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GENETIC CHARACTERIZATION OF SOME QUANTITATIVE CHARACTERS IN WHEAT (*TRITICUM AESTIVUM* L. EM. THELL)

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ABSTRACT

Three crosses of wheat, viz. CPAN 1961 x MUW 27, CPAN 1933 x HW 517 and Eagle x Mendose, were studied for gene effects for yield and yield components. Both additive and nonadditive gene effects were found important for various traits. Simultaneous exploitation of these gene effects through biparental crossing followed by recurrent selection would provide further improvement in grain yield in wheat.

Key words: Wheat, yield components, gene effects, generation means.

Information regarding nature and magnitude of gene effects controlling the inheritance of yield and its component characters in different populations helps in designing the suitable breeding strategy for better exploitation of the genetic potential of a crop [1, 2]. Keeping this in view, generation mean analysis was carried out in three crosses of wheat to study gene effects for grain yield and its component characters.

MATERIALS AND METHODS

The experimental material comprised parents, F_1, BC_1, BC_2 and F_2 generations of three crosses: CPAN 1961 x MUW 27, CPAN 1933 x HW 517 and Eagle x Mendose. The material was evaluated in a randomized block design with three replications in 1.5 m long rows spaced 30 cm apart. Plant-to-plant distance within a row was 10 cm. Each of the parental and F_1 generation was represented by one row, each BC_1 and BC_2 by two rows, and F_2 by 10 rows. Five random plants from each row in a replication of each generation were scored for eight quantitative traits. Scaling testes [3, 4] were applied to detect epistasis and to

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determine the adequacy of the three parameter model. The gene effects were estimated following the models of Hayman [5] and Jinks and Jones [6].

RESULTS AND DISCUSSION

The estimates of scaling tests (Table 1) revealed the presence of digenic interactions for all the characters in all the crosses except for biological yield and grain weight/ear in CPAN 1933 x HW 517 where additive–dominance model was adequate.

The digenic epistatic model assumes that both fixable and non fixable gene effects are significant for tiller number in the crosses CPAN 1933 x HW 517 and Eagle x Mendose; for plant height and biological yield in Eagle x Mendose, and for grain yield in CPAN 1961 x MUW 27. Chapman and McNeal [7] and Gill et al. [8] also revealed the importance of these effects for wheat yield components. However, nonfixable gene effects were significant only for tiller number in the crosses CPAN 1961 x MUW 27. This shows the complex nature of inheritance of these traits in wheat, rather than the presence of either additive or dominance gene effects only. Moreover, epistatis in such cases was of duplicate type which further confirms the complex nature of these traits, as also reported earlier [9, 10]. Complementary type of epistasis was observed for days to flowering and plant height only in the cross CPAN 1961 x MUW 27. Such traits, where both additive and nonadditive gene effects are important, can better be improved by the breeding procedures involving biparental mating followed by recurrent selection.

The dominance component of gene effects was significant and higher in magnitude than the additive component for days to flowering only in two crosses CPAN 1961 x MUW 27, and Eagle x Mendose; for tillers/plant and plant height in CPAN 1961 x MUW 27; and for grain weight/ear in Eagle x Mendose. Pathak and Nema [11] and Khalifa et al. [12] also reported the importance of dominance component for these traits in wheat.

Additive gene effects were significant for grains/ear in all the three crosses; for plant height, grain weight/ear, and grain yield in CPAN 1933 x HW 517; for biological yield in CPAN 1961 x MUW 27; and for grain yield/plant in Eagle x Mendose, and were of higher magnitude than the dominance effects in two crosses, viz., CPAN 1961 x MUW 27 and Eagle x Mendose. For these traits additive variance accounted for the major part of genetic variance. These traits can, therefore, be improved by simple selection procedures. Srivastava et al. [13] reported the importance of additive effects for these traits.

Table 1. Estimates of scaling tests and genetic parameters for various characters in wheat crosses

Character	A	B	C	D	m	[d]	[h]	[i]	[j]	[l]	Type of epistasis
CPAN 1961 x MUW 27											
Days to flowering	1.92	1.78	-5.16*	-4.43*	90.58*	0.07	8.06*	8.86*	0.14	12.56*	Complementary
No. of tillers/plant	1.00	-0.56	-2.42*	-1.43*	6.90*	0.03	3.37*	2.86*	1.44*	-3.30*	Duplicate
Plant height	-7.83*	1.31	15.60*	11.06*	91.40*	-0.34	-18.18*	-22.12*	-9.14	-28.64*	Complementary
Biological yield/plant	3.35	-9.06*	-7.05*	2.68	40.33*	-2.46*	2.46	-5.36	5.71*	17.77*	—
No. of grains/ear	21.12*	-3.13	3.35	-7.32*	59.37*	7.66*	9.98	14.67*	24.17*	-32.63*	—
Weight of grains/ear	0.55*	-0.48*	-0.27	-0.17*	2.53*	0.21	0.47	0.34	1.03*	-0.41	—
Grain yield/plant	5.37*	-1.52*	-1.81*	-3.01*	14.35*	1.95*	7.19*	6.02*	7.54*	-10.23*	Duplicate
CPAN 1933 x HW 517											
Days to flowering	-0.02	0.59	-6.99	-3.78	87.76*	0.57	-16.58	—	—	—	—
No. of tillers/plant	0.64*	0.04	-6.00*	-3.34*	8.93*	0.80*	7.08*	6.68*	0.60*	-1.36*	Duplicate
Plant height	28.97*	-13.57	15.24*	0.08	86.42*	16.92*	-4.72	0.16	42.54*	-15.56	—
Biological yield/plant	5.70	-8.22	16.96	9.74	67.01*	3.30	-38.48	—	—	—	—
No. of grains/ear	-0.54	-2.16*	-2.56	0.07	65.17*	2.93*	1.98	2.26	1.62*	2.44	
Weight of grains/ear	-0.05	-0.03	-0.14	-0.02	2.33*	0.24*	-0.07	—	—	—	—
Grain yield/plant	-3.06*	8.60*	3.44	-1.05	21.62*	-3.85*	3.52	2.10	-11.66*	-7.64	—
EAGLE x MENDOSE											
Days to flowering	2.31	0.06	-3.67	-3.02	94.85*	0.22	113.43*	—	—	—	—
No. of tillers/plant	-19.98*	0.38	-1.62	8.99*	16.08*	-7.23*	-15.51*	-17.98*	-20.36*	37.58*	Duplicate
Plant height	-25.56*	3.21	1.01	11.68*	90.89*	-7.44*	-23.52*	-22.12*	-14.88*	45.71*	Duplicate
Biological yield/plant	36.35*	9.47*	-72.00*	-22.41*	45.58*	-19.17*	43.66*	21.85*	-46.12*	-17.64*	Duplicate
No. of grains/ear	14.39*	-0.97	-18.14*	-1.39	53.43*	-3.09*	3.07	2.78	-13.42*	12.58*	—
Weight of grains/ear	-0.28*	0.32	-1.96*	-1.00*	1.51*	0.12	1.98*	2.00*	-0.60*	-2.04*	Duplicate
Grain yield/plant	-1.11*	-0.19	-8.62*	1.34	19.27*	4.60*	-1.67	-2.68	-10.92*	13.98*	—

*Significant at 5% level.

REFERENCES

1. R. E. Comstock and H. F. Robinson. 1952. Genetic parameters, their estimation and significance. Proc. VI. Intern. Grassland Congr. National Publ. Co. Washington, D. C. **1**: 284–291.

2. E. E. Gamble. 1962. Gene effects in corn. I. Separation and relative importance of gene effects for yield. Can. J. Pl. Sci., **42**: 339–348.

3. K. Mather and J. L. Jinks. 1982. Biometrical Genetics, 3rd edn. Chapman and Hall, London.

4. B. I. Hayman and K. Mather. 1955. The description of genetic interaction in continuous variation. Biometrics, **11**: 69–82.

5. B. I. Hayman. 1958. The separation of epistasis from additive and dominance variation in generation mean. Heredity, **12**: 371–390.

6. J. L. Jinks and R. M. Jones. 1958. Estimation of the component of heterosis. Genetics, **43**: 223–234.

7. S. R. Chapman and F. H. McNeal. 1971. Gene action for yield components and plant height in a spring wheat cross. Crop Sci., **11**: 384–386.

8. K. S. Gill, K. S. Dhillon and K. S. Bains. 1972. Combining ability and inheritance of yield components in crosses involving Indian and exotic germplasm. Indian J. Genet., **32**: 421–430.

9. H. Ketata, E. L. Smith, L. H. Edwards and R. W. McNew. 1976. Detection of epistasis, additive and dominance variation in winter wheat (*Triticum aestivum* L. em. Thell). Crop Sci., **16**: 1–4.

10. R. B. Srivastava, R. S. Paroda and O. P. Luthra. 1980. Estimation of gene effects for components of yield in wheat. Cereal Res. Commun., **9**: 31–37.

11. N. N. Pathak and D. P. Nema. 1983. Gene action and heterosis in a spring wheat cross under high temperature and moisture stress conditions. Proc. 6th Intern. Wheat Genet. Symp. Kyoto, Japan: 555–561.

12. M. A. Khalifa, E. E. Mahdy and H. H. El-Henawy. 1988. Genetic studies of yield components in some wheat crosses. Proc. 7th Intern. Wheat Genet. Symp., Cambridge: 1125–1132.

13. R. B. Srivastava, O. P. Luthra, D. Singh and K. C. Goyal. 1981. Genetic architecture of yield, harvest index and related traits in wheat. Cereal Res. Commun., **9**: 31–37.