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Studies on Gene Effects in a Cross of Intervarietal Hirsutum Varieties*

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Six generations, P1, P2, F1, F2, B1 and B2 of an inter-varietal cross H. 297 x P.S. 16 were used in estimation of gene effects for seven characters by generation means method. For the character seed cotton yield, additive and dominance gene effects were highly significant while interaction gene effects were non-significant. Duplicate type of epistasis were found for the characters boll number, fibre length, ginning percentage, seed index and lint index while complementry type of epistasis was found for boll weight.

The present paper describes the estimates of gene effects of yield of seed cotton, its components and quality characters in an intervarietal cross i.e. H. 297 x P.S. 16 using the generation means method of Jinks and Jones (1958) and Hayman (1958).

MATERIAL AND METHODS

The parental materials, H. 297 and P.S. 16 (designated them as P1 and P2) were grown for making the crosses. The resulted F1s were back crossed to both the parents which resulted in producing seed of B1 and B2 progenies. Part of F1 material was grown to get F2 seeds. Seeds of all generations (P1, P2, F1, F2, B1 and B2) were grown in *Kharif* 1974 in a randomised block design with three replications. Each replication had one row of each parent and two rows (each with 10 plants) of F1, F2 and two backcross progenies. The spacing adopted was 75 cm x 30 cm. The data for

TABLE I. Analysis of variance of six generations for seven characters in cross H. 297 x P.S. 16

Source	D.F.	Mean sum of squares						
		Yield per plant	Boll number	Boll weight	Halo-length	Ginning percentage	Seed index	Lint index
Replication	2	22.00	0.08	0.01	0.09	0.02	0.01	0.01
Generations	5	962.12**	226.98**	0.77**	2.64**	1.79**	0.78**	0.20**
Error	10	115.90	1.82	0.03	0.02	0.07	0.01	0.01

** Significant at 1% level of significance

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all generations were analysed by generation means method of Jinks and Jones (1958) and Hayman (1958). Joint Scaling Tests (Mather, 1949) were also used.

RESULTS AND DISCUSSION

The differences between the different generations were found to be highly significant at 1 per cent level. This indicated that the parents and their different generations were quite distinct from each other in respect of various characters (Table I).

The mean performance of P1, P2, F1, F2, B1 and B2 of cross H. 297 x P.S. 16 for various traits is given in Table II.

Yield per plant: The F1 yield was significantly superior over P1, P2, F2, B1 and B2 at 1 per cent. The F1 showed 169.7 per cent heterosis over superior parent (H. 297). However, the differences between, parents F2, B1 and B2 were not significant. The inbreeding depression from F1 to F2 was of the order 58.5 per cent though the F2 was 57.3 per cent superior over P2, the high yielding parent. The F1 performance indicated the high degree of dominance for this character.

Boll number per plant: The number of bolls per plant was significantly different in different generations. The F1 showed 89.0 per cent heterosis over H. 297 the better parent. The depression in F2 from F1 was 60.3 per cent. The B1 value was lower than its mid-parental value while B2 value was almost equal to its mid-parental value.

Boll weight: The F1 was almost equal to mid-parental value (2.98). On the basis of mean values this character seems to be controlled by additive genes.

Halo-length: The F1 was intermediate and almost equal to mid-parental value. F2 length was significantly lower than mid-parental value. Thus, the additive type of gene action was operating for this character.

Ginning percentage: The F1 value was significantly higher than mid-parental value (33.4) while the B2 was

TABLE II. Mean performance of six generations for different characters in cross H.297 x P.S.16

Characters	Mean performance of generations						± S.E.	C.D. 5%	1%
	P1	P2	F1	F2	B1	B2			
Yield per plant	26.24	20.65	70.75	41.28	47.00	41.74	3.78	19.56	27.32
Boll number	16.23	7.36	30.66	18.51	18.36	19.81	1.10	2.47	3.48
Boll weight	2.34	3.64	3.30	2.67	2.52	3.18	0.14	0.31	0.44
Halo-length	26.57	28.68	27.08	26.09	26.78	27.22	0.13	0.29	0.41
Ginning percentage	33.47	31.62	33.36	33.20	33.60	35.38	0.21	0.46	0.66
Seed index	8.81	8.72	8.27	7.54	7.91	8.96	0.09	0.22	0.31
Lint index	4.36	3.99	4.10	3.69	4.03	4.44	0.10	0.22	0.32

TABLE III. Mather's scaling test for different characters in cross H. 297 x P.S. 16

Scales	Characters						
	Yield/ plant	Boll number	Boll weight	Halo-length	Ginning percentage	Seed index	Lint index
A	−2.99	+26.77	−0.60	−0.90	+0.37	−1.26	−0.46
	±6.62	± 2.66	±0.15	±0.03	±0.22	±0.26	±0.10
B	−7.92	+13.90	−0.58	+0.08	+1.78	+0.93	+0.79
	±8.92	± 2.47	±0.15	±0.00	±0.22	±0.10	±0.20
C	−23.27	+13.73	−0.19	−5.05	+0.99	−3.91	−1.79
	±13.14	± 5.71	±0.53	±1.13	±0.72	±0 61	±0.59

significantly more than its mid-parental value (32.4). On the basis of mean values, partial dominance was found.

Seed index: The F1, F2 and B1 were significantly lower in seed index than the parents. There was 9.11 per cent inbreeding depression in F2 from F1. The B1 value was significantly lower than its mid-parental value (8.54) while the B2 value was significantly higher than its mid-parental value (8.67) per cent.

Lint index: The F1 value was almost intermediate and equal to mid-parental value. F2 was significantly lower than F1 and mid-parental value. While B2 was significantly higher than mid-parental value, based on different means partial dominance was found.

Scaling test: The value fot A, B and C scaling tests as per Mathers scaling Test are given in Table III.

The A, B, and C were found significant for the seed cotton yield while the values were highly significant for rest of the characters except for halo-length where only B value was non-significant. Thus, the additive dominance model was found suitable for yield only. While for rest of the characters this model was not appropriate.

Gene effects based on six parameter model

The estimates in respect of seven characters are given in Table IV.

For the characters seed cotton yield, additive and dominance gene effects were highly significant while interaction gene effects were non-significant. The scaling test also indicated the same. The magnitude of dominant effect was of much higher magnitude than additive gene effects. The heterotic value was also much higher than unity (2.12). Similar results were reported by Marani (1968) in an interspecific cross of tetraploid cottons. This cross also showed significant additive genetic variance thereby indicating better chances of yield improvement by utilizing additive genetic variance.

The estimation of gene effect for boll number per plant revealed that the six types of gene effects were found significant. The magnitude of gene

TABLE IV Estimates of genetic parameter from the generation means on the basis of six parameter model in cross H297 x PS 16.

Genetic parameter	CHARACTERS						
	Yield/ plant	Boll number	Boll weight	Halo-length	Ginning percentage	Seed index	Lint index
m	+41.28	+18.51	+2.67	+26.09	+33.20	+7.54	+3.69
	± 3.11	± 1.04	∓1.00	± 0.28	± 0.17	∓0.14	∓0.50
d	+ 5.26*	+10.87**	−0.66	− 1.14**	+ 0.22	−1.05**	−0.41**
	± 2.52	± 1.13	±0.22	∓ 0.50	± 0.14	∓0.10	±0.15
h	+59.66**	+33.50**	+1.03**	+ 4.49**	+ 1.97**	+3.08**	+2.10**
	±14.45	± 5.13	±0.35	± 1.13	± 0.75	±0.61	±0.42
i	+12.36	+26.94**	+0.72**	+ 5.04**	+ 1.16*	+3.58**	+2.18**
	±14.36	± 4.75	±0.23	± 1.13	± 0.54	±0.60	±0.23
j	+ 4.93	+12.87**	−0.02*	− 0.17	− 1.41**	−2.19**	−1.19**
	± 7.13	± 2.37	±0.01	± 0.10	± 0.28	±0.24	±0.43
l	− 1.45	−67.61**	+0.46**	− 5.03**	− 3.31**	−3.25**	−2.50**
	±19.27	± 7.29	±0.15	± 1.13	± 0.91	±0.73	±0.58
Heterosis/ h-i/-/ d-j/j	2.12	0.29	0,05	− 0.31	− 0.10	0.51	0.27

*Significant at 5% level

**Significant at 1% level

effects for dominance and epistatic interactions were of higher magnitude. The signs of $\hat{h}$ and $\hat{l}$ were in opposite direction, thus, duplicate type of interaction was operating for this character. The results are in confirmity with those reported by Joshi, *et al.* (1961).

For boll weight, additive, dominance, add. x add. and dom x dom gene effects were highly significant. The magnitude $\hat{h}$, $\hat{i}$ and $\hat{l}$ were much higher than additive gene effects. The signs for $\hat{h}$ and $\hat{l}$ were in same direction indicating the complementry type of interaction. The results were similar to those of Joshi, *et al.* (1961). Based on gene action studies it was apparent that this cross had better chances for the improvement of boll weight as the complementry epistasis and higher magnitude of additive variance both of which are fixable through selection.

For halo-length, $\hat{d}$, $\hat{h}$, $\hat{i}$ and $\hat{l}$ were significant. The magnitude of $\hat{h}$, $\hat{i}$ and $\hat{l}$ were much higher than $\hat{d}$ type of gene effects. The duplicate type of gene

action was found to be operating for this character. Marani (1968) also reported significant duplicate type of gene action in American cotton.

The character ginning percentage, the dominance, add x add, add x dom and dom x dom gene effects were found significant. Duplicate type of gene action was found as $\hat{h}$ and $\hat{l}$ signs were in opposite directions.

For seed index, the additive gene effects were much lower than the dominance effect and the epistatic interactions. The duplicate type of gene action was in operation. In contrast Marani (1968) found both additive and dominance gene effects to be significant.

In the case of lint index, similar situation was observed in case of ginning percentage and seed index. The duplicate type of gene action was found in operation. Marani (1968) also observed significant $\hat{d}$, $\hat{h}$, $\hat{i}$ and $\hat{l}$ effects. Ramey (1963) also found dominant and epistatic gene action.

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