*Int.J.Curr.Microbiol.App.Sci* (2019) *8*(12): 1225-1230

*International Journal of Current Microbiology and Applied Sciences*
***ISSN: 2319-7706* Volume 8 Number 12 (2019)**
Journal homepage: http://www.ijcmas.com

**Original Research Article** https://doi.org/10.20546/ijcmas.2019.812.151

# Influence of Meteorological Parameters on the Incidence and Abundance of Leaf Miner (*Aproaerema modicella*), Aphid (*Aphis craccivora*), and Bihar Hairy Caterpillar (*Spilosoma obliqua*) of Groundnut (*Arachis hypogaea* L.)

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**Keywords**

*Aproaerema modicella*, *Aphis craccivora*, *Spilosoma obliqua* and Groundnut (*Arachis hypogaea* L.)

**Article Info**

***Accepted:***
12 November 2019
***Available Online:***
10 December 2019

**A B S T R A C T**

The population of *Aproaerema modicella* initiated from 11$^{th}$ standard week when the population was maximum 5.82/plant. The minimum leaf miner population of 0.40/plant was recorded at 15$^{th}$ standard week when minimum temperature, relative humidity and sunshine hours were recorded highest. The lowest population of *Aphis craccivora* was recorded as 1.92 / plants in the 14$^{th}$ standard week while population of BHC was recorded as 0.35 larvae/plants and 13$^{th}$ standard week. The population of *Aphis craccivora* and *Spilosoma obliqua* was found maximum (20.10/ plants) and (7.23 larvae/plant) during 17$^{th}$ standard week when maximum temperature, minimum temperature, temperature gradient, relative humidity, and sunshine hour was (42.32$^0$C, 23.89$^0$C, 19.91$^0$C, 64.42%, 8.51 hr) respectively. The larval and aphid population was found to decrease steadily after the 17$^{th}$ standard week due to increase in the age of the crop and rainfall.

## Introduction

Groundnut (*Arachis hypogaea* L.) belongs to family Fabaceae, is an important oil seed crop that contributes a major role in economy around the world (FAO, 2006; Narada *et al.*, 2003; Nwokolo, 1996; Wiess, 2000). It is the 3rd most important source of vegetable protein and contains 50 percent edible oil, 28 percent digestible protein and 20 percent carbohydrates (Bhatti and Soomro, 1996; Christensen *et al.*, 2004; Shah *et al.*, 2012). In India, Groundnut is cultivated during *kharif* season (June-July to September–October) mostly under rainfed conditions with a few protective irrigations. The crop is also grown during *Rabi* season (October-November to February-March) under residual moisture and

minimal irrigation situation. In summer (January - February to April-May), groundnut is grown as an irrigated crop. The spring groundnut is grown from March-April to July-August. The crop can be grown successfully in places receiving a rainfall of 500 to 1250 mm and performs better in the sandy loam and loamy soils and also in black soils with good drainage. Several factors are responsible for economic losses to groundnut crop such as variable rainfall, low soil fertility, crop management practices, pests and diseases (Naab *et al.*, 2004). Several insect pests attack the groundnut crop that may cause moderate to severe damage (Javed *et al.*, 2014). Among groundnut producing countries of Asia (including Pakistan) the major insect pest of groundnut include leaf miner, white grub, jassid, aphid, thrips, red hairy caterpillars and termites (Salihah *et al.*, 1988; Sheirdil *et al.*, 2012). Soil insect pests cause serious economic losses to groundnut crop (Wightman *et al.*, 1990).The incidences of different insect pest of groundnut are examined in respect to abiotic factors. Therefore, an investigation was conducted to study the Incidence and abundance of leaf miner (*Aproaerema modicella*), Aphid (*Aphis craccivora*), and Bihar hairy caterpillar (*Spilosoma obliqua*) in relation to meteorological parameters of West Bengal.

## Materials and Methods

The field experiment was conducted during pre-summer season of 2015-2016 in plot number East-4 at the Agriculture college farm, Palli Siksha Bhavana (Institute of Agriculture) Visva-Bharati, Sriniketan, Birbhum, which is situated between $23.39^0$ N latitude and $87.42^0$ E longitudes having an altitude of 58.90m above the mean sea level in the sub-humid lateritic belt of West Bengal. The physiographic characteristic is undulated with mid to steep gradient, and terraces of distinct top sequence. In high lands the soil consists of gravels and poor inorganic matter. The physico-chemical properties of the soil of experimental site are presented in Table 1.

It is evident from the above information that the soil of the experimental plots was sandy loam, with high percent of clay. The soil was acidic, low in total nitrogen and available phosphate and moderate in potash contents.

The details of climatic factors (temperature, rainfall, relative humidity, sunshine hours) during the period of experimentation as observed and recorded from the meteorological observatory, Sriniketan is presented in (Table 2). Variety TAG-24 was chosen for the present research work which is grown well in dry season.

Data on the observations of insect-pest incidence of leaf miner, aphid and bihar hairy caterpillar was taken from 10 tagged plants per replication from each standard week. The collection of data on insect-pest incidence continued till the $22^{nd}$ week. The groundnut plants were closely examined at regular intervals commencing from flowering to pod maturity. The data on insect-pests (leaf miner, aphids, and bihar hairy caterpillar) was recorded at each standard week starting from early vegetative to pod maturity.

## Results and Discussion

### Leaf miner

The population of leaf miner (*Aproaerema modicella*) initiated from $2^{nd}$ week of March i.e. from $11^{th}$ standard week when the population was maximum 5.82/ plant. The population of leaf miner gradually decreased as the crop entered into the flowering stage. The population of leaf miner was nil from the $16^{th}$ standard week. The minimum leaf miner population of 0.40/plant was recorded at $15^{th}$ standard week i.e. the second week of April

when minimum temperature, relative humidity and sunshine hours were recorded highest (Table 2). The present findings are in accordance with Hanamant Gadad *et al.*, (2013) who recorded that the incidence of leaf miner was noticed during 5 to 14th MSW (1st week of Feb to 1st week of April) at Kurvinkoppa with a population range of 0.46 to 4.20 larvae per plant. While during 14th MSW (1st week of April) lowest leaf miner incidence was recorded (0.46 larvae/plant). Chaudhuri and Senapathi (2004) observed that seasonal incidence of leaf miner was much lower at beginning of the season. The higher level of infestation was maintained during 11th- 19th standard week.

## Aphid

*Aphis craccivora* is another important insect-pest in this region and its population was found throughout the crop growth stage. The aphid population per 10 cm shoot (mainly till 3 leaves) of groundnut was recorded as 1.92 / plants in the 14th standard week. The results substantiate its attack in the initial vegetative stage when maximum temperature, minimum temperature, temperature gradient, relative humidity, and sunshine hour was (36.45$^0$C, 24.12$^0$C, 12.33$^0$C, 67.85% and 5.89 hr) respectively. The leaf damage percentage gradually increased from 14th standard week with a maximum (20.10/ plants) (Table 2) during 17th standard week when bright sunshine hour and relative humidity recorded 7.98 hr and 67.29 respectively. Gradually the population of aphid declined due to increase in the age of the crop and rainfall. The present findings are in agreement with Singh *et al.*, (2005). They revealed that maximum population of aphid was observed at 38th standard week, thereafter the population declined and reached to minimum levels during 43rd standard week. The aphid appeared during 32nd standard meteorological week (SMW) i.e. 6th -12th August (2nd week) with a mean population of 2.20 aphid/3 leaves. The population increased gradually and attained its peak in the third week of September (38th SMW) with a mean population of 7.60 aphid/3 leaves, when the mean atmosphere temperature and relative humidity were 26.15°C and 68.05%, respectively. Thereafter, the population declined and reached to minimum levels of 1.00 aphid/3 leaves during 43rd SMW i.e. 22nd 28th October. The temperature and relative humidity favored the pest population build up.

Similar reports have been observed by Karim *et al.*, 2001, who reported that the aphid population started growing from August, reached highest in January and almost vanished in April.

## Bihar Hairy Caterpillar

*Spilosoma obliqua* is one of the major insect-pests of Groundnut. It feeds on the leaves voraciously and defoliates the plants. This pest is polyphagous in nature and was observed in groundnut from vegetative stage to pod maturity stage.

**Table.1** The physico-chemical properties of the soil of experimental site

| Sand (%) | Silt (%) | Clay (%) | pH | Organic carbon (%) | Available N (Kg/Ha) | Available P (Kg/Ha) | Available K (Kg/Ha) |
|---|---|---|---|---|---|---|---|
| **75.6** | 14.8 | 9.6 | 5.65 | 0.33 | 197.35 | 17.43 | 141.50 |

**Table.2** Influence of meteorological parameters on the incidence and abundance of different insect pest of groundnut (*Arachis hypogaea* L.) during 2016

| SW | Leaf miner population / plant | Aphid Population/ 10cm Plants | Bihar Hairy caterpillar Larvae/ plant | Important Weather Parameters As Recorded During The Respective Standard Week | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Correlated With The Standard Week | Max$^{m}$ Temp. (˚C) | Min$^{m}$ Temp. (˚C) | Temp. Gradient (˚C) | RH (%) | Rainfall (mm) | Sunshine Hour |
| **11$^{th}$** | 5.82 | 0.00 | 0.00 | 10$^{th}$ | 33.59 | **20.19** | 13.4 | 66.85 | **0.04** | 7.04 |
| **12$^{th}$** | 3.06 | 0.00 | 0.00 | 11$^{th}$ | 36.1 | 20.6 | 15.5 | 62.42 | 0.07 | 8.7 |
| **13$^{th}$** | 0.68 | 0.00 | 0.35 | 12$^{th}$ | 35.92 | 23.14 | 12.78 | 51.85 | 2.15 | **4.1** |
| **14$^{th}$** | 0.60 | 1.92 | 1.18 | 13$^{th}$ | 36.45 | 24.12 | 12.33 | 67.85 | 0.00 | 5.89 |
| **15$^{th}$** | 0.40 | 3.42 | 3.69 | 14$^{th}$ | 41.95 | **26.42** | 17.05 | **42.42** | 0.00 | **9.64** |
| **16$^{th}$** | 0.00 | 7.56 | 5.43 | 15$^{th}$ | 41.22 | 22.41 | 14.8 | 67.29 | 0.00 | 7.98 |
| **17$^{th}$** | 0.00 | 20.10 | 7.23 | 16$^{th}$ | **42.32** | 23.89 | **19.91** | 64.42 | 0.00 | 8.51 |
| **18$^{th}$** | 0.00 | 10.62 | 5.77 | 17$^{th}$ | 38.81 | 24.72 | 14.92 | 66.71 | 0.15 | 6.9 |
| **19$^{th}$** | 0.00 | 8.31 | 5.03 | 18$^{th}$ | 38.51 | 24.72 | 13.43 | **87.14** | 3.05 | 8.99 |
| **20$^{th}$** | 0.00 | 3.58 | 2.59 | 19$^{th}$ | 36.54 | 24.85 | 11.69 | 72.85 | **7.22** | 8.54 |
| **21$^{st}$** | 0.00 | 1.29 | 2.57 | 20$^{th}$ | **35.31** | 25.61 | **9.7** | 70.29 | 1.6 | 5.72 |
| **22$^{nd}$** | 0.00 | 0.00 | 1.63 | 21$^{st}$ | 35.5 | 24.21 | 11.29 | 71.5 | 3.99 | 5.07 |

The lowest larval population of 0.35 larvae/plant was observed during the 13th standard week (Table 2) when maximum temperature, minimum temperature, temperature gradient, relative humidity, rainfall and sunshine hour was (35.92, 23.14$^0$C, 12.78$^0$C, 51.85$^0$C, 2.15%, 4.1 hr). The highest larval population was observed during the 17th standard week (7.23 larvae/plant) when maximum temperature, minimum temperature, temperature gradient, relative humidity, and sunshine hour was (42.32$^0$C, 23.89$^0$C, 19.91$^0$C, 64.42%, 8.51 hr) respectively. The larval population was found to decrease steadily after the 17th standard week.

Biswas (2006) Studied the incidence of hairy caterpillar, *S. obliqua* on sesame at Oilseed Research Centre, BARI, Gazipur and found that the pest appeared in the sesame crop in the fourth week of April at the flowering stage at 45 - 55 DAS and remained up to third week of June at pod maturity stage, 90 - 95 DAS. The peak population of *S. obliqua* (4.00 – 4.50 larvae/ plant) and its severe infestation (100 % infestation) was recorded in the fourth week of May, at pod filling stage, 60-70 DAS of the crop.

The experiment concluded that the highest infestation of leaf miner was recorded as 5.82/plant at initial period of crop growth and gradually decreased as the crop entered into the flowering stage. Highest infestation of aphid and BHC was recorded as (20.10/ plants) and (7.23 larvae/plant) during 17th standard week when maximum temperature, minimum temperature, temperature gradient, relative humidity, and sunshine hour was (42.32$^0$C, 23.89$^0$C, 19.91$^0$C, 64.42%, 8.51 hr) respectively.

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**How to cite this article:**

Virendra Kumar and Swarnali Bhattacharya. 2019. Influence of Meteorological Parameters on the Incidence and Abundance of Leaf Miner (*Aproaerema modicella*), Aphid (*Aphis craccivora*), and Bihar Hairy Caterpillar (*Spilosoma obliqua*) of Groundnut (*Arachis hypogaea* L.). *Int.J.Curr.Microbiol.App.Sci.* 8(12): 1225-1230.
doi: https://doi.org/10.20546/ijcmas.2019.812.151