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Helicovepaarmigera Pest Population Prevalence on Tomato in Sitarganj, Uttarakhand: The Effect of Abiotic Variables

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Abstrat: The impacts of several abiotic conditions on the population of the tomato fruit borer Helicoverpaarmigera were examined in Sitarganj Udham Singh Nager between September 2023 and January 2024. In this exploration, we examined the intricate relationship of abiotic parameters (like temperature, moisture, and rush) on the prevalence of pest populations. Our findings revealed that the population of H. armigera larva reached its peak 4.2 mean in 45th week when the maximum and minimum temperature was 28.7°Cand 13.8℃, respectively, relative humidity Morning and evening 89.6% and 41.7 rainfall 0.0 mm was recorded.. The larva popullation, a non-significant positive relationship was set up between larval populations with maximum ,minimal temperature and sun hour (r= 0.6041), (r= 0.2223), and (r = 0.7174), independently. A non-significant positive relationship was set up independently amid larval populations with morning RH and Evening (r=-0.6731) and (r= -0.8226). These findings provide valuable insights into the relationship between abiotic parameters and the prevalence of the pest population, which can aid in developing effective pest management

Keyword: Helicoverpaarmigera, correlation ,abiotic parameters, tomato pest , tomato fruit borer

Introduction

The dangerous insect Helicoverpaarmigera, often known as the maize earworm or cotton bollworm, mostly affects temperate and subtropical countries. This little bug might cause significant harm to tomatoes. In India, H. armigera, a major nonentity pest in agriculture, is treated with 50% of crop protection treatments. The pest's multivoltine nature, quick movement, fecundity, hostile feeding habits, overlapping generations, and direct attack on structures undergoing reconstruction exacerbate the problem.

Identifying the seasonal cornucopia may enhance integrated pest treatment, but it requires precise ecological data. Numerous environmental factors affect the populations of nonentity pests. In the emergence and spread of nonentity pests, abiotic factors are crucial. In Uttarakhand, a state in northern India with a diverse topography and climate, Helicoverpaarmigera's existence and behavior may be influenced by a variety of abiotic variables. Examining a range of abiotic factors and their effects on Helicoverpaarmigera's seasonal predominance, this study adopts a comprehensive methodology. The seasonality of the tomato fruit borer will surely aid in the development of nonentity pest management methods for H.

armigera in Udham Singh Nagar. Understanding the impact of different abiotic factors on Helicoverpaarmigera seasonal predominance has been attempted.

Material and methods

The study area is located in Sitarganj district Udham Singh Nager. It situated an altitude range of 93°N 79.70°E . and an average elevation of 298m above the sea level. The field trial was conducted at the Sitarganj(Fig. 1). The sonais the name of the tomato variety cultivated inSitarganj. In a 5 × 4 m2 experimental plot, seedlings were planted in a randomized full block pattern with a 10 cm factory-to-plant and 30 cm row-to-row spacing. With the exception of factory protection measures that allowed H. armigera (Fig. 2) to grow in an area devoid of fungicides, all advised agronomic methods were followed during the crop's production. The larval population was observed once a week on a single farm. Data was collected between the first week of September 2023 till the December 2024. The population of H. armigera larvae was recorded on ten randomly selected plants For the study and its conclusions, meteorological data were obtained from the meteorological department unit of GOVIND BALLABH PANT UNIVERSITY OF AGRICULTURE & TECHNOLOGY. The meteorological parameters correlating with the incidence of tomato insect pests included relative Humidity (Morning and Evening), Maximum and Minimum Temperatures, daylight hours, Rainfall, and Sunshine hours. The relationship between the frequency of pests and the meteorological data was analyzed using the correlation method.

Result and discussion,

The 35SW (0.5) had the first recorded occurrence of the pest. In that time frame, the highest and lowest temperatures, morning-evening relative humidity (RH), rainfall, and hours of darkness were 34.0, 25.6, 91.3, 7:12, 62.1, (14.12), 0.0, and 8.2 hours, respectively. When the maximum-minimum temperature and morning-evening relative humidity (RH) were 28.7 13.8, 89.6 (07:12am), and 41.7 (14:12pm), respectively, the maximum larva was 45 SW (4.2). At the beginning of the 47 SW the larva were decline. The flowering and fruiting stages of the tomato correspond with the peak population of H. armigera, as demonstrated by Kamble et al. (2005).

Fig 3: Fruit from an infected tomato As the crop approached maturity and had fewer

Larvae per plant, it was noted that the number of H. armigera was declining during the 21s SW. Chakraborty et al. (2012) observed similar outcomes, noting that the quantity of larvae started to decrease as the plant age neared the terminal stage. In a similar vein, Patel et al. (1998) highlighted the appearance of a pest population that was noted from November to February and peaked in December. Singh et al. (2011) state that Helicoverpaarmigera original population grew steadily. Although it was restricted to vegetative growth, it quickly spread throughout the fruiting stage and peaked during the second week of November, which is the 47" standard week; following that, fewer pests were seen.

Infected tomato fruit

H.armigera

Study site

Table 1:-Weekly meterological data about larval population recorded during the crop growth period (2023-2024)

Month	Metro week	Maximum temp	Minimum temp	MRH% Morning	ERH% Evening	Rainfall (mm)	Sunshine (Hr)	Sitarganj
								Place 1
Sep	35	34.0	25.6	91.3	62.1	0.0	8.2	0.5
Sep	36	34.3	25.4	88.4	67.6	42.0	5.6	1.0
Sep	37	31.0	25.4	91.1	74.6	152.0	4.4	1.3
Sep	38	32.6	24.6	90.4	69.7	47.4	6.7	2.0
Oct	39	32.9	23.5	88.6	57.9	60.2	8.0	2.0
Oct	40	33.6	22.8	88.7	51.7	0.0	9.2	2.5
Oct	41	33.0	19.3	79.6	46.7	0.0	8.8	2.8
Oct	42	30.2	16.3	84.1	48.6	7.4	7.1	3.2
Oct	43	30.9	14.3	88.9	36.9	0.0	9.7	3.6
Nov	44	30.4	15.2	86.4	40.7	0	8.2	3.8
Nov	45	28.7	13.8	89.6	41.7	0	6.3	4.2
Nov	46	28.5	12.7	87.1	40.7	0	7.2	3.5
Nov	47	27.4	11.3	91.6	42.7	0	8.1	2.9
Nov	48	26.2	13.0	84.7	49.6	0	4.4	2.3
Dec	49	26.5	10.9	85.3	42.4	1.0	7.8	2.1
Dec	50	22.8	5.9	93.6	47.0	0	6.5	1.5
Dec	51	22.9	6.0	92.0	41.6	0	6.5	1.2
Dec	52	22.0	8.4	93.1	59.6	0	5.5	1.0
Jan	1	17.5	7.9	94.7	69.7	0	2.2	0.5
Jan	2	14.1	7.7	93.7	79.4	0	0.2	0
Jan	3	13.4	6.8	95.7	85.7	0	1.2	0
Jan	4	13.6	4.6	96.0	77.4	0	1.4	0

Table 2:- Correlation coefficient between meteorological condition and the occurrence of tomato Helicoverpaarmigera larvae

Correlation coefficient(r)		
Season	Weather parameter	Correlation coefficient
		Sitarganj
		Place 1
Sep 2023- Jan 2024	Maximum Temperature	r = 0.6041
	Minimum temperature	r = 0.2223
	Relative Humidity morning	r = -0.6731
	Relative Humidity evening	r = -0.8226
	Rainfall	r = -0.1129
	Sunshine	r = 0.7174

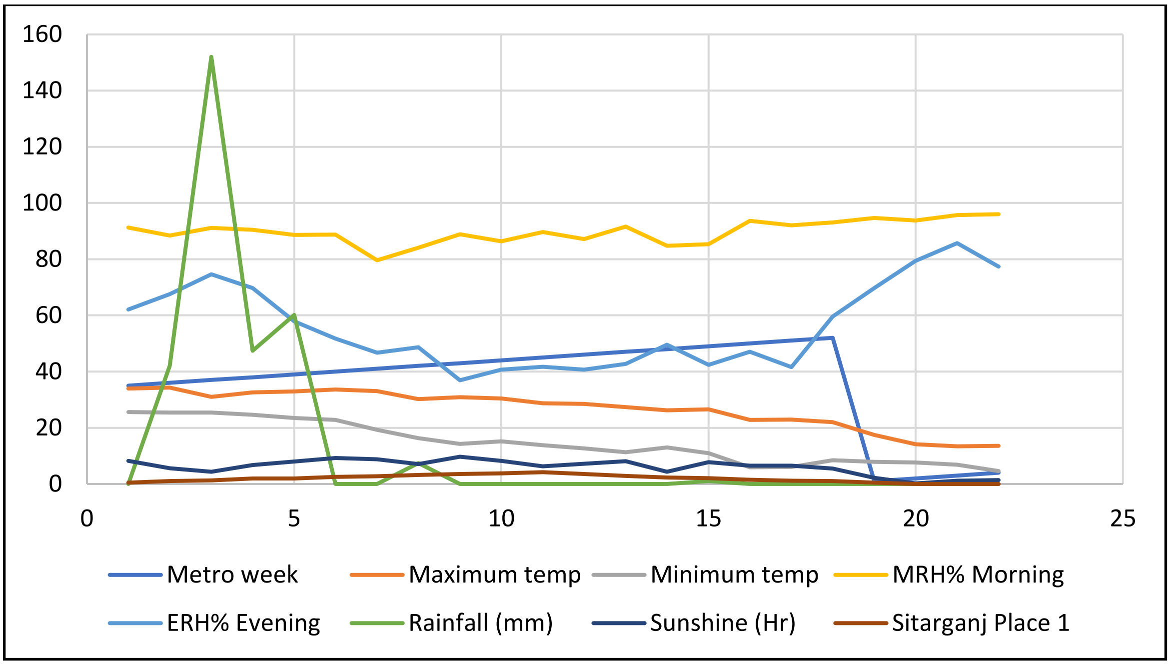

Table 2 displays information regarding the impact of meteorological factors on the growth of the pest population. There is a positive association (r = -0.8226) between the relative wetness in the evening and the quantity of larvae. Additionally, a non-significant positive connection was found between the larval population and the minimum, maximum, and between solar hours, with independent values of (r = 0.6041) and (r = 0.2223). (r = 0.7174) Rainfall and morning relative humidity had a non-significantly negative relationship with the larval population (r = -0.1129 and -0.6731, respectively).

As stated by Kharpuse (2005) and Mandal (2012) , Helicoverpaarmigera is a significant tomato fruit borer pest that affects the crop during its whole reproductive cycle. Our data is consistent with Yadav et al.'s (1991) findings, which state a substantial positive correlation between H. armigera with both maximum and minimum temperature and a negative correlation with relative humidity. The H. armigera population showed a significant and positive connection with both minimum temperature (0.289) and maximum temperature (0.224), according to Kakati et al. (2005). And the relative humidity in the morning. Chula et al. (2017) found that the larval population showed a positive association with the lowest and highest temperatures but a negative correlation (r = -0.830 and -0.369) with relative humidity. These findings are comparable to those of Singh and Gupta (2017) and Vikram et al. (2018), who discovered that the population of H. armigera exhibited a positive association with temperature (maximum, minimum) and a negative correlation with relative humidity (morning, evening). Meena et al. (2014) discovered a negative and non-significant association between the minimum and maximum temperatures, which contrasts with the current findings.

Conclusion:

The present study's findings revealed that the tomato fruit borer, Helicoverpaarmigera, first appeared during the first week of September and remained active in the field until the third week of January. This clearly indicates that the pest persists throughout the major growing period of the tomato crop. The population gradually increased as the season progressed, reaching its peak during the third week of November. This period of maximum infestation coincides with the fruiting and ripening stages of the crop, during which the damage caused by H. armigera can lead to severe economic losses if not managed properly.

Therefore, the timing of pest management practices is of critical importance. Based on the observed pest dynamics, it is recommended that insecticidal sprays should be carefully scheduled before the population reaches its peak, ideally during the early stages of infestation, rather than in November when the population is already at its highest. Spraying insecticides during the peak period may not only be less effective but can also increase the risk of pesticide resistance and harm to beneficial natural enemies. Hence, preventive and integrated pest management strategies, including monitoring, and application of eco-friendly bioagents or botanical insecticides, should be initiated from September onwards to effectively suppress the buildup of H. armigerapopulation and minimize crop damage.

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