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Use of the Potential of Afro-Asian (Gossypium Her-Baceum) and Indochinese (Gossypium Arboreum) Cotton Species

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Abstract: The article presents the results of the studies to identify genetic and breeding posibilities with use the comparative morphology methods, intra and interspecific hybridization, practical genetics. The studies revealed morphological characteristics and economic-valuable traits of the wild, ruderal and cultural-tropical forms of G.herbaceum L., G.arboreum L. and also new intra- and interspecific hybrids. The degree of compatibility of the intraspecific forms, their specific features with intra- and interspecific hybridization was determined. The features of inheritance and the degree of heritability of some morphological and economically valuable traits in the intra- and interspecific hybrids F_1 and F_2.

Keywords: genus, species, subspecies, variety, form, morphobiology, intra- and interspecific hybridization.

The creation of promising lines and varieties is impossible without the creation of source material with valuable germplasm, with the unique potential of wild and cultivated species, encompassing the rich polymorphism of traits and properties of the genus *Gossypium* L.

In this regard, the potential of the Afro-Asian (*Gossypium herbaceum*) and Indochinese (*Gossypium arboreum*) cotton species of the Old World (mainly in Asian countries and India) has been extremely underutilized. In terms of breeding, many forms of the subspecies of these species, as well as the species *Gossypium hirsutum*, are of great practical interest, possessing a number of very valuable economic traits, such as high precocity, resistance to water deficiency and diseases, and good fiber quality [1, 6-8].

Taking into account the above, a number of studies have been conducted to identify genetic selection possibilities using methods of comparative morphology, intra- and interspecific hybridization, and practical genetics. As a result of the research, morphobiological features and economically valuable traits of wild, ruderal, cultivated-tropical and subtropical forms of the species were identified: *Gossypium herbaceum* (subsp.*africanum* (Watt) Mauer, subsp.*pseudoarboreum* Mauer, subsp.*pseudoarboreum* f.*harga*, variety "377" (subsp.*euherbaceum* Mauer) and *Gossypium arboreum* (subsp.*obtusifolium* (Roxb.) Mauer, subsp.*obtusifolium* var.*indicum*, subsp.*perenne* (Blanco) Mauer, subsp.*neglectum* (Tod.) Mauer, subsp.*neglectum* f.*sanguineum*, subsp.*nanking* (Meyen) Mauer) variety "VIR 1372"), as well as new intra- and interspecific hybrids. The degree of compatibility of intraspecific forms and their specific features during intra- and interspecific hybridization have been established. The features of inheritance and the degree of heritability of some morphological and economically valuable traits in intra- and interspecific hybrids F_1 and F_2 have been revealed [2-5].

Intra- and interspecific hybridization revealed that the studied wild, ruderal, cultivated tropical, and subtropical varieties of *Gossypium herbaceum* and *Gossypium arboreum* interbreed well and produce fertile offspring. The crosses yielded a number of intraspecific hybrids with varying degrees of fertility.

During intraspecific hybridization of varieties and forms of the species *Gossypium herbaceum* the following features were revealed: basically all the studied intraspecific varieties and forms can be crossed, the formation of hybrid capsules and the formation of full-fledged seeds in them is 4.7-53.3%, 55.0-92.1%; in hybrid combinations in which subsp.*pseudoarboreum* f.*harga* is involved as the maternal form. Low formation of hybrid capsules was revealed (4.7-5.5%), which may be due to the peculiarities of the morphological structure of flowers; when crossing ruderal forms in the hybrid combination subsp.*pseudoarboreum* x subsp.*pseudoarboreum* f.*harga*, hybrid capsules are formed, but all seeds are full.

Intraspecific hybridization of the intraspecific species *Gossypium arboreum* revealed medium and low rates of hybrid capsule set (22.2-50.0%; 1.4-10.0%), high seed set in hybrid capsules (72.0-96.9%); it was not possible to obtain full-fledged hybrid capsules when crossing the wild form subsp.*obtusifolium* with the ruderal form subsp.*perenne*, which indicates their isolation.

Hybridization of Indochinese (*Gossypium arboreum*) and Afro-Asian (*Gossypium herbaceum*) cotton species has generally revealed low seed set in hybrid bolls, with the exception of some combinations. This may be due to flowering characteristics and their ecological and geographical origin. Seed set in hybrid bolls is generally high, indicating their close phylogenetic relationship and genetic compatibility.

It has been established that the most closely related subspecies among the wild and ruderal forms of the species *Gossypium herbaceum* and *Gossypium arboreum* in phylogenetic terms are the subspecies subsp.*africanum* and subsp.*perenne*, and among the ruderal and cultivated-tropical forms - subsp.*pseudoarboreum* f.*harga* and subsp.*neglectum*. Features of the inheritance of such economically valuable traits as precocity, fiber length and yield, raw cotton weight of one boll and 1000 seeds in intra- and interspecific hybrids F_1 and F_2 have been revealed.

When studying the inheritance characteristics of the length of the growing season in intraspecific F_1 hybrids (*Gossypium arboreum*), dominant, over dominant, and intermediate inheritance of the trait under study was observed. The length of the growing season is 102-125 days. The earliest maturing hybrid forms were obtained by crossing ruderal forms with cultivated tropical forms, as well as between cultivated tropical forms. Overdominance of the early maturity trait is observed, the dominance coefficient is hp = 9.2; 16.0. In interspecific F_1 hybrids obtained by crossing intraspecific varieties of the species *Gossypium herbaceum* and *Gossypium arboreum*, dominant, over dominant, or intermediate inheritance of the trait under study is also observed. High rates of early maturity were obtained by crossing ruderal and tropical forms. The earliest maturing hybrid forms of this group have a growing season of 105-111 days, and a dominance coefficient of hp = 10.2; 1.57.

In the second generation, intra- and interspecific hybrids exhibited a clear decline in early maturity. The average maturity was 127-153 days. The heritability coefficient was high, equal to 0.95; 0.98.

It should be noted that among the F_2 hybrid combinations of subsp.*euherbaceum* cultivar "377" x subsp.*pseudoarboreum*, introgressive forms with high rates of early maturity (109 days) were identified, compared with the original and F_1 hybrid forms. A certain pattern of inheritance of the length of the growing season is observed; in F_1 and F_2, the parameters of the maternal forms predominate, with a few exceptions.

The features of inheritance of the traits of fiber length and yield in intraspecific varieties of the species *Gossypium herbaceum* and *Gossypium arboreum* were studied. The original parental forms of these species are characterized by short fiber: in wild, ruderal tropical and cultivated

forms of the species *Gossypium herbaceum* - 19.6-25.0 mm, and in representatives of the species *Gossypium arboreum* - 21.3-25.0 mm.

In intra- and interspecific hybrids obtained by crossing intraspecific varieties of the species *Gossypium herbaceum* and *Gossypium arboreum*, fiber length is inherited dominantly and superdominantly; heterosis is observed in all hybrid combinations. In the second generation, a decrease in the studied trait is observed, but in the F_2 hybrid combinations subsp.*neglectum* f.*sanguineum* x subsp.*obtusifolium* var.*indicum* and subsp.*obtusifolium* var.*indicum* x subsp.*pseudoarboreum*, the average value of fiber length indicators is preserved in the F_1 hybrids and the original forms. The heritability coefficient in intra- and interspecific F_2 hybrids is high, within 0.64-0.87. Relatively high heritability indices indicate a significant influence of the hybrid genotype on the inheritance of this trait.

Fiber yield indicators vary between the original parental forms and intra- and interspecific F_1 hybrids. The trait is inherited in an intermediate, dominant, or superdominant manner, with positive or negative heterosis.

In the second generation, intra- and interspecific hybrids exhibit high variability in fiber yield, with the exception of the combination of subsp.*euherbaceum* cultivar "377" x subsp.*pseudoarboreum*. In the remaining cases, high average yield values (32.6-33.8%) and a very high heritability coefficient (h^2 = 0.99) are observed. High heritability indices indicate a significant influence of the hybrid genotype on the inheritance of the trait under study.

Thus, among the second generation plants, high-yield, transgressive forms were identified, the indicators of which were significantly higher than the indicators of the original parental forms and F_1 hybrids, where the fiber yield was 38.0-40.0%. As a result of studying the inheritance characteristics of intra- and interspecific F_1 and F_2 hybrids obtained by crossing intraspecific representatives of the species *Gossypium herbaceum* and *Gossypium arboreum*, a number of transgressive forms with high fiber length and yield were obtained, which will undoubtedly serve as donors in the creation of long-fiber and high-yield cotton varieties.

The intraspecific diversity of the species *Gossypium herbaceum* and *Gossypium arboreum* is characterized by small seeds (42.0-61.0 g and 55.0-83.0 g, respectively) and low weight of raw cotton per boll (0.9-1.7 g and 1.0-2.1 g, respectively).

In intraspecific hybrids obtained by crossing intraspecific diversity of the species *Gossypium herbaceum*, raw cotton weight is inherited semi-dominantly or dominantly, and the 1000-seed weight trait is inherited superdominantly. Negative heterosis was also observed in the inheritance of these traits in intraspecific hybrids of the species *Gossypium arboreum* In interspecific hybrids, dominant, superdominant, and, in rare cases, semi-dominant inheritance is observed for the studied traits. Strong heterosis was revealed for the 1000-seed weight of interspecific F1 hybrids. In the second generation, slight variability and a decrease in the average trait value are observed in intraspecific hybrids for the raw cotton weight of one boll. Transgressive forms with high raw cotton weight values (2.3-2.5 g) were isolated from this hybrid population. In intra- and interspecific hybrids, an average, low and comparatively high level of heritability of this trait (0.37-0.75) was noted, which indicates a different influence of the hybrid genotype and the external environment on this trait.

In intra- and interspecific F_2 hybrids, high variability and heterosis persistence are observed for the 1,000-seed weight, with a very high heritability coefficient (h^2 = 0.97-0.99). This indicates a significant influence of the hybrid genotype on the inheritance of this trait. Transgressive forms with high raw cotton weight and 1,000-seed weight, isolated from the F_2 hybrid population, are yield donors and will be used in genetic selection processes to increase cotton productivity.

Thus, as a result of comprehensive research, a series of transgressive hybrid forms with new genotypes, which are donors of valuable traits, were obtained for the first time. The genetic potential of wild representatives of the studied species, intra- and interspecific hybrids, and the

practical significance of individual representatives were revealed. From the F_2 hybrid population, valuable cotton forms with economically useful traits such as fertility, early maturity, high fiber yield and length, potential resistance to diseases and pests, as well as environmental stress factors, were isolated. These forms will serve as the starting material for genetic breeding programs.

REFERENCES

1. Mauer F.M. Origin and systematics of cotton.//V. kn.: Khlopchatnik. - T.: Academy of Sciences of the UzSSR, 1954.- T. 1.- 384 p.
2. Muminov Kh.A., Ernazarova Z.A., Rizaeva S.M. Crossability and seed setting in intraspecific hybridization of varieties and forms of the species G.herbaceum L. and G.arboreum L.//Uzb. biol. zhurnal. - T.: Fan, 2008.- Special issue. - P. 29-32.
3. Muminov Kh.A., Rizaeva S.M., Ernazarova Z.A., Abdullaev F.Kh., Arslanov D.M. Inheritance of some economically valuable traits in diploid species G.herbaceum L. and G.arboreum L.//The role of the seed industry in ensuring food security: Proc. int. scientific-practical. conf. - September 2015. - From the Tajik Academy of Agricultural Sciences. - Pp. 47-49.
4. Muminov Kh.A., Ernazarova Z.A., Abdullaev A.A., Rizaeva S.M. Creation of source materials using the example of intraspecific hybrids of Afro-Asian (G.herbaceum L.) cotton.//Reports of the Academy of Sciences of the Republic of Uzbekistan. - T.: Fan, 2013. - No. 2. - Pp. 54-56.
5. Muminov H.A., Ernazarova Z.A., Abdullaev A.A., Rizaeva S.M. Inheritance and variability of the trait of early maturity in intraspecific hybrids F1, F2 of the species G.herbaceum L.//Uzb. biol. journal.- T.: Fan, 2013.- No. 1.- P. 34-37.
6. Omran A., Asadollah A., Saiid N. Intragenomic diversity and geographical adaptability of diploid cotton species revealed by cytogenetic studies.//African J. of Biotech.- 2007.- Vol. 6.- № 12.- P. 1387-1392.
7. Pathak V.D., Patel U.G. Studies on heterosis, combining ability and phenotypic stability in Asiatic cotton (*Gossypium herbaceum* L.).//Gujarat. Agr. Univ. Res. J.- 2000.- Vol. 26.- № 1.- P. 75.
8. Singh V.V., Mohan P., Kulkarni V.N., Baitule S.J., Pathak B.R. Explorations within India for collection of cotton species germplasm.//Plant Genetic Resource Newsletter, 2003.- P. 40-46.