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DIALLEL ANALYSIS IN BREADWHEAT

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ABSTRACT

General and specific combining ability effects and variances for eight quantitative characters were studied involving five parent diallel (excluding reciprocals). Both additive and nonadditive genetic variances played important role in the inheritance of all the characters studied. In view of this, selective diallel mating system may prove to be fruitful in creating variability upon which effective selection for desirable characters could be made. The additive genetic variance, which was larger in magnitude for grain yield and other component characters except spike length, will be effective in getting transgressive segregates. The predictability ratio was near unity and gca/sca ratio was more than one for all the characters except spike length, suggesting greater importance of additive genetic variance for these characters. Hence, pedigree selection will be suitable for yield improvement in breadwheat. Kharchia 65 and CPAN 3013 are recommended for breeding programme as they expressed high positive and significant gca effects for grain yield and are expected to give high yielding transgressive segregates.

Key words: Combining ability, inheritance, breadwheat.

The diallel analysis studies are necessary to evaluate different wheat varieties for determining their usefulness as parents and to assess the gene action involved in various characters. The present investigation aims to obtain information on the nature of combining ability operating in the inheritance of grain yield and its different yield contributing traits in breadwheat.

MATERIALS AND METHODS

Five varieties of breadwheat (*Triticum aestivum* L.), namely, Kharchia 65, PR 2, NI 8611, CPAN 3013 and HS 207, were crossed in all possible combinations, excluding reciprocals. The resulting 10 F_1s and 5 parents were grown in randomised block design with two replications. Each plot consisted of two rows of 3 m length with a spacing of 23 cm between rows and 10 cm between plants. The recommended practices were followed to raise a good crop. Ten competitive plants were randomly taken for recording observations on eight quantitative traits. The progeny means were used for statistical analysis. The combining ability analysis was done according to Method II, Model I of Griffing [1]. The predictability ratio was computed by following the method of Baker [2].

RESULTS AND DISCUSSION

The analysis of variance revealed that the genotypes differed significantly for all the characters. Mean squares due to gca and sca effects were significant for all the characters, indicating that both the genetic variances, i.e. additive and nonadditive, were important in

Table 1. ANOVA (mean squares) for combining ability in breadwheat

Source	d.f.	Plant height	Tillers per plant	Spikelets per spike	Grains per spike	Spike length	Peduncle length	1000-grain wt.	Grain yield per plant
Gca	4	257.2*	30.2*	11.2*	180.1**	1.7*	67.3**	10.4**	182.2**
Sca	10	105.6*	8.5*	7.2*	81.5*	2.3*	17.2**	8.1**	71.4*
Error	14	16.7	3.2	2.4	9.8	0.1	1.9	0.2	12.8
Gca/sca		2.4	3.6	1.5	2.2	0.7	3.9	1.3	2.5
Predictability ratio		0.8	0.9	0.7	0.8	0.6	0.9	0.7	0.8

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

the expression of these characters. Both additive and nonadditive gene effects for these characters were indicative of exploiting recurrent selection programme in wheat. However, the magnitude of additive effects was greater for these characters except for spike length, suggesting preponderance of additive gene effects which were confirmed by the predictability ratio as was also reported by other investigators [3–7].

These results indicated that the crosses, Kharchia 65 x PR 2, NI 8611 x CPAN 3013 and PR x NI 8611 had significant positive sca effects for grain yield and 2–3 component traits. In these crosses, only one parent was good general combiner for grain yield and at least three other traits in combination. The second parent in each cross was a poor combiner for grain yield. Intermating between them followed by selection may be useful for exploitation of these crosses for grain yield. This method of breeding provides opportunity for breaking the undesirable linkages and create a broad genetic base against which the rearranged genes may be expressed.

Table 2. Estimates of sca and gca effects in breadwheat

Cross/parent	Plant height	Tillers per plant	Spikelets per spike	Grains per spike	Spike length	Peduncle length	1000-grain wt.	Grain yield per plant
				Specific combining ability				
Kharchia 65 x PR 2	8.74*	– 0.67	6.17*	11.59**	0.89*	– 3.60**	4.17**	8.02**
Kharchia 65 x NI 8611	10.24*	2.55	3.45	1.74	0.08*	– 0.56	– 0.36	– 8.45**
Kharchia 65 x CPAN 3013	– 3.43	– 0.52	2.02	6.26*	0.68*	– 0.87	1.49**	3.31**
Kharchia 65 x HS 207	– 10.85*	– 4.31*	1.16	– 6.40*	– 1.13**	– 3.13*	1.74**	– 3.29**
PR 2 x NI 8611	– 9.38*	4.09*	– 1.47	1.67*	0.59*	– 4.95**	– 0.75	12.97**
PR 2 x CPAN 3013	– 2.21	3.33	0.09	1.17	0.79*	0.67	2.96**	4.61**
PR 2 x HS 207	3.43	0.05	0.74	11.52**	1.49**	2.44*	0.41	4.62**
NI 8611 x CPAN 3013	20.48**	2.05	6.12*	1.71*	0.81*	9.30**	0.43	7.69**
NI 8611 x HS 207	1.13	2.26	– 3.47	– 15.33**	– 2.20**	1.97	2.43	– 5.31**
CPAN 3013 x HS 207	0.20	2.19	1.09	4.16	– 0.92*	– 1.99	4.36**	– 3.66**
				General combining ability				
Kharchia 65	6.92*	3.32*	– 2.21	4.00*	0.38	4.67**	– 1.77**	7.04*
PR 2	– 6.05	– 0.03	0.21	– 0.93	0.01	– 1.64*	0.11	– 1.38
NI 8611	1.64	– 0.24	0.42	– 4.57*	– 0.44*	0.74	– 0.55*	– 4.45*
CPAN 3013	4.06*	– 0.67	0.85	6.42*	0.73*	– 0.10	1.08**	3.40*
HS 207	– 6.57	2.38	0.71	– 4.92*	– 0.67*	– 3.67**	1.13**	4.60*
SEgi	1.38	0.60	0.98	1.05	0.13	0.47	0.16	1.21
SEsij	3.57	1.56	2.53	2.72	0.33	0.96	0.41	0.87

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

Both additive and nonadditive gene effects were involved in the inheritance of all the characters under study. Rapid improvement in the productivity of breadwheat, may not be achieved through conventional breeding programmes. Population improvement programme like concurrent random mating along with mass selection [8] in early segregating generations could be a dependable breeding procedure for improvement of yield in breadwheat. Multiple crosses followed by intermating among the desirable selected plants in later segregating generations may also be of much use for simultaneous improvement for grain yield.

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