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Genetic Variability, Correlations and Path Coefficient Analysis in Wheat (*Triticum aestivum* L.)

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In a study to estimate the genetic variability, heritability, genetic advance and correlation coefficients for eight quantitative characters and path coefficients for yield components in wheat (*Triticum aestivum* L.), the highest genotypic and phenotypic coefficient of variation was observed for yield per plant whereas the high heritability along with high genetic advance was observed for plant height, 100-seed weight, yield per plant and number of kernels per spike. Yield per plant had strong positive correlation with number of tillers per plant, length of spike, number of kernels per spikelet and 100-kernel weight. 100-kernel weight was highly and positively correlated with length of spike and spikelets per spike at genotypic level, number of spikelets per spike was highly correlated with length of spike and kernels per spike, kernels per spike and plant height with number of tillers per plant and length of spike; kernels per spikelet was strongly and positively correlated with kernels per spike. In path coefficient analysis, the length of spike seemed to make higher contribution to yield per plant as it gave the highest direct positive effect.

The hertiable variation of quantitative characters is masked by the non-heritable variation which, creates difficulty in selection programme. This suggests the need for partitioning the over all variances into heritable and non-heritable components for proper breeding programme. The correlation coefficient, is useful as basis of selecting the desirable parents. These further permit the evaluation of relative influence of various characters on yield. Path coefficient analysis is applied to partition the correlation coefficients into direct and indirect effects. Although the information on variability and correlations are available in this crop (Sikka, Maini, 1962: Gandhi *et.al*, 1964: Gill and Brar, 1973: and Singh *et.al*, 1973) the information on path coefficient analysis is very limited. Hence the present study was undertaken in wheat (*Triticum aestivum* L.), and the results are presented in this paper.

MATERIALS AND METHODS

Fifty varieties of wheat were taken for the present study. The field experiment was-laid-out in a randomized block design with three replications at Regional Station of Agricultural Research, Vallabhnagar during rabi 1971.

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72. The spacing adopted was 23 X 8 cm. Ten plants were selected at random from each variety in each replication and data were recorded on plant height, number of spikelets per spike, number of tillers per plant, length of spike, num -ber of kernels per spikelet, number of kernels per spike, 100 kernels weight and yield per plant.

Genotypic and phenotypic coefficient of variation was estimated according to Burton (1951), heritability in percentage in broad sense according to Johnson *et.al.*, (1955) wereas genetic advance was estimated according to Lush (1949). Correlation coefficients at genotypic and phenotypic level were computed according to Fisher (1954). Path coefficient analysis was done following Dewey and Lu (1959).

RESULTS AND DISCUSSION

The analysis of variance revealed highly significant differences among different characters studied. The range in gross varition indicated that plant height, number of kernels per spike, number of tillers per plant and yield per plant had shown vide range in variation where as length of spike, number of spikelets per spike, number of kernels per spikelet and 100-kernel weight had a narrow range in their gross variability (Table I). These findings are similar to those obtained by Gandhi *et.al.* (1974).

The maximum genetic coefficient of variation was observed for yield per plant (26.83%), followed by number of kernels per spike (21.44%) and 100-kernels weight (18.98%). The maximum phenotypic coefficient of variation was observed for yield/plant (30.93%) followed by number of tillers per plant (29.85%) and number of kernels per spike (25.55%). These findings are in conformation on with the reports of Gill and Brar (1973) and Tripathi *et al* (1973) in wheat.

TABLE I. Range, mean, genotypic and phenotypic variability, heritability and genetic advance for eight characters in wheat.

Character	Range	Mean	Genetypic variance.	Phenotypic variance.	GCV	PCV	Herita-bility.(%)	G.A.	GA as % of mean
Plant-height	54.3-120.0	84.50	231.40	244.10	18.22	18.48	94.79	30.50	36.09
No. of tillers/ Plant.	3.5- 17.3	8.49	3.32	6.43	17.90	29.85	51.6b	2.69	31.77
Length of spike	4.6- 11.7	8.71	1.58	2.21	14.47	16.99	71.66	2.18	25.08
Number of kernels/spike	21.3- 74.5	38.20	67.23	95.25	21.44	25.55	70.58	14.19	37.15
No. of spikelets / spike	13.0- 23.0	17.64	2.21	3.69	8.39	11.88	59.89	2.36	13.43
No.of kernels/ spikelets.	1.7- 4.0	2.52	0.12	0.21	13.49	17.86	56.53	0.52	20.79
100-kernel weight.	2.350 6.600	4.349	0.68	0.74	18.98	19.78	92.09	1.63	37.53
Yield/plant	5.3- 21.3	10.16	7.42	9.87	26.83	30.93	75.21	4.87	47.93

GCV: Genotypic Coefficient of Variation.
PCV: Phenotypic Coefficient of Variation.

High heritability along with high value of genetic advance as expressed in percentage of mean was observed for plant height, 100-kernel weight, yield per plant, length of spike and number of kernels per spike as recorded by Gill and Brar (1973) and Tripathi *et. al* (1973). Thus, high heritability along with high genetic advance shows the best conditions for selection. (Johnson *et. al* 1955). The high heritability observed for these characters is because of the fact that these characters are less influenced by the environment and that there would be greater correspondence between phenotype and breeding values. Gandhi *at. al.* (1964) had reported high heritability for ears per plant and high heritaibility with high genetic advance for ear length, ears per plant, 100-grain weight, and yield per plant. Singh *et.al* (1973) have also obtained high estimates of heritability and genetic advance in yield per plant and number of grain per plant.

The correlation coefficients at genotypic and phenotypic levels revealed that genotypic correlation coefficients were generally higher than their corresponding phenotypic correlations in most of the cases (Table II).

At genotypic level yield per plant was significantly and positively correlated with number of tillers per plant, length of spike, kernels per spikelet and 100-kernel weight. Such correlations

TABLE: II. Phenotypic and genotypic correlation coefficient in wheat.

Character		No.of tillers/ plant.	Length of spike.	No. of kernels/ spike.	No. of spike-lets/spike.	No. of kernels/ spikelets.	100-kernels weight.	Yield/ plants.
Plant height	(G)	+0.5255**	+0.3997**	-0.1027	-0.2126	-0.0100	+0.2111	+0.0625
	(P)	+0.3599*	+0.3204*	-0.1069	-0.1800	+0.0072	+0.1928	+0.0727
Tillers/plant	(G)		+0.3150*	+0.4151**	-0.0284	+0.0188	+0.0279	+0.2804*
	(P)		+0.2089	+0.2652	+0.0335	-0.0514	-0.1715	+0.3803**
Length of spike	(G)			+0.3195*	+0.5191**	+0.2404	+0.9591**	+0.5505**
	(P)			+0.3549*	+0.4651**	+0.0736	-0.5809**	-0.2085
No. ofkernels/ Spike	(G)				+0.5753**	+0.6004**	+0.5595**	+0.2252
	(P)				+0.5594**	+0.5376**	-0.2184	+0.0200
No. of spikelets / spike.	(G)					-0.1967	+0.6882**	+0.0758
	(P)					+0.1157	-0.2639	-0.0210
No. of kernels/ spikelet	(G)						+0.0125	+0.3172**
	(P)						+0.0085	+0.1597
100 kernel weight.	(G)							+0.5006**
	(P)							+0.3730**

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

and high heritability revealed the possibility that in these populations selection for strains with higher number of tillers per plant, spike length, kernels per spikelet and higher 100-kernel weight can be expected to result in higher yielding strains. Plant height was highly and positively correlated with number of tillers per plant and length of spike; tillers per plant with length of spike and number of kernel/spike; length of spike with number of kernels/spike, number of spikelets per spike and 100-kernel weight; number of kernels per spike with number of spikelets per spike, nnmber of kernels per spikelet, and 100-kernel weight; and number of kernels/spikelet had significant positive correlation with 100-kernel weight.

At phenotypic level yield per plant had significant positive correlation with tillers per plant and 100-kernel weight; 100-kernel weight is highly and negatively correlated with the length of spike; kernels per spikelet is positively and significantly correlated with number of kernels per spike whereas there was significant positive correlation between number of spikelets per spike and length of spike; spikelets per spike and kernels per spike; number of kernels per spike and spike length; spike length and plant height; and number of tillers per plant and plant height. Sikka and Maini (1962), Jain and Singh (1973), Singh *et. al.* (1973), Virk (1973) and Virk and Anand (1973).

Gandhi *et.al* (1964) reported grain yield per plant was found to be highly and positively correlated with ears per plant, 100-seed weight and grain per ear.

The path coefficient analysis between yield and yield components viz., tillers per plant spike length, kernels per spike and 100-kernel weight revealed that the length of spike has the highest direct positive effect where as its indirect effect through number of tillers per plant, number of kernels per spike and 100-kernel weight is very low. The number of tillers per plant, kernels per spike and 100-kernel weight had low direct positive effect where as the indirect contribution of 100-kernel weight on yield per plant through length of spike is quite high. Similarly the indirect contribution of tillers per plant and kernels per spike on yield per plant through length of spike was higher than through other characters.

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TABLE III. Path coefficient analysis between yield and yield components in wheat.

Character	Genotypic correlation with yield.	Tillers/ plant.	Spike-length	Kernel/spike	100-kernel weight.
Tillers/plant	+ 0.2804	+ 0.1149	+ 0.1597	+ 0.0057	+ 0.0001
Spike length	+ 0.5505	+ 0.0362	+ 0.5071	+ 0.0044	+ 0.0028
Kernels/spike	+ 0.2252	+ 0.0475	+ 0.1620	+ 0.0138	+ 0.0016
100-kernel weight	+ 0.5006	+ 0.0032	+ 0.4864	+ 0.0077	+ 0.0029

Residual effect + 0.8271

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