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Anuj Kumar Patel
M.Sc. Student,
Department of Entomology,
College of Agriculture, IGKV,
Raipur, Chhattisgarh, India

Purjeet
M.Sc. Student,
Department of Entomology,
College of Agriculture, IGKV,
Raipur, Chhattisgarh, India

Kishor Kumar
M.Sc. Student,
Department of Entomology,
College of Agriculture, IGKV,
Raipur, Chhattisgarh, India

Kamesh Dhanger
M.Sc. Student,
Department of Entomology,
College of Agriculture, IGKV,
Raipur, Chhattisgarh, India

PK Netam
Assistant Professor, Department
of Entomology, RP CARS,
Kanker, Chhattisgarh, India

Sonali Deole
Principal Scientist,
Department of Entomology,
College of Agriculture, IGKV,
Raipur, Chhattisgarh, India

Corresponding Author:
Anuj Kumar Patel
M.Sc. Student,
Department of Entomology,
College of Agriculture, IGKV,
Raipur, Chhattisgarh, India

Seasonal incidence of fall armyworm, *Spodoptera frugiperda* (J.E. Smith) on maize (*Zea mays* L.) in Kanker District of Chhattisgarh, India

Anuj Kumar Patel, Purjeet, Kishor Kumar, Kamesh Dhanger, PK Netam and Sonali Deole

Abstract

The present experiment entitled “Seasonal incidence of fall armyworm, *Spodoptera frugiperda* (J.E. Smith) on maize (*Zea mays* L.) in Kanker district of Chhattisgarh, India.” was conducted in the Instructional cum Research Farm, RP CARS, Kanker (C.G.) during 2022-2023. Seasonal incidence of fall armyworm, *Spodoptera frugiperda* peak population was observed during 9th SMW (2.11 larvae/plant). The maximum temperature during *rabi* in 2023 was found significantly positively correlated with the fall armyworm (*Spodoptera frugiperda*) in correlation studies ($r = 0.535^*$). The regression equation ($y = 0.236x - 6.739$) implies that the population of fall armyworms will rise by 0.311 larvae/plant for every 1 °C increase in maximum temperature.

Keywords: Fall armyworm, seasonal incidence, correlation, weather parameter

Introduction

Maize, scientifically known as *Zea mays* L. but commonly referred to as corn, belongs to the family Poaceae. This highly versatile crop exhibits exceptional adaptability, enabling it to thrive across a wide range of agro-climatic conditions. Recognized globally for its potential to achieve superior genetic yields among cereals, it is often hailed as the “Queen of Cereals.” (Jeyaraman, 2017) [5].

Maize, also known as corn, plays a vital role as a source of essential nutrients such as minerals, protein, iron, vitamin B, and carbohydrates. Comprising 72% starch, 10% protein, 4.8% oil, 8.5% fiber, 3.0% sugar, and 1.7% ash, maize grains possess significant nutritional value (Chaudhary, 1983) [1].

In India, maize holds the position of being the 3rd most important cereal, following rice and wheat, in both cultivated area and production. It exhibits the highest growth rate among food crops. Presently, over 170 countries collectively contribute to the production of approximately 1147.7 million metric tons of maize, cultivated across an area of 193.7 million hectares, achieving an average yield of 5.75 tons per hectare (FAOSTAT, 2022) [4].

On a global scale, maize consumption is divided as follows, 61% for animal feed, 17% for human consumption, and 22% for industrial purposes. Among the nations, India holds the 4th position in terms of cultivated area and the 7th position in production, accounting for approximately 4% of the world's maize cultivated area and 2% of the total global production. In the 2018-19 period, maize cultivation in India expanded to cover an area of 9.2 million hectares.

According to officials, Chhattisgarh support to achieve a maize crop output of approximately 7.45 lakh metric tonnes this year. A significant portion, accounting for 40%, of the state's maize production hails from the districts of Kondagaon, Kanker, and Bastar. Additionally, officials are optimistic about a reasonably favorable crop output in the Surguja division for the current year (Dhruw *et al.* 2022) [3].

The fall armyworm (FAW), scientifically known as *Spodoptera frugiperda* (J.E. Smith), is a lepidopteran pest originally native to tropical and subtropical regions of the America. It poses a threat to more than 80 various crop species, with a notable preference for cereal crops, particularly maize (Sparks, 1979) [7].

The fall armyworm, originally native to the America, was first identified as an invasive pest in West Africa in late 2016. Its presence in India was initially reported on maize in the Shivamogga district of Karnataka during May-June 2018.

Spodoptera frugiperda in Chhattisgarh was first noted in Raipur (Deole and Paul, 2018) [2].

Materials and Methods

The Seasonal incidence of fall armyworm studies were conducted at Instructional cum Research Farm, RP CARS, Kanker (C.G.) during 2022-2023.

Table 1: Experimental details

Season	Rabi 2022
Crop	Maize
Variety	C.P. 333
Design	Randomized Block Design

Method of observations

To determine the seasonal incidence of fall armyworm on maize, weekly observation of insect populations was recorded on randomly selected 10 plants from four corners and center, starting from 10 days after germination to the maturity stage of the cropping season.

Results and Discussion

Seasonal incidence of fall armyworm, *Spodoptera frugiperda* (J.E. Smith) in relation to abiotic parameters

The fall armyworm appeared during 5th SMW i.e., the first week of February with an average larval population of 0.22 larvae/plant. The population slowly increased and reached to its peak in the first week of March (10th SMW) with an average larva population of 2.14 larvae/plant. When the maximum and the minimum atmospheric temperature, total rainfall, relative humidity and the wind velocity were 34.9 °C, 17.4 °C, 00 mm, 44.50 percent and 2.9 Km/h respectively.

Thereafter, the population declined gradually and reached to a level of 0.61 larvae/plant during first week of April (14th SMW).

The findings indicated that the population of the larva of fall armyworm showed non-significant negative correlation with morning relative humidity ($r = -0.311$) and evening relative humidity ($r = -0.472$). While, non-significant positive correlation with the minimum temperature ($r = 0.320$), total rainfall ($r = 0.358$) and wind velocity ($r = 0.118$). The results indicated that the population of the larva of fall armyworm showed significant positive correlation with maximum temperature ($r = 0.535$). The regression equation being ($y = 0.236x - 6.739$) indicating that with an increase in 1 °C maximum temperature there will be increase in the population of the larva of fall armyworm by 0.311 larvae/plant.

The present result were similar with the findings of Sohel Rizvi (2022) [6] who reported that the fall armyworm appeared during the second week of August with an average larval population of 0.50 larva/plant. With a regression equation of $y = 0.4328x - 12.658$, the fall armyworm demonstrated a significant positive correlation with the highest temperature ($r = 0.510$), indicating that for every 1 °C increase in temperature, there will be an increase in population of 0.432 larva/plant. However, these results are in contrast to those, who found that the populations of *Spodoptera litura* and *Spodoptera frugiperda* showed a non-significant correlation with mean atmospheric temperature but a significant negative correlation with relative humidity ($r = -0.647$) and total rainfall ($r = 0.536$). A negative association between the populations of *S. litura* infesting the groundnut crop is proven by the minimum temperature, relative humidity, and total rainfall.

Table 2: Seasonal incidence of fall armyworm on maize crop during Rabi, 2022-23 and correlation coefficient between different dependent and independent variables

SMW	Duration	Average no. of larvae of fall armyworm/plant	Max Temp. (°C)	Min. Temp. (°C)	Rain Fall (mm)	RH I (%)	RH II (%)	Wind Velocity (Km/h)
1	01 Jan - 07 Jan	0	28.4	12.3	0	88.6	47.1	3.3
2	08 Jan - 14 Jan	0	29.1	10	0	83.3	29	2.7
3	15 Jan - 21 Jan	0	31.3	15	0	88.1	33.6	2.3
4	22 Jan - 28 Jan	0	31.3	15.6	0	87.3	36.4	2.1
5	29 Jan - 04 Feb	0.22	30.5	14.0	0	59.1	26.1	5.6
6	05 Feb - 11 Feb	0.55	31.0	12.6	0	40.1	15.5	4.0
7	12 Feb - 18 Feb	0.68	31.9	10.9	0	62.3	21.4	3.6
8	19 Feb - 25 Feb	1.89	33.9	15	0	70.7	22.7	2.7
9	26 Feb - 04 Mar	2.04	33.3	15.4	0	72.1	22.4	2.4
10	05 Mar - 11 Mar	2.14	34.9	17.4	0	63	26	2.9
11	12 Mar - 18 Mar	1.96	34.4	18.7	0.3	64.9	23.7	4.4
12	19 Mar - 25 Mar	1.81	30.6	19.4	1.9	79.7	28.9	6.7
13	26 Mar - 01 Apr	1.02	33	20.4	0	77.7	31.3	4.3
14	02 Apr - 08 Apr	0.61	33	20.6	0.0	76.3	30.9	3.3
15	09 Apr - 15 Apr	0	35.1	21.3	0	78.3	29	4.7
Correlation of coefficient (r) for fall army worm population and abiotic factor			0.535*	0.320	0.358	-0.311	-0.472	0.118

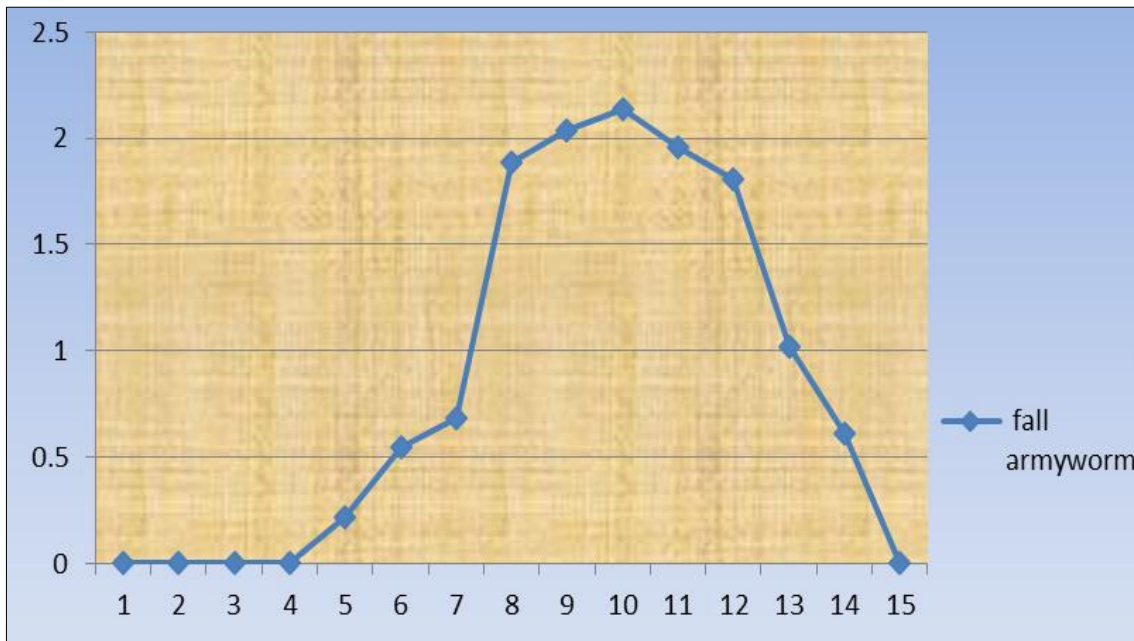


Fig 1: Mean larval population of fall armyworm, *Spodoptera frugiperda* during Rabi 2022-23

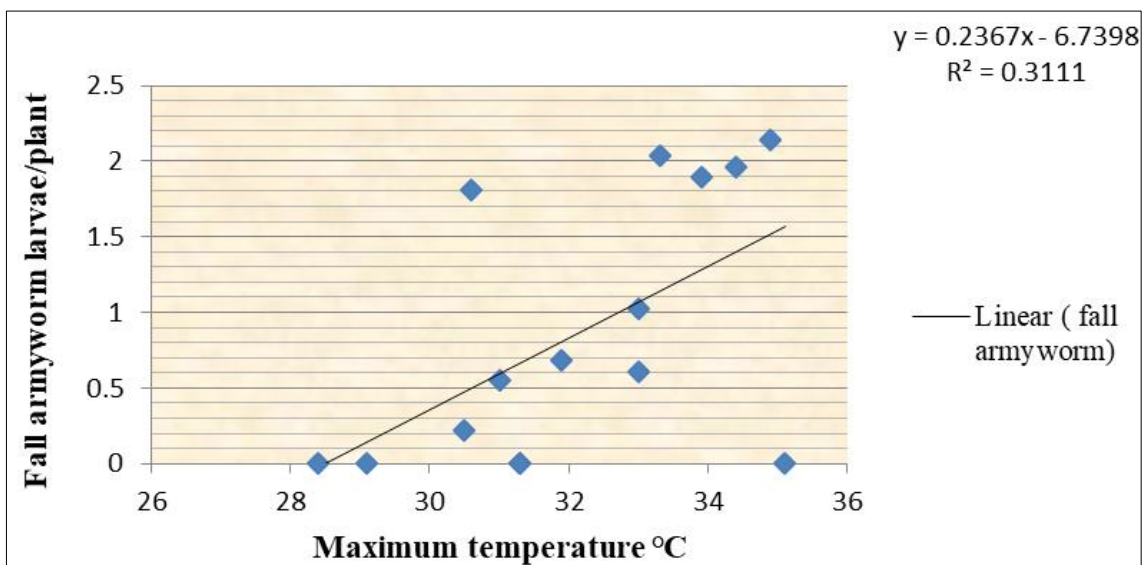


Fig 2: Regression of fall armyworm larval population on abiotic parameter (2022-23)

Conclusion

Fall armyworm, *Spodoptera frugiperda*, peaked in abundance during the 9th SMW (2.11 larvae/plant). The fall armyworm population and maximum temperature had a significant positive correlation ($r = 0.535^*$). The regression equation ($y = 0.236x - 6.739$) predicts that the population of fall armyworms will rise by 0.311 larvae/plant for every 1 °C increase in maximum temperature.

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