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Seasonal incidence of tomato fruit borer, *Helicoverpa armigera* (Hubner) and their correlation with abiotic factors

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Abstract
The results revealed that the population of fruit borer appeared on tomato fruit borer *Helicoverpa armigera* (Hub.) cultivar i.e. Selaction 22 was conducted during September. to March 2015 at Central Research Farm, SHIATS, Naini, Allahabad. The occurrence of tomato fruit borer commenced from 8rd standard week (February third week) with an average population of 2.04% infestation. The tomato fruit borer, *Helicoverpa armigera* (Hub.) population increased and gradually reached its weak 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. To know the effect of abiotic factors on the incidence of fruit borer on tomato, the correlation coefficient was worked out between mean fruit borer population and weather parameters. The maximum and minimum temperatures showed significantly positive correlation whereas, the relative humidity revealed negative significant correlation with fruit borer population, respectively. The rainfall showed significantly negative correlation with fruit borer population. The wind velocity and sunshine showed significantly positive correlation with fruit borer population on Tomato.

Keywords: Tomato, *Helicoverpa armigera,* incidence, rainfall, population, temperature

Introduction
Tomato, *Lycopersicon esculentum* (Miller) new name *Solanum lycopersicon*, is one of the most popular and nutritive vegetable crops grown all over the world. Tomato belongs to family Solanaceae and is native of Peru and México. It is a warm season crop. It is grown as an off-season vegetable in the hills of India and farmers fetch good income after sending their produce in the plains from June to September. The fruit can be eaten raw or cooked. Tomato in large quantities is used to produce soup, juice, ketchup, puree, paste and powder. Tomato, *Lycopersicon esculentum* (Mill.) is an important vegetable crop grown around the world occupying the daily food regime of a majority of people (Hussain and Bilal, 2007) [6]. In India tomato crop is mainly grown in the states of M.H, A.P. Orissa, West Bengal, Karnataka, Jharkhand, Gujarat, Tamil Nadu, U.P. Rajasthan *etc*. Total area under the tomato crop in India is about 864 thousand hectare with production of 16826.4 thousand metric tones. (Anonymous, 2010-2011) [1]. The recent production of tomato in India is about 964 thousand hectare with production of 23986.97 thousand metric tones (Anonymous, 2013) [2]. Insect pest act as a limiting factor in harvesting high yields of healthy and quality of tomato fruits. About 16 insect and other pests species which caused damage to tomato crop in India. Among the various pests, the tomato fruit borer, *Helicoverpa armigera* Hub. (Lepldoptera: Noctuidae) is the most destructive. It is found round the year all over our country causing damages to a variety of host plants *viz.,* pulses, millets, cotton, vegetables. Tomato fruit borer, *Helicoverpa armigera* is an important pest which causes considerable losses in quantity as well as quality of tomato fruits. The monetary loss due to this pest in India has been estimated over rupees one thousand coror per year and yield losses ranged from 14 – 100 percent on different crops. (Singh and Singh, 1975) [13], (Yadav, 1980) [15] and (Kakar *et al*. 1980) [7]. The pest is highly poly phagous and is reported on nearly 181 host plants (Manjunath *et al.* 1987) [9]. At the same time adequate ecological data The knowledge on the seasonal incidence of fruit borer will certainly be helpful in formulating the insect pest management strategies for *H. armigera*. Hence, the present study was taken up to investigate the seasonal occurrence of *H. armigera* at Allahabad conditions.

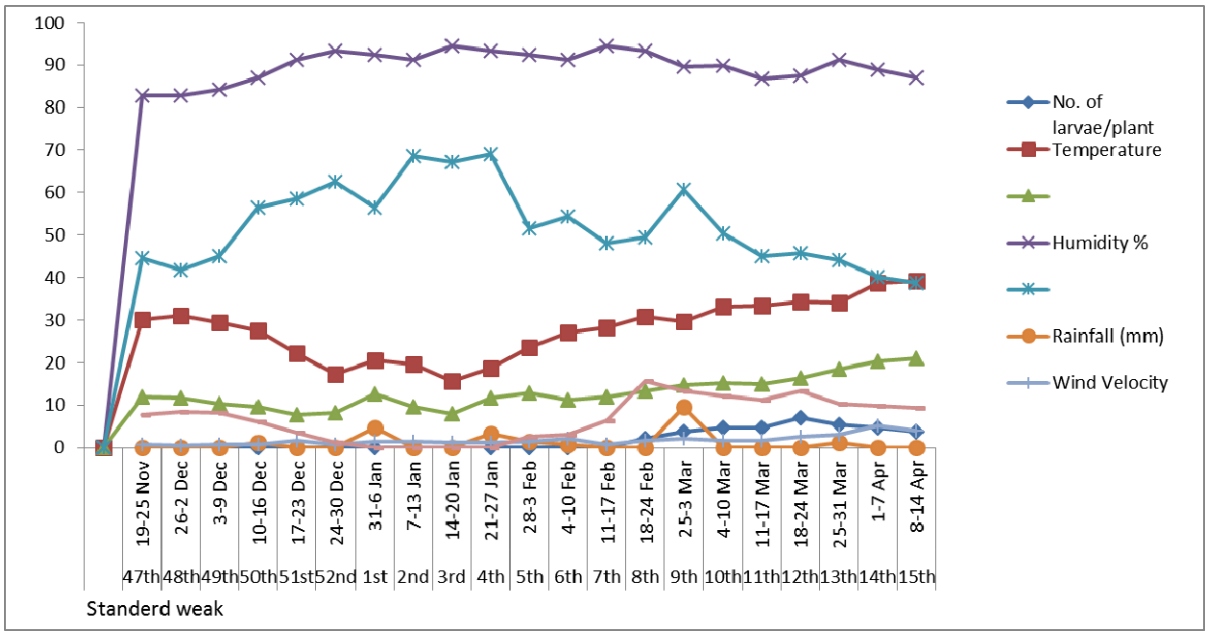
Materials and Methods

The present investigation was conducted at the Agricultural Research Farm Station of "Sam Higginbottom Institute of Agriculture, Technology and Sciences" Allahabad, Uttar Pradesh during *Rabi* season 2014-2015. The research farm is situated on the right side of Allahabad Rewa road at 20 degree and 150 North, 600.03 east longitude city and is about 129.2 cm above sea level. The site selected was uniform, cultivable with typical sandy loam soil having good drainage. Tomato variety selection 22 was sown on 10th September, 2014. Seed rate 375gram/ha. The seedlings of the one month. The sowing was transplanted plant to plant and row to row spacing of 60 X 45 cm. was maintains b/n seedlings Gap filling was done. 10 days later to ensure uniform plant population in each plot. The observation also recorded at weekly interval from the time of sowing to harvesting. Data recorded on insect pest and metrological parameters were statistically analyzed. Simple correlation was computed between population of pest, damage indices and abiotic factors, *viz.*, minimum and maximum temperature, relative humidity, sunshine hours, rainfall were collected from of the unit of Department of Agro metrology, SHIATS, Allahabad Uttar Pradesh. The data of incidence population fruit borer and correlation between fruit borer and weather parameters are presented given in the table.1.1

Results and Discussion

Table 1.1: Occurrence of tomato fruit borer, *H. armigera* (Hubner) and weather parameters during *Rabi* season, 2014-2015.

Standard week	Date	No. of larvae/plant	Temperature		Humidity %		Rainfall (mm)	Wind Velocity	Sunshine (hr/day)
			Max.	Min.	Morning	Evening			
47th	19-25 Nov	0	30.02	11.88	82.71	44.57	0.00	0.64	7.8
48th	26-2 Dec	0	31.05	11.62	82.71	41.85	0.00	0.52	8.44
49th	3-9 Dec	0	29.54	10.37	84.28	45.14	0.00	0.69	8.28
50th	10-16 Dec	0	27.51	9.54	87	56.42	1.20	0.73	6.22
51st	17-23 Dec	0	22.25	7.84	91.28	58.57	0.00	1.77	3.51
52nd	24-30 Dec	0	17.20	8.2	93.42	62.57	0.00	0.83	1.10
1st	31-6 Jan	0	20.65	12.74	92.28	56.42	4.71	1.46	0.00
2nd	7-13 Jan	0	19.71	9.65	91.28	68.57	0.00	1.40	0.00
3rd	14-20 Jan	0	15.71	7.92	94.57	67.14	0.00	1.29	0.00
4th	21-27 Jan	0	18.62	11.64	93.42	69.14	3.28	1.25	0.00
5th	28-3 Feb	0	23.62	12.90	92.28	51.57	1.51	1.43	2.65
6th	4-10 Feb	0	27.08	11.17	91.28	54.42	0.74	2.10	3.08
7th	11-17 Feb	0	28.20	11.94	94.57	48.14	0.00	0.79	6.45
8th	18-24 Feb	2.04	30.85	13.34	93.42	49.42	0.82	1.68	15.68
9th	25-3 Mar	3.8	29.58	14.71	89.57	60.57	9.62	2.16	13.35
10th	4-10 Mar	4.6	33.20	15.11	89.85	50.42	0.00	1.73	12.20
11th	11-17 Mar	4.67	33.37	15.02	86.71	45.14	0.02	1.78	11.25
12th	18-24 Mar	7.05	34.31	16.45	87.57	45.71	0.00	2.66	13.25
13th	25-31 Mar	5.45	34.14	18.37	91.14	44.14	1.20	3.09	10.32
14th	1-7 Apr	4.6	38.76	20.24	89	40.23	0.00	5.23	9.73
15th	8-14 Apr	3.75	39.25	21.00	87	38.74	0.00	4.02	9.32
		r=	0.652	0.762	-0.830	-0.369	0.158	0.798	0.373
		t=	3.858	4.433	-6.756	-1.841	0.663	4.763	1.427
		F- test	S	S	Ns	NS	S	S	S



Occurrence of tomato fruit borer, *H. armigera* (Hubner) and weather parameters during *Rabi* season, 2014-2015

The results showed that the larval population of *H. armigera* was recorded with peak period during entire crop season first from the 8Th standard week (February third week) with an average 2.04 larva/ plant. The larval population has been fluctuate with a biotic environmental factors and second from the 12st standard week (March third week). The infestation per cent increased and gradually reached peak level of 7.05 larva/plant (March last week) in year 2015 and There after declined trend was observed due to increasing of maximum and minimum temperatures as optimum weather condition and decrease sharply it further increase in temperature. The larval population showed a positive correlation with minimum and maximum temperatures (r = 0.652 and 0.762 respectively), however it showed negative correlation with relative humidity (r = -0.369 and - 0.830) and rainfall (r = 0.158) during 2015 respectively. Relative humidity was the other most important factor closely related to the activity of the pest. The correlation coefficient of the both morning and evening (minimum and maximum) relative humidity was -0.369 and -0.830. The relative humidity recorded during the 12th and 13th standard week may be optimal for the larval development and in this period the higher incidence of larvae was observed in year. The population of *H. armigera* flourished during second half of February outbreak situations were found throughout March Lal, 1996 [1]. Probably owing to the optimum temperature and abundant food in the fruit. This is in accordance with other studies which state at the peak of *H. armigera* larval population generally corresponds to appropriate climatic conditions (Agrawal *at al,* 2013 and Sarwar, M. 2012) [3, 12]. Full bloom and fruit formation stage of the crop (Lal, 1996; Patel and Koshiya, 1999) [1, 11]. Rainfall is considered as most important factor for the regulating insect population. During the time investigation period a total rainfall 30.85 mm was received which was more less equally distributed in March. The correlation coefficient (0.082) indicated positive relationship between the larval population and rainfall but it is non-significant. According to. Early good rain in September or October favored the buildup of the first generation larval population of chickpea fruit borer. The distribution range was such that a non significant positive correlation was established between rainfall and incidence of tomato fruit borer. The wind velocity beings important metrological factor in the closely related the air. Form the data it was evident that wind velocity gradually increased throughout the crop period. The correlation coefficient (0.798) indicated that the wind velocity and the incidence of the larvae were non-significant positively correlated with each other. The sunshine (hrs/day) beings on important metrological indicator in the closely related the temperature. Hossain *et al.* (2007) [6] From the data it was evident that sunshine hours gradually increased throughout the crop season. The correlation coefficient (0.373) indicated that the sunshine hours and the incidence of the larvae were non-significant positively correlated with each other

Conclusion

The larval population of *H. armigera* observed during *Rabi* season 2014-15 showed that the activity continued throughout the crop season with larval population peaking twice. The highest mean population of 7.05 larva/plant was observed during at 12th standard week in year. There was a significant positive correlation between both minimum and maximum temperature and the pest incidence observed. Rainfall is considered as most important factor regulating the insect population. The correlation coefficient indicated negative relationship between the larval population and rainfall.

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