Plant Archives Vol. 14 No. 1, 2014 pp. 225-227 *ISSN 0972-5210*

GENETIC DIVERGENCE STUDIES IN FRENCH BEAN (*PHASEOLUS VULGARIS*)

K. Gangadhara[1]*, R. C. Jagadeesaha and P. L. Anushma

Department of Crop Improvement and Biotechnology,
K. R. C. College of Horticulture (UHS, Bagalkot), Arabhavi - 591 310 (Karnataka), India.
[1]Department of Plant Breeding & Genetics, College of Agriculture, Vellayani,
Thiruvananthapuram-695 522 (Kerala), India.

Abstract

Field experiments were conducted at the Department of Crop Improvement and Biotechnology, Arabhavi, U.H.S., Bagalkot (Karnataka), India during 2011-12 with 66 genotypes of french bean (*Phaseolus vulgaris* L.). Genetic diversity among the genotypes was worked out using Mahalanobis D^2 statistics. On the basis of genetic distance, these genotypes were broadly grouped into two clusters. Cluster II was the largest, consisting of 48 genotypes, while cluster I contained 18 genotypes. Among the different characters studied, days to fifty per cent flowering (43.86%) contributed maximum to the total genetic diversity among the genotypes followed by hundred seed weight (22.33%), green pod yield (11.79%), pod weight (11.04%) and pod length (6.71%). The maximum inter cluster distance was recorded to be 148.840 between cluster I and cluster II. Cluster I showed maximum intra-cluster distance (122.419). The genotypes belonging to the cluster with maximum inter cluster distance are genetically more divergent and these genotypes could be used in hybridization programme to obtain promising segregants.

Key words: French bean, genetic diversity, clustering.

Introduction

French bean (*Phaseolus vulgaris* L., 2n = 22) of family Leguminosae is a nutritious vegetable consumed as tender pods, shelled beans and dry beans. It has evolved from wild growing vine distributed in the high lands of Middle-America and Andes. It is the most important legume worldwide for human consumption (Singh, 2007). It also possesses some medicinal properties, which are useful in controlling diabetics and certain cardiac problems and it is a good natural cure for bladder burn. It has both carminative and reparative properties against constipation and diarrhoea, respectively. Genetic improvement mainly depends upon the amount of genetic variability present in the population. In any crop the germplasm serves as a valuable source of base population and provides scope for wide variability. Information on the nature and degree of genetic divergence would help the plant breeder in choosing the right parents for breeding programme. Therefore in the present study, 66 french bean genotypes were evaluated to assess the genetic diversity among these genotypes.

***Author for correspondence :** E-mail- gangacib@gmail.com

Materials and Methods

The present study was carried out to assess the diversity among 66 diverse genotypes of french bean. The 66 genotypes were grown in a simple RCBD with two replications at Kittur Rani Channamma College of Horticulture, Arabhavi, University of Horticultural Sciences, Bagalkot (Karnataka), India. Arabhavi is situated in northern dry zone of Karnataka state at 16°15' North latitude, 74°45' East longitude and at an altitude of 612.03 meters above the mean sea level and comes under zone-3 of region-2 among the agro-climatic zones of Karnataka. The experimental plot was ploughed repeatedly and land was brought to a fine tilth. About 25 tonnes of FYM per hectare and recommended basal dose of fertilizers (62.5: 100: 75 kg NPK/ha) were incorporated as per the packages of practices of UAS, Dharwad (Anon., 2010). Observations on plant height at 30 days after sowing (DAS), plant height at 60 days after sowing,

Table 1 : Cluster composition based on D^2 statistics in French bean.

Cluster	Number of genotypes	Genotypes included in the cluster
I	18	IC328296, IC326974, IC328626, IC311698, IC372701, IC313295, EC324976, VRFB1, DDFBBS1, IC258275, IC372638, EC024946, EC286071, MFB2, EC271489, IC372698, IC405512, EC381446.
II	48	VRFB2, IC328871, VRFB(B)1, EC316028, IC381080, IC265939, IC382215, IC373375, IC382280, IC313620, IC370764, IC382211, DWDFB1, Local Bangalore, DWDFB53, EC129372, EC284253, Swarna Priya, EC397826, IC328625, DWDFB57, IC248487, EC316026, IC280007, HAFB3, IIHR909, IC278499, FB53, EC121013, Rajma bean, IC262834, EC024948, EC284258, IC280816, EC398587, EC109731, EC286073, IC256073, IC258284, IC328653, IC381023, IC231181, Arka Komal, IC372696, EC398591, EC381081, EC398577, Arka Anoop.

Table 2 : Intra cluster and inter cluster D^2 and D values in French bean.

Cluster number	I	II
I	122.419 (11.164)	148.84 (12.20)
II		86.14 (9.281)

Table 3 : The mean of 11 characters for 2 clusters in French bean.

S. no.	Characters	Cluster I	Cluster II
1.	Plant height at 30 DAS (cm)	47.577	43.061
2.	Plant height at 60 DAS (cm)	61.013	59.707
3.	No. of branches per plant at 30 DAS	3.713	3.602
4.	No. of branches per plant at 60 DAS	6.167	5.921
5.	Pod weight (g)	5.560	5.131
6.	Pod length (cm)	10.816	10.557
7.	No. of pods per plant	14.369	15.267
8.	No. of seeds per plant	38.986	50.807
9.	100 seed weight (g)	45.941	42.168
10.	Green pod yield per plant (g)	66.950	62.481
11.	Days to 50% flowering	41.343	42.352

Table 4 : Relative contribution of the different characters to the total divergence in French bean germplasm.

S. no.	Character	No. of times ranked first	% Contribution to total divergence
1	Plant height at 30 DAS (cm)	19	0.8858
2	Plant height at 60 DAS(cm)	3	0.1399
3	No. of branches per plant at 30 DAS	5	0.2331
4	No. of branches per plant at 60 DAS	5	0.2331
5	Pod weight (g)	237	11.049
6	Pod length (cm)	144	6.7133
7	No. of pods per plant	22	1.0256
8	No. of seeds per plant (g)	37	1.7241
9	100 seed weight (g)	479	22.331
10	Green pod yield per plant (g)	253	11.7949
11	Days to fifty per cent flowering	941	43.8695

number of branches per plant at 30 days after sowing, number of branches per plant at 60 days after sowing, pod weight, pod length, number of pods per plant, number of seeds per plant, 100 seed weight, days to 50 per cent flowering and green pod yield per plant were recorded on the five plants chosen at random in each genotype in each replication and the mean of five plants were taken for analysis. The genetic divergence was estimated using D^2 statistics of Mahanalobis and the population was grouped into cluster by following the method suggested by Toucher (Rao, 1952). The intra and inter-cluster distances were calculated by the formula described by Singh and Choudhary (1979).

Results and Discussion

The analysis of variance for different quantitative characters for 66 genotypes of french bean were highly significant (P = 0.01) differences among genotypes for all eleven characters studied. Based on relative magnitude of D^2 estimates (table 1), 66 genotypes were broadly grouped into two clusters with variable numbers of genotype revealing the presence of considerable amount genetic diversity in the materials. Among the two clusters, cluster I contained 18 genotypes and cluster II contained 48 genotypes. The pattern of group constellation revealed that significant variability existed among the genotypes. The D^2 value

ranged from 86.14 to 148.84 indicating a wide range of diversity among the genotypes. In general, inter cluster distance were higher than the intra cluster distance (table 2). Higher inter and Intra cluster D^2 values revealed very interesting trend of genetic diversity. Thus, the genotypes included within a cluster tended to diverse less from each other. The lowest intra cluster distance was in the cluster II ($D^2 = 86.14$), whereas the highest intra cluster distance was in the cluster I ($D^2 = 122.419$). This high intra- cluster distance indicated the wider genetic diversity among the genotypes, which could be used in yield improvement of frenchbean. Similar results were given by Thaware *et al*. (1997) and Chaubey *et al*. (2003) in french bean and Narayanankutty *et al*. (2003), Dalsaniya *et al*. (2009) in cowpea. The maximum inter cluster distance was noticed between Cluster I and II ($D^2 = 148.84$). A wide range of variation was observed in cluster means for all the characters studied (table 3). Cluster I having maximum mean values for plant height at both 30 and 60 days after sowing 47.577 and 61.013 respectively, pod weight (5.56), pod length (10.816), hundred seed weight (45.941) and green pod yield per plant (66.95). Cluster II having maximum mean values for number of pods per plant (15.267), number of seeds per plant (50.807) and days to 50 per cent flowering (42.352) were recorded. The genotypes with maximum mean values are used a parents in future breeding programme. Similar results were given by Thaware *et al*. (1997) and Chaubey *et al*. (2003) in french bean.

The clustering pattern could be utilized in crossing the parents and deciding the cross combinations, which may generate maximum possible variability for various traits. The genotypes with high values of any cluster can be used either for direct adoption or for hybridization for further selection and improvement (Dalsaniya *et al*., 2009). The selection and choice of parents mainly depends upon contribution of characters towards divergence (table 4). The present study days to fifty per cent flowering (43.86%) contributed maximum to the total genetic diversity among the genotypes followed by hundred seed yield (22.33%), green pod yield (11.79%), pod weight (11.049%), pod length (6.713%). Hence, days to fifty per cent flowering, hundred seed yield, green pod yield per plant, pod weight and pod length were considered to be important traits contributing towards genetic divergence. Similar results were given by Dalsaniya *et al*. (2009) and other characters like number of seeds per plant (1.724%), number of seeds pods per plant (1.025%), plant height at 30 DAS (0.885%), number of branches per plant at 30 DAS (0.233%), number of branches per plant at 60 DAS (0.233%) and plant height at 60 DAS (0.139%) also shows a minimum contribution to the total genetic diversity among the genotypes. Similarly divergence studies were carried out by Prasad (1995), Govanakoppa *et al*. (2002) and Chaubey *et al*. (2003).

Conclusion

The inter cluster distance between the two clusters is moderately high. Therefore, logical attempt to cross among the genotypes belonging to these clusters so as evolve hybrids. The genotypes belonging to the clusters with maximum inter cluster distance are genetically more divergent and these genotypes could be used in hybridization programme to obtain promising segregants. Presently, Among the 66 genotypes evaluated, better performing genotypes were selected and breeding programme is under progress to develop high yielding French bean varieties suited to Krishna-Ghatprabha river belt and other southern parts of India at K.R.C. College of Horticulture, Arabhavi under University of Horticultural Sciences, Bagalkot (Karnataka), India.

References

Anonymous (2010). Improved Cultivation Practices for Horticultural Crops (Kannada). Univ. Agric. Sci., Dharwad.

Chaubey, P. K., S. P. Singh and T. Chaubey (2003). Genetic divergence in rajmash (*Phaseolus vulgaris* L.). *Vegetable Science*, **30(2)** : 190-191.

Dalsaniya, S. B., V. K. Poshiya, J. J. Savaliya, A. G. Pansuriya and B. K. Davada (2009). Genetic divergence in cowpea [*Vigna unguiculata* (l.) Walp.]. *Legume Res*., **32(4)** : 250-254.

Govanakoppa, R. B., R. M. Hosamani and P. M. Salimath (2002). Genetic diversity in french bean under moisture stress condition. *Vegetable Science*, **29 (1)** : 37-39.

Mahalanobis, P. C. (1928). On the generalised distance in statistics. *Proc. Nat. Acad. Sci.*, **19** : 201-208.

Narayanankutty, C., R. Mili and U. Jaikumaran (2003). Variability and genetic divergence in vegetable cowpea. *J. Maharashtra Agric. Univ*., **28(1)** : 26-29.

Prasad, V. S. R. (1995). Genetic divergence of yield and its components in bush bean. *Indian J. Hort.*, **52** : 46-50.

Rao, C. R. (1952). Advanced Statistical Methods in Biometrical Research. John Wiley and Sons, New York.

Singh, A. K., K. P. Singh and B. K. Singh (2007). Genetic variability, heritability and genetic advance in french bean (*Phaseolus vulgaris* L.). *Haryana J. Hort. Sci*., **36(3/4)** : 352-353.

Singh, R. H. and B. D. Chaudhary (1979). Biometrical Methods in Quantitative Analysis. Kalyani Publishers, Ludhiana.

Thaware, B. L., S. P. Birari and U. B. Apte (1997). Genetic divergence in forage cowpea. *Legume Res*., **20(3-4)** : 236-238.