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Issue Article

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THE DEVELOPMENT OF COTTON BOLLWORM (HELICOVERPA ARMIGERA HBN.) IN TOMATOES GROWN IN GREENHOUSE CONDITIONS AND THE CRITERION OF ECONOMIC THRESHOLD

Abstract*: The article presents the results of experiments on the development of bollworm (Helicoverpa armigera Hbn.) in tomatoes grown in greenhouse conditions and the criterion of economic risk. In this case: the 1st-year-old worms first feed on the leaves at the point of growth, then the 2-3-year-old worms damage the pods and flowers, and the older worms damage the fruit and make it unfit for consumption, and the hatched worm develops in greenhouse conditions for 25-30 days. 20-25 pods, flowers and fruits were destroyed. Egg-laying of mature breeds continued for 15-20 days in tomato. At air temperature of 27 °C and humidity of 60-65%, it was observed that the average number of eggs laid by butterflies is 300-400. It has been confirmed in the conducted experiments that the criterion of economic threshold of cotton bollworm in greenhouse conditions during the fruit ripening period was 0.06 per plant i.e. 6 per 100 plants. So in greenhouse conditions the economy threshold of cotton bollworm is 6 units per 100 plants, which means that it is expedient to carry out protection measures against the pest from this period.*

Key words*: Greenhouse, plant, tomato, harvest, flowering, fruiting, pest, cotton bollworm, egg, worm, butterfly, mature breed, food.*
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Introduction

Tomato crop is grown as a food product in more than 100 countries of the world and satisfies the food demand of the world population to a certain extent. The tomato plant is of great importance in human life and occupies an important place in the diet. In order to continuously provide the population with these products throughout the year, it is important to find ways and means of effective protection of their crops from diseases and pests. Tomatoes are grown in the farms of all regions and districts of our Republic and in private plots of the population. Various diseases and pests occur in large numbers in this crop and cause great damage.

Today, several types of pests damage the tomato crop in greenhouse conditions, reducing the yield and spoiling its quality. Such pests include tomato rust mite (*Aculops lycopersici* Massee), spider mite (*Tetranychus urticae* Koch.), greenhouse whitefly (*Trialeurodes vaporariorum* West.), greenhouse thrips (*Heliothrips haemorrhoidalis* Bouché) and plant aphids (Aphididae), autumn nightworm (*Agrotis segetum* Den. et Schiff.), cotton bollworm (*Helicoverpa armigera* Hbn.), caradrina (*Spodoptera exigua* Nb.), pore-forming flies (Agromyzidae), nematodes (Meloidogyne) and other pests belonging to various systematic families, resulting in a plant yield of 40–50 %, and in some greenhouses, even 50-60% is lost.

The cotton bollworm *Helicoverpa armigera* butterfly is 12-18 mm, the forewings are yellowish-gray in color, sometimes reddish-brown or pink, or bluish in color, and the wings have a dark color pattern, slightly inward from the tip of the forewings. and there are two spots in the middle of the inconspicuous belt and wings [1;4].

Many literatures provide complete information on the distribution, feeding and migration of this pest,

natural entomophages, and development period[1;2;]. In the northern regions of Central Asia, depending on the weather conditions, the cotton tunlan gives 3-4 generations in a year, counting with the first generation, which is very small in number.

As overwintering fungi go dormant, about 85% of this pest emerges from winter. Cotton bollworms overwinter in the soil near those plants at a depth of 10-15 cm. The first adult butterflies appear in late April - early May. Butterflies collect their eggs and lay them on plant leaves, at growth points [5].

Each butterfly lays 250-500 eggs in its lifetime, and some up to 1000 eggs. According to the results of observations of the Central Asian plant protection station, the first flight period of cotton night butterflies begins when the average daily air temperature is higher than +15°C; wintering mushrooms develop well when the temperature is not lower than -15°C.

Newly hatched worms are shiny with a light green color, and later the body begins to darken. At first, the younger ones feed on the young leaves and twigs of the plant, while the older ones feed on tomato fruits. Depending on the type of plant the worm is eating, the color of the worm's body changes from gray-green blue to yellow-white [6].

In agricultural crops, the economic threshold of cotton tundra - the criterion of economic harmful amount (threshold) was determined in cotton and other crops under field conditions. Studies have also been conducted on the development, damage and control of nightshade pests in vegetable crops. In areas where the cotton bollworm is not controlled, it can multiply and destroy 70-80% of vegetable crops and 35-40% of cotton crops.

Experimental results: Experiments were carried out to determine the size of the growing cotton bollwormin different periods under greenhouse conditions. At the time of damage to tomatoes, bollworms were collected from tomato fields, fed and observed in laboratory conditions (Fig. 1). In this case, the length of the 1st young worm is 3-4 mm, the 2nd year - 7-8 mm, the 3rd year - 11-14 mm, the 4th year - 20-22 mm, the 5th year - 26-29 mm, and the 6th year bollworm was observed to be 33-35 mm (Table 1). According to the results of observation, it was observed that in the fields planted with vegetable crops (tomatoes), the bollworms of the last age of the cotton bollworm fell into the soil and turned into cones at a depth of 5-12 cm between the soil.

Figure 1. Experiments conducted in laboratory conditions

In rare cases, it can become a tuber outside the nest, that is, in leaf axils or inside fruits. The color of cotton bollworm varies from pale pinkish yellow to reddish brown. The height of the bulb is 17-21 mm. On the last growth of the tenth segment of the abdomen there are two parallel spines. A newly formed bulb has four dark black dots around the eye, which is not fully colored.

Table 1. Size of cotton bollworm by different ages (Cotton bollworm laboratory experiment.)

The age of larvas	Observed time second generation	Length of larvas, mm	Weight of larvas, g
I	19.07	3-4	0,01
II	23.07	7-8	0,13
III	29.07	11-14	0,19
IV	06.08	20-22	0,24
V	13.08	26-29	0,33
VI	20.08	33-35	0,39
Pupaes	27.08	16-18	0,5

Butterflies lay one, sometimes two, eggs on the stems at the point of growth of tomatoes. The 1st-year-old worms that hatched from the eggs first feed on the leaves at the point of growth, then the 2-3-year-old worms damage the pods and flowers, and the older worms damage the fruit and make it unfit for consumption. It was observed that the worm hatched from the egg develops in greenhouse conditions for 25-30 days and destroys 20-25 pods, flowers and fruits. It was found that this pest is particularly damaging to tomatoes planted in autumn and winter in the greenhouse (Fig. 2).

Figure 2. The damage of cotton bollworm in tomatoes of different ages

Experiments on the damage of cotton bollworm were conducted in the greenhouse of "Shamurod oglu" LLC in Kibrai district of Tashkent region. From the results of the scientific research, it became known that in the tomatoes planted for the autumn-winter period in the greenhouse conditions, the appearance of mature varieties of cotton bollworm was observed from the second and third ten days of August.

On the 3rd ten days of August and the first ten days of September, it was observed that mature breeds (samka) began to lay eggs on the growth points of the tomato plant. Emergence of worms from laid eggs occurred from September 10 to September 20. Usually, the coolness of autumn and high humidity have a negative effect on the development of this pest. According to the results of our researches, it was confirmed that the cotton bollworm develops in greenhouse conditions without going into diapause. In our experimental plots, the pest, which turned into a pupaes by the beginning of December, was killed by various entomopathogenic fungi due to high humidity. 3 of the female butterflies, which were flown from the pupaes collected from the nature and fertilized, were released in the pieces separated during the tomato picking season. In the rest of the pieces, the pollen of the next generation of cotton bollworm was studied.

Control was carried out every 3 days until the mature breeds died after laying eggs. From the observations, it was known that the egg-laying of mature breeds continued for 15-20 days in tomatoes. At an air temperature of 27 °C and humidity of 60-65%, the average number of eggs laid by butterflies was 300-400 (Fig-3).

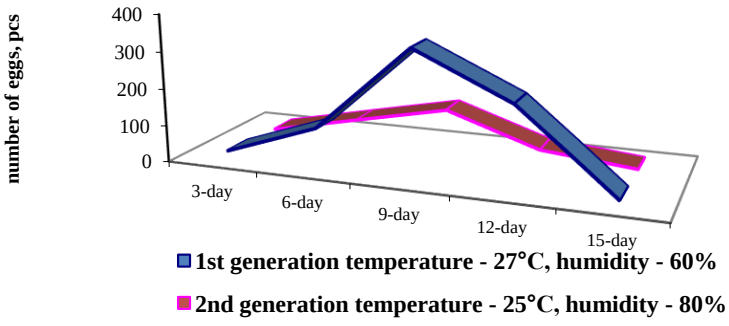

Figure 3. In the greenhouse, the flowering of the cotton tunlami mature breed

After the worms were fully fed and developed into pupae, they were picked and released into the second part of the isolated greenhouse in the same order as above. In the greenhouse during this period, the air temperature was low (22 °C), humidity was high (75-80%), which was unfavorable for butterflies to lay eggs. The average clutch of each female butterfly was 190 eggs, more than half of which, 55% or 104, did not hatch. Based on the above, the lack of additional food for feeding butterflies in greenhouses, as well as low air temperature and high humidity, is evidence that the biological parameters of cotton night butterflies have been negatively affected.

We conducted field experiments to study the

damage caused by cotton bollworm in tomatoes on Videtta F1 hybrid. In this case, the artificially infested plants were covered with gauze in boxes (to prevent them from being infected by other insects).

During the flowering and fruiting periods of the plant, the first young worms of the nightworm were placed in 3 repetitions, and the plant in the control variant was left pest-free. It was observed that the laid young worms start to damage the leaves and growth points and stems of tomatoes. Damaged pods and flowers began to dry up, and fruits were observed to rot under the influence of fungi and bacteria. The results of the experiment are presented in Table 2.

As can be seen from this table, tomato yield is reduced by 73.3% compared to the control in the variant infested with pest worms during the flowering period. The total yield showed a decrease of 2.15 kg of yield from each plant. During the fruiting period, in the variant affected by cotton borer, 53.3% less fruits were observed compared to the control, and 1.4 kg of yield was observed per plant.

Table 2. Damage caused by cotton bollworm to tomato productivity (Greenhouse of "Shamurod oglu" LLC)

№	Tomato variety	The period of growth affected by the pest	Backaches	Yield from 1 plant, kg	Yield loss relative to control	
					kg	%
1.	Videtta F1	bloom	1	0,8	2,2	73,3
			2	0,9	2,1	70,0
			3	0,8	2,2	73,3
	Average		-	0,83	2,15	72,2
2.	Videtta F1	fruit bearing	1	1,5	1,5	50,0
			2	1,4	1,6	53,3
			3	1,3	1,7	56.6
	Average			1,4	1,6	53,3
	Control		-	3,0	-	-
	EKF_{05}			1,2		

The degree to which cotton bollworms damage a plant depends on its quantity. Therefore, it is important to determine the economic threshold level criterion (ETHLC) of cotton bollworm in different plants. Economic threshold has been extensively studied by various scientists in various agricultural crops such as cotton and tomatoes, which are major pests [7].

However, the number of economically dangerous thresholds of cotton in greenhouse conditions has not been studied. Therefore, in our research, we aimed to determine the economic threshold of cotton bollworm under greenhouse conditions. The results of the experiment are presented in (Table 3). As can be seen from this table, the number of fruits decreased by 14.1 units, the weight of the fruits also decreased, and the yield was 1350.2 grams less from one bush of tomatoes. The damage level of the fruit crop compared to the control crop was 60.8%. In the second version of the experiment, when 2 cotton bollworms were found on 1 plant, the fruit yield was reduced by 1787.2 grams per plant compared to the control, and it was determined that the level of damage was 79.7%.

Table 3. The economic risk limit criterion of the cotton bollworm in the tomato plant in the greenhouse n=5, M±m ("Son of Shamurod" greenhouse of MJCh, variety Charlotte F1)

1 in the plant worms number, pcs	1 plant- taken fromaverage yield, g	in 1 plant fruits number, pcs	Harvest decrease, g	3 separation coefficient, %	Economy threshold
Control (pest free)	2210,2±0,86	22,8±0,8	-	-	0,06
1	859,26±0,71	8,7±0,42	1350,2±1,15	60,856±0,886	
P<	0,01	0,05	-	-	
2	422,4±0,57	3,85±0,37	1787,2±0,86	79,702±0,918	
P<	0,05	0,05	-	-	
3	346,2±1,15	4,06±0,59	1864,2±1,06	84,08±0,64	
P<	0,05	0,05	-	-	

In the third version of the experiment, 1864.2 grams less yield was obtained compared to the control when 3 cotton bollworms were found in one tomato plant. In this case, the damage rate of the crop was 84.08% (Table 3).

Conclusion: As it can be seen from the conducted experiments, the criterion of the economic risk level of the cotton plant in the greenhouse conditions during fruit ripening was 0.06 per plant, i.e. 6 per 100 plants. So, the IHMM of cotton bollworm in greenhouse conditions is 6 units per 100 plants, which means that it is justified to carry out protection measures against the pest from this period.

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