Creating inbred systems with positive and minus selection for the survival of silk worms with the best combinations

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Abstract: *Inbred systems were derived from F-1 (high survival - HS) and F-2 (low survival - LS) from Linia 51, systems F-3 (HS) and F-4 (LS) were taken in Linia 48. An analysis of reproductive, biological and technological signs of inbred systems and their hybrids with initial autbred breeds has shown that all inbred systems manifest heterotics, which can be used for hybridization.*

Key Words: *Inbred, system, top cross, bottom cross, in cross, heterotic vigor, hybrid, silk worm, cocoons, cocoon shell, silk ability.*

1. INTRODUCTION:

According to many scientists' conclusions usage of close relationship for reproduction in the silk worm selection and breeding work, [3, 4, 6] leads to an increasing the uniformity of the cocoons, outputting in silk, and silk raw material, and improvement to be better whirled of cocoons. So, it is important to become stronger of the economic-efficient signs in descendants and investigations that concern with the usage of increasing inbred in order to rise of heterotic efficient in crossbreed hybrids which taken in intra-hybridization of inbredization systems in the conducted selection-breeding works on mulberry silkworm.

By the [5, 6] investigations, one of the causes of heterozis is slowly emergence of a compensatory complex (ECC) of positive genes that generates inbred and hiders inbred depression. Inbred systems also have a higher survival rate and low survival as a mechanism to initiate the generation of the ECC. [5] is based on genetics of sexual behavior of drosophila [1], which is reflected in the research.

2. MATERIALS AND METHODS:

As experimental material the Linia 48 and Linia 51with large-scale cocoons selection systems were used. By breeding of "sister and brother" in the selection process, there were two pre-installed systems in each system: F-1 and F-2 from Line 48 -, F-3 and F-4 from Line 51 - Selection on the high survival rate of silkworms F-1 and F-3 systems, while low viability F-2 and F-4 systems were carried out. In the present study, five inbred generations (J5, J6, J7, J8, J9) were studied and reaction was determined relatively to an inbreeding genus that directed to selection systems. As a control, the same silkworms, which were obtained by means of autbred hybridization of these genus race, were presented.

3. RESULTS AND DISCUSSIONS:

The results of the research are shown in Table 1.

Table 2 shows the normal egg pieces of F-1, F-2, F-3, F-4 systems clearly visible as the weight of the installer, and the inbred depression of one egg weight. For example, linen 51 contains 711 eggs, F-1 and F-2 inbred systems which derived from it have 637 and 646 pieces, while the average weight of one egg in line 48 constituted 0.587 mg, with F-3 and F-4 inbred systems - 0.587 and 0.549 mg respectively.

At the same time, there is no almost difference between high and low surviving inbred systems of silkworms on reproductive performance. This can be explained by the existence of weak correlation or in general absence between the survival of silkworms and the number of eggs in the linen 48 and Linia 51. In this case, selection on viability can not lead to significant changes in reproductive symptoms, and we can see this in the experience.

The correlation between silkworm survival the number of eggs in the S-5 was very low, and it constituted of 0,041, the correlation between survival for per egg weight - 0.126 was also confirmed by insignificant studies. The Inbred depression has been largely inhibited by the invasion of the eggs (Table 1).

It is known by Turkmen scientist's studies [2], that considerably harmful effects on the survival of the eggs of inbridization has not been observed not only in single-contact, but also three-and four-times intercross.

Table 1

Reproductive and Revival Indicators of Inbred Systems (2007-2011)

Systems		Years	The average number of normal eggs. pcs		Weight loss, mg		The average weight of one egg, mg		Physiologically unsuitable, %		Revival of Eggs %	
			X±Sx	Cv	X±Sx	Cv	X±Sx	Cv	X±Sx	Cv	X±Sx	Cv
F-1	J_5	2007	497±19,6	18,6	287±10,1	18,6	0,578±0,001	9,6	3,7±0,6	11,4	96,9±4,0	3,0
	J_9	2011	637±17,1	14,8	371±8,1	13,7	0,581±0,002	7,8	5,2±0,4	13,4	95,3±3,5	3,4
F-2	J_5	2007	527±17,8	21,1	293±8,4	20,4	0,556±0,01	8,3	2,2±0,5	9,3	94,2±4,5	4,8
	J_9	2011	646±14,8	12,3	368±8,3	10,9	0,570±0,005	4,0	3,2±0,2	8,6	97,4±2,0	3,5
Systems-51(K)		2011	711±8,7	7,8	392±5,9	10,0	0,580±0,003	6,2	2,1±0,1	6,0	96,1±3,0	3,0
F-3	J_5	2007	438±22,4	24,6	258±10,6	23,0	0,589±0,006	6,0	5,6±1,5	9,2	93,3±5,2	4,1
	J_9	2011	619±17,4	13,9	361±9,6	15,6	0,587±0,007	6,0	3,2±1,0	7,4	91,9±5,0	4,2
F-4	J_5	2007	458±27,1	19,0	260±10,1	14,7	0,568±0,007	6,3	4,0±0,1	5,5	87,8±5,1	4,0
	J_9	2011	620±17,1	11,6	340±8,7	7,5	0,549±0,005	4,2	4,0±0,5	6,8	94,0±4,9	3,5
Systems-48(K)		2011	663±6,7	6,2	415±5,3	9,6	0,587±0,005	8,4	5,3±0,1	5,6	96,7±3,0	3,0

Table 2

Biological Indicators for Selection Inbred Systems (2007-2015)

Systems	Inbree-ding genera-tions lors	Years	The viability of silkworms, %		Shell weight, mg		Weight of cocoon, g.		Silkiness	
			X±Sx	Cv, %	X±Sx	Cv, %	X±Sx	Cv %	X±Sx	Cv %
F-1	J_5	2007	66,8±2,8	18,3	384±8,5	9,6	1,05±0,03	6,7	23,4±0,2	3,2
	J_9	2011	77,4±5,8	18,3	432±16,6	9,4	1,84±0,06	7,5	23,6±0,2	1,7
F-2	J_5	2007	60,9±6,9	43,6	395±8,9	8,7	1,73±0,03	6,4	22,9±0,2	3,4
	J_9	2011	77,7±6,1	19,2	394±19,8	12,3	1,72±0,08	7,8	23,2±0,3	3,0
Systems -51(к)			81,8±1,9	8,6	515±9,8	7,5	2,05±0,03	5,1	25,1±0,2	3,8
F-3	J_5	2007	54,0±3,9	29,5	377±8,4	9,2	1,72±0,03	7,5	22,1±0,3	1,1
	J_9	2011	84,9±3,9	11,2	422±13,3	13,5	1,85±0,06	7,8	22,8±0,7	6,9
F-4	J_5	2007	53,1±3,5	28,2	405±12,4	12,2	1,72±0,04	9,1	23,8±0,03	4,8
	J_9	2011	78,3±5,7	17,7	430±4,9	2,8	1,85±0,02	2,2	23,2±0,2	1,6
Systems -48(к)			84,7±1,6	8,2	534±10,0	6,9	2,11±0,03	4,8	25,2±0,3	4,0

In our experience, the revival of inbred systems is slightly different than that the control. For example, the revival of F-1 and F-2 systems is 95.3% and 97.4% respectively, that is 95.1% for L-51 controls. The highest coefficient of the phenotypic correlation with the S-5 breed correspond to the results found in the experimental findings between the survival of silkworms and the revival of the eggs, the weight of the cocoons and as well as eggs. Thus, in the systems positive selected for survival rates are the following: F-1 at 95.3%, F-3 at 91.9%, and F-2 in the minus selection system - 97.45% and for F -4 made up 94.0 %.

An interesting view of the viability of silkworms has been seen in Table 2.

In experimental studies [7;], the survival rate has been detected for first inbred descendants of SANISH-21 and SANISH-30 was low and since the fourth generation, all subsequent generations have reached at high level of inbred material survival, and not less than control, but even more.

In our experience, the viability of the studied systems is as in control.

However, there is no stabilization of survival inbreeding generations. About this high coefficient of the variability is evidenced for all inbred systems.. For example, F-1 is Sv = 183, F-2 is Sv = 19.2, in control - 8.2. This is due to the fact that the viability of silkworm is closely related to the environment.

There is no difference in productivity indices in systems with positive and minus selection. The weight of the cocoons of the F-1 and F-3 systems positive selected for survival are 1.84 g and 1.85 g, and the shell weight are 432 mg and 422 mg, which is practically the same as the F-2 and F-4 minus systems - 1.72 g and 1.85 g respectively; 394 mg and 420 mg. It is obviously, the selection of viability leads to the accumulation of recessive semi-lethal and subletal genes in the homozygote of the system. As a result, some of the organisms die in different stages of development. However, some of them survive, possibly because of the accumulation of less harmful genes and, on the other hand, the existence of a sufficient number of positive genes to compensate for the effects of harmful genes, i.e emergence of the UPS.

If this process did not take place, undoubtedly, a few generations of negative choices would have been died of the system. Therefore, in systems with high viability, the UPS does not occur. Positive superior genes are achieved to negative genes without them. Besides that, the mutation process accelerates under the influence of the negative selection,. This enhances the diversity of genes.

Thus, it is not only the reserve, but also the source of new emerging for the blocks of both categories.

In our research, the technological properties of cocoons of inbred systems were also detected in Table 3.

According to technological indicators, inbred systems at 7-8-9 levels have reached to an initial autbred genus on their cocoon weight and even to produce in silk have over passed. The metric number of the inbred systems, the overall length of the cord fiber and the length of the shrinkable length were higher than those of Linia 51 and Linia 48. As it is evident, at the level of 7-8-9 inbred generations, technological features of cocoon fiber have reached to the level of initial genus' biological indicators and even more.

Table 3

Results of technological tests for Inbred Generations of Inbred systems (2009-2011)

Genus and hybrids	Genera-tions	Output of the product, %		Unwin-ding , %	Metric number, m/g	Length without plucking, m	Total length, m
		Raw silk	Silk products				
F-1	J_7	42,08	50,10	83,90	3062	924	1220
	J_8	38,98	47,32	82,38	2896	800	1104
	J_9	42,39	49,88	84,98	2902	964	1154
F-2	J_7	41,78	49,95	83,69	2929	745	1095
	J_8	41,32	50,16	82,38	2679	840	1101
	J_9	41,54	47,88	86,76	3271	901	1054
F-3	J_7	43,04	50,61	85,04	2913	1048	1205
	J_8	42,72	50,82	84,06	3024	990	1356
	J_9	41,96	48,40	86,69	3110	753	1089
F-4	J_7	41,11	50,99	80,62	3405	1023	1322
	J_8	41,08	49,92	82,29	2942	813	1205
	J_9	41,04	51,95	79,00	3574	791	1241
Linia 48 (k)		41,87	50,77	82,47	3223	1029	1235
Linia51(к)		44,19	49,80	88,72	2785	843	1129

This indicates a significant accumulation of positive genes as a result of selection of viability under the impact on negative semi lethal genes that passed to homozygote state on inbred systems. Researches conducted in three generations (J7, J8, J9), which have survival plus and minus selection, give the following conclusions:

During the 9year, carrying systematic propagation with intensive selection on viability brings to absolutely disappearing inbred depression for the future generation;

- Selection of inbred systems which are selected based on viability will increase not only viability, but also certain technological signs (length of metric number, total length and durability of the length fibers without unwinding);

- There is no difference between biological and technological parameters selected for inbred systems on high and low viability of silkworms.

A series of crossbreeds was conducted in order to study the combination value of inbred systems: topcrosses (xgenus inbred system), bottomcrosses (inbred system xgenus), incubates (inbred system1 inbred system 2).

Heterotic indices of top crosses, bottomcrosses and in crosses indices were identified in order to determine whether the combination value at the same time increases with survival.

Heterotic intensive was identified by Svechin K.B. formula:

$$HI = \frac{F * 100}{R\ (Four)};$$

HI - heterosis index
F - indicator
R (Four) - parent's average indicator.

Due to the fact that the bottom crosses and toprcrosses are only the right and the opposite of the hybrid and are not genotypically different, we only provide data for the bottomscross for the convenience of the analysis.

We conducted to check the heterotic power of Inbred systems at level 7 through 8-9. We present the obtained data in Table 4.

As shown in the table, the heterotic efficient has been observed on the survival of silkworms and cocoon weight. These hybrids correspond with the obtained data of SANIISH 21 breed that manifested viability and heterotic on the cocoon weight since the third inbred breed. Silky heterotic has not been observed.

Table 4

On biological indicators of heterotic power in bottomcrosses in control inbred descendants relatively (2010-2011)

Crossbreed method	Inbreeding descendants	Silkworms viability, %	Cocoon weight, %	Shell weight, %	Silk ability, %
F-1 x L-51	**J_7**	125,1	108,2	108,7	101,2
	J_8	109,3	106,6	104,6	98,4
	J_9	102,5	100,1	99,8	97,1
F-2 x L-51	**J_7**	131,1	110,3	110,3	100,8
	J_8	97,9	94,4	94,9	100,4
	J_9	110,3	105,2	98,6	98,4
F-3 x L-48	**J_7**	130,6	100,9	98,9	98,0
	J_8	101,7	104,0	102,8	98,8
	J_9	109,4	101,0	97,2	97,9
F-4 x L-48	**J_7**	117,0	103,8	105,1	102,0
	J_8	103,5	103,7	102,6	99,2
	J_9	112,2	103,5	100,3	100,3

It is well-known that data from 2003-2005, but still has not been published yet, the initial breeds of autbred descendants which they came from primary inbred descendants have the same indicators with the second pair indicators, and these indicators from the second descendant have increased by 1-2% and that in the third generation by 3-15%.

4. CONCLUSION:

The effect that is kept and taken by topcross, bottomcross and incrosses inbred systems evidence about increased selection of silkworms from J7 to J9 through Linia 48 and Linia 51 with large cocoon and forming of the high combinational ability of selection systems and rising selective effect from decreased survival.

Inbred systems and fine silk-fiber systems have been used in order to create hybrids that combine superior combinative properties as well as best technological properties of fiber.

Inbred systems F-1(high survival-HS) and F-2(low survival -LS) have been taken in Linia 51, F-3(HS) and F-4(LS) have been taken in Linia 48.

According to the analysis of reproductive, biological and technological signs of inbred systems with initial autbred breeds and their hybrids are all manifest heterotic vigor i.e they can be used for hybridization.

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