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Article

Indicators of Certain Morphological Traits in Breeding Material

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Abstract: This article presents an analysis of the morphological traits of hybrids obtained from crossbreeds involving introgressive lines and the Bukhara-102 variety as the starting material. As a result, among the hybrids with dominant morphological traits, F_4T-4679-81 x Bukhara-102, F_4T-MVG-2 x Bukhara-102, F_4T-4674-77 x Bukhara-102, F_4T-200 x Bukhara-102, and F_4T-12/06 x Bukhara-102 were identified. Additionally, combinations T-4674-77, T-470/1, T-4684-86, T-58, T-158, and T-12/06 prevailed over introgressive lines as starting materials.

Keywords: Cotton, Morphological Features, F4, Introgressive, Hybrid, Line, Variety, Yield, Genotype

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Introduction

Today, creating high-yielding, early-maturing, and stress-resistant cotton varieties is one of the most pressing issues in cotton breeding. In this process, the in-depth study of morphological features is of great scientific and practical importance. Morphological features are the primary phenotypic indicators representing the external structure and biological characteristics of the plant, and they are widely utilized in the evaluation of breeding materials.In cotton, traits such as plant height, number of fruiting branches, boll size, leaf shape, and pubescence directly affect yield and product quality. Furthermore, due to the different genetic inheritance of these traits, wide variability is observed in hybrid populations. Furthermore, it is important to preserve, study, enrich, and effectively use the unique diversity of genetic resources in the national economy through interspecific hybridization of cotton.This valuable genetic fund serves as the basis for basic and applied research and serves as the basis for creating new high-yielding and high-quality cotton varieties that are resistant to biotic and abiotic environmental factors, qualitatively responsive in the national economy, and competitive in the global market[1].

Cotton (*Gossypium* spp.) is one of the most important industrial crops in the world for growing natural fiber. One of the main goals in the breeding process is to create varieties with high yield, fiber quality, early maturity, and resistance to biotic and abiotic stress factors. Therefore, a comprehensive assessment of cotton genotypes based on morphological and economic traits is an important stage of breeding work [2][3].

In the study conducted on 266 samples of Indonesian cotton germplasm, the diversity of 16 morpho-agronomic traits was studied. As a result of the research, descriptive statistics, correlation, path analysis, scatterplots, and grouping methods were used. As a result, it was established that plant height is the most variable trait, while fiber length is the lowest. The authors showed the possibility of identifying promising cotton genotypes for breeding by determining the relationships between morpho-agronomic traits [4].

Scientists note that most of the main economic traits in cotton, such as yield and fiber quality, are polygenic in nature, and it is necessary to consider the interaction of the genotypic environment when evaluating them. In modern breeding programs, selection efficiency increases significantly when phenotypic evaluation is used in conjunction with molecular methods. Furthermore, the comprehensive analysis of morpho-economic traits serves as an important scientific basis for assessing the genetic potential of breeding material, identifying high-yielding and high-quality fiber genotypes, and creating new varieties[5].

Genetic control of cotton morphological and productivity traits was carried out through 6 x 6 diallel crosses. The study established that the influence of a non-additive, dominant gene is important in the inheritance of yield, and broad and narrow inheritance coefficients for most traits are high. As a result, the CIM-1100 variety was identified as a promising parent for breeding [6].

In his research, he analyzed methods for assessing and predicting the maturity period of cotton. The authors summarized 12 measurements and 10 prediction methods for determining cotton ripening time based on morphological and phenological characteristics. In the study, the number of opened and unopened bolls and the total heat from sowing to maturity were studied to assess the maturation period [7].

It consists of creating new varieties adapted to the soil climate of Karakalpakstan, scientifically substantiated as a result of the use of various hybridization methods used in cotton breeding, with a new yield of 40-45 centners per hectare, high fiber yield, and high fiber quality. Also, according to the results of the analysis of materials obtained from varieties of the USA and Mexico in 1-2 breeding nurseries, 3 lines with high indicators of economically valuable traits were selected from the first-year breeding nursery and 7 from the second-year breeding nursery [8]. Additionally, morpho-economic traits were studied by comparing 24 hybrids and the variety S-4727 in terms of plant height, growing season, and number of bolls. As a result, it was observed that the number of bolls in 4 hybrids was in the range of 19.7-21.4 units, which is 5-8 units more than in other hybrids. In the research, it was possible to obtain hybrids with relatively low height, early maturity, and a large number of bolls from combinations obtained with the participation of foreign varieties Xin Lu Zhong-73, Hongtai-6636, line T-115, and local varieties KK-3535, Chimbay-5018, and Sulton [9].

According to the results obtained by the researchers from the variety testing field, the varieties did not differ significantly in morphological traits from the data provided by the breeders. Only the S-4728 variety was lower than the indicator specified in the description. This is due to the influence of certain field soil conditions and agrotechnical measures. The height of other varieties was close to the indicator specified in the description. It was observed that the indicators of the varieties in terms of the number of sympodiums are in most cases close. Regarding the number of bolls per plant, it was established that fewer bolls appeared in the varieties S-9090 and S-9091 (from 16.1 to 16.5 units, respectively) compared to the varietal characteristics [10].

In the studies, 24 families were isolated from interspecific hybridization and compared with the Namangan-77 variety as a standard; when studying the height of the main stem and the node where the first fruit branch is located, it was observed that the indicators of 5 families were higher. As a result of the selection, promising families were selected and recommended for the practical selection process [11].

It was established that the formation of morphological traits in new hybrids obtained through the hybridization of cotton species belonging to several genomes is inherited depending on the genotype of the species involved in the crossbreeding. It has also been scientifically substantiated that, along with cultivated varieties, the wild diploid species *G.thurberii* Tod. and *G.raimondii* Ulbr. exert a high influence on the inheritance of morphological traits. This confirms the possibility of combining traits characteristic of wild and cultivated species into a single genotype based on complex interspecific hybridization [12]. Morpho-economic traits include plant height, number of monopodial and sympodial branches, mass of one boll, number of bolls per plant, yield, fiber yield, fiber length, fiber strength, micronaire index, 1000-seed mass, and the growing season. These traits are formed as a result of the interaction between the genotype and the external environment and are of great economic importance in breeding.

In recent years, the improvement of approaches to assessing plant phenotypes has significantly expanded the possibilities for identifying and analyzing quantitative traits of a complex nature. In the process of fully characterizing these traits, alongside morphological and physiological indicators, methods based on modern imaging technologies are also applied, which contributes to the genetic and phenotypic improvement of crops [13],[14].

Identifying variability based on morphological traits and isolating promising specimens serves to increase breeding efficiency. Therefore, in this study, the indicators of cotton genotypes for certain morphological traits were studied and comparatively analyzed.

Materials and methods

The research was conducted on the experimental plots of the Research Institute of Breeding, Seed Production, and Agrotechnology of Cotton Cultivation. Hybrid combinations were obtained from the crosses of introgressive cotton lines T-4672-73, T-4674-77, T-4679-81, T-4684-86, T-138, T-470/1, T-95, T-158, T-200, T-MVG-2, T-58, T-1979, T-175/248, T-12/06, T-4747-48, T-BSG-2/06, and T-588, as well as the Bukhara-102 variety as the parent, and they were studied for many years by comparing morpho-economic traits with the standard variety C-6524. (B.A.Dospekhov 1985) morphological features were analyzed in field conditions [15].

Results and Discussion

When analyzing morpho-economic traits, special attention must be paid to aspects related to the plant's external structure and yield, as well as to agrotechnical measures. Of course, increasing crop yields is one of the most important factors for obtaining effective profits from agricultural crops. Solving these problems primarily depends on selection processes and agrotechnical measures.

According to the results of Table 1, among the morpho-economic traits, plant height, number of bolls, and the number of monopodial and simpodial branches were analyzed. Also, according to the results of the introgressive lines used as the starting material, the highest plant height was 110-120 cm in the lines T-4674-77 and T-1979, while the lowest height was 85-90 cm in the line T-588, and the plant height in the introduced parental material ranged from 85 to 120 cm. The number of monopodial branches ranged from 1 (T-138, T-95) to 2-3 (T-4679-81, T-MVG-2, and T-58).

We can see that the number of sympodial branches in line T-138 is 17-19, i.e., relatively high, while in line T-158 it is 16-18, in line T-4674-77 it is 15-18, and in line T-BSG-2/06 and T-588, it ranges from 11 to 14 and from 12 to 13 respectively (Table 1).

Table 1. Analysis of morphological features of introgressive lines

No	Varieties and introgressive lines	Plant height, cm	Monopodial number of branches	Number of sympodial branches	Number of bolls
1	Template S-6524	95-100	1-2	13-15	19-22
2	Bukhara-102	95-105	1-2	14-16	21-23
3	T-4672-73	100-105	2	13-16	18-22
4	T-4674-77	110-120	1-2	15-18	27-32

5	T-4679-81	100-110	2-3	14-15	19-21
6	T-4684-86	95-100	1-3	13-15	28-30
7	T-138	100-105	1	17-19	25-29
8	T-470/1	95-100	1-3	15-16	30-32
9	T-95	95-100	1	15-17	18-21
10	T-158	100-110	1-3	16-18	27-30
11	T-MVG-2	105-110	2-3	14-15	24-27
12	T-58	115-117	2-3	15-17	28-31
13	T-1979	110-120	1-2	15-17	20-22
14	T-4747-48	105-110	1-2	15-16	26-28
15	T-12/06	100-110	1-3	13-14	27-30
16	T-175/248	105-110	1-2	15-16	26-29
17	T-BSG-2/06	90-95	1-2	11-14	22-25
18	T-588	85-90	1-2	12-13	19-22
19	T-200	100-105	1-2	15-16	25-28

In the studies, one of the most important morphological indicators demonstrating productivity was the number of bolls; in the T-470/1 line, the number of bolls was 30-32, in the T-4674-77 combination 27-32, which is relatively more, and in the T-4672-73 combination 18-22, which is relatively less.

Figure 1. Introgressive lines and hybrids in the field experimental farm.

According to the data in Table 2, when measuring the plant height in the fourth-generation hybrid combinations, it was noted that in the F_4T-4679-81 x Bukhara-102 combination, it was 90–100 cm, and in the F_4T-4674-77 x Bukhara-102 and F_4T-470/1 x Bukhara-102 combinations, it was 110–125 cm. It was also observed that the number of monopodial branches in F_4MVG-2 x Bukhara-102 was the highest at 2-3 units, while in most other hybrid combinations, it was 1-2 units.

Table 2. Morphological characteristics of F_4 hybrid plants.

No	Varietal and hybrid combinations	Plant height, cm	Monopodial number of branches	Number of sympodial branches	Number of bolls
1	Template S-6524	90-100	1-2	13-15	19-22
2	F_4T-4672-73 x Bukhara-102	95-110	1-2	13-15	25-29

3	F_4T-4674-77 x Bukhara-102	110-125	1-3	17-19	27-31
4	F_4T-4679-81 x Bukhara-102	90-100	1-2	16-18	30-32
5	F_4T-4684-86 x Bukhara-102	100-110	1-2	13-15	23-26
6	F_4T-138 x Bukhara-102	105-110	1-2	15-17	24-27
7	F_4T-470/1 x Bukhara-102	110-125	1-2	14-16	25-27
8	F_4T-95 x Bukhara-102	100-110	1-2	15-17	26-29
9	F_4T-158 x Bukhara-102	95-115	1-2	13-16	22-26
10	F_4T-200 x Bukhara-102	110-120	1-3	17-20	27-32
11	F_4T-MVG-2 x Bukhara-102	105-115	2-3	16-19	28-33
12	F_4T-58 x Bukhara-102	90-110	1-2	12-14	22-26
13	F_4T-1979 x Bukhara-102	105-120	1-3	13-15	19-24
14	F_4T-175/248 x Bukhara-102	110-120	1	12-14	19-24
15	F_4T-12/06 x Bukhara-102	105-116	1	16-17	28-33
16	F_4T-4747-48 x Bukhara-102	90-105	1-2	11-13	22-25
17	F_4T-BSG-2/06 x Bukhara-102	110-115	1	12-14	24-28
18	F_4T-588 x Bukhara-102	100-110	1-2	13-15	26-30

During observations in the field experimental farm, the number of sympodial branches in the F_4T-4674-77 x Bukhara-102 and F_4T-200 x Bukhara-102 combinations was 17–20 more than in other hybrids. The lowest number of sympodial branches was observed in the F_4T-4747-48 x Bukhara-102 combination -11-13 units (Table 2). When calculating the number of bolls in hybrid nurseries, the highest number of bolls was recorded in hybrids F_4T-4679-81 x Bukhara-102 (30-32 units), F_4MVG-2 x Bukhara-102 (28-33 units), F_4T-12/06 x Bukhara-102 (28-33 units), F_4T-200 x Bukhara-102 (27-32 units), while the lowest number was in hybrids F_4T-175/248 x Bukhara-102 (19-24 units) and F_4T-1979 x Bukhara-102 (19-24 units).

Conclusion

In conclusion, several breeding material samples were identified that showed high results in morpho-economic traits. Specifically, hybrids such as F_4T-4679-81 x Bukhara-102, F_4T-4674-77 x Bukhara-102, F_4T-MVG-2 x Bukhara-102, F_4T-200 x Bukhara-102, and F_4T-12/06 x Bukhara-102 showed high indicators. The results of this research play a crucial role in selecting promising genotypes during the breeding process.

REFERENCES

[1] B. A. Dospekhov, *Methodology of Field Experiment*. Moscow, Russia: Agropromizdat, 1985, 351 p.

[2] U. E. Aytjanov, B. U. Aytjanov, and R. S. Seytbaev, "Analysis results of materials obtained from U.S. and Mexican varieties in the first- and second-stage breeding nurseries under the conditions of Karakalpakstan," *Agroilm Journal*, no. 5, pp. 4–7, 2025.

[3] S. G. Boboyev, G'. A. Muratov, Sh. E. Namazov, A. Muratov, and D. M. Ismailova, "Analysis of certain morphological characteristics of F1 plants of new complex interspecific polygenomic cotton hybrids," in *Proc. Republican Scientific-Practical Conf. "Current Problems and Prospects for the Development of Cotton Breeding, Seed Production, and Cultivation Agrotechnologies"*, Tashkent, Uzbekistan, Dec. 20, 2017, pp. 88–91.

[4] L. Chen, S. Li, X. Wang, L. Ke, Y. Yu, and Y. Sun, "Advancing cotton improvement: A review of functional gene mining through molecular markers, GWAS, and map-based cloning," *Journal of Cotton Research*, vol. 9, Art. no. 28, 2026, doi: 10.1186/s42397-026-00272-2.

[5] D. D. Fang and R. G. Percy, Eds., *Cotton*, Agronomy Monograph No. 57. Madison, WI, USA: American Society of Agronomy, Crop Science Society of America, and Soil Science Society of America, 2015, doi: 10.2134/agronmonogr57.

[6] Z. Ghorbanzadeh, B. Panahi, L. Purhang, Z. Hossein Panahi, M. Zeinalabedini, M. Mardi, M. Hamid, and M. R. Ghaffari, "Integrative genomics and precision breeding for stress-resilient cotton: Recent advances and prospects," *Agronomy*, vol. 15, no. 10, Art. no. 2393, 2025, doi: 10.3390/agronomy15102393.

[7] C. O. Gwathmey, M. P. Bange, and R. Brodrick, "Cotton crop maturity: A compendium of measures and predictors," *Field Crops Research*, vol. 191, pp. 41–53, 2016, doi: 10.1016/j.fcr.2016.01.002.

[8] G. D. Ismaylova, B. U. Aytjanov, U. E. Aytjanov, and G. M. Utepbergenova, "Inheritance of plant height, growing period, and number of bolls in F1 hybrids involving foreign varieties," *Agroilm Journal*, no. 6 (127), pp. 12–14, 2026.

[9] N. U. Khan and G. Hassan, "Genetic effects on morphological and yield traits in cotton (*Gossypium hirsutum* L.)," *Spanish Journal of Agricultural Research*, vol. 9, no. 2, pp. 460–472, 2011, doi: 10.5424/sjar/20110902-166-10.

[10] Kh. A. Muminov, "Morphological and agronomic characteristics of cotton amphidiploid hybrids," *Multidisciplinary Journal of Science and Technology*, vol. 4, no. 12, pp. 560–563, 2024.

[11] T. H. Side Rahman, M. Yamin, S. Mulyani, S. N. Qadri, L. Ayunawati, and A. P. Aji, "Diversity and selection of cotton germplasm based on morpho-agronomic character performance," *HAYATI Journal of Biosciences*, vol. 32, no. 2, pp. 341–355, 2024, doi: 10.4308/hjb.32.2.341-355.

[12] D. I. Rasulov, N. M. Xojamberganov, and S. X. Turapov, "Compliance of new cotton varieties with varietal descriptions based on economically valuable traits," *Agroilm Journal*, no. 2, pp. 6–7, 2025.

[13] M. Reynolds, S. Chapman, L. Crespo-Herrera, G. Molero, S. Mondal, D. N. Pequeno, F. Pinto, F. J. Pinera-Chavez, J. Poland, and C. Rivera-Amado, "Breeder-friendly phenotyping," *Plant Science*, vol. 295, Art. no. 110396, pp. 1–21, 2020.

[14] M. Watt, F. Fiorani, B. Usadel, U. Rascher, O. Muller, and U. Schurr, "Phenotyping: New windows into the plant for breeders," *Annual Review of Plant Biology*, vol. 71, pp. 689–712, 2020.

[15] M. B. Xalikova, X. Saydaliyev, N. Aliyarov, J. Maxmatkulov, T. Seytnazarova, and Q. Jo'rayev, "Formation of certain economically valuable traits in interspecific hybrid families," in *Proc. Republican Scientific-Practical Conf. "Current Problems and Prospects for the Development of Cotton Breeding, Seed Production, and Cultivation Agrotechnologies"*, Tashkent, Uzbekistan, Dec. 20, 2017, pp. 57–61.