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Seasonal incidence of major lepidopteran pests and natural enemies in sweet corn (*Zea mays convar. saccharata* var. *rugosa.* L)

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ABSTRACT

The field experiment was conducted at Agricultural college, Naira Farm during *rabi* 2024-25, to know the seasonal incidence of lepidopteran pests infesting sweet corn and also the natural enemies occurring on the crop. Among them fall army worm *Spodoptera frugiperda* (J.E. Smith) and pink stem borer *Sesamia inferens* (Walker) appeared to be the major pests infesting the crop. Fall army worm appeared during 52nd SMW *i.e.* 3rd week of December, pink stem borer was observed during 51st SMW *i.e.* 2nd week of December and the incidence of natural enemies was observed during 51st SMW *i.e.* 2nd week of December. The correlation between pink stem borer and abiotic parameters during *rabi*, 2024-2025 indicated that a significant positive correlation was observed with morning relative humidity (r= 0.469*). Whereas correlation between ladybird beetles, spiders and abiotic parameters during *rabi*, 2024-2025 indicated a significant positive correlation with morning relative humidity (r= 0.059*) and (r=0.558*) respectively.

Key Words : *Correlation, Fall armyworm, Seasonal incidence, Sweet corn and Weather parameters*

Sweet corn (*Zea mays convar. saccharata* var. *rugosa.* L), also known as sugar corn or pole corn, is a variety of maize primarily cultivated for human consumption due to its high sugar content. Its sweetness results from natural recessive mutations in the genes that regulate the conversion of sugar to starch in the kernel's endosperm. Unlike field corn, sweet corn is harvested while the kernels are still immature and sugary, typically around 75–80 days after sowing. Beyond human consumption, the leftover stalks serve as valuable fodder for livestock.

Nutritionally, sweet corn offers a rich composition, approximately 19.02 g of carbohydrates, 2.70 g of dietary fibre, 1.18 g of fat, and 3.2 g of protein per 100 grams. It contains 5–6 per cent sugar, 10–11 per cent starch, 3 per cent water-soluble polysaccharides, and around 70 per cent water, vitamins (notably in yellow varieties), and potassium (Oktem & Oktem, 2005). With its rising commercial value, sweet corn is in high demand, particularly in restaurants where it is used for soups, cooked or roasted cobs, and processed food items.

Nearly 250 insect species have been documented globally on maize crops, in which only a few are of economic significance (Mathur, 1991).

These pests pose a significant barrier to maximizing yields. Among the most economically damaging insect pests in sweet corn are the spotted stem borer *Chilo partellus* (Swinhoe), pink stem borer *Sesamia inferens* (Walker), and fall armyworm *Spodoptera frugiperda* (J.E. Smith). These Lepidopteran pests affect the crop from the seedling to the maturity stages, causing damage such as boring into the stem, feeding on foliage, and damaging developing kernels.

Combined, these pests can lead to significant economic damage. Bergvinson *et al.* (2002) estimated yield losses due to insect infestations during both cultivation and post-harvest storage 10%. Moreover, during the rainy and winter seasons, pink and spotted stem borers can cause losses ranging between 25–40 per cent (Khan *et al*., 1997). Traditionally, the control of these insect pests has relied heavily on foliar application of broad-spectrum insecticides. These practices are effective in reducing pest populations but causes environmental pollution, development of pest resistance, resurgence of minor pests, and depletion of beneficial natural enemies. These practices

have altered pest dynamics, leading to increased infestations and more frequent pest outbreaks. Therefore, comprehensive and updated research on pest populations, their natural enemies, and effective management methods are were formulated and studies for development of sustainable pest management strategies in sweet corn cultivation.

MATERIAL AND METHODS

A field experiment was conducted at Agricultural College Naira, Srikakulam (Dist.) during *rabi* 2024-2025 under field condition to study the occurrence of insect pests and natural enemies in sweetcorn ecosystem. The Sugar-75 was raised and maintained without insecticide application to study the dynamics of major insect pests and natural enemies on maize in relation to abiotic factors *viz.,* maximum temperature, minimum temperature, relative humidity (morning and evening) and rainfall.

To determine the seasonal incidence of insect pests on sweet corn, weekly populations were recorded on randomly selected twenty plants from four corners and center starting from sowing to the late stage of the cropping season. Direct count of natural enemies was recorded by using a m^2 quadrat of the size of one square meter.

The occurrence of major lepidopteran pests was recorded in the field and per cent plant and stem infestation was calculated using the following formula:

$$\text{Per cent Plant Infestation} = \frac{\text{No. of Plants Infested}}{\text{Total No. of Plants}} \text{X100}$$

$$\text{Per cent Stem Tunneling} = \frac{\text{Length of Tunneling(cm)}}{\text{Total Length of the Stem(cm)}} \text{X100}$$

The data was subjected to simple correlation and multiple linear regression (MLR) analysis using SPSS Software.

RESULTS AND DISCUSSION

The fall armyworm incidence was observed from 52nd (6.2%) to 12th standard week (6.4%). The peak infestation (55.3%) was observed during 8th standard week (76 DAS) when the maximum temperature, minimum temperature, morning relative humidity and evening relative humidity was 34.7°C, 26.2°C, 87.0 per cent and 64.8 per cent respectively with no rainfall.

The correlation studies for assessment of relationship between fall armyworm and the abiotic factors were presented in Table 1. Among the five parameters, maximum temperature (r=0.308) and minimum temperature (r = 0.341) showed non-significant positive correlation. However, it also showed non-significant positive correlation with the morning relative humidity (r = 0.458) and evening relative humidity (r=0.021) and negative non-significant correlation with rainfall (r= -0.175).

The data Table 4 on the occurrence of fall armyworm was subjected to multiple linear regression analysis and the following equation was arrived.

$Y = -158.222 - 3.048\ X_1 + 3.910X_2 + 1.585X_3 + 0.864X_4 - (3.959)\ X_5$

The findings of present study are in accordance with Nivetha *et al*. (2022) who reported, that the incidence recorded from 38th MSW to 46th MSW on maize exhibited positive non- significant association with maximum temperature (r= 0.307) and minimum temperature (r=0.151) and morning relative humidity (r=0.078) and negative non-significant correlation with evening relative humidity (r= -0.155) and rainfall (r= -0.111).

The pink stem borer incidence started during 51st standard week with 3.0 cm stem tunnelling. The average maximum and minimum temperatures in relation to the incidence of stem borer during 51st standard week were 28.9°C and 18.0°C respectively, the average morning and evening relative humidity were 65.8 and 65.8 per cent respectively, and 0.4 mm of rainfall was recorded. The peak incidence of stem borer was observed with a 28.4 cm stem tunnelling during 9th standard week, during which maximum, minimum temperature of 35.5°C, 25.8°C and the average morning and evening relative humidity of 87.5 and 60.8 per cent and no rainfall was recorded.

The correlation studies for assessment of relationship between pink stem borer and the abiotic factors were presented in table 2. Among the five parameters maximum temperature (r=0.249) and minimum temperature (r=0.247) showed non-significant positive correlation. However, it also showed significant positive correlation with morning relative humidity (r = 0.469*) and non-significant negative correlation with evening relative humidity

Table:1 Influence of abiotic factors on the incidence of fall armyworm, *Spodoptera frugiperda* on sweet corn during *rabi,* 2024-2025

S.No.	Standard Week	Date & Month	Mea		Mean		Rain fall (mm)	% Plant infestation
			Max.	Min.	Mor.	Eve.		
1	49	30Nov- 6Dec	24.5	18	65.8	65.8	0.4	0
2	50	7Dec –13Dec	32.5	18.2	88.5	66	0	0
3	51	14Dec-20Dec	28.9	16.8	82.6	58.5	0.3	0
4	52	21Dec-27Dec	25.3	18.5	88.1	86.3	11.4	6.2
5	1	28Dec-3Jan	28.4	17.3	87.6	67.1	0.3	9.8
6	2	4Jan - 10Jan	31.1	22.4	87.5	62.8	0	10.3
7	3	11Jan - 17Jan	30.5	20.8	85.5	59.3	0	16.4
8	4	18Jan –24Jan	30.1	22.4	84.8	60.8	0	20.7
9	5	25Jan-31Jan	32	19.8	83.3	53.5	0	26.3
10	6	1Feb-7Feb	33.1	23	90.1	61.1	0	32.6
11	7	8Feb-14Feb	34.1	25	89.5	61.3	0	40.5
12	8	15Feb-21Feb	34.7	26.2	87	64.8	0	55.3
13	9	22Feb-28Feb	35.5	25.8	87.5	60.8	0	32.4
14	10	1Mar-7Mar	34.5	26	87	56.8	0	24.6
15	11	8Mar-14Mar	35.2	26.8	83.8	55.3	0	12.3
16	12	15Mar-21Mar	36.1	27.4	81	55	0	6.4
17	13	22Mar-28Mar	36.2	28.2	77	45.6	0	0
18	14	29Mar- 4Apr	36.5	26	85	55.1	0	0

Table 2: Influence of abiotic factors on the incidence of pink stem borer, *Sesamia inferens* on sweet corn during *rabi,* 2024-2025

S.NO	Standard Week	Date & Month	Mean Temp (OC)		Mean RH (%)		Rainfall (mm)	Per cent stem tunneling
			Max.	Min.	Mor.	Eve.		
1	49	30Nov- 6Dec	24.5	18	65.8	65.8	0.4	0
2	50	7Dec –13Dec	32.5	18.2	88.5	66	0	0
3	51	14Dec-20Dec	28.9	16.8	82.6	58.5	0.3	3
4	52	21Dec-27Dec	25.3	18.5	88.1	86.3	11.4	3.2
5	1	28Dec-3Jan	28.4	17.3	87.6	67.1	0.3	6.1
6	2	4Jan - 10Jan	31.1	22.4	87.5	62.8	0	8.8
7	3	11Jan - 17Jan	30.5	20.8	85.5	59.3	0	12.2
8	4	18Jan –24Jan	30.1	22.4	84.8	60.8	0	16.7
9	5	25Jan-31Jan	32	19.8	83.3	53.5	0	20.2
10	6	1Feb-7Feb	33.1	23	90.1	61.1	0	20.5
11	7	8Feb-14Feb	34.1	25	89.5	61.3	0	22.6
12	8	15Feb-21Feb	34.7	26.2	87	64.8	0	26.8
13	9	22Feb-28Feb	35.5	25.8	87.5	60.8	0	28.4
14	10	1Mar-7Mar	34.5	26	87	56.8	0	18.5
15	11	8Mar-14Mar	35.2	26.8	83.8	55.3	0	4.2
16	12	15Mar-21Mar	36.1	27.4	81	55	0	0
17	13	22Mar-28Mar	36.2	28.2	77	45.6	0	0
18	14	29Mar- 4Apr	36.5	26	85	55.1	0	0

(r = - 0.016) and negative non- significant correlation with rainfall (r= -0.200).

The data in Table 5 on the occurrence of pink stem borer was subjected to multiple linear regression analysis and the following equation was arrived. Y = - 73.743 - 2.561 X_1 +2.287X_2 +1.270 X_3 + 0.148X_4 – (2.226) X_5

The results on the analysis indicated that all the weather variables together contributed to the incidence of pink stem borer by 43.50 (R^2 = 0.435) per cent. Results indicated a positive association with morning relative humidity (r= 1.270), evening relative humidity (r=0.148) and with minimum temperature (r=2.287). Whereas a negative non- significant association was observed with maximum temperature (-2.561) and rainfall (r= -2.226).

The present findings were accordance with the study of Deole *et al*. (2019) who reported that the incidence of *Sesamia inferens* was observed from seedling to maturity stage. Sidar *et al*. (2017) reported that incidence of pink stem borer showed non-significant positive correlation with maximum temperature (r= 0.008) and non- significant negative correlation with evening relative humidity (r= -0.16) and rainfall (r= -0.34).

The natural fauna *viz*., ladybird beetles (*Coccinella sexmaculata* and *Cheilomenes propinqua*) and spiders (*Chrysilla spp*.) started during 51st standard week, when the mean maximum (28.9^{0}C) and minimum (16.8^{0}C) temperatures were recorded. The morning and evening relative humidity observed during the period were 82.6 and 58.5 per cent, respectively and rainfall of 0.3 mm was observed Table 3.

Ladybird population gradually increased and reached maximum at 6th standard week with maximum and minimum temperatures of 33.1°C and 23.0°C respectively. Other parameters recorded during standard week were, morning relative humidity (90.1%), evening relative humidity (61.1%) and no rainfall was recorded.

The spider population was noticed from 51st standard week and reached maximum during 7th standard week when the maximum and minimum temperatures were 34.1°C, 25.0°C and average morning relative humidity and evening relative humidity were 89.5, 61.3 per cent with no rainfall.

The correlation studies for assessment of relationship between ladybird beetles and the abiotic factors were presented in table 6. Among the five parameters maximum temperature (r=0.086) and minimum temperature (r=0.088) showed non-significant positive correlation. However, it had significant positive correlation with morning relative

Table:3 Influence of abiotic factors on the incidence of natural enemies in sweetcorn during *rabi*, 2024-2025

S.NO	Standard Week	Date & Month	Mean		Mean		Rainfall (mm)	No. of ladybird beetles	No. of spiders
			Max.	Min.	Mor.	Eve.			
1	49	30Nov- 6Dec	24.5	18	65.8	65.8	0.4	0	0
2	50	7Dec –13Dec	32.5	18.2	88.5	66	0	0	0
3	51	14Dec-20Dec	28.9	16.8	82.6	58.5	0.3	2.66	0.5
4	52	21Dec-27Dec	25.3	18.5	88.1	86.3	11.4	3	0.6
5	1	28Dec-3Jan	28.4	17.3	87.6	67.1	0.3	4.26	0.6
6	2	4Jan - 10Jan	31.1	22.4	87.5	62.8	0	4.5	0.7
7	3	11Jan - 17Jan	30.5	20.8	85.5	59.3	0	5.06	0.8
8	4	18Jan –24Jan	30.1	22.4	84.8	60.8	0	6.93	0.9
9	5	25Jan-31Jan	32	19.8	83.3	53.5	0	7.6	0.9
10	6	1Feb-7Feb	33.1	23	90.1	61.1	0	10.46	1
11	7	8Feb-14Feb	34.1	25	89.5	61.3	0	8.4	1.4
12	8	15Feb-21Feb	34.7	26.2	87	64.8	0	8	1.3
13	9	22Feb-28Feb	35.5	25.8	87.5	60.8	0	4.66	1.2
14	10	1Mar-7Mar	34.5	26	87	56.8	0	4.5	1
15	11	8Mar-14Mar	35.2	26.8	83.8	55.3	0	3	1
16	12	15Mar-21Mar	36.1	27.4	81	55	0	2.66	0
17	13	22Mar-28Mar	36.2	28.2	77	45.6	0	0	0
18	14	29Mar- 4Apr	36.5	26	85	55.1	0	0	0

Table 4. Simple correlation between abiotic factors and fall armyworm, *Spodoptera frugiperda* incidence in sweet corn during *rabi*, 2024-2025

Abiotic (Weather parameters)	Correlation coefficient (r)
X1 – Maximum temperature (^{0}C)	0.308
X2 – Minimum temperature (^{0}C)	0.341
X3– Morning relative humidity (%)	0.458
X4– Evening relative humidity (%)	0.021
X5– Rainfall (mm)	-0.175

*Significant at 5 % level

Table 5. Simple correlation between abiotic factors and pink stem borer, *Sesamia inferens* incidence in sweet corn during *rabi*, 2024-2025

Abiotic (Weather parameters)	Correlation coefficient (r)
X1 – Maximum temperature (^{0}C)	0.249
X2 – Minimum temperature (^{0}C)	0.247
X3– Morning relative humidity (%)	0.469*
X4– Evening relative humidity (%)	-0.016
X5– Rainfall (mm)	-0.2

*Significant at 5 % level

Table 6. Simple correlation between abiotic factors and ladybird beetles occurrence in sweet corn during *rabi*, 2024-2025

Abiotic (Weather parameters)	Correlation coefficient (r)
X1 – Maximum temperature (^{0}C)	0.086
X2 – Minimum temperature (^{0}C)	0.088
X3– Morning relative humidity (%)	0.531*
X4– Evening relative humidity (%)	0.059
X5– Rainfall (mm)	-0.11

*Significant at 5 % level

Table 7. Simple correlation between abiotic factors and Spiders in sweet corn during *rabi*, 2024-2025

Abiotic (Weather parameters)	Correlation coefficient (r)
X1 – Maximum temperature (^{0}C)	0.136
X2 – Minimum temperature (^{0}C)	0.185
X3– Morning relative humidity (%)	0.558*
X4– Evening relative humidity (%)	0.107
X5– Rainfall (mm)	-0.047

*Significant at 5 % level

humidity (r = 0.531*) and non-significant positive correlation with evening relative humidity (r = -0.059) and negative non- significant correlation with rainfall (r= -0.110).

The data Table 6 on the occurrence of ladybird beetles was subjected to multiple linear regression analysis and the following equation was arrived. Y = -12.625 - 1.305X1 + 0.810X2 +0.568X3 -0.118X4 – (0.545) X5

The results on the analysis showed that all the weather variables together contributed to the incidence of ladybird beetles by 53.30 (R^2 = 0.533) per cent. Results indicated a positive non-significant association with minimum temperature (r= 0.810), morning relative humidity (r= 0.568) and negative non-significant association with evening relative humidity (r= -0.118), maximum temperature (r= -1.305) and rainfall (r= -0.545).

The correlation studies for assessment of relationship between spiders and the abiotic factors were presented in table 3. Among the five parameters maximum temperature (r=0.136) and minimum temperature (r=0.185) showed non-significant positive correlation. However, it had significant positive correlation with morning relative humidity (r = 0.558*) and non-significant positive correlation with evening relative humidity (r= 0.107) and negative non-significant correlation with rainfall (r=-0.107).

The data Table 7 on the occurrence of spiders was subjected to multiple linear regression analysis and the following equation was arrived.
Y=-2.864-0.193X1+0.143X2+0.083X3–0.008X4 – (0.082) X5

The results the analysis showed that all the weather variables together contributed to the incidence of spiders by 56.90 (R^2 =0.389) per cent. Results indicated a positive non- significant association with minimum temperature (r= 0.143), morning relative humidity(r=0.083) and evening relative humidity (r=0.008) and negative non-significant association with maximum temperature (r= -0.193) and rainfall (r= -0.082).

These findings in the present study are accordance with Kumar *et al.* (2016) who reported positive significant correlation with morning relative humidity (r=0.590*).

CONCLUSION

Studies on Seasonal occurrence of major

lepidopteran pests *viz*., fall armyworm and pink stem borer on sweet corn revealed that, on *rabi* crop, fall armyworm incidence reached its peak during 8th standard week. Peak of pink stem borer populations were recorded during 11th standard week and peak of natural enemies were recorded during 6th and 7th standard week respectively. Correlation coefficient between different weather parameters and population of insect pests revealed that, morning relative humidity recorded significant positive correlation with population of pink stem borer and natural enemies.

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