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EFFECT OF TEMPERATURE ON SOME BIOLOGICAL INDICATORS OF *Cydia pomonella* Linnaeus, 1758

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ВЛИЯНИЕ ТЕМПЕРАТУРЫ НА НЕКОТОРЫЕ БИОЛОГИЧЕСКИЕ ПОКАЗАТЕЛИ *Cydia pomonella* Linnaeus, 1758

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Abstract. In 2022-2023 The influence of temperature on the development and reproduction of the codling moth butterfly was studied. Experiments have shown that the optimal temperature regime for mass reproduction of the codling moth in laboratory conditions is within 20-25°C. At low temperatures (15°C), butterflies live 34-35 days, and some individuals can live up to 45-50 days. This shows that these characteristics of butterflies allow them to remain viable in an unfavorable environment, although their reproduction is reduced. The experiments carried out make it possible to obtain the necessary temperature parameters for the development of fruit-eating apple trees.

Аннотация. В 2022-2023 гг. изучено влияние температуры на развитие и размножение бабочек яблоневой плодожорки. В результате было выявлено, что оптимальный температурный режим для массового размножения яблоневой плодожорки в лабораторных условиях находится в пределах 20-25°C. При низких температурах (15°C) бабочки живут 34-35 дней, а некоторые особи могут дожить до 45-50 дней. Данные особенности бабочек позволяют им сохранять жизнеспособность в неблагоприятной среде, хотя их репродуктивность снижается. Исследование позволило получить необходимые температурные параметры для развития яблонной плодожорки.

Keywords: codling moth, development, ontogenesis, reproduction.

*Ключевые слова***:** яблонная плодожорка, развитие, онтогенез, размножение.

The *Cydia pomonella* (Lepidoptera, Tortrcidae) is a serious pest of seed and stone fruit plants, spreading widely in the agrocenosis of apple, pear, peach, apricot, plum, cherry, and even the walnut agrocenosis of the fruit-bearing plants, causing a large amount of damage to farms every year. The distribution area of this pest is very wide, covering Western and Eastern Europe, Central Asia, Eastern and Western Siberia, the Far East, North and South Africa, the Middle East, South and North America, Tasmania, New Zealand, the Caucasus, etc. covers [1; 6].

It should be noted that this pest is found in all geographical zones where apples are grown. Depending on the climate, it can produce from one to four generations. Fruits damaged by the pest fall prematurely, before ripening. At the same time, the fruits damaged by the pest become a

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breeding ground for other microorganisms. Therefore, the study of the dependence of the bioecological indicators of this pest on various environmental factors is of great scientific and practical importance.

From this point of view, the study of the effect of temperature on the development and reproduction of butterflies (imagoes), which are the cause of the generation, is of particular importance. It is known that the role of physical and biological factors of the external environment is great in the development and reproduction of living things, including insects. Insect species composition, number dynamics, distribution, nutrition, etc. in different years. characteristics change directly or indirectly depending on the influence of environmental factors. This also manifests itself in different forms depending on the specific development characteristics of individual species, the form of reproduction, and the type and food objects in parasitic and predatory species. Temperature, being an environmental factor, has a serious effect on the changes in biochemical processes occurring in the body, the activity of enzymes, and other biological substances, and regulates their development by seasons. The role of temperature in the reproduction and development of insects is invaluable. There is a large amount of data on the response of the *Cydia pomonella* to temperature [2; 3; 5; 7].

These data are general statements about the effect of temperature and do not allow obtaining the necessary parameters for development. Taking this into account, we found it necessary to study the effect of temperature on the development and reproduction of the apple fruit-eating butterfly in 2022-2023.

For this purpose, experiments were conducted in 2 directions:

1. Butterflies obtained from caterpillars developed at a constant temperature in laboratory conditions were placed in different temperature regimes, and the effect of temperature on the reproduction of butterflies was investigated.

For this purpose, 1♀+1♂ hatched butterflies were placed in 0.5-liter jars at 15, 20, 25, 30, 35^0C mode thermostats. Soaked cotton was placed inside the jars to create humidity, and folded paper and hanging cloth were placed inside the jars to lay eggs. The reproducibility of butterflies was determined by conducting regular observations. Experiments were performed in 3-4 replicates.

2. Newly hatched caterpillars were used in this series of experiments. For this, 10 caterpillars were placed on the apple and placed in glass jars. Wrapped paper and hanging cloth material were placed inside the jars for pupation of caterpillars. Experiments were carried out 15, 20, 25, 30 and 35^0 C mode thermostats, 4-5 times. During the laboratory experiments, the humidity in the thermostat was 65-70%, the light flood was 120 lux, and the photoperiod was 16 hours.

In the adopted regimes, the butterflies that emerged from the pupa were placed in different temperature regimes and their life time was determined. When feeding the primary materials, the temperature in the thermostats was 25^0C, the relative humidity was 60-65%, the light flood was 800 lux and the light regime was 16 hours. During the experiments, the caterpillars were given apple fruits as food, and the butterflies were given 10% sugar syrup. Experimental results were processed according to variance statistics [4].

The results obtained regarding the effect of temperature on the development period of butterflies are given in the first table. As can be seen from the table, with the increase in temperature, the life span of butterflies is legally shortened. This regularity becomes more obvious between 15-25^0C. Thus, in this regime, the life expectancy of males is 31, 19 and 15 days, and the life expectancy of females is 34, 21 and 16 days, respectively.

However, as the temperature increases, the lifespan of males becomes shorter than that of females, which means that females live longer than males. This shows that males are more sensitive to temperature changes than females. As you can see, the temperature regime favorable for the

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development of butterflies is between 20-25^{0}C. So, in these regimes, butterflies can live completely healthy for 15-20 days. The results of the experiments on the effect of temperature on the reproduction of butterflies are given in the second Table 1, 2.

Table 1

EFFECT OF TEMPERATURE ON DEVELOPMENT TIME OF BUTTERFLIES

t°C	*Lifespan of butterflies* (*days*)		
	♂♂	♀♀	♂+♀(*medium*)
15	31,15±1,7	34,3±2,4	32,7
20	19,4±1,4	21,7±1,9	20,6
25	15,2±2,0	16,7±1,5	15,9
30	8,5±1,4	12,4±0,8	10,5
35	6,5±1,1	8,5±1,3	7,5

Table 2

THE EFFECT OF TEMPERATURE ON THE REPRODUCTION OF BUTTERFLIES

Temprature C	*number of females*	*Number of eggs*	
		common	*Average for* 1♀
15	12	1025	85,4±12,7
20	12	1995	166,3±34,4
25	14	2434	173,8±26,5
30	14	2516	79,7±32,4
35	14	640	45,7±6,2

It can be seen from the table that low (15°C) and high (30; 35) temperature regimes have a negative effect on the egg-laying potential of females. Thus, the productivity in these regimes is 85, 79 and 45 eggs, respectively. The temperature regime of 20 and 25°C can be considered optimal for the reproduction of female individuals. At 15°C, the productivity of one female individual was 80-85 eggs, while at 20°C and 25°C, this indicator was 166 and 173 eggs, respectively. Similarly, at 30°C and 35°C, the reproductive rate decreased to 79 and 45 eggs.

At the same time, during experiments, it was determined that butterflies complete the egg-laying process in 9-10 days. Maximum egg laying is recorded on the 3rd and 4th day of the process.

The results obtained during the above-mentioned experiments prove that the *Cydia pomonella* is a highly ecologically plastic species. In this regard, the effect of temperature on the lifespan of butterflies is more interesting. So, while at low temperature (15°C) butterflies live 34-35 days, some individuals can even live up to 45-50 days. This shows that these characteristics of butterflies allow them to maintain their vitality in an unfavorable environment, although their reproduction decreases.

The obtained results allow obtaining the necessary temperature parameters for the development of the *Cydia pomonella*. It is known from the experiments that the optimal temperature regime for mass reproduction of the *Cydia pomonella* in laboratory conditions is within 20-25°C.

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