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Inheritance Productivity of F_1 Plants and Combining Ability of Long Fibrous Cotton Varieties

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Abstract: ***The present experiment was carried out to assess inheritance productivity of F_1 plants and combining ability of five local varieties of G.barbadense L. of Surkhon-9, Termiz-32, Bukhoro-7, DuruGavkhar and Surkhon-10. The sign was inherited by the type of superdominance. Presence of the heterosis effect in the reciprocal hybrids of varieties Surkhan-9 with Surkhan-10 and Termez-32, the level of which is quite significant and ranges from 117,8% to 157,2% of the best parent, makes them valuable for heterotic selection. Presence of reciprocal effects in advantageously most F_1 combinations points to the essential role of cytoplasmic genes in the regulation of this trait. This indicates to prospects of using varieties Surkhan-9 and Termez-32 as high-level donors yields at the selection of highly-productive cotton varieties.***

Keywords: G.barbadense, cotton, variety, F_1 hybrids, heterosis, combining ability

1. Introduction

Fiber is a main product of cotton, quality of which determines the reasonability of its cultivation. Improvement of fiber quality and promotion of yields is the main target of cotton breeding programs around the world (I.Y. Abdurakhmonov, 2008). The Republic of Uzbekistan - is one of the few countries in the world where fine-fibrous cotton culture is successfully mastered. As M.I. Iksanov (2009) notes, this was encouraged by the unique soil-climatic conditions of the Southern regions of our Republic. In 1987, forlong fibrous cottonvarieties, 204,000 ha of crop acres were occupied, and raw cotton harvest amounted to 587,000 tons. By volume of production of this cotton, our republic occupied the second place in the world, after Egypt.

But from 1988 to 1999, sowingareas of long fibrous cotton varieties in Uzbekistan fell from 200 thousand ha to 8 thousand ha. In 2008, only 6,5 thousand ha were sown in varieties of long fibrous cotton - Termiz-31, Surkhon-9 and Surkhon-14 (Vic. A. Avtonomov, 2008). In following years, decrease in crops under long fibrous cotton continued and some varieties of this species occupied an insignificant area in the Surkhondaryaprovince.

Currently, according to Resolution of the Cabinet of Ministers of Uzbekistan №378 from November 1, 2016, it was resumed sowing of long fibrous cotton varieties in the Surkhondarya region. This is a very correct approach, since there are motivations for a more complete use of the potential application for this kind of cotton. From the position of economic motivation, it is a necessity to supply raw materials for textile industry, fiber export,high earning capacity of this sector due to higher prices for raw cotton, as well as fiber prices in the world cotton market (M.Kh. Kimsanbaev et al., 2009).

2. Materials and Methods

In our experiment, carried out on the experimental field of the institute, object of the research was local varieties of long fibrous cotton known as high quality fiber - Surkhon-9, Termiz-32, DuruGavkhar, Bukhoro-7, Surkhon-10 and their hybridsF$_1$, obtained by diallel crossing of the initial forms. Parents and 20 F_1 hybrids were planted in spring in randomized complete block design with three replications at the experimental fields of Institute of Genetics and Plant Experimental Biology of Academy of Sciences of the Republic of Uzbekistan. A plot size of 4 rows 5 m long for parent and their hybrids F_1. Ten plants from each block making total 40 plants from each entry were randomly labeled to record the observations and determine seed cotton yield, fiber quality and another characters. Plots were harvested by hand.

The dominance coefficient (hp)were determine by formula S. Wright (1965):

$$hp = \frac{F_1 - MP}{P - MP}$$

hp – the dominance coefficient;F_1– mean of plants F_1
MP – mean mediumof both parent; P – mean of the best parent.
The data were analyzed using Griffing's model I method IV.

3. Results

Analysis of the data showed that the highest productivity of seed cotton yield (raw cotton)per plant is Bukhoro-7 -46,2 grams, value of this feature invarieties Surkhon-9 and Surhon-10 is 42,3 and 42,2 grams, respectively, and in Termiz -32 and DuruGavkhar, respectively, 37,4 and 35,7 grams for one plant(table 1).

Table 1: Inheritance of a trait "productivity of one raw cotton plant" of F_1 plant of long fibrous cotton varieties

Varieties and their hybrids F_1	$\bar{x}$	hp	heterosis; %
Surkhon-9	42,3		
Termiz-32	37,4		
Duru-Gavkhar	35,7		
Bukhoro-7	46,2		
Surkhon-10	42,2		
Surkhon-9 x Termiz-32	66,5	10,88	157,2
Surkhon-9 xDuruGavkhar	44,6	1,70	-
Surkhon-9 x Bukhoro-7	63,9	10,08	138,3
Surkhon-9 x Surkhon-10	52,8	211,0	124,8
Termiz-32 x Surkhon-9	53,7	5,65	127,0

Termiz-32 xDuruGavkhar	50,9	16,88	136,1
Termiz-32 x Bukhoro-7	47,4	1,27	-
Termiz-32 xSurkhon -10	62,9	9,63	149,1
DuruGavkharx Surkhon-9	60,2	6,42	142,3
DuruGavkhar x Termiz-32	56,8	23,82	151,9
DuruGavkhar x Bukhoro-7	57,9	3,23	125,3
DuruGavkhar x Surkhon-10	52,7	4,23	124,9
Bukhoro-7 x Surkhon-9	60,7	8,44	131,4
Bukhoro-7 x Termiz-32	54,4	2,86	117,8
Bukhoro-7 x Duru-Gavkhar	46,0	0,96	-
Bukhoro-7 x Surkhon-10	34,6	-4,80	82,0
Surkhon-10 x Surkhon-9	51,9	193,0	122,7
Surkhon-10 x Termiz-32	66,1	10,96	156,6
Surkhon-10 x DuruGavkhar	62,8	7,34	148,8
Surkhon-10 x Bukhoro-7	42,8	-0,7	-
$LSD_{0,05}$	3,1		

According to the readings of the dominance coefficient (hp), out of 20 hybrid combinations of F_1, in 18 combinations the trait was inherited by the type of superdominance, at 17 combinations with positive, and one with negative heterosis. In one combination, the complete it is observed dominance of the best parent, and in the other, it is observed incomplete dominance of the worst parent. Presence of the heterosis effect in the reciprocal hybrids of varieties Surkhon-9 with Surkhon-10 and Termiz-32, the level of which is quite significant and ranges from 117,8% to 157,2% of the best parent, makes them valuable for heterotic selection.

Obtained results on productivity of raw-cotton testify on selective value of the studied local long fibrous cotton varieties at obtaining of intraspecific heterozygous hybrids with a set of economically valuable traits for further refinement of them to the level of a more perfect variety than existing ones.

Reciprocal effects were detected in direct and reverse hybrids of varieties: Surhon-9 with Termiz-32, Duru-Gavkhar and Bukhoro-7; Termiz-32 with Duru-Gavkhar, Bukhoro-7 and Surkhon-10; Duru-Gavkhar with Bukhoro-7 and Surkhon-10; Bukhoro-7 with Surhon-10. Presence of reciprocal effects in advantageously most F_1 combinations points to the essential role of cytoplasmic genes in the regulation of this trait.

Analysis of GCA (general combining ability) effects showed that on "productivity of one raw cotton plant", positive effects of GCA are Surkhon-9 and Termiz-32 ($\hat{g}_i$, respectively, on 4,69).

This indicates to prospects of using varieties Surkhon-9 and Termiz-32 as high-level donors yields at the selection of highly-productive cotton varieties. Other varieties, i.e. DuruGavkhar, Bukhoro-7 and Surhon-10, possessed negative effects of GCA (ĝi, respectively – 2,55, -3,28, and -3,55) with an average yield of 35,7 grams, 46,2 grams and 42,2 grams of raw cotton per plant. Inadequacy between the high values of $\bar{x}$ in last two varieties and their low values of GCA effects, in our opinion, was due to the different concentration of dominant and recessive genes in the genotype of these varieties (table 2).

Table 2: Estimation of effects GCA ($\hat{g}_i$), SCA ($\hat{s}_{ij}$), varians SCA (y^2_{si}) and varians GCA (y^2_{gi}) on the trait "productivity of one raw cotton plant"

♂ / ♀	Termiz -32	Duru Gavkhar	Bukhoro -7	Surkhon -10	$y\hat{s}_{ij}^2$	y^2_{si}	y^2_{gi}	$\hat{g}_i$
Surkhon -9	3,7	-11,1	9,1	-1,7	221,6	73,1	21,7	4,69
Termiz -32		-4,6	-7,4	8,3	160,1	52,6	21,68	4,69
DuruGavkhar			10,3	5,4	279,3	92,3	6,19	-2,55
Bukhoro -7				-12,0	387,6	128,4	10,44	-3,28
Surkhon -10					245,4	80,99	12,29	-3,55

$S_{ij} = S_{ji} y S_{ji} = 0$ $\quad y g_i = 0$

In all varieties of $y^2_{si} > y^2_{gi}$, that shows a predominant role of nonadditive variances in the expression of "productivity of raw cotton per plant" trait.

We created a new variety of long fibrous cotton "Marvarid", on the basis of the long-term selection works in the population of Surkhon-9 x Termiz-32, that, on the recommendation of the Interdepartmental Commission of the Republic of Uzbekistan, is tested in the control of the State Kind Test in 2017 and successfully passed from this commission. The variety is early maturity (a yield of raw cotton in September), plants of zero branching type, plant height90-95 cm, the number of nodes on the main stalk is 20 or more pieces, the weight of raw cotton in one box is 3,5 grams and higher, weight of 1000 seeds is 115-120 g, fiber yield is 34% and higher, fiber index is 6.6 g., fiber length is 36-38 mm., weight of raw cotton per plant is 70 grams and higher. High rates of productivity and early maturity make this variety suitable for cultivation in the middle latitudes of our republic.

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