Appearance of biological and productivity indicators of foreign breeds and hybrids of *bombyx mori* l. propagated in seed enterprises in different conditions

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Abstract. At the global level, special attention is paid to the care of the mulberry silkworm Bombyx mori L. in different climatic conditions, the adaptation of monovoltine breeds and hybrids to different ecological regions, and the production of high-quality raw silk that meets the requirements of the international standard 2A, 3A, 4A. being directed. Today, creating a new generation of mulberry silkworm breeds and hybrids and improving the technological properties of cocoons and silk raw materials obtained from them, determining the effects of various environmental factors and objectively evaluating the physical and mechanical properties of cocoons are considered as urgent problems on a global scale. Currently, some of the mulberry silkworm seeds, which are not enough for farms in our country, are imported from the People's Republic of China. The economic value of these imported elite and industrial hybrids, namely silkworm egg viability, worm viability, length of larval larval period, biological factors such as mulberry silkworm, cocoon and shell weight, cocoon yield, silkiness and cocoon productivity such as fertile and non-fertile cocoons. It is scientifically based on the extent to which the natural climatic conditions of the regions of Uzbekistan affect productivity indicators such as percentage, dry weight of cocoons, percentage of defective cocoons.

1 Introduction

Throughout the history of civilization, mankind has been in constant search for the preparation and rational use of food, clothing and household items for its needs, especially its demand for natural fibers and fabrics has been extremely high [1-4].

Currently, scientific and research work is being carried out to create new breeds and hybrids of silkworms by developing selection methods that increase flexibility and resistance to different climatic conditions, taking into account the need for natural fiber and natural fabrics in the world market and the global change of climate conditions on earth [5-9]. Scientists of the leading research centers of countries such as Japan, the People's

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Republic of China, India, Vietnam and South Korea, where sericulture has developed, have been conducting a number of research and development works on the creation of new breeds and hybrids with high levels of cocoon productivity and technological indicators, suitable for the rapidly changing natural climate conditions, positive results have been achieved [9-11]. Currently, using new effective methods of genetics and selection processes, creating breeds and hybrids that meet the changing natural climate conditions of our country, meet the requirements of industrial enterprises, and have high cocoon productivity and technological characteristics is an urgent scientific and practical task [1-3].

Especially in the world market, the demand for cocoon raw material, which produces silk fiber with a high metric number, is increasing year by year, it is urgent for silk scientists to create new industrial hybrids suitable for different climatic conditions, raw silk yield, total length and physical-mechanical properties of the fiber according to the requirements of production enterprises. is setting tasks [5].

At the global level, special attention is paid to the care of the mulberry silkworm Bombyx mori L. in different climatic conditions, the adaptation of monovoltine breeds and hybrids to different ecological regions, and the production of high-quality raw silk that meets the requirements of the international standard 2A, 3A, 4A. being directed [5,6]. Today, creating a new generation of mulberry silkworm breeds and hybrids and improving the technological properties of cocoons and silk raw materials obtained from them, determining the effects of various environmental factors and objectively evaluating the physical and mechanical properties of cocoons are considered as urgent problems on a global scale [9,8].

Year after year, important measures are being implemented in Uzbekistan to increase the production of cocoon raw materials, to increase the production of super-elite, elite and industrial seeds of mulberry silkworm. Special attention is paid to the selection and placement of eggs based on environmental conditions and the natural climate of the region in breeding industrial hybrids of the mulberry silkworm. In this regard, the research of new methods and agrotechnologies is of great practical importance. A number of works are being carried out by foreign and local scientists in this direction [1-5].

A great geneticist [1] stated that the greatest service of genetics to animal breeding was the development of the concept of genetic, paratypic and phenotypic variation and their different importance in evolutionary processes occurring in nature and under the influence of human selection, while genotypic and paratypic variation or the development of a methodology for determining the relative position of selected characters in certain environmental conditions and for certain populations. [2,3] created heat-resistant hybrids using polyvoltine and bivoltine breeds, evaluated them for biological and cocoon productivity characteristics under temperature and humidity conditions, and conducted research on the cultivation of quality cocoon raw materials. Research scientists [4] have substantiated the resistance of polyvoltine eggs to changes in external environmental factors during their embryonic development. [5] showed that the global changes in the world's climate have an effect on the areas where worms are raised in Azerbaijan, and scientifically substantiated the fact that they harm the economy of cocoon-growing and cocoon-spinning enterprises.

In this regard, a number of studies have been conducted by leading scientists in our country. [6] evaluated the silk productivity and metric number of fibers in the summer and autumn seasons of the large-cocooned and thin-fibered Golden Valley 1 and Golden Valley 2 Gozal x S8, Marvarid x S8, and Atlas x Margilon hybrids.

The effect of nutritional properties of mulberry leaves in the summer season on biological, cocoon productivity and technological properties of silkworm breeds and hybrids was studied [7]. Research scientists [8] analytically studied to what extent the physical and mechanical properties of cocoon raw materials prepared in regions with

different natural climatic conditions of Uzbekistan. A group of scientists [9] conducted research on the effect of economic traits on silkworms of selection numbers №2-02, №3-02, №4-02, №5-02 and №7-02, which are being tested in an experimental farm under the authority of the Scientific Research Institute of Sericulture. . According to [10, 11], the mulberry silkworm Bombyx mori L. is considered a monophagous insect, and it is extremely sensitive to environmental factors due to the fact that it feeds only on mulberry leaves. Years of unfavorable weather for larvae change not only their productivity, but also the genetic parameters of breeding populations. As an example, they admit that the indicators of silkiness and silk productivity of the Marvarid breed have changed. Leading technologists have researched the existence of a correlation between the thinness and hardness of silk fiber and the increase of physical and mechanical properties of the fiber with the thinning of the fiber depending on the relative hardness of the silk fiber [11].

2 Materials and methods

Our initial experiments will be conducted at Tashkent State Agrarian University, Silk Research Institute and different regions of the Republic of Uzbekistan based on the experimental scheme presented in Fig. 1. The methodology of "Agrotechnical rules for the care of white cocoon breeds" of mulberry silkworm is used in conducting experiments [1-5].

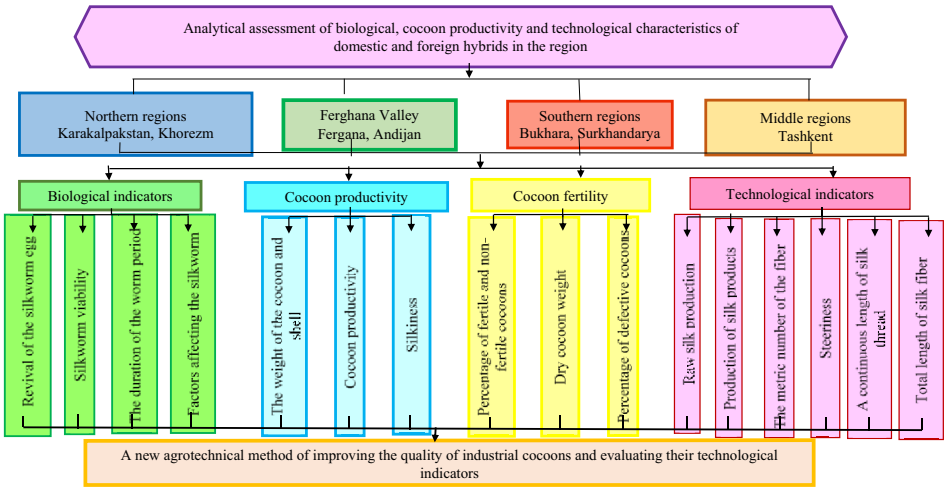

Fig. 1. Scheme of experiments in which research work was carried out.

Hybrid worms in the experiment are kept in worm houses that meet agrotechnical requirements in an optimal hygrothermal regime. Young worms are fed with crushed mulberry leaves 7-8 times a day at a temperature of 26-27 ºC, relative humidity of 75-80%. Adult worms are maintained at a temperature of 24-25 ºC and relative humidity of 60-65%, 5 times a day with horned leaves. Worms in the experiment are maintained with leaves of a mixture of varieties of the same quality at the rate of 1000 kg of leaves per 1 box of worms.

During the cocooning period, the temperature is kept at 25 ºC, and the relative humidity is 60-65%. Natural and artificial stalks are used for wrapping the cocoon (Fig. 2).

Fig. 2. Natural and artificial piles.

Industrial hybrids "Uzbekistan 5", "Uzbekistan 6", "Musaffo tola 1", "Musaffo tola 2" and "Jingsong x Hoayou" imported from the PRC to Uzbekistan are used in the experiments. At the same time, it is possible to participate in experiments with Japanese and Chinese breeds, which have been maintained at seed breeding enterprises in our country [1-3].

Every year, the eggs of hybrids taken for experiments are fully analyzed in January-February. The number of eggs in the clutch, the weight of the clutch, the weight of one egg and the physiological parameters of each hybrid are analytically studied. The obtained ovipositors are studied individually, the seeds are counted, and the indicator of physiological fertility is calculated based on the number of dried, unfertilized eggs. The weight of each egg is determined by weighing it individually on a torsion scale [5-9].

For the spring season, hybrid seeds are pooled and egg samples are taken in 4 replicates of 100 each to determine egg viability. The percentage of egg survival is calculated from the number of viable eggs in the samples [1-4].

Worm viability is determined by the percentage of healthy cocoons reared from 250 worms in 3 replicates. Cultivated cocoons were separated into healthy, deaf and double cocoons, and the percentage of disease was analyzed by the number of deaf cocoons.

Cocoon fertility By sorting the cultivated cocoons, fertile, non-fertile and black cocoons are divided into groups.

3 Results and discussion

Research on the effect of environmental factors on biological and productivity indicators of mulberry silkworm elite and industrial hybrids should definitely include more hybrids and breeds. In our ongoing research, we thoroughly studied the influence of the weather conditions of different regions on this sign and feature of the foreign hybrid brought to our republic in large quantities from the PRC. As a result, it was found that the hybrids have the same genotype, but their sensitivity to external environmental factors differs sharply in the regions, and it was concluded that special attention should be paid to the air temperature and relative humidity level in showing the potential of these hybrids in terms of biological, cocoon productivity and technological characteristics.

At present, 8 silkworm nurseries and 5 breeding stations are operating in our country. Since 2018, elite seeds of Japanese and Chinese breeds have been brought to Uzbekistan from the PRC in 8 seed enterprises, and industrial hybrids are being prepared in the combination of ♀Chinese x ♂Japanese and ♀Japanese x ♂Chinese. The volume of these

hybrids was 80 thousand boxes in 2019 and 150 thousand boxes in 2020. The breed and hybrids are monovoltine breeds with medium cocoons and are considered high in silk fiber.

We collected cocoons from these breeds and hybrids in Fergana, Andijan, Khorezm, Bukhara, Tashkent regions and the Republic of Karakalpakstan and analyzed their main biological and productivity indicators.

Preliminary data were obtained for Fergana region, the data are presented in Table 1.

Table 1. Biological and productivity indicators of elites and hybrids produced in Fergana region (2019)

#	Company and organization name	Hybrid and elite seeds		Egg revival, %	Worm viability, %	Butterfly emergence from brood cocoons, %	Cocoon weight, g	Cocoon weight, g	Silkiness, %	Cocoon productivity from 1 box, kg
1	"Fergana cocoon breeding" LLC	Elite	Japan	95.0	89.0	94.0	1.50	0.310	20.7	57.0
			China	96.0	88.0	95.0	1.52	0.319	21.0	57.7
2	"Fergana mulberry silkworm seeds" LLC	Elite	Japan	96.0	83.0	92.0	1.40	0.287	20.5	50.0
			China	95.0	79.0	94.0	1.50	0.315	21.0	51.0
3	Toshlok "Agropilla" LLC	Hybrid	Japan × China	96.5	89.0	-	1.50	0.318	21.2	57.9
			China × Japan	96.0	93.0	-	1.40	0.290	20.7	56.2

Before discussing the numbers in Table 1, it should be noted that experimental worms were kept in three organizations: "Fergana Cocoa Breeding" LLC, "Fergana Mulberry Silkworm Seeding" LLC and Toshloq "Agropilla" LLC. Egg viability of Japanese and Chinese elite seeds and hybrids with their participation was almost the same, i.e. 95.0-96.0%. In terms of worm viability, as expected, hybrids showed a slightly higher index - 89.0-93.0%. In elite breeds, this indicator was equal to 79.0-89.0%.

As for the cocoon productivity, the cocoon weight of the Japanese and Chinese breeds was 1.40-1.50 g, which showed that they are medium cocoon breeds. In the hybrid generation, it was not observed that hybrids produced abundantly in Fergana region. The average weight of the cocoon is 1.40-1.50 g; The yield of cocoons from 1 box was determined to be 56.2-57.9 kg.

The next region is Andijan region, experiments were conducted in the farms of "Khojaabad silkworm seed preparation" LLC and "Agropilla" LLC of Buloqbashi district. Biological and cocoon productivity indicators of these breeds and hybrids are presented in Table 2.

Table 2. Biological and productivity indicators of elite and hybrids prepared in Andijan region (2019)

#	Company and organization name	Hybrid and elite seeds		Egg revival, %	Worm viability, %	Butterfly emergence from brood cocoons, %	Cocoon weight, g	Cocoon weight, g	Silkiness, %	Cocoon productivity from 1 box, kg
1	"Khojaabad silkworm seed prepa-ration" LLC	Elite	Japan	95.6	85.0	94.6	1.62	0.351	21.7	59.2
			China	95.0	86.0	95.2	1.63	0.341	20.7	59.7
2	Bulagboshi "Agropilla" LLC	Hybrid	Japan× China	96.0	89.0	-	1.40	0.281	20.1	54.0
			China × Japan	96.3	92.0	-	1.45	0.302	20.8	52.3

In the conditions of Andijan region, the viability of eggs of Japanese and Chinese elite breeds was 95.0-96.6%, and the viability of worms was at the level of 85.0-86.0%. In their forward and reverse hybrids, these indicators were 96.0-96.3% and 89.0-92.0%, respectively.

Cocoon productivity figures obtained in this area showed conflicting results. This condition can be seen in cocoon weight. In Japanese and Chinese breeds, the average cocoon weight was 1.62-1.63 g, while in Japanese x Chinese, Chinese x Japanese hybrids, the cocoon weight decreased for some reason (1.40-1.45 g). There was no significant difference between breeds and hybrids in silkiness of cocoons. As a result, the yield of cocoons from one box of worms was 52.3-54.0 kg.

We conducted observations on Japanese x Chinese and Chinese x Japanese hybrids only in "Agropilla" LLC, Ortachirchik district of Tashkent region (Table 3).

Table 3. Biological and productivity indicators of hybrids prepared in Tashkent region (2019)

#	Company and organization name	Hybrid and elite seeds		Egg revival, %	Worm viability, %	Butterfly emergence from brood cocoons, %	Cocoon weight, g	Cocoon weight, g	Silkiness, %	Cocoon productivity from 1 box, kg
1	Urtachirchik "Agropilla" LLC	Hybrid	Japan × China	94.0	74.0	-	1.33	0.266	20.0	41.6
			China × Japan	94.0	74.0	-	1.34	0.275	20.5	41.9

The climate of this region is somewhat moderate, but it should be noted that the industry is developed in this region and there are many different production enterprises. Egg survival and worm viability shown in Table 3 are slightly lower than in the previous 2

valley regions, confirming that the region's climatic conditions are not very good. Egg viability was 94.0%, and worm viability was 74.0%.

It is not difficult to see that cocoon productivity is proportional to biological indicators in the indicator of average cocoon weight (1.33-1.34 g). Naturally, a high cocoon yield cannot be obtained from cocoons of such weight (41.6-41.9 kg).

Japanese x Chinese and Chinese x Japanese hybrids were cultivated in the southern region of Bukhara region selected for our experiments (Table 4).

It can be noted that the results obtained in the southern region indicate that the hot climate had a positive effect on the biological and cocoon productivity indicators of the hybrids.

Table 4. Biological and productivity indicators of hybrids prepared in Bukhara region (2019)

#	Company and organization name	Hybrid and elite seeds		Egg revival, %	Worm viability, %	Butterfly emergence from brood cocoons, %	Cocoon weight, g	Cocoon weight, g	Silkiness, %	Cocoon productivity from 1 box, kg
1	Shafirkon "Agropilla" LLC	Hybrid	Japan × China	95.0	85.0	-	1.60	0.326	20.4	59.3
			China × Japan	95.6	84.0	-	1.60	0.334	20.9	58.0

The survival of eggs is almost at the level of production requirements - 95.0-95.6%, but the viability of worms does not meet the requirements for industrial hybrids - 84.0-85.0%. Usually this level of vitality is characteristic of an elite population. The weight of the cocoon was 1.60 g, and the silkiness was 20.4-20.9%. The yield of cocoons from one box of worms was 58.0-59.3 kg.

The Republic of Karakalpakstan and the Khorezm regions are considered northern regions and are characterized by sharp changes in climate. The next stage of our experiments was conducted in the conditions of these two regions (Tables 5 and 6).

Table 5. Biological and productivity indicators of elite and hybrids produced in Khorezm region (2019)

#	Company and organization name	Hybrid and elite seeds		Egg revival, %	Worm viability, %	Butterfly emergence from brood cocoons, %	Cocoon weight, g	Cocoon weight, g	Silkiness, %	Cocoon productivity from 1 box, kg
1	“Urgench Silkworm pro” LLC	Elite	Japan	96.0	90.0	95.0	1.40	0.301	21.5	54.4
			China	95.0	84.0	94.0	1.40	0.308	22.0	50.0
2	Khanka "Agropilla" LLC	Hybrid	Japan × China	95.0	84.2	-	1.50	0.308	20.5	54.0
			China ×	96.0	80.7	-	1.50	0.300	20.0	52.3

			Japan							

Table 6. Biological indicators of elites and hybrids in the Republic of Karakalpakstan (2019)

#	Company and organization name	Hybrid and elite seeds		Egg revival, %	Worm viability, %	Butterfly emergence from brood cocoons, %	Cocoon weight, g	Cocoon weight, g	Silkiness, %	Cocoon productivity from 1 box, kg
1	Ellikkala "Agropilla" LLC	Hybrid	Japan × China (Shandong)	94.0	89.0	-	1.50	0.305	20.3	57.0
			China × Japan (Tunshang)	93.2	84.0	-	1.60	0.326	20.9	56.0

As expected, the viability of worms in these northern regions is much lower than the norm - 80.7-89.0%. Egg survival was recorded at a low level (93.2-94.0%) only in Karakalpakstan.

The weight of the cocoon was 1.40 g in the elite population, and 1.50-1.60 g in hybrids. But the yield of cocoons was 52.3-57.0 kg, significantly lower than other regions.

4 Conclusions

The results of the experiment conducted in this direction certainly encourage us to investigate the biological and productivity indicators of cocoons grown in these significantly different regions. Important parameters such as egg viability, worm viability, butterfly emergence from fertile cocoons, cocoon weight, cocoon shell weight, silkiness, cocoon yield from 1 box were analyzed separately in each region.

As a result of the conducted research, the formation of biological and productivity indicators in different regions of the republic was reflected in the correlation with the natural climatic conditions of each region during the worm feeding season.

Based on the above, it would be appropriate to revive foreign mulberry silkworm hybrids in different regions of the republic, distribute their larvae to worm feeding units and carry out agrotechnical measures correctly, determining the optimal periods of care for worms in young and old.

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