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# Seasonal incidence of sucking insect pests of green gram

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**Abstract**
The investigation on Seasonal Incidence and Management of Sucking Insect Pests of Green Gram [*Vigna radiata* (L.) Wilczek] under semi-arid condition was conducted at Agronomy Farm, S. K. N. College of Agriculture, Jobner (Rajasthan) during *Kharif*, 2015. The initiation of jassid and whitefly population recorded in the first week of August (32 SMW) which reached its peak in first week of September, *i.e.* 36$^{th}$ SMW (12.90 jassid and 14.20 whitefly/ three leaves) when maximum temperature, minimum temperature and relative humidity was 36.1 and 21.7 $^{0}$C and 90 percent, respectively and gradually decline thereafter. The relationship between jassid, *Empoasca motti* population with maximum temperature, minimum temperature, relative humidity and rainfall revealed negative correlation (r=-0.621, r=-0.289, r=-0.425, r=-0.329, respectively). The whitefly, *Bemisia tabaci* population with maximum temperature revealed significant positive correlation (r=0.764) but minimum temperature, relative humidity and rainfall revealed negative correlation (r=-0.288, r=-0.515, r=-0.282, respectively).The population of sucking pest (jassid and whitefly) and *Coccinella septempunctata* had a significant positive correlation (r=0.886).

**Keywords:** Seasonal incidence, sucking insect pests, jassid, whitefly

## 1. Introduction
Pulses constitute an excellent supplement of protein in the vegetarian diet of human beings and plays a significant role in correcting the wide spread malnutrition in the country. Among various pulses, greengram [*Vigna radiata* (L.) Wilczek] commonly known as poor man's meat for vegetarians is one of the most important Kharif pulse crop grown in the arid and semi-arid region of the country. India is the world's largest producer as well as consumer of green gram. The total area under pulses was about 25.2 million hectares with an annual production of 19.3 million tonnes (Anonymous, 2015a) [1]. Green gram is mainly grown in the states like Andhra Pradesh, Maharshtra, Orissa, Rajasthan, Gujarat, Madhya Pradesh, Punjab and Uttar Pradesh. In Rajasthan, the total area under pluses was 20.70 lakh hectares with annual production of 6.50 million tonnes out of which green gram occupied 9.17 lakh hectares area with total production of 2.5 million tonnes (Anonymous, 2015b) [2].
The area under green gram has increased in the last two decades mainly because of the availability of short duration cultivars but multitude of pests still creating bottleneck in higher productivity due to infestation from germination to maturity of the crop. The insect pests reported on green gram includes jassid, *Empoasca motti* Pruthi; thrips, *Caliothrips indicus* Bagnall; whitefly, *Bemisia tabaci* (Genn.); semilooper, *Plusia orichalcea* (Fab.); cutworm, *Agrotis ipsilon* (Hufn.); galerucid beetle, *Madurasia obscurella* Jacoby; tortricid moth, *Cydia ptychora* Meyr; pod borer, *Maruca testulalis* Geyer; pod borer, *Helicoverpa armigera* (Hubner); stem fly, *Ophiomyia phaseoli* (Tryon.); green bug, *Nezara viridula*, (Linn.); (Kumar *et. al.*, 2004; Nitharwal and Kumawat, 2013) [5, 6, 4]. Out of which the sucking insect pests like whitefly, *B. tabaci* and jassid, *E. motti* cause considerable losses in the yield of green gram crop by sucking the sap from the ventral surface of leaves.
Nymphs and adults of jassid suck the cell sap from ventral surface of leaves and prolonged feeding causes "Hopper Burn". In which the older leaves below the growing tips burn first. They inject toxin with saliva, induce cell swelling, crush phloem and disrupt movement of photosynthates in plants. As a result of their feeding, the affected parts become yellowish, the leaves wrinkle and curl downwards and are ultimately shed. Besides the feeding, these insects exude honey dew which favors the development of sooty mould which hinders the photosynthesis of the plant resulting in stunting growth.

Besides this both nymphs and adults of whitefly infest plants by sucking the juices from new growth causing stunted growth, leaf yellowing and reduced yields. Plants become weak and susceptible to disease.

Dar *et al*. (2002) [3] studies the insect pests of summer crops on mung bean and urd bean (*Vigna mungo*) in Aligarh district, Uttar Pradesh, India. They observed that the crops were mainly infested by *Bemisia tabaci*, *Empoasca kerri*, *Aphis craccivora*, *Ophiomyia phaseoli*. *B. tabaci*, the most important among these pests, was observed from the 16th to 26th week (from vegetative to pod formation stage) on mung bean and from the 16th to the 25th week on urd bean. Its population peaked at the 25th and 26th weeks on urd bean and mung bean, respectively.

Kumar *et. al.* (2004) [5, 6] recorded the peak population of whitefly on mungbean and urd bean in first fortnight of May and second fortnight of September in *Zaid* and *Kharif* crops, respectively. Temperature and sunshine hours exhibited positive correlation with whitefly population.

Shivanna *et al.* (2011) [8] investigated population dynamics and the impact of abiotic factors on population dynamics of sucking insect pests of transgenic cotton viz., leafhopper (*Amrasca biguttula biguttula* Ishida), aphid (*Aphis gossypii* Glover), whitefly (*Bemisia tabaci* Gennadius) and thrips (*Thrips tabaci* Linnman), under unprotected condition. The peak population of leafhopper and aphid was observed 19.20, 45.07 per three leaves during second fortnight of may and whitefly and thrips was 29.50 and 26.81 during second fortnight of April, respectively. Simple correlation analysis revealed that maximum temperature showed significant positive effect on all the sucking pests. The minimum temperature showed negative effect on aphid population and non significant effect on leafhopper, whitefly and thrips population.

Panduranga *et al.* (2011) [7] reported that the occurrence of *B. tabaci* and incidence of mungbean yellow mosaic virus (MYMV) on mung bean was investigated in two districts (Warangal and Khamman) of Andhra Pradesh, India, during vegetative and flowering stages of the crop in the *Rabi* season. The population of whitefly recorded in mandals of Warangal ranged from 1.0 to 8.0 whiteflies per plant during the vegetative stage and 1.0 to 11 whiteflies per plant during the flowering stage. In Khamman, 52.4 percent mean incidence of MYMV recorded during vegetative and flowering stages. The population of whitefly vector ranged from 1.0 to 5.0 per plant during the vegetative stage and 3.0 to 11.0 per plant during the flowering stage.

Nitharwal and Kumawat (2013) [4] observed that jassid, *E. motti*; whitefly, *B. tabaci* and thrips, *C. indicus* are the major insect pests of green gram, *V radiata* in the semi-arid region of Rajasthan. The population started from first week of August and remained active throughout the crop season. The infestation gradually reached to the peak in the first week of September during both the years. Among natural enemies, the population of *Chrysoperla carnea* and *Coccinella septempunctata* were high, whereas, *Monomorium indicum*, *Menochilus sexmaculatus* and *Brumus suturalis* were low.

Singh and Yadav (2013) [10] studies on seasonal abundance of insect pests during *Kharif* season revealed that the mean population of jassid and whitefly ranged from 0.4-5.8/ cage and 0.2-7.4/ cage, respectively. Incidence of the jassid and whitefly were started in 31st standard week with 0.4/ cage and 0.2/ cage, respectively. The jassid population had significant positive correlation with sunshine and evaporation and non-significant with other factors. The population of whitefly had significant negative correlation with maximum temperature, sunshine hours and evaporation. The incidence of thrips, blister beetle, tobacco caterpillar, epilachna beetle was also observed.

## 2. Materials and Methods

The present investigations were carried out at S. K. N. college of Agriculture, Jobner, during *kharif*, 2015. Geographically, Jobner is located at longitude of $75^0$28' east, latitude of $26^0$06' north and at the elevation of 427 metres from the mean sea level (MSL) in Jaipur district of Rajasthan. It falls under agro-climatic zone 3rd A, the 'semi-arid eastern plain' region of Rajasthan. The climate of the region is typically semi-arid which is characterized by extremes of the temperature both during the summer and winter which in winter falls as low as 2-3 $^0$C and in summer goes as high as 45 $^0$C. The average rainfall is 500-700 mm which is mostly received from July to mid September. This region provides a safe long growing season for most of the crops. The experimental plot was ploughed twice with a *Deshi* plough and levelled with a heavy wooden plank (*patta*). Being a leguminous crop, green gram needs a small quantity of nitrogen for early growth period. Fertilizers were applied at the rate of 20 kg of nitrogen per hectare as a starter dose and 40 kg phosphorus per hectare in the soil before sowing.

The seed @ 12 kg ha$^{-1}$ was used and before sowing it was treated with fungicide, bavistin @ 2.0 g /kg of seed and also with rhizobium culture, *Rhizobium phaseoli.* The seeds were sown on 13 July 2015 in an already laid out Randomized Block Design in furrows opened with a manually operated hand driven plough at a row to row and plant to plant spacing of 30 cm and 10 cm, respectively. Meteorological data regarding temperature (maximum and minimum), relative humidity and total rainfall were obtained from the meteorological section of, Department of Agronomy, S.K.N. college of Agriculture, Jobner (Table -1)

**Table 1:** weekly mean meteorological data recorded during the crop season (July to October, 2015)

| SMW* No. | Period | | Temperature ($^0$C) | | Relative humidity (%) | Rainfall (mm) |
|---|---|---|---|---|---|---|
| | From | To | Max. | Min. | | |
| 27 | 2-7-15 | 8-7-15 | 33.7 | 23.5 | 68.5 | 12.6 |
| 28 | 9-7-15 | 15-7-15 | 31.6 | 25.4 | 73.5 | 34.4 |
| 29 | 16-7-15 | 22-7-15 | 37.5 | 25.7 | 65.5 | 00.0 |
| 30 | 23-7-15 | 29-7-15 | 33.5 | 25.3 | 75.0 | 20.0 |
| 31 | 30-7-15 | 5-8-15 | 32.2 | 25.1 | 66.0 | 00.0 |
| 32 | 6-8-15 | 12-8-15 | 35.5 | 24.1 | 60.5 | 00.0 |
| 33 | 13-8-15 | 19-8-15 | 38.2 | 24.3 | 58.0 | 00.0 |
| 34 | 20-8-15 | 26-8-15 | 38.0 | 23.1 | 55.0 | 00.0 |
| 35 | 27-8-15 | 2-9-15 | 38.2 | 23.7 | 56.5 | 00.0 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 36 | 3-9-15 | 9-9-15 | 33.5 | 23.8 | 78.0 | 35.0 |
| 37 | 10-9-15 | 16-9-15 | 33.7 | 23.9 | 64.5 | 00.0 |
| 38 | 17-9-15 | 23-9-15 | 32.7 | 21.6 | 65.0 | 22.2 |
| 39 | 24-9-15 | 30-9-15 | 34.8 | 19.2 | 57.5 | 00.0 |
| 40 | 1-10-15 | 7-10-15 | 35.6 | 16.6 | 44.5 | 00.0 |

* Standard meteorological week number.

The Observation on population of jassid and whitefly was recorded soon after their appearance. All the observations were recorded early in the morning. The methods used for recording the population of major sucking insect pests, *viz*., jassid, *Empoasca motti* Pruthi; whitefly, *Bemisia tabaci* (Genn.) have been described: Jassid, *Empoasca motti* Pruthi; The population of jassid was recorded on five randomly selected and tagged plants in each plot. Three leaves, *viz*., one each from top, middle and lower canopy of the plant were taken into account for recording the jassids. The population of jassid was recorded visually in the early morning hours. Whitefly, *Bemisia tabaci* (Genn.); The population of whitefly was recorded by counting the nymphs and adults on five randomly selected and tagged plant in each plot. Three leaves, *viz.*, one each from top, middle and lower canopy of plant were taken into account to record the population. The population of whitefly were recorded visually or by using magnifying lens in the early morning hours.

The data on jassid and whitefly population recorded from experimental plots were subjected to analysis of variance (Snedecor and Cochran, 1967) [9]. The materials used and methodologies employed above were common for all the experiments. The specific materials and methodologies used for individual experiment are described; To monitor the sucking insect pests and their natural enemies on green gram, the genotype RMG-492 was sown on 13th July 2015 in five plots of 3.0 x 2.4 $m^2$ keeping row to row and plant to plant distance of 30 and 10 cm, respectively. for recording the observations, the crop was left for natural infestation. the observations on insect pest population and natural enemies were recorded from five randomly selected and tagged plants at weekly interval from their appearance of insect pests and natural enemies till harvesting of the crop. the data recorded on pests, natural enemies and meteorological parameters were used for statistical analysis. To interpret the results of seasonal incidence of insect pests on green gram, simple correlation was computed between pest population and abiotic factors, *i.e.* the minimum and maximum temperature, relative humidity and rainfall.

## 3. Results and discussion-

Seasonal incidence and abiotic factors: The population of jassid and whitefly recorded during the crop season *Kharif*, 2015 on variety RMG-492 has been presented in table 2 and fig. 1 along with meteorological parameters, viz., minimum temperature, maximum temperature, relative humidity and rainfall. The data revealed that the jassid and whitefly population commenced in the first week of August (32nd standard meteorological week, SMW) and the first observation was recorded on 6th August. Initially, population of jassid and whitefly were 1.70 and 2.70/ three leaves, respectively. The population gradually increased and reached its peak in 36th SMW (12.90 jassid and 14.20 whitefly/ three leaves). A gradual decline in the pest population was evident thereafter. The population of jassid and whitefly were 2.70 and 4.10/ three leaves respectively in the 39th SMW and observed in traces thereafter. A view of experimental field with jassid and whitefly infested and healthy plant have been depicted in Plate-1.

**Table 2:** Seasonal incidence of sucking insect pests and their natural enemies on green gram in relation to abiotic factors of environment

| | | | Mean population /three leaves | | | Temperature ($^0$C) | | Meteorological parameter | |
|---|---|---|---|---|---|---|---|---|---|
| **S. No.** | **SMW** | **Date of observation** | **Jassid** | **Whitefly** | ***C. septum.*** | **Maximum** | **Minimum** | **Average relative humidity (%)** | **Total rainfall (mm)** |
| 1 | 32 | 06/08/2015 | 1.70 | 2.70 | 0.00 | 32.6 | 25.8 | 77 | - |
| 2 | 33 | 13/08/2015 | 5.00 | 3.60 | 0.40 | 32.4 | 24.4 | 79 | - |
| 3 | 34 | 20/08/2015 | 8.20 | 7.40 | 1.80 | 32.9 | 24.3 | 69 | - |
| 4 | 35 | 27/08/2015 | 10.20 | 11.50 | 2.70 | 35.6 | 23.4 | 63 | - |
| 5 | 36 | 03/09/2015 | 12.90 | 14.20 | 3.20 | 36.1 | 21.7 | 60 | 35.00 |
| 6 | 37 | 10/09/2015 | 10.80 | 10.20 | 3.80 | 37.9 | 21.9 | 54 | - |
| 7 | 38 | 17/09/2015 | 4.60 | 8.60 | 2.00 | 35.7 | 24.3 | 67 | 22.20 |
| 8 | 39 | 24/09/2015 | 2.70 | 4.10 | 0.90 | 34.6 | 19.8 | 53 | - |

The maximum temperature was in the range of 32.4 to 37.9$^0$ C in different weeks of the crop season. The maximum temperature was lowest on 13 August, *i.e.* 33st SMW (32.4$^0$ C) and highest in the 37th SMW (37.9 $^0$C). The minimum temperature was observed in the range of 19.8 to 25.8 $^0$C, the minimum being in the 39th SMW and maximum in the 32th SMW. The relative humidity during the crop season was in the range of 53 to 79 percent, the minimum in the 39th SMW and received maximum in the 33th SMW. The rainfall was not received during 32th, 34th 35th and 37th SMW and maximum in the 36th SMW crop season was in the range of 0.00 to 35.00 mm. The rainfall was not received except 30th, 36th and 38th SMW. The highest jassid and whitefly population, *viz.*, 12.90 and 14.20, respectively was observed at 21.7 $^0$C minimum temperature, 36.1 $^0$C maximum temperature and 60 percent relative humidity.

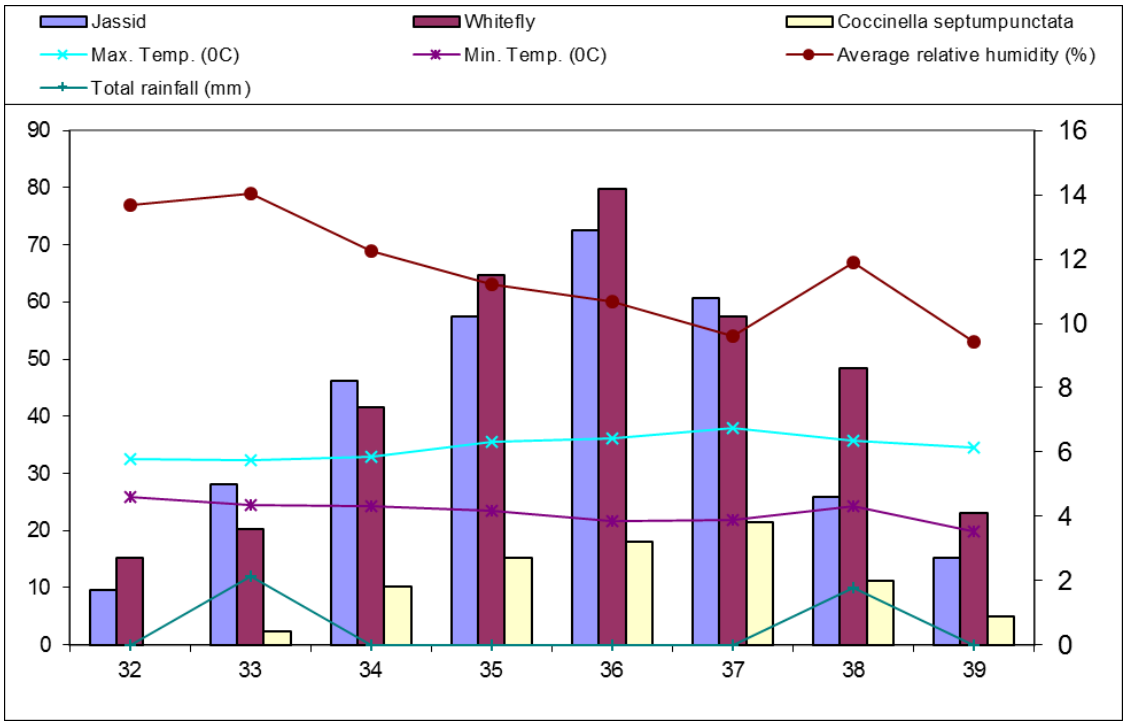


**Fig 1:** Seasonal incidence of sucking insect pests and their natural enemies on green gram in relation to abiotic factor

The lady bird beetle, *Coccinella septempunctata* was recorded in the experimental field of green gram. The population of *C. septempunctata* is the range of 0.40 to 3.80 per plant, minimum being in the 33th SMW and maximum in the 37th SMW. A gradual decline was observed after the latter date. The peak population of the *C. septempunctata* was recorded to be 3.80 per plant on 10th September (37th SMW) when the minimum and maximum temperature was 21.9 $^0$C and 37.9$^0$ C, respectively, and 54 percent relative humidity.

Effect of abiotic factors on jassid, *E. motti* and whitefly, *B. tabaci* and *C. septempunctata*-

The correlation coefficient (Table 3.) worked out that maximum and minimum temperature, relative humidity and rainfall had non-significant effect on incidence of jassid. the maximum temperature showed positive significant correlation (r = 0.764) whereas non-significant correlation with minimum temperature, relative humidity and rainfall on incidence of with whitefly. While, *C. septempunctata* had significant positive correlation with jassid (r = 0.890) and whitefly (r = 0.929).

**Table 3:** Correlation coefficient between the pest population, predator and weather parameters on green gram

| Particulars | Correlation coefficient (r) | | |
|---|---|---|---|
| | Jassid | White fly | *Coccinella septempunctata* |
| Maximum temperature | -0.621 | 0.764* | 0.886* |
| Minimum temperature | -0.289 | -0.288 | -0.415 |
| relative humidity | -0.425 | -0.515 | -0.666 |
| Rainfall | -0.329 | -0.282 | -0.388 |
| *Coccinella septempunctata* | 0.890* | 0.929* | - |

* Significant at 5% level

Seasonal incidence of sucking insect pests of green gram- The data on seasonal incidence of a pest provide useful information on the population build up of pest in relation to the abiotic factors of environment. Such information can effectively be utilized in predicting the buildup of pest population and thus helpful in integrated pest management programme. In the present study the data revealed that the jassid and whitefly population commenced in the first week of August (32nd standard meteorological week, SMW) and the first observation was recorded on 6th August. Initially, population of jassid and whitefly were 1.70 and 2.70/ three leaves respectively. The population gradually increased and reached its peak in 36th SMW (12.90 jassid and 14.20 whitefly/ three leaves). A gradual decline in the pest population was evident thereafter. The present finding was partially corroborated by Nitharwal and Kumawat (2013) [4]. the maximum temperature showed significant positive correlation with whitefly (r = 0.764) and significant negative correlation with jassid (r = -0.621) whereas minimum temperature revealed negative correlation with whitefly (r = -0.288) and jassids (r = -0.289). The relative humidity also showed negative correlation (r = -0.515) and (-0.425) with whitefly and jassid population, respectively. The present finding also get support from the results obtained by Shivana *et al.* (2011) [8]. The lady bird beetle, *Coccinella septempunctata* was recorded in the experimental field of green gram. The population of *C. septempunctata* is the range of 0.40 to 3.80 per plant, minimum being in the 33th SMW and maximum in the 37th SMW. A gradual decline was observed after the latter date. The peak population of the *C. septempunctata* was recorded to be 3.80 per plant on 10th September (37th SMW) when the minimum and maximum temperature was 21.9 $^0$C and 37.9 $^0$C, respectively, and 54 percent relative humidity. The present findings are also in agreement with Nitharwal and Kumawat (2013) [4] who reported that *C. septempunctata* was higher during cropping season.

## 4. Conclusion

The study on seasonal incidence of sucking insect pests in the field revealed that jassid, *Empoasca motti* Pruthi and whitefly, *Bemisia tabaci* (Genn) were found to be the major sucking insect pests. Initially the infestation of whiteflies and jassids were recorded 2.70 and 1.70 per three leaves, respectively in first week of August and gradually increased and reached at

peak on 3rd September, 2015 where population was 12.80 and 14.20 per three leaves respectively and after this gradual decline in the insect pests population was registered. Among natural enemies the population of lady bird beetle *Coccinella septempunctata* Linn, was high. The correlation coefficients were worked out between mean jassid and whitefly population and weather parameter. The maximum and minimum temperatures, relative humidity and rainfall had non-significant effect on incidence of jassid. In case of whitefly, the maximum temperature showed positive significant correlation (r = 0.764) whereas, minimum temperature, relative humidity and rainfall showed non-significant correlation. The maximum temperature, jassid and whitefly population showed significantly positive correlation (r = 0.886) with *C. septempunctata*.

The initiation of jassid and whitefly population was recorded in 32th standard meteorological week (SMW) which reached peak in 36th SMW (12.90 jassids/ three leaves and 14.20 whitefly/ three leaves) when minimum temperature, maximum temperature and relative humidity was 21.7 $^0$C, 36.1 $^0$C and 60 percent, respectively and gradually declined thereafter. The maximum and minimum temperature, relative humidity and rainfall had non-significant effect on incidence of jassids. In case of whitefly the maximum temperature showed positive significant correlation with whitefly and *Coccinella septempunctata* and non-significant correlation with minimum temperature, relative humidity and rainfall and the population of jassid and whitefly showed positive significant correlation with *C. septempunctata*.

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