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THE POLLEN VIABILITY OF THE ORIGINAL SPECIESAND INTERSPECIFIC HYBRIDS OF COTTON

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ABSTRACT

This article contains a cytological analysis of pollen grains in the Magnibracteolata Tod section and their hybrids, as well as plants F_1, C_1 - C_4 The high viability of hybrids pollen makes it possible to use them in hybridization in solving theoretical and practical problems of breeding, for example, the transfer of the characteristics of wild species to cultivated varieties.

KEYWORDS: viability, pollen, fertility, species, subspecies, interspecific, hybrid, cotton.

1. INTRODUCTION

The success of hybridization is achieved by obtaining a viable offspring. Pollen viability analysis facilitates the creation of proper understanding of conditions that determine its normal existence, which is essential in establishing the timing of artificial pollination and of hybridization.

If during the development of pollen spontaneous or induced doubling of the number of chromosomes occurs, then completely homozygous fertile plants are formed - doubled haploids (digaploids). Under natural conditions, the frequency of androgenesis is extremely low and is described only in isolated cases.[2,3.5,6]

Researchers present data on the dependence of pollen viability on the location of a flower on a bush, on sympodium, etc. The highest (90.1-93.3%) viability was observed in the flowers located in the first places (3-5 sympodial branches). In cotton, the first and second fruit branches are unproductive. The most productive are the fifth, sixth and seventh fruit branches.[1]

2. MATERIALS AND METHODS

The study material are tetraploid species of cotton *Gossypium barbadense* L., *Gossypium hirsutum* L., *G.tomentosum*, *G. mustelinum*, *Gossypium hirsutum* var. *morili*, *G. barbadense* ssp. *ruderale* section *Magnibracteolata* Tod., as well as varieties AN-Bayaut-2, Bukhara-6 and their hybrids F1, induced polyploids C1-C4 (plants after colchicination) generations.
The analysis of pollen viability and tetrad analysis in the studied species and hybrids was carried out according to the method of Z.M. Pausheva.[4]

For analysis, pollen was taken from ten plants average and several flowers from the middle part of the bush along the main stem. And pollen viability analysis was determined by starch content.

3. RESULTS AND DISCUSSION

The results of the analysis of pollen viability in the initial species and hybrids turned out to be high. The highest viability was found in An-Bayaut-2 (99.2±1.8) (see. Table), the lowest among original species in *G. mustelinum* (92,0±2.1), *G. tomentosum* (96.2±1.9), *G. hirsutum* var. *morili* (95.0±0.8)%. In F1 hybrids, pollen viability is lower compared to the original species. The lowest pollen viability among F_1 hybrids was in combination *G. hirsutum* var. *morili* × *G. tomentosum* and was (39.0±1.6)%, high viability percentage was found in F1 AN-Bayaut-2 × *G. mustelinum* (59.6±1,2). In C_2 generation pollen fertility in hybrids AN-Bayaut-2 × *G. tomentosum* (79.5±1.6), *G. hirsutum* var. *morili* × *G. tomentosum* (86.2±2,2), *G. mustelinum* × *G. tomentosum* (89.0±1,8), AN-Bayaut-2 × *G. mustelinum* (89.2±1.8)% is higher in comparison with F1 hybrids, but slightly lower in comparison with parent ones. This fact indicates that meiosis was stabilized on the basis of a harmonious combination of their chromosomes.

Table: Pollen fertility of the original parent species, interspecific hybrids F_1 and C_2 -C_4.

№	Variations	Number of analyzed pollen grains (pcs.)	pollen grains fertility (%) x±m	Variation coefficient (V %)
1	*AN-Bayaut-2*	1306	99.2 ± 1.8	1,2
2	*G. tomentosum*	1248	96.2 ± 1.9	1,2
3	*G. mustelinum*	1542	92.0 ± 0.7	2.1
4	*G. hirsutum L. var morili*	1364	95.0 ± 0.8	1,2
5	F_1 *AN-Bayaut-2 × G.tomentosum*	1724	59.4 ± 1.1	11.2
6	F_1 *G. hirsutum var. morili × G. tomentosum*	1625	39.0 ± 1.6	12.3
7	F_1 *G. mustelinum × G. tomentosum*	1248	50.2 ± 1.2	12.6
8	F_1 *AN-Bayaut-2 × G. mustelinum*	1625	59.6 ± 1.3	12,2
9	C_2 *AN-Bayaut-2 × G. tomentosum*	1348	79.5 ± 1.6	12.6
10	C_2 *G. hirsutum var. morili × G. tomentosum*	1520	86.2 ± 2.2	9.6
11	C_2 *G. mustelinum × G. tomentosum*	1426	89.0 ± 1.8	12,2
12	C_2 *AN-Bayaut 2 × G. mustelinum*	1124	88.2 ± 1.4	12,4
13	C_4 *G. mustelinum × G. tomentosum*	910	89.2 ± 1.8	1,2
14	C_4 *AN-Bayaut-2 × G. tomentosum*	802	88.0 ± 0.7	2.1
15	C_4 *G. tomentosum × AN-Bayaut-2*	889	89.0 ± 0.8	1,2
16	C_4 *G. tomentosum. × G. mustelinum*	900	91.1 ± 1.1	1,2

In combination C_2 *G. hirsutum* (AN-Bayaut-2 × *G. tomentosum*) viability was the smallest (79.5±1.6) % apparently due to disharmonious structure of karyotype.

The highest rate of pollen fertility in C_2 generations was found in combination *G. mustelinum* × *G. tomentosum* and amounted to (89.0±1.8) %. In hybrid generations of C3 and C4 plants pollen was observed to be highly viable. In combination C_4 *G. tomentosum* × *G. mustelinum* pollen viability was (91.1± 1.1) %, since meiosis stabilized in these generations due to a harmonious karyotype.

The reasons for the fertility and sterility of octoploids can also be explained by the following:

- If, in hybridization and obtaining of F_1 plants, species are involved in which homeologous chromosomes with similar morphology when elevated to the octaploid level (8n = 104), the number of identical chromosomes increases and this leads to clumping of chromosomes, the formation of various chromosomal abnormalities (polyvalents tri-, tetra-, penta, hexavalents). This leads to disruption of the process of microsporogenesis and a decrease in fertility.
- In case of hybridization, the chromosomes in the initial species are not similar to each other, in this case it is more difficult to obtain F_1 and there are more violations of the microsporogenesis process, so homeologous chromosomes in this case conjugate more difficultly or do not conjugate at all, this leads to a decrease in fertility in F_1 plants.
- when elevated (after colchicination) to octaploid level each chromosome creates a homologous pair and normal conjugation process restores. This leads to the normalization of meiosis, the formation of normal tetrads, increased fertility of hybrid plants.

4. CONCLUSIONS

It was established that meiosis in F1 also proceeds normally, the pollen performance rate is high, and a slight violation of meiosis does not affect the development of normal pollen in the hybrids we study.

It was determined that after the return of octaploids (8n = 104) again to the tetraploid level of ploidy (4n = 52), disturbances in incongruent crosses (such as *G. hirsutum* × *G. tomentosum*, *G. mustelinum* × *G. tomentosum*, *G. barbadense* × *G. tomentosum*) there is less disturbance in microsporogenesis, and their pollen viability is higher than that of the congruent crossing pairs G. hirsutum × *G. barbadense* ssp. *vitifolium* var. *brasilense*, *G. hirsutum* × *G. mustelinum* and others.

It was found that according to the results of the analysis, the pollen viability in the initial species and their hybrids was high.

It was determined that in the combination C_2 *G. hirsutum* (An-Bayaut-2 × *G. mustelinum*), the viability was the least, apparently due to the disharmonious structure of its karyotype.

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