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**SV Sangle**
PG Scholar, Department of Agricultural Entomology, College of Agriculture, Vasantrao Naik Marathwada Krushi Vidyapeeth, Parbhani, Maharashtra, India

**NE Jayewar**
Department of Agricultural Entomology, College of Agriculture, Ambajogai Vasantrao Naik Marathwada Krushi Vidyapeeth, Parbhani, Maharashtra, India

**BB Gaikwad**
Ph.D. Scholar, Department of Agricultural Entomology, College of Agriculture, Vasantrao Naik Marathwada Krushi Vidyapeeth, Parbhani, Maharashtra, India

**Corresponding Author:**
**SV Sangle**
PG Scholar, Department of Agricultural Entomology, College of Agriculture, Vasantrao Naik Marathwada Krushi Vidyapeeth, Parbhani, Maharashtra, India

# Studies on seasonal incidence and correlation of fall armyworm and weather parameters

**SV Sangle, NE Jayewar and BB Gaikwad**

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**Abstract**
Investigations were carried out to study the "Seasonal incidence and correlation fall armyworm of maize at the Department of Agricultural Entomology, College of Agriculture, Parbhani during *Rabi* 2018-19. The experiment is carried out in unprotected condition with net plot size 10 x 10 $m^2$ in non-replicated and divided in four quadrants. Five plants or 1 m row was randomly selected from each quadrant for recording pest wise observations. All recommended agronomical practices were followed from time to time to raise the crop successfully to have full benefits. The first appearance of fall armyworm was noticed in 1st SMW (16 larvae/ 10 plant) thereafter it was increased gradually and reached its peak (22 larva/10 plant) in 6th SMW. Correlation between weather parameters and fall armyworm of maize showed that the larval population of fall armyworm showed non-significant positive correlation with maximum temperature (r=0.451) and minimum temperature (r=0.374). While morning relative humidity (r=-0.284) and evening relative humidity (r =-0.246) showed non-significant negative correlation with larval population of fall armyworm.

**Keywords:** Fall armyworm, maize, weather parameters, seasonal incidence and correlation

## Introduction
Maize is a fully domesticated plant that has coexisted with humans and evolved since ancient times. India rank 4$^{th}$ in area and 7$^{th}$ in production, representing around 4% of the world maize area and 2% of total production. During 2018-19 in India, the maize area has reached to 9.2 million ha. During 1950-51 India used to produce 1.73 million MT maize, which has increased to 27.8 million MT by 2018-19, recording close to 16 times increase in production. The average productivity during the period has increased by 5.42 times from 547 kg/ha to 2965 kg/ha, while the area increased nearly by three times. Among Indian states Madhya Pradesh and Karnataka has highest area under maize (15% each) followed by Maharashtra (10%), Rajasthan (9%), Uttar Pradesh (8%) and others. After Karnataka and Madhya Pradesh Bihar is the highest maize producer. Andhra Pradesh is having the highest state productivity. Some districts like Krishna, West Godavari etc. records as high as 12 t/ha productivity. Maharashtra maize production was at level of 2.24 million tonnes in 2020, up from 1.77 million tonnes previous year, this is a change of 26.55%. Though the productivity in India is almost half of the world the average per day productivity of Indian maize is at par with many lead maize producing countries. (Anonymous 2023)

A number of factors are responsible for low productivity, out of which insect-pests and diseases are among major constrains. In India, about 13.2 per cent economical yield losses have been reported due to insect pest attack and diseases incidence. Maize is attacked by about 139 species of insect pests with varying degree of damage; however, only about a dozen are quite serious. Apart from this the recently introduced pest fall armyworm (*Spodoptera frugiperda)* is of serious concern due to its notorious and polyphagous behaviour. The main reason for its fast spread might be its strong capacity to fly and disperse long distance annually during the summer months (Mallapur *et al.*, 2019) [4]. According to a recent study, in the absence of control measures, *S. frugiperda* has the potential to cause losses of an estimated 8.3 to 20.6 m tonnes of maize per year.

The severity of the problem is compounded by the ability of the fall armyworm to harm a variety of vegetative structures of reproductive plants, creating the opportunity to cause crop yield loss. Spodoptera frugiperda is a highly polyphagous insect pest that attacks more than 80 plant species, including maize, sorghum, millet, sugarcane, and vegetable crops. Young larvae mainly feed on epidermal leaf tissue and also make holes in leaves. In India, *S. frugiperda* is recently reported in Karnataka Tamilnadu and Telangana infesting maize crop. It is also found in Maharashtra of Solapur district. (Sisodiya *et al.,* 2018) [7]. Therefore, current studies have been planned to study seasonal incidence and correlation fall armyworm of maize with weather parameter.

## Materials and Methods

The details of the experimental material used, methods adopted and techniques followed during the course of experimentation entitled "Seasonal incidence and and correlation fall armyworm of maize with weather parameter " are as follows.

The field experiments were conducted during Rabi 2018-19 at the experimental farm of Department of Agril. Entomology, Vasantaro Naik Marathwada Krishi Vidyapeeth, Parbhani.

For seasonal incidence the experiment was conducted in unprotected condition with net plot size 10 x 10 $m^2$ which will be non-replicated and divided in four quadrants. Five plants or 1 m row was randomly selected from each quadrant for recording pest wise observations. All recommended agronomical practices were followed from time to time to raise the crop successfully to have full benefits. Five plants or 1m rows were randomly selected from each quadrate and field observations was recorded on incidence of pests fall armyworm. Weekly data on different weather parameters during experimental period was collected from central meteorological observatory of VNMKV, Parbhani. The data obtained was averaged. Then it was subjected to statistical analysis after suitable transformation for interpretation of the results. The correlation and stepwise regression was done using SAS software.

## Results and Discussion

### Seasonal incidence of fall armyworm on maize

The population of recorded as larvae /10 plant. The population of fall armyworm appeared in first week of January (16 larvae /10 plant). The highest fall armyworm population (22 larvae / 10 plant) was noticed during first week of February (6th MW) with the prevalence of maximum (30.8 °C) and minimum (9.8 °C) temperature, morning (73%) and evening (20%) relative humidity, respectively. The larval population was noticed in entire crop growth period it was ranging between 18 -20 larvae/10 plant during 7th -11th MW.

### Correlation between weather parameters and fall armyworm of maize

In present piece of investigation, the larval population of fall armyworm showed non-significant positive correlation with maximum temperature (r=0.451) and minimum temperature (r=0.374). While morning relative humidity (r=-0.284) and evening relative humidity (r =-0.246) showed non-significant negative correlation with larval population of fall armyworm (Table No. 1)

The present finding are more less in line to the results obtained by other workers like Paul *et al*. (2020) Fall army worm appeared during 37th SMW i.e. 2nd week of September with a mean population of 0.12 larva/plant. The peak population were observed in the fourth week of September with a mean population of 0.56 larva/plant. Thereafter, the population declined gradually and reached to a minimum level of 0.16 larva/plant during 4th week of October (42nd SMW). The correlation between fall army worm, *S. frugiperda* and abiotic parameters during *kharif* 2018 results indicated that the population demonstrated a significant positive correlation with maximum temperature (r = 0.586).

Kumar *et al*., (2020) [2] *S. frugiperda* incidence was minimum during second fortnight of October, 2019 (10 per cent) and maximum incidence was recorded in first fortnight of November, 2019 (72 per cent). During *Kharif* and *Rabi*, occurrence of *S. frugiperda* in terms of larval population showed significant positive correlation with the maximum temperatures (r = 0.7205) and negative correlation and significant relationship with relative humidity (r = -0.6739) and rainfall (r = -0.8293) in Perambalur district.

Silva *et al*., (2016) [6] reported fall armyworm development rate is greatly affected by temperature. Development rate is faster at higher temperatures, although it does begin to decline at temperatures above 93°F. Fall armyworms cannot survive freezing temperatures. Populations usually begin to decline a little before first frost because fall armyworms cannot develop at temperatures below about 50°F.

Macharia *et al*., (2019) [3] indicate the trend where percent incidence of fall armyworm is declining and severity in damage increasing across all treatments. The FAW incidence at the early stages was generally high across all plots (over 70 per cent). Severity rating was low at the beginning and this can be attributed to the fact the FAW larvae were still young and could only cause mild damage on maize.

**Table 1:** Seasonal incidence and correlation of fall armyworm with weather parameter on maize

| Sr. No | SMW | Period | Humidity (%) | | Temperature (°C) | | No. of Larva/10 plant |
|---|---|---|---|---|---|---|---|
| | | | RH1 | RH2 | Max | Mini | |
| 1 | 50 | 10-16 DEC | 75 | 34 | 29.5 | 13.5 | 0 |
| 2 | 51 | 17-23 DEC | 76 | 34 | 27.4 | 9.9 | 0 |
| 3 | 52 | 24-31 DEC | 75 | 20 | 27.9 | 8.3 | 0 |
| 4 | 1 | 01-07 JAN | 75 | 19 | 30.4 | 7.9 | 16 |
| 5 | 2 | 08-14 JAN | 76 | 28 | 29.5 | 9.5 | 18 |
| 6 | 3 | 15-21 JAN | 77 | 25 | 31.0 | 11.0 | 19 |
| 7 | 4 | 22-28 JAN | 75 | 37 | 30.1 | 13.8 | 20 |
| 8 | 5 | 29-04 FEB | 76 | 22 | 29.4 | 10.7 | 21 |
| 9 | 6 | 05-11 FEB | 73 | 20 | 30.8 | 9.8 | 22 |
| 10 | 7 | 12-18 FEB | 73 | 21 | 33.7 | 13.1 | 18 |
| 11 | 8 | 19-25 FEB | 70 | 19 | 36.4 | 16.2 | 17 |
| 12 | 9 | 26-04 MAR | 55 | 15 | 29.9 | 12.5 | 19 |
| 13 | 10 | 05-11 MAR | 65 | 15 | 35.5 | 14.9 | 20 |
| 14 | 11 | 12-18 MA | 63 | 15 | 38.1 | 18.8 | 18 |
| | | Correlation coefficient @ 5% | -0.284 | -0.246 | 0.451 | 0.374 | |

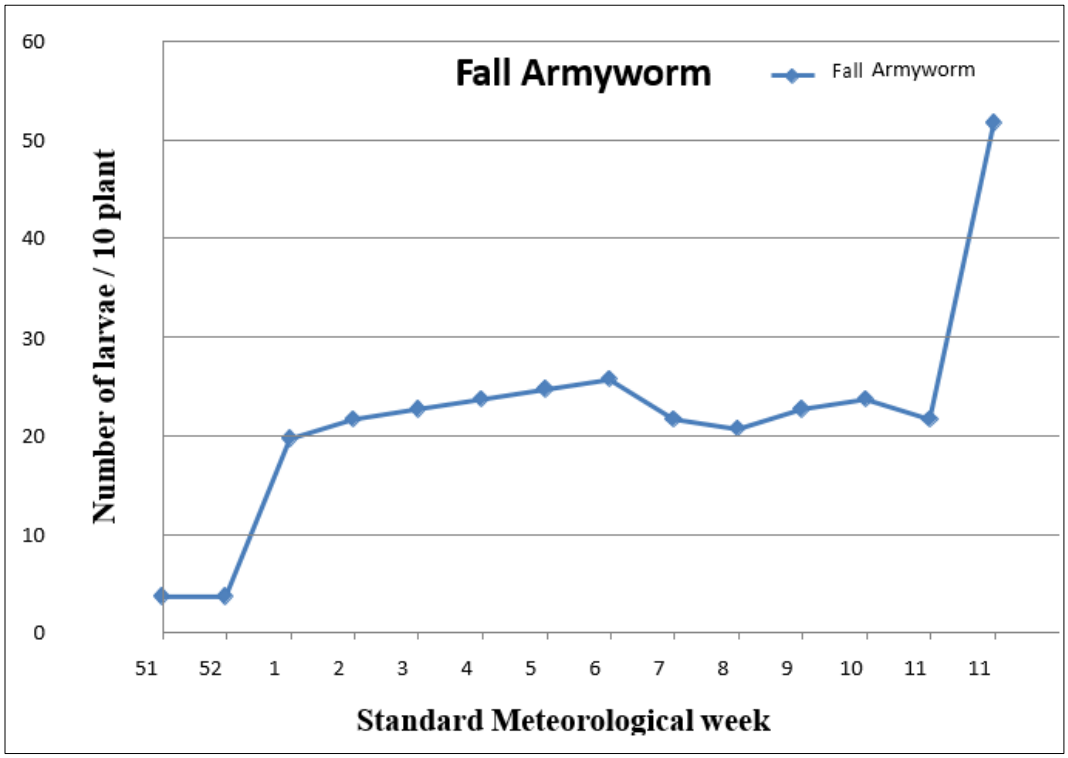


**Fig 1:** Seasonal incidence of fall armyworm on maize

## Conclusion

The first appearance of fall armyworm was noticed in 1st SMW (16 larvae/ 10 plant) thereafter it was increased gradually and reached its peak (22 larva/10 plant) in 6th SMW. The analysis brought out correlation with weather parameters of fall armyworm shows non-significant positive correlation with maximum temperature and minimum temperature. While morning relative humidity and evening relative humidity showed non-significant negative correlation with larval population of fall armyworm.

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