The Study of Genetic Parameters Ecologically Stable Mulberry Silkworms Breeds on Different Conditions

Çevresel Dayanıklı Dut İpekböceği Türlerinin Farklı Koşullarda Genetik Parametrelerinin Öğrenilmesi

Research Article

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ABSTRACT

For the first time by adaptive selection have created new high viable and productive hybrid lines suitable for the climatic conditions of Ganja-Gazakh region. Experiments were carried out in 2 different conditions. Thus the results of the studies prove that on the basis of a 3 year adaptive selection, each of the created 4 lines, with the exception of 1-2, technological performance and productivity are on high rate. According to the envorimental resistance of the material as well as its first selection, the second generation, is significantly more productive than regionalized highly productive Mayak-3 type.

Key Words
Mulberry silkworm, hybrid, test, genotype, coefficient of ecological stability, environmental tolerance.

ÖZ

Uyarlanabilir seçimle ilk defa Gence-Gazah iklim koşulları için uygun olan yeni, yüksek uyarlanabilir ve verimli melez hatları oluşturulmuştur. Deneyler 2 farklı koşul da gerçekleştirilmiştir. Bu çalışmaların sonucunda, 3 yıllık adaptatif seleksion sürecinde oluşturulan dört hattın her biri hariç tüm biyolojik, teknolojik ve verimlilik göstergelerine sahiptir. Ayrıca çevresel dayanıklılığına göre çok verimli Mayak-3 türünü içermektedir. Yeni türler sadece kuru kozanın ipekliliği dışında kozaların tüm biyolojik ve teknolojik yönden Azerbaycan Cumhuriyetinin yeni oluşturulan dut ipekböceği türleri ve melezleri için konulan tüm sınırlara cevap vermektedir.

Anahtar Kelimeler
İpekböceği, melez, test, genotip, ekolojik stabilitik katsayısı, çevresel dayanıklı.

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INTRODUCTION

Artificial selection is one of the most important and powerful tools for creating new breeds and improving existing breeds in the modern selection of agricultural animals, including mulberry silkworm. The effectiveness of the selection depends largely on the correct assessment of the pedigree value of the selected breeds [1]. As a result of genetic studies, it was determined that the inheritance coefficient, selector differential, variation coefficient, phenotypic and genotypic correlation coefficients and other genetic parameters should be used for the proper evaluation of the genotype [2,3]. It should be noted that the mulberry silkworm's genotypes should have a complex selection, taking into account productivity and environmental sustainability. There fore, considering these two characteristics, it is necessary to determine the selection criteria that will lead to an effective result.

Only some sort of commodities and silk products are obtained from mulberry silkworm breed and hybrids. But the quantity and quality of the raw-silk products are affected by a number of quantitative indicators of economic value by this or that degree [4,5]. The cocoon products, the ability of the survival of the worms, opening ability of dry cocoon, raw silk output, the degree of tolerance of sex or a hybrid to various infectious diseases and the effective use of spent food have a stronger influence on the amount of raw silk product(s) than other features and characteristics [6,7].

The inseparable and total length of the silk wire opening from the cocoon, the metric number and the inequality have a significant effect on the quality of raw silk products. The genetic improvement of each of these symptoms and signs ultimately leads to an increase in the quantity and quality of raw silk products [8-10].

The results of hundreds of special investigations and selection studies that have been carried out in the last 50 to 60 years have clarified that genetic parameters allow to characterize the genetic structure of the selection patterns by quantitative characteristics, to evaluate the effects of genotype and ambient conditions on the development and formation of quantitative signs and other important selective issues to solve. They, in turn, significantly improve the efficiency of selective work by improving the efficiency of selection methods, more optimal planning of selection programs and shorter and better quality of implementation.

MATERIALS and METHODS

Materials

As the material of selection was taken thesegenus Mayak-2, Chine-21 and Ukraine-1. In the process of selection we conducted experiments in 2 different conditions in unconditional and conditional conditions. In the experiments in unconditional conditions, silkworms are fed on the basis of agro-technical regulations adopted in our country. In experiments carried out in pessimal conditions, the worms in the first three years are also fed under optimal conditions, and in the last 2 years- in conditional conditions, using 2 ecofactors. Prepared selective material was fed in summer and autumn and the main lines were selected and separated.

In our research, the range of breeding lines for years and generations was 16-32 families. In order to study the adaptive ability of the selection lines and to determine the environmental stability ratios, representative control populations have been created and used in every generation. The volume of control populations consisted of 3-4 repeats of 150-200 worms per generation.

The mass of the live cocoon, which is the most important ingredient of the live silkworm, was used in the selection process as the leading selection criteria for improving adaptive ability. 3-way selection was applied on selection lines. In the first and second stages - the selection of the family, and the third one - individual selection.

In summer, hybrids of the above-mentioned genes were fed optimally until the end of the third year. At the third age, each family is divided into 2 half-families. From the first day of the fourth year to the end of the fodder, the first half-families of each family are fed in optimal conditions, and the second half-families- in pessimal conditions. Average mass prices of a living cocoon and threadof a cocoon in every half-family ($X_{oş}$ və$X_{pş}$) and based on these prices the average prices of each family by both signs from two environments (X_{or}), environmental sustainability coefficient (ES_i) and selection index ($Sİ_i$) are determined by the following formula of B. H. Abbasov:

$$ES_i = X_i^{-pş} / X_i^{-oş} \quad (1)$$

$$Sİ_i = ES_i\,(X_i^{-pş} + X_i^{-pş}) / 2 \quad (2)$$

where:

$X_i^{-pş}$ - the average value of the evaluated sign of genotype in pessimal conditions;

$X_i^{-oş}$ - the average value of the evaluated sign of the genotype in optimal conditions

We should analyze several aspects to further characterize the environmental sustainability, biological, technological and productivity indicators of newly created breeds. 30 Females, 30 males were taken from materials bred both in optimal and pessimal conditions for setting biological and technological indicators of the newly created sexes.

The weight and silkiness of the wet cocoon were determined separately. The coefficient of ecological stability and phenotypic parameters of variability according to the received indicators are separately determined depending on the gender of the main signs of reproduction of each sex and is compared with the corresponding parameters of the signs of the Mayak-3.

RESULTS and DISCUSSION

The phenotypic variability parameters of the main breeding characteristics of new breeds, mean square displacements (σ) and coefficients of variation (Cv) are much lower in both optimal and pessimal conditions compared to the control ones (Tables 1 and 2). Another important fact is that many economic values, in particular the phenotypic and paratypic variability of the biological symptoms of all living creatures, as well as silkworm breeds, increase as a result of deteriorating environmental conditions.

The discussion of biological and technological parameters of the newly created breeds with the genus Mayak-3 is shown in the first table. Table 1 shows that, in comparison with the type of control «Mayak-3», the weight change of a wet cocoon on the Chinese-21 line x-Mayak-2 is 2.73 absolute percent, the coefficient of variation in the weight of the cocoon thread increased by 3.0 percent.

It is also visible from the table, that the coefficient of variation in the age range of new breeds increased by 0.12-0.32%. The reason for this fact is that these new species have high environmental sustainability. This is also confirmed by the ecological sustainability of the breeds. Thus, the coefficient of stability of the cocoon mass in Mayak-3 is 0.926 and in new breeds is 0.969-0.970, the ecological stability of the threadmass in the control breed is 0.916, and in new breeds 0.974-0.985 mg (Table 2).

Thus, the results of the research prove that each of the four lines that we created with a 3-year adaptive selection, with the exception of 1-2, significantly exceed in all biological, technological and production indicators, as well as environmental sustainability, their first selection material, namely, the second generation, as well as the high-yielding genus Mayak-3, widespread in our country.

It should be noted that newly created breeds, except the silkiness of the dry cocoon, correspond to all the progressive limits imposed on the newly created silkworm breeds and hybrids in the Republic of Azerbaijan for all biological and technological indicators.

CONCLUSIONS

It is clear that for both reasons the ecological sustainability of the Mayak-3 control breed is average, and in new breeds it is high. Thus, a comparative analysis of the phenotypic variability parameters or the environmental stability coefficients also indicate that the new breeds are superior to the regionalized Mayak-3 genus due to the resistance of the main selection features.

Table 1. Average cocoon thread prices of control and new breeds in optimal and pessimal conditions, parameters of variability and coefficients of ecological stability.

Sex	Optimal condition			Pessimal condition			ES
	X±m	σ	CV	X±m	σ	CV	
			Mayak-3 (control)				
♀	2.50±0.038	0.207	8.27	2.34±0.050	0.273	11.68	0.936
♂	2.10±0.031	0.169	8.03	1.92±0.035	0.194	10.07	0.914
Average	2.30±0.034	0.188	8.15	2.13±0.042	0.234	10.88	0.926
			Chine-21 x Mayak-2 (F_{10})				
♀	2.46±0.026	0.144	5.86	2.37±0.026	0.144	6.08	0.963
♂	2.00±0.020	0.110	5.49	1.95±0.021	0.114	5.83	0.975
Average	2.23±0.23	0.127	5.68	2.16±0.024	0.129	5.96	0.969
			Mayak-2 x Chine-21 (F_{10})				
♀	2.46±0.030	0.163	6.63	2.37±0.029	0.161	6.78	0.963
♂	2.08±0.024	0.134	6.42	2.03±0.024	0.132	6.49	0.976
Average	2.27±0.027	0.148	6.52	2.20±0.026	0.146	6.64	0.969
			Mayak 2 x Ukraine-1 (F_{10})				
♀	2.63±0.029	0.157	5.98	2.54±0.029	0.157	6.19	0.966
♂	2.13±0.023	0.124	5.80	2.08±0.022	0.121	5.81	0.976
Average	2.38±0.026	0.140	5.89	2.31±0.026	0.139	6.00	0,970
			Ukraine-1 x Mayak-2 (F_{10})				
♀	2.52±0.026	0.142	5.63	2.44±0.026	0.142	5.80	0.968
♂	2.12±0.020	0.108	5.06	2.06±0.021	0.113	5.47	0.972
Average	2.32±0.023	0.125	5.36	2.25±0.024	0.128	5.64	0.970

Table 2. Average cocoon thread prices of control and new breeds in optimal and pessimal conditions, parameters of variability and coefficients of ecological stability.

Sex	Optimal condition			Pessimal condition			ES
	X±m	σ	CV	X±m	σ	CV	
Mayak-3 (control)							
♀	551±7.7	42.0	7.63	501±10.0	54.8	10.95	0.909
♂	519±6.6	36.2	6.98	479±8.4	46.2	9.4	0.923
Average	535±7.1	39.1	7.30	490±9.2	50.5	10.30	0.916
Chine-21 x Mayak-2 (F_{10})							
♀	552±6.6	36.0	6.51	540±6.6	36.3	6.72	0.978
♂	520±5.4	29.5	5.67	516±5.6	30.8	5.96	0.992
Average	536±6.0	32.7	6.09	528±6.1	33.5	6.34	0.985
Mayak-2 x Chine-21 (F_{10})							
♀	555±6.9	37.7	6.80	541±6.9	38.0	7.02	0.975
♂	525±6.1	33.7	6.42	515±6.1	33.7	6.54	0.981
Average	540±6.5	35.7	6.61	528±6.5	35.8	6.78	0.978
Mayak-2 x Ukraine-1(F_{10})							
♀	582±7.2	39.5	6.78	565±7.1	39.1	6.91	0.971
♂	554±6.6	36.2	6.54	541±6.6	36.0	6.65	0.976
Average	568±6.9	37.8	6.66	553±6.8	37.5	6.78	0.974
Ukraine-1 x Mayak-2 (F_{10})							
♀	562±5.6	30.6	5.44	550±5.8	31.6	5.74	0.979
♂	530±4.8	26.2	4.95	522±5.0	27.7	5.30	0.985
Average	546±5.2	28.4	5.20	536±5.4	29.6	5.52	0.982

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