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GENETIC DIVERGENCE FOR MORPHOPHYSIOLOGICAL CHARACTERS IN *VIGNA RADIATA* L. WILCZEK

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The genetic diversity in 12 indigenous varieties of green gram was studied for 6 characters using D^2 estimates. The study indicated the presence of ample genetic diversity among the cultivars irrespective of their origin. Days to flowering, economic yield and plant height contributed maximally towards genetic divergence.

INTRODUCTION

The choice of suitable parents is of prime importance in breeding programmes. Varieties from geographically diverse localities are generally presumed to have greater likelihood of recovering promising segregants. However, this criterion can hardly be utilized for discrimination between parents. Selection of parents based on the extent of genetic divergence has been successfully utilized in different crop species [1, 2, 4, 5, 6, 7, 8]. The selection of cultivars may further be simplified if one could identify the characters contributing towards divergence between parents. Reports available on this aspect in local green gram cultivars are scanty. Therefore, this study was conducted to find out the nature and magnitude of genetic diversity among a group of green gram cultivars, *Vigna radiata.*

MATERIALS AND METHODS

The material which was comprised of 12 indigenous cultivars of green gram was grown in a radomized complete block design with 4 rows of 4 meter length, spaced 30 cm apart, accomodating 40 plants at 10 cm distance. The crop was raised under rainfed conditions. A total precipitation of 658 mm was recovered during the growth cycle of the crop. Observations were recorded on m^2 basis for economic and biological yield and harvest index percentage [3]. Observations were also recorded on 5 randomly selected plants from each plot for characters, viz., days to flowering, pods per plant, plant height and 100 grain weight.

Following the analysis of variance and covariance, the original mean values for all the characters were transformed to standardised, uncorrelated variables by pivotal condensation [10]. The divergence between any two populations was obtained as the sum of squares of the differences in the value of the corresponding transformed variates. Based on these D^2 values, the 12 populations were grouped into clusters using Tocher's method [10]. The percent contribution of a character towards genetic divergence was calculated as the percentage of combinations in which the character was ranked first.

RESULTS AND DISCUSSION

The analysis of variance revealed highly significant differences among the cultivars for all the characters under study. The relative contribution of each character to the total genetic divergence based on the magnitude of D^2 values (Table 1) revealed that days to flowering (25.76%) were the largest contributor to the divergence, followed by economic yield (24.24%). The least contribution was of harvest index (3.03%).

The D^2 values ranged from 24.58 to 169.76 which shows considerable high divergence among the varieties. The 12 cultivars, all with origin in the Punjab, could be grouped into 4 clusters based on the relative magnitude of D^2 values among themselves than those belonging to two different clusters. The largest cluster (1) had 6 strains and other clusters, viz, II III and IV accommodated only two cultivars each (Table 2). The maximum genetic divergence was observed between varieties of clusters III and IV (13.03) followed by clusters II and IV (10.93), mainly due to plant height and biological yield. The least divergence was noted between clusters I and III (8.39), mainly due to 100 seed weight. The intra-cluster distance ranged from 4.96 to 9.43, the maximum divergence being in cluster IV (Table 3). Cluster II showed high mean values for plant height, biological yield and 100 grain weight, cluster I for harvest index, and economic yield; and cluster III for days to flowering (Table 4).

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Table 1. Percent contribution of each character towards divergence.

Cluster	Days to flowering	Plant height (cm)	Biological yield (g./m^2)	Harvest index (%)	100 grain weight (g.)	Economic yield (g./m^2)	Total
Number of times appearing 1st in ranking	17	11	11	2	9	16	66
Percent contri-bution	25.76	16.67	16.67	3.03	13.63	24.24	100

Table 2. Custers of genotypes.

Cluster	Varieties
I	Pak-32, M-133-100, M-22-24, E-76, M-3854, Pak-16.
II	M-19-19, Pak-23.
III	M-29-37, M-28
IV	Pak-32, 6601

Although evolved in a common habitat, the varieties had ample genetic diversity and fell into different clusters, which could be due to marginal outcrossing, induced mutations, directional selection for agronomic characters

Table 3. Average hitra and inter-cluster distance "D" (in parenthesis) and D^2 values

Cluster	I	II	III	IV
I	38.46 (6.20)	77.31 (8.79)	70.37 (8.39)	100.58 (10.03)
II		24.58 (4.96)	92.22 (9.60)	119.39 (10.93)
III			75.56 (8.69)	169.76 (13.03)
IV				88.97 (9.43)

Table 4. Values of cluster means, means, range and standard deviation for 6 characters.

	Days to flowering	Plant height (cm)	Biological yield (g./m^2)	Harvest Index (%)	100 grain weight (g.)	Economic yield (g/m^2)
Mean for cluster 1	54.67	93.74	356.88	20.75	3.15	74.19
Mean for cluster II	61.5	97.38	392.75	15.46	3.38	57.73
Mean for cluster III	64.0	95.39	341.88	15.29	3.10	60.91
Mean for cluster IV	55.5	85.26	378.13	18.27	3.18	65.33
Mean	57.92	93.21	369.52	18.55	3.15	67.75
Range	48–65	82.97–99.93	327.5–398.75	12.51–25.54	2.85–3.43	49.82–89.42
Standard deviation	5.69	6.65	22.19	4.31	0.17	13.64

Note: The underlined values of cluster means represent the distrbution of highest and lowest mean value among different clusters for each character.

or genetically diverse nature of the parents used in evolving these genotypes.

A remarkable phenotypic homogeneity of the individual clusters recognized in the process of discriminant analysis, reveals the efficacy of this technique to resolve genetic diversity. The varietal clusters thus obtained could readily provide desirable genotypic material for a breeding programme not usually available through traditional statistical techniques. The days to flowering followed by economic yield and plant height predominantly contributed to intervarietal diversity. Almost similar observations were also recorded by Murthy *et al.* [9] and Malhotra *et al.* [6]. It is, therefore, suggested that days to flowering, economic yield and plant height should be considered for selecting genetically divergent lines in green gram. The diversity among the genotypes should be utilized for maximum expliotation of hybrid vigour and thus to throw superior segregates.

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REFERENCES

1. G.M. Bhat, Aust. J. Agr. Res., **21**, 1 (1970).
2. R.K. Dixit, Indian J. Agr. Sci., **50**, 222 (1980).
3. C.M. Donald, J. Aust. Inst. Agr. Sci., **28**, 1972 (1962).
4. A.K. Jain, N.K. Dhagat and A.S. Tiwari, Indian J. Genet., **41**, 346 (1981).
5. R.P. Katiyar, Indian J. Agr. Sci., **48**, 451 (1978).
6. V.V. Malhotra, S. Singh and K.B. Singh, Indian J. Agr. Sci., **44**, 811 (1974).
7. P.A. Miller and A. Marane, Crop Sci., **3**, 441 (1963).
8. R.W. Moll, W. S. Sallhuana and H.F. Robinson, Crop Sci., **2**, 197 (1962).
9. B.R. Murthy and I.J. Anand, Indian J. Genet., **26**, 21 (1966).
10. G.R. Rao, "Advanced Statistical Methods in Biological Research", John Wiley & Sons, New York, USA, (1952), p. 357.