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Genetic divergence in mungbean

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ABSTRACT

Sixty genotypes of mungbean (*Vigna radiata* L. Wilczek) were evaluated for 13 characters to assess genetic variability, heritability, correlation, genetic advance and genetic diversity. Total dry matter, plant height, number of pods per plant and yield per plant exhibited high variability and heritability coupled with genetic advance indicating the influence of additive gene action. Correlation studies indicated that the total dry matter, number of pods per plant, number of clusters per plant, number of branches per plant and days to 50% flowering were positive and significantly associated with seed yield. Total dry matter and number of pods per plant had direct positive effect on seed yield while plant height had negative effect. The results of multivariate analysis indicated the presence of considerable genetic divergence among the genotypes studied. The genotypes were grouped into eight clusters. Days to maturity, 100-seed weight, number of pods per plant and total dry matter contributed maximum towards diversity. Crosses can be effective between the genotypes of cluster V and VII followed by cluster I and VII where the maximum inter-cluster distance was exhibited for getting desirable segregants.

Key words: Correlation, Genetic divergence, Heritability, Mungbean, Path analysis, *Vigna radiata*

Mungbean (*Vigna radiata* L. Wilczek) is one of the widely grown short duration grain legumes in India fitting well in all cropping systems. It is grown as *Kharif* (both as sole and intercrop), *rabi* and summer crops in Andhra Pradesh. The genetic variability present in the base population for desired characters plays a vital role in development of new varieties (7). As the variability present in the cultivated mungbean lines is less, the identification of divergent parents is essential. Hence, the present study on variability, heritability, correlation and genetic divergence in mungbean germplasm lines was attempted.

MATERIALS AND METHODS

The experimental material consisted of 60 exotic and indigenous mungbean germplasm lines grown in a randomized block design with two replications during *rabi* 2000 at Regional Agricultural Research Station, Lam, Guntur. Each genotype was sown in a two-row plot of 4 m long with inter and intra row spacings of 30 x 10 cm. Observations were recorded on five randomly selected plants for each genotype in two replications for days to 50% flowering, days to maturity, plant height, number of branches per plant, number of clusters per plant, number of pods per plant, pod length, number of seeds per pod, total dry matter per plant, 100-seed weight, harvest index, seed yield and protein content. Different genetic parameters such as variability, heritability and expected genetic advance were estimated following Johnson *et al.* (3). Character association and path co-efficient analysis were carried out as per the procedure of Dewey and Lu (2). The data were subjected to multivariate analysis as suggested by Mahalanobis (4) and genotypes were grouped into different clusters following Tocher's method as described by Rao (6).

RESULTS AND DISCUSSION

The range, coefficient of variation, heritability in broad sense and genetic advance for yield and its components are

Table 1. Estimates of genetic parameters for yield and its components in mungbean

Character	Range		Mean	GCV	PCV	h^2b	GA
	Max	Min					
Days to 50% flowering	42.50	25.50	33.17	9.04	9.19	96.7	6.07
Days to maturity	83.50	56.50	65.25	7.37	7.44	98.1	9.86
Plant height (cm)	62.15	22.16	41.17	16.00	16.27	96.6	13.34
Number of branches per plant	5.00	0.40	2.31	41.52	43.28	93.4	1.93
Number of clusters per plant	12.20	5.00	7.58	17.44	25.13	48.2	1.89
Number of pods per plant	64.75	15.64	28.78	34.66	36.69	89.2	19.42
Pod length (cm)	9.70	5.60	7.05	10.66	11.19	90.7	1.48
Number of seeds per pod	12.40	5.00	10.28	12.04	12.43	93.9	2.47
100-seed weight (g)	5.30	2.95	4.08	13.16	13.42	96.2	1.09
Seed yield per plant (g)	24.17	6.11	12.18	36.65	39.22	87.3	8.54
Total dry matter per plant (g)	73.32	13.74	35.39	37.18	38.12	95.1	26.45
Harvest index (%)	40.72	25.69	34.07	4.80	9.15	27.5	1.77
Protein content (%)	25.75	21.31	22.80	1.24	5.19	5.70	0.14

PCV: Phenotypic coefficient of variation, GCV: Genotypic coefficient of variation,
h^2b: Heritability in broad sense, GA : Genetic advance

Table 2. Phenotypic correlations among yield and yield components in mungbean

Character	Days to 50% flowering	Days to maturity	Plant height (cm)	Branches per plant	Clusters per plant	Pods per plant	Pod length (cm)	Number of seeds per pod	100-seed weight (g)	Yield per plant (g)	Total dry matter per plant	Harvest index (%)	Protein content (%)
Days to 50% flowering	1.000	0.860**	0.165.	0.316**	0.237**	0.306**	-0.008	0.115	-0.357	0.236**	0.283**	-0.061	0.007
Days to maturity		1.000	0.228*	0.270**	0.207*	0.257**	0.004	0.167	-0.302	0.215*	0.278**	-0.088	0.022
Plant height (cm)			1.000	-0.045	0.082	-0.085	0.178	0.020	0.036	-0.069	-0.042	-0.049	0.068
Number of branches/plant				1.000	0.471**	0.513**	0.147	0.033	-0.269	0.417**	0.417**	0.045	-0.074
Number of clusters per plant					1.000	0.724**	-0.032	0.112	-0.133	0.683**	0.549**	0.498**	0.072
Number of pods per plant						1.000	0.126	0.120	-0.163	0.907**	0.841**	0.365**	0.047
Pod length (cm)							1.000	0.224*	0.272**	0.248**	0.282**	-0.031	-0.132
Number of seeds per pod								1.000	0.145	0.402**	0.451**	-0.016	-0.066
100-seed weight (g)									1.000	0.167	0.109	0.199*	-0.106
Seed yield per plant (g)										1.000	0.933**	0.390**	0.000
Total dry matter per plant											1.000	0.058	-0.036
Harvest index (%)												1.000	0.126
Protein content													1.000

* and ** Significant at 5 and 1% levels

Table 3. Direct (diagonal) and indirect effects of yield and its components in mungbean

Character	Days to 50% flowering	Days to maturity	Plant height (cm)	Branches per plant	Clusters per plant	Pods per plant	Pod length (cm)	Number of seeds per pod	100-seed weight (g)	Total dry matter per plant	Harvest index (%)	Protein content
Days to 50% flowering	**0.0188**	0.0166	0.0033	0.0063	0.0053	0.0060	-0.0002	0.0021	-0.0069	0.0055	-0.0024	-0.0001
Days to maturity	-0.0060	**-0.0868**	-0.0017	-0.0019	-0.0018	-0.0019	-0.0001	-0.0012	0.0022	-0.0020	0.0009	-0.0003
Plant height (cm)	-0.0038	-0.0054	**-0.0217**	0.0009	-0.0009	0.0028	-0.0043	-0.0004	-0.0010	0.0011	0.0043	0.0013
Number of branches per plant	0.0024	0.0020	-0.0003	**0.0070**	0.0043	0.0039	0.0011	0.003	-0.0021	0.0031	0.0003	-0.0003
Number of clusters per plant	0.0125	0.0118	0.0019	0.0273	**0.0447**	0.0317	0.0001	0.0059	-0.0090	0.0274	0.0109	-0.0022
Number of pods per plant	0.1275	0.1115	-0.0514	0.2238	0.2849	**0.4014**	0.0656	0.0484	-0.0759	0.3498	0.0993	-0.0101
Pod length (cm)	-0.0001	0.0001	0.0015	0.0011	0.0000	0.0012	**0.0073**	0.0017	0.0022	0.0023	0.0000	-0.0010
Number of seeds per pod	0.0122	0.0195	0.0022	0.0043	0.0146	0.0133	0.0263	**0.1101**	0.0170	0.0501	-0.0064	-0.0136
100 seed weight (g)	-0.0544	-0.0471	0.0071	0.0435	-0.0289	-0.0280	0.0443	0.0228	**0.1481**	0.0142	0.0437	-0.0158
Total dry matter per plant	0.1488	0.1457	-0.0263	0.2257	0.3109	0.4419	0.1604	0.2308	0.0487	**0.5070**	0.0282	-0.0303
Harvest index (%)	-0.0149	-0.0164	-0.0232	0.0042	0.0289	0.0293	0.0004	-0.0068	0.0349	0.0066	**0.1183**	-0.0028
Protein content	0.0000	-0.0002	0.0003	0.0002	0.0002	0.0001	0.0006	0.0005	0.0005	0.0003	0.0001	**-0.0043**
r_{iy}	0.2340	0.2314	-0.1083	0.4554	0.6611	0.9016	0.3014	0.4142	0.1585	0.9655	0.2972	-0.0794

Residual effect = 0.0607

presented in Table 1. The genotype Lam M 2 was found very late in flowering (42 days) and maturity (84 days) with tall plant habit (62.15 cm) while M 1450 recorded maximum number of pods per plant (64.75), seed yield per plant (24.17 g) and total dry matter per plant (73.32 g). The earliest flowering genotype (25.50 days) was UPM 98-1. The genotypic and phenotypic coefficients of variation were higher for number of branches per plant, seed yield per plant and number of pods per plant, indicating considerable variation in these traits. The effect of environment was found to be low for all other traits except for number of clusters per plant.

The heritability was high for all the characters studied except for number of clusters per plant, harvest index and protein content. Traits like plant height, total dry matter per plant and number of pods per plant showed high heritability with high genetic advance. This indicates that selection would be effective for these traits even in early generation. These results are in accordance with findings of Yadav *et al.* (8). Therefore, direct selection for these characters would be effective (5).

The associations between seed yield and all other characters except plant height, 100-seed weight and protein content were positive and highly significant (Table 2). The highest association of seed yield was with total dry matter (0.933**) followed by number of pods per plant (0.907**). These results are in accordance with the findings of Sandhu *et al.* (7). However, seed yield per plant recorded negative correlation with plant height which was also reported by Ahuja and Chaudhary (1).

The direct and indirect effects of yield and its components are presented in Table 3. Traits like total dry matter per plant, number of pods per plant and 100-seed weight exhibited high direct effects on seed yield. The positive indirect effect of total dry matter on seed yield was through pods per plant indicating that these traits should be taken into account while formulating breeding strategies of mungbean. The residual effect was very low (0.0607) indicating that the characters selected for the study were appropriate.

The multivariate analysis of 60 genotypes grouped them into eight clusters (Table 4). The clusters I and IV had 14 genotypes each, cluster VII one genotype (Lam M2) and cluster VIII three genotypes (M 501, M 638, M 1450). The pattern of distribution of genotypes from different eco-geographical regions into eight clusters was at Random indicating that geographical diversity and genetic diversity were not related. The maximum inter-cluster distance (1588.34) was found between cluster V and cluster VII (Table 5). The cluster V included genotypes which flowered and matured early. The cluster VII comprised one genotype (Lam M2) which was late in flowering and maturity. It was noted that cluster VIII possessed genotypes with more number of pods, high seed yield and high total dry matter. Crosses can be effective between the genotypes of cluster V and VII followed by clusters I and VII for obtaining desirable and useful segregants.

Table 4. Distribution of 60 genotypes of mungbean into different clusters

Cluster	No. of genotypes	Genotypes
I	15	AKM 92401, Sipai, HUM 1, ML 803, PDM 139, K 851, M 1319B, LGG 460, Ganga 8, PS 16, Pusa Baisaki, LGG 446, Pusa 102, ML 955
II	3	BDYR 3, TM 99-15, UPM 79-3-4
III	8	AKM 9243, Pusa 105, Pusa Bold, M 1643, Pusa 9072, TM 96-2, M 1218, Pusa Visal
IV	14	LGG 407, LGG 450, LGG 444, WGG 37, VGG 14, LGG 521, MGG 347, Neelalu, M 1475, ML 613, TARM 1, ML 267, ML 33, PDM 54
V	9	Basanti, BDYR 1, BDYR 4, NM 1, VC 6173A, NM 92, VC 3960-88, UPM 98-1, VD 6370
VI	7	WGG 2, LGG 410, CO 4, LGG 456, M 59, LGG 494, LGG 489
VII	1	Lam M2
VIII	3	M 501, M 638, M 1450

Table 5. Intra and inter cluster (D^2) values in mungbean

Cluster	I	II	III	IV	V	VI	VII	VIII
I	**66.08**	135.93	223.59	193.04	176.46	373.03	1122.92	823.12
II		**36.31**	301.96	232.83	282.03	320.33	907.15	980.94
III			**172.52**	274.29	388.72	288.93	957.46	446.05
IV				**184.19**	435.76	283.45	816.07	723.07
V					**103.53**	678.28	1588.34	1066.02
VI						**174.39**	417.303	492.84
VII							**0**	920.51
VIII								**212.58**

LITERATURE CITED

1. Ahuja, S.L. Chowdhury, R.K. 1991. Correlation and path coefficient analysis in greengram. *Agricultural Science Digest* **11**: 223-226.
2. Dewey, D.R. and Lu, K.H. 1959. A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agronomy Journal* 51(9): 515-518.
3. Johnson, H.W., Robinson, H.F. and Comstock, R.E. 1955. Estimates of genetic and environmental variability in soybean. *Agronomy Journal* **47**: 314-318.
4. Mahalanobis, P.C. 1936. On the generalized distance in statistic. Proceedings of *National Institute of Science* (Indian) **2**: 49-55.
5. Panse, V.G. 1957. Genetics of quantitative characters in relation to plant breeding. *Indian Journal of Genetics and Plant Breeding* **17**: 318-328.
6. Rao, C.R. 1952. *Advanced Statistical Methods in Biometrical Research*. John Wiley and sons, New York, pp. 390-395.
7. Sandhu, T.S., Singh, K. and Singh, B. 1988. Mungbean germplasm resources: Evaluation and utilization. Proceedings, the Second International Symposium on Mungbean, AVRDC, Taiwan. Pp 29-34.
8. Yadav, G.C., Singh, P.K., Singh, B.B. and Ritu Verma. 2001. Genetic variability and path coefficients in urdbean. *Indian Journal of Pulses Research* **14**: 143-144.