INTERNATIONAL JOURNAL OF SCIENCE AND NATURE

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ANALYSIS OF GENETIC VARIABILITY PARAMETERS FOR YIELD AND RUST RESISTANCE IN BC_2F_3 POPULATION OF BREAD WHEAT

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ABSTRACT
The study was undertaken to estimate the genetic variability parameters of wheat for grain yield and its component traits in BC_2F_3 populations of the cross DWR162 XNIL PBW343. High phenotypic and genotypic coefficient of variation was observed for number of productive tillers per plant, grain yield per plant and coefficient of infection for leaf rust. The high heritability coupled with high genetic advance as percent of mean was seen for grain yield per plant, number of productive tillers per plant, spike length, number of spikelets per spike, number of seeds per spike and coefficient of infection for leaf rust. This suggested better scope for selecting superior transgressive segregants in this population. Hence, these traits should be taken into account while selecting superior and desirable plants for further improvement of yield parameters and leaf rust resistance in evolving high yielding and rust resistant genotype in wheat.

KEY WORDS: Wheat, Genetic variability, Heritability, Genetic advance, rust resistance.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the main staple food crop of the world. In India wheat is grown in an area of 31.2 m ha with production of 96 mt and the average productivity is 3140 kg per hectare (Arati *et al.*, 2015). Among the several constraints towards realizing the potential yield in wheat, the leaf rust diseases pose major threat to wheat production worldwide including India. Hence, there is a need to increase the productivity of wheat by developing high yielding varieties with rust resistance through appropriate breeding program to meet the demand of ever increasing population. Development of wheat cultivars with resistance to leaf rust is the most effective, economical and eco-friendly method of disease control and was used in numerous wheat breeding programs**.** Study of genetic parameters from segregating population is useful in understanding the genetic consequences of hybridization. Genetic variability for yield and yield components is essential in the base population for successful crop improvement. Heritability and genetic advance help in determining the influence of environment in expression of the characters and the extent to which improvement is possible after selection. Yield is a complex trait governed by many genes and greatly influenced by the environment. Variation in yield from year to year due to unpredictable weather and biotic stresses can have major economic impact. The extent of genetic variability has been considered as an important factor which is an essential pre-requisite for a successful hybridization aimed at producing high yielding progenies. High magnitude of variability in a population provides the opportunity for selection to evolve a variety having desirable characters (Santosh *et al.*, 2013). Therefore, it is necessary to estimate and study the genetic variation and mode of inheritance in different yield parameters and biotic stress resistance to initiate productive wheat breeding programs. Hence, the present investigation was conducted to study the extent of the genetic variability, heritability and genetic gain expected to occur during the selection for yield parameters in BC_2F_3 population of cross DWR162 X NILPBW343.

MATERIAL & METHODS

The present investigation was conducted to assess the genetic variability for yield and yield attributing traits in BC_2F_3 population of the cross DWR162 X NILPBW343 at All India Coordinated Wheat Improvement Project, Main Agricultural Research Station, University of Agricultural Sciences, Dharwad during rabi 2014. The experiment was laid out in augmented design with four blocks for the BC_2F_3 population and five checks. Each entry was grown in two rows of 3 meters length with spacing of 20 cm between rows. The crop was raised under irrigated condition and all the recommended package of practices was followed to raise a good and healthy crop. The observations were recorded on five randomly selected plants for ten quantitative traits *viz.*, days to 50 per cent flowering, days to maturity, plant height (cm), number of productive tillers per plant, spike length (cm), number of spikelets per spike, number of grains per spikelet, thousand grain weight (g), grain yield per plot (g) and coefficient of infection (CI) for leaf rust. The data collected from the experiments were subjected to statistical analysis to estimate genetic parameters. Different genetic parameters like range, mean, phenotypic and genotypic coefficients of variation, heritability and genetic advance were estimated for all the traits under study by the following method suggested by Burton and De Vane, 1953; Johnson *et al.*, 1955.

For leaf rust resistance, each individual plant of F_5 was scored in percentage at both vegetative and reproductive stages. Response of the plants to disease was assessed using a modified Cobb's scale. The final disease severity data for the leaf rust was converted into a coefficient of infection (CI) by multiplying severity with a constant value for field response (Peterson *et al.,* 1948).

RESULTS & DISCUSSION

The results of analysis of variance pertaining to the set of entries of BC_2F_3, evaluated in augmented design were presented in Table 1. The analysis of variance indicated significantly higher amount of variability among the genotypes for all the characters studied *viz.*, days to 50 percent flowering, days to maturity, plant height, spike length, number of spikelets per spike, number of tillers per plant, number of grains per spike, grain yield per plant and thousand grain weight. Hence variability in the material was considered for further analysis. In BC_2F_3 population there was wide range of variability observed for all the traits considered for investigation and the estimates of the genetic variability parameters in BC_2F_3 population of DWR 162 X NIL PBW 343 is presented in Table 2. High PCV and GCV were recorded for number of productive tillers per plant and grain yield per plant. Moderate PCV and GCV were recorded for plant height, spike length, number of spikelets per spike and number of seeds per spike whereas, low PCV and GCV were recorded for the characters days to maturity, days to 50 per cent flowering and thousand grain weight. These results are in consonance with report of Singh *et al.* (2001), Mahesh *et al.* (2001) and Kumar *et al* (2009).Very narrow difference between the values of GCV and PCV indicated that the environmental effect was small for the expression of these characters and these traits are governed by additive gene action. Similar reports of high PCV and GCV in wheat for different quantitative traits has been reported by Subhashchandra *et al*. (2009), Abinasa *et al*. (2011) and Arati, *et al.* (2015) in early segregating generations.

The high estimate of heritability was recorded for all the traits under study. Heritability estimates along with genetic advance are normally more helpful in predicting the gain under selection than heritability estimates alone (Johnson *et al.,* 1955). High heritability coupled with high genetic advance as percent of mean was observed for plant height, number of productive tillers per plant, spike length, number of spikelets per spike, number of seeds per spike and grain yield per plant. This indicates that heritability is due to the additive genetic effects and selection could be effective in early segregating generations for these traits. Similar findings have been reported by Dwivedi *et al.* (2002), Yousaf *et al.* (2008) Binod Kumar *et al*. (2013) and Arati, *et al.* (2015). For the leaf rust infection, high PCV, GCV, heritability and GAM was recorded, suggesting that there is a high variability for this trait in BC_2F_3 population of the cross DWR 162 X NIL PBW 343, gain from selection is high in this population. Similar findings have been reported by Arati, *et al.* (2015).

Thus, it is evident from the present finding that substantial genetic variability was envisaged for yield and its component traits in the BC_2F_3 population of cross DWR 162 X NILPBW343. It also exhibited high heritability coupled with high genetic advance as percent of mean for grain yield per plant, number of productive tillers per plant, spike length, number of spikelets per spike, number of seeds per spike and coefficient of infection for leaf rust. Therefore, these traits should be taken into account while selecting superior and desirable plants for further improvement of yield parameters and leaf rust resistance in evolving high yielding and leaf rust resistant genotype in wheat.

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TABLE 1: ANOVA for BC_2F_3 population of the cross DWR 162 X NIL PBW 343 under protected condition

Sources	DF	Days to 50% flowering	Days to maturity	Plant height (cm)	Spike length (cm)	No. of spikelets per spike	No. of grains per spike	Number of productive tillers per plant	Thousand grain weight (g)	Grain yield per plant (g)
Treatments	124	14.58**	26.37**	100.36**	1.71**	6.22**	50.32**	26.39**	14.30**	34.20**
Checks	4	16.95**	110.45**	147.20**	4.82**	38.2**	218.82**	85.76**	29.48**	31.64**
Checks+Var vs. Var.	120	14.50**	23.57**	98.80**	1.60**	5.16**	44.70**	24.41**	13.79**	34.29**
Block (eliminating Check+Var)	8	2.18*	4.18	2.33	0.91*	1.01	1.13	1.57**	1.44	0.233
Entries (ignoring Blocks)	124	14.91**	27.53**	126.24**	1.82**	6.67**	56.66**	28.94**	14.70**	36.92**
Varieties	119	13.86**	9.74**	117.06**	1.65**	5.52**	46.84**	26.35**	11.61**	36.64**
Checks vs. Varieties	1	131.21**	1812.4**	1135.10**	9.42**	17.94**	577.30	109.65**	323.31**	91.35**
Error	12	0.51	2.35	1.50	0.18	0.44	0.59	0.16	1.48	0.36

TABLE 2: Estimation of genetic variability parameters in BC_2F_3 population of DWR 162 X NIL PBW 343 under protected condition

Characters	Range		PCV (%)	GCV (%)	h^2% (bS)	GAM (%)
	Min	Max				
Days to 50 per cent flowering	56.00	89.00	5.20	5.00	95.00	10.40
Days to maturity	110.00	126.00	2.50	2.10	73.00	3.80
Plant height (cm)	33.00	89.75	14.40	14.10	98.00	29.30
Number of productive tillers per plant	6.00	35.00	30.50	30.00	97.00	62.00
Spike length (cm)	5.80	15.00	11.50	10.70	87.00	20.70
Number of spikelets per spike	12.00	24.00	11.20	10.20	91.00	21.00
Number of seeds per spike	35.00	71.00	11.42	11.30	98.00	23.10
Thousand grain weight (g)	23.50	42.40	9.60	8.90	85.00	17.07
Grain yield per plant (g)	7.15	41.65	31.40	30.00	98.00	64.10
Coefficient of infection (CI) for leaf rust	0.00	50.00	69.54	63.47	59.00	93.83

PCV: phenotypic coefficient of variation; GCV: Genotypic coefficient of variation; h^2 (bs): heritability in broad sense; GAM: genetic advance over mean