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COMPONENT TRAITS INFLUENCING SEED YIELD IN SOME INDIGENOUS AND EXOTIC LINES OF MUNGBEAN

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Abstract

Among the pulse crops grown in India, mungbean (*Vigna radiata* L.) is third most widely cultivated crop. It has wider adaptability and can be grown around the year. For the development of genotypes having high productivity, there is a need to identify parents with desired characters. Generally, the germplasm lines from different eco-geographic regions result in greater amount of variability when hybridized. Hence, the present study was carried out to assess the variability for different characters of economic importance in diverse germplasm lines from different parts of India and AVRDC, Taiwan. Wide range of variability for all the characters studied was present. Promising genotypes for different traits were identified. Plant height, seeds per pod and pods per plant had positive correlation with seed yield. Heritability estimate was maximum for 100-seed weight followed by seed yield per plot and days to maturity. However in mungbean the bold seed size cultivars have shown higher yield potential to work out the optimum limit of seed size, the lines were categorized into two groups according to third seed size *viz.*, Group I (100-seed weight < 3.75 g) and Group II (100 seed weight > 3.75 g). No correlation was observed 100-seed weight and seed yield in both the groups. Path analysis revealed the maximum direct effect of plant height on seed yield followed by pod length, days to maturity, seeds per pod and clusters per plant. The promising lines identified in the present study can be utilized in breeding programme and selection should be focused on plant height, pod length, pods per plant and seeds per pod for development high yielding mungbean genotypes.

Key words : Mungbean, path analysis, seed yield and 100- seed weight.

Introduction

In India, among the pulse crops, mungbean [*Vigna radiata* (L.) Wilczek] is the third most widely cultivated crop. It has wider adaptability and can be grown around the year. In North India, it is being grown in spring/summer and *kharif* seasons and in South India, it is also grown in *rabi* season. During the past few decades inspite of the efforts, the productivity of mungbean remains to be on the lower side. For the development of genotypes having high productivity, there is need to identify parents with desired characters. Such parents can be utilized in hybridization programme to isolate an ideal genotype. Generally, the germplasm lines from different eco-geographic regions results in greater amount of variability when hybridized. The seed size in seed legumes, in general, had negative correlation with seed yield.

However in mungbean the bold seed size cultivars have shown higher yield potential (Brar *et al.*, 2004). It is yet to be proved that up to what limit the seed size can be increased. Hence, the present study was carried out to assess the variability among germplasm lines for different characters of economic importance and to study the association of different characters with seed yield for indirect selection.

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Materials and Methods

The experimental material consisted of 69 elite genotypes collected from different parts of India and AVRDC, Taiwan. These genotypes were evaluated in randomized block design with two replications at experimental area of Punjab Agricultural University, Ludhiana (Punjab), India during *kharif*, 2013. Each plot consisted of two rows of 4 m length spaced at 30 cm and plant to plant spacing was 10 cm. Recommended packages of practices were followed to raise healthy crop. Data were recorded on five randomly selected plants with respect to plant height (cm), clusters per plant, pods

Table 1 : Mean, range, variability, heritability and genetic advance estimates in mungbean germplasm.

S. no.	Character	Mean	Range	GCV	PCV	H^2(%)	GA	GA as % of mean
1.	Days to 50% flowering	36.90	31.0 - 51.0	6.27	10.48	35.83	2.85	7.73
2.	Days to maturity	67.74	62.0 -72.50	3.62	4.32	70.15	4.23	6.24
3.	Plant height (cm)	78.52	46.80 - 99.30	12.18	16.80	52.62	14.30	18.21
4.	Clusters per plant	11.8	6.30 - 25.0	22.96	34.08	45.39	3.76	31.87
5.	Pods per plant	28.68	13.95 - 57.30	27.82	36.36	58.53	12.57	43.84
6.	Pod length(cm)	7.97	6.15 - 9.60	8.40	14.75	32.39	0.78	9.84
7.	Seeds per pod	10.06	7.40 - 12.50	8.96	17.29	26.87	0.96	9.57
8.	100-seed weight (g)	3.82	2.35 - 4.95	16.99	17.95	89.64	1.27	33.14
9.	Seed yield per plot (g)	271.09	35 - 460	33.67	36.84	83.55	171.87	63.40

Table 2 : Genotypic (G) and phenotypic (P) correlation coefficients in mungbean.

S. no.	Characters		Days to maturity	Plant height	Clusters per plant	Pods per plant	Pod length	Seeds per pod	100-seed weight	Seed yield per plot
1.	Days to 50% flowering	G	0.93	-0.05	0.15	0.09	-0.82	0.06	-0.69	-0.20
		P	0.67**	-0.02	0.05	0.04	-0.28**	-0.09	-0.37**	-0.09
2.	Days to maturity	G		0.03	-0.01	0.08	-0.51	-0.23	-0.63	-0.02
		P		0.06	0.09	0.14	-0.27**	-0.06	-0.47**	-0.00
3.	Plant height (cm)	G			-0.04	0.19	-0.41	0.86	-0.34	0.58
		P			0.11	0.15	-0.17*	0.29**	-0.21**	0.39**
4.	Clusters per plant	G				0.92	0.02	0.09	-0.28	0.14
		P				0.84**	-0.05	0.16	-0.19*	0.14
5.	Pods per plant	G					0.05	0.21	-0.27	0.35
		P					-0.06	0.24**	-0.22**	0.27**
6.	Pod length (cm)	G						0.33	0.82	0.24
		P						0.00	0.47**	0.09
7.	Seeds per pod	G							0.00	0.84
		P							-0.04	0.35**
8.	100-seed weight (g)	G								0.05
		P								0.02

*, ** : Significant at 5 and 1%, respectively.

per plant, pod length (cm), seeds per pod and 100-seed weight (g). The data on days to flowering, days to maturity and seed yield (g) were recorded on plot basis. The data, thus generated were subjected to standard statistical procedures to estimate mean, range, coefficients of variation, heritability and genetic advance. The correlation and path analysis were done following the methodology of Al-Jibouri *et al*. (1958) and Dewey and Lu (1959), respectively. To work out the optimum limit of seed size, the lines were categorized into two groups according to their seed size, *viz.* Group I (100-seed weight < 3.75 g) and Group II (100 seed-weight > 3.75 g) to workout the correlations of seed weight with seed yield and other traits.

Results and Discussion

The analysis of variance revealed significant differences among the genotypes for all the traits under consideration. The mean values and estimates of different parameters of variability are given in table 1. All the characters showed wide range of variation. Maximum genotypic coefficient of variation (GCV) was observed for seed yield (33.67) followed by pods per plant (27.82), clusters per plant (22.96) and 100-seed weight (16.99).

Table 3 : Phenotypic correlation coefficients in mungbean genotypes with 100-seed weight <3.75 g (Group-I) and 100-seed weight >3.75 g (Group-II).

S. no.	Characters		Days to maturity	Plant height	Clusters per plant	Pods per plant	Pod length	Seeds per pod	100-seed weight	Seed yield per plot
1.	Days to 50% flowering	G-I	0.88**	-0.28*	0.10	0.02	-0.03	-0.27*	-0.26*	-0.08
		G-II	0.43**	-0.06	-0.06	-0.06	-0.12	-0.06	-0.03	-0.01
2.	Days to maturity	G-I		-0.20	0.13	0.01	-0.05	-0.25	-0.28*	-0.05
		G-II		0.06	-0.04	0.14	0.00	0.06	0.25*	-0.09
3.	Plant height (cm)	G-I			-0.02	0.03	-0.06	0.29*	0.36**	0.19
		G-II			0.16	0.22	-0.07	0.33**	0.50**	-0.29*
4.	Cluster per plant	G-I				0.81**	-0.06	0.16	0.26*	-0.22
		G-II				0.86**	0.04	0.16	0.08	-0.10
5.	Pods per plant	G-I					-0.02	0.28*	0.39**	-0.15
		G-II					0.03	0.20	0.21	-0.20
6.	Pod length (cm)	G-I						-0.08	0.18	0.01
		G-II						0.10	0.05	0.30*
7.	Seeds per pod	G-I							0.26*	-0.12
		G-II							0.42**	0.09
8.	100-seed weight (g)	G-I								0.08
		G-II								-0.06

*, ** : Significant at 5 and 1percent level, respectively.

High estimates of variability for pods per plant and seed yield were also reported by Ranga Rao *et al*. (2006). Plant height, pod length and seeds per pod depicted medium estimates, while days to flowering and days to maturity recorded low estimates of GCV. The phenotypic coefficients of variation (PCV) were higher than their corresponding GCV values, though the trend was similar for all the traits indicating the effect of environment on the expression of characters. Heritability estimate was maximum for 100-seed weight (89.64%) followed by seed yield per plot (83.55%) and days to maturity (70.15%). Pods per plant and plant height recorded medium heritability, while clusters per plant, days to 50% flowering, pod length and seeds per pod had low estimates of heritability. High estimates of heritability for 100-seed weight, days to maturity and seed yield were also reported by Singh (2005) and Rahim *et al*. (2010). Genetic advance (GA) expressed as per cent of mean was maximum for seed yield followed by pods per plant, 100-seed weight and clusters per plant. High heritability coupled with high genetic advance as per cent of mean for seed yield and 100-seed weight indicated the importance of additive gene action controlling these characters.

Genotypic and phenotypic correlation coefficients are given in table 2. At phenotypic level, seed yield per plot had significant positive correlation with plant height, seeds per pod and pods per plant. Days to flowering had significant positive correlation with days to maturity. Days to flowering and maturity had significantly negative association with 100-seed weight and pod length. It suggests that for deriving bold seeded genotypes with longer pods the selection should be done for relatively early flowering and early maturing genotypes. Plant height was positively correlated with seeds per pod but negatively with 100-seed weight. Pods per plant had positive correlation with seeds per pod but had negative association with 100-seed weight. Pod length had significant positive correlation with 100-seed weight suggesting that indirect selection can be done for 100-seed weight visually on the basis of pod length.

At genotypic level seed yield had high positive correlation with plant height, pods per plant, pod length and seeds per pod. In general, the genotypic correlations showed similar trends to that of phenotypic correlations and were higher than the respective phenotypic correlation coefficients indicating strong genetic association between characters and effect of environment on the expression

Table 4 : Direct (in bold) and indirect effects of different traits on seed yield in mungbean.

S. no.	Characters	Days to 50% flowering	Days to maturity	Plant height	Clusters per plant	Pods per plant	Pod length	Seeds per pod	100-seed weight	Correlation with seed yield per plot
1.	Days to 50% flowering	**-0.086**	0.358	-0.031	0.024	0.001	-0.429	0.012	-0.054	-0.204
2.	Days to maturity	-0.070	**0.388**	0.023	-0.002	0.002	-0.267	-0.039	-0.049	-0.025
3.	Plant height (cm)	0.004	0.013	**0.669**	-007	0.003	-0.217	0.145	-0.026	0.585
4.	Clusters per plant	-0.013	-0.005	-0.029	**0.161**	0.017	0.012	0.017	-0.022	0.137
5.	Pods per plant	-0.008	0.033	0.124	0.148	**0.018**	0.024	0.036	-0.021	0.353
6.	Pod length (cm)	0.071	-0.198	-0.278	0.004	0.001	**0.523**	0.055	0.064	0.242
7.	Seeds per pod	-0.005	-0.091	0.577	0.016	0.004	0.172	**0.169**	0.000	0.842
8.	100-seed weight (g)	0.059	-0.244	-0.227	-0.045	-0.005	0.428	0.001	**0.078**	0.045

Residual effect = 0.299

of different traits. Positive association of pods per plant and pod length (Gupta *et al*., 2005 and Hakim, 2008) with yield was also reported earlier.

The correlations were also worked out by making two groups of these genotypes according to their seed size *i.e*. Group I (100-seed weight < 3.75 g) and Group II (100-seed weight > 3.75 g). No correlation was observed between 100-seed weight and seed yield in both the groups (table 3). In group II, plant height showed significant negative correlation, whereas pod length showed significant positive correlation with seed yield. This means in bold seeded types, selection should be made for relatively medium to dwarf genotypes having longer pods. For all other characters there was hardly any difference in correlations with seed yield. Days to flowering showed negative correlations with plant height, seeds per pod and 100-seed weight in group I but these correlations were non-significant in group II. Days to maturity had a negative correlation with seeds per pod and 100-seed weight in group I and a positive correlation with 100-seed weight in group II. This suggests that for deriving genotypes with bold seeds, selection for late maturity is desirable.

Clusters per plant in group I had significant correlation with 100-seed weight but this correlation was non-significant in group II. These results indicate that selection can be made for clusters per plant in medium seed size genotypes. The correlation of pods per plant with seeds per pod and 100-seed weight was positive in group I but non-significant in group II, suggesting that simultaneous selection can be made for these traits for improving seed yield in medium seeded genotypes. Seeds per pod showed a significant positive correlation with 100-seed weight indicates that genotypes with more seeds per pod are bold seeded.

Path coefficient analysis (table 4) revealed that plant height exerted maximum direct effect (0.669) on seed yield followed by pod length (0.523), days to maturity (0.388), seeds per pod (0.169) and clusters per plant (0.161). Positive direct effect of days to maturity (Gupta *et al*., 2005) and clusters per plant and days to maturity on seed yield (Kumar *et al*., 2010; Mittal *et al*., 2007) was also reported earlier. Plant height had indirect positive effect via seeds per pod but negative effect via pod length on seed yield. Pod length had negative indirect effect through days to maturity and plant height on seed yield. This may be the reason of low value of correlation of pod length with seed yield. Seeds per pod had positive indirect effects on seed yield through plant height and pod length. This may be the reason of high correlation coefficient of seeds per pod with seed yield.

On the basis of correlation and path analysis, the traits plant height, pods per plant, pod length and seeds per pod were identified as important yield contributing traits. These characters should be considered during selection programme for developing and deriving high yielding genotypes in mungbean.

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