Indian J. Genet., 55 (4): 406–409 (1995)

GENETIC DIVERGENCE IN WINTER WHEAT (*TRITICUM AESTIVUM* L. EM. THELL.)

JAG SHORAN AND J. P. TANDON*

Division of Crop Improvement, Vivekananda Parvatiya Krishi Anusandhan Shala Almora 263601

(Received: March 24, 1992; accepted: June 10, 1995)

ABSTRACT

Genetic divergence of 50 varieties of winter wheat (*Triticum aestivum* L. em. Thell.) was assessed using Mahalanobis' D^2 statistic. They were grouped into six clusters. Grain weight/main spike, grains/main spike, grain yield/plant, biological yield/plant, 1000-grain weight, plant height, days to 50% flower and days to maturity contributed maximum to total genetic divergence. Based on mean performance, genetic distance and clustering pattern, hybridization involving cvs. Tufilar, Agent, Holdfast, Bolal and Compair belonging to clusters IV, VI, V, III and I, respectively, as parents should give high yielding varieties.

Key words: Winter wheat, *Triticum aestivum*, multivariate analysis, genetic divergence.

High yielding parents with greater genetic diversity are required to develop productive hybrids. For identifying genetically diverse parents for hybridization, multivariate analysis (Mahalanobis' D^2 statistic) has been used in spring wheat [5–8]. It is a powerful tool for quantification of genetic divergence among the parents. However, such information is limited in winter wheat. An attempt was, therefore, made to work out genetic diversity in a group of winter wheat varieties.

A large collection of winter wheat germplasm is being maintained at the V.P.K.A.S., Almora (U.P.). From this collection, a representative sample of 50 varieties was taken for the present investigation. The experiment was conducted in randomized block design with three replications at Hawalbagh situated 1250 m above m.s.l. in the Kumaun hills of Uttar Pradesh. Each variety was grown in three rows of 3 m length, spaced at 30 cm. The distance between plants within rows was 10 cm. Five plants were randomly taken from the central row of each experimental plot to record observations on ten quantitative traits of economic value. The observations on days to 50% flower and days to maturity were recorded on plot basis.

*Present address: B–14, I.A.R.I., New Delhi 110012.

Mean values of different characters were used to carry out general analysis of variance following the standard procedures. Mahalanobis' D^2 statistic was used to assess the divergence. Varieties were grouped into different clusters using the Tocher's method as described by Rao [1].

The analysis of variance revealed highly significant differences among the varieties for all the characters, indicating adequate genetic variability in the experimental material.

All the 50 varieties under test were grouped into six clusters (Table 1). The largest number of varieties (43) were included in cluster I, followed by 2 varieties each in clusters

Table 1. Cluster composition in winter wheat

Cluster	Number of varieties	Names of varieties
I	43	Maldoa, Rossulaka, Opal, NS 879/4, Stepoa, Martonvasur, Bezostaya, Burgas-2, Samson, Victor, Chancellor, Marisdoe, Maris- 5-3, Strempalli, Kitacome, Aurora, Budifan, Kavkaz, Yorkwin, Blueboy-II, Dunav-1, Doina, Slavyanka, Rescue, Axminister x CC, Erithrospermum, Beserka, Likafen, Chinese-66, Produe 6922A-16, TW 238/26/7/9/3, GKF-2, NSR-1, Newton, Compair, Frondoso, Favorit, Gomod Local, CI/3449/Cntyle, EC 1774, Mura, Sentinal, Centurk.
II	2	Mariswidgeon, Flevina
III	2	Sappo, Bolal
IV	1	Tufilar
V	1	Holdfast
VI	1	Agent

II and III. Clusters IV, V and VI consisted of one variety each. Therefore, most of the varieties under investigation forming cluster I did not exhibit much genetic divergence. At the same time, grouping of the 50 varieties into six clusters provided enough opportunity to select genetically diverse genotypes from the experimental material.

The average intercluster D values ranged from 14.0 to 30.6 (Table 2). The highest intercluster D value (30.6) was observed between clusters IV and VI with one genotype each. Therefore, the varieties falling in these clusters were genetically most divergent. The minimum intercluster D value (14.0) was recorded between cluster I with 43 genotypes and cluster III with 2 genotypes, indicating that the genotypes of these two clusters were genetically close.

Cluster means for different characters indicated that the mean values for grain yield/plant, harvest index, biological yield/plant, grain weight/main spike and grains/main spike were highest in cluster IV (Tufilar) besides desirable plant height and shortest durations for 50% flowering and maturity (Table 3). Cluster V (Holdfast) showed highest 1000-grain weight and shortest plant height. Clusters I (Compair), II (Bolal) and VI (Agent) exhibited highest number of effective tillers/plant, spikelets/main spike, and tillers/plant, respectively. Cluster VI also maintained highest plant height, longest durations for 50% flowering and maturity, whereas, cluster II (Mariswidgeon) had, by and large, low mean values for majority of charactcıs.

Table 2. Average inter- and intracluster (diagonal in bold) distances (D) in winter wheat

Clusters	I	II	III	IV	V	VI
I	**11.4**	19.5	14.0	16.6	15.1	22.2
II		**14.9**	15.9	26.4	17.5	19.9
III			**15.2**	19.2	15.6	22.3
IV				**0.0**	15.5	30.6
V					**0.0**	26.5
VI						**0.0**

Table 3. Cluster means for different characters in winter wheat

Cluster	Days to 50% flower	Days to maturity	Plant height (cm)	Tillers per plant	Effective tillers per plant	Spikelets per main spike	Grains per main spike	Grain weight per main spike (g)	Biological yield per plant (g)	Harvest index	1000-grain weight (g)	Grain yield per plant (g)
I	164.4	206.1	115.8	17.4	12.9	21.9	42.7	1.22	43.5	0.24	28.9	10.3
II	188.5	223.7	106.7	16.4	8.8	22.6	32.5	0.45	31.8	0.11	17.4	3.5
III	171.8	211.2	110.0	15.6	11.4	25.4	42.8	0.89	50.3	0.10	19.3	4.8
IV	155.7	202.3	100.0	14.0	8.8	24.5	71.0	2.70	63.3	0.29	38.7	18.7
V	167.3	217.7	98.1	15.9	12.5	22.8	49.0	1.63	46.7	0.24	41.3	11.3
VI	207.0	230.7	141.7	17.7	12.0	21.5	32.9	0.80	37.0	0.23	26.9	8.3

Cluster means varied considerably with respect to all the characters excluding spikelets/spike, tillers/plant, and effective tillers/plant (Table 3). Singhal and Upadhyay [6] also did not observe marked differences among clusters for spikelets/spike and tillers/plant in spring wheat. A comparison of mean values in the most diverse clusters (IV and VI) showed marked variation with respect to grain weight/main spike, grains/main spike, grain yield/plant, biological yield/plant, 1000-grain weight, plant height, days to

50% flower and days to maturity. Therefore, these characters can be considered responsible for creating divergence and differentiation between varieties in winter wheat. Jatasra and Paroda [7] also reported the importance of plant height, grain weight/ear, 1000-grain weight and grain yield/plant in genetic diversity in spring wheat.

Hybridization between the varieties falling in the most distant clusters (Tufilar and Agent) is likely to generate superior segregates. Based on the mean performance, genetic distance and clustering pattern, hybridization involving cvs. Holdfast, Bolal and Compair should result in desirable combinations leading to development of useful genetic stocks and varieties.

ACKNOWLEDGEMENTS

The authors are thankful to Mr. B. D. Pandey and Mr. K. K. S. Bisht for providing help in field experimentation and data analysis, respectively. Thanks are due to Dr. K. D. Koranne, Director of the Institute, for critically examining the manuscript.

REFERENCES

1. C. R. Rao. 1952. Advanced Statistical Methods in Biometrical Research. John Wiley and Sons, New York: 390.

2. J. A. Wilson. 1968. Problems in hybrid wheat breeding. Euphytica, **17**(Suppl. I): 13–33.

3. F. H. Mc Neal, D. E. Baldridge, M. A. Berg and G. A. Watson. 1965. Evaluation of three hard red spring wheat crosses for heterosis. Crop Sci., **5**: 399–400.

4. G. M. Bhatt. 1973. Comparison of various methods of selecting parents for hybridization in common bread wheat (*Triticum aestivum* L.). Aust. J. Agric. Res., **24**: 457–464.

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

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

7. D. S. Jatasra and R. S. Paroda. 1978. Genetic divergence in wheat under different environmental conditions. Cereal Res. Comm., **6**: 307–318.

8. P. L. N. Somayajulu, A. B. Joshi and B. R. Murty. 1970. Genetic divergence in wheat. Indian J. Genet., **39**: 47–58.