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Short Communication

GENETIC DIVERGENCE IN FRENCH BEAN (*PHASEOLUS VULGARIS* L.)*

B.D. Joshi and K.L. Mehra[1]

National Bureau of Plant Genetic Resources
Regional Station, Phagli, Shimla-171 004

Genetic variation providing wide opportunities for the improvement of autogamous crop plants through hybridization and heterosis is known to depend on extent of genetic diversity between the parents. In India, information on studies on genetic divergence in French bean is lacking. Hence, Mahalanobis's D^2 analysis was carried out in the present study on 42 genotypes of French bean to estimate the extent and nature of genetic diversity.

Forty two accessions of French bean were sown in single row plots, during *Kharif* (July-October) seasons of 1979 and 1980, in a randomised complete block design with four replications. The rows were 2.25m long, spaced 50cm apart and with seeds dibbled 15cm apart within rows. Five randomly selected competitive plants, in each replication, were used for recording data on days to flower, days to maturity, plant height (cm), number of leaves, number of branches, number of clusters, number of pods, pod length (cm), number of seeds, 100 seed weight (g) and seed yield per plant (g). The average values of these characters were used for statistical analysis. Mahalanobis's (1936) generalised distance was used for the estimation of genetic divergence, as outlined by Rao (1952).

There were significant differences among the forty two genotypes which could be grouped into 11 clusters. Cluster 1 was the largest having 9 genotypes from different countries. Clusters II, III, IV, V, VI, VII and VIII consisted of 8,5,4,4,3,3, and 3 genotypes respectively, whereas cluster IX, X and XI were represented by a

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1. Ex Director, NBPGR, New Delhi-110 012

TABLE 1

Table 1 : Distribution of 42 *Phaseolus vulgaris* genotypes in different clusters

Clusters	Varieties	Number	Geographic Origin
I	EC 19038, EC 24948, EC 31230, EC 36664, EC 42960, EC57080, Premier, PLB 14-1 and PLB 256	9	Mexico, USSR, USA, Australia, India.
II	EC 22365, EC 44760, EC 57260, EC 93621, EC 93828, EC 100677, EC 100680 and EC 108101	8	USA, Holland, Colombia.
III	EC 34023, EC 44758, EC 77005, EC 94455, and EC 109975	5	USA Brazil, Bulgaria.
IV	EC 44787, EC 44790, EC 93625 and. EC 99540	4	Canada, Colombia, U.K.
V	EC 26399, EC 43893, EC 44624 and EC 109977	4	Mexico, Japan, Canada, Brazil.
VI	EC 94453, EC 99541 and PLB 10-1	3	Bulgaria, U.K. India.
VII	EC 18611(B), EC 26402 and EC 43896	3	Nepal, Mexico, Japan.
VIII	EC 43900, EC 44747 and EC 94469	3	Japan, USA, Bulgaria.
IX	EC 18600	1	Nepal.
X	EC 109508	1	Australia.
XI	PLB 440	1	India.

TABLE 2

Table 2. Cluster means for 11 characters in French bean

Cluster	No. of leaves/ plant	Plant height (cm)	No. of branches/ plant	No. of clusters/ plant	No. of pods/ plant	Pod length (cm)	No. of seeds/ plant	Seed yield/ plant (g)	100-seed weight (g)	Days to flowering	Days to maturity
I	16.68	36.33	3.00	6.45	9.22	10.57	36.92	9.52	25.97	43.90	90.43
II	20.02	40.85	3.51	7.46	10.51	11.47	38.08	12.64	33.70	42.38	89.43
III	30.72	63.76	3.32	10.14	15.68	10.10	75.30	16.28	22.60	53.52	99.48
IV	28.40	44.59	3.45	10.40	17.47	8.32	71.92	12.22	17.12	52.25	95.30
V	20.46	46.43	3.13	6.90	8.96	12.43	31.80	16.36	5.76	44.26	92.56
VI	26.70	62.43	3.76	8.33	10.56	12.53	33.20	16.06	50.50	45.15	94.90
VII	27.83	47.33	3.66	8.80	12.46	12.80	40.20	15.33	38.20	50.70	98.50
VIII	30.10	73.62	3.22	10.92	16.15	10.65	62.55	18.77	30.25	53.47	101.20
XI	47.24	127.29	3.68	12.98	18.18	10.67	62.80	25.33	40.98	60.70	117.20
X	41.16	64.84	3.52	14.24	22.05	9.03	112.58	14.92	14.93	58.90	110.70
XI	38.94	111.96	3.20	9.15	13.49	9.80	60.74	14.99	23.97	61.30	112.35

TABLE 3

Table 3 : Intra and inter-cluster divergence $\sqrt{D^2}$ values in 42 varieties of French bean

Cluster	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
I	2.62	6.34	12.09	13.83	12.91	10.21	9.40	11.20	20.08	19.61	21.29
II		3.16	10.14	9.66	18.78	11.22	13.64	12.07	26.63	16.80	20.92
III			3.28	6.10	21.31	13.07	18.62	7.78	21.15	8.85	13.17
IV				3.77	24.58	16.10	21.68	12.68	18.29	8.85	26.94
V					3.79	9.74	5.78	16.93	21.86	28.28	25.78
VI						4.61	7.92	10.00	20.12	19.99	19.65
VII							4.60	14.80	22.24	26.06	24.16
VIII								6.35	16.43	14.14	12.20
IX									0.00	25.10	12.90
X										0.00	15.51
XI											0.00

single genotype from Nepal, Australia and India respectively (Table 1).

In general, the cultivars in cluster 1 were dwarf (Table 2). Cluster X represented by single genotype having the highest mean value for number of clusters (14), number of pods (22), number of seeds (112). EC 18600 of cluster XI gave the highest seed yield (25g). The genotypes earliest to flower (42 days) belonged to cluster II. Hundred seed weight was recorded the highest in cluster VI (50.5g). The earliest maturing genotypes fell in cluster II (89 days) and longest pod bearing genotypes in cluster VII (12.8 cm). Cluster IX was characterized by having a genotype with highest number of leaves (47.2). Cluster I,II, VI, VII, IX and X had genotypes that would prove useful in obtaining desirable recombinants for improving yield and its contributing characters. The genetic divergence (Table 3) was the maximum between cluster V and X (28.28), followed by IV and XI (26.94) and II and IX (26.63). Selecting such divergent genotypes for hybridization might result in better segregants and high heterotic response. The intra-cluster distance ranged from 0.00-6.35.

Considering high mean value alongwith high genetic distance, EC 109508, EC 43625, EC 43896, EC 44760, EC 24948, EC 18600 and PLB 440 were promising. These may be crossed in several combinations or in a complete diallel fashion to achieve high yield in French bean. D^2 analysis showed that genotypes possessing similar characteristics, though far separated geographically, have come together. Hence geographic diversity had no relation with genetic diversity. Perhaps these genotypes were subjected to the similar selection pressure for suiting to local requirements and adaptation. The genetic architecture of such populations could be the result of prolonged selection by various natural and artificial forces. Successful use of D^2 analysis to assess the relative combination of different components of yield to the total divergence and to determine the nature of forces operating at intra and inter-cluster levels have been emphasised by various workers in French bean (Froussios, 1970; Pegingtin, 1972; Singh *et al.*, 1991 and Vaid *et al.*, 1988).

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