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Genetic Divergence Analysis of Agronomic Traits in Bread Wheat (*Triticum aestivum* L.) Genotypes

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A B S T R A C T

Experimental plot was conducted to the study of genetic diversity of 36 bread wheat (*Triticum aestivum* L.) germplasms under the area of Department Genetics and Plant Breeding, C.C.S. University (Campus) Meerut, U.P. during the *rabi* season 2011-12 was evaluated for genetic diversity for 12 traits i.e., plant height, days of 50% flowering, flag leaf length, flag leaf width, number of tillers per plant, spike length, number of grains per spike, seed vigour index, germination% after harvesting, germination% before harvesting, 1000 grain weight and grains yield per plant. The cluster analysis grouped 36 wheat genotypes into 7 different clusters. 12 genotypes were grouped in cluster II that showed the maximum diversity. On the basis of the data on genetic divergence and mean performance of yield and other traits diverse and superior genotypes namely NWRF-02, UP-2338, NWRF-03, NWRF-09, NWRF-11, NWRF-16, NWRI-06, NWDM-11, NWDM-10 and NWDM-06. Further, on the basis of cluster means, cluster VII has been identified for selecting parents for incorporating flag leaf length, 1000 grain weight, seed vigour index and germination% after harvesting, cluster II for flag leaf width, spike length, number of grains per spike and germination% before harvesting and cluster IV for grain yield per plant and number of tillers per plant.

Introduction

Wheat (*Triticum aestivum* L.) is the most important cereal crop for the majority of world's populations. It is the most important staple food of about two billion people (36% of the world population). Wheat belongs to family *Poaceae* (*Gramineae*) which includes major crop plants such as wheat (*Triticum spp.* L.), barley (*Hordeum vulgare* L.), oat (*Avena sativa* L.), rye (*Secale cereale*L.), maize (*Zea mays* L.) and rice (*Oryza sativa* L.). Wheat is grown in all the states in India except Southern and North Eastern states. Uttar Pradesh, Haryana, Punjab, Rajasthan are the major wheat producing states and accounts for almost 80% of total production in India. Today, India ranks second in wheat production with a harvest of 93.9 million ton during the season 2011-12.Its cultivation area is 28 M Ha. The record production of 94.88 million MT in 2011-12. The productivity of wheat which was 3140 kg/hectare in 2011-12. The major increase in the productivity of wheat has been observed in the states of Haryana, Punjab and Uttar Pradesh.

Materials and Methods

The 36 genotypes of wheat (*Triticum aestivum* L.) were obtained from the Directorate of Wheat Research (DWR) Karnal, Haryana sown in the research area of Department of Genetics and Plant Breeding,

C.C.S. University, Meerut on December 2011 with RBD field design. The experiment was laid out in R.B. Design with three replications. Each genotype in each replication was grown in a plot of 3 rows of 2 meter length each with a spacing of 10 cm between rows. Cluster analysis was performed by using the STATISTICA software. At maturity five guarded plants from three rows were selected at random from each plot in each replication.

Results and Discussion

Genetic divergence

On the basis of relative magnitude of D^2 values, the 36 genotypes were grouped into 7 clusters having 3, 12, 2, 4, 3, 3 and 9 genotypes, respectively (Table-1). The maximum number of genotypes (12) were included in cluster II followed by 9 genotypes in cluster VII and minimum number of genotype 1 in cluster III.

The cluster distance (Table 2), which reflects to some extent the genetic dissimilarity between and within groups, revealed that intra-varietal group clusters had a genetic distance that was much less (0.00 to 22.075) and then inter-varietal group clusters (21.864 to 182.092). The highest inter-cluster genetic distance was found between cluster V and VI (182.092) closely followed by II and VI (102.887), VI and VII (102.793), III and V (102.286) and III and VII (99.832). The distance was low between clusters I and IV (21.64) followed by I and II (27.139) and II and V (27.742).

For genotypes grouped into 7 clusters, mean value for 12 characters given in Table-3. The trait plant height is highest mean values (112.491) for cluster number V and low mean values (77.120) for cluster number VI, the trait flag leaf length is highest mean values (23.125) for cluster number VII and low mean values (19.319) for cluster number III, the trait flag leaf width is highest mean values (1.794) for cluster number II and low mean values (1.578) for cluster number V, the trait number of tillers per plant is highest mean values (11.000) for cluster number IV and low mean values (7.333) for cluster number VII, the trait spike length is highest mean values (12.133) for cluster number II and low mean values (7.825) for cluster number VII, the trait number of grains per spike is highest mean values (49.222) for cluster number II and low mean values (33.667) for cluster number V, the trait 1000-grain weight is highest mean values (45.300) for cluster number VII and low mean values (41.005) for cluster number I, the trait day of 50% flowering is highest mean values (80.133) for cluster number VI and low mean values (63.333) for cluster number IV, the trait grain yield per plant is highest mean values (21.180) for cluster number IV and low mean values (13.087) for cluster number VI, the trait seed vigour index is highest mean values (2785.583) for cluster number VII and low mean values (2369.600) for cluster number VI, the trait germination % after harvesting is highest mean values (91.500) for cluster number VII and low mean values (85.833) for cluster number II, and the trait germination % before harvesting is highest mean values (92.944) for cluster number II and low mean values (89.133) for cluster number VI. The contribution of each character to total diversity was observed and presented in table 4. Plant height (ranked first 209 times) contributed 33.17 per cent to divergence of genotypes. This was followed by day of 50% flowering (22.70), spike length (22.06%), flag leaf length (6.67), No of grain/spike (4.92), seed vigour index (2.86), 1000-grain weight and germination % after harvesting (2.38), flag leaf width (1.27), No of tiller/plant and germination % before sowing (0.63) and grain yield per plant (0.32).

Table.1 Grouping of genotypes into clusters

Clusters	No. of genotypes	Cluster Members
I	3	9, 14, 26
II	12	4, 5, 6, 7, 10, 12, 15, 19, 21, 24, 25, 27
III	2	2, 36
IV	4	8, 13, 20, 23
V	3	3, 11, 16
VI	3	30, 31, 34
VII	9	1, 17, 18, 22, 28, 29, 32, 33, 35

Table.2 Cluster mean among different traits in bread wheat (*Triticum aestivum* L)

Character / Cluster	Day of 50% flowering	Plant height (cm)	Flag leaf length (cm)	Flag leaf width (cm)	Tillers / plant	Spike length cm	Grains/ spike	1000 grain weight in (g)	Seed vigour index	Germination % after harvesting	Germination %before harvesting	Grain yield/ plant (g)
Cluster I	76.292	85.834	22.058	1.667	8.583	11.313	41.375	41.005	2515.625	88.958	90.750	14.620
Cluster II	78.278	93.887	22.756	1.794	9.000	12.133	49.222	41.314	2463.611	85.833	92.944	18.337
Cluster III	76.111	91.884	19.319	1.607	9.704	10.770	37.296	41.707	2618.778	88.222	92.481	14.986
Cluster IV	63.333	82.543	22.867	1.767	11.000	10.033	46.000	41.967	2400.000	88.333	91.667	21.180
Cluster V	78.444	112.491	21.722	1.578	9.111	9.867	33.667	45.087	2675.778	89.556	92.778	14.054
Cluster VI	80.133	77.120	19.740	1.660	7.600	8.473	38.600	43.693	2369.600	86.000	89.133	13.087
Cluster VII	80.000	84.082	23.125	1.625	7.333	7.825	41.083	45.300	2785.583	91.500	89.250	14.888

Table.3 Average intra (bold) and inter -cluster distance between 7 clusters for 36 genotypes of bread wheat (*Triticum aestivum* L.)

Cluster No.	I Cluster	II Cluster	III Cluster	IV Cluster	V Cluster	VI Cluster	VII Cluster
I Cluster	**14.412**	27.139	31.068	21.864	49.128	68.873	52.515
II Cluster		**10.445**	48.101	45.927	27.742	102.887	74.586
III Cluster			**22.075**	37.797	102.286	41.749	99.832
IV Cluster				**0.000**	74.269	46.143	35.074
V Cluster					**0.000**	182.092	77.318
VI Cluster						**0.000**	102.793
VII Cluster							**0.000**

Table.4 Contribution of different traits towards diversity

Sources	Day of 50% flowering	Plant height (cm)	Flag leaf length (cm)	Flag leaf width (cm)	Tillers/ plant	Spike length cm	Grains/ spike	1000 grain weight in (g)	Seed vigour index	Germination % after harvesting	Germination %before harvesting	Grain yield/ plant (g)
Ranked	143	209	42	8	4	139	31	15	18	15	4	2
Contribution %	22.70	33.17	6.67	1.27	0.63	22.06	4.92	2.38	2.86	2.38	0.63	0.32

These findings are similar in agreement with earlier reported by Gupta *et al.,* (1996), Jai Chand Rana *et al.,* (2000), Bergale *et al.,* (2001), Nimbalkar *et al.,* (2002), Yousaf Ali, *et al.,* (2008), Tsegaye *et al.,* (2012), Yagd *et al.,* (2012), Redhu *et al.,* (1995), Walia and Garg (1996) and Hailegiorgis *et al.,* (2011).

It is concluded that the distribution pattern of all the genotypes into various clusters showed the presence of considerable genetic divergence among the genotypes for most of the traits.

Plant height (ranked first 209 times) contributed 33.17 per cent to divergence of genotypes.

The intra cluster distances ranged from 0.000 (cluster IV) to 61.736 (cluster V).

The number of cluster VI and V showed maximum divergence (inter-cluster distance = 340.773) followed by members of cluster V and VI (inter-cluster distance 283.096).

The trait plant height is highest mean values (112.491) for cluster number V and low mean values (77.120) for cluster number VI.

The genotypes in cluster II may be used for the improvement of plant height and day of 50% flowering in cluster VI in wheat.

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