International Journal of Food, Agriculture and Veterinary Sciences ISSN: 2277-209X (Online)
An Online International Journal Available at http://www.cibtech.org/jfav.htm
2012 Vol. 2 (3) September-December, pp. 64-70/Tiwari et al.
Research Article

GENETIC DIVERGENCE ANALYSIS IN MUNGBEAN (*VIGNA RADIATA* L. WILCZEK)

[1]Ajay Tiwari*, [2]Jitendra Kumar Tiwari and S.P. Mishra[1]
[1]Department of Crop science, M.G.C.G.V. Chitracoot, Satna M.P.
[2]Department of Genetics and Plant Breeding, IGKVV, Raipur (C.G)
**Author for Correspondence*

ABSTRACT
Multivariet analysis by means of Mahalanobis's D^2 statistics is a powerful tool in quantifying the degree of divergence among genotype, biological populations at genotypic level to assess the relative contribution of different characters to the total variation. Hence present study was undertaken to provide information on nature and magnitude of genetic diversity among promising genotypes of mungbean, genetic divergence were estimated in 30 elite genotypes for yield trait by using Mahalanobis's D^2 statistics. The genotypes were grouped into 14 clusters, clusters I showed maximum. Intra clusters distance while the highest inter clusters distance was observed between clustersIX and III The cluster XIV has high mean for days to maturity, plant and biological yield per plant. Thus genotypes of these clusters may be used as potential parents for hybridization program for developing high yielding mungbean varieties.

Key Words: *Mungbean, Genetic Divergence and Hybridization*

INTRODUCTION
Pulse crops play an important role in Indian economy. They have been integral part of Indian agriculture since time immemorial and are gaining more importance globally as they are the chief source of vegetable protein. Its production is not sufficient to ensure a per capita per day availability of 70dal, which is minimum as recommended by the National Commission on Agriculture. In fact, nutritionally, pulses and cereals are complementary to each other, the former being rich in lysine but deficient in sulphur containing amino acids, methionine and cystein, while the later being rich in methionine and cystein but deficient in lysine.

The success of any crop breeding programme depends on the nature and amount of variability existing with germplasm collections. The genetic reconstruction of plant is required for developing high yielding varieties by incorporating and improving the characters. The available germplasm serves as the most valuable natural reservoir in providing the needed attributes for obtaining the high yielding crop varieties (Hawkes, 1981).

India the centre of origin/diversity, considerable variability exists within the germplasm constituting indigenous collections. Therefore, evaluation of germplasm and genetic variability is essential for the present as well as future crop improvement programmes, However, up to till now very little systematic work on germplasm evaluation in mungbean has been accomplished in India (Singh *et al*., 1988, Pundir *et al*., 1992, Bisht *et al*., 1998). Moreover, proper utilization of germplasm requires testing of genetic potential under local conditions or environment for which the breeding programmer is aimed**.**

MATERIALS AND METHODS
The present investigations were conducted at Department of Crop science, Mahatma Gandhi Chitrakoot Gramodaya Vishwavidyalaya, Chitrakoot, Satna (M.P.) during Kharif 2009. The experimental material comprised of 30 genotypes GM-3, T-44, PDM-11 ,NDM-1 ,PS-10, LGG-407, LGG-450, ML-818, AKM-8803,Pusa Baishakhi, RMG-268, BD N-2, Pant Mung-2, Dholi, BPMR-145, Pratap, PDM-54, Pant Mung-1, RMG-62, Samrat, Pant Mung-5, AKM-9910, BM-4, RMG-492, IPM 99-125, Sona, Shalimar-

1, MH 96-1, ML-267, Pusa-9072 . The Experiment was conducted to evaluate the thirty genotypes/varieties under normal soil and rain fed condition. The experiment was laid out fallowing Randomized Block Design (RBD) with three replications during *Kharif* 2009-10. The experiment was shown on 25 July, 2009-10. Each treatment was grown in 3m long single row plot spaced 45cm apart. The plant to plant distance was maintained 15cm by thinning. Recommended agronomic practices and plant protection measures were adopted to raise a good crop. All the recommended cultural practices and plant protection measures were followed, data were recorded for twelve characters viz Day to flowering , plant height (cm) ,days to maturity , Number of cluster per plant, Number of pods per cluster , Number of pods per plant , pod length (cm) Number of seeds per pod, 100-seed weight, Biological yield per plant (cm) , Harvest index(%), Seed yield per plant(g). The data were subjected to analysis of variance and multivariate analysis of D^2 statistics according to Mahalanobis (1936).

RESULTS AND DISCUSSION

The study of genetic divergence of 30 mungbean germplasm for twelve quantitative characters was done through Mahalanobis's D^2 statistics as described by (Rao, 1952). The results have been described as under:

Thirty mungbean germplasm were grouped in to 14 clusters. Cluster IV had highest number of germplasm (5) followed by cluster II, III, V, VI and VII which had 3 germplasm. Cluster I and VIII had 2 germplasm. Six germplasm RMG-268, BDN-2, Samrat, Pant Mung-5, RMG-492 and Pusa 9072 could not be grouped together and formed separate cluster IX, X, XI, XII, XIII and XIV, respectively.

The intra cluster D^2 values ranged from 0.00 (Cluster IX, X, XI, XII, XIII and XIV) to 149.11 (Cluster I). The inter cluster D^2 value indicated that the most diverse cluster were IX and III (1190.48) followed by Cluster IX and V (895.34). The minimum inter-cluster values was between cluster X and VII (103.15) followed by Cluster II and VII (170.26) which indicated that these group were less diverse.

The mean performance of all the characters in different cluster is presented in Table. Cluster I showed low mean for number of pods per cluster (2.02), number of pods per plant (14.77), number of seeds per pod (11.30) and seed yield per plant (4.40). Cluster III and cluster X had low mean for number of cluster per plant (5.71) and 100-seed weight (3.23), respectively. Cluster V and cluster VI had high mean for days to maturity (79.00) and number of seeds per pod (12.47), respectively. Cluster VIII had high mean for number of pods per cluster (3.38) and harvest index (20.44). Cluster IX had high mean for number of cluster per plant (12.00) while low mean for days to flowering (33.00) and days to maturity (66.00). Cluster XI had high mean for number of pods per plant (32.40) and seed yield per plant (8.95) while low mean for days to flowering (33.00), plant height (58.73) and pod length (6.63). Cluster XII had high mean for pod length (8.70) and 100-seed weight (4.54). Cluster XIII had high mean for number of seeds per pod (12.47) and low mean for biological yield per plant (33.40). Cluster XIV has high mean for days to flowering (40.00), plant height (97.07), biological yield per plant (73.80) and showed lowest mean for harvest index (7.85).

Character Contribution

Per cent character contribution ranged from 0.00 to 22.53. The contribution of number of cluster per plant (22.53%), days to maturity (21.84%), number of pods per cluster (19.31%) and seed yield per plant (12.64) was highest whereas, the contribution of harvest index (5.98), number of pods per plant (4.60), biological yield (3.91), 1000-seed weight (2.76%), number of seeds per pod (2.53%), plant height (2.30%) and pod length (1.61%) was very low. Days to flowering contributed nothing towards genetic divergence.

The information about nature and magnitude of genetic diversity existing in the available germplasm collections of a crop is essential for selection of diverse parents which upon hybridization may provide a wide spectrum of gene recombinations of quantitatively inherited traits. Genetic diversity has become one

Table 1: Distribution of 30 Mungbean Germplasm in Different Clusters

Cluster number	Number of germplasm	Germplasm
I	2	GM-3, Pant Mung-2,
II	3	T-44, BM-4, AKM-9910
III	3	PDM-11, LGG-407, MH 96-1,
IV	5	NDM-1, BPMR-145, PS-10, ML-267, Sona
V	3	LGG-450, Shalimar-1, Pratap,
VI	3	ML-818, Pant Mung-1,PDM-54,
VII	3	AKM-8803, IPM 99-125,RMG-62,
VIII	2	Pusa Baisakhi, Dholi
IX	1	RMG-268
X	1	BDN-2
XI	1	Samrat
XII	1	Pant mung-5
XIII	1	RMG-492
XIV	1	Pusa 9072

Table 2: Intra and Inter-Cluster D^2 and D Values Among 14 Clusters in Mungbean

Cluster Number	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	XIII	XIV
I	**149.11 (12.21)**	341.52 (18.48)	300.05 (17.32)	233.48 (15.28)	363.39 (19.06)	484.21 (22.00)	323.12 (17.98)	620.14 (24.90)	783.23 (27.99)	363.38 (19.06)	799.79 (28.28)	477.11 (21.84)	183.60 (13.55)	536.30 (23.16)
II		**126.05 (11.23)**	527.12 (22.96)	235.74 (15.35)	363.19 (19.06)	276.90 (16.64)	170.26 (13.05)	333.38 (18.26)	326.56 (18.07)	204.72 (14.31)	306.45 (17.51)	265.31 (16.29)	205.12 (14.32)	502.77 (22.42)
III			**102.55 (10.13)**	269.87 (16.43)	178.42 (13.36)	406.38 (20.16)	558.43 (23.63)	394.44 (19.86)	1190.48 (34.50)	592.49 (24.34)	876.98 (29.61)	617.33 (24.85)	283.21 (16.83)	225.21 (15.01)
IV				**115.43 (10.74)**	223.65 (14.95)	199.90 (14.14)	193.30 (13.90)	386.10 (19.65)	528.54 (22.99)	224.57 (14.99)	475.72 (21.81)	279.95 (16.73)	235.20 (15.34)	226.52 (15.05)
V					**145.71 (12.07)**	211.92 (14.56)	400.23 (20.01)	339.93 (18.44)	895.34 (29.92)	493.42 (22.21)	643.96 (25.38)	459.27 (21.43)	270.32 (16.44)	244.31 (15.63)
VI						**112.33 (10.60)**	214.52 (14.65)	351.94 (18.76)	461.48 (21.48)	254.07 (15.94)	316.75 (17.80)	316.28 (17.78)	374.37 (19.35)	275.20 (16.59)
VII							**128.12 (11.32)**	494.00 (22.23)	241.83 (15.55)	103.15 (10.16)	268.69 (16.39)	244.04 (15.62)	301.29 (17.36)	495.84 (22.27)
VIII								**114.86 (10.72)**	750.39 (27.39)	496.13 (22.27)	441.66 (21.02)	661.32 (25.72)	262.45 (16.20)	287.67 (16.96)
IX									**0.00 (0.00)**	195.56 (13.98)	295.26 (17.18)	528.12 (22.98)	675.11 (25.98)	893.32 (29.89)
X										**0.00 (0.00)**	188.11 (13.72)	230.45 (15.18)	401.60 (20.04)	495.19 (22.25)
XI											**0.00 (0.00)**	350.57 (18.72)	619.67 (24.89)	659.06 (25.67)
XII												**0.00 (0.00)**	543.87 (23.32)	588.59 (24.26)
XIII													**0.00 (0.00)**	420.33 (20.50)
XIV														**0.00 (0.00)**

Bold figures represent intra-cluster distance.

Table 3: Cluster Means for Twelve Quantitative Characters in Mungbean

Cluster numbers	Days to flowering	Plant height (cm)	Days to maturity	Number of clusters per plant	Number of pods per cluster	Number of pods per plant	Pod length	Number of seeds per pod	100-seed weight (g)	Biological yield	Harvest index	Seed yield per plant
I	35.83	80.63	71.67	6.70	2.02#	14.77#	6.93	11.30#	3.55	50.37	8.82	4.40#
II	34.89	76.11	71.00	9.20	2.42	21.89	7.53	11.84	4.50	41.13	17.70	7.27
III	37.11	89.04	72.22	5.71#	2.92	16.18	7.11	11.56	3.38	54.18	8.27	4.44
IV	36.07	87.12	73.60	7.89	2.56	19.16	7.14	12.08	3.94	61.99	9.31	5.73
V	36.89	85.22	79.00+	7.70	2.63	18.91	7.15	11.91	3.84	47.96	11.57	5.49
VI	36.00	81.35	76.44	9.61	2.70	24.38	7.33	12.47+	3.33	50.91	13.71	6.98
VII	34.55	72.24	70.44	9.71	2.38	22.22	7.08	12.18	3.71	50.13	12.83	6.42
VIII	35.33	83.37	73.67	7.70	3.38+	24.10	7.15	12.40	3.61	36.40	20.44+	7.43
IX	33.00#	81.87	66.00#	12.00+	2.33	27.93	7.50	12.33	3.76	43.00	18.14	7.80
X	34.33	79.60	68.00	9.60	2.77	24.60	7.23	11.47	3.23#	52.67	13.92	7.33
XI	33.00#	58.73#	70.33	10.67	3.33	32.40+	6.63#	11.93	3.80	47.73	18.74	8.95+
XII	35.33	69.20	73.33	8.73	2.60	23.20	8.70+	11.87	4.54+	67.13	13.21	8.87
XIII	36.00	73.73	72.00	7.20	2.27	16.27	7.00	12.47+	3.52	33.40#	16.16	5.40
XIV	40.00+	97.07+	76.67	7.53	3.30	21.93	6.93	11.93	3.52	73.80+	7.85#	5.47

#, + indicates lowest and highest values, respectively

Table 4: Per Cent Character Contribution in Mungbean

Characters	Days to flowering	Plant height (cm)	Days to maturity	Number of clusters per plant	Number of pods per cluster	Number of pods per plant	Pod length	Number of seeds per pod	100-seed weight (g)	Biological yield	Harvest index	Seed yield per plant
Percent contribution	0.00	2.30	21.84	22.53	19.31	4.60	1.61	2.53	2.76	3.91	5.98	12.64

of the most important criteria for choosing parents for hybridization either to exploit heterosis or to select desirable segregants. Earlier workers considered the distance in place of origin as index of genetic diversity and used it for selection of parents for hybridization. However, the genetic diversity of parents has not been always found to be based on factors such as geographical diversity, place of release or ploidy level (Bhatt, 1970, Malhotra and Singh, 1971, Mishra, 1986, Naidu and Satyanarayan, 1991, Reddy, 1997, Murty and Arunachalam, 1966; Brown, 1983). Hence, characterization of genetic divergence for selection of suitable and diverse genotypes should be based on second statistical procedures, such as D^2 statistics and cluster analysis. These characters genetic divergence using the criteria of similarity or dissimilarity based on the aggregate effect of a number of agronomically important characters.

In the present study, 30 mungbean germplasm were grouped in to 14 clusters using Mahalanobis's D^2 statistics as described by Rao, (1952). Cluster IV had highest number of germplasm (5) followed by cluster II, III, V, VI and VII which had 3 germplasm. Cluster I and VIII had 2 germplasm. Six germplasm RMG-268, BDN-2, Samrat, Pant Mung-5, RMG-492 and Pusa 9072 could not be grouped together and formed separate cluster IX, X, XI, XII, XIII and XIV, respectively.

The inter-cluster distances were greater than intracluster distances, revealing that considerable amount of genetic diversity existed among the genotypes studied. Cluster I showed maximum intra-cluster distances (149.11), inter-cluster distance is the main criterion for selection of genotypes using D^2 analysis. Genotypes belonging to the clusters with maximum inter-cluster distances are genetically more divergent and hybridization between genotypes of divergent clusters are likely to produce wide variability with desirable segregants. The maximum inter cluster distance was recorded between IX and III (1190.48) followed by Cluster IX and V (895.34) which indicated that these clusters were most diverse. The minimum inter-cluster values was between cluster X and VII (103.15) followed by Cluster II and VII (170.26) which indicated that these group were less diverse. Cluster V and cluster VI had high mean for days to maturity and number of seeds per pod, respectively. Cluster VIII had high mean for number of pods per cluster and harvest index. Cluster IX had high mean for number of cluster per plant. Cluster XI had high mean for number of pods per plant and seed yield per plant. Cluster XII had high mean for pod length and 100-seed weight. Cluster XIII had high mean for number of seeds per pod. Cluster XIV has high mean for days to flowering, plant height and biological yield per plant. Thus, the genotypes of outstanding mean performance from these clusters may be identified as potential parents and could be utilized in hybridization programme for developing high yielding varieties.

ACKNOWLEDGEMENT

Authors thank to the Director, Indian Institute of Pulse Research, Kanpur (U.P) for providing seed material for present research work. I also express my sincere thanks to Dr. S. Rajan, Principal Scientist, C.I.S.H., Lucknow for statistical analysis.

REFRENCE

Gupta MP and Singh RB (1970). Genetic divergence for yield and its components in green gram. *Indian Journal of Genetics* **30** 212-221.

Mahalanobis PC (1936). On the generalized distance in statistics. *Proceedings National Academy of Science* India **2**49-55.

Ramanujam S, Tiwari AS and Mehra RV (1974). Genetic divergence and hybrid performance in mungbean. *Theoretical and Applied Genetics* **45** 212-214.

Rao GR, Rao YK and Rao CHM (2006). Genetic divergence in mungbean. *Indian Journal of Pulses Research* **19**(1) 61-63.

Reddy KHP (1997). Genetic divergence in green gram [*Vigna radiata* (L.) Wilczek]. *Annals Agriculture Research* **18**(4) 554-555.

Sharma RN and Talukdar P (1996). Causal relationship in micromutants of mungbean [*Vigna radiata* (L.) Wilczek]. *Annals Agriculture Research* **17**(1) 38-41.

Singh RK and Chaudhary BD (1979). Biometrical methods in quantitative genetic analysis. Kalyani Publishers New Delhi.

Vikas, Paroda RS and Singh SP (1998). Genetic variability in mungbean [*Vigna radiata* (L.) Wilczek] over environments in kharif season. *Annals Agriculture Biology Research* **3**(2) 311-315.
Reddy DM, Rao YK, Murthy SNS and Reddy MV (2004). Genetic variability and divergence in mungbean. *Indian Journal of Pulses Research* **17**(1) 77-79.
Pundir SR, Singh VP and Gupta KR (1992). Genetic variability for some quantitative traits in mungbean [*Vigna radiata* (L.) Wilczek]. *Haryana Agriculture University Journal Research* **22**(2) 109-112.
Murty BR and Arunachalam V (1966). The nature and divergence in relation to breeding system in some crop plants. *Indian Journal of Genetics* **26** 188-198.
Henry A and Mathur BK (2007). Correlation path coefficient analysis and varietal diversity in green gram. *Journal of Arid Legumes* **4**(1) 43-46.
Henry A and Mathur BK (2007). Correlation path coefficient analysis and varietal diversity in green gram. *Journal of Arid Legumes* **4(**1) 43-46.