www.ThePharmaJournal.com

The Pharma Innovation

Swetha BS
M.Sc (Agri) Department of
Agricultural Entomology,
College of Agriculture, VNMKV,
Parbhani, Maharashtra, India

FS Khan
Assistant Professor, Department
of Agricultural Entomology,
College of Agriculture, VNMKV,
Parbhani, Maharashtra, India

Tupe AP
M.Sc (Agri) Department of
Agricultural Entomology,
College of Agriculture, VNMKV,
Parbhani, Maharashtra, India

Effect of biotic and abiotic factors on *Spodoptera frugiperda* in Parbhani, Marathwada region

Swetha BS, FS Khan and Tupe AP

Abstract
The study of effect of biotic and abiotic factors on *Spodoptera frugiperda* in Parbhani, Marathwada region was carried out at the Department of Agricultural Entomology, VNMKV, Parbhani during *Rabi* 2021-22. The seasonal incidence results showed that the population of Fall armyworm (larvae per ten plants) ranged between 0-13.5 and first appearance was noticed in 1st SMW (1.5). Thereafter, it increased progressively and peaked in 11th SMW (13.5). The population of sucking pests on maize was negligible. The first appearance of natural enemy, Coccinellid beetles (grubs and adults per plant) was noticed in 1st SMW (0.13) while they peaked in (0.45) in 11th SMW. The correlation study of weather parameters with Fall armyworm and Coccinellid beetle showed significant negative correlation with evening relative humidity.

Keywords: Fall armyworm, seasonal incidence, weather correlation, coccinellid beetles

Introduction

Fall armyworm, *Spodoptera frugiperda* is a transboundary polyphagous insect pest indigenous to tropical and subtropical regions of America. Its diverse host range includes Maize, Sorghum, Rice, Sugarcane, Cotton, Alfalfa, forage grasses and occasionally other crops (Bhavani *et al.*, 2019) [3]. The Fall armyworm first appeared on the Indian sub-continent in 2018 in Maize fields at the College of Agriculture, Shivamogga, Karnataka (Sharanabasappa *et al.,* 2018) [8]. Later, it was also reported from several regions of the nation (Ganiger *et al.,* 2018) [5]. Fall armyworm *Spodoptera frugiperda,* is a newly discovered destructive insect pest now gained a major pest importance causing damage to the crop at all the growing stages and the yield losses range upto 73 percent (Kumar *et al.,* 2018) [6]. To know the status of newly emerging destructive pest like Fall armyworm in a particular region, it is essential to study the influence of abiotic and biotic factors. Abiotic factors are non-living factors of an environment like temperature (maximum and minimum temperatures), morning and evening relative humidity, rainfall, wind velocity, evaporation and bright sunshine hours have an impact on the growth and development of insect pest population by affecting the rate of reproduction, feeding habit, crop damage, mortality rate and migration. Biotic factors are the living component that affects another organism. Natural enemies (predators and parasitoids) and microorganisms are the important biotic factors that affects the insect pest population. Coccinellids, Predatory bugs and Earwigs are some of the natural enemies of Fall armyworm reported in Marathwada region (Warkad *et al.*, 2021) [9], other natural enemies reported against Fall armyworm are *Campoletis chloridae* (Hymenoptera: Ichneumonidae) and *Exorista xanthaspis* (Diptera: Tachinidae) (Darshan and Prasanna, 2022) [4]. Hence the present investigation was carried out to study the effect of biotic and abiotic factors on *S. frugiperda* in Parbhani, Marathwada region.

Methodology

The study of effect of biotic and abiotic factors on *S. frugiperda* in Parbhani, Marathwada region was carried out in the Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani during *Rabi* 2021-22. Ten plants were selected randomly from each quadrate from the maize experimental plot of 10x10 m and field observations were recorded at weekly intervals starting from crop emergence to harvesting. The incidence of Fall armyworm was recorded on ten randomly chosen plants in each plot at weekly interval. Observations were recorded as number of larvae per 10 plants. The incidence of natural enemy, Coccinellid beetle was recorded on ten randomly chosen plants in each plot at weekly interval.

Corresponding Author:
Swetha BS
M.Sc (Agri) Department of
Agricultural Entomology,
College of Agriculture, VNMKV,
Parbhani, Maharashtra, India

Observations were recorded as number of grubs and adults per plant. The correlation was worked out between weather parameters and larval population of fall armyworm.

Results and Discussion
Seasonal variation of Fall armyworm on Maize
The population of Fall armyworm recorded as number of larvae per ten plants. The observations presented in the table 1 revealed that the larval population of Fall armyworm, *S. frugiperda* appeared in the first week of January (1.5). Thereafter the larval population of Fall armyworm steadily increased till the third week of March, after that the larval population started to decrease gradually. The highest Fall armyworm population (13.5) was noticed during the eleventh standard meteorological week. During this period morning and evening relative humidity, maximum and minimum temperature, rainfall, wind velocity, evaporation and bright sunshine hours were 56 per cent, 10 per cent, 37.4 ºC, 16.3 ºC, 0 mm, 3.6 kmph, 8.9 mm and 8.4 hours, respectively. The larval population was noticed in the entire crop growth period.

Correlation between weather parameters and Fall armyworm of Maize
The presented observation in the table 2 revealed that the, larval population showed significant negative correlation with evening relative humidity (r=-0.554). Also, the larval population showed non-significant positive correlation with maximum temperature(r=0.243), evaporation (r=0.220) and bright sunshine hours (r=0.307). While morning relative humidity (r=-0.311), minimum temperature (r=-0.024), rainfall (r=-0.204) and wind velocity (r=-0.122) showed non-significant negative correlation with the larval population of Fall armyworm.

Seasonal incidence of sucking pests on Maize
The population of sucking pests on maize was negligible.

Seasonal variation of natural enemy Coccinellid beetles on Maize
The population of natural enemy Coccinellid beetles were recorded as number of grubs and adults per plant. The observations presented in the table 1 revealed that, the population of Coccinellid beetle appeared in the first week of January (0.13).Thereafter the population of Coccinellid beetles showed variation in every week. The highest population of Coccinellid beetles (0.45) was noticed during the eleventh standard meteorological week. During this period morning and evening relative humidity, maximum and minimum temperature, rainfall, wind velocity, evaporation and bright sunshine hours were 56 per cent, 10 per cent, 37.4 ºC, 16.3 ºC, 0 mm, 3.6 kmph, 8.9 mm and 8.4 hours, respectively.

Table 1: Seasonal incidence of Fall armyworm and Coccinellid beetles on Maize during *Rabi* 2021-22

Sr. No.	SMW	Duration	Humidity (%)		Temperature (ºC)		RF (mm)	WV (kmph)	Evaporation (mm)	BSH	FAW	Coccinellid beetles
			RH1	RH2	MAX	MIN					No. of larvae/10 plants	No. of grubs & adults/plant
1.	52	24-31 Dec.	88	44	28.9	13.6	0	3	3.1	4.9	0	0
2.	1	01-07 Jan.	89	39	28.6	13	0	2.5	3	6.3	1.5	0.13
3.	2	08-14 Jan.	87	55	27.1	15.9	0	4.6	3	4.1	2.75	0.15
4.	3	15-21 Jan.	92	44	26.7	11.8	0	2.8	2.9	5.9	4.25	0.2
5.	4	22-28 Jan.	78	34	26.8	9.9	0	4.2	4.5	7.6	5.5	0.3
6.	5	29-04 Feb.	83	19	30	8	0	2.8	4.8	9.6	7	0.25
7.	6	05-11 Feb.	75	28	30.4	11.8	0	3.5	5.1	8.3	7.75	0.4
8.	7	12-18 Feb.	72	25	31.1	14.4	0	3.7	5.7	8	8.5	0.33
9.	8	19-25 Feb.	74	20	34	14.6	0	3.2	6.2	8.9	10	0.38
10.	9	26-04 Mar.	62	16	34.9	16.4	0	2.9	6.6	8.6	11.25	0.2
11.	10	05-11 Mar.	62	21	34.3	17.5	0	3.6	7.1	6.9	12	0.3
12.	11	12-18 Mar.	56	10	37.4	16.3	0	3.6	8.9	8.4	13.5	0.45
13.	12	19-25 Mar.	43	13	39.3	20.6	0	3.4	9	6.5	10.75	0.28
14.	13	26-01 Apr.	48	8	40.4	18.6	0	3.5	9	8.2	9	0.35
15.	14	02-08 Apr.	48	10	41.4	21.6	0	2.9	10.1	8.9	7.25	0.3
16.	15	09-15 Apr.	38	16	40.2	24.2	0	2.7	8.5	6.5	5.5	0.2
17.	16	16-22 Apr.	46	12	41.3	22.3	0	4.1	12	9.5	4.25	0.1
18.	17	23-29 Apr.	46	12	41.1	24	1.5	4.3	11	9.5	3.5	0.18
19.	18	30-06 May.	42	13	42.6	24.7	0	4.7	12.5	10	3	0.2

Correlation between weather parameters and natural enemy Coccinellid beetles
The presented observation in the table 2 revealed that the, population of Coccinellid beetles showed significant negative correlation with evening relative humidity (r=-0.625). Also, the Coccinellid population showed non-significant positive correlation with maximum temperature(r=0.072), wind velocity (r=0.002), evaporation (r=0.046) and bright sunshine hours (r=0.066). While morning relative humidity (r=-0.350), minimum temperature (r=-0.083) and rainfall (r=-0.005) showed non-significant negative correlation with the population of Coccinellid beetles.

The result findings by earlier researchers were like Anandhi *et al* (2020) [1] who reported that the larval population of *S. frugiperda* had significant positive correlation with maximum temperature of both same (r=0.32 to 0.45) and previous week (r=0.21 to 0.52) at all the locations of Cauvery Delta Zone. In same and previous week minimum temperature had no significant correlation at all locations. The rainfall of same week (r=-0.36 to -0.47) and previous week (r=-0.19 to -0.24) were significantly and negatively correlated.

Anandhi *et al.* (2020) [2] reported that the larval population of Fall armyworm ranged from 0.66 to 2.60 larvae per plant during *Rabi* season. The maximum larval population was recorded in 45th SMW (2.01 to 2.60 larvae per plant) during *Rabi* season.

Kumar *et al* (2020) [7] reported that the incidence of Fall armyworm was minimum during 2nd fortnight of October, 2019 (10%) and maximum incidence was recorded in 1st fortnight of November, 2019 (72%). During *Kharif* and *Rabi,* occurrence of *S. frugiperda* in terms of larval population showed significant positive correlation with 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.

Warkad *et al.* (2021) [9] reported that during *Rabi* season the maximum larval population (1.6 larvae/plant) was noticed during third week of March (11th SMW). The maximum population of Coccinellid was observed in 11th SMW. The coefficient of determination (R^2 value) was 0.941 and 0.675 for Fall armyworm larval population and coccinellids, respectively.

Table 2: Correlation of Fall armyworm and Coccinellid beetles on Maize with weather parameters during *Rabi* 2021-22

Weather parameters	Correlation coefficient ('r' value)	
	Fall armyworm larval Population	Coccinellid beetles (Grubs and adults)
Morning relative humidity (%)	-0.311	-0.350
Evening relative humidity (%)	-0.554*	-0.625*
Maximum temperature (℃)	0.243	0.072
Minimum temperature (℃)	-0.024	-0.083
Rainfall (mm)	-0.204	-0.005
Wind velocity (kmph)	-0.122	0.002
Evaporation (mm)	0.220	0.046
Bright sunshine hours (h)	0.307	0.066

*Significant at 5%

References

1. Anandhi S, Saminathan VR, Yasodha P, Roseleen SSJ, Sharavanan PT`, Rajanbabu V. Correlation of Fall armyworm *Spodoptera frugiperda* (JE Smith) with weather parameters in Maize ecosystem. International Journal of Current Microbioliology and Applied Sciences. 2020;9(8):1213-1218.
2. Anandhi S, Saminathan VR, Yasodha P, Sharavanan PT, Rajanbabu V. Seasonal dynamics and spatial distribution of Fall armyworm *Spodoptera frugiperda* (JE Smith) on Maize (*Zea mays* L.) in Cauvery Delta Zone. Journal of Pharmacognosyand Phytochemistry. 2020;9(4):978-982.
3. Bhavani B, Chandra Sekhar V, Kishore Varma P, Bharatha Lakshmi M, Jamuna P, Swapna B. Morphological and molecular identification of an invasive insect pest, Fall armyworm, *Spodoptera frugiperda* occurring on Sugarcane in Andhra Pradesh, India. Journal of Entomology and Zoology Studies. 2019;7(4):12-18.
4. Darshan R, Prasanna P. Seasonal incidence of Fall armyworm *Spodoptera frugiperda* in Maize. Indian Journal of Entomology; c2022. p. 431.
5. Ganiger PC, Yeshwanth HM, Muralimohan K, Vinay N, Kumar ARV, Chandrashekara K. Occurrence of the new invasive pest, Fall armyworm, *Spodoptera frugiperda* (J.E. Smith) (Lepidoptera: Noctuidae), in the Maize fields of Karnataka, India. Current Science. 2018;115(4):621-623.
6. Kumar P, Singh R, Suby SB, Kaur J, Sekhar JC, Soujanya PL. An overview of crop loss assessment in Maize. Maize Journal. 2018;7:56-63.
7. Kumar NV, Yasodha P, Justin CGL. Seasonal incidence of Maize Fall armyworm *Spodoptera frugiperda* (JE Smith) (Noctuidae; Lepidoptera) in Perambalur district of Tamil Nadu, India. Journal of Entomology and Zoology Studies. 2020;8(3):1-4.
8. Sharanabasappa, Kalleshwaraswamy CM, Ashokan R, Mahadeva Swamy HM, Maruthi MS, Pavithra HB, *et al*. First report of the Fall armyworm, *Spodoptera frugiperda* (Smith) (Lepidoptera: Noctuidae), an alien invasive pest on Maize in India. Pest Management in Horticultural Ecosystems. 2018;24(1):23-29.
9. Warkad TP, Bhede BV, Shinde GS. Seasonal variations in Fall armyworm *Spodoptera frugiperda* and its natural enemies on Maize. Journal of Entomological Research. 2021;45(4):702-706.