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Study of Cytoplasmic Effect on Some Morphological and Economic Traits in *Gossypium*

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Ten hybrids and their reciprocals were studied to assess the cytoplasmic effects on the expression of some morphological and economic attributes in *Gossypium hirsutum*. The hybrids with *G. harknessii* cytoplasm recorded highest number of anthers, whereas a marked reduction was noticed due to *G. anomalum* background. Four cytoplasms influenced the ovule number. None of the cytoplasmic backgrounds showed definite effect on any other character studied.

Key Words: *Gossypium*, **Cytoplasm, Morphology**

Introduction

A vast majority of the commercial cultivars of *Gossypium hirsutum* L. derive their cytoplasmic background from the race *latifolium*, believed to have originated around Guatemala. The cytoplasmic uniformity therefore makes them more prone to the dangers of new pests and disease. However, before actually testing for disease and pest preferences, it is essential to evaluate the effect of different cytoplasmic backgrounds on characters related to productivity. Meyer (1973a) developed 16 new cytoplasmic strains by transferring *G. hirsutum* genotype into the cytoplasmic background of 7 different species, viz. *herbaceum*, *arboreum*, *anomalum*, *harknessii*, *longicalyx*, *barbadense* and *tomentosum*. The performance of 13 such strains and the effect of cytoplasmic background on the expression of some morphological and economic attributes in crosses with local *hirsutum* cultivars, has been studied.

Materials and Methods

Thirteen cytoplasmic lines, viz., DES-HERB 16, DES-HERB 277, DES-ARB16, DES-ARB 277, DES-ANOM 16, DES-HAF 16, DES-HAF 277, DES-LONG 16, DES-LONG 277, DES-BARB 16, DES-BARB-277, DES-TOM 16 and DES-TOM 277 deriving their cytoplasmic background from *G. herbaceum*, *G. arboreum* (cultivated diploids), *G. amomalum* *G. harknessii*, *G. longicalyx* (wild diploids), *G. barbadense* (cultivated tetraploid) and *G. tomentosum* (wild tetraploid), respectively, were crossed to varieties SRT 1 and/or Bikaneri Narma (B.N.) reciprocally during 1979. The hybrid combinations secured in 1980, were studied along with their parental strains and Hybrid 4 in a randomised block design with three replications under rainfed conditions, with ten plants per replication (60×60 cm spacing). Five plants from each plot were randomly selected for initiation of squaring and flowering, number of monopodial and sympodial branches, first fruiting node, number of leaves at the onset of flowering (60 days after sowing), number of anthers and ovules per flower, plant height, lint index, seed index and mean halo length. Anthers and ovules were counted in two flowers plants in each replication. To minimize environmentally-induced differences, observations in each attribute were completed in 3 consecutive days.

Results and Discussion

The analysis of variance showed existence of highly significant genotypic differences for different characters (table 1a). The lines showed differences compared to check SRT 1 for leaves at onset of flowering, anther and ovule numbers. Very small/no differences were seen for other characters.

The mean performance of 20 hybrids including their reciprocals with the CD values for different characters are given in table 1b. Change in cytoplasmic background showed no influence on the number of leaves at onset of flowering.

The number of anthers per flower was highest in the crosses of DES-HAF 16 and DES-HAF 277 (*harknessii* cytoplasm). Meyer (1971), has also reported a significant enhancement in the number of anthers due to the *G. harknessii* cytoplasm. The *anomalum* cytoplasm caused

Table 1a *Performance of cytoplasmic strains in respect of six attributes in* G. hirsutum *(Mean over 3 replications)*

	Leaves at onset of flowering	Anthers per flower	Ovules per ovary	Seeds per boll	Lint index (g)	Seed index (g)
DES-HERB 16	15.2**	80.9	31.0	24.7	4.06	6.8**
DES-HERB 277	16.4**	82.9	31.9	23.9	4.64	8.9
DES-ARB 16	18.1**	67.8**	30.7	26.1*	3.86	7.6
DES-ARB 277	19.5**	63.4**	31.5	23.2	4.09	8.9
DES-ANOM 16	18.1**	52.8**	34.5*	23.8	3.84	7.3
DES-HAF 16	22.8	104.1*	34.5*	23.9	4.65	9.1
DES-HAF 277	24.1	100.0	33.2	24.8	5.20	9.7*
DES-LONG 16	18.8**	65.3**	32.9	22.7	3.99	8.2
DES-LONG 277	14.5**	57.4**	31.6	21.5	3.68	7.6
DES-BARB 16	17.7**	76.3	34.3	25.3	4.39	7.5
DES-BARB 277	19.8*	75.7	35.3**	24.8	4.24	8.9
DES-TOM 16	19.0**	83.9	34.2*	25.2	3.94	7.3
DES-TOM 277	23.8	85.7	33.9	24.5	4.67	9.6*
Bikaneri Narma	24.7	90.7	34.5*	25.3	2.40**	6.3**
SRT 1	31.1	87.2	32.1	21.3	4.52	8.4
C.D. at 5% level	8.7	13.7	2.1	4.5	0.89	1.2
C.D. at 1% level	11.6	18.2	2.8	5.9	1.18	1.5

*,** Differences significant at 5% and 1% levels respectively w.r.t. the control, SRT 1

Table 1b *Performance of reciprocal hybrids of cytoplasmic lines in* G. hirsutum

Hybrid	Leaves at onset of flowering	Anthers per flower	Ovules per ovary	Seeds per boll	Lint index (g)	Seed index (g)
DES-HERB 16×B.N.	24.7	76.0**	29.2	28.4	2.76	6.1
B.N.×DES-HERB 16	25.4	94.4	27.8	26.1	3.49	7.2
DES-HERB 277×SRT 1	36.1	89.9	30.6	26.5	4.68	8.9
SRT 1×DES-HERB 277	31.1	81.3	31.2	24.1	4.96	9.5
DES-ARB 16×SRT 1	32.5	80.8	32.2	26.2	4.99	9.5
SRT 1×DES-ARB 16	35.8	84.2	32.3	23.7	4.72	8.9
DES-ARB 277×B.N.	28.0	98.0	30.4	27.9	3.47	8.0*
B.N.×DES-ARB 227	24.7	91.1	29.9	24.0	3.22	6.8
DES-ANOM 16×SRT 1	34.2*	63.0*	33.6	25.9	5.63*	9.3
SRT 1×DES-ANOM 16	25.1	77.8	34.9	24.6	4.59	8.6
DES-ANOM 16×B.N.	31.3	51.7**	30.8*	29.2	4.52	8.0
B.N.×DES-ANOM 16	27.7	86.1	28.5	28.1	3.95	7.7
DES-HAF 16×SRT 1	29.2	103.2	37.7	27.0	4.50	8.2*
SRT 1×DES-HAF 16	27.7	89.7	37.5	25.9	5.11	9.5
DES-HAF 277×SRT 1	31.4	104.3	33.4	28.7	5.27	9.3
SRT 1×DES-HAF 277	29.1	101.7	34.7	29.3	5.08	9.2
DES-HAF 277×B.N.	29.7	103.0	31.5	29.1	4.50*	8.4*
B.N.×DES-HAF 277	23.6	90.9	31.6	31.3	3.48	7.0
DES-LONG 16×SRT 1	26.8	81.6	30.3**	22.5	4.32	9.2
SRT 1×DES-LONG 16	26.9	92.0	35.2	23.2	4.46	8.1
DES-LONG 16×B.N.	32.2	86.0	32.7	25.1	4.10	8.2
B.N.×DES-LONG 16	33.5	96.2	31.7	27.6	4.51	8.1
DES-LONG 277×SRT 1	17.5**	79.5	35.5**	23.1	5.06	9.3
SRT 1×DES-LONG 277	29.7	82.1	32.4	25.1	5.05	9.2
DES-LONG 277×B.N.	17.3	96.3	27.8**	27.1	4.28	7.8
B.N.×DES-LONG 277	21.0	94.9	33.0	30.0	4.50	8.3
DES-BARB 16×SRT 1	29.9	85.3	32.7**	23.8	5.16	9.4
SRT 1×DES-BARB 16	28.4	93.6	35.6	26.9	5.26	9.6
DES-BARB 277×SRT 1	27.7	88.8	30.0*	27.9	5.39	9.4
SRT 1×DES-BARB 277	27.1	93.6	32.6	25.3	5.29	9.6
DES-BARB 277×B.N.	25.5	94.2	32.2*	33.0	4.96	8.6
B.N.×DES-BARB 277	29.9	97.3	34.8	31.7	4.45	8.1
DES-TOM 16×SRT 1	23.7	89.3	32.4	30.5	5.36	9.5
SRT 1×DES-TOM 16	25.9	91.8	30.5	26.1	4.70	9.0
DES-TOM 16×B.N.	25.5	77.5	29.6*	29.6	4.37	7.8
B.N.×DES-TOM 16	28.9	88.7	32.3	29.3	3.97	7.2
DES-TOM 277×SRT 1	27.5	97.1	33.9**	30.2	5.38	9.7
SRT 1×DES-TOM 277	29.1	84.0	30.8	26.6	5.07	9.0
DES-TOM 277×B.N.	20.9	93.0	35.1	28.7	4.20	8.1
B.N.×DES-TOM 277	28.4	94.3	35.0	30.2	4.49	8.2
H-4	33.7	92.6	34.2	24.0	4.75	10.2
C.D. at 5% level	8.7	13.7	2.1	4.5	0.89	1.2
C.D. at 1% level	11.6	18.2	2.8	5.9	1.18	1.5

*,** Significant reciprocal differences at 5% and 1% levels respectively.

a marked reduction in the number of anthers. Meyer and Meyer (1964) too have reported similar findings. The other cytoplasms did not show any definite influence on the number of anthers.

Reciprocal differences were observed for ovule number in the crosses involving *anomalum*, *longicalyx*, *barbadense* and *tomentosum* cytoplasms. However, such effects were not observed at the seed formation stage.

The *arboreum* and *anomalum* cytoplasms appeared to effect slight increase in the lint and seed indices. No reciprocal effects were observed in general on the onset of squaring and flowering phases, number of monopodia and sympodia, first fruiting node, boll weight, plant height and mean halo length. Also no differences due to the ploidy level of the cytoplasm were seen for most of the characters except for *anomalum* cytoplasm which caused a marked reduction in the number of anthers. Meyer (1973b) reported significant reciprocal differences due to five diploid cytoplasms in crosses with upland cotton, but not due to *barbadense* and *tomentosum*, both being tetraploid cytoplasms.

These preliminary findings tend to suggest that different cytoplasmic backgrounds would have no deterimental effect on the expression of economic and floral traits and plant habit. Meredith et al. (1979) have also reported that the cytoplasm from different species had no strong deleterious effect on yield components and fibre properties. These experimental strains would from a working material to develop cytoplasmically diverse lines for further investigations related to disease and pest preferences.

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