Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2018; 6(2): 399-401

Received: 14-01-2018
Accepted: 18-02-2018

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Effect of weather parameters on seasonal abundance of fruit borer, *Helicoverpa armigera* (Hubner) infesting tomato

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Abstract
The present investigation entitled "Seasonal incidence fruit borer, *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) infesting tomato" was carried out during *rabi* season in 2015-16 at the Central Experimental Station, Wakawali, Dist.-Ratnagiri. The study revealed that there were marked differences in fruit borer infestation as regard Standard Meteorological Weeks. The initiation of pest incidence was found in the first week of January. During the cropping season the fruit damage varied from 7.88 to 42.83 percent on a number basis. Minimum (7.88%) fruit borer infestation was recorded in 14th SMW (2-8 April), while maximum (42.83%) fruit borer infestation was recorded during 11th SMW (12-18 March). It was evident from the results that tomato fruit borer, *H. armigera* incidence increased gradually with the advancement of the cropping season.

Keywords: *Helicoverpa armigera*, tomato, seasonal incidence

Introduction

Tomato (*Solanum lycopersicon* L.) is one of the major and remunerative vegetable crops which have achieved tremendous popularity over the last century. It is grown worldwide either in the field, green houses or net houses. It is one of the most important protective crops. It is grown either for fresh fruits or for processing. Tomatoes provide an excellent amount of vitamin C, a very good amount of the mineral manganese and vitamin E. In terms of phytonutrients, it includes flavanones, flavonolsand carotenoids like lycopene, zeaxanthin and beta-carotene. Reduced risk of heart disease is an area of health benefits in which tomatoes truly excel. There are two basic lines of research that have repeatedly linked tomatoes to heart health. The first line of research involves antioxidant support and the second line involves regulation of fats in the blood stream (Mateljan, 2006) [8].

India ranks second in tomato production after China. The total of the area of various vegetables in India is 92.05 million hectares with production of 162.18 million tonnes, of which tomato is cultivated in an area of 882,000 hectares with total production of 18735.9 MT and average productivity of 21.2 tonnes per hectare in 2013-14. It contributes 9.4 percent of total vegetable area and 11.5 percent of total vegetable production. The major tomato producing states are Andhra Pradesh (17.90%), Karnataka (11.04%), Madhya Pradesh (10.34%), Maharashtra (6.40%), Bihar (5.67%), Uttar Pradesh, Orissa and Assam. In Maharashtra, tomato is grown over an area of 50,000 hectares with a production of 1200 metric tons and productivity is 24 tons per ha during 2013-14 (Anon, 2014).

More than 100 insect pests and 25 non-insect pests are reported to ravage the tomato fields (Lange and Bronson, 1981) [5] and among them, fruit borers are of much significance and causes extensive damage to fruits. Among fruit borers, *Helicoverpaarmigera* (Hubner) is responsible for considerable losses in quantity as well as quality of tomato fruits (Reddy and Zehr, 2004) [10]. *H. armigera* is a cosmopolitan, polyphagous pest.Fruit borer infesting tomato has been found to cause a yield loss of up to 35 percent in tomato and up to 37.79 percent loss in Karnataka (Dhandapani *et al.*, 2003) [3].

For developing an effective pest management strategy it is necessary to know population dynamics of the pest and to have a continuous vigil on the pest complex under agroclimatic conditions prevailing in a particular area. There are many environmental factors which influence the insect pest populations (Lode and Sharma, 1993) [6]. Among them abiotic factors play a vital role in their multiplication and distribution.

With the the view of obtaining information regarding the effect of weather parameters on the incidence of tomoto fruit borer infestation, the present investigation were undertaken.

Materials and Methods

To study the seasonal incidence of fruit borer, *H. armigera* infesting tomato, a field experiment was carried out at Central Experiment Station, Wakawali, from October 2015 to April 2016.

Details of the field experiment:

S. No	Size of plot	:	27.72 m^2 (Gross) 16.20 m^2 (Net)
1	Method of planting	:	On ridges and furrows
2	Spacing	:	60 cm x 60 cm
3	Cultivar	:	ArkaAlok
4	Date of transplanting	:	8th November, 2015

Method of recording observations

Seedlings of the tomato cultivar, Arka Alok (25 days old) were transplanted in the well prepared field. All recommended cultivation practices were followed.

All four blocks were kept unsprayed throughout the cropping season. The observations were recorded when incidence was noticed. Observations were recorded in each block on all the plants. The number of healthy and infested fruits was counted at each picking to work out the percent fruit infestation.

Percent fruit infestation was calculated by the following formula:

$$\text{Per cent fruit damage (\%)} = \frac{\text{No. of infested fruit}}{\text{Total number of fruits}} \times 100$$

Results and Discussion

The data on seasonal incidence of fruit borer, *H. armigera* infesting tomato are presented in Table 1.

The study revealed that there were marked differences in fruit borer infestation as regard Standard Meteorological Weeks. The initiation of pest incidence was found in the first week of January. During the cropping season the fruit damage varied from 7.88 to 42.83 percent on a number basis. Minimum (7.88%) fruit borer infestation was recorded in 14th SMW (2-8 April), while maximum (42.83%) fruit borer infestation was recorded during 11th SMW (12-18 March). It was evident from the results that tomato fruit borer, *H. armigera* incidence increased gradually with the advancement of the cropping season.

Similar results were reported by Tewari and Krishna Moorthy (1984) [16]. They found that tomato harvested during January-February and March-April, 18.00 and 21.64 percent of the total number of fruits were damaged, respectively. Similarly Devi *et al*. (1991) [2] observed that the pest was first noticed in the third week of March.

Lal and Lal (1996) [4] reported that during early March the infestation of *H. armigera*was found on flowers, flower buds and young developing fruits, while by the end of March or early April, the green fruits were badly damaged. Ravi and Verma (1997) [9] revealed that the incidence of *H. armigera* started by first week of January (0.3 larvae per 10 plants) and reached to its peak (23 larvae per 10 plants) by March (7th SMW), while Reddy and Kumar (2004) [11] noticed that the maximum incidence of fruit borer, *H. armigera* was during March to April.

Singh *et al*. (2010) [14] found that the maximum larval population was observed in the crop on 12 and 13 Standard Meteorological Weeks (10 and 13 larvae/ 10 plants respectively) during the year 2006-07. Sharma *et al*. (2012) [13] noticed that the fruit borer population first recorded in the 13th SMW (3.00 borers/ plant). Singh (2013) [15] reported that the first appearance (0.12 and 0.10 larvae/m row) of *H. armigera* on tomato was recorded in the last fortnight of December (50th and 52nd SMW) and attained its peak *i.e.* 52.20 and 55.75 percent in a 15th standard week. Selvaraj and Bisht (2014) [12] noticed that the fruit borer marked its first appearance (1.0 larva/ plant) and attained a peak population (8.55 larvae per plant) in 7th and 9th SMW *i.e.* (February and March) and in 16th SMW (April), respectively. Waluniba and Ao (2014) [17] revealed that the highest fruit borer infestation (1.88/ plant) on a number basis followed by (1.43/ plant) was observed on 9th SMW. Mandloi *et al.* (2015) [7] also reported that the peak activity of *H. armigera* (6.11 larval population/ plant) was during 19th to 25th March 2013.

Table 1: Mean percent infestation of fruit borer, *H. armigera* infesting tomato in relation to weather parameters

SMW No.	Temperature (^{0}C)		Relative humidity (%)		BSS*	Mean percent infestation
	Tmax	Tmin	RH I	RH II		
1	31.38	11.31	73.29	48.71	7.61	20.83
2	31.02	12.45	74.14	66.00	7.51	22.22
3	31.23	9.29	81.14	60.29	8.29	24.27
4	31.53	10.65	72.71	61.86	7.84	27.76
5	32.30	14.43	69.14	67.29	8.44	29.57
6	32.01	11.94	73.43	61.57	7.86	33.33
7	30.14	11.55	82.71	69.00	8.31	35.69
8	31.93	14.49	79.43	68.86	7.86	38.89
9	31.64	14.06	67.63	65.88	6.06	41.18
10	32.09	15.49	77.57	64.71	7.57	41.25
11	32.02	14.91	68.29	66.29	8.17	42.83
12	32.83	15.26	70.29	67.00	8.09	35.06
13	32.82	16.79	80.43	73.71	7.53	20.59
14	32.30	18.46	70.14	77.86	6.14	07.88
15	32.53	18.17	76.00	77.00	8.10	0.00

*Bright Sun Shine Hours

Conclusion

During present investigations, the study on seasonal incidence of fruit borer, *H. armigera* infesting tomato revealed that there were marked differences in fruit borer infestation as regard Standard Meteorological Weeks. The initiation of pest incidence was found in the first week of January. During the cropping season the fruit damage varied from 7.88 to 42.83 percent on a number basis. Minimum (7.88%) fruit borer infestation was recorded in 14th SMW (2-8 April), while maximum (42.83%) fruit borer infestation was recorded during 11th SMW (12-18 March). It was evident from the results that tomato fruit borer, *H. armigera* incidence increased gradually with the advancement of the cropping season.

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