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Population Dynamics of Tomato Fruit borer (*Helicoverpa armigera* Hubner) Infesting Tomato (*Lycopersicon esculentum* Mill) Crops and their Correlation with Diverse Meteorological Factors under Field Condition

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ABSTRACT: The investigation was carried out during Rabi season in 2021–2022, and 2022–2023, at Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, in the Student Instructional Farm (SIF), geographically, the district of Kanpur Nagar is located between latitude 260 29' north and longitude 79031' and 80034' east. It is in the subtropical zone. It is located 125.9 metres above the gangetic alluvial in the centre of Uttar Pradesh. This experiment was conducted to study on the population dynamics of fruit borer *Helicoverpa armigera* Hubner on tomato, *Lycopersicon esculentum* Mill. "of insect-pest infesting tomato crops. It was found that tomato was attacked by tomato fruit borer (*Helicoverpa armigera*), *H. armigera* incidence reaching its peak population (7.70 larvae/ plant) in 12 th SMW (4th week of March) during 2021-22 while *H. armigera* incidence reaching its peak population (8.15 larvae/ plant) in 13 th SMW (4th week of March and first week of April) during 2022-23. Correlation between tomato fruit borer and abiotic parameter in the year 2022 – 23 that the correlation revealed that larvae population of tomato fruit borer showed significant negative correlation with morning RH (r = -0.662) and evening RH (r = -0.636**), significant positive correlation with maximum temperature (r = 0.962**), and non significant negative correlation with minimum temperature (r= -0.347), while evaporation have non significant positive correlation (r = .320) with population. The BSS (r = 0.580**) showed significant positive correlation and positive non significant correlation with rainfall (0.311) was observed with insect population. Correlation between tomato fruit borer and abiotic parameter in the year 2022 – 23 that the larval population of tomato fruit borer correlated with abiotic factors showed that significant positive (r = 0.829**) correlation with maximum temperature while negative significant relation found with minimum temperature. RH morning had positive significant (r = 0.655) relationship and negative significant (r = -0.643**) with the population of tomato fruit borer. The evaporation had significant positive (r = 0.432*) correlation while B.S.S (hr) had also significant positive (r = 0.648**) relation with larval population.**

Keywords: Population dynamics, *Helicoverpa armigera*, Tomato, Correlation, larvae, Azad T-6.

INTRODUCTION

The Solanaceae family plant, the tomato (*Lycopersicon esculentum* Mill.), is farmed widely for both fresh consumption and processing. The tomato is a crop that is native to tropical America. It ranks as the world's second-largest vegetable crop, only below sweet potatoes and potatoes. Vegetables are crucial components of our daily diet worldwide, providing essential micro-nutrients, vitamins, and minerals. Among different commercially cultivated vegetable crops in India, tomato *Lycopersicon esculentum* Mill. hold the third position in area as well as production (Sharma, 2004). This adaptable fruit is used both raw and cooked, earning it the nickname "poor man's apple" in the world of vegetables. Beyond being consumed fresh, tomatoes are widely used to make a variety of products, including soup, juice, ketchup, puree, paste, and powder. Surprisingly, the tomato, *Lycopersicon esculentum* (Mill.), plays an important role in everyday diets all over the world, profoundly affecting the

nutritional intake of a sizeable section of the population (Hussain and Bilal 2007). In India, it is grown in 814 (000) million ha. area with 20,515 (000) million tones production and 25.20 t/ha productivity. In India, Andhra Pradesh contributed maximum production (2845.64 MT) and share 13.87% of total state production but highest productivity was occupied by Maharashtra (28.20 tons/ha) Anymmos (2018). In U.P., tomato grown in an area of about 21.2 million hectare and production is about 832.50 million tons Anymmos (2017-18). Pests caused by insects are a barrier to producing abundant crops of strong, excellent tomato fruits. Notably, roughly 16 different species of insects and other pests have been blamed for the harm done to tomato crops in India. The tomato fruit borer, formally known as *Helicoverpa armigera* Hub. (Lepidoptera: Noctuidae), stands out as the most formidable foe among the different pests encountered. Its pervasiveness over the entire country causes significant harm to a wide variety of host plants, including pulses, millets, cotton, and different crops. Due to its negative effects on the quantity and quality of tomato fruits, the tomato fruit borer, *Helicoverpa armigera*, is classified as a major pest. The economic costs of this pest's activities in India have been estimated at over one trillion rupees a year, with production losses ranging from 14% to 100% for different crops (Yadav, 1980).

MATERIAL AND METHODS

The experiment was carried out in student instruction farm (SIF), Chandra Shekhar Azad University Agricultural and technology, Kanpur during *Rabi* 2021-22 and 2022-23. Nursery of the tomato crop *cv*. Azad T6 was raised in Department of Vegetable Science, Chandra Shekhar Azad University Agricultural and technology, Kanpur and it was The transplanting was done on 3 November 2021 and 1 November 2022, for both the year. For present experiment 31 days old seedlings of tomato variety Azad T-6 were transplanted in the field. Both the experiment was laid out in Completely Randomized Block Design (CRBD) first one having nine treatments including one control and another one include 9 treatments with control and replicated thrice. The tomato seedlings were transplanted in 3×2.5 m^2 plots with 60×45 cm spacing and all the recommended agronomical practices were followed to raise the crop. Single seedling was transplanted at a single spot and a light irrigation was provided after planting of the seedlings. Only the healthy plants were allowed to grow and weaker and dead plants were replace by gap filling process after one week of transplanting to get better yield from the field.

The prescribed agricultural practices were adhered to for cultivating the crop, with the exception of the methods for safeguarding the crop. Throughout the crop's growth cycle, data regarding the fluctuation in population was collected, spanning from the transplantation phase to the final harvesting. Monitoring the presence of the tomato fruit borer, *Helicoverpa armigera*, which targeted the tomato plants, involved observing 20 arbitrarily chosen plants on a weekly basis within each plot. This observation commenced 20 days after the transplantation, covering both the upper and lower sections of each plant. The process was repeated for an additional 20 randomly selected plants in every plot, excluding the border rows. Incidence of the fruit borer was documented by tallying the larvae count on 20 randomly selected plants (with 5 plants per quadrant) on a weekly basis until the crop reached maturity, utilizing the "direct visual counting method."Weekly weather data on different parameters like temperature (˚C), relative humidity (%), rainfall and total bright sunshine hours procured from Agro meteorological observatory of the Department of Agro meteorology, Chandra Shekhar Azad University Agricultural and technology, Kanpur during the crop period of *Rabi* season 2021-22 and 22-23. The relationships between these weather parameters and population fluctuations of tomato fruit borer *Helicoverpa armigera*, in the field were worked out. The data was statistically analyzed by standard analysis of variance method suggested by Panse and Sukhatme (1967). Correlation was calculated by using the statistical package for social science (SPSS) programme.

RESULTS AND DISCUSSION

A. Population dynamics 2021 – 22

The incidence of *Helicoverpa armigera* Hubner on tomato crop was recorded as number of insect larvae per plant. The larval population was observed during 48 standard week when the crop was at vegetative stage as 0.5 larvae per plant. The occurrence of fruit borer was started from 48 standard week (first week of December, 2021) and studies were made up to 17th standard week (Second week of April, 2021-22) with varying population ranging from 0.5 to 1.30 larvae per plant. After 48 standard week the population of tomato fruit borer larvae start increasing and reached 0.65, 0.95, 1.10 and 1.50 at 49, 50, 51, and 52 standard week at minimum temperature 13.5, 8.6, 7.1 and 9.0 °C, maximum temperature 26.3, 23.7, 22.1 and 20.0 °C, morning RH 92, 95, 85 and 97 percent, evening RH 47, 44, 43 and 75 percent, evaporation mm per day 16.2, 16.2, 16.0 and 17.60, B.S.S. 4.8, 4.3, 4.4 and 1.2 respectably. After 52 standard week the population of tomato borer larvae continue resigning as 1, 2, 3 and 4 standard week and reached 1.60, 1.85, 2.40, and 3.00 at minimum temperature 8.5, 10.3, 4.9, and 7.7°C, maximum temperature 20.4,19.6, 15.7, and 17.9 °C, morning R.H. 96, 94, 93 and 95 percent , evening RH 70, 74, 72, and 66 percent, evaporation 11.2, 10, 9.8 and 8.6 mm per day, B.S.S. 2.6, 2.3, 2.1 and 2.3 respectably. The larvae population raising continue 5, 6, and 7 standard week and reached 3.40, 3.60 and 4.00 larvae per plant at minimum temperature 7.5, 8.1 and 8.1, maximum temperature 21.2, 22.7 and 25.00, morning R.H. 91, 93 and 93 percent, evening R.H. 58, 52 and 50 percent, evaporation 8.4, 9.4 and 11 mm per day, B.S.S. 6.3, 6.3 and 8.4 per hr. The larvae population raising continue on experimental field 8, 9,

10 and 11 standard week and reached 4.50, 5.10, 5.70 and 7.0 larvae per plant at minimum temperature 12.3, 11.7, 13.9 and 17.4, maximum temperature 27.4, 27.8, 29.2 and 33.4, morning R.H. 87, 90, 87 and 83 percent, evening R.H. 42, 46, 44 and 44 percent, evaporation13.4, 14.6, 15.4 and 38.4 mm per day, B.S.S. 8.3, 8.0, 6.6 and 7.0. The peak period of this insect was observed in 12 standard week (21-27 March, 2022) when the crop fruit formation and ripening stage. The maximum population of this insect larvae was recorded as 7.70 larvae per plant. The maximum infestation of fruit borer larvae was recorded at minimum temperature 18.6°C, maximum temperature of 36.4°C, morning relative humidity 79%, evening relative humidity 30 per cent, evaporation 18.2 mm/day, B.S.S. 6.00 per hours and total rainfall 0.00 mm. There after the population started to decline from 13th standard week with larva was recorded as 6.30 per plant at 13 standard week weather parameter like that minimum temperature 18.4°C, maximum temperature 38.2, morning relative humidity 72, evening relative humidity 28, evaporation 19 mm/day and B.S.S. 7.2 per hours. The larvae population decrease continue 14, 15 and 16 standard week and recorded 4.90, 3.40 and 1.70 at minimum temperature 17.6, 21.1 and 22.00, maximum temperature 40.0, 40.8 and 41.1, morning relative humidity 68, 64 and 55 percent, evening relative humidity 22, 25 and 26 percent, evaporation 23.8, 26 and 26.6 mm per day, B.S.S. 7.2, 6 and 6.3. The minimum larvae per plant population 1.3 was recorded at 17 standard week with minimum temperature 22.2°C, maximum temperature of 42.2°C, morning relative humidity of 46% and evening relative humidity 19 per cent, evaporation 26.6 mm per day, B.S.S. 6.2 per hours and rainfall 0.0 mm (Table 1 and Graph 1).

B. Correlation between tomato fruit borer and abiotic parameter in the year 2021 - 22

The correlation (Table 3) revealed that larvae population of tomato fruit borer showed significant negative correlation with morning RH (r = -0.662**) and evening RH (r = -0.636**), significant positive correlation with maximum temperature (r = 0.962**), and non significant negative correlation with minimum temperature (r= -0.347), while evaporation have non significant positive correlation (r = .320) with population. The BSS (r = 0.580**) showed significant positive correlation and positive non significant correlation with rainfall (0.311) was observed with insect population Bala and Sarkar (2017). The larval population of tomato fruit borer, *H. armigera* first appeared in the field during 3rd standard metrological week (SMW) which gradually increased and reached its peak (7.37 larvae per plant) during 12th SMW i.e. on 21.3.16. Correlation between various abiotic factors viz., maximum relative humidity (r=-0.38), minimum relative humidity (r=-0.21) and rainfall (r=-0.33) with fruit borer larval population was found to be negative where as maximum temperature (r=0.88), minimum temperature (r=0.86) and sunshine hour (r=0.34) were positively correlated with *H. armigera* larval population.

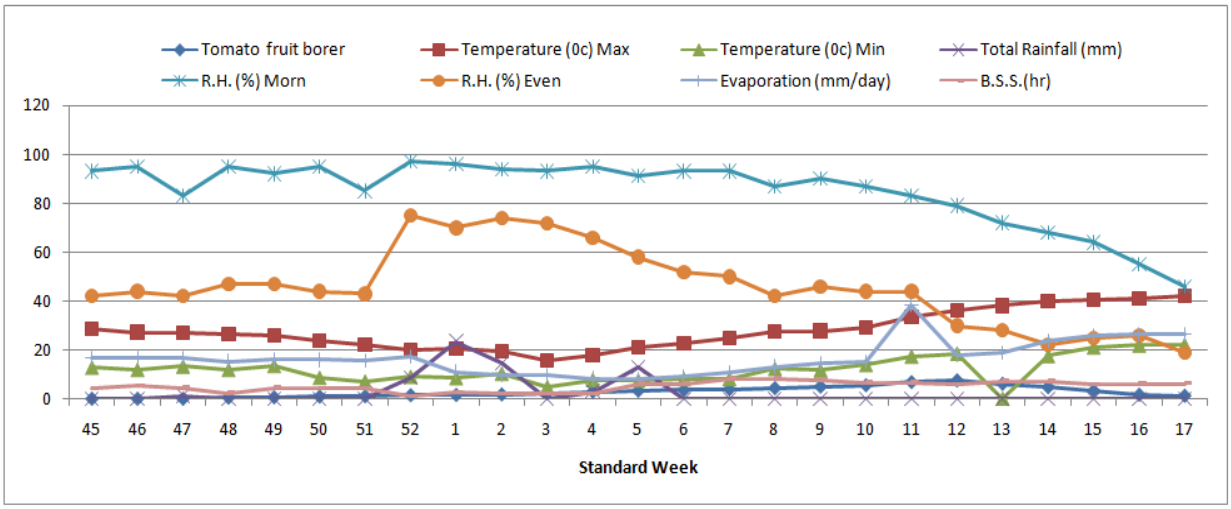
C. Population dynamics 2022 – 23

The population of *Helicoverpa armigera* Hubner on tomato crop was recorded as number of insect larvae per plant. The larval population was observed during 48 standard week when the crop was at vegetative stage as 0.2 larvae per plant. The occurrence of fruit borer was started from 48 standard week (first week of December, 2021) and studies were made up to 17th standard week (Second week of April, 2021-22) with varying population ranging from 0.5 to 3.10 larvae per plant. After 48 standard week the population of tomato fruit borer larvae start increasing and reached 0.55, 0.75, 1.10 and 1.35 at 49, 50, 51, and 52 standard week at minimum temperature 9.7, 10.1, 7.5 and 7.6 °C, maximum temperature 24.9, 25.2, 23.3 and 20.6 °C, morning RH 91, 87, 95 and 93 percent, evening RH 45, 42, 55 and 60 percent, evaporation mm per day 15.4, 16.2, 16.0 and 17.60, B.S.S. 1.5, 5.6, 2.4 and 2.6 respectably. After 52 standard week the population of tomato borer larvae continue resigning as 1, 2, 3 and 4 standard week and reached 1.65, 2.05, 2.15, and 2.10 at minimum temperature 5.4, 6.3, 7.4 and 8.80c, maximum temperature 13.9, 17.8, 20.4, and 22.3 0c, morning R.H. 95, 95, 93 and 92 percent , evening RH 69, 68, 46, and 71 percent, evaporation 12.4, 10.2, 8.8 and 8.4 mm per day, B.S.S. 2.6, 2.3, 2.1 and 2.3 respectably. The larvae population raising continue 5, 6, and 7 standard week and reached 2.50, 3.15 and 3.85 larvae per plant at minimum temperature 9.7, 10.9 and 11.10, maximum temperature 22.7, 28.1 and 26.7, morning R.H. 91, 90 and 83 percent, evening R.H. 59, 51 and 50 percent, evaporation 9.6, 10.6 and 13.6 mm per day, B.S.S. 5.9, 9.3 and 8.1 per hr. The larvae population raising continue on experimental field 8, 9, 10 and 11 standard week and reached 4.80, 5.65, 6.40 and 7.0 larvae per plant at minimum temperature 11.8, 14.4, 15.1 and 15.8, maximum temperature 31.0, 31.2, 30.4 and 30.3, morning R.H. 92, 92, 47 and 90 percent, evening R.H. 47, 53, 54 and 60 percent, evaporation 14.0, 15.2, 18.2 and 16.8 mm per day, B.S.S. 7.1, 8.0, 7.1 and 5.8. The peak period of this insect was observed in 13 standard week (27 March to 2 April, 2022) when the crop fruit formation and ripening stage. The maximum population of this insect larvae was recorded as 8.15 larvae per plant. The maximum infestation of fruit borer larvae was recorded at minimum temperature 16.7°C, maximum temperature of 32.2°C, morning relative humidity 82%, evening relative humidity 43 per cent, evaporation 20.4 mm/day, B.S.S. 7.30 per hours and total rainfall 0.00 mm. There after the population started to decline from 14th standard week with larva was recorded as 6.75 per plant at weather parameter like that minimum temperature 16.8°C, maximum temperature 33.7, morning relative humidity 65, evening relative humidity 28, evaporation 21.4 mm/day and B.S.S. 8.8 per hours. The larvae population decrease continue 15 and 16 standard week were recorded 5.60 and 4.25 at minimum temperature 18.3 and 21.8°C, maximum temperature 37.5 and 39.2°C,

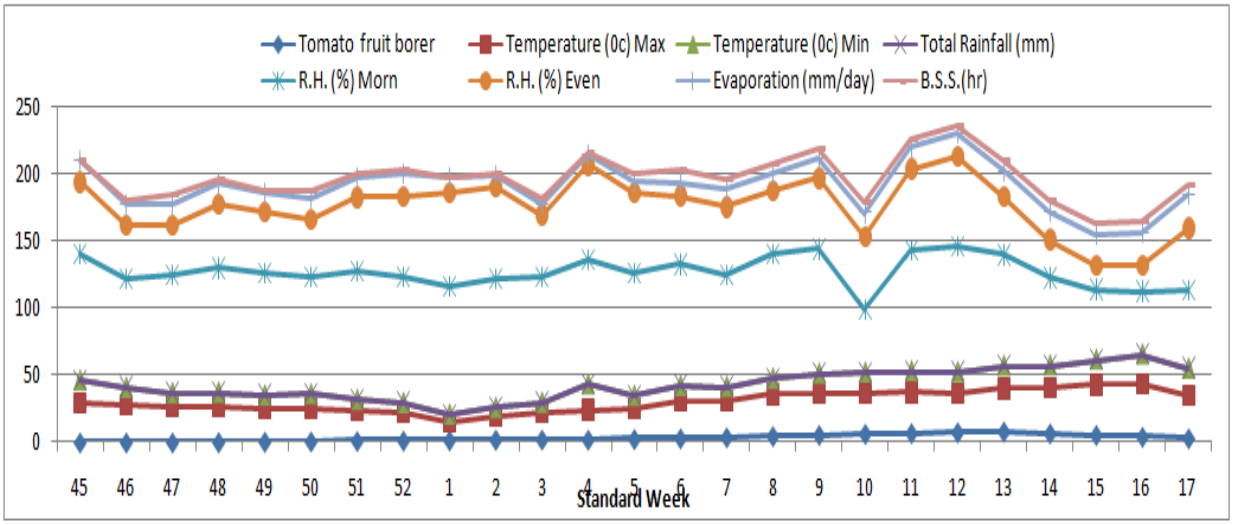
morning relative humidity 52 and 47 percent, evening relative humidity 18 and 19 percent, evaporation 23.4 and 25.0 mm per day, B.S.S. 8.3 and 7.6. The minimum larvae per plant population 3.10 was recorded at 17 standard week with minimum temperature 19.3°C, maximum temperature of 32.5°C, morning relative humidity of 58 % and evening relative humidity 46 per cent, evaporation 26.0 mm per day, B.S.S. 7.0 per hours and rainfall 0.0 mm (Table 2 ; Graph 2)

D. Correlation between tomato fruit borer and abiotic parameter in the year 2022 – 23

The larval population of tomato fruit borer correlated with abiotic factors showed that significant positive (r = 0.829**) correlation with maximum temperature while negative significant relation found with minimum temperature. RH morning had positive significant (r = 0.655) relationship and negative significant (r = -0.643**) with the population of tomato fruit borer. The evaporation had significant positive (r = 0.432*) correlation while B.S.S (hr) had also significant positive (r = 0.648**) relation with larval population. Positive relation showed that one factor increase other will be also increased while negative correlation indicated that one factor other will be certainly decreases and vice – versa. Chula *et al.* (2017) reported that the results revealed that in the year 2015 at Central Research Farm, SHIATS, Naini, Allahabad. *Helicoverpa armigera* (Hub.) population increased and gradually reached its peak level of infestation 48.14% at 13st standard weak (March second weak) there after declined trend was observed as temperature decreased gradually till the crop was matured in last week of April. Sharma *et al.* (2013) the fruit borer (*Helicoverpa armigera* Hubner) population was first recorded in the 14th standard week (2.50 borer/plant) with a population peak of 13.70 borer/ plant during the 21st standard week. The borer, *H. armigera* population exhibited significant positive correlation with the temperature (maximum, minimum) (r=0.921, 0.626) but positive and non-significant with sunshine hours (r =0.246). Correlation study revealed that fruit borer witnessed significant positive correlation with the maximum temperature and minimum temperature. Fruit borer recorded negative non-significant correlation with the morning relative humidity and evening relative humidity.



Graph 1: Influence of abiotic factors on Population Dynamics of *Helicoverpa armigera* in tomato crop *(*2021-22).



Graph 2: Influence of abiotic factors on Population Dynamics of *Helicoverpa armigera* in tomato crop (2022-23).

Table 1: Influence of abiotic factors on Population Dynamics of *Helicoverpa armigera* in tomato crop (2021 - 22).

Week	Periods (2021-22)	Tomato fruit borer	Temperature (0c)		Total Rainfall (mm)	R.H. (%)		Evaporation (mm/day)	B.S.S.(hr)
			Max	Min		Morn	Even		
45	8 - 14 Nov	0.0	28.8	12.8	0.0	93	42	16.8	4.4
46	15 -21 Nov	0.0	27.3	11.9	0.0	95	44	16.8	5.4
47	22– 28 Nov.	0.0	26.9	13.3	1.2	83	42	16.8	4.6
48	29 Nov. – 5 Dec.	0.5	26.3	11.9	0.0	95	47	15.6	2.5
49	6 - 12 Dec.	0.65	26.0	13.5	0.0	92	47	16.2	4.8
50	13 – 19 Dec.	0.95	23.7	8.6	0.0	95	44	16.2	4.3
51	20 – 26 Dec.	1.10	22.1	7.1	0.0	85	43	16.0	4.4
52	27 – 2 Jan.	1.50	20.0	9.0	8.6	97	75	17.6	1.2
1	3 – 9 Jan.	1.60	20.4	8.5	23.5	96	70	11.2	2.6
2	10 – 16 Jan.	1.85	19.6	10.3	14.5	94	74	10	2.3
3	17 – 23 Jan.	2.40	15.7	4.9	0.0	93	72	9.8	2.1
4	24 – 30 Jan.	3.00	17.9	7.7	3	95	66	8.6	2.3
5	31Jan – 6 feb.	3.40	21.2	7.5	13	91	58	8.4	6.3
6	7 – 13 Feb.	3.60	22.7	8.1	0.0	93	52	9.4	6.3
7	14 – 20 Feb.	4.00	25.0	8.1	0.0	93	50	11	8.4
8	21 – 27 Feb.	4.50	27.4	12.3	0.0	87	42	13.4	8.3
9	28 – 6 March.	5.10	27.8	11.7	0.0	90	46	14.6	8.0
10	7 – 13 March	5.70	29.2	13.9	0.0	87	44	15.4	6.6
11	14 – 20 March	7.0	33.4	17.4	0.0	83	44	38.4	7.0
12	21 – 27 March	7.70	36.4	18.6	0.0	79	30	18.2	6.0
13	28 March - 3 Apr.	6.30	38.2	18,4	0.0	72	28	19	7.2
14	4 - 10 Apr.	4.90	40.0	17.6	0.0	68	22	23.8	7.2
15	11 – 17 Apr.	3.40	40.8	21.1	0.0	64	25	26	6
16	18 – 24 Apr.	1.70	41.1	22.0	0.0	55	26	26.6	6.3
17	25 Apr. – 1 May.	1.30	42.2	22.2	0.0	46	19	26.6	6.2

Table 2: Correction between Tomato fruit borer and abiotic factors 2021 – 22.

	Max Temp	Min. Temp	Total Rainfall (mm)	RH Morning	RH Evening	Evaporation (mm/day)	B.S.S.(hr)	Tomato fruit borer
Max Temp	1.000	0.962**	-0.436*	-0.873**	-0.920**	0.765**	0.590**	0.340
Min. Temp		1.000	-0.347	-0.857**	-0.824**	0.788**	0.449*	0.288
Total Rainfall (mm)			1.000	0.311	0.616**	-0.363	-0.447*	-0.164
RH Morning				1.000	0.792**	-0.662**	-0.423*	-0.186
RH Evening					1.000	-0.636**	-0.663**	-0.241
Evaporation (mm/day)						1.000	0.320	0.227
B.S.S.(hr)							1.000	0.580**
Tomato fruit borer								1.000

Table 3: Influence of abiotic factors on Population Dynamics of *Helicoverpa armigera* in tomato crop (2022 - 23).

Week	Periods (202 23)	Tomato fruit borer	Temperature (0c)		Total Rainfall (mm)	R.H. (%)		Evaporation (mm/day)	B.S.S. (hr)
			Max	Min		Morn	Even		
45	7 – 13 Nov	0.0	29.9	16.30	0.0	94	53	16.8	0.9
46	14 – 20 Nov.	0.0	27.8	12.9	0.0	81	39	16.8	3.2
47	21 – 27 Nov.	0.0	27.0	9.9	0.0	87	37	16.8	6.5
48	28 Nov. – 4 Dec.	0.20	26.8	10.3	0.0	92	48	15.6	2.4
49	5 - 11 Dec.	0.55	24.9	9.7	0.0	91	45	15.4	1.5
50	12 – 18 Dec.	0.75	25.2	10.1	0.0	87	42	16.2	5.6
51	19 -25 Dec.	1.10	23.3	7.5	0.0	95	55	16.0	2.4
52	26 Dec. – 1 Jan.	1.35	20.6	7.6	0.0	93	60	17.6	2.6
1	2 – 8 Jan.	1.65	13.9	5.4	0.0	95	69	12.4	0.0
2	9 – 15 Jan.	2.05	17.8	6.3	0.0	95	68	10.2	0.3
3	16 – 22 Jan.	2.15	20.4	7.4	0.0	93	46	8.8	3.3
4	23 – 29 Jan.	2.10	22.3	18.8	0.0	92	71	8.4	1.3
5	30 Jan.- 5 Feb.	2.50	22.7	9.7	0.0	91	59	9.6	5.9
6	6 – 12 Feb.	3.15	28.1	10.9	0.0	90	51	10.6	9.3
7	13 – 19 Feb.	3.85	26.7	11.1	0.0	83	50	13.6	8.1
8	20 – 26 Feb.	4.8	31.0	11.8	0.0	92	47	14.0	7.1
9	27 Feb.- 5 Mar.	5.65	31.2	14.4	0.0	92	53	15.2	8.0
10	6 – 12 Mar.	6.40	30.4	15.1	0.0	47	54	18.2	7.1
11	13 – 19 Mar.	7.00	30.3	15.8	0.0	90	60	16.8	5.8
12	20 – 26 Mar.	7.55	29.1	15.7	0.0	93	67	17.8	5.9
13	27 Mar. – 2 Apr	8.15	32.2	16.7	0.0	82	43	20.4	7.3
14	3 – 9 Apr.	6.75	33.7	16.8	0.0	65	28	21.4	8.8
15	10 – 16 Apr.	5.60	37.5	18.3	0.0	52	18	23.4	8.3
16	17 – 23 Apr.	4.25	39.2	21.8	0.0	47	19	25.0	7.6
17	24 – 30 Apr	3.10	32.5	19.3	0.0	58	46	26.0	7.0

Table 4: Correction between Tomato fruit borer and abiotic factors 2022 – 23.

	Max Temp	Min. Temp	RH Morning	RH Evening	Evaporation (mm/day)	B.S.S.(hr)	Tomato fruit borer
Max Temp	1.000	0.829**	-0.693**	-0.715**	0.754**	0.729**	0.542**
Min. Temp		1.000	-0.653**	-0.416*	0.637**	0.480*	0.528**
RH Morning			1.000	0.655**	-0.735**	-0.541**	-0.395
RH Evening				1.000	-0.643**	-0.536**	-0.105
Evaporation (mm/day)					1.000	0.432*	0.348
B.S.S.(hr)						1.000	0.648**
Tomato fruit borer							1.000

*Correlation is significant at the 0.01 level; **Correlation is significant at the 0.05 level

CONCLUSIONS

Initial incidence of the *Helicoverpa armigera* Hubner was observed on 3.12.2021, in 48th standard week i.e., with a mean number of fruit infestation of 0.05. The fruit damage reached to peak by March 23, 2021 with mean larval population of 7.70 during 12nd standard week.

More or less similar results of larval population of *H. armigera* were recorded during 2022-23. Initial incidence of the pest was observed on 2.12.2022, in 48th standard meteorological week i.e., with a mean fruit infestation of 0.20. The fruit damage reached to peak by March 28, 2023 with mean larval population of 8.15 during 13th standard meteorological week.

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