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# Effect of meteorological parameters on the incidence of insect-pests of green gram during summer and *Kharif* season

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## ABSTRACT

*Green gram is a leguminous crop cultivated for its edible seed and recorded 30-50 per cent losses in yield due to insect pests. It is important to understand the incidence of insect pests in the field and their relation with weather conditions. The crop was sown two times in a year, first in April-July (summer season) and second in August-October (Kharif season). Two insect pests (Bemisia tabaci and Aphis craccivora) were recorded from the summer season and two (Liriomyza cicerina and Helicoverpa armigera) were recorded from the Kharif season. B. tabaciand A. craccivora were reported during 20th Standard Meteorological Week (SMW), reached peak at 23rd SMW. L. cicerina and H. armigera were observed first time during the 38th SMW and reached peak at 40th SMW. The correlation coefficient between the insect pests and meteorological parameters revealed a positive significant correlation with maximum temperature and a negative non-significant correlation with minimum temperature, relative humidity and rainfall. The information generated from the seasonal incidence of insect-pest will be helpful in improving crop yield and sustainable agriculture.*

***Keywords:*** *Correlation, green gram, incidence, insect-pests, weather factors*

## INTRODUCTION

Green gram (*Vigna radiata* L.), a significant legume crop belongs to the family Fabaceae (Leguminosae), mainly consumed as human food by cooking, fermenting and sprouting[1]. India is the world's top producer of green gram, contributing around 75 percent of the global production of this crop, followed by Myanmar, China, and Indonesia [2]. In Punjab, it occupied 2.1 thousand hectares, with a total production of 2.0 thousand tonnes during 2021-22[3]. Due to its short life cycle (70 days or less), green gram can be easily incorporated into various cropping systems in warmer and drier climates [4]. Several factors are responsible for the low productivity of green gram which includes environmental stress, post-harvesting losses and insect-pests [5]. Among all the factors, a diverse range of insect pest species infests at regular intervals, resulting in significant output losses of up to 38.06 percent [6]. Green gram is susceptible to sap-sucking pest complexes, including aphids (*Aphis craccivora* Koch), jassids (*Amrasca biguttula* Ishida), whiteflies (*Bemisia tabaci* Gennadius), thrips (*Thrips tabaci* Linnaeus), Leaf miner (*Liriomyza cicerina* Rondani) as well as pod borer complexes such as gram pod borer (*Helicoverpa armigera* Hubner), spotted pod borer (*Maruca tetulalis* Fabricius), and tobacco caterpillar (*Spodoptera litura*Fabricius) [7]. Different insect-pests have varying response to the various weather parameters. The meteorological parameters play a vital role in determining the incidence of insect-pest complex. Temperature can affect the development and activity of insect-pests. Warmer temperature can accelerate insect life cycle leading to faster reproduction and population growth [8].

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Rainfall can influence insect-pests by washing out or drown. High humidity levels can create favourable conditions for certain pests, such as aphids and whiteflies. Hence there is a great need to study the seasonal incidence and its correlation with meteorological parameters in green gram.

## MATERIAL AND METHODS

Two cultivars *viz.* SML 1827 and SML 668 were sown in summer and *Kharif*, respectively at research fields of Khalsa College, Amritsar, Punjab. Geographically, Amritsar is located at 31.63°N 74.87°Ewith an average elevation of 234 meters (768 ft) in the Majha region of the state of Punjab in North India and lies about 15 miles (24 km) east of the border with Pakistan. Amritsar has a hot semi-arid climate bordering on a monsoon-influenced humid subtropical climate. Temperatures in Amritsar usually range from −1 to 45°C. It experiences four primary seasons: winter (December to March), when temperatures can drop to −1°C, summer (April to June), when temperatures can reach 45°C, monsoon (July to September) and post-monsoon (October to November). Annual rainfall is about 726.0 millimeters (28.6 inches).

The experiment was replicated twice in a randomized block design (RBD) with a plot size of 3m x 5m and having one-meter spacing between them without any application of manures and fertilizers. All the recommended agronomic practices were done except insecticidal spray according to a package of practices of Punjab Agricultural University, Ludhiana to raise a good crop[3]. The observations were made at weekly intervals by randomly selecting 5 plants, *B. tabaci* (adults/ 3 leaves), *A. craccivora* (nymph/ 3 leaves), *L. cicerina*(larvae/leaf), and *H. armigera* (larvae/plant) after initiating of pest till harvesting of crop and further correlated with meteorological parameters such as maximum and minimum temperature, relative humidity and rainfall (Table 1). The data recorded was subjected to statistical analysis as per the requirement of the experiment. The computer program namely, PAST was used for the statistical analysis of the data.

## RESULTS

The incidence of *B. tabaci* and *A. craccivora* was recorded in the summer season whereas, *L. cicerina* and *H. armigera* were observed during the *Kharif* season. *B. tabaci* and *A. craccivora*infestation started at the vegetative stage (20th SMW) and continued till harvesting of the crop (28th SMW). *B. tabaci*(19.7 adults/3 leaves) and *A. craccivora* (17.4 nymph/3 leaves) population was recorded first time during the 20th SMW. A peak population of *B. tabaci* (59 adults/3 leaves) and *A. craccivora* (53.6 nymph /3 leaves) was observed in the 23rd SMW. The minimum population of *B. tabaci*and *A. craccivora* was 11.3 adults per 3 leaves and 14.6 nymphs per 3 leaves, respectively. Both the pests start decreasing in the 25th, 26th, 27th, and 28th SMW (Fig.1).

***Table 1 Meteorological parameters in summer and Kharif season of green gram during 2022***

| Summer season | | | | |
|---|---|---|---|---|
| **Standard Meteorological week (SMW)** | **Maximum Temperature (ºC)** | **Minimum Temperature (ºC)** | **Relative humidity (%)** | **Rainfall (mm)** |
| **20** | 37.40 | 25.95 | 24.28 | 0.00 |
| **21** | 39.11 | 23.37 | 37.85 | 0.00 |
| **22** | 41.50 | 24.10 | 32.57 | 7.00 |
| **23** | 44.62 | 27.11 | 20.57 | 0.00 |
| **24** | 42.81 | 26.31 | 41.14 | 21.00 |
| **25** | 35.14 | 22.14 | 66.85 | 31.90 |
| **26** | 38.88 | 28.01 | 65.57 | 12.90 |
| **27** | 36.68 | 27.90 | 76.28 | 8.80 |
| **28** | 36.04 | 26.04 | 77.42 | 41.80 |
| ***Kharif* season** | | | | |
| **38** | 30.04 | 24.64 | 74.57 | 7.00 |
| **39** | 31.65 | 23.07 | 75.85 | 19.95 |
| **40** | 32.50 | 17.95 | 64.28 | 0.00 |
| **41** | 31.85 | 14.91 | 65.28 | 0.00 |
| **42** | 31.02 | 22.75 | 81.57 | 0.00 |
| **43** | 31.02 | 19.28 | 79.28 | 0.49 |

The incidence of *L. cicerina* (8 larvae/leaf) and *H. armigera* (3.6 larvae /plant) commenced during the 38th SMW and continued till the 43rd SMW. The population of *L. cicerina* (8 larvae/leaf) and *H. armigera*(8.2 larvae /plant) was at peak during40th SMW. The population starts decreasing from 41st SMW to 43rd SMW. The least population of both the pests, *L. cicerina* (3.9 larvae/leaf) and *H. armigera* (3.1 larvae /plant) was during the 43rd SMW (Fig. 2).

The correlation coefficient between insect-pests and meteorological parameters (Table 2) showed that the population of *B. tabaci* with meteorological parametershad a significant positive correlation with maximum temperature (r=0.77*). However, a negative and non-significant correlation was noticed with minimum temperature (r=-0.09), relative humidity (r=-0.50), and rainfall (r=-0.23). The relationship between *A. craccivora*and meteorological parameters revealed that maximum temperature (r=0.72*) showed a significant positive correlation while with minimum temperature (r=0.06). showed a positively non-significant correlation. A negative and non-significant correlation was observed between *A. craccivora*population and relative humidity (r= -0.34) and rainfall (r= -0.15).

The incidence of *L. cicerina* was positively and significantly correlated with maximum temperature (r= 0.82*) whereas negative and non-significantly correlated with minimum temperature (r= 0.60), relative humidity (r=-0.55), and rainfall (r= -0.41) was observed. Whereas, the larval population of *H. armigera* correlated with meteorological parameters data revealed a positive significant correlation with maximum temperature (r= 0.83*) and other factors like minimum temperature (r= - 0.47), relative humidity (r=-0.63) and rainfall (r= -0.18) had negative non-significant correlation.

***Table 2 Correlation of meteorological parameterswith insect-pests of green gram during first and second sowing***

| Correlation coefficient (r-value) | | | | |
|---|---|---|---|---|
| **Weather factors** | **First trial** | | **Second trial** | |
| | ***Bemisia tabaci*** | ***Aphis craccivora*** | ***Liriomyza cicerina*** | ***Helicoverpa armigera*** |
| **Maximum temperature (°C)** | 0.77* | 0.72* | 0.82* | 0.83* |
| **Minimum temperature (°C)** | -0.09$^{ns}$ | 0.06$^{ns}$ | -0.60$^{ns}$ | -0.47$^{ns}$ |
| **Relative Humidity (%)** | -0.50$^{ns}$ | -0.34$^{ns}$ | -0.55$^{ns}$ | -0.63$^{ns}$ |
| **Rainfall (mm)** | -0.23$^{ns}$ | -0.15$^{ns}$ | -0.41$^{ns}$ | -0.18$^{ns}$ |

*values are significant at 5% level of significance, ns-non significant

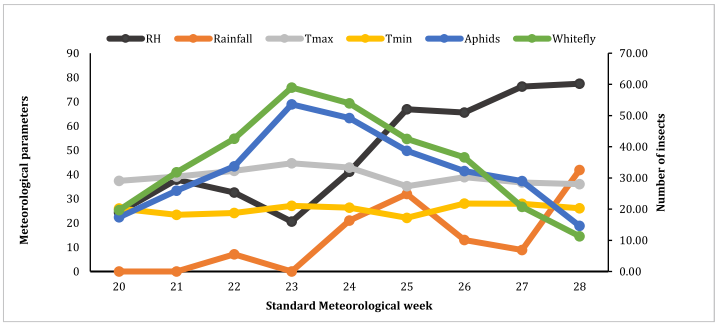


***Figure 1 Incidence of insect-pests in relation with meteorological parameters during first sowing***

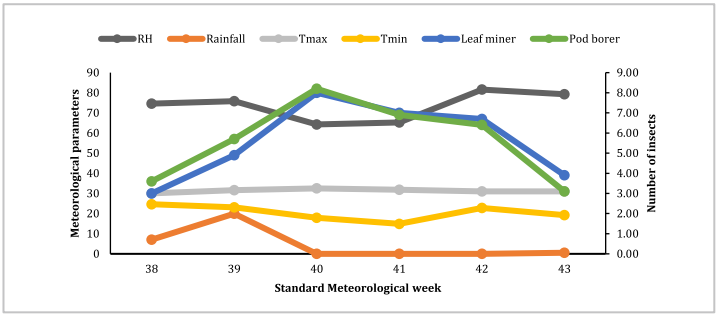


***Figure 2 Incidence of insect-pests in relation with meteorological parameters during second sowing***

## DISCUSSION

Incidence of *B. tabaci* and *A. craccivora* during summer season was due to favourable environmental conditions such as high temperature, relative humidity and rainfall. Our results about *B. tabaci* incidence and correlation with meteorological parameters were in agreement with the results of [9] who reported the first incidence of *B. tabaci* (66.67 adults/ plant) during the 22nd SMW and increased 76.67 adults per plant in the 23rd SMW. The relation between the *B. tabaci* and weather factors had a positive significant correlation with maximum temperature and with minimum temperature, relative humidity and rainfall had showed a non-significant correlation. [10]and[11] also recorded the same results.In contrast to our findings about *A. craccivora,*[12] reported the incidence of *A. craccivora* (0.40 nymph/plant)in 35th SMW, and the peak population (4.97 nymph/plant) was recorded at 39th SMW. Correlations revealed a significant positive correlation with maximum temperature and a negative non-significant correlation with minimum temperature, relative humidity, and rainfall. Our results are also in support with [13] and [14].

During the *Kharif* season, temperature (maximum and minimum) was decreased, and relative humidty was high, which were the suitable conditions for the growth of *L. cicerina* and *H. armigera*. Contrary to our findings of *L. cicerina* population and correlation with meteorological factors, [15] recorded the peak population of *L. cicerina* in January and February (1-9th SMW) when maximum and minimum temperature was 17.06 ºC and 6.35 ºC, where relative humidity was 81.4 per cent. The incidence of *L. cicerina* is most common in post-monsoon flushes during the August- December and reached the peak during October-November[16]. Weather factors like temperature and post-monsoon period were favorable conditions for the incidence and growth of the *L. cicerina.*Results of *H. armigera* population and relation with weather factors are in agreement with[17] who recorded the incidence of *H. armigera* (0.50 larvae/plant) at 31st SMW and at peak (8.50 larvae/plant) during 36th SMW when maximum and minimum temperature was 30.5ºC and 22.9ºC, relative humidity was 81 percent and 33.00mm rainfall. The correlation coefficient results revealed that *H. armigera* had a negative significant correlation with maximum temperature, a negative non-significant with minimum temperature and a positive non-significant correlation with relative humidity and rainfall. [18] and [19] also recorded the same.

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