# Indications of High-Generation Convergent Hybrids Based on Transgressive Recombination Prints in Cotton

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**Abstract.** In the article, it is presented that the use of complex and convergent hybridization is an effective method for increasing cotton weight per bag, 1000 seed weight, fiber yield and fiber length. Among the complex and convergent families based on the principle of transgressive recombination in increasing the cotton weight per bag, mainly O-401-03 and O-175-178 families, among the families based on complex hybridization in improving the weight of 1000 seeds, the O-401-03 family, convergent O-109 O-401-03, O-470-72, O-109-110, O-774-776, O-369-372 from the -110 families, as well as from the O-504-09 and O-609-610 families, improving fiber yield , O-504-09 and O-365-366 from families based on complex and convergent hybridization, relatively high values in families based on complex hybridization in terms of fiber length in families O-440-46 and O-289-90, among convergent hybrid families based on the principle of transgressive recombination The expediency of using O-609-610, O-393-94 and O-899-900 families in genetic-selection studies is highlighted.

Key words: cotton, complex hybridization, convergent hybridization, selection, transgressive recombination principle, boll weight, 1000 seed weight, fiber yield, fiber length.

## 1 Introduction

Today, 90 percent of the cotton fiber grown in the world belongs to the cultivated G. hirsutum L. type [1]. In 86 countries where cotton is grown, 20-22 mln. tons of fiber are collected and exported [1]. One of the important problems in the selection of cotton is the creation of high-yielding, high fiber yield and quality, quick-ripening varieties and their wide use in production [2]. it is important to get a high and quality harvest.

In our republic, extensive measures are being taken to create new cotton varieties whose fiber quality and productivity meet the requirements of the world cotton market [3-6]. It should be noted that the creation of new varieties of cotton is significantly influenced by digital technologies [7-12] and scientifically based legal positions in this area [13-20]. As a result of this, the creation of valuable breeding materials suitable for different soil-climate regions, productive, resistant to water scarcity, insects and pests, and other stress factors has become

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important, and a number of researches are required in this regard.

In order to solve these problems at the world level, the widespread use of various methods in cotton breeding, which are widely used in other agricultural crops, is relevant [21]. As a result of the transgressive variation that occurs in convergent hybridization, the increase in the possibility of isolating recombinants, which are the source of new genetic variations, which gives the opportunity to create new varieties with a positive set of valuable economic characters in a short time, has been confirmed in the selection of other crops [22]. Research on the creation of valuable starting materials through convergent hybridization in the selection of cotton varieties was carried out by us for the first time and high efficiency was achieved.

In our research, convergent hybridization is a valuable starting point for cotton selection based on the comparative study of convergent hybrids created by using transgressive recombination, which makes it possible to ensure 50% of the genetic characters of the recurrent variety in newly created lines, and combined transgressive recombination and recrossing methods, which preserves the amount of genetic characters of the recurrent variety up to 75%. and researches were carried out in order to create selective objects.

## 2 Materials and methods

S. Boroevich [23] shows that the intended goal will not be realized as the breeding methods become more complicated. However, in hybrids, the possibility of selecting parental forms on a set of certain positive traits increases. One of the complex breeding methods is double breeding, and this method is used in order to show the positive signs of parental forms in the created variety. In this case, in a double cross, each of the 4 parents {(AxV)x(SxD)} transmits its genetic traits equally to the hybrid.

In breeding, complex cross-breeding also plays an important role and is one of the sources of creating genetic diversity and improving agricultural crops.

There is very little information on convergent hybridization in cotton, that is, convergent hybridization was carried out on a large scale in cereal, leguminous, and vegetable crops, but in cotton selection, this method started in 2000 [24, 25].

In improving fiber quality, the use of convergent cross-breeding is more effective than other cross-breeding methods [26].

The new convergent breeding method is highly effective in obtaining recombinant cotton plants with valuable complex economic traits and using them as the main starting source for the selection process [27].

Convergent crossbreeding is superior to existing methods in improving various economic traits of cotton [28-32]. Acceleration of scientific researches in this regard will make it possible to maintain the characteristics of various regionalized cotton varieties at the level of demand in the future.

Through convergent and interspecific backcross hybridization, some traits lacking in recurrent parental forms can be improved in cotton, which indicates the high efficiency of these hybridization methods. Also, it is evidenced by the fact that there is very little research on complex hybridization in the selection of medium-fiber cotton varieties in our republic, and the existing ones are carried out on varieties with different genetic inheritance. Therefore, it is urgent to create a starting material, which includes early, productive, high fiber quality and output, resistant to diseases and pests, and water shortage, based on the involvement of new and relatively rich heredity varieties in complex hybridization. In this regard, preliminary research was conducted based on Mac Key's principle of convergent hybridization and transgressive recombination [33].

G.R. Kholmurodova, Sh.E. Namozov [34] according to the data obtained in the experiments, it is recommended to involve the Tashkent-6, S-9070, S-4911 varieties with high efficiency of UKQ (general combining ability) in convergent hybridization to increase productivity.

It was also observed that most of the isolated convergent families were superior to the model varieties in terms of valuable economic characteristics (fiber yield, fiber length, disease resistance), and some were equal to the model variety [33].

Based on the review of the literature, it can be concluded that the correct selection of parental forms and breeding methods, taking into account the genetic variability of the characters, is important for achieving positive results in the selection process.

One of the more advanced methods of compound hybridization is the divergent convergent method. The method of convergent breeding is considered an effective method for agricultural crops, and the possibility of creating valuable starting materials for cotton selection in this method has not been sufficiently studied in our republic. Therefore, solving this problem is of theoretical and practical importance in cotton genetics and breeding.

Cotton as an object of study *G.hirsutum L.* higher generations of convergent hybrids created by crossing 8 pairs and 4 complex hybrids obtained with the participation of Tashkent-6, S-6532, Oqdaryo-6, Yulduz, S-9070, S-4911 varieties of the type, based on the principle of transgressive recombination; convergent cotton hybrids, families and lines obtained with the participation of Yulduz, Kyrgyz-3, Okdaryo-6, S-4911, S-9070, An-415, S-6524 varieties took part in the principle of combined transgressive recombination and incomplete recrossing.

The origin of separated families:

**Complex hybrids in the style of the principle of transgressive recombination**

**СГ-1-**[$F_1$(C-9070 x C-6532) X ($F_1$ An-415x C-6532)]

**СГ-2-** [$F_1$(Akdarya -6 x C-6532) x ( $F_1$Yulduz x C-6532)]

**СГ-5 -** [$F_1$(Akdarya-6 x Tashkent-6) x ( $F_1$C4911 x Tashkent -6)]

**СГ-6-**[$F_1$ (C-9070 x Tashkent -6) x ( $F_1$ Yulduz x Tashkent -6)

**СГ-7-**[$F_1$(C4911 x Tashkent-6) x ($F_1$ Akdarya-6 x Tashkent -6)]

**Convergent hybrids in the style of the principle of transgressive recombination**

**ВК-1-{**[$F_1$(Yulduz x C-6532) x (Akdarya-6 x C-6532)] x [($F_1$C9070 x C-6532) x ($F_1$ An-415 x C-6532)]}

**ВК-2-**{$F_1$[$F_1$(C-4911 x C-6532) x $F_1$(Akdarya-6 x C-6532)] x [$F_1$(C-9070xC-6532)x $F_1$(Yulduz xC-6532)]}

**ВК-3-** {[$F_1$(Yulduzx Tashkent-6) x (Kyrgyzstan-3 x Tashkent-6)] x [($F_1$Akdarya-6 x Tashkent-6) x $F_1$ Kyrgyzstan-3 x Tashkent-6)]}

**ВК-5-{**[$F_1$(Kyrgyzstan-3 x Tashkent-6) x (Akdarya-6x Tashkent-6)] x [(F1 4911 x S6532) x ( F1 S-9070 x Tashkent-6)]}

**ВК-7-{**[F1(An-415 x S-6532) x (S-9070 x S-6532)] x [(F1 Akdarya-6 x S-6532) x ( F1 Star x S-6532)])}.

**ВК-8-{**[F1(Aqdarya-6 x S-6532) x (Star x S-6532) ] x [(F1 An-415 x S6532) x (F1S9070 x S-6532)]}

**ВК-9-**{[ F1(S-9070 x S-6532) x (YulduzxS-6532) x [(F1S-4911 x S-6532) x (F1Aqdaryo-6 x S-6532)]}

**ВК-10-{**[F1(S-4911xTashkent-6) x (Oqdarya-6 x Tashkent-6)] x [(F1Yulduz x Tashkent-6) x ( F1Kyrgyz-3 x Tashkent-6)]}

**ВК-11-{**[F1(Yulduz x Tashkent-6) x (Kyrgyz-3 x Tashkent-6) ]x [(F1 S-4911 x Tashkent-6) x (F1 Okdarya-6 x Tashkent-6)]}

**ВК-12-{**[F1(S-4911xTashkent-6) x (Okhdaryo-6xTashkent-6) ]x [ ( F1S9070 x Tosh-6) x (F1Yulduz xTashkent-6)]}

**ВК-13-{**[F1(S-4911 x S-6532) x (Oqdarya-6xS-6532)] x [(F1Yulduz x Tashkent-6) x (F1Kyrgyz-3 x Tashkent-6)]}

The subject of the study was to determine the transgression of characters in sources obtained in the methods of transgressive recombination, combined transgressive recombination and incomplete recombination.

As methods of research, convergent hybridization was carried out according to options 1 and 2 proposed by Mac Key (5 varieties A type-50-50-50% and 5 varieties A type-75%-75%-75%). All mathematical and statistical analyzes were carried out based on the methods of BA Dospekhov (1985).

## 3 Research results

High-generation convergent hybrids based on the principle of double, complex and transgressive recombination of cotton, as well as studies on families with their participation, were studied and analyzed for complex valuable economic characters.

As a result of long-term research carried out in previous years, a number of families with a positive set of valuable traits for the farm were isolated (table).

It is known that productivity plays an important role in the selection of cotton varieties. The weight of cotton in one bag and the weight of 1000 seeds are considered as the main elements of productivity. According to the results of the analysis, in all the created families, cotton weight per 1 bag was higher compared to the Namangan-77 (5.5 g) and S-6524 (5.6 g) varieties. The O-401-03 family, created by complex hybridization, showed results of 7 g, the O-440-46 family 6.5 g, and the O-289-90 family 6.0 g. Although only O-201-02 (5.7 g) and O-470-72 (5.6 g) families had lower results compared to other isolated families, sample S-6524 (5.6 g), Namangan-77 (5.5 g) showed a marked advantage over varieties.

All of the families obtained by convergent hybridization based on the principle of transgressive recombination have 5.6 g (O-899-900, O-393-94) to 6.9 g (O-175- 178) results were recorded. The fact that the weight of cotton in one bag of the families based on convergent hybridization was mostly higher than 6 grams, in the families with relatively lower results (O-899-900 and O-393-94), the pattern S-6524 (5.6 g) and Namangan-77 ( 5.5 g) was shown to be at or above grade level.

The results obtained on cotton boll weight confirm that complex and convergent hybridization techniques are effective in improving the trait.

In complex hybrid families based on the principle of isolated transgressive recombination, the indicators for the weight of 1000 seeds ranged from 120.1 (O-470-72) to 135 (O-401-03) grams, sample S-6524 (118.5 g) and Namangan- 1.6 g and 2.8 g, respectively, compared to varieties 77 (117.3 g); 16.5 g and 17.7 g of dominance were noted. Other complex hybrid families isolated showed results of 124.8 g and 124.7 g in O-289-90 (126.7 g), O-201-02 and O-440-46 families, respectively.

High results of 137.1 g (O-109-110), 130 g (O-504-09 and O-609-610) were recorded in convergent hybrid families based on the principle of transgressive recombination. In the other isolated families, it was mainly between 118 g and 125 g, and only in the family O-393-94 (114.8 g) compared to the model S-6524 (118.5 g) and Namangan-77 (117.3 g), respectively. Lower results were observed at 3.7 g and 2.5 g.

Therefore, it is reasonable to use the O-401-03 family from the families based on complex hybridization, the convergent O-109-110 families, as well as the O-504-09 and O-609-610 families as starting materials in genetic-selection studies to improve the trait.

It is known that today, according to the fiber yield requirements of cotton varieties, the fiber yield should not be less than 38-40%. Accordingly, we paid special attention to fiber output in our research.

**Table 1.** Indicators of valuable economic traits of some families isolated on the basis of complex and convergent hybridization

| Family | Hybrid combinat ion sions | Weight of 1 bag, g | | | 1000 seed weight, g | | | Fiber yield, % | | | Fiber length, mm | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | M±m | δ | V% | M±m | δ | V% | M±m | δ | V% | M±m | δ | V% |
| complex hybrid families based on the principle of transgressive recombination | | | | | | | | | | | | | |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 |
| O-201-02 | СГ-1 | 5,7±0,3 | 0,7 | 12,6 | 124,8±3,68 | 9,7 | 7,8 | 35,5±0,63 | 1,7 | 4,7 | 34,7±0,22 | 1,2 | 3,5 |
| O-289-90 | СГ-2 | 6,0±0,41 | 0,7 | 12,0 | 126,7±3,33 | 5,8 | 4,5 | 35,5±0,71 | 2,9 | 8,3 | 36,0±0,68 | 1,2 | 3,2 |
| O-401-03 | СГ-5 | 7,0±0,46 | 0,2 | 13,6 | 135,0±2,88 | 5,7 | 4,3 | 40,2±0,49 | 0,9 | 2,5 | 35,5±0,32 | 0,9 | 0,9 |
| O-440-46 | СГ-6 | 6,5±0,26 | 0,7 | 11,7 | 124,7±4,80 | 12,7 | 10,3 | 38,5±0,95 | 2,3 | 6,0 | 36,2±0,75 | 1,8 | 5,1 |
| O-470-72 | СГ-7 | 5,6±0,45 | 0,8 | 13,9 | 120,1±0,81 | 10,0 | 8,4 | 40,1±1,22 | 2,1 | 5,4 | 33,6±0,63 | 1,1 | 3,3 |
| convergent hybrid families based on the principle of transgressive recombination | | | | | | | | | | | | | |
| O-504-09 | ВК-1 | 6,0±0,19 | 0,5 | 8,4 | 130,0±6,54 | 18,5 | 14,2 | 39,6±0,73 | 2,07 | 5,2 | 34,3±0,58 | 1,7 | 4,8 |
| O-609-610 | ВК-2 | 6,0±0,19 | 0,28 | 4,71 | 130,0±0,10 | 14,1 | 10,8 | 35,0±2,14 | 3,04 | 8,7 | 36,2±0,70 | 0,9 | 2,7 |
| O-357-362 | ВК-3 | 6,3±0,2 | 0,51 | 7,37 | 125,0±5,00 | 10,0 | 8,0 | 36,2±0,37 | 0,74 | 2,1 | 34,7±0,52 | 1,04 | 3,0 |
| O-365-366 | ВК-5 | 6,7±0,2 | 0,6 | 8,48 | 125,7±2,02 | 5,34 | 4,25 | 39,6±0,48 | 1,28 | 3,2 | 33,2±0,40 | 1,14 | 3,4 |
| O-175-178 | ВК-7 | 6,9±0,2 | 0,4 | 5,42 | 121,7±1,66 | 4,08 | 3,35 | 38,8±0,65 | 1,72 | 4,4 | 31,8±0,45 | 1,01 | 3,2 |
| O-109-110 | ВК-8 | 6,5±0,2 | 0,5 | 8,3 | 137,1±2,85 | 7,55 | 5,51 | 40,0±0,68 | 1,80 | 4,5 | 32,8±0,31 | 0,81 | 2,5 |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| O-369-372 | BK-9 | 6,3±0,2 | 0,5 | 7,6 | 115,0±3,41 | 8,36 | 7,27 | 39,6±1,02 | 2,49 | 6,3 | 32,2±0,56 | 1,39 | 4,3 |
| O-774-776 | BK-10 | 6,1±0,2 | 0,5 | 7,9 | 121,4±4,04 | 10,69 | 8,80 | 39,9±1,19 | 3,17 | 7,9 | 34,8±0,48 | 1,29 | 3,7 |
| O-899-900 | BK-11 | 5,6±0,2 | 0,6 | 9,9 | 118,3±5,46 | 13,29 | 11,23 | 35,1±1,12 | 2,75 | 7,8 | 35,0±0,47 | 1,05 | 2,9 |
| O-779-786 | BK-12 | 6,3±0,1 | 0,4 | 5,8 | 118,0±25,0 | 6,32 | 5,36 | 38,9±0,22 | 0,69 | 1,8 | 33,4±0,58 | 1,84 | 5,5 |
| O-393-94 | BK-13 | 5,6±0,1 | 0,3 | 6,3 | 114,8±25,0 | 5,34 | 4,67 | 37,3±0,88 | 2,17 | 5,8 | 35,2±0,62 | 1,53 | 4,4 |
| C-6524 (St) | | 5,6±0,2 | 0,3 | 5,9 | 118,5±2,35 | 10.7 | 9.06 | 36,2±0,75 | 1,30 | 3,6 | 33,6±0,77 | 1,35 | 4,0 |
| Namangan -77 (St) | | 5,5±0,2 | 0,3 | 5,2 | 117,3±3,33 | 5,77 | 4,68 | 37,4±1,17 | 2,02 | 5,7 | 32,2±0,57 | 1,00 | 3,2 |

The analysis of the fiber yield index of the complex hybrid families based on the isolated transgressive recombination principle showed that 40.2% results were recorded in the O-401-02 family and 40.1% in the O-470-72 family. A relatively positive result was also observed in the O-440-46 family, the fiber yield was 38.5%. Only in the O-201-02 (35.5%) and O-289-90 (35.5%) families, the fiber yield was higher than that of the S-6524 (36.2%) and Namangan-77 (37.4%) varieties, respectively. 1.9% and 0.7% lower.

In convergent hybrid families based on the principle of transgressive recombination, the index for the character was mainly from 35% (O-609-610) to 40% (O-109-110). So, the fiber output is 1.2% and 2.4% lower and 3.8% and 2.6% higher, respectively, compared to the sample S-6524 (36.2%) and Namangan-77 (37.4%) varieties. was recorded. O-774-776 (39.9 %), O-369-372 (39.6 %), O-779-786 (38.9 %) and O-175-178 (38.8 %) families are also marked positive results were observed. Only the O-899-900 family showed 35.1% fiber yield, which was slightly lower than the model cultivars (1.1% and 2.3%, respectively).

Hence, complex and convergent hybridization of O-401-03, O-470-72, O-109-110, O-774-776, O-369-372, O-504-09 and O-365-366 in improving fiber yield It is considered appropriate to use the families based on it as a starting material in genetic-selection research.

Fiber length is one of the main economic indicators. According to the results obtained for this sign, 11 out of 18 families were superior to both models. In all families based on complex hybridization, model S-6524 (33.6 mm) and Namangan-77 (32.2 mm) showed superiority. The index of fiber length in these families was from 33.6 mm (O-470-72) to 36.2 mm (O-440-46). Relatively high indicators were shown in families O-440-46 (36.2 mm) and O-289-90 (36.0 mm).

Among the convergent hybrid families based on the principle of transgressive recombination, the sample Namangan-77 (32 .2 mm) and S-6524 (33.6 mm) varieties were superior. In the O-109-110 (32.8 mm) and O-369-372 (32.2 mm) families, lower than standard varieties or standard varieties (S-6524-33.6 mm; Namangan-77-32.2 mm) results equal to

In general, it can be concluded that the efficiency of convergent hybridization method is high in terms of pod weight, 1000 seed weight, fiber yield and fiber length. This will allow them to be widely used in the future in the creation of breeding materials with a positive set of main economic characters.

## 4 Conclusion

The use of complex and convergent hybridization is an effective method to increase cotton weight per boll, 1000 seed weight, fiber yield and fiber length.

Among the complex and convergent families based on the principle of transgressive recombination in increasing the cotton weight per bag, mainly O-401-03 and O-175-178 families, among the families based on complex hybridization in improving the weight of 1000 seeds, the O-401-03 family, convergent O-109 -110 families, as well as O-504-09 and O-609-610 families, are considered to be useful as starting materials for character improvement.

O-401-03, O-470-72, O-109-110, O-774-776, O-369-372, O-504-09 and O-365-366 from complex and convergent hybridization families in improving fiber yield, relatively high values in families based on complex hybridization in terms of fiber length in families O-440-46 and O-289-90, among convergent hybrid families based on the principle of transgressive recombination in families O-609-610, O-393-94 and O-899-900 it is appropriate to use it in genetic-selection studies.

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