Indian J. Pl. Genet. Resources 12(3): 348-351, 1999

EVALUATION AND CLASSIFICATION OF FACULTATIVE AND WINTER WHEAT GERMPLASM

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One hundred and sixty seven exotic facultative and winter wheat germplasm collections were evaluated for 4 characters using non- hierarchical Euclidean analysis. All the genotypes were grouped into 11 different clusters showing existence of high genetic diversity in the material. The intra cluster distance was maximum (1.222) in cluster VII and minimum (0.607) in cluster I. Cluster one and eight were highly diverse (3.99) from each other. Donors for plant height, test weight, days to 50% heading and grain yield/plant were identified.

Key words : *Triticum aestivum*, evaluation, divergence

Wheat (*Triticum aestivum* L. em Thell.) is one of the important cereal crop of India. With 68.2 mt production and 27 q/ha productivity in 1997-98, India has now become second largest producer of wheat in the world. To further enhance the productivity a thrust on collection and evaluation of facultative and winter wheat germplasm is being given to identify donor parents for genetic restructuring of genotypes towards resistance to biotic and abiotic stress and to harness new yield genes. For identifying genetically diverse parents for hybridization, multivariate analysis (Mahalanobis D^2 statistic) has ben used in spring wheat (Bhatt, 1970; Singhal and Upadhyay, 1977; Jatasra and Paroda, 1978, Garg and Gautam, 1997) and in winter wheat (Jag Shoran and Tandon, 1995). Multivariate analysis based on Mahalnobis D^2 statistic and canonical analysis have the limitations for classifying huge germplasm collections (Arunachalam, 1981). However, Beale (1969) suggested the use of Non-Hierarchical Euclidean analysis to overcome these limitations. As, the utility of this analysis for choosing parents for generating good segregates has received very little attention. Hence the present investigation was undertaken to study the nature and extent of genetic variability and divergence in the 167 germplasm lines and to identify the donors for yield and yield contributing characters.

MATERIALS AND METHODS

The experimental material consisted of 167 exotic facultative and winter wheat germplasm and six check varieties viz., Bez, Seri, BLL, GRK, ATAY 85 and VL 6161. These genotypes were evaluated during *rabi* 1997-98 in an augmented design at the VPKAS Experimental Farm, Hawalbagh (Almora) situated at an altitude of 1250 m. Each plot consisted of two rows, each 2.8 meter long with 23 cm row to row and 10 cm plant to plant distance. Recommended package of practices were followed to raise a healthy crop. Observations were recorded on four quantitative characters days to 50 per cent heading, plant height (cm), grain yield (g/plot) and test weight (g). Five plants were randomly selected for recording the observation on plant height Rest of the observation were recorded on plot basis.

Genetic divergence was studied using Non-Hierarchical Euclidean cluster analysis (Beale, 1969 and Spark, 1973). The SPAR 1 package developed by IASRI, New Delhi was used for classifying the genotypes.

RESULTS AND DISCUSSION

The general means, coefficient of variability and range for different characters are given in Table 1. For an effective breeding programme, existence of sufficient genetic variability is a prerequisite. In the present study, range for various characters showed wide variations, suggesting sufficient scope for further improvement for these traits. Further variability can be incorporated in other characters by hybridization among distant accessions.

Table 1. Range, mean, check mean and coefficient of variation for various characters

Characters	Days to 50% flowering	Plant height (cm)	Grain yield (g/plot)	Test weight (g)
Mean	155.58	107.54	525.09	36.74
Range	111-176	80-145	210-1040	22.9-54.4
Best check mean	119.67	100	826.67	43.67
C.V.	11.16	12.95	26.74	15.84

The classificatory procedures for ear marking, distant genotypes have been emphasized by several scientists (Griffing and Lindstrom, 1954; Moll *et al.*, 1962, Arunachalam, 1981). Non-Hierarchical Euclidean analysis has been found quite useful for estimating the genetic divergence utilizing unreplicated data in the large germplasm collections. In this case, all the variables were converted to single index of similarity in the form of principal component. The eigen vectors, roots and associated variance have been given in Table 2. The maximum variation 54.30 per cent was explained by first latent vector followed second vector (24.56%). Thus around 78% variation was explained by first two vectors & rest of other two.

Table 2. Eigen root vector, eigen roots and associated variances for different components in winter wheat germplasm

Characters	1	2	3	4
1. Days to 50% heading	0.570	−0.315	−0.510	−0.562
2. Plant height (cm)	0.372	0.825	0.270	−0.330
3. Grain yield (g/plot)	0.084	−0.453	0.799	−0.386
4. Test weight (g)	0.728	−0.122	0.170	0.653
Eigen roots	2.172	0.978	0.558	0.292
% Variation	54.30	24.56	13.94	7.29

All the 167 genotypes have been grouped into 9 different non-over lapping clusters. The appropriate cluster arrangement as determined by F test revealed that the 9 clusters were most suited. Cluster I is the smallest containing only three accessions which had the highest values for test weight (51.57 g) and lowest values for days to 50 per cent heading (120 days) and grain yield (376.67 gm). Cluster II consisted of the highest number of accessions (37) with moderate values, while cluster III consists of 10 accessions which had the highest value for plant height

Table 3. Characters mean in different clusters of winter wheat

Characters	I(3)	II(37)	III(10)	IV(2)	V(19)	VI(23)	VII(16)	VIII(15)	IX(22)
Days to 50% heading	120.00	162.68	139.20	167.77	128.42	171.35	134.00	166.33	159.09
Plant height (cm)	101.67	103.65	133.00	122.73	98.95	90.00	114.38	102.33	112.50
Grain yield (g/plot)	376.67	447.03	572.00	488.18	541.05	383.04	804.38	491.33	646.82
Test weight (g)	51.57	38.66	41.39	32.66	40.39	30.95	43.72	28.35	37.01

Table 4. Average intercluster and intracluster distance D values among 9 clusters in winter wheat germplasm

	1	2	3	4	5	6	7	8	9
1	0.607								
2	3.266	1.037							
3	2.072	2.618	1.137						
4	3.387	1.802	2.498	1.021					
5	2.355	1.926	2.624	3.155	1.062				
6	3.103	1.650	2.655	2.376	2.137	0.854			
7	3.580	2.216	2.206	2.515	2.016	2.402	1.222		
8	3.991	1.890	2.340	1.713	2.898	1.384	2.249	0.746	
9	3.160	1.693	1.964	1.704	2.246	2.853	2.211	2.126	0.929

Table 5. Minimum and maximum values for morphological traits in winter wheat germplasm

Character	Minimum			Maximum		
	Name	Value	Group	Name	Value	Group
Days to 50% heading	89 Zhong 228	132	V	TRAKIA/KNR, ODESSKAY 132, MIRLEBEN	176	II,VI,VI
Plant height (cm)	VORONA, ODESSKAY 132, KHVYLYA ERYTHROSPERMUM 896-89	80	VI,VI, VI,VI	47A*2.OGOSTA	145	III
Grain yield (/plot)	1.27.7876/CONDOR	210	II	MOMCHIL.KATYA	1040	VII
Test weight (g)	CO 900777	22.9	IV	WU GENG 8025	544	I

(133.00 cm). Cluster IV, V and IX contained 22, 19 and 22 accessions respectively and these had moderate values. Cluster VI consisted of 23 accessions and with highest value for days to 50% heading (171.35) while reverse was true in case of plant height (90.00 cm), Cluster VII had 16 accessions, which had highest values for grain yield/plot (804.38 g/plot), Cluster VIII contains 15 accessions and had lowest value for test weight (28.35 g). All cluster have exotic strains suggesting wide spectrum of genetic diversity among exotic germplasm.

The average inter and intra cluster distances are presented in Table 4 indicated that cluster I and VIII were located at the maximum diverse ends. The generalized intra-cluster distance (D) ranged from 0.607 (Cluster I) to 1.222 (Cluster VIII). Therefore, broadly it can be concluded that relatively less genetic divergence exists in Cluster I while individuals in Cluster VIII are more genetically divergent.

The minimum inter-cluster distance (1.38) was found between Cluster VI and VIII while reverse was true for Cluster I & VIII (3.99). This situation reflected the relative divergence of clusters which allows a convenient selection of a group of genotypes for any hybridization programme facilitating better exploitation of germplasm resources. Thus hybridization between Cluster I and VIII may be helpful in developing heterotic combination to derive desirable recombinants.

ACKNOWLEDGEMENT

The authors acknowledge Mr. B.D. Pande and Mr Daya Shanker of VPKAS, Almora (UP) for their technical help.

REFERENCES

Arunachalam, V. 1981. Genetic divergence in plant breeding. *Indian J. Genet.* 42 (2): 226-236.

Beale, E.M.L. 1969. Euclidean cluster analysis. Contributed paper to the 37th session of the International Statistical Institute, U.K.

Bhatt, G.M. 1970. Multivariate analysis approach to selection of parents for hybridization aiming at yield improvement in self pollinated crops. *Aust. J. Agri. Res.* 21: 1-7.

Garg, D.K. and P.L. Gautam. 1997. Genetic divergence studies in wheat germplasm using Non-Hierarchical Euclidean cluster analysis. *Indian J. Pl. Genet. Resources* 10 (1): 11-15.

Griffing, B and E.W. Lindstrom. 1954. A study of the combining ability of corn hybrids having varying proportion of corn belt and non corn belt germplasm. *Agron. J.* 46: 545-552.

Jag Shoran and J.P. Tandon. 1995. Genetic divergence in winter wheat (*Triticum aestivum* L. em. Thell.). *Indian J Genet.* 55(4): 406-409.

Jatsra, D.S. and R.S. Paroda. 1978. Genetic divergence in wheat under different environmental conditions. *Cereal Res. Commun.* 6: 307-318.

Moll, R.N., W.S. Salhauna and H.F. Robinson. 1962. Heterosis and genetic diversity in variety crosses of maize. *Crop Sci.* 2: 197-198.

Singhal, N.S. and M.K. Upadhyay. 1977. Genetic divergence in wheat. *Cereal Res. Commun.* 5: 275-286.

Spark, D.N. 1973. Euclidean cluster analysis Algorithm. *Apl. Stat.* 22: 126-130.