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Assessment of genetic variability in wheat genotypes

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ABSTRACT : An experiment was conducted to study the variability parameters for eleven (11) traits in the 169 genotypes of wheat by simple lattice design. All the genotypes exhibited significant differences for all the traits. In the present study the phenotypic and genotypic coefficient of variation was found to be moderate for days to 50 per cent flowering, days to maturity, plant height, peduncle length, number of productive tillers per meter, spike length, number of spike lets per spike and number of grains per spike, except 1000 grain weight. Results obtained from present investigation has revealed moderate GCV and PCV indicating still there is possibility of improvement of genotypes through these characters. Heritability values for all the characters were found to be high for most of the characters *viz.*, number of days to 50 per cent flowering, days to maturity, plant height, peduncle length, number of productive tillers per meter length, spike length, number of spikelets per spike, number of grains per spike and grain yield per plot, had shown high heritability and genetic advance as per cent mean, however, the same character exhibited moderate GCV and PCV hence direct selection of genotypes can be done through these characters for further improvement of genotypes.

Key Words : Wheat, GCV, PCV, Heritability, Genetic advance

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Wheat (*Triticum aestivum* L.) is the world most cultivated food crop known as the king of all cereal crops as its cultivation is easier, ecologically suitable and contain high amount of nutrients. It is rich in protein (7-22%), carbohydrate, calcium, lysine, iron, glutein, vitamin and minerals. Wheat is cultivated over an area of 230.16 million ha with a production of 673.09 million ton in the world (FAOSTAT, 2003). In India it is the second important crop after rice and covers an area over 27.75 million hectares which is about 20 per cent of the total cultivated area under cereal. India has attained a record of 80.58 million tons of wheat production in 2008-2009 and continues to remain as the second largest producer of wheat in the world (USDA, 2009).

Analysis of variability among the traits and the association of a particular character in relation to other traits contributing to yield of a crop would be great importance in planning a successful breeding programme. Development of high-yielding varieties requires a thorough knowledge of the existing genetic variation for yield and its components. The observed variability is a combined estimate of genetic and environmental causes, of which only the former one is heritable. However, estimates of heritability alone do not provide an idea about the expected gain in the next generation, but have to be considered in conjunction with estimates of genetic advance, the change in mean value between generations. Success in crop improvement generally depends on the magnitude of genetic variability and the extent to which the desirable characters are heritable.

RESEARCH PROCEDURE

The material for the present investigation consisted of 169 wheat genotypes along with checks DWR 162 and Kalyansona, collected from Directorate of wheat research, Karnal. The experiment was laid out in an Simple lattice design with two replications. Each genotype in each replication was grown in a plot of 3 rows of 2 meter length each with a spacing of 23 cm between rows, at Wheat Improvement Project, Main agricultural Research station Dharwad. Both genotypic and phenotypic coefficients of variability were computed as per the method suggested by Burton and Devane (1953).The heritability was categorized as low, moderate and high as given by Robinson *et al.* (1949).Genetic advance as per cent mean was categorized as low, moderate and high as given by Johnson *et al.* (1955).

All the agronomic practices were followed during the crop

growth period. Observations were recorded on five randomly selected competitive plants for eleven characters days to 50 per cent flowering (X_1), days to maturity(X_2), plant height(X_3), peduncle length(X_4), number of productive tillers per meter(X_5), spike length(X_6), number of spike lets per spike(X_7), number of grains per spike(X_8), 1000 grain weight(X_9), protein content (X_{10}) and grain yield per plot(X_{11}).

RESEARCH ANALYSIS AND REASONING

The results obtained from the present investigation have been duscussed below:

Genetic variability:

All the genotypes exhibited significant differences for all the traits (Table 1). Many early workers including Pawar *et al.* (1988), Hanchinal and Maled (1995), Sharma *et al.* (1995), Kamat (1996) and Kamboj *et al.* (2000) reported high variability for different traits in wheat. Thus, it is implied that there was reasonably sufficient variability in the material used for their study, which provides ample scope for selecting superior and desired genotypes by the plant breeders for further improvement.

The assessment of heritable and non-heritable components in the total variability observed is indispensable in adapting suitable breeding procedure. The heritable portion of the overall observed variation can be ascertained by studying the components of variation such as GCV, PCV, heritability and predicted genetic advance. In the present study (Table 2) the phenotypic and genotypic coefficient of variation was found to be moderate for days to 50 per cent flowering, days to maturity, plant height, peduncle length, number of productive tillers per meter, spike length, number of spike lets per spike, number of grains per spike and 1000 grain weight. For all these traits except 1000 grain weight for which genotypic coefficient of variation was found to be low. Similar observations were also reported by Pathak and Nema (1985), Pawar*et al.* (1988), Jagashoran (1995) and Muhammed and Hussain (2004) for plant height. Dixit (1990) reported moderate GCV for days to 50 per cent flowering, Bahadur *et al.* (1994) and Jagashoran (1995) reported moderate PCV and GCV for number of grains per spike. Reports of Singh *et al.* (1996) and Sharma *et al.* (1998) support our results for 1000 grain weight for GCV and PCV, respectively.

There were no reports of moderate GCV and PCV for the

Table 1 : Mean sum of squares for 11 characters in wheat genotypes

Characters	RMSS	GMSS	EMSS
Days to 50% flowering	90.56	74.33**	0.84
Days to maturity	227	382.97**	0.87
Plant height(cm)	1.25	278.38**	6.21
Peduncel length(cm)	0.22	40.26**	2.84
Number of productive tillers/mt	1259	1413.59**	45.49
Spike length(cm)	1.23	3.8**	0.19
Number of spikelets / spike	7.08	11.18**	1.27
Number of grains / spike	88.59	93.74**	8.2
1000 grain weight(g)	0.25	39**	8.02
Protein content	9.77	2.69**	0.37
Grain yield per plot	286288	78079.61**	9723.9

* and ** indicate significance of values at P=0.05 and 0.01, respectively

Table 2 : Genetic variability parameters in wheat genotypes

Characters	Mean	Range	GCV	PCV	h^2 (%)	GAM (%)
Days to 50% flowering	55.60	41-69.50	10.90	11.03	97.80	22.21
Days to maturity	94.44	67-116.50	14.64	14.67	99.50	30.08
Plant height(cm)	80.74	55-113	14.45	14.77	95.60	29.11
Peduncle length(cm)	29.73	19.17-40.50	14.55	15.62	86.80	27.92
Number of productive tillers/mt	157.17	96-213.35	16.64	17.18	93.80	33.19
Spike length(cm)	9.14	6.09-12.60	14.72	15.46	90.60	28.88
Number of spikelets / spike	18.33	12.66-26.33	12.15	13.61	79.60	22.31
Number of grains / spike	37.53	23.83-61.00	17.42	19.02	83.90	32.88
1000 grain weight (g)	42.39	30.99-56.04	9.29	11.44	65.90	15.52
Protein content	15.02	12.25-17.7	7.17	8.23	76.00	12.92
Grain yield per plot	887.52	360-1635	20.83	23.61	77.90	37.86

traits such as number of spike lets per spike, spike length and . . . . . *et al.* (1989) reported low PCV and GCV for number of spikelets per spike and spike length. Whereas, Dixit and Patil (1983) reported high PCV and Sharma *et al.* (1998) reported low PCV and GCV for peduncle length. The result for number of productive tillers was in accordance with Mahesh *et al.* (2001) for moderate GCV.Results obtained from present investigation has revealed moderate GCV and PCV indicating still there is possibility of improvement of genotypes through these characters.

The protein content exhibited low GCV and PCV values, similar results were obtained by Nayeem *et al.* (2002) in durum genotypes. Sharma *et al.* (1998) and Bergale *et al.* (2001) reported high PCV and GCV for grain yield per plot by using 300 genotypes of bread wheat and durum wheat and 50 bread wheat cultivars, respectively which supported the present results, indicating selecting genotypes through these characters will be effective.

It is interesting to note that the differences between GCV and PCV values were minimum implying least influence of environment and additive gene effects indicating genotypes can be improved and selected for these characters.

The co-efficient of variation indicated only the extent of variability present in these characters and does not indicate the heritable portion. This could be ascertained from heritability estimates which in broad sense include both additive and non-additive gene effects and in narrow sense include the proportion of heritable variation which is due to additive component (Lush, 1949). The knowledge of heritability is helpful in assessing merits and demerits of a particular trait as it enables the plant breeder to decide the course of selection procedures to be followed under a given situation. In the present study, heritability values for all the characters *viz.*, number of days to 50 per cent flowering, days to maturity, plant height, peduncle length, number of productive tillers per meter length, spike length, number of spikelets per spike, number of grains per spike, 1000 grain weight, protein content and grain yield per plot was found to be high.

High heritability values for these traits indicated that the variation observed was mainly under genetic control and was less influenced by environment. In confirmation with results of earlier workers *viz.*,Bijendrapal and Garg (1992) noticed higher heritability value for plant height, days to 50 per cent flowering, number of productive tillers per meter length, grain yield, test weight and number of grains per spike. Thakur *et al.* (1999) also reported high heritability values for plant height, tillers per meter and spike length. Kamboj *et al.* (2000) reported high heritability values for number of grains per spike, 1000 grain weight and grain yield per plot.

Heritability estimates are useful in deciding the characters to be considered while making selection, but selection based on this factor alone may limit the progress, as it is prone for changes with environment, material etc. (Singh 1996). In other words, estimates of heritability have a role to play in determining the effectiveness of selection of a character, provided they are considered in conjugation with the predicted genetic advance as suggested by Johnson *et al.* (1955).

In the present study for most of the characters *viz.*, number of days to 50 per cent flowering, days to maturity, plant height, peduncle length, number of productive tillers per meter length, spike length, number of spikelets per spike, number of grains per spike and grain yield per plot, had shown high heritability and genetic advance as per cent mean, however, the same character exhibited moderate GCV and PCV hence direct selection of genotypes can be done through these characters for further improvement of genotypes. The results are in accordance with reports of earlier work done by Thakur *et al.* (1999) for plant height, number of productive tillers per meter and spike length. In confirmation with these results Mandal *et al.* (1991) and Mahamood and Shahad (1991) also reported high genetic advance for plant height and number of spikelets per spike with respect to days to maturity high genetic advance was reported by Jagshoran (1995). In the present study moderate genetic advance as per cent mean was recorded for 1000 grain weight and protein content where as per Mahamood and Shahad (1991) and Shah (1998) reported high genetic advance for 1000 grain weight. However, Kumar and Lutra (1995) reported low genetic advance for number of days to 50 per cent flowering and number of grains per spike. Nirmala and Jha (1998) also reported low genetic advance for number of grains per spike. In these characters where high heritability was associated with high genetic advance, the variation was mostly due to additive gene effects. In the present study high heritability coupled with moderate genetic advances was observed for 1000 grain weight and protein content suggesting further improvement of genotypes for these characters for further selection and subsequent use in breeding programme.

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