Indian J. Genet., **51** (4): 424–428 (1991)

COMBINING ABILITY AND INHERITANCE OF FIBRE FINENESS IN DIPLOID COTTONS: A COMPARISON FOR F_1 AND F_2 GENERATIONS

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(Received: November 3, 1989; accepted: April 19, 1991)

ABSTRACT

An experiment with eight established varieties of Asiatic cottons were used for nonreciprocal diallel crossing. Intrinsic fineness was evaluated in F_1 and F_2 generations. Combining ability and genetic components were found out. Fibre fineness was governed by additive type of gene action. In both generations, general combining ability was significant.

Key words: Combining ability, intrinsic fineness, hybrid vigour.

In India, significant success was achieved in cotton production by the exploitation of hybrid vigour [1]. Hybridization is done for combining desirable characters among the existing varieties. The F_1 progenies may supersede the parents in yield and/or quality. Hybrid 4 and G Cot Hybrid 6 are the examples of such efforts in *G. hirsutum* species. Selection is also practiced in segregating generations to evolve varieties.

In Gujarat, 50% area under cotton cultivation is covered by *G. herbaceum*. This accounts for 30% of total cotton production in the State. In general, Asiatic cottons are drought resistant, and tolerant to pests and diseases. Because of these added advantages, the farmers cultivate desi varieties. At the Main Cotton Research Station, Surat, efforts were made to develop desi cotton hybrids and, as a result, G Cot Desi Hybrid 7 was evolved [2]. Many of the existing desi hybrids have coarse fibre quality. They could not be spun to high counts. Fineness in cotton is one of the important qualities for determining its spinning value [3]. The present study was undertaken with a view to estimate hybrid vigour and analyse the gene action in controlling the fineness in desi cottons. Genetic components in F_1 generation of Asiatic cottons had been discussed by Subrahmanyam et al. [4].

MATERIALS AND METHODS

Four varieties of *G. herbaceum*, 2272, 3652, 785/IV/3 and 2340/58, and four varieties of *G. arboreum*, G 27, AKH 4, LD 210 and NA 39, with a wide range in fibre fineness were included in the study. Nonreciprocal diallel crossing was done among these varieties during 1985–86. The resultant 28 crosses and 8 parents were sown in 1986–87, and the F_2 progenies and parents were tested in 1987–88. In both years, the experiment was conducted in randomized block design replicated thrice maintaining spacing of 1.20 x 0.45 m. Random selection of 5 plants was done in F_1 generation and 30 plants in F_2 generation in each replication, and the lint was tested for fibre fineness by the gravimetric method. Intrinsic fibre fineness was determined using the formula

$$\text{Intrinsic fineness} = \frac{\text{Fibre weight in millitex}}{\text{Maturity coefficient}}$$

The combining ability analysis was based on Method 2, Model 1 of Griffing [5]. The estimation of components of variance for F_1 was based on Hayman [6] and that in F_2 as given by Jinks [7].

RESULTS AND DISCUSSION

Mean squares due to treatments, parents and hybrids were highly significant in both generations. The analysis of variance revealed wide genetic diversity among the genotypes. The parents vs hybrids comparison was significant only for F_2 generation, which implies persistance of heterosis. Variance due to gca was significant in both generations. The mean performance and gca effects (Table 1) indicated that fibre fineness ranged from 229 (NA 39) to 405 (G 27) millitex. The strain NA 39 was the finest genotype, followed by AKH 4 (235) and 2272 (229). In F_2 generation, the fibre fineness for parents ranged from 241 (NA 39) to 491 (LD 210) millitex. Here also NA 39 was the finest strain. The range

Table 1. General combining ability and mean performance for fibre fineness

Parents	Fibre fineness parameters			
	F_1		F_2	
	mean	gca	mean	gca
2272	299	10.7**	284	20.1**
3652	300	–6.8*	285	–27.3**
785/IV/3	333	10.0**	295	7.2*
2340/58	347	13.2**	305	6.5*
G 27	405	30.4**	374	23.2**
AKH 4	235	–36.7**	286	–15.7**
LD 210	375	40.8**	491	57.3**
NA 39	229	–40.2**	241	–31.0**
Variance for gca	8559.5**		8951.6**	

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

and levels of fineness between the parents were nearly similar in both the years. It was observed that the parents 2272, 3652, AKH 4 and NA 39 had negatively significant gca effects (which was desirable) in both the generations. These parents were very good general combiners. The cv. NA 39 showed maximum gca effect.

The estimates of sca effects were not consistent over two generations (Table 2). This may be due to segregation in F_2. Similar trends of desirable sca effects were observed for the crosses 2272 x G 27, 3652 xG 27, 785/IV/3 x G 27, and 2340/58 x NA 39.

The genetic components are presented in Table 3. In both years, additive component (D) was significant. Dominance components (H_1 and H_2) were significant in F_1, whereas only H_1 was significant in F_2 generation. The magnitudes of H_1 and H_2 were low as compared to D in F_1 which suggests the importance of additive component. The covariance component (F) was operative in two generations. The parameter E was effective in F_1 whereas H_2 was effective in F_2 generation.

Table 2. Specific combining ability and mean performance for fibre fineness

Cross	Fibre fineness parameters			
	F_1		F_2	
	mean	sca	mean	sca
2272 x 3652	279	–15.2	233	–11.6
2272 x 785/IV/3	311	3.8	285	5.4
2272 x2340/58	302	–8.4	294	15.1
2272 x G 27	312	–15.9	280	–15.1
2272 x AKH 4	255	–5.7	225	–31.7**
2272 x LD 210	358	20.1*	291	–38.1**
2272 x NA 39	251	–5.9	253	11.6
3652 x 785/IV/3	316	1.7	230	–41.8**
3652 x 2340/58	312	–5.5	288	16.6
3652 x G 27	302	–33.0**	262	–26.5**
3652 x AKH 4	264	–0.9	213	–36.2**
3652 x LD 210	366	20.3*	331	8.8
3652 x NA 39	265	0.9	231	–3.2
785/IV/3 x 2340/58	347	15.9	307	1.2
785/IV/3 x G 27	341	–7.5	320	–2.3
785/IV/3 x AKH 4	276	–5.4	345	61.4**
785/IV/3 x LD 210	347	–11.6	358	1.7
785/IV/3 x NA 39	267	–10.6	266	–2.4
2340/58 x G 27	341	–10.8	339	17.4*
2340/58 x AKH 4	276	–8.6	262	–20.9*
2340/58 x LD 210	355	–7.1	337	–18.6*
2340/58 x NA 39	277	–4.4	257	–10.4
G 27 x AKH 4	298	–3.8	328	28.6**
G 27 xLD 2210	384	5.0	285	–87.7**
G 27 x NA 39	288	10.0	299	14.9
AKH 4 x LD 210	311	2.1	307	–27.0**
AKH 4 x NA 39	255	24.1*	220	–25.2**
LD 210 x NA 39	308	–0.3	311	–7.5
Variance for sca	210.9		1248.8**	

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

The proportions of genetic components (Table 4) revealed that the potence ratio (H_1/d) was less than unity in both generations, confirming partial dominance. The ratio of total number of dominant and recessive genes (KD/KR) was equal in F_1 population, but not in F_2. Again, the proportion of genes with positive and negative effects ($H_2/4H_1$) in two cases was the same.

Ware and Harell [8] earlier observed that the F_1 mean was somewhat on the coarser side than finer side and the F_2 mean also showed influence of the coarser parent than the finer parent. It was pointed out by Marani [9] that interspecific F_1 hybrids had finer measurement than either of the parental varieties and the F_2 performance was near the average of F_1 and parental mean. Al-Rawi and Kohel [10] reported overdominance of fibre fineness in upland cotton.

Table 3. Estimates of genetic components for fibre fineness

Genetic components	F_1	F_2
D	$3762.9 \pm 91.0^{**}$	$5973.2 \pm 603.0^{**}$
F	$645.3 \pm 214.9^{*}$	$7480.8 \pm 2843.4^{*}$
H_1	$947.6 \pm 209.1^{**}$	$14651.87 \pm 5545.2^{*}$
H_2	$736.5 \pm 181.9^{**}$	10587.9 ± 4824.3
H_2	215.6 ± 122.02	$10696.9 \pm 3235.4^{*}$
E	$150.7 \pm 30.3^{**}$	367.9 ± 201.0

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

Table 4. Proportions of genetic components

Proportions of genetic components	F_1	F_2
$(H_1/D)^{0.5}$	0.5	0.8
KD/KR	1.0	8.9
$H_2/4H_1$	0.19	0.18

ACKNOWLEDGEMENT

The authors are grateful to Dr. V. G. Munshi, for encouragement in this study.

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