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Studies on Variability in Wheat (*Triticum aestivum* Linn.)

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Abstract: *Significant treatment mean sum of squares for eleven characters studied revealed the presence of considerable amount of variability in F_2's of 21 crosses, 7 parents and 2 checks. The magnitude of GCV and PCV were high for productive tiller per plant and spikelets per spike; whereas, days to maturity and days to 50 per cent flowering exhibited least GCV and PCV. The high heritability was accompanied with high genetic advance as per cent of mean for length of spike, productive tillers per running meter, 1000 grain weight and grain yield per plant indicating additive genetic control in the expression of these characters.*

Keywords: Wheat, GCV, PCV, heritability, genetic advance

Introduction

Wheat is the world's most extensively grown important grain and principal staple food crop for a large part of the world's population. It's wide spread cultivation in all the continents and it's versatility in adaptation to diverse climate, edaphic and pathological conditions, it's value in human diet as a source of carbohydrates and protein and it's baking qualities makes it more important as a human food than other cereal. Wheat belongs to the genus *Triticum* of the grass family, *Graminae (Poaceae)*. The genus *Triticum* is characterized as mid tall to tall annual grass and consist of several species. *Triticum aestivum* and *Triticum durum* are the most important agricultural species. Wheat today, occupies the foremost important position among the major food crops of the world, followed by rice, both in area and production. In Indian sub-continent, wheat is under cultivation since pre- historic times. All the wheat species cultivated in India are of spring types; but they are grown in winter season. Three species *viz., Triticum aestivum* (Bread wheat), *Triticum durum* (Macaroni wheat) and *Triticum dicoccum* (Emmer wheat) are grown in India on commercial basis. Nearly 86 percent of the total area is under *T. aestivum* and a little over 12 percent under *T. durum* wheat, which is grown on a very limited area mostly in the Southern states. Wheat breeding in India in the earlier period from 1905 to 1961 passed through three distinct phases. All the wheat varieties bred up to 1961 and bred there after 1965up's with the exception of C 518 and NP 824 were tall and weak strawed and hence not suitable for intensive agriculture. The more recent phase of wheat improvement in India was marked with the introduction of dwarf and semi-dwarf varieties from Mexico in 1963-64. The National demonstration programme started in 1965, which introduced farmers to the new varieties in wheat yield opened by the dwarf and semi-dwarf types.

Wheat is the major object of study because of its primacy among all crops in feeding mankind and because of intellectual challenge that it poses in the range of biological disciplines. In India wheat ranks next only to rice both in area and production. The area under wheat crop, its production and yield per hectares i.e. productivity for India (Anonymous, 2011).

Since 2000, India's wheat production has been almost stagnant and by 2014, wheat demand in the country is expected to cross 110 million tonnes, hence there is need to maintain 3% compound average growth rate in the production to meet the growing demands. A minimum rise of 0.5^0C in temperature due to accumulation of greenhouse gases in the atmosphere would cause 0.45 t/ha reduction in India's wheat production in next 10 years (Anonymous, 2008).

The selection of parent for hybridization is largely based upon wide adaptation, high yielding potential. Progenies derived from a set of diverse cross are expected to throw a broad spectrum of variability thereby providing a larger scope for isolating high yielding segregants in advanced generations and hence the present investigations were undertaken to see the magnitude of variability for important yield and its contributing characters.

Materials and Methods

The experimental material consisted F_2's of 21 crosses obtained in half diallel fashion from seven genotypes of wheat *viz.*, DI-9, LOK-62, FLW-8, WH-147,WR-1392, PHS-0622, MP-4080, two checks (NIAW-301, NIAW-917). The experiment was carried out in rabi 2011 in randomized block design and all recommended practices were carried out to obtain a good crop stand. The observations were recorded on eleven metric characters on each plants from F_2 crosses. To test the significance of differences between treatments, the analysis of variance for randomized block design (RBD) was carried out by following Panse and Sukhatme (1967) for all metric characters. The genotypic and phenotypic coefficients of variation were calculated by following Burton and Devane (1953). Heritability (broad sense), genetic advance and the range of genetic advance as per cent of mean was calculated according to the method suggested by Johnson *et al.* (1955) for each character studied.

Results and Discussion

The magnitude of phenotypic coefficient of variation compared to the genotypic coefficient of variation for all the traits studied, indicated that the variation is not only due to the phenotypes but also due to the environmental factors (Table 1).

In the present investigation higher estimates of genotypic and phenotypic coefficient of variations were observed for length of spike (13.99 and 14.00), 1000 grain weight(13.03 and 13.75), grain yield per plant (11.89 and 12.37), dry gluten content (10.59 and 11.62), productive tillers per running meters (10.41 and 10.48) and spikelets per spike (9.16 and 11.28). Ajmal *et al*. (2009), Gaibriyal *et al.* (2009), Zecevic *et al.*(2010) and Abinasa *et al*. (2011) indicated scope for improving these traits by selection. Moderate estimates of GCV and PCV were observed for the characters *viz.*, productive tillers per plant (7.42 and 10.52), plant height (6.40 and 6.51) and wet gluten content (6.20 and 6.52).

Low genotypic and phenotypic coefficient of variations were observed for the characters *viz.*, days to 50% flowering (6.05 and 6.36), days to maturity (5.16 and 5.31) and grains per spike (6.19 and 6.94) indicating hardly any scope for improvement of these traits by selection.

The heritability is the ratio of genotypic variance to the phenotypic variance. If the estimate of heritability is high the character is least influenced by the environmental factors. Selection may or may not be rewarding for such traits because the phenotypic variance includes both fixable and non-fixable components variances.

In the present investigation almost all the characters showed very high estimates of broad sense heritability (Table 1). The heritability (b.s.) ranged from 66.72% (Spikelets per spike) to 99.83%

(length per spike), productive tillers per running meter (98.68) , plant height (96.81), days to maturity (94.36) and grain yield per plant (92.47) which had high heritability along with high genetic advance indicating that these traits were governed by additive gene action and simple selection would be effective. Similar results were observed by Khan *et al.*(2003), Ajmal *et al*. (2009), Laghari *et al*. (2010), Jalal and Ahmad (2012) and Golestani *et al.* (2012).

The traits *viz*., length of spike (99.83 and 1.87), days to 50% flowering (90.60 and 7.23), dry gluten content (83.10 and1.29) and productive tillers per plant (79.89 and 5.65) exhibited high heritability coupled with low genetic advance indicating importance of non-additive gene action in the inheritance of these traits. Heterosis breeding may be useful in such characters. The maximum genetic advance as per cent of mean was observed for the character length per spike (28.80). The moderate genetic advance as per cent of mean was observed for the remaining characters. Similar results were obtained by Chauhan *et al*. (1977), Yadhav and Haque (1981), Patil *et al.* (1992) and Jalal and Ahmad (2012). Further, high values of genetic advance as per cent of mean were observed for the characters *viz.* length of spike, 1000 grain weight, grain yield per plant and productive tillers per running meters suggesting scope for improvement. Low heritability accompanied by low genetic advance was found for spikelets per spike, followed by for grain per spike. It indicated that the characters were highly influenced by environmental effects and selection would be ineffective for these traits.

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Table1. Parameters of Genetic variability for yield and yield contributing characters in wheat

Sr. No.	Character	General Mean	GCV	PCV	heritability (broad sense.)	GeneticAdvance	GA as % of mean
1	**Days to 50% flowering (No.)**	60.54	6.05	6.36	90.60	7.23	11.88
2	**Days to maturity (No.)**	104.78	5.16	5.31	94.36	10.86	10.32
3	**Plant height (cm.)**	89.48	6.40	6.51	96.81	11.67	12.98
4	**Productive tiller per plant (No.)**	15.04	7.42	10.52	79.89	5.65	10.79
5	**Productive tiller per running meter (No.)**	104.52	10.41	10.48	98.68	22.89	21.31
6	**Length per spike (cm)**	10.64	13.99	14.00	99.83	1.87	28.80
7	**Spikelet's per spike (No.)**	18.25	9.16	11.28	66.72	2.74	15.33
8	**Grain per spike (No.)**	52.55	6.19	6.94	79.61	5.88	11.38
9	**1000 grain weight (g.)**	42.41	13.03	13.75	89.75	11.02	25.42
10	**Grain yield per plant (No.)**	47.23	11.89	12.37	92.47	12.18	23.56
11	**Dry gluten content (%)**	6.70	10.59	11.62	83.10	1.29	19.88
12	**Wet gluten content (%)**	32.88	6.20	6.52	90.61	4.07	12.17