temperature had a non-significant positive correlation with leafhopper incidence. Nayak *et al.* (2019) also reported a positive relationship between leafhopper incidence with maximum temperature.

The relationship between the weather factors and major sucking pests during *Rabi-Summer* and *Kharif* seasons revealed the positive relationship between aphids and thrips with maximum temperature, minimum temperature and the negative relationship with maximum humidity, minimum humidity and rainfall. The above findings are supported by Saritha *et al.* (2020) and Selvam *et al.* (2021) who also reported the positive effect of maximum temperature and the negative effect of rainfall on aphid and thrips infestation.

Regression analysis on the influence of weather parameters *viz.,* maximum temperature, minimum temperature, mean temperature, maximum relative humidity, minimum relative humidity, mean relative humidity and rainfall during *Rabi* 2019-*Summer* 2020 on the major sucking pests of groundnut such as aphids, thrips and leafhopper *viz.,* 88.9 per cent (R2=0.889), 95.3 per cent (R2=0.953) and 32.3 per cent (R2=0.323). Altogether the influence of weather parameters on major sucking pests of groundnut during *Kharif* 2020 extent to 90.4 per cent (R2=0.904), 94.5 per cent (R2=0.945) and 93.9 per cent (R2=0.939) on the incidence of the pests *viz.,* aphids, thrips and leafhoppers. The regression equation developed for the major sucking pest of groundnut with relevant to the weather parameters for both seasons (Table-5). These findings were supported by Kandakoor *et al.* (2012), Radhika *et al.* (2013), Harish *et al.* (2015) and Saritha *et al.* (2020).

**AUTHOR’S CONTRIBUTION**

Conceived the presented idea developed the theory performed the computations (VA), Verified the analytical methods (VA and PM), Encouraged the investigation and supervised the overall research (DSR), results and contributed to the final manuscript (VA, PM, DSR).

**DECLARATION**

The authors declared that they have no conflict of interest

**ACKNOWLEDGEMENT**

The authors thankfully acknowledged the Regional research station, Aruppukottai, TNAU.

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**Table-1. Seasonal incidence of major sucking pests of groundnut concerning weather parameters in “*Rabi* 2019-*Summer* 2020”**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SMW** | **Temp. (ºc)** | **Mean temp (ºc)** | **RH (%)** | **Mean relative humidity (%)** | **Rainfall (mm)** | **Aphids** | **Thrips** | **Leafhopper** |
| **Max** | **Min** | **Max** | **Min** |
| 52 | 29.86 | 21.29 | 25.57 | 90.14 | 51.29 | 70.71 | 0.00 | 7.31 | 0.21 | 0.00 |
| 01 | 31.14 | 20.86 | 26.00 | 88.00 | 42.00 | 65.00 | 0.00 | 9.25 | 0.24 | 0.00 |
| 02 | 29.57 | 21.14 | 25.36 | 93.14 | 55.43 | 74.29 | 1.14 | 5.23 | 0.00 | 1.20 |
| 03 | 30.57 | 19.43 | 25.00 | 89.43 | 45.29 | 67.36 | 0.00 | 6.71 | 0.67 | 2.01 |
| 04 | 30.86 | 20.43 | 25.64 | 89.00 | 41.71 | 65.36 | 0.00 | 3.91 | 2.71 | 4.11 |
| 05 | 31.71 | 19.14 | 25.43 | 83.71 | 34.57 | 59.14 | 0.00 | 14.33 | 3.67 | 9.52 |
| 06 | 33.00 | 19.29 | 26.14 | 89.43 | 41.00 | 65.21 | 0.00 | 24.14 | 4.46 | 15.23 |
| 07 | 32.86 | 22.29 | 27.57 | 83.14 | 41.86 | 62.50 | 0.00 | 21.61 | 4.21 | 19.33 |
| 08 | 33.00 | 20.57 | 26.79 | 80.57 | 39.14 | 59.86 | 0.00 | 37.42 | 5.32 | 36.16 |
| 09 | 35.00 | 22.14 | 28.57 | 79.86 | 33.57 | 56.71 | 0.00 | 38.65 | 6.37 | 25.30 |
| 10 | 34.57 | 22.00 | 28.29 | 89.43 | 35.71 | 62.57 | 0.00 | 30.26 | 6.12 | 27.12 |
| 11 | 34.43 | 24.86 | 29.64 | 88.71 | 49.86 | 69.29 | 1.14 | 28.65 | 6.73 | 30.43 |
| 12 | 37.29 | 24.43 | 30.86 | 83.71 | 30.71 | 57.21 | 0.00 | 42.65 | 7.34 | 25.11 |
| 13 | 33.86 | 22.71 | 28.29 | 84.43 | 34.29 | 59.36 | 0.00 | 29.21 | 5.65 | 32.76 |
| 14 | 37.29 | 26.00 | 31.64 | 81.71 | 41.29 | 61.50 | 0.00 | 40.61 | 7.82 | 30.14 |
| 15 | 37.43 | 26.57 | 32.00 | 83.86 | 39.86 | 61.86 | 3.57 | 39.77 | 8.92 | 17.35 |
| 16 | 38.86 | 27.29 | 33.07 | 78.29 | 33.29 | 55.79 | 0.00 | 43.21 | 11.36 | 12.63 |
| 17 | 39.14 | 27.43 | 33.29 | 79.43 | 32.71 | 56.07 | 0.00 | 47.34 | 11.46 | 10.63 |
| 18 | 39.57 | 28.00 | 33.79 | 76.57 | 35.43 | 56.00 | 0.00 | 42.30 | 11.86 | 6.21 |
| 19 | 38.00 | 25.71 | 31.86 | 85.00 | 43.14 | 64.07 | 13.71 | 13.21 | 5.71 | 7.20 |

**Table-2. Seasonal incidence of major sucking pests of groundnut concerning weather parameters in “*Kharif* 2020”**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **SMW** | **Temp. (ºc)** | **Mean temp (ºc)** | **RH (%)** | **Mean relative humidity (%)** | **Rainfall (mm)** | **Aphids** | **Thrips** | **Leafhopper** |
| **Max** | **Min** | **Max** | **Min** |
| 35 | 35.71 | 21.64 | 28.68 | 78.43 | 65.43 | 71.93 | 46.80 | 0.00 | 0.00 | 11.21 |
| 36 | 37.36 | 22.14 | 29.75 | 75.71 | 61.71 | 68.71 | 3.80 | 16.21 | 4.32 | 36.34 |
| 37 | 36.38 | 21.95 | 29.17 | 78.00 | 64.71 | 71.36 | 20.40 | 5.11 | 2.11 | 30.21 |
| 38 | 35.36 | 23.43 | 29.39 | 73.57 | 54.71 | 64.14 | 1.80 | 12.65 | 5.76 | 44.34 |
| 39 | 32.79 | 23.86 | 28.32 | 83.57 | 70.00 | 76.79 | 23.40 | 4.11 | 2.06 | 29.71 |
| 40 | 32.93 | 22.50 | 27.71 | 86.71 | 65.57 | 76.14 | 72.40 | 0.00 | 0.00 | 8.92 |
| 41 | 34.07 | 24.14 | 29.11 | 74.86 | 64.57 | 69.71 | 7.40 | 3.61 | 3.92 | 38.15 |
| 42 | 32.93 | 23.36 | 28.14 | 83.71 | 64.14 | 73.93 | 17.80 | 3.11 | 1.17 | 25.23 |
| 43 | 32.36 | 21.57 | 26.96 | 82.14 | 66.86 | 74.50 | 22.20 | 4.33 | 0.00 | 27.60 |
| 44 | 31.29 | 23.29 | 27.29 | 89.14 | 69.43 | 79.29 | 35.20 | 0.00 | 0.00 | 22.16 |
| 45 | 32.25 | 21.75 | 27.00 | 84.50 | 64.17 | 74.33 | 0.00 | 5.21 | 2.25 | 49.41 |
| 46 | 32.17 | 22.79 | 27.48 | 91.43 | 68.71 | 80.07 | 5.51 | 2.4 | 3.64 | 44.26 |

**Table-3. Correlation of major sucking pest incidence on groundnut concerning weather parameters during “*Rabi* 2019-*Summer* 2020”**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Aphid** | **Thrips** | **Leafhopper** |
| Coefficient of correlation (r) for pest population and Maximum Temperature | 0.827\*\* | 0.943\*\* | 0.301 NS |
| Coefficient of correlation (r) for pest population and Minimum Temperature | 0.692\*\* | 0.845\*\* | 0.148 NS |
| Coefficient of correlation (r) for pest population and Mean Temperature | 0.782\*\* | 0.919\*\* | 0.234 NS |
| Coefficient of correlation (r) for pest population and Maximum Relative Humidity | -0.778\*\* | -0.798\*\* | -0.316 NS |
| Coefficient of correlation (r) for pest population and Minimum Relative Humidity | -0.674\*\* | -0.649\*\* | -0.370 NS |
| Coefficient of correlation (r) for pest population and Mean Relative Humidity | -0.771\*\* | -0.764\*\* | -0.374 NS |
| Coefficient of correlation (r) for pest population and Rainfall | -0.172 NS | 0.043 NS | -0.154 NS |

\* -Significant at 0.05%, \*\* -Significant at 0.01% level of probability, NS- Non Significant

**Table-4. Correlation of major sucking pest incidence on groundnut concerning weather parameters during “*Kharif* 2020”**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Aphid** | **Thrips** | **Leafhopper** |
| Coefficient of correlation (r) for pest population and Maximum Temperature | 0.627\* | 0.437 NS | 0.016 NS |
| Coefficient of correlation (r) for pest population and Minimum Temperature | -0.028 NS | 0.367 NS | 0.159 NS |
| Coefficient of correlation (r) for pest population and Mean Temperature | 0.613\* | 0.607\* | 0.090 NS |
| Coefficient of correlation (r) for pest population and Maximum Relative Humidity | -0.624\* | -0.501 NS | -0.165 NS |
| Coefficient of correlation (r) for pest population and Minimum Relative Humidity | -0.704\* | -0.626\* | -0.339 NS |
| Coefficient of correlation (r) for pest population and Mean Relative Humidity | -0.707\* | -0.595\* | -0.255 NS |
| Coefficient of correlation (r) for pest population and Mean Relative Humidity | -0.629\* | -0.759\*\* | -0.933\*\* |

\* -Significant at 0.05%, \*\* -Significant at 0.01% level of probability, NS- Non Significant

**Table 5. Stepwise linear regression of major sucking pests of groundnut and weather parameters**

|  |  |  |
| --- | --- | --- |
| **Pest** | **Regression model** | **Regression coefficient (R2)** |
|  | ***Rabi* 2019-*Summer* 2020** |  |
| Aphid (Y1) | -124.55-106.66x1-115.80x2+226.66x3 -58.35x4-57.24x5+115.58x6-2.40x7 | 0.889 |
| Thrips (Y2) | -28.11+2.48x1+1.12x2-2.52x3 -58.64x4-58.54x5+117.14x6-0.28 x7 | 0.953 |
| Leafhopper (Y3) | -73.71+150.10x1+139.86x2-288.98x3 -645.43x4-645.04x5+1290.68x6-1.09 x7 | 0.323 |
|  | ***Kharif* 2020** |  |
| Aphid (Y1) | -82.24+333.48x1+331.27x2-662.42x3 +104.13x4+104.13x5-208.03x6-0.12 x7 | 0.904 |
| Thrips (Y2) | -62.99+36.34x1+36.60x2-70.90x3 +95.93x4+95.61x5-191.45x6-0.05 x7 | 0.945 |
| Leafhopper (Y3) | -27.23+23.28x1+23.80x2-45.59x3 +387.67x4+386.47x5-773.86 x6-0.53 x7 | 0.939 |

x1= Maximum Temperature, x2= Minimum Temperature, x3= Mean Temperature, x4= Maximum Relative Humidity, x5= Minimum Relative Humidity, x6= Mean Relative Humidity, x7= Rainfall.