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Genetic Architecture of Yield and its Components in Bread Wheat (*Triticum aestivum* L.)

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ABSTRACT

The genetic components analysis showed that both additive and non-additive type of gene action played an important role in the genetic architecture of almost all the characters with a significant contribution of non-additive gene action. Asymmetrical distribution of positive and negative genes in the parents was observed. Overdominance was observed for all the characters except plant height. The estimates of narrow sense heritability were moderate to high in most of the traits.

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INTRODUCTION

Wheat occupies prime position among the cereals in India, which contributes about 33 per cent to the total food grain production of the country. There is a little scope for further increase in area, however, tremendous scope exists to ameliorate the inherent production potential of cultivars by way of further breeding work. Hence, a good knowledge of gene action involved in the inheritance of quantitative characters of economic importance is required to frame an efficient breeding programme leading to rapid improvement.

MATERIALS AND METHODS

In a diallel cross, eight cultivars of wheat namely, K 65, Pitic 62, Raj 1777, HD 2189, GW 496, GW 173, HI 1077 and Lok 1 were used. The trial was conducted in a randomized block design with three replications at Junagadh under each environment (1st Nov., 15th Nov., 1st Dec.) during *rabi* 1993-94. Each entry was planted in a single row of 2.5 m length keeping an inter and intra row spacing of 22.5 x 5 cm. The observations were recorded on five randomly selected plants for various characters studied. The genetic components of variation for different characters were evaluated over environments using Hayman's (1954 a, b) approach.

RESULTS AND DISCUSSION

Genetic components of variance analysis showed that the dominance component was relatively larger in magnitude than the additive component for all the

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TABLE 1

Genetic components analysis over environments in wheat.

Genetic component	*Days to flower-ing*	*Days to maturity*	*Plant height*	*Productivity tillers/ plant*	*Length of main spike*	*Number of grain/ spike*	*1000-grain weight*	*Grain yield/ plant*
D	92.88**	58.00**	145.94**	0.11	1.74**	46.30**	30.15**	0.44
	±3.70	±4.02	±4.09	±0.44	±0.16	±6.36	±1.40	±2.97
F	87.06**	64.05*	25.57	-0.91	-0.76	-57.67	2.53	-5.55
	±17.46	±18.93	±19.31	±2.06	±0.75	±30.07	±6.59	±14.04
H_1	155.66**	140.69**	116.07*	29.76**	5.12*	465.67**	72.06**	142.55**
	±33.98	±36.93	±37.58	±4.02	±1.45	±58.52	±12.83	±27.32
H_2	108.68*	119.93**	106.51*	26.35**	3.66*	354.81**	63.29**	126.06**
	±29.56	±32.13	±32.70	±3.49	±1.26	±50.91	±11.16	±23.77
h^2	5.13	54.33**	8.94	25.51**	0.87**	303.20**	61.88**	102.65**
	±4.96	±5.39	±5.48	±0.59	±0.21	±8.54	±1.87	±3.98
E	0.13	0.15	0.35	0.06	0.02	0.54	0.12	0.06
	±1.23	±1.34	±1.36	±0.15	±0.05	±2.12	±0.47	±0.99
$(H_1/D)^{1/2}$	1.29	1.56	0.89	16.34	1.71	3.17	1.55	18.05
$H_2/4H_1$	0.17	0.27	0.23	0.22	0.18	0.19	0.22	0.22
KD/KR	2.13	2.10	1.22	0.60	0.77	0.67	1.06	0.48
$k=h^2/H_2$	0.05	0.45	0.08	0.97	0.24	0.85	0.98	0.81
H_1-H_2	46.98	20.76	9.56	3.41	1.46	110.86	8.77	16.49
r(Wr+Vr) YR	0.59	-0.85	0.47	-0.21	0.76	-0.59	-0.91	0.51
%Heritability (n.s.)	49.16	19.62	70.66	24.99	68.04	54.61	53.29	26.2
t^2	3.47	0.22	0.68	11.26*	0.09	0.37	0.37	58.25**
t for b-0	7.30**	2.15	4.38**	1.39	1.65	3.49*	3.72**	-0.12
t for b-1	1.24	1.61	0.12	-6.34**	-2.34	-1.09	-1.39	-15.77**

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

characters except plant height for which significant additive effect (D) was recorded (Table 1). The values of H1 and H2 for all the characters except for plant height, were higher than those of D and were significant and positive, which indicate the preponderance of non-additive genetic variance to control most of the characters under study. Similar results have also been reported earlier by Sharma and Singh (1976), Sharma and Ahmad (1980), Sharma and Gupta (1980) and Sharma *et al.* (1986). In majority of the cases F values mostly negative and non-significant except for days to flowering and maturity, indicating that recessive alleles were more frequent than dominant ones. This was also corroborated by the lower values of KD/KR for productive tillers/plant, length of main spike, number of grains/spike and grain yield/plant. The values of net dominance variance effect (h^2) was significant for days to maturity productive tillers/plant, length of main spike, number of grains/spike, 1000-grain weight and grain yield/plant.

The t^2 estimates to test the uniformity of the Wr, Vr values were non-significant for days to flowering, days to maturity, plant height, length of main spike, number of grains/spike and 1000-grain weight indicating the fulfilment of diallel assumptions for these traits. For remaining traits the t^2 values were highly significant indicating the failure of one or a few assumptions for diallel mating design. Non-significant regression coefficients deviating from unity for most of the characters under study revealed absence of linkage and epistasis except for productive tillers/plant and grain yield/plant.

The values of (H1/D)½ ratio were more than unity for all the characters except plant height indicating the operation of overdominance as repoted earlier by Rao (1977), Gill *et al.* (1979) and Mitkees and Rassas (1986). However, for plant height partial dominance was observed. The H_2 component was smaller than the H_1 indicating the unequal proportion of positive and negative alleles in the loci governing the characters. The asymmetrical distribution of positive and negative genes in the parents was evidenced by the value of $H_2/4H_1$ which was less than 0.25 in most of the cases. The ratio h^2/H_2 was nearer to unity indicating that one gene or gene group operated in the inheritance of these traits under investigation. The moderate to high estimates of narrow sense heritability were obtained for most of the characters suggesting that the phenotypic variability for different traits was attributed due to genetic part rather than environmental influence. Moderate to high heritability for various characters have been reported by Gill *et al.* (1979), Mitkess and Rassas (1986) and Nayeem (1994).

As both additive and non-additive genetic components were important in the inheritance of yield and its components, biparental mating in early generation among the selected lines is suggested for the improvement of the characters studied.

REFERENCES

Gill, K. S., G. S. Nanda, G. Singh and K. L. Sehgal (1979). Inheritance of grain number, grain size, protein content and grain yield in two spring x winter crosses. *SABRAO*, J., II : 1-7. Hayman, B. I. (1954a). The theory and analysis of diallel crosses. *Genetics*, 39 : 789-809.

Hayman, B. I. (1954b). The analysis of variance of diallel tables. *Biometrics*, 10 : 235-244.

Mitkees. R. A. and H. N. Rassas (1986). Gene action in the inheritance of some characters of bread wheat. *Egyp. J. Genet. Cyto.*, 15 : 135-146.

Nayeem, K. A. (1994). Genetic architecture of flowering and maturity in wheat Triticum Spp. *Indian J. Genet.*, 54(1) : 63-66.

Rao, V. S. P. (1980). Combining ability studies in wheat using F2 generation. *Biovigyanam*, 6 : 37-42.

Sharma, G. S. and R. B. Singh (1976). Inheritance of plant height and spike length in dwarf spring wheat. *Indian J. Genet.*, 36 (2) : 173-183.

Sharma, J. C. and Z. Ahmad (1980). Genetic architecture for some traits in spring wheat. *Indian J. Agric. Sci.*, 50 (6) : 457-461.

Sharma, M. L. and P. K. Gupta (1980). Genetic components of grain yield and its contributing characters in wheat. *Biovigyanam*, 6 : 157-166.

Sharma, J. K., H. B. Singh and G. S. Sethi (1986). Gene action and selected parameters in bread wheat. *Himachal J. Agril. Res.*, 12 (1) : 1-5.