



## Population Dynamics of Fruit Borer *Heliothis armigera* on Different Varieties of Tomato Crop

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### Abstract

During the field experiments, population dynamics (multiplication per day, infestation per fruit and infestation rate) of *Heliothis armigera* were observed on different tomato varieties such as Arka abha, Arka Saurabh, Pant bahar, Ratna, and Pusa Gaurav. The minimum infestation (3.01%) of *H. armigera* during the cropping season was observed in tomato variety Pant Bahar at 9<sup>th</sup> standard week in 81 days old crop. While maximum infestation (38.33%) of pest recorded on tomato variety Pusa Gaurav at 14<sup>th</sup> standard week in 116 days old crop. The minimum intensity (0.04 larva/fruit) was found in 9<sup>th</sup> standard week in 81 days old crop while it was maximum (0.54 larva/fruit) at 14<sup>th</sup> standard week in 116 days old crop of tomato. The minimum multiplication (0.06 per day) found at 12<sup>th</sup> standard week and 102 days old crop. The maximum multiplication (0.96 multiplication per day) found at 10 February, 11 standard week and 95 days old crop. The infestation of the tomato fruit borer with its intensity increases continuously till the last picking of the fruit February to March found as conducive period.

**Keywords:** Bioindicator, *Heliothis armigera*, Pant bahar, Pusa Gaurav, Arka abha, Arka Saurabh

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## 1. INTRODUCTION

India is one of the world's top producers of veggies. Currently, 84.8 million tons of vegetables are produced annually on 6.09 million hectares of land. The nation is fortunate to have a variety of climates in different seasons, which allows for the cultivation of more than a hundred different kinds of vegetables. Because they are high in vitamins and minerals, vegetable crops play a significant role in the human diet. There is no need to advocate for the preventive role that vegetables serve in the human diet. More than 70 different kinds of vegetables are grown in our nation, but some essential vegetables—such as tomatoes, brinjal, chillies, cauliflower, cabbage, peas, and a few significant cucurbits—have received the most attention. One of the most well-liked and extensively cultivated vegetables among them is the tomato (*Lycopersicon esculentum* Mill.), a member of the Solanaceae family. This crop is grown on 478 million hectares and produces 60616 million tons a year. After potatoes, tomatoes (*Lycopersicon esculentum* Mill.) are the second most important vegetable crop. Over the past century, the tomato has become one of the most popular vegetable crops. Phytochemicals and nutrients like lycopene, potassium, iron, folate, and vitamin C can be found in tomatoes (*Solanum lycopersicum*). In addition to lycopene and vitamin C, tomatoes include phenolic components such flavonoids, hydroxycinnamic acid, chlorogenic, homovanillic acid, and ferulic acid, as well as additional

antioxidants like beta-carotene. Tomatoes can be eaten raw or cooked without losing their nutritional value, and they can play a significant role in a balanced diet. More than 80% of tomatoes farmed for commercial purposes are used to make processed goods like ketchup, soup, and juice. A diet high in tomatoes and tomato-based products is known to have a number of health benefits, many of which are linked to the antioxidant content of tomatoes. The effects of growing circumstances on tomato cultivars and their health-related characteristics will be covered in this review. It is grown in net houses, greenhouses, and open fields in almost every nation on earth. The tomato plant is highly adaptable, and the crop can be separated into two groups: processing tomatoes, which are cultivated exclusively outside for the canning industry and mechanically harvested, and fresh market tomatoes, which are what we are concerned with. In both situations, global output and consumption have increased significantly during the previous 25 years. Approximately 100 million tons of fresh fruit are currently produced worldwide on 3.7 million hectares. There were reports of tomato production in 144 nations. Insect pests are one of the main causes of reduced tomato yields; they have been shown to damage tomatoes at every stage of crop growth. According to reports, the fruit borer, *Helicoverpa armigera* Hubner, does more damage than all other insect pests combined, with losses ranging from 20 to 50 percent. The primary hosts of *Helicoverpa armigera*, a polyphagous pest, are tomatoes and corn, followed by cotton, pepper, legumes, ornamental plants, etc. On the natural vegetation, it can finish the cycle. Larvae favor eating on plant sections with high nitrogen contents. The tomato's fruits are the most damaged section, but the blooms, stems, and leaves can also sustain damage, creating the ideal environment for rot or secondary pest attacks. One larva may attack several fruits per day if the fruits are small and the larvae are large. The rate at which *H. armigera* larvae develop can be influenced by the nutritional value of the host plants, which in turn can impact the pest's population dynamics. Additionally, plant characteristics are linked to insect performance through food consumption and utilization. An essential component of integrated pest management (IPM) is host plant resistance.

## 2. MATERIALS AND METHODS

The details of plant materials, methodology and techniques employed in the research work are given in the following chapter as under:-

The investigation on the population dynamics, economic status and management of tomato fruit borer *Heliothis armigera* had been carried out at the department of Zoology, Acharya Narendra Dev Nagar Nigam Mahila Mahavidyalaya, Kanpur during 2015-16 and 2016-17.

### 2.1 Experimental plan and layout

The experiments for determining population were carried out in winter season at A.N.D. College, Kanpur. About one-month old nursery plants, sown on 5th November, 2016. In a plot, measuring 3522 m, having three replications in randomized block design (R.B.D.) with 1.0 m block border. The plots measuring 6.03.0 m was separated by 0.5m border. The distance between rows and plants 7575 cm. Completely randomized design (C.R.D.) for laboratory experiments and randomized block design (R.B.D.) for field experiments will be employed.

The seedling of tomato varieties Arka Abha, Arka Saurabh, Pant Bahar, Ratna, Pusa Gaurav were sown on 5th November 2016 in botanical garden of A.N.D. College, Kanpur. To determine the economic status of the pest in a field plot measuring 35.022.0 m having three replications in randomized block design, surrounding by a border of 1.0 m and each replication was separated by 1.0 m broad irrigation channel or block border. The plot was measuring 6.03.0 m having a plot border of 0.75m. The main irrigation channel was on one side of the experimental field within field border.

### 2.2 Nursery Raising

The seed of tomato variety, Arka Abha, Arka Saurabh, Pant Bahar, Ratna, Pusa Gaurav obtained from Vegetable Research Station, Kalyanpur, Kanpur were sown on November 5, 2016 at botanical garden of A.N.D. College, Kanpur. Raised beds of size 31 m and 15 cm in height were prepared. The nursery bed was maintained in the manner such that excess water may drain out easily. Weeding, light and irrigation were provided as and when required, till the seedling become ready for transplanting.

### 2.3 Field Preparation

Before transplanting the seedling, the experimental fields were well prepared by ploughings with soil turning plough –followed by two ploughing with cultivator and leveled by planking.

### 2.4 Irrigation

The experimental fields were kept moist by providing required irrigation in order to maintain the suitable crop

growth.

## 2.5 Cultural operation

Normal weeding and hoeing practices were adopted to keep the fields free from weed to increase soil aeration and to conserve the moisture.

## 2.6 Population dynamics

The incidence of tomato fruit borer was recorded at weekly intervals in the experiments starting from the first appearance of the pest after transplanting of crop and continued till the harvesting of the crop. The intensity and infestation of *Heliothis armigera* on fruit were recorded on ten randomly selected plants of tomato variety Arka Abha, Arka Saurabh, Pant Bahar, Ratna and Pusa Gaurav raised in three replications under field condition. The fruit at each picking of all plants were stored separately in infested and fresh fruits groups. The percentage infestation was calculated on the number and weight basis of healthy and damaged fruits and intensity was recorded by counting larval holes on damaged fruits.

## 3. RESULT AND DISCUSSION

The *Heliothis armigera* of the fruit borer on tomato was noticed with intensity of 0.04 larvae/fruit on 3.21 plants in the January at 81 days old crop, which continued with the intensity and infestation in next week i.e. 88 days old crop. The highest intensity of the *Heliothis armigera* recorded in 15 weeks and 14 weeks having 0.52 and 0.44 larvae/ fruit in 17,18 and 19 weeks having 0.40, 0.37 and 0.31 intensity larvae/ fruit of March on 137,144- and 151-days old crop, respectively (Table 1 and Figure 1).

The data recorded on table 1 and figure 1 shows that infestation in standard week 8,9,10,11,12 and 13, being 0.00%, 3.21%, 3.22%, 10.33%, 10.35% and 30.30% respectively in tomato variety Pusa Gaurav. The minimum multiplication found at 12th standard week and 102 days old crop (0.06 per day). The maximum multiplication found at 10 February, 11 standard week and 95 days old crop in 0.96 multiplication per day.

The data enumerated in table 1 and figure 1 indicated that the intensity of fruit borer *Heliothis armigera* was 0.04 larvae/fruit in January 9th week and 81 days old crop followed the 0.04, 0.18 and 0.18 larvae/fruit standard week 10, 11 and 12 of February on 88, 95 and 102 old crops. The maximum intensity 0.54 and 0.52 larvae/fruit 14 and 15 week of March on 116 and 1123 old crop respectively.

It is obvious from the table 1 and figure 1, the infestation of 27 January, 3 February, 10 February, 17 February and 24 February being 3.06%, 3.10%, 9.69%, 10.42% and 29.37% infestation respectively in variety Ratna. The maximum infestation found on variety Ratna 38.05%, 36.06% and 34.56 % in 14, 17 and 15 weeks of March on 116, 137 and 123 days old crop respectively. It is apparent from the data presented in table 1 and figure 1 that the maximum infestation found on variety Arka Saurabh 37.97% in 14th week of March on 116 days old crop and minimum 3.12 % in 10th week of February on 88 days old crop.

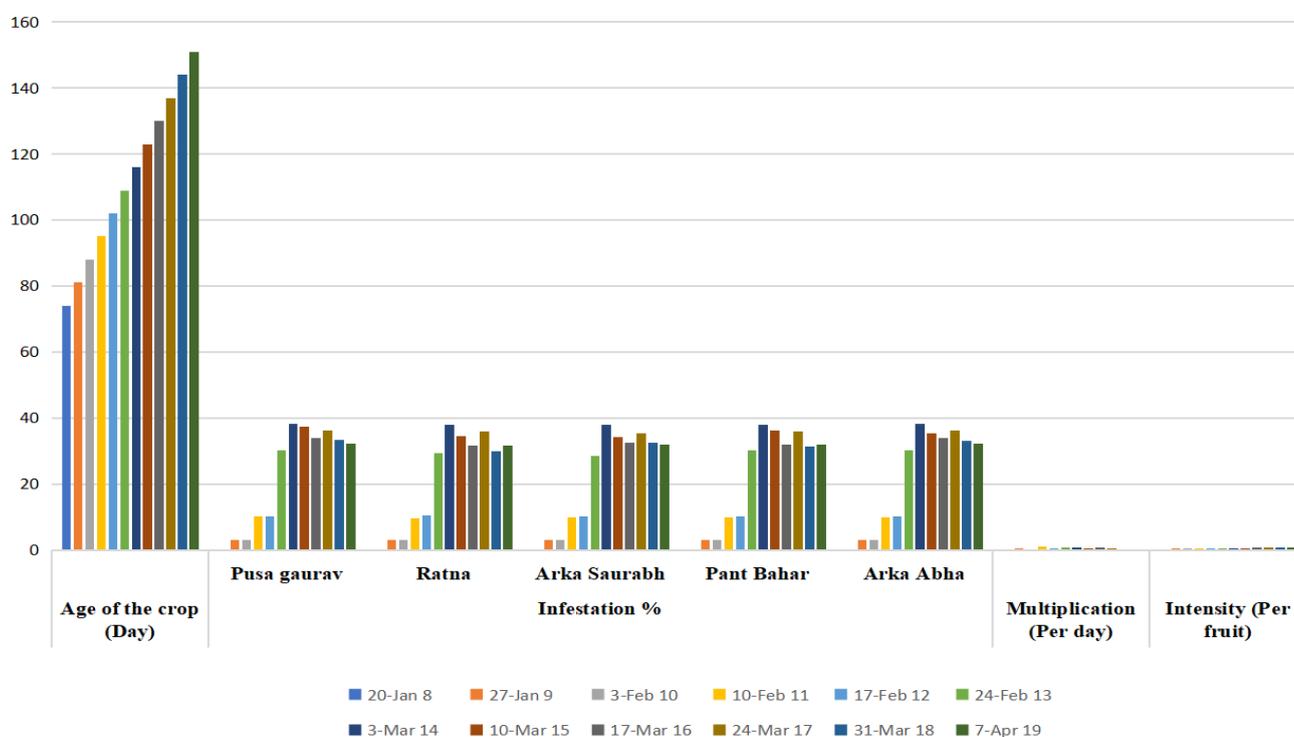
The trends of fruit borer infestation by *Heliothis armigera* on variety Pant Bahar, minimum 3.01 % 9th week of January on 81 days old crop and minimum infestation 38.08 % at 14th week of March on 116 days old crop followed by 32.32% and 36.04% infestation 15 and 17 weeks of March on 123 and 137 days old crop (table 1 and figure 1) respectively. The data recorded maximum infestation on variety Arka Abha was 38.26% in 14th week of March on 116 days old crop followed 36.19, 35.32, 33.83, 33.04, 32.13 and 30.22% at 137, 123, 130, 144, 151 and 109 days old crops of March and February respectively (Table 1 and figure 1).

**TABLE 1: Population Dynamics Of Fruit Borer *Heliothis armigera* On Tomato Crop**

Observation date	Standard week	Age of the crop (Day)	Infestation %					Multiplication (Per day)	Intensity (Per fruit)
			Pusa Gaurav	Ratna	Arka Saurabh	Pant Bahar	Arka Abha		
20 Jan	8	74	0.00	0.00	0.00	0.00	0.00	0.00	
27 Jan	9	81	3.21	3.06	3.14	3.01	3.18	0.46	
3 Feb	10	88	3.22	3.10	3.12	3.19	3.17	0.00	

10 Feb	11	95	10.13	9.69	9.87	10.07	10.02	0.96	0.18
17 Feb	12	102	10.35	10.42	10.23	10.31	10.18	0.06	0.18
24 Feb	13	109	30.30	29.37	28.62	30.16	30.22	0.82	0.44
3 Mar	14	116	38.33	38.05	37.97	38.08	38.26	0.66	0.54
10 Mar	15	123	37.33	34.56	34.32	36.32	35.32	0.21	0.52
17 Mar	16	130	34.03	31.65	32.56	31.89	33.83	0.40	0.41
24 Mar	17	137	36.33	36.06	35.32	36.04	36.19	0.63	0.40
31 Mar	18	144	33.31	29.98	32.65	31.45	33.04	0.00	0.37
7 Apr	19	151	32.30	31.78	31.93	32.09	32.13	0.00	0.31

**Figure 1: Population Dynamics of Fruit Borer *Heliothis Armigera* on Tomato Crop**



#### 4. CONCLUSION

The findings of population dynamics of tomato fruit borer *Heliothis armigera*, the infestation of tomato fruit borer on tomato variety Arka Saurabh, Arka Abha, Pant Bahar, Ratna and Pusa Gaurav on Nov 5th 2016-17, standard 2.93%, 2.99%, 3.01%, 3.06% and 3.09% . The infestation of the tomato fruit borer with its intensity increase continuously till the last picking of the fruit February to March was found as conducive period for the best multiplication period, it increased rapidly up to 35.89%, 35.64%, 35.34%, 34.49% and 34.18% infestation at botanical garden A.N.D. College, Kanpur. The result of population dynamics of tomato fruit borer *Heliothis armigera*, the pest infestation of tomato fruit borer on tomato variety Pusa Gaurav, Arka Abha, Arka Saurabh, Ratna, Pant Bahar on Nov 5th, 2016-2017 started 3.21%, 3.18%, 3.14%, 3.06% and 3.04% infestation and 0.04 larvae/fruit during 9th standard week of January on 81 days old crop. The infestation of the tomato fruit borer with its intensity increases continuously till the last picking of the fruit February to March found as conducive period. It increased rapidly up to 38.33%, 38.26%, 38.08%, 38.05% and 37.97% infestation at botanical garden A.N.D. College, Kanpur. The *Heliothis armigera* was found to multiply faster than the initial period. The fruit

borer on tomato crop grown in winter season showed that February and March month is important for the infestation of this pest.

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