

Impact of change in air temperature on the biological parameters of larvae and productivity of silkworm cocoons

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Abstract. Especially, the construction of special silkworm rooms near the mulberry yards, which are organized for harvesting mulberry silkworms several times a year, gives positive results. "...construction of special facilities for silkworm breeding, increasing the planting of mulberry seedlings on the edges of the farm, intensively continuing the activities aimed at ensuring the employment of the population due to the effective use of existing opportunities" are defined as urgent tasks. For this purpose, it is necessary to ensure that the area of rooms and special silkworm rooms selected for silkworm rearing by the silkworm rearing units of the homesteaders and farms involved in silkworm rearing is adequate, and when the silkworms pass from age to age, they should be thinned out, fertilized, and provided with sufficient quality feed. Summing up on the basis of the analyzed data, it is worth noting that during the period of silkworm rearing, full feeding of larvae during their youth, moderate air temperature in the silkworm room, smooth development of silkworms without becoming large and small, and vitality by ensuring that the biological indicators of the mulberry silkworm are high and the activity of the silk-secreting glands is increased, the productivity and yield characteristics of the cultivated silkworm cocoons are achieved.

Keywords. Mulberry silkworm, hybrid, egg, larva, viability, silkworm, mulberry yard.

1 Introduction

During the development of a number of silkworm cocooning networks in the world, effective work is being carried out on the development of new intensive agrotechnologies and methods of reviving mulberry silkworm eggs in a differential way, caring for larvae at young and old ages in special complex silkworm rooms, and its scientific justification [1-3]. In this regard, it is important and practical to expand the scope of scientific research on the extent to which the feeding area, optimal storage of reserve feed, and the quality and quantity of feed given to silkworms affect the biological, productivity and technological characteristics of silkworm cocoons in special complex silkworm rooms. is considered important [4].

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In Uzbekistan today, extensive reforms are being carried out for the development of silkworm cocoon farming [5]. Scientific research and wide implementation of new innovative developments together with increasing the efficiency of the work performed in the field of security gain significant scientific and practical importance [6].

When feeding mulberry silkworms without adequate feed, a sudden change in the temperature in the silkworm house was observed, and it was found that the biological productivity of the larvae, the silkworm cocoon, and the fertility indicators decreased due to the negative effect on the silk gland activity [7-9]. Also, it has been proved that there is a relationship between the body indicators of mulberry silkworms, the development of mulberry silkworms according to their age, and the activity of the silk gland and silk productivity, and its use in the creation of new breeds and hybrids of silkworms has been proven to be of practical importance [10, 11].

It is known that mulberry silkworms feed only on mulberry leaves, so it is very difficult to meet all their biological and physiological requirements for food [12, 13]. Because the varieties of mulberries available in the regions and regions differ in terms of the level of agrotechnical care, the methods of using mulberry yards, which does not affect the biochemical composition and productivity of the leaves.

2 Materials and methods

Experiments were carried out at the Department of Silk and Mulberry Production and the Scientific Research Institute of Silk Production of Uzbekistan. Experimental work on new breeds and hybrids of mulberry silkworm, egg, resuscitation, larva, silk gland, special silkworm house, feeding mulberry yard, mulberry leaf, living silkworm cocoon, silkworm cocoon shell, etc. received.

During the seasonal silkworm feeding period, it is necessary to feed the larvae in the right amount at the right time during their youth, keep the air temperature in the silkworm room moderate, ensure that the larvae develop evenly, that the shedding process is effective, that the silkworms do not become large and small, and in exchange for ensuring high viability and increased activity of silk glands, biological indicators of larvae, productivity and yield characteristics of cultivated silkworm cocoons were created.

Currently, new hybrids of silkworm are being bred in Uzbekistan farms. For this new and productive breed and hybrids, the quantity of leaves required for one box (19 g) of silkworms is set at 1000 kilograms according to the rules of agrotechnics. However, in the conditions of production, i.e. in the conditions of raising silkworms in the households of villagers, these norms are not paid attention to, in many cases there is a shortage of leaves, which has a negative effect on the harvest. First of all, it is important to determine whether this situation affects the growth, development and body parameters of silkworms. Therefore, it was studied how the amount of food affects the body parameters of the silkworm. The experiments consisted of 6 options, the silkworms of the first and third option were provided with leaves completely (100%), that is, at the rate of 1000 kg per 1 box, the larvae of the second and fourth option were provided with 75% of the norm (750 kg), fifth and sixth option larvae were given 50% of the norm (500 kg) of leaves. The data obtained on the basis of research are presented in Table 1 below.

The numbers presented in this table indicate that the change in the body parameters of the larvae is directly related to the amount of food given to them. Silkworms are mainly raised in farms. Silkworm breeders have different experiences, and most of them prefer to change the temperature in the room to be moderate (25-26°C), low (20-21°C) or high (28-29°C). They put 'l. Such sudden changes will definitely have a negative impact on the development of silkworms. Therefore, the next direction of our research was focused on studying the effect

of changing the temperature in the silkworm room from the norm on the parameters of the silkworm's body and silk cloth.

Table 1. Effect of the amount of food on the body parameters of larvae.

Options	Amount of food given to larvae, %	Body indicators of larvae					
		Weight, mg			Volume, cm ³		
		When hatched from an egg	Silkworm before wrapping cocoon	How many times it has grown	When hatched from an egg	Silkworm before wrapping cocoon	How many times it has grown
Ipakchi-1 breed							
V-1	100	0.41	4500	10976	0.007	4.30	6143
V-2	75	0.41	4010	9780	0.007	4.02	5743
V-3	50	0.41	3690	9000	0.007	3.70	5286
Ipakchi-2 breed							
V-4	100	0.42	4600	10952	0.007	4.35	6214
V-5	75	0.42	4140	9857	0.007	4.05	5785
V-6	50	0.42	3790	9024	0.007	3.75	5357

3 Results and discussion

When silkworms are fed normally, the weight of one larva before wrapping a silkworm cocoon is 4500-4600 milligrams, and when the amount of feed is reduced to 75%, this figure is 4010-4140 mg. When the amount of feed was reduced to 50%, it was equal to 3690-3790 milligrams, compared to the weight of normally fed silkworms, it was observed that it was 810 milligrams less. In other words, due to the lack of food, the weight of silkworms decreases by 18-20% and becomes slightly dehydrated. All this is due to the fact that at the end of the silkworm's life, the body's activity is focused on accumulating a lot of silk material, which is necessary for wrapping the silkworm cocoon, and the increase in the size of the silk separating compartment is due to the abundant protein compounds in the silkworm's body during the process of wrapping the silkworm cocoon. indicates the possibility of silk production. Silkworm's future will depend on this process. The effect of changes in silkworm room temperature on silkworm body parameters is presented in Table 2.

The data in Table 2 confirm our above opinion, the growth and development of silkworm depends on the air temperature in the silkworm room, and its lower or higher temperature has a negative effect on the body parameters of the silkworm. it turned out. If the temperature in the silkworm house is moderate, the silkworms develop well and before wrapping the silkworm cocoon, their weight is 4,500-4,600 milligrams, and their volume is 4.30-4.35 cm³, and they increase during the larval period. below the waist, these indicators are 4205-4280 mg, the volume is equal to 4.15-4.18 cm³, the weight is increased 10256-10439 times, the volume is increased 5929-5971 times.

As a result, we can see that the weight of the silkworm is 295-320 mg, the volume is reduced by 0.15-0.17 cm³, and the growth of the body is 537-696 times less. As a result of its negative influence on the uniform development of silkworms, it can affect other important biological indicators of silkworms.

Silkworm rearing units belonging to farms and clusters operating in Uzbekistan are allowed to provide insufficient or insufficient feed during silkworm feeding, as well as sudden temperature changes in the silkworm room. Therefore, in our experiments, a special

place was given to the study of the influence of changes in the amount of food and air temperature on the biological indicators of silkworms and the activity of the silk gland.

Table 2. Effect of air temperature changes in the silkworm room on the body parameters of the silkworm.

Options	Air temperature in Silkworm house, °C	Body indicators of larvae					
		Weight, mg			Volume, cm ³		
		When hatched from an egg	Silkworm before wrapping cocoon	How many times it has grown	When hatched from an egg	Silkworm before wrapping cocoon	How many times it has grown
Ipakchi-1 breed							
V-1	25-26	0.41	4500	10976	0.007	4.30	6143
V-2	20-21	0.41	4205	10256	0.007	4.15	5929
V-3	28-29	0.41	4020	9805	0.007	4.00	5714
Ipakchi-2 breed							
V-4	25-26	0.42	4600	10952	0.007	4.35	6214
V-5	20-21	0.42	4280	10439	0.007	4.18	5971
V-6	28-29	0.42	4090	9976	0.007	4.05	5786

It is known that silkworms feed only on mulberry leaves. Therefore, its growth, development, biological and economic indicators depend on the amount of food given to the larvae, and this process, in turn, affects the activity of silk glands that produce silk fluid that will later turn into silk fiber. shows the effect.

Therefore, the effect of the amount of food on the biological properties of silkworms and the parameters of the silkworm was studied. It was found that insufficient feeding of mulberry silkworms has a negative effect not only on the extension of the larval period, but also on the viability of silkworms. Information about this is given in the table below (Table 3).

Table 3. Effects of feeding on silkworm biological parameters and silk performance.

Options	Feeding amount of silkworms, %	Extension of silkworm feeding period, days	Silkworm viability, % $X \pm S_x$	Silkworm indicators before cocooning		P _d
				Weight, mg	Volume, cm ³	
Ipakchi-1 breed						
V-1	100%	23	94.5±0.93	1450	1.470	-
V-2	75%	27.5	80.0±0.64	1250	1.200	0.986
V-3	50%	31	66.5±0.51	1035	1.100	0.990
Ipakchi-2 breed						
V-4	100%	23	95.0±0.94	1500	1.520	-
V-5	75%	27.5	81.±0.65	1300	1.250	0.982
V-6	50%	31	67.0±0.52	1070	1.130	0.980

The data in this table clearly show that there is a large variation in the biological performance of silkworms depending on the level of feeding. In particular, it was observed that the period of silkworm feeding lasted 23 days when the larvae were fed with normal

(100%) feed, 27.5 days when 75% of the normal feed was given, and 31 days when 50% of the feed was given. As it can be seen from the given figures, the lack of proper feeding of silkworms leads to an extension of the larval period from 4.5 to 8 days.

Analyzing the numbers in the table, it became clear that when silkworms were fed with a standard feed (1000 kg per silkworm in 1 box), the larval viability was 94.5-95.0%, compared to when silkworms were fed 75% feed (13.5-14.5% compared to 80.0-81.5%), and 28% higher than when fed with 50% feed (66.5-67.0%) due to lack of feed.

Experiments were conducted on silkworms of the fifth age of Ipakchi-1 and Ipakchi-2 breeds. The silkworms in the first and fourth options are full, that is, at the rate of 1000 kg of leaves per box, the silkworms in the second and fifth options are 75% of the norm, the silkworms in the third and sixth options are in the absence of leaves, that is, 50% of the land was fed.

Based on the information mentioned above, the amount of food given to silkworms is also important for the development and full performance of the silk-secreting gland. In the absence of food, any animal species cannot realize its potential. Taking this into account, the extent to which the weight and size of the silkworms change in silkworms fed with normal and less than normal amounts of leaves was also studied.

Feeding silkworms with full-diet foliar diet resulted in greater increases in silkworm performance than foliar feeding options at 75 or 50 percent of the diet. For example, feeding silkworms with leaves in the amount of 50% of the norm is complete, that is, the weight of the silk gland is 40.1-40.2% higher, and the volume is 33.6-34.5 was the reason for the low growth by %.

If the silkworms were fully fed, the weight of the silkworm increased 14.6 times, and the size increased 14.5 times compared to the first day of the fifth age (100-102 mg) before wrapping the silkworm cocoon (1450-1500 mg), but it increased only 8 times in conditions of leaf deficiency.

However, according to agrotechnical rules, the temperature in the silkworm room is 25-26°C for larvae. This has a strong influence on the development of silkworms, especially on the viability and activity of silk glands. The results of the experiments conducted in this regard are shown in Table 4 below.

Table 4. Effect of changes in air temperature in the silkworm house on the viability of larvae and the activity of the silk gland.

Options	Feeding amount of silkworms, %	Extension of silkworm feeding period, days	Silkworm viability, % $X \pm S_x$	Silkworm indicators before cocooning		P_d
				Weight, mg	Volume, cm ³	
Ipakchi-1 breed						
V-7	25-26	23	94.5±0.93	1450	1.47	-
V-8	20-21	30	88.0±0.70	1300	1.30	0.984
V-9	28-29	20	84.0±0.68	1180	1.20	0.980
Ipakchi-2 breed						
V-10	25-26	23	95.0±0.95	1500	1.52	-
V-11	20-21	30	88.5±0.78	1350	1.35	0.992
V-12	28-29	20	85.0±0.71	1250	1.25	0.988

If we look at the information presented in the next table, the temperature in the silkworm room is lower or higher than the norm, which has a negative effect on the life activity of the silkworm in the postembryonic period. For example, when silkworms are fed at a temperature of 20-21°C, their larval period is extended to 30 days, the viability is 88.0-88.5%, when fed at 28-29°C, the silkworm period is shortened (lasts 20 days), the viability is 84.0-85. When it is 0%, the viability of larvae fed under conditions of normal air temperature (25-26°C) is 94.5-95.0%, the silkworm period is equal to 23 days, and the viability is 6.5-10 compared to other options, 0% more, the period of silkworm was shortened to 7-10 days.

Therefore, the results of the experiments conducted on the effect of the temperature change in the silkworm room on the silkworm's vitality indicate that the temperature in the room is lower or higher than the norm during the care of silkworms, slows down or accelerates the metabolism process in the body of silkworms, as a result, physiological processes are disturbed, and silkworms die. it will cool down. Especially when the temperature rises, silkworms become agitated, lose water in their body and development is disturbed, as a result, silkworms get sick.

In addition to studying the growth, development and biological indicators of silkworm larvae, it was also observed what kind of diseases they can get under the influence of changes in the amount of food and temperature. As a result of the tests, it was found that due to not providing adequate nutrition to silkworms, silkworms lag behind in development, become small and large, and by the age of 4-5 years, it has been found that they encounter bacterial diseases (plague and downy mildew). When the temperature in the silkworm house is lower than the norm (20-21°C), silkworms suffer from fungal and yellow diseases, and when the temperature is high (28-29°C), they suffer from hemorrhagic and plague diseases.

Summing up based on the above information, it is worth noting that during the period of silkworm rearing, adequate feeding of larvae, keeping the air temperature in the silkworm room moderate will ensure uniform development of silkworms, increase their vitality and increase the activity of silk glands. providing, the ground is created for the biological indicators of silkworm cocoons to be high, productivity and yield characteristics.

This, in turn, depends on the silkworm cocoon productivity, productivity characteristics and the determination of the quantity of silk raw materials and the biological characteristics of the live silkworm cocoons to obtain silk fiber at the required level. The weight of silkworm cocoons and silk shells are considered the main biological indicators of live silkworm cocoons, and their amount depends not only on the breed or hybrids of silkworms and the influence of the external environment, but also on the activity of the silk gland. The correlation between the weight of silkworm cocoons and the weight of the silk shell and the activity of the silk gland has not been studied. That is why it is important to study in depth the causes of quantitative change of silkworm cocoon and silk weight in the conditions of silkworm rearing from a scientific and practical point of view.

Rajabov and Akhmedov [11] concluded from the experiments on the change in the weight of silkworms depending on the feeding rate that when silkworms are provided with sufficient amount of food, they become overweight, and the vitality characteristics deteriorate and the productivity decreases. It was observed that the larval period of silkworms fed with 50% of the feed standard was extended by 7 days, their viability decreased by 36.0%, silk synthesis in the silk gland slowed down, and the silkworm cocoons they wrapped had less silk fiber.

Therefore, we paid special attention to the study of the relationship between the activity of the silk gland, which synthesizes silk fluid in the silkworm body, and the biological indicators of silkworm cocoons.

As we have mentioned above, the indicators of silkworms, in turn, depend on the amount of food given to silkworms and the temperature in the silkworm room. That is why, in order to do this problem correctly, we first focused on studying the quantitative relationship

between silk gland activity and silkworm cocoon and silk shell weight depending on the amount of leaves given to silkworms.

Therefore, the correlation between silkworm activity and silkworm cocoon and silkworm weight is determined based on the experiments conducted to determine the growth of silkworm weight and size with the body parameters of larvae. It is known from the obtained data that as the silkworm's body parameters (weight and size) decrease, the weight and size of the silk gland also decrease. Such a change occurs due to a decrease in the amount of food given to silkworms. The decrease in the size of the silk glands affects the weight of the silkworm cocoon and silk shell. Information on this is presented in Table 5 below.

Table 5. Effect of feeding amount on silk gland activity and biological indicators of silkworm cocoons.

Options	Amount of feed given to silkworms, %	Silk cocoon indicators		Average weight of a silkworm cocoon, g $\bar{X} \pm S_x$	P_d	Silk shell weight, mg $\bar{X} \pm S_x$	P_d	Silkiness of the silkworm cocoon
		Weight, mg	Volume, cm ³					
Ipakchi-1 breed								
V-1	100	1450	1.470	2.05±0.28	-	480±6.85	-	23.4
V-2	75	1250	1.200	1.65±0.20	0.982	375±6.40	0.998	22.7
V-3	50	1035	1.100	1.25±0.18	0.980	275±5.70	0.998	22.0
Ipakchi-2 breed								
V-4	100	1500	1.520	2.10±0.27	-	495±6.95	-	23.6
V-5	75	1300	1.250	1.78±0.21	0.984	390±6.60	0.999	22.9
V-6	50	1070	1.130	1.30±0.19	0.982	285±5.80	0.996	22.0

The analysis of the data in Table 5 shows that a decrease in the amount of feed given to silkworms not only leads to a decrease in silkworm performance, but also to a decrease in the average weight of the silkworm cocoon and the weight of the silk shell. Including, if the silkworms are full that is, when fed with 100% feed, the weight of the silk gland is 1,450-1,500 mg, the volume is 1,470-1,520 cm³, the weight of the separated silk liquid is 2.05-2.10 g, the weight of the shell is silkworm cocoon weighing 4.80-495 mg.

When the amount of food given to silkworms is less than the norm, for example, when 75% food is given, the weight of the silk gland is 1250-1300 mg, the volume is 1.20-1.30 cm³, and the weight of the silkworm cocoon is 1.65-1.70 g, the weight of the shell is 375-390 mg, in the case of lack of food given to silkworms, i.e. when 50% food is given, the weight of the silk gland is 1035-1070 mg, the size is 1.10-1.30 cm³, the weight of the silkworm cocoon formed from them was 1.25-1.30 g, the weight of the shell was only 275-285 mg.

In other words, the reduction of the amount of food given to silkworms from the norm decreases the weight of the silkworm by 40.0-40.2%, the volume by 33.6-34.5%, the weight of the silkworm cocoon by 61.5-64.4%, the silk shell It has been proven to reduce weight by 73.7-74.5%. The fact that the amount of feed is less than the norm was also confirmed by the index of silkiness of the silkworm cocoon. For example; when silkworms are given 100% of leaves, silkiness is 23.4-23.6%, and we see that this indicator decreases by 1.4-1.5 absolute percent when there is a lack of food.

Therefore, the biological indicators of live silkworm cocoons are directly dependent on the activity of the silk gland, and the more silk fluid accumulates in the silk glands, the greater the weight of the silkworm cocoon and silk shell. the more it will be. In order to develop well in the silk gland and accumulate enough silk, silkworms need to be fed in full.

In a word, it was proved that there is a correlation between the body and silk glands of silkworms and the amount of food given to larvae and the biological indicators of silkworm cocoons. We consider it appropriate to take into account and use this relationship in silkworm breeding and creation of new breeds and hybrids.

It is known that the life activity of the mulberry silkworm depends on temperature, which is one of the most important factors of the external environment. If the temperature in the silkworm room is moderate, the silkworms will be well fed, grow quickly and be productive. A temperature below or above the norm causes disruption of the physiological and biochemical processes in the body of the silkworm and, as a result, it becomes ill due to the inability to properly digest food. Digestion of food depends on the activity of enzymes in the stomach. Enzymes act as catalysts and accelerators in biochemical reactions that occur as a result of metabolism. Enzymes can not only speed up reactions, but also create them.

As the temperature increases, the rate of the reaction also increases, but only up to a certain maximum, at which the temperature rises to an optimum. As the temperature increases further, the speed of the reaction decreases, and when the maximum point is reached, the enzymes cease to act. A decrease in temperature from a moderate level also reduces the activity of enzymes. This biochemical law causes an increase or decrease in temperature during the feeding of silkworms, causing severe damage to silkworms, a decrease in their life activity, disease and death.

This process also affects the activity of the silk gland. As a result, the lower or higher temperature than the norm causes less accumulation of silk substance in the silk glands and, as a result, the biological indicators of silkworm cocoons change dramatically.

Table 6. Effect of silk gland activity on the productivity indicators of silkworms during temperature changes.

Options	Silkworm feeding temperature, °C	Silk cocoon indicators		Average weight of a silkworm cocoon, g X±Sx	Pd	Silk shell weight, mg X±Sx	Pd	Silkiness of the silkworm cocoon, %
		Weight, mg	Volume, cm ³					
Ipakchi-1 breed								
V-7	25-26	1450	1.470	2.05±0.28	-	480±6.85	-	23.4
V-8	20-21	1250	1.200	1.70±0.22	0.996	390±6.50	0.996	22.9
V-9	28-29	1035	1.100	1.60±0.20	0.994	360±6.30	0.998	22.5
Ipakchi-2 breed								
V-10	25-26	1500	1.520	2.10±0.27	-	495±6.95	-	23.6
V-11	20-21	1350	1.350	1.75±0.23	0.998	400±6.60	0.996	22.9
V-12	28-29	1250	1.250	1.65±0.21	0.999	375±5.40	0.998	22.7

The figures in Table 6 show that a sharp change in the temperature in the silkworm house during the fifth year of the larvae had a negative effect not only on the indicators of the silkworm, but also on the yield characteristics of the cultivated silkworm cocoons. As a result of low temperature, silk fluid is slow and less synthesized, because silkworms eat less and metabolism decreases. As a result, the silkworms spin a smaller and softer silkworm cocoon.

If the temperature is higher than the norm, the physiological processes are slightly accelerated, the amount of water in the silkworm's body is reduced due to the increased amount of water in the silkworm's body, and as a result, the pieces of leaves that come to the stomach are not moistened properly and they go out without being properly digested. Even in this case, the silk-secreting glands wrap a small and hard-shelled silkworm cocoon without producing silk fluid well.

The data presented in the table confirm our opinion, as a result of the low temperature in the silkworm room, the amount of silk material is low, the average weight of the silkworm cocoon is 1.70-1.75 grams, the weight of the shell is 390-400 milligrams. cocoon weight (2.05-2.10) and shell weight (390-400 mg) average weight of 0.30-0.35 g, the weight of the shell is 0.90-0.95 mg, or 20.0-20.6% of the weight of the silkworm cocoon, and 23.1-23.6% less than the weight of the shell was determined to be.

We observe this situation even when the temperature in the silkworm room exceeds the norm. For example, when silkworms are reared at 28-29°C, the silkworm cocoons they weave weigh 1.60-1.65 grams, compared to 0.45, or 27.2-28.2, of silkworm cocoons spun by silkworms reared at moderate temperatures. And the weight of the silkworm cocoon was proved to be 120 mg, or 32.0-33.3%. These indicators are also confirmed by the silkiness of the silkworm cocoon (Figure 1).

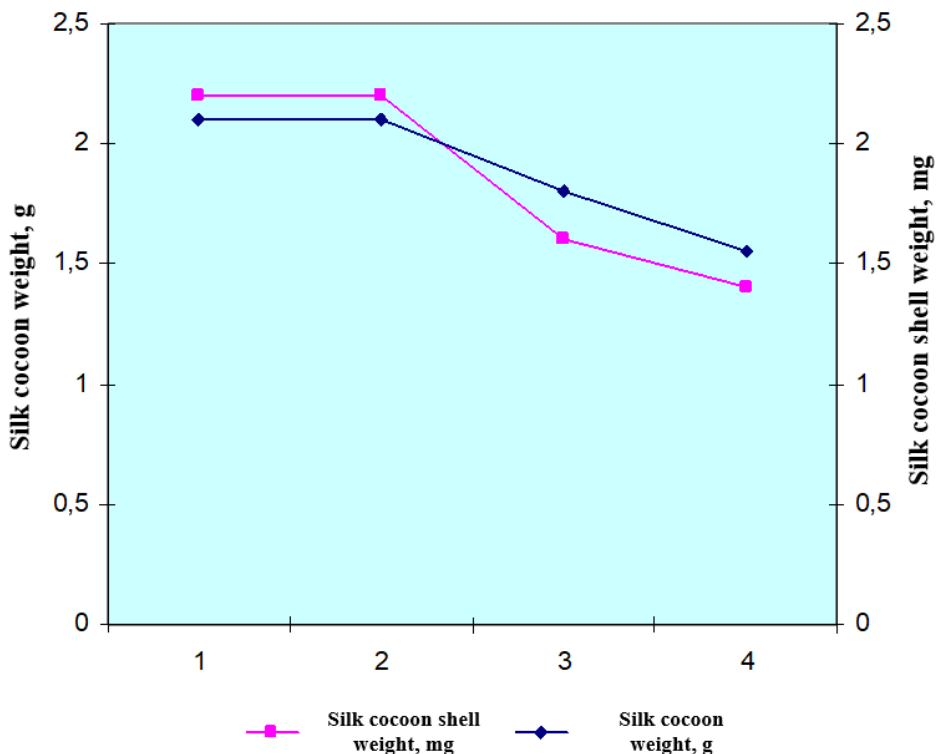


Figure 1. Effect of temperature change on biological indicators of silkworm cocoons.

4 Conclusions

In short, the activity of the silk gland depends on the temperature in the silkworm room, and during the feeding process of the silkworm, the temperature below the norm (20-21°C) or higher (28-29°C) leads to less synthesis of silk substance in the silk-secreting gland. As a

result, during the period of silkworm cocooning, silkworms weave silkworm cocoons that are light in weight, have a soft or hardened shell, and are of poor quality and defective.

Accordingly, during the youth of the mulberry silkworm, the growth of body indicators and the amount of food given to the activity of the silk gland, and the change of the air temperature in the silkworm room, the correlation between the biological and productivity indicators of the silkworm cocoons, silkworm cocoon weight, affects shell weight and silkiness.

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