Heredity and Variability of Early Maturity of Cotton Hybrids Developed By Participation of the Introgressive Progenies

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Abstract. In the article described the results of the analysis of the dominancy and variability of the main components of early maturing, i.e. the "germination-50% flowering" and the "germination-50% maturing" periods of F1-F4 hybrids developed by the participation of the introgressive cotton progenies. As result of investigations there are found out mainly negative heterosis, full dominance and intermediate inheritance, i.e. early maturing occur for the "germination - 50% flowering" and "germination-50% maturing" periods at hybrids developed by the participation of introgressive cotton progenies. It was concluded possibility of using of them in the breeding of F1 hybrids with high heterosis. The cotton progenies PL-4684-86/16 of; PL-470/1/16; PL-58/16 and PL-588/16 and hybrid combinations PL-4679-81/16 x Jarkurgan; PL-58/16 x Jarkurgan; PL-200/16 x Jarkurgan; PL-4747-48/16 x Jarqurgan and PL-BSG/16 x Jarqurgan developed through introgressive selection method were recommended to be widely used in studies on improvement of early maturity.
Keywords: hybrid, genotype, dominancy, variability, introgressive progene, interspecific, agronomic traits, early maturity, heredity.

1 Introduction

It is known that cotton is one of the important economic and social fiber crops in the world. Therefore, in such leading cotton-growing countries as USA, China, India, Brazil, Australia, Pakistan, Uzbekistan and other ones are being carried out intensive research toward developing of cotton varieties with early maturity, high fiber yield and fiber quality and resistant to biotic and abiotic factors. The breeding of early maturing cotton varieties for Uzbekistan, which is located in the northernmost region among the cotton-growing countries, is one of the actual directions [1].

In addition, all this becomes relevant with the proper use of the achievements of digital technologies [2-8], with the improvement of legal support mechanisms for this activity [9-15], as well as with the introduction of other support measures [16-17].

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Based on many years of research, it has been confirmed that the genus *Gossypium* L. includes about 53 cotton species, and mainly four of them are, i.e. two diploid and two allotetraploid species [18-21] are cultivated. Later, some scientists discovered and described new cotton species [22].

There are conducting researches by using of various hybridization techniques to developing of genetically enriched cotton varieties by scientists of the most cotton-growing countries. In particular, the variation and formation of agriculturally valuable characters in multi-genome interspecies introgressive cotton hybrids is being studied at the Cotton breeding seed production and agrotechnology's research institute (9). Based on the conducted researches there are has been found to be a valuable donor for in the enrichment of the genome of cultivated species found out that fiber maturity, fineness and resistance to wilt disease of *G. thurberi* Tod. belonging to the D genome, tolerances to *Xantomonas malvaceanum* Dowson, insects, soil salinity and water deficit of *G. raimondii* Ulbr. belonging to the AD genome. A new polygenome [(*G. thurberi* Tod. x *G. raimondii* Ulbr.) x *G.arboreum* L.] and [(*G. thurberi* Tod. x *G. raimondii* Ulbr.) x *G.arboreum* L.] x *G .hirsutum* L. synthetic amphidiploids of cotton were synthesized [23, 24].

By some scientists it has been identified pest tolerances of introgressive cotton varieties with complex intergenomic origins. Particularly, by our previous researches it was determined that the presence of heliosides of the H group in the seeds of the Jarkurgan variety, which was created on the basis of the combination of [F_4(F_1*G. thurberi* x *G. raimondii*) *G. hirsutum* L.] by the method of interspecies composite hybridization, it leads to comparative high tolerances to the *Heliothis armigera* Hb of this cotton variety in field conditions [25].

A number of scientists also have conducted researches toward improving of early maturity by the participation of wild cotton species and confirmed that it is possible to create valuable initial breeding materials for this trait [26]. As a result of the researches, it was determined polygene character of the early maturity, i.e. the duration of "germination-50% flowering" and "germination-50% maturing" periods, location of the first sympodial branch, number of bolls, weight per boll of raw cotton and other characters. It was determined that it depends on the external environmental factors and agro technologies (temperature, length of day, fertilizer and irrigation rate). By most researchers it has been noted a great opportunity of selecting early maturing recombinants among the F1 generation of the interspecific hybrids [27-30].

The obtained results indicate the possibility of developing early maturing breeding materials by studying the heredity and variability of the trait at hybrids created by the participation of introgressive cotton progenies. Therefore, it is important to incorporate the unique genes of wild amphidiploids developed by the introgressive selection method into one genotype using of the latest advances in breeding and genomics.

Based on the above, in this article are presented, the results of the study of the heredity and variability of the important components of early maturity, i.e. "germination-50% flowering" and "germination-50% maturing" periods of hybrids developed with the participation of the introgressive cotton progenies and the variety Jarkurgan, which has a new genetic basis.

2 Materials and methods

New developed introgressive cotton progenies in the laboratory of "Cotton Genetics, Cytology" such as PL-4672-73/16, PL-4674-77/16, PL-4679-81/16, PL-4684-86/16, PL-138/16, PL-470/1/16, PL-95/16, PL-158/16, PL-200/16, PL-ISH/16, PL-58/16, PL-1979/16, PL-175/248/16, PL-12/06/16, PL-4747-48/16, PL-BSG/16 and PL-588/16 with the presence of medium staple cotton variety Jarkurgan were used as an initial material

(Table-1). Field experiments performed according to the methods of breeding and agrotechnologies (1). The results obtained from the research were processed according to B.A.Dospekhov (9).

3 Results and discussion

The results obtained in our research showed (Table 2) that the period of "germination-50% flowering" at introgressive cotton progenies ranged between 53.5-57.0 days. It was found that the cotton progenies PL-470/1/16, PL-4747-48/16 and PL-588/16 flowered comparatively early than the other ones, and only the cotton propene PL-4679-81/16 flowered relatively late. So in 2017, it was observed that most of the introgressive cotton progenies flowered 0.5-1.5 days earlier than the standard variety S-6524 (55 days), and some ones 0.5-2 days later.

Relatively low variation of the trait observed at the introgressive cotton progeny PL-138/16 (1.25%) and highest ones at progenies PL-58/16 (5.05%), PL-4747-48/16 and PL-588/16 (3.96%). Also, it can be noted that the relatively high variation indicators of the PL-470/1/16 and PL-ISH/16 progenies, i.e. 3.69% and 3.75%, respectively. Thus it was concluded that these progenies are relatively unstable for the "germination-50% flowering" period.

The obtained dates in 2018 showed (Table 2) that among the investigated introgressive cotton progenies comparative the best (55.5 days)"germination - 50% flowering" period was find out at PL-470/1/16, which on 3.7 days better than control variety S-6524 (59.2 days).

Table 1. Origin Of Introgressive Cotton Progenies

№	Progenies	Hybrid combinations
1	PL-4672-73/16	Namangan-1 - (S-1622 x 159-F) x (Acala-4-42 x 06422)) 06422= G.hirsutum ssp.mexicanum var. nervosum K-203 - (F_1 G. hirsutum L. x G. anomalum L.) x G.raimondi Ulbr.
2	PL-4674-77/16	K-58 (G.thurberi Tod. x G.raimondii Ulbr.) G.hirsutum L. type
3	PL-4679-81/16	K-69 (G.thurberi Tod. x G.raimondii Ulbr.) G.barbadense L. type
4	PL-4684-86/16	Surkhan-5-(ML-101 x 07630) 07630 = F-4180 S-2602. (06422 x Acala-4-42)
5	PL-138/16	b-28/1;F_1 (F_2 G.thurberi.Tod x G.raimondi Ulbr) x G.arboreum ssp.
6	PL-470/1/16	F_7(F_1 9647- I x 4857) x S-7059
7	PL-95/16	(F_1 K–69 x F_1 K–58) x Tashkent-1 K-69 (G.thurberi Tod. x G.raimondii Ulbr) G.barbadense L. type K-58 (G.thurberi Tod. x G.raimondii Ulbr) G.hirsutum L. type Tashkent-1 {(S-4727 x 06422) x S-4727)} 06422= G.hirsutum ssp.mexicanum var. nervosum
8	PL-158/16	F_{14}{(K–69 x F_2K–58 x S-7059 (G.hirsutum L)}
9	PL-ISH/16	F_1K-177 x L-175); L-175;F_8(S-2602 x Qarshi-2)
10	PL-58/16	F_{15}K-58 x G.thurberi Tod.) G. arboreum ssp. type
11	PL-1979/16	$F_{19}F_3$K-121 (G.hirsutum L.) x S-6037 (G.barbadense L.) K-121:{F_2(G.thurberi Tod. x G.raimondii Ulbr.)) x S-6037 (G.barbadense L.)}

12	PL-175/248/16	F_9(S-2602 (G.hirsutum L.) x S-6037(G.barbadense L.)
13	PL-12/06/16	S-6524. (159-F x 05152) 05152- G.hirsutum ssp. punctatum
14	PL-4747-48/16	K-58 (G.thurberi.Tod. x G.raimondii Ulbr.) G. arboreum ssp. type
15	PL- BSG /16	F_5BC_1(F_1(F_1K-28 x S-4727) x Omad) x Omad
16	PL-588/16	F_{21}(K-121 (G.hirsutum L) x G. arboretum ssp.)
17	Jarqurgan	F_{10}{(F_1G.thurberi Tod. x G.raimondii Ulbr.) x LCG-187}

Table 2. “Germination-50% flowering” period of the introgressive cotton progenies, days.

№	Cotton progenies	2017		2018		2019		2020	
		M±m	V	M±m	V	M±m	V	M±m	V
1	PL-4672-73/16	56,0±1,00	2,52	59,7±0,33	1,37	59,7±0,2	1,58	61,4±0,60	2,2
2	PL-4674-77/16	55,5±0,50	1,27	59,3±0,61	2,54	60,5±0,06	1,19	62,7±0,94	3,4
3	PL-4679-81/16	57,0±1,00	2,48	59,2±0,54	2,25	60,3±0,36	1,05	60,3±0,70	2,6
4	PL-4684-86/16	55,0±1,05	2,00	58,5±0,22	0,94	60,5±0,26	1,74	60,8±1,05	3,9
5	PL-138/16	56,5±0,50	1,25	58,2±0,31	1,29	59,9±0,29	0,86	61,4±0,70	2,6
6	PL-470/1/16	53,5±1,49	3,69	55,5±0,34	1,51	60,8±0,16	0,47	60±0,73	2,7
7	PL-95/16	54,5±0,50	1,29	59,2±0,17	0,69	63,0±1,46	4,03	61,7±0,59	2,2
8	PL-158/16	55,0±1,00	2,54	56,7±0,56	2,41	61,0±0,29	0,84	61,3±0,81	3,0
9	PL-200/16	55,0±0,50	1,28	58,2±0,60	2,53	60,0±0,56	1,63	62,9±0,70	1,6
10	PL-ISH/16	56,5±1,49	3,75	58,7±0,56	2,33	61,1±0,59	1,70	64±0,42	1,5
11	PL-58/16	56,0±2,00	5,05	57,3±0,67	2,85	59,9±0,46	1,35	63,4±0,63	2,3
12	PL-1979/16	55,5±0,50	1,27	59,2±0,67	1,27	59,5±1,05	2,91	62,6±0,78	2,8
13	PL-175/248/16	54,5±0,50	1,29	59,7±0,42	1,73	61,5±0,5	1,41	62,1±0,61	1,4
14	PL-12/06/16	54,5±0,50	1.29	59,7±0,42	1,73	59,9±0,46	1,35	62,1±1,12	2,6
15	PL-4747-48/16	53,5±1,49	3,96	59,2±0,17	0,69	60,5±1,ғ4	2,86	62,1±0,61	1,4

16	PL- BSG /16	54,5±0,50	1,29	59,2±0,31	1,27	61,2±0,78	2,23	61,6±1,35	3,1
17	PL-588/16	53,5±1,49	3,96	60,0±0,26	1,05	60,1±0,33	0,96	61,1±0,82	1,9
18	Jarkurgan	55,4±0,40	1,61	60,0±0,37	1,49	60,7±0,26	0,76	62,2±0,78	2,8
	S-6524(Standard)	55,0±0,65	1,85	59,2±0,2	1,07	60,2±0,44	2,32	61,5±0,90	3,3

Research results obtained in 2019 for the "germination-50% flowering" period showed that the average dates of the investigated introgressive cotton progenies ranged from 59.5 days (PL-1979/16) up to 63.0 days (PL-95/16). It was found out that most of the introgressive cotton progenies flowered at the level of the control cultivar S-6524 (60 days) or 1.0-3.0 days late. It was observed that the variation of introgressive cotton progenies for this period were relatively low, i.e., ranged from 0.46% (Jarkurgan) up to 2.91% (PL-1979). Thus the obtained dates of the variability of the "germination-50% flowering" period confirmed that the newly developed introgressive cotton progenies are stabilized for the trait.

In 2020, the average dates of the "germination-50% flowering" period of the introgressive cotton progenies ranged between 60-64 days. It was observed that only the progeny PL-470/1/16 was comparatively earlier than the S-6524 variety among the studied varieties, while the rest of the introgressive cotton progenies were relatively late, i.e. 61 days. However, the variation of the trait ranged from 1.4% (PL-4747-48/16) up to 3.1% (PL-BSG/16) confirms our conclusions for previous years and indicates stabilization of new developed introgressive cotton progenies.

In our research, the characteristics of the introgressive cotton progenies enriched in genotype were also studied for the trait "germination-50% maturing" period. The obtained dates showed that in 2017, the early maturity of the studied progenies ranged between 104.0-108.5 days (Table 3). The introgressive cotton progenies PL-470/1/16, PL-58/16, PL-4674-77/16 and PL-4747-48/16 were comparatively early (104-104.5 days) than cotton progenies PL-588/16 and PL-4684-86/16, which are expressed relatively late maturity (108.5 days).

In 2018, the PL-470/1/16 and PL-58/16 progenies were early maturing (107.6 days), and the PL-588/16 and PL-12/06/16 progenies are late (114 day) among the studied introgressive cotton progenies. It can be noted that most studied introgressive cotton progenies were on 0.5-2.5 days earlier than the standard variety S-6524 (111 days), except some progenies which are matured on 0.5-3.0 days later.

The obtained dates in 2019 of introgressive cotton progenies for the "germination-50% maturity" period showed that the progenies PL-47/1/16 (116.5 days), PL-588/16 (117.1 days), PL-ISH-2/16 (117.2 days) and PL-58/16 (117.2 days) progenies were early maturing on 2.1-3.1 days than the standard variety S-6524 (119.6 days). However, the variety Jarkurgan (120.5 days) and introgressive cotton progenies PL-BSG-2//16 (120.5 days), PL-12/06/16 (120.4 days), PL-58/16 (120.3 days) showed similar maturity to the S-6524 variety or 1-2 days later.

The dates of the "germination-50% maturing" of the introgressive cotton progenies obtained in 2020 showed that PL-58/16 (112.4 days), PL-470/1/16 (112.8 days), PL-4679-81/16 (113.8 days) and PL-4684-86/16 (114.9 days) which are were earlier on 2.5-3.0 days than the standard variety S-6524 (115.2 days). The rest of the progenies were the similar maturity to the S-6524 or later maturity up to 6.0 days. These results allow us to conclude that the "germination-50% flowering" and "germination-50% maturing" periods, which are important components of early maturity, are becoming stable in genotype-enriched introgressive cotton progenies, and they can be used as some initial materials for improving of early maturity.

As we mentioned above, in researches the major periods of days to maturing of "germination -50% flowering" and "germination -50% maturing" were analyzed among the hybrids developed between of introgressive cotton progenies and the Jarkurgan variety. The obtained data showed that the "germination-50% flowering" period of the hybrids ranged from 52 days (F_1PL-1979/16 x Jarkurgan) up to 57 days (F_1PL-M-BG/16 x Jarkurgan). Most of the hybrid combinations showed an advantage over the Jargorgan variety (55.4 days) participating as a male parent. Among the 17 studied hybrids 13 combinations

bloomed 0.5-3.5 days earlier than the variety Jarqurgan, and the remaining four hybrids bloomed relatively late (Table 3).

Most of the F_1 hybrids had a less days of the "germination - 50% flowering" period of early maturing, and it was found that they flowered in a relatively short time. Among the of 17 studied hybrid combinations 13 ones showed negative heterosis, complete dominance and intermediate inheritance. The remaining four hybrids are expressed late flowering, i.e. it was find out positive heterosis (hp=3.0) at PL-ISH/16 x Jarkurgan and F_1PL-4684-86/16 x Jarkurgan, complete dominance (hp=1.0) at F_1PL-470/1/16 x Jarkurgan and F_1PL-158/16 x Jarkurgan hybrids.

Among the studied the hybrids, F_1PL-4679-81/16 x Jarqurgan (hp=-3.0), F_1PL-58/16 x Jarqurgan (hp=-3.0), F_1PL-138/16 x Jarqurgan (hp=-5.0)), F_1PL-1979/16 x Jarkurgan (hp=-5.7) combinations bloomed earlier than other hybrids and showed a relatively high level of negative heterosis.

Investigations of the F_2 hybrids created with the participation of introgressive cotton progenies for the "germination and 50% flowering" period showed that the average days for flowering of F_2(PL-470/1/16 x Jarkurgan) and F_2PL-58/16 x Jarkurgan (respectively,57.8 and 57.8 days) were on 1.4 days earlier than the standard variety S-6524. In general, it was found that almost all hybrids of this generation flowered earlier than the variety Jarkurgan (60 days).

Among the F_3 generation of the studied hybrids, a relatively short average indicator (59.0 days) of the "germination-50% flowering" period was determined at the F_3PL-138/16 x Jarkurgan hybrid, and long ones (61.3 days) at the F_3PL-470/16 x Jarkurgan (Table 4). It should be noted that most of the hybrids flowered earlier than the standard variety S-6524 (60.2 days).

The average dates of "germination -50% flowering" period of the studied F_4 hybrids, ranged between 60 days (F_4PL-470/1/16 x Jarkurgan) and 64 days (F_4PL-MBG/16 x Jarkurgan). It was observed that most of the combinations of this generation flowered earlier than the standard variety S-6524 (61.5 days). It should be noted that such hybrid combinations as F_4PL-12/06/16 x Jarkurgan, F_4PL-1979/16 x Jarkurgan, F_4PL-4747-48/16 x Jarkurgan, F_4BSG/16 x Jarkurgan bloomed 1-2 days later than the standard variety.

In our research, were also analyzed the days of "germination -50% maturing" period of F_1-F_4 hybrids created with the participation of introgressive cotton progenies. The obtained data showed that the speed of maturation of the studied F_1 hybrids was from 104 days (F_1PL-58/16 x Jarkurgan, PL-12/06/16 x Jarkurgan) to 108.5 days (F_1PL-ISG/16 x Jarkurgan) (Table 5). In most of the studied hybrids, that is, in 14 out of 17 combinations, indicators of negative heterosis, complete dominance and dominance in the intermediate state were determined. Only two, i.e., PL-ISG/16 x Jarkurgan and PL-4674-77/16 x Jarkurgan combinations, showed a high level of positive heterosis (hp=5.0 and hp=1.4, respectively), i.e. late maturing. The obtained results indicate that most of the hybrids created with the participation of studied introgressive cotton progenies can be used in the selection of F_1 hybrids with high heterosis.

Table 3. "Germination-50% maturing" period of the introgressive cotton progenies, days.

№	Cotton progenies	2017		2018		2019		2020	
		M±m	V	M±m	V	M±m	V		
1	PL-4672-73/16	107±1.00	1.32	112,8±0,60	1,30	119,1±1,67	3,15	117,3±0,51	0,99
2	PL-4674-77/16	104.5±0.50	0.67	111,6±0,95	2,09	119,6±2,36	4,43	118,3±1,41	2,67
3	PL-4679-81/16	105.5±1.50	2.01	110,8±1,22	2,70	118,4±1,64	3,11	113,8±0,98	1,93
4	PL-4684-86/16	108.5±1.50	1.95	108,5±0,80	1,82	117,1±1,27	2,37	114,9±1,27	2,48
5	PL-138/16	107.0±1.00	1.32	109,6±0,76	1,70	118,7±1,31	2,48	115,4±1,09	2,13
6	PL-470/1/16	104.0±1.00	1.35	107,6±0,49	1,12	119,2±1,15	2,16	112,8±1,02	2,04
7	PL-95/16	105.0±2.00	2.69	109,8±1,07	2,40	119,6±2,11	3,95	116,2±1,36	2,62
8	PL-158/16	107.0±1.00	1.32	109,1±0,83	1,87	120,3±2,18	4,05	116,1±1,30	2,52
9	PL-200/16	105.0±1.00	1.35	109,1±0,40	0,90	118,5±3,51	4,20	118,8±1,19	1,41
10	PL-ISH/16	106.5±0.50	0.66	110±0,63	1,41	117,2±1,39	2,66	120,8±0,78	1,45
11	PL-58/16	104.5±0.50	0.67	107,6±0,49	1,12	117,2±1,22	2,34	112,4±1,02	1,92
12	PL-1979/16	105.0±1.00	1.34	110,5±1,08	2,41	118,6±2,31	4,36	119±1,50	2,83
13	PL-175/248/16	105.5±0.50	0.67	110,8±1,62	3,58	118,8±1,71	3,22	118±2,58	3,09
14	PL-12/06/16	106.0±1.00	1.33	114,1±0,65	1,40	120,4±1,87	3,48	117,9±1,47	1,76
15	PL-4747-48/16	104.5±0.50	0.67	110,1±0,79	1,76	119,6±2,60	4,86	118,1±1,27	2,41
16	PL- BSG /16	105.2±0.25	0.33	110,6±0,95	2,11	120,5±3,60	4,24	116,3±2,53	3,07
17	PL-588/16	108.5±0.5	0.65	107,6±1,03	2,26	117,1±2,01	2,43	115,3±1,65	2,02
18	Jarkurgan	107.0±0.31	0.66	111,8±0,79	1,74	120,5±1,85	3,44	116,3±1,09	2,11
	S-6524 (Standard)	110±0,54	1,09	111±0,94	2,69	119,6±1,21	3,21	115,2±1,37	2,68

Table 4. "Germination -50% flowering" period of the studied F1-F4 hybrids, days 2017-2020.

№	Hybrids	"Germination -50% flowering" period								
		F_1			F_2		F_3		F_4	
		M±m	V	hp	M±m	V	M±m	V	M±m	V
1	Jarkurgan	55,4±0,40	1,61		60,0±0,37	1,49	60,7±0,26	0,76	62,2±0,78	2,82
2	PL-4672-73/16 x Jarkurgan	55,0±1,00	2,57	-1,7	59,2±0,87	3,61	60,2±0,73	2,10	63,1±1,53	3,43
3	PL-4674-77/16 x Jarkurgan	54,5±0,50	1,29	-2,3	59,5±0,34	1,41	60,6±0,67	1,93	61,9±1,64	3,77
4	PL-4679-81/16 x Jarkurgan	54,0±1,00	2,61	-3,0	58,5±0,34	1,43	59,9±1,06	3,07	62±1,29	2,94
5	PL-4684-86/16 x Jarkurgan	56,0±1,00	2,57	1,0	59,5±0,43	1,76	59,7±0,37	1,08	62,3±1,56	3,55
6	PL-138/16 x Jarkurgan	55,5±0,50	1,27	-5,0	59,0±0,26	1,07	59,0±0,78	2,31	61,3±1,15	2,67
7	PL-470/1/16 x Jarkurgan	55,5±0,50	1,27	0,1	57,8±0,48	2,02	61,3±0,43	1,23	62,2±1,36	3,11
8	PL-95/16 x Jarkurgan	54,5±0,50	1,29	-1,0	59,0±0,26	1,07	59,0±0,82	2,42	61±1,37	3,19
9	PL-158/16 x Jarkurgan	54,0±1,00	2,57	-1,0	58,8±0,40	1,67	60,2±0,14	1,42	61,4±1,38	3,18
10	PL-200/16 x Jarkurgan	53.5±1.49	3,96	-2,5	58,7±0,56	2,33	60,1±0,66	1,91	60,8±1,75	4,09
11	PL-ISH/16 x Jarkurgan	57,5±0,50	1,22	3,0	58,8±0,48	1,99	58,9±0,74	2,18	62,4±1,11	2,53
12	PL-58/16 x Jarkurgan	55,0±1,00	2,57	-3,0	57,8±0,95	4,01	60,2±0,14	2,42	61,8±0,93	2,13
13	PL-1979/16 x Jarkurgan	52,0±1,00	2,71	-5,7	58,5±0,62	2,59	60,3±0,20	2,28	63,3±1,05	2,36

14	PL-175/248/16 x Jarkurgan	53,5±1,49	3,96	-1,8	58,0±0,26	1,09	60,6±0,20	1,58	63±1,64	3,70
15	PL-12/06/16 x Jarkurgan	53,5±1,49	3,96	-1,8	58,8±0,17	0,69	60,2±1,01	2,91	63,4±1,29	2,90
16	PL-4747-48/16 x Jarkurgan	54,5±0,50	1,29	-0,4	59,0±0,26	1,07	59,3±0,92	2,69	64,1±0,70	1,55
17	PL- BSG /16 x Jarkurgan	55,0±1,00	2,57	0,6	59,5±0,34	1,41	60,3±1,06	3,07	63,3±0,73	1,63
18	PL-588/16 x Jarkurgan	54,5±0,50	1,29	-0,4	59,0±0,45	1,86	59,4±0,50	1,47	63,1±1,27	2,86

Table 5. "Germination -50% maturing" period of the studied F1-F4 hybrids, days 2017-2020.

№	Cotton hybrids	F_1			F_2		F_3		F_4	
		M±m	**V**	**hp**	**M±m**	**V**	**M±m**	**V**	**M±m**	**V**
1	S-6524 (Standard)				111±0,94	2,69	119,6±1,21	3,21	117,2±1,37	2,68
2	Jarkurgan	107,0±0,31	0,66		111,8±0,79	1,74	120,5±1,85	3,44	116,3±1,09	2,11
3	PL-4672-73/16 x Jarkurgan	106,0±1,00	1,33	-1,0	111±0,68	1,51	118,4±1,05	2,82	119,3±2,53	3,00
4	PL-4674-77/16 x Jarkurgan	107,5±0,50	0,66	1,4	110,5±0,56	1,25	118,9±1,12	2,98	116,9±2,75	3,34
5	PL-4679-81/16 x Jarkurgan	105,5±0,5	0,67	-1,0	112,8±0,87	1,89	116,6±1,17	3,19	116,9±2,45	2,98
6	PL-4684-86/16 x Jarkurgan	106,5±0,50	0,66	-1,7	112,6±0,88	1,92	117,8±1,04	2,80	118,8±1,87	2,24
7	PL-138/16 x Jarkurgan	106,0±1,00	1,33	-1,0	111,1±0,87	1,92	120,7±1,81	4,75	116±2,40	2,93
8	PL-470/1/16 x Jarkurgan	105,5±0,50	0,67	0,01	107,1±0,90	2,08	120,5±1,84	4,84	117,5±2,71	3,27
9	PL-95/16 x Jarkurgan	105,5±0,50	0,67	-0,5	111,0±0,51	1,14	117,8±1,53	4,12	116,6±2,08	2,53

10	PL-158/16 x Jarkurgan	104,5±0,50	0,67	-2,5	109,3±0,55	1,25	119,0±1,32	3,52	115,8±2,46	3,01
11	PL-200/16 x Jarkurgan	105,0±1,00	1,34	-1,0	110,3±0,55	1,24	117,0±1,44	3,91	115,8±3,08	3,77
12	PL-ISH/16 x Jarkurgan	108,5±1,50	1,95	5,0	111,5±0,71	1,58	116,5±1,25	3,42	118,6±2,12	2,53
13	PL-58/16 x Jarkurgan	104,0±1,00	1,35	-1,4	112,3±0,95	2,08	118,8±1,06	2,83	117,1±1,71	2,07
14	PL-1979/16 x Jarkurgan	104,5±0,50	0,67	-1,5	110,5±1,05	2,34	119,6±0,94	2,50	119,9±2,41	2,85
15	PL-175/248/16 x Jarkurgan	106,0±1,00	1,33	-0,3	108,6±0,42	0,95	118,0±1,07	2,88	120,7±3,39	3,98
16	PL-12/06/16 x Jarkurgan	104,0±1,00	1,36	-5,0	108,0±0,36	0,83	118,4±1,07	2,88	120,7±2,53	2,98
17	PL-4747-48/16 x Jarkurgan	105,5±1,49	2,01	-0,2	112,0±1,00	2,19	116,6±1,68	4,56	122,6±1,34	1,55
18	PL- BSG /16 x Jarkurgan	105,5±0,50	0,67	-0,7	112,3±0,84	1,84	116,5±1,34	3,65	120,8±1,61	1,89
19	PL-588/16 x Jarkurgan	107,5±0,50	0,66	-0,7	110,8±1,51	3,35	119,4±1,13	3,01	120,8±2,39	2,81

Research results showed that an average dates of the trait on 3-5 days higher than in F_1, that is, it ripened later as a result of the wide variation of the period of "germination -50% maturing" of the F_2 generation of the studied hybrids. It was found that the mean indicator of the mark was in the range from 107.0 days (F_2PL-470/1 x Jarkurgan) to 113.0 days (F_2PL-4684-86/16 x Jarkurgan and F_2PL-4679-81/16 x Jarkurgan). Relative maturity according to the trait F_2PL-4684-86/16 x Jarqurgan (112.6 days), F_2PL-4679-81/16 x Jarqurgan (112.8 days), F_2PL-4747-48/16 x Jarqurgan (112.0 days) and F_2PL-BSG/16 x Jarkurgan (112.3 days) combinations were observed. It should be noted that in this generation, most of the hybrids showed precociousness compared to the Jarqurgan variety (111.8 days), which participated as a father.

It was observed that the "germination-50% maturing" period of F_3 hybrids with introgressive cotton progenies was higher than the previous generations, i.e. late maturing of them. Among the hybrids of this generation, the combinations F_3ISH/16 x Jarqurgan, F_3BSG-2/16 x Jarqurgan, F_3PL-4679-81/16 x Jarqurgan and F_3PL-4747-48/16 x Jarqurgan ripened in 116 days, that is, the model variety S-6524 (120 days) showed a speed of 4 days. However, the F_3PL-470/1/16 x Jarqurgan and F_3PL-138/16 x Jarqurgan combinations were 4-5 days later compared to the parent variety and were equal or faster than the model variety. In most F4 combinations, it was found that the average rate of maturing was lower than that of the F3 generation, that is, it ranged from 115.8 days (F_4PL-58/16 x Jarkurgan) to 122.6 days (F_4PL-4747-48/16 x Jarkurgan). Among the studied hybrids, F_4PL-138/16 x Jarqurgan, F_4PL-200/16 x Jarqurgan, and F_4PL-58/16 x Jarqurgan combined with the standard cotton variety S-6524 (117.2 days), F_4PL-470/1/16 x It can be noted that the hybrids of F_4PL-1979/16 x Jarqurgan, F_4PL-12/06/16 x Jarqurgan and F_4PL-175/248/16 x Jarqurgan and F_4PL-4747-48/16 x Jarqurgan showed late maturity.

4 Conclusions

It was confirmed that among the genetically enriched breeding materials developed by using the introgressive selection method the cotton progenies PL-4684-86/16, PL-470/1/16, PL-58/16 and PL-588/16 are being early compared to S-6524 and Jarkurgan varieties.

Research results showed negative heterosis, complete dominance and intermediate inheritance of 13 combinations among the investigated 17 hybrids developed with the participation of introgressive cotton progenies for the "germination -50% flowering" period, i.e. early flowering and positive heterosis, complete dominance and intermediate heredity, i.e. late flowering, was found at the remaining 4 hybrids.

There are find out the negative heterosis, intermediate and complete dominance at 14 combinations among the studied 17 F_1 hybrids for "germination and 50% maturing" period, early maturity, and high positive heterosis (hp=5.0 and hp=1.4), i.e. late maturing was observed in the remaining 2 combinations. It was concluded that most of the hybrids developed with the participation of the studied introgressive cotton progenies can be used in the selection of F_1 hybrids with high heterosis.

The hybrids PL-4679-81/16 x Jarkurgan; PL-58/16 x Jarkurgan; PL-200/16 x Jarkurgan; PL-4747-48/16 x Jarkurgan ва PL-BSG/16 x Jarkurgan among the hybrids created with the participation of studied introgressive progenies have shown early maturity over other hybrids for the years of the experiment. Among the segregation populations of these combinations positive recombinants for early maturity and combining high parameters of agronomic valuable traits were selected and are being studied as a enriched cotton progenies in our researches.

It is recommended to widely use of the method of introgressive breeding and the new cotton progenies selected on the basis of the conducted researches for improving of the early maturity.

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