Volume 3, Issue 3, March - 2025
ISSN (E): 2938-3781

Web of Agriculture: Journal of Agriculture and Biological Sciences
webofjournals.com/index.php/8

PHENOLOGY OF AUTUMN TUNDRA DEVELOPMENT

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Abstract
The article presents data on the phenology of the winter moth (Agrotis segetum) monitored in the conditions of the Pskent district, Tashkent region. It is noted that in the 2024 season, the pest developed in 4 generations and went into hibernation in the second decade of October with a fairly high sum of effective temperatures, that is, 6160 degrees. Laboratory observations recorded data on the survival of caterpillars and pupae of the winter moth, the number of oviparous females and the eggs they laid. The lifespan of the imaginal phase of the pest was established.

Keywords: Winter moth, butterflies, eggs, caterpillars, pupae, postembryonic development, vital activity indicators.

Introduction

The autumn bollworm – Agrotis segetum Schiff is distributed in various soil-climatic zones of Uzbekistan and is distinguished by its harmfulness. According to the literature, its larvae belong to more than 30 plant families and cause damage to many of their species. The most important of these are cotton, alfalfa, sugar beet, corn, grain crops, and the best food for the pest is field ivy [1]. The larvae of the first (spring) instar of the autumn bollworm cause significant damage to cotton in some years, and this situation is often recorded for the next 2-3 years. The damage caused by the larvae occurs during the initial period of cotton development, that is, from the moment the seed germinates until the cotton has 6-8 true leaves. The second-instar worms are found in sparse cotton fields, tomatoes, and other grass-covered crops. The third-instar worms are often found in late corn.

In some cases, the number of seedlings in the fields is sparse due to many late crops, in the fields, and in weeds, and the crops have to be replanted. Rootworms are easy to identify; when the fields are inspected in the morning, fallen or wilted seedlings are noticeable. If the bottoms of these seedlings are examined and dug to an average depth of 5-6 cm, small 1-2-year-old or large grayish worms 3-6 years old can be found [2].

Depending on the area of development, the autumn borer can produce 3-4 generations per year. In cotton, the first generation is considered the most harmful. It should be noted that currently, as a result of changes in the structure of agricultural crops, the culture of dekaning has also changed. It is noticeable that these changes affect the development, wintering, nutrition and other biological characteristics of a number of insects. In the spring, wintering autumn borers wake up when the air temperature is 100 and above and, depending on weather conditions, turn into pupae on average

Volume 3, Issue 3, March - 2025
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at the end of March. The pupae develop in the soil, at a depth of 3-5 cm, for 20-25 days.

The emergence of butterflies depends on the air temperature, which in our conditions falls on April and May. Their life cycle is 20-40 days. Butterflies fly only at night, and during the day they hide under stumps, thick grass, and fallen leaves. One female butterfly can lay up to 800-1200 eggs on average. Adult butterflies can lay up to 2000 eggs. For the development of eggs, a beneficial temperature of 500 is required, starting from the lower temperature threshold of 100. For the larval stage, 3500, for the pupa, 1500, for the full development of one stage, the temperature must be 5500. When the average air temperature is below 250, the worms go into hibernation without turning into pupae. If the nutrition of the last generation of the pest is incomplete, its development can continue until the next year. The manifestation of high viability of the pest depends on air temperature, humidity, and the type of plant on which it feeds (favorites). Conditions are created for the development of the first generation of the moth only when the average 10-day air temperature sum is 2500, and the humidity should not exceed or decrease by 50% [3].

Research Method

In 2024, experiments were conducted in laboratory conditions to study the development and viability of autumn moths. In this case, when adult worms that had overwintered well in natural conditions and had high viability were taken, it was found that they had different sizes of head shells. For observations, larvae of worms of different weights (232-361 mg) were taken. Butterflies that emerged from male and female larvae of similar weight were fed in natural conditions in 0.5 liter jars and 5% sugar syrup. The period of egg laying of the butterflies and the number of eggs they laid throughout their lives (quantity) were monitored daily. The life of the worms that emerged from the eggs was measured from the 10th day of the experiment, that is, from the 3rd age, and their viability was calculated based on these sizes. From 5 to 15 worms aged 3-4 years were taken and fed until they turned into pupae and the butterfly flew out. During the observations, the number of butterflies that flew out of the experimental jars, the number of eggs laid by female butterflies were counted, and the lifespan of female butterflies was calculated. In this way, the development and viability of the next generation of butterflies were determined depending on the number and quality of the eggs they laid. In this case, the larger the head shell of the worms and the higher the weight of the pupa, the more permanent the viability of the pest [4].

In order to determine the phenology of the development of the autumn moth, observations were mainly conducted in cotton fields in the Pskent district of the Tashkent region. Agrometeorological data from the meteorological station in the district were used to develop a forecast of the development period of the autumn moth. Agrometeorological data are calculated from the average 10-day air temperature, humidity, and average soil temperature at a depth of 10 cm from spring to late autumn.

The emergence of the autumn moth from hibernation in 2024 coincided with the third decade of March. By the second decade of June, the development of the first generation was completed and the development of the second generation began. The completion of the development of the second generation coincided with the second decade of July, and the completion of the development of the third generation - with the second decade of August. The completion of the development of the fourth generation continued until the first decade of October, and it was found that the

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preparation for wintering was high, and the sum of useful temperatures reached 6160. When the air temperature is high in the autumn months and the sum of useful temperatures reaches 4000-5000, the 6th-instar larvae of the autumn moth develop well, and their weight is on average around 500-700 mg. Such worms overwinter at a depth of 10-15 cm in the soil, where they become resistant to frost and can emerge well from hibernation and develop rapidly the following year (Table 1).

Table 1

Phenology of development of autumn borers

(Tashkent region, Pskent district, 2024)

	March		April		May		June		July		August		September		October	
10-day average air temperature																
	8,1	13,1	12,9	12,7	12,5	12,8	18,1	19,9	21,9	20,6	25,7	25,9	27,1	27,9	29,1	28,0	26,3	23,8	19,1	22,4	20,5	16,8	14,3	12,7
Average ten-day beneficial temperature																								
		31	29	27	25	28	81	99	119	106	157	159	171	179	191	180	163	138	91	124	105	68	43	27
The sum of the useful air temperatures of 5500																								
			+	▪	▪	▪	▪	L_1- L_6	▪		L_1- L_4		L_1- L_6		L_1- L_6		▪▪		L_1- L_6	▪				
			50^0								550^0		550^0		550^0		550^0					550^0		
Term			27. III								13. VI		17. VII				13. VIII					3.X		
																							∑ 3ff. 616^0	

Symbols:

L_1-L_6 - *first and sixth instar larvae*

∑ **eff.** 616^0 - *The sum of useful heat consumed during the wintering period*

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The results of our observations conducted in laboratory conditions are shown in Table 2. Here, the total number of eggs laid by each female butterfly, the number of larvae hatched from the eggs, and the weight of the cocoons were calculated and measured. It was found that the higher the weight of the cocoons, the higher the number of eggs laid by the butterflies.

It was observed that the days of egg laying by the butterflies lasted on average from 1 to 13 days. It was found that the maximum egg-laying process lasted for 3-4 days, and the subsequent egg-laying of butterflies decreased somewhat. Observations showed that the number of larvae hatching from eggs within 2-3 days was 2-3 times higher than that of subsequent eggs. The survival of larvae hatched from eggs laid in the first brood of autumn moths was found to be slightly higher than that of larvae hatched from eggs laid later (Table 2).

Table 2 Postembryonic development and viability of the autumn toad

Serial number	Number of worms, pcs.	Those who perished, one		Number and weight of fungi, units/mg		Egg-laying butterflies and the eggs they lay, a piece	Egg laying duration, days
		Worms	Mushrooms				
1	10	2	-	(3) 177-291	(5) 204-280	(4) 20-923	2-10
2	15	3	1	(11) 165-264	(1) 216	(6) 35-716	1-9
3	15	4	2	(1) 233	(8) 151-305	(7) 70-979	1-13
4	5	-	-	(3) 185-231	(2) 220-262	(1) 167	1-10
5	5	-	3	(1) 201	(1) 216-330	(3) 85-890	8-12
6	5	1	-	(1) 201	(3) 216-330	(3) 85-890	8-12
7	10	8	-	-	(2) 212-264	(1) 481	5-9
8	5	1	-	(3) 202-270	(1) 360	(1) 760	7-11
9	10	6	-	(1) 201	(3) 177-210	(2) 415-600	5-8

Thus, based on the above studies, it can be noted that the fact that the last generation of autumn moths (usually the 3rd or 4th generation) of older, well-fed, and fat-storing larvae, which have reached a sufficiently productive temperature in favorable conditions, go into hibernation, allows them to emerge from hibernation with minimal losses the following year and reproduce in a mass manner.

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