

Genetic Variability and Inter-Relationship Analysis in F₂ Population of Bread Wheat (*Triticum aestivum* L.)

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Abstract A study was undertaken to estimate the genetic variability, correlation and path coefficient analysis of yield and yield contributing traits in F₂ population of the wheat cross RAJ3765 × WH711. High value of PCV and GCV was recorded in biological yield/plant followed by grain yield/plant except for plant height. High heritability was observed for biological yield, grain yield/plant and number of tillers/plant. This suggested better scope for selecting superior transgressive segregants in this population. Highest genetic advance was recorded for number of grains/ear and biological yield. Correlation and path analysis studies revealed that, characters harvest index > tiller number > grain weight/spike in that

order are the most important characters as these exhibited positive and strong association and maximum positive direct effects on grain yield. Present investigation suggests that selection in F₂ population of RAJ3765 × WH711 will be effective in selecting superior plants for yield traits in evolving high yielding genotype in wheat.

Keywords Genetic advance, Heritability, Correlation, Path analysis.

Introduction

Bread wheat (*Triticum aestivum* L), a self-pollinating annual plant in the true grass family *Gramineae* (*Poaceae*), is the largest cereal crop extensively grown as staple food sources in the world Mollasadeghi and Shahryari [1]. The grain yield is highly sensitive to environment than the component characters. It is already known fact greater the variability among the genotypes better is the chance for further improvement in the crop. Study of genetic variability in segregating population is helpful in understanding the genetic consequences of hybridization. High heritability associated with high genetic advance for different yield components have a better scope for selecting high yielding genotypes Shoukat Ali et al. [2]. Correlation is useful in disclosing the magnitude and direction of the relationship between various yield contributing traits and yield Nukasani et al. [3]. Path coefficient analysis

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Table 1. Estimation of mean, range, coefficient of variation (GCV and PCV), heritability, genetic advance and genetic advance as percent of mean for eleven traits in F_2 populations of cross RAJ 3765 × WH 711 in wheat.

Characters	Mean	Range	PCV	GCV	Heritability H ² (b.s) %	Genetic Advance	Genetic advance as % of mean
PH	97.8	82-125	8.77	7.69	87.70	15.50	15.85
NTPP	5.95	2-14	28.57	26.74	93.61	5.48	55.09
EL	9.66	6.0-14.0	16.60	14.89	89.75	2.96	30.68
EW	2.12	1.0-4.1	33.62	30.04	89.34	1.31	61.88
NG/E	34.99	5-67	32.11	30.48	94.92	21.97	62.79
GW/E	3.2	3-4	22.10	20.37	92.20	1.34	41.97
NG/S	18.37	9-23	13.40	10.97	81.85	4.15	22.60
NS/E	3.79	1.5-4.76	16.05	8.75	54.52	0.68	18.03
100GW	10.5	2.8-30.5	44.30	42.27	95.42	9.14	87.08
GY/P	22.46	5-41	47.98	45.87	95.60	21.22	94.49
BY/P	0.34	0.10-0.486	16.11	11.39	70.71	0.08	23.47

permits the separation of correlation coefficient into direct and indirect effects (effects exerted through other variables). Hence, in the present investigation an attempt was made to assess the variability, and also to find out the interrelationship of yield and yield contributing characters in wheat and to partition the observed correlations into their direct and indirect effects.

Materials and Methods

The experiment was conducted at the Research Farm, Department of Genetics and Plant Breeding, Chaudhary Charan Singh Haryana Agricultural University Hisar (India) during *rabi* season of 2013-2014. The experimental material comprised of the F_2 population of cross RAJ3765 × WH711. Two hundred fifty F_2 seeds were space planted along with resistant parent RAJ 3765 for yellow rust and a susceptible parent WH 711. Data were recorded at the time of maturity for various quantitative traits and genetic parameters correlation, path analysis and analysis like mean, range, genotypic coefficient of variation (GCV) and phenotypic coefficient of variation (PCV), heritability (broad sense) and genetic advance were calculated.

Results and Discussion

The amount of genotypic and phenotypic variability that exist in a species is of great importance in breed-

ing. The genetic variability in F_2 population showed high mean and wider range for all the traits and this suggested the existence of sufficient genetic variability in this population (Table 1). The results revealed that PCV was higher than its respective GCV for all the characters studied but close proximity between PCV and GCV values for most of the characters indicated less influence of environment on the expression of the characters under study Shankarrao et al. [4] and these traits are governed by additive gene action.

The highest values of PCV and GCV were observed for biological yield/ plant followed by grain yield/plant and lowest values observed for plant height. Abinasa et al. [5] also reported high genetic variability for grain yield and its component characters in early segregating generations of wheat. The high heritability indicated that the characters were less influenced by environment. Highest heritability obtained for traits such as grain yield/plant, biological yield/plant, number of grains/ear. Which in fact demonstrate the presence of additive genes effect indicating effectiveness of selection for the improvement of these traits. Kumar et al. [6] and Yousaf et al. [7] also reported high heritability estimates for grain yield per plant which support the present findings.

High heritability accompanied with high genetic advance as percent of mean was recorded for bio-

Table 2. Correlation coefficients among various traits of F₂ population of cross RAJ 3765 × WH 711 in wheat. * Significant at p=0.05, ** Significant at p = 0.01.

Ch.	PH	NTPP	EL	EW	NG/E	GEW/E	NG/S	NS/E	100GW	GY/P
PH										
NTPP	-0.557**									
EL	0.957**	-0.480**								
EW	-0.866**	0.631**	-0.772**							
NG/E	0.928**	-0.484**	0.938**	-0.791**						
GEW/E	-0.621**	0.556**	-0.501**	0.779**	-0.469**					
NG/S	-0.943**	0.670**	-0.884**	0.906**	-0.865**	0.708**				
NS/E	0.973**	-0.547**	0.965**	-0.842**	0.928**	-0.592**	-0.942**			
100GW	-0.322**	0.257**	-0.291**	0.481**	-0.322**	0.433**	0.413**	-0.351**		
GY/P	-0.483**	0.476**	-0.436**	0.565**	-0.409**	0.521**	0.560**	-0.493**	0.829**	
BY/P	0.869**	-0.284**	0.879**	-0.742**	0.923**	-0.452**	-0.825**	0.886**	-0.324**	-0.34**
HI	-0.963**	0.565**	-0.927**	0.849**	-0.898**	0.606**	0.939**	-0.960**	0.363**	0.519**

logical yield/plant followed by grain yield/plant. Yadawad et al. [8] and Asif et al. [9] also obtained similar results for grain yield/plant. This indicates the lesser influence of environment in expression of these traits and prevalence of additive gene action in their inheritance, hence there are scope for simple selection.

Prior to any breeding program for the improvement in crops, it is important to obtain information regarding the association of yield with different characters and among themselves since it facilitates a quick assessment of high yielding genotypes in selection program. Grain yield had significant and positive correlation with number of tillers/plant (0.47**),

100 grain weight (0.82**), ear weight (0.56**) and harvest index (0.85**) and negative association with plant height and ear length (Table 2). Such positive association of grain yield/plant with these trait was also observed by Khan et al. [10] and Rajpoot et al. [11].

In path coefficient analysis residual effect (0.195) was considerably low indicating a high contribution of independent traits to the dependent trait (grain yield). 100 grain weight (0.774) had the highest direct contribution towards grain yield/plant followed by biological yield/plant (0.257), harvest index (0.206), number of grains/ear (0.204) and number of tillers/plant (0.147) (Table 3). Hence, these

Table 3. Path coefficient analysis of grain yield per plant with its component characters of F₂ population of cross RAJ 3765 × WH 711 in wheat. Residual are 0.19586 PF : Plant height, NTPP : Number of tillers per plant, EL : Ear length, EW : Ear weight, NG/E : Number of grains/ear, GEW/E : Grain weight/ear, NG/S : Number of grains /Spikelets, NS/E : Number of Spikelets/ear, 100GW : 100 grain weight, BY/P : Biological yield per plant, HI : Harvest index, GYP : Grain yield per plant.

Charac- ters	PH	NTPP	EL	EW	NG/E	GEW/E	NG/S	NS/E	100GW	BY/P	HI
PH	-0.36367	-0.08189	-0.11023	0.14807	0.19001	-0.00521	-0.07725	0.04207	-0.24933	0.22338	-0.19856
NTPP	0.20254	0.14703	0.05532	-0.10790	-0.09905	0.00466	0.05487	-0.02367	0.19923	-0.07307	0.11644
EL	-0.34814	-0.07064	-0.11515	0.13195	0.19197	-0.00420	-0.07242	0.04174	-0.22573	0.22611	-0.19114
EW	0.31502	0.09281	0.08889	-0.17093	-0.16191	0.00654	0.07424	-0.03639	0.37225	-0.19089	0.17494
NG/E	-0.33761	-0.07115	-0.10800	0.13521	0.20467	-0.00393	-0.07084	0.04014	-0.24953	0.23737	-0.18518
GEW/E	0.22589	0.08176	0.05771	-0.13321	-0.09598	0.00839	0.05801	-0.02561	0.33502	-0.11631	0.12489
NG/S	0.34290	0.09847	0.10179	-0.15490	-0.17696	0.00594	0.08193	-0.04072	0.32003	-0.21214	0.19359
NS/E	-0.35385	-0.08047	-0.11115	0.14386	0.19000	-0.00497	-0.07715	0.04324	-0.27205	0.22784	-0.19790
100GW	0.11708	0.03782	0.03356	-0.08216	-0.06594	0.00363	0.03385	-0.01519	0.77447	-0.08339	0.07477
BY/P	-0.31591	-0.04178	-0.10125	0.12689	0.18894	-0.00379	-0.06759	-0.03831	-0.25114	0.25715	-0.17601
HI	0.35030	0.08305	0.10677	-0.14506	-0.18386	0.00508	0.07694	-0.04151	0.28092	-0.21957	0.20614

traits turned out to be the major components of grain yield and direct selection on these traits may be effective. Plant height had negative effect (-0.363) on grain yield. Suryakant et al. [12] also reported similar results that the grain yield/plant showed positive and significant correlation with effective tillers/plant, number of grains/ear, 1000 grain weight, biological yield/plant and negative significant correlation with plant height. Thus, path analysis suggest that 100 grain weight, biological yield/plant and number of tillers/plant may serve as effective selection attributes during breeding program for yield improvement in wheat.

Thus, it is evident from the present findings that variability parameters, correlation and path coefficient analysis was envisaged for yield and its component traits in the F₂ population of cross RAJ3765 × WH711. It exhibited high heritability coupled with high genetic advance as percent of mean for grain yield per plant, biological yield/plant whereas, in case of correlation grain yield had positive correlation with number of tillers/plant and 100 grain weight. Therefore, these traits should be taken into account while selecting superior and desirable plants for genetic improvement of yield parameters in evolving high yielding genotype in wheat.

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