



Improvement of Unique Economic Indicators in Georgian Breeds of Mulberry Silkworm

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ABSTRACT

Methods of improving the viability of Georgian breeds of silkworm (Digomi 1 and Digomi 2) with excellent properties are considered in the work. The cocoons of the breeds of the initial Digmuri group are characterized by a long thread (2000 m) and high silkiness (24-25%). The only disadvantage of these breeds is that they have a relatively low viability, and this work was carried out just to improve this deficiency. As a result of carrying out complex selection work to increase the viability of the initial breeds, new improved hybrid combinations were obtained, which in their biotechnological properties are equal or higher than the initial breeds.

Key words: mulberry silkworm, selection, cocoon, viability.

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Introduction

In the Georgian gene pool of the mulberry silkworm, breeds bred by both old folk selection and scientific selection are preserved. Breeds bred by folk selection are characterized by a short thread and a cocoon with a thin shell. At the beginning, the breeds bred by scientific selection were also characterized by a short thread (700-900 m and did not even differ in purity, metric number 2000-2200), as a result of which it was necessary winding of 6-7-cocoons together to obtain raw silk. In subsequent years, the biotechnological parameters of breeds used in selection gradually improved and the length of the thread of breeds bred in 1985-1990 (Digomi 1 and Digomi 2) reached 1800-2000 m, and the metric number was more than 3500. It's true, these breeds are old enough, but they are characterized by high biotechnological parameters, due to which their use in selection works (in the form of a starting component) and in hybrid combinations (for production) gives a very good result, so it is

important not only to preserve them, but also to improve their viability, in view of the fact that they are characterized by low viability, so selection was aimed at improving their viability.

Material and procedure

In the experiment, the local breeds Digomi 1 and Digomi 2 were taken for improvement, and the breeds with high viability also of local origin: Tbilisuri and Kartli were selected as an improving component [2]. The main leading features for the selection were the length of the cocoon thread of at least 1800 m, the purity of 3500 metric number heterogeneity inside the cocoon - no more than 30, between cocoons-17 and total -35, the caliber of the cocoon is -16-19 mm [3,4].

In sericulture, the effectiveness of selection work depends on complex factors, such as: selection of a qualitative initial material, the level of inheritance of selected selection features, the presence of genotypic correlation between them and the intensity of

selection. A complex of methodological questions that includes a whole cycle of the selection process includes: selection of parental forms, respectively, with the intended task, obtaining the initial population and reproduction of the selection material.

To improve viability, the moths, which emerged on the first day, the eggs, which were laid on the first day and larvae which appeared on the first day were used. Depending on how viable the pupa is, the process of metamorphosis proceeds so normally and quickly, so just such individuals were selected and left. The selection of moths was also carried out according to their viability, the eggs of such moth which survived for another 6-7 days after the laying the eggs were selected for reproduction. Blood infusion method was also used as well, and related breeds with high viability were selected as enhancers.

The method of preliminary prediction-determination of proteins in hemolymph was used for evaluation of initial and improved breeds, [5,6].

Results and analysis

Breeds for improving Digomi 1 and Digomi 2 have the following biotechnological indicators: silkiness of the alive cocoon 24.0-25.0%, silkiness of the air-dry cocoons 49.5-50.0%, raw silk yield 43.0-43.6%, silk filament length 1900-2000 m, dry cocoon yield ratio 22.1 (Table 1). As noted above, these breeds are characterized by high biotechnological properties and only need to improve their viability. To this end, the moths emerged after feeding of mulberry silkworm were crossed with the moths of the breeds- improvers Tbilisuri and Kartli, which are characterized by high viability. As a result, F₁ generation was obtained, the selected healthy eggs (grain) of which was revived artificially, after their feeding the biotechnological indicators of the hybrid generation F₁ were slightly better than of the previous, initial generation.

Table 1. *Biotechnological indicators of the initial material*

Characteristics	Breeds	Basic statistical parameters					
		Σ	n	M	δ	m	C
Raw mass of alive cocoon g	Digomi 1	36.55	18	2.03	0.189	0.044	9.30
	Digomi 2	56.45	26	2.17	0.203	0.040	9.33
Cocoon shell weight, mg	Digomi 1	450	540	3749.3	18	430.52	157.57
	Digomi 2	470.3	26	468.09	139.338	27.326	29.77
Silkiness of an alive cocoon	Digomi 1	436.5	20	21.83	6.880	1.538	31.52
	Digomi 2	444.3	2	20.36	8.580	2.477	42.14
Length of cocoon thread, m	Digomi 1	34514.3	20	1725.72	612.693	137.002	35.50
	Digomi 2	32244.3	19	1697.07	611.992	140.401	36.06
Metric number of cocoon	Digomi 1	62989.3	21	2999.49	1014.349	221.349	33.82
	Digomi 2	65927.3	21	3139.40	1062.354	231.825	33.84

At a subsequent stage, work was carried out by analytical selection and attention was intensified again to improve viability (along with preserving other indicators) and fixation in generations. As a result of selecting the best individuals and crossing

with the initial forms, complex hybrid combinations were obtained, i.e., grain of the second F₂ generation, in these breeds, work on preserving technological indicators and improving viability was again continued.

Table 2. Results of three-day feeding of mulberry silkworm (average)

N		Digomi 1	Digomi 1 ₂	Digomi 2	Digomi 2 ₂
1	Amount of grains in 1 g, pcs	1600	1595	1600	1610
2	Number of larvae in 1 g, pcs	2220	2240	2240	2250
3	Grains revitalization, %	96.7	98.7	96.7	98.4
4	Duration of feeding, days	30	30	30	30
5	Silkworm viability, %	88.0	91.4	88.6	92.5

6	Mass of living cocoon, g.	2.12	2.2	2.1	2.2
7	Shell weight, mg.	510	554	514	570
8	Silkness fresh cocoon, %	24.1	26.4	24.5	25.9
9	Cocoon crop with 1 g larvae, kg.	4.1	4.5	4.2	4.6
10	Among them: normal cocoons, %	94.8	95.6	93.9	95.5
11	Double cocoons, %	2.2	2.0	3.0	2.2
12	Epmty, %	3.0	2.4	3.1	2.3
13	Cocoon winding capacity, %	90.6	91.2	91.5	92,7
14	Average thread length	1990	2100	2000	2170

After feeding the larvae of the mulberry silkworm and emerging the moth, the above-mentioned crossing method was repeated, as a result of which grain of F₃-generation was obtained, the biotechnological indicators of which are much better than those of the original breeds.

Average biotechnological values obtained as a result of three-day feeding of mulberry silkworm of Digmuri group breeds are given in Table 2.

Discussion of the results

As noted above, the only disadvantage of Digmuri breeds is that they have relatively low viability under extreme conditions and just in order to improve this deficiency, this work was carried out. Selection work for the improving the marked breeds was carried out with strict selection and input of blood, on the basis of which families and individuals with high biotechnological indicators were selected, on the basis of which in the future it is possible to create new breeds with higher biotechnological performance and with much higher viability. [10,11.12].

From the data of Table 2 it can be seen that in terms of the average biotechnological indicators of three breeds, promising experimental breeds exceed the initial breeds and mainly meet the regulatory requirements of the breeds established for breeding.

The best indicators are: yields of alive cocoons with 1 g of grain, which is 4.5-4.6 kg and 0.4 kg more than of the original breed. As for the main goal of our experiment- to increase viability, this indicator increased from 88.0-88.6% in the initial breeds to 91.4-92.5%, which is a great achievement in the selection work of mulberry silkworm.

As can be seen from the table, as a result of selection work, it became possible not only to preserve the main features during selection (thread length and purity) in the marked breeds (Digomi 1 and Digomi 2), but also their significant improvement.

At the same time, in selected for reproduction individuals of experimental breeds, the average length of the cocoon thread increased by 110-170 m.

In the breeds of the Digmuri group, such families were identified, the length of the cocoon thread of which exceeded 2100 m, and in some individuals this figure reached 2400 m. Due to the large length and purity of the thread from the cocoons of the Digmuri breeds, it is possible to obtain raw silk that is used in the production of thin and expensive silk fabric.

As for the other biotechnological indicators, they have improved in many ways in experimental breeds [12]. Together with that, according to the main characteristics of selection (length of cocoon thread, purity and improvement of viability), we justify our preliminary goal. Despite this, work to improve and stabilize these features will be continued again, due to the large potential of experimental breeds.

As noted above, the method of preliminary prediction - the method of determining proteins in hemolymph - was used to evaluate the initial and evolved breeds. As you know, there is a direct correlation between the mass of silk glands and the silkiness of the cocoon - the greater the mass of silk glands, the higher the silkiness of the cocoon. The mass of silk glands grows especially intensely from the third day of the fifth age to the eighth day, i.e. till the forming of cocoon, due to the nutrition of mulberry caterpillars rich in carbohydrates, proteins and nitrogen. Approximately 70% of the mass of silky glands is produced as a result of the processing of proteins obtained from mulberry leaves, and the remaining 30% by the synthesis of hemolymph of mulberry and plant mulberry proteins. At the same time, a certain part of the proteins (15%) is produced in the body of larvae while forming of cocoon, i.e., when the larvae of the mulberry silkworm no longer takes food. At the first age the mass of glands of larvae of a mulberry silkworm is 4% of its weight, at the fifth age this indicator already reaches 25-26%,

and the length of silk glands exceeds the length of the larvae five times.

To determine the number of proteins in the hemolymph on the third day of the fifth age, 10 larvae from each variant were weighed each day before the cocoons were formed, and silk glands were also separately weighed. The mass of larvae of mulberry

silkworm and silk glands gradually grows from the third day of the fifth age to the eighth day.

As it turns out from the results of the experiment, the reason for increasing silkiness is the intense growth of silk glands, and the accumulation of a large amount of silk mass in them. The results of the experiment are shown in Table 3.

Table 3. Amount of protein in hemolymph of silkworm, %.

Breeds	Sex of the larvae	3 averages of the experiment			
		Sex of the larvae		Sex of the larvae	
		♀	♂	♀	♂
Digomi 1		8.5	8.2	8.7	8.3
Digomi 1 ₁		8.9	8.4	9.4	8.8
Digomi 2		10.6	8.7	11.3	9.3
Digomi 2 ₂		12.3	9.2	12.8	9.8

As can be seen from Table 3, the increased total protein content of Digomi 1₁ and Digomi 2₂ hemolymph gave better results than Digomi 1 and Digomi 2. This indicates that the selection of silkworm larvae by this method contributes to the synthesis of proteins in the body, which subsequently affects the

increase in silkiness of silkworm cocoons. At the same time, the regularity of the content of proteins depending on sex remains, of course, the number of proteins in the hemolymph of female larvae of mulberry silkworm is much higher compared to the male ones.

Table 4. Effect of the amount of total proteins in hemolymph (♀♂ average) on some biological indicators of mulberry silkworm.

Breeds	Number of total proteins, %	Silkiness of the cocoon, %	Number of grains in clutch, pcs
Digomi 1	8.3	23.6	670
Digomi 1 ₁	8.6	24.1	690
Digomi 2	9.6	24.8	712
Digomi 2 ₂	10.7	25.3	789

As the data of Table 4 show, there is a clear difference between the two experimental breeds of mulberry silkworm, moth fertility and the content of common proteins in hemolymph. For example, with an average protein content of 10.7%, respectively, the average silkiness of individuals of both breeds is higher, as well as the average number of eggs in the grain (790 pcs).

The purpose of the experiment was to establish a relationship between the concentration of common proteins in the hemolymph of larvae at the end of the fifth age, silkiness and fertility of the moth.

Based on the analysis of the data of table 4, a correlation was revealed between the concentration of common proteins in the hemolymph of silkworm larvae, the silkiness of the fresh cocoon, as well as the fertility of the moth. In particular, in Digomi 1 hemolymph, the content of total proteins in hemo-

lymph is 12.3%, the average amount of fertilized eggs (laid by one moth) is 789 pcs, which is 77-119 pcs more compared to other versions.

Therefore, the greater the number of total proteins in the hemolymph, the higher the silkiness of the live cocoon of the mulberry silkworm and the fertility of the moth.

Conclusions

1. As a result of selection work, improved lines of mulberry silkworm Digomi 1₂ and Digomi 2₂ with high biotechnological properties, which are relatively resistant against various diseases of mulberry silkworm and are considered promising breeds, are obtained by the method of rapid improvement.
2. The silkworm breeds Digomi 1₂ and Digomi 2₂,

which originated from the breeds of Digmuri group, mainly contain medium size cocoons and are characterized by high biotechnological properties. Especially they have high indicators for the length of the cocoon thread, which is more than 2000 m.

3. The silkworm breeds Digomi 1 and Digomi 2, which originated from the breeds of Digmuri group and the evolved breeds Digomi 1₂ and Digomi 2₂ are valuable starting materials for producing even more highly productive breeds and production hybrids.
4. The mass of silky glands from the third day to the eighth day of the fifth age increased 4-7 times and amounted to 22.3-29.2% of the mass of mulberry silkworm, which accordingly affected the silkworm of a fresh cocoon, there is a direct connection between the mass of silkworm glands and the mass of silk in the cocoon, which can be used in the selection work of mulberry silkworm.

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