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GENETIC ARCHITECTURE OF SOME QUANTITATIVE CHARACTERS IN COMMON WHEAT

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ABSTRACT

Five generations involving P_1, P_2, F_1, F_2 and F_3 were studied for six quantitative characters, *viz.*, tillers/plant, ear length, grains/ear, yield/ear, yield/plant and 100-grain weight in five common wheat crosses namely, CAPAN 1962 x CC 493, CAPAN 1961 x MUW 27, CPAN 1933 x HW 517, CPAN 1959 x HUW 1 and WH 147 x CPAN 1874. Both scales (C and D) were significant in all the crosses for majority of the characters therefore, non-allelic interaction (i) and (l) type existed; (d) and (i) were more important.

KEY WORDS : Wheat, Genetic Architecture, Quantitative Characters

Genetic improvement of wheat (*Triticum aestivum*L.) is essential for sustained productivity throughout the country. For that, generation mean analysis becomes an important tool so as to have knowledge on breedings startegy under the specific situation. This has extensively been used to study the inheritance of important yield traits of common wheat. Nevertheless, there remains some sort of unconfirmity in crops like wheat. An attempt, therefore, was made to study the genetics of yield traits by using five parameter model in wheat.

MATERIALS AND METHODS

The exprimental material comprised of five crosses *viz.*, CPAN 1962 x CC 493, CPAN 1961 x MUW 27, CPAN 1933 x HW 517, CPAN 1959 x HUM 1 and WH 147 x CPAN 1874 of common wheat The parents, F_1 s and F_2s of five crosses were obtained from the Department of Agricultural Botany, Meerut University, Meerut. All the five during *rabi* 1989-90 in a randomized block design with three replications at the Experimental Research Farm, Meerut University, Meerut. The distance between and within rows were kept as 20 and 10 cm, respectively. Non-segregating generations (p_1, P_2, and F_1) were raised in a three m long single row, whereas the segregating F_2 and F_3 generations were grown in 9 rows, each 3m long. Usual agronomic practices were adopted to raise the crop.

The data on number of tillers/plant, ear length (cm), number of grains/ear, yiled/ear (g), yield/plant (g) and 100 grain weight (g) were recorded on five randomly selected plants from P_1, P_2 and F_1 generations in each replication, whereas 50 plants in each replication in respect of F_2 and F_3 generations. The mean values were first subjected to scaling tests of scales C and D, (Mather, 1949) and to the five parameter model (Hayman and Mather, 1955) to detect the non-allelic interactions.

RESULTS AND DISCUSSION

The cross CPAN 1962 x CC 493 was marked with having significant C and/or D component of variations for all the traits except hundred- grain weight; whereas other crosses with significant C and D scales were CPAN 1933 x HW 517 for hundred grain weight; CPAN 1959 x HUW 1 for hundred-grain weight and WH 147 x CPAN 1874 for yield/ear, indicating there by that the simple additive dominance model did not hold good and that non-allelic interaction (i) and (1) type existed. Therefore, five parameter model was utilized to estimate the different gene effects (Table 1).

Amongst 120 parameter-character-cross combination, additive (d) component was significant in 17 cases (character-cross combinations) (Table 2). The additive x additive interaction was significant in 21 cases and dominance x dominance interaction in 10 cases. The mean effects were significant in all the crosses in respect of all the characters and magnitude was greater over the corresponding genetic parameters indicating the importance of additive gene effect.

Significant additive gene effect was observed in CPAN 1961 x MUW 27, CPAN 1933 x HW 517 and WH 147 x CPAN 1874 for tillers/plant, in CPAN 1962 x CC 493, CPAN 1961 x MUW 27 and CPAN 1959 x HUW 1 for ear length; in all crosses for grains/ear; in CPAN 1933 x HW 517 for yield/ear; in CPAN 1961 x MUW 27 and WH 147 x CPAN 1874 for yield/plant and in CPAN 1962 x CC 493, CPAN 1933 x HW 517 and CPAN 1959 x HUW 1 for hundred grain weight. The importance of additive gene effect for several quantitative characters in wheat has earlier been reported by Bakshi Ram *et al.*, (1987) and Pawar *et al.* (1988). Walia *et al* (1994) also reported similar results for hundred-grain weight in wheat. It is revealed from the forgoing discussion that additive gene effects were more important. Therefore, genetic improvement can be made following direct selection in the concerned crosses.

Regarding the epistatic effects, the additive x additive interaction was significant in all the crosses for majority of the characters. This preponderance of (i) gene effect indicated that the advantage of this sub-component of epistasis could be easily utilized for these characters. Such results were also observed by Paroda and Joshi (1970), and Walia *et al* (1994) in various traits.

The dominance component was generally higher compared to the corresponding additive genetic component for all the traits irrespective of the crosses. The dominance effect was important for grains/ear in CPAN 1962 x CC 493; for yield/ear in CPAN 1961 x MUW 27; for hundred-grain weight in CPAN 1933 x HW 517; for ear length, yield/plant and hundred-grain weight in CPAN 1959 x HUW 1 and for yield/ear, yield/plant and hundred-grain weight in WH 147 x CPAN 1874. This type of genetic effect is non-fixable. Therefore, breeding methods such as biparental mating followed by selection are likely to result in good segregants. Such schemes have been discussed by Redden and Jenson (1974) for the improvement of wheat yield.

Table 1. Estimates of scaling tests for various characters in five wheat crosses

Cross No. Character	Scale	CPAN 1962XCC493	CPAN 1961XMUW	CPAN 193XHW	CPAN 1959XHUW	WH147XCPAN1874
Tillers/Plant	C	6.8*±1.9	-1.1±2.0	-0.1±1.7	2.3±2.2	5.2*±2.0
	D	6.9*±1.6	-0.7±1.9	1.4±1.4	1.6±1.4	0.6±1.5
Ear length	C	2.4±1.2	1.9*±0.9	0.1±0.8	-0.5±1.2	2.5*±1.2
	D	2.6*±0.8	0.1±0.6	-0.1±0.6	-4.4*±0.7	-0.2±0.9
Grains/ear	C	24.7*±11.9	3.6±9.1	-0.8±6.2	13.0±12.7	14.4±9.6
	D	-22.0*±7.3	-4.2±7.7	10.1±6.2	15.2±8.6	21.1*±7.6
Yield/ear	C	1.5±1.1	1.9*±0.7	-0.4±0.3	0.4±0.6	2.7*±0.5
	D	-1.1*±0.4	-0.8±0.5	0.7±0.4	0.9±0.5	-1.6*±0.4
Yield/plant	C	16.6*±2.0	-0.1±3.5	3.3±3.3	6.1±4.4	11.3*±4.1
	D	-0.9±2.8	-0.8±3.2	5.1*±2.4	-0.7±2.7	-1.6±3.3
100-grain weight	C	0.5±0.4	0.3±0.5	-2.3±0.5	-1.8*±0.4	0.4±0.6
	D	-0.4±0.3	-0.4±0.3	-0.7*±0.3	-3.5*±0.3	-0.1±0.4

* Si ficant at five ercent level of si nificance

Table 2. Estimates of gene effects for six characters in five wheat crosses

Cross	Genetic components					Type of epistasis
	m	$\hat{d}$	$\hat{h}$	$\hat{i}$	$\hat{l}$	
1	2	3	4	5	6	
			Tillers/Plant			
CPAN 1962XCC 493	7.0*±0.3	0.1±0.3	-4.4*±1.2	-3.2*±1.2	0.1±3.6	D
CPAN 1961XMUW 27	6.1*±0.4	-1.0*±0.3	-0.5±1.4	-1.7±1.4	0.5±4.1	D
CPAN 1933XHW 517	6.8*±0.3	-1.3*±0.3	-0.5±1.0	-3.6*±1.1	2.1±3.1	D
CPAN 1959XHUW 1	6.9*±0.4	-0.2±0.4	0.3±1.2	-1.0±1.3	-1.0±3.8	D
WH 147XCPAN 1874	7.0*±0.3	1.0*±0.4	1.0±1.1	2.4*±1.1	-6.1±3.5	D
			Ear length			
CPAN 1962XCC 493	10.5*±0.1	-0.6*±0.2	-1.4*±0.6	-2.6*±0.7	0.4±1.9	D
CPAN 1961XMUW 27	10.1*±0.1	0.5*±0.2	0.8±0.4	1.2*±0.6	-2.4±1.5	D
CPAN 1933XHW 517	9.7*±0.1	-0.1±0.1	-6.9*±0.5	-3.9*±0.5	-0.3±1.4	C
CPAN 1959XHUW 1	10.9*±0.2	1.0*±0.2	2.2±0.5	4.9*±0.7	-5.2*±1.8	D
WH 147XCPAN 1874	10.0*±0.2	-0.6±0.3	0.7±0.6	-0.9±0.9	-2.7±1.8	D
			Grains/ear			
CPAN 1962XCC 493	50.7*±1.1	5.4*±2.1	12.9±5.5	45.1*±6.2	-62.4*±18.3	D
CPAN 1961XMUW 27	47.8*±1.2	-6.7*±2.9	5.5±4.3	-10.0±5.5	-10.4±13.3	D
CPAN 1933XHW 517	43.5*±1.1	-4.7*±1.9	-1.3±8.7	-0.3±6.8	1.2±11.0	D
CPAN 1959XHUW 1	51.8*±1.4	-12.9*±3.1	-2.5±5.6	-33.7±8.3	3.0±18.5	D
WH 147XCPAN 1874	45.1*±1.7	-5.7*±2.0	-25.9*±5.3	-23.2*±6.4	9.0±17.1	D
			Yield/ear			
CPAN 1962XCC 493	2.2*±0.1	0.1±0.1	0.6±0.4	1.0*±0.5	-3.4*±1.5	D
CPAN 1961XMUW 27	2.3*±0.1	0.1±0.2	1.1*±0.3	0.8±0.4	-3.6*±0.9	D
CPAN 1933XHW 517	1.7*±0.1	-0.2*±0.1	-0.4±0.2	-1.0*±0.3	1.4*±0.6	D
CPAN 1959XHUW 1	2.2*±0.1	-0.3±0.2	-0.2±0.3	-1.6*±0.5	0.7±0.8	D
WH 147XCPAN 1874	2.6*±0.1	0.1±0.1	1.5*±0.3	1.4*±0.3	-5.7*±0.8	D
			Yield/plant			
CPAN 1962XCC 493	9.9*±0.6	0.5±0.7	0.2±1.9	6.1*±2.1	-35.2*±6.9	D
CPAN 1961XMUW 27	8.2*±0.5	-3.2*±0.8	-1.4±2.1	-5.8*±2.3	-1.0±6.2	C
CPAN 1933XHW 517	7.1*±0.5	0.4±0.6	-1.6±1.7	-3.7±2.1	2.5±5.6	D
CPAN 1959XHUW 1	10.1*±0.7	-0.7±0.7	5.1*±2.2	-5.5*±2.4	-9.0±7.3	D
WH 147XCPAN 1874	9.6*±0.6	1.4*±0.7	5.0*±2.5	9.5*±2.5	-17.1*±7.4	D
			100-grain weight			
CPAN 1962XCC 493	4.3*±0.1	-0.2*±0.1	0.1±0.2	-0.1±0.3	-1.2±0.7	D
CPAN 1961XMUW 27	4.5*±0.1	0.1±0.1	0.5±0.3	0.4±0.5	0.9±1.5	D
CPAN 1933XHW 517	4.1*±0.1	0.7*±0.1	0.5*±0.2	1.4*±0.3	2.2*±0.7	C
CPAN 1959XHUW 1	4.3*±0.1	0.5*±0.1	2.3*±0.2	3.1*±0.3	-2.4*±0.7	D
WH 147XCPAN 1874	4.4*±0.1	-0.2±0.2	0.6*±0.3	0.9*±0.4	-0.5±0.8	D

* Significant at five per cent level of significance; D : Duplicate interaction; C : Complementary interaction

The dominance x dominance type of epistasis was significant for all the characters except tillers/plant. The cross CPAN 1962 x CC 493 was significant for grains/ear, yield/ear and year/plant; whereas CPAN 1961 x MUW 27 was only significant for yield/ear and CPAN 1933 x HW 517 for yield/ear and hundred-grain weight, CPAN 1959 x HUW 1 for ear length and hundred-grain weight, WH 147 x CAPN 1874 for yield/ear and yield/plant. Duplicate epistasis was observed in almost all the crosses for all the yield contributing characters. The opposite signs of (h) and (1) showed a duplicate type of interactions for various characters. Owing to duplicate interactions, most of the genotypes in the F_2 generation will tend to have the same phenotype resulting in the reduction of genetic variability. Conversely, the variance increases with the complementary gene action. The similar signs of (h) and (1) indicated the presence of complementary gene action. In the case where all the three types of gene effects (additive, dominance and epistatic) were significant, the suitable breeding methods might be recurrent selection procedures to exploit all the three types of gene effects. Simultaneously as under such a situation breeding for homozygous lines in wheat by a routine pedigre method would mean only partial exploited of genetic variance.

The crosses, CPAN 1962 x CC 493 and WH 147 x CPAN 1874 having high means, additive and additive x additive gene effects for grain yield/plant and its components may provide better opportunities for improvement through simple selection procedures.

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EFFECT OF MID-STORAGE TREATMENT ON STORAGE LIFE OF TOMATO AND BRINJAL

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ABSTRACT

Eight month old seeds of tomato (cv. Co 3) and brinjal (cv. Annamalai) were given the hydration-dehydration treatment with water and different anti-oxidants. The treated seeds after dehydration were stored in ambient condition along with control and evaluated for the seed quality parameters at bimonthly interval. Among the treatments, the disodium phosphate (10^{-4}m) recorded higher germination and drymatter production in both tomato and brinjal even after eight months of storage. The treated seeds recorded lower electrical conductivity and higher dehydrogenase activity.

KEY WORDS : Tomato, Brinjal, Seeds, Storage Life, Mid storage Treatments

In the hot and humid climatic conditions of India, maintenance of vigour and viability of seeds, especially of carryover stock, under ambient storage is the main problem. Maintenance of good germinability of the seed would, therefore, be of considerable advantage to the farmers who are facing acute shortage of good seed. Attempts have been made to evaluate the effectiveness of the hydration-dehydration treatment to prolong the shelf life of tomato and brinjal seeds under storage.

MATERIALS AND METHODS

Harvest fresh seeds of tomato (cv. Co 3) and brinjal (cv.Annamalai) obtained from the Vegetable Research Station, Tamil Nadu Agricultural Universtiy, Palur were stored under