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Association Analysis for Certain Plant Characteristics in Some Local and Exotic Strains of Mungbean (*Vigna radiata* L.)

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Abstract: Study regarding correlation and path coefficient in 20 local and exotic genotypes of mungbean (*Vigna radiata* L.) were undertaken to establish important traits contributing towards grain yield. Observation were taken on plant height, days to flowering, number of branches per plant, number of pods per plant, number of seeds per pod, 100-grains weight, biological yield per plant, harvest index and grain yield per plant. The results indicated that all the characters under study were positively associated with grain yield. Number of pods per plant, number of seeds per pod, biological yield per plant and harvest index showed highly significant association with grain yield, while correlation between number of branches per plant and grain yield was significant. Harvest index had maximum direct effect on grain yield followed by biological yield per plant. Direct effects of number of branches per plant, number of pods per plant and number of seeds per pod on grain yield were very small but greater indirect effects via harvest index and biological yield resulted in highly significant correlation with grain yield. Biological yield and harvest index may be exploited in selecting high yielding cultivars in mungbean.

Key words: Association analysis, mungbean, *Vigna radiata*, correlation, interrelationship, path analysis, selection criteria, yield components

Introduction

As grain yield in mungbean is a function of several yield components, it may be more efficient to select plants on the basis of contributing characters rather than yield itself. Correlation coefficient analysis is a handy technique, which elaborates the degree and extent of relationship among important plant characters. It provides a realistic basis for allocation of weightage to each of the contributing components in deciding upon a suitable selection criteria for the genetic improvement of complex character like yield (Rehman *et al.*, 1998). Dewey and Lu (1959) demonstrated the validity of path analysis in effective plant selection that results in selection of desirable genotypes. Yield contributing characters like number of clusters per plants, 1000 grain weight, pods per plant and number of seeds per pod qualify as the indices for selection of genotypes in breeding programme of mungbean (Zubair and Srinives, 1986).

Number of pods per plant and biological yield were considered very important for more grain yield by Ghafoor *et al.* (1990) and Ali and Tufail (1991). Highest positive direct effects of number of pods per plant and number of seeds per pod towards grain yield per plant were reported by Ram *et al.* (1997). Number of clusters had maximum effect on seed yield followed by days to flowering and number of pods per plant (Yaqoob *et al.*, 1997). Rehman *et al.* (1998) strongly recommended harvest index as selection criterion for maximum grain yield in mungbean. The tall varieties may produce high grain yield (Niazi *et al.*, 1999). Sharma (1999) reported number of seeds per plant as major yield contributing character.

The main objective of this research work was to assess the interrelationship among various plant traits and to partition the genotypic correlation into its direct and indirect effects so that appropriate weightage can be given to each character at the time of section.

Materials and Methods

The research was conducted at National Agricultural Research Center, Islamabad during kharif, 2000. The study was undertaken to ascertain the character association in mungbean and the role of different attributes towards yield, either directly or indirectly. Twenty genotypes of mungbean (*Vigna radiata* L.), having local and exotic origin, were grown in a randomized complete block design. Six rows of 5 m length were planted in each plot by keeping 30 and 10 cm^2 spacings between and within rows, respectively. All cultural practices were followed according to the recommendations. At maturity, data were recorded on plant height (cm), number of branches per plant, number of pods per plant, number of seeds per pod, grain yield per plant(g), 100-grains weight (g), biological yield per plant (g) and harvest index (%) on ten competitive plants selected randomly from four middle rows. Days to flowering were recorded on plot basis. The data recorded on all the characters were statistically analyzed for the variance and covariance using the method given by Steel and Torrie (1980). Phenotypic and genotypic correlation coefficients were calculated utilizing the procedure described by Kwon and Torrie (1964). Path coefficient analysis was performed according to the method explained by Dewey and Lu (1959) by solving simultaneous equations using genotypic correlations.

Results and Discussion

The analysis of mean squares revealed highly significant ($p < 0.01$) differences for all characters under study except for 100-grain weight, where the difference was significant at $p < 0.05$ (Table 1). Phenotypic and genotypic correlation coefficients between yield and its components and among the components themselves were computed. The correlation coefficients of grain yield was positive with all the characters (Table 2). It was highly significant with harvest index, biological yield, number of seeds per pod and number of pods per plant; and significant with number of branches per plant. Similar results were reported in mungbean by Ghafoor *et al.* (1990). Plant height had positive and significant correlation with number of branches and biological yield. Ammanullah and Hatam (2000) also observed positive but non-significant correlations between these characters. Number of branches showed highly significant and positive association with number of seeds per plant, while positive and significant with biological yield and days to flowering. Significant and positive association of number of branches with number of seeds per plant was also shown by Ali and Tufail (1991). Days to flowering were positively and highly significantly correlated with biological yield. Association of days to flowering was positive and significant with 100-grains weight. The results get support from the findings of Iqbal (1988). Number of pods per plant had highly significant positive correlation with biological yield per plant and harvest index. Ghafoor *et al.* (1990) also reported positive and highly significant correlation between number of pods per plant and biological yield per plant.

The picture became more refined when genotypic correlation coefficients were partitioned into direct and indirect effects by path analysis (Table 3). Harvest index had maximum direct effect on grain yield followed by biological yield per plant. The results are in close agreement with those of Ghafoor *et al.* (1990) and Yaqoob *et al.* (1997). Direct effects of number of pods per plant and number of seeds per pod on grain yield were very small but great

Table 1: Analysis of variance for different characters in mungbean (mean squares)

Source of variance	Df	Plant height (cm)	Number of branches per plant	Days to flowering	Number of pods per plant	Number of seeds per pod	Grain yield per plant (g)	100-grains weight (g)	Biological yield per plant (g)	Harvest index (%)
Treatments	19	144.39**	1.73**	12.35**	8.15**	1.29**	1.17**	0.54*	6.69**	76.32**
Replications	2	5.00	0.14	0.87	0.44	1.00*	0.19	0.11	0.15	24.03
Error	38	6.54	0.07	1.85	1.46	0.28	0.13	0.23	1.66	16.13

Table 2: Genotypic (G) and phenotypic (P) correlation among yield and yield components of mungbean

Source of variance	Number of branches per plant	Days to flowering	Number of pods per plant	Number of seeds per pod	100-grains weight (g)	Biological yield per plant (g)	Harvest index (%)	Grain yield per plant (g)
Plant height	(G) 0.467*	(G) 0.228	(G) 0.180	(G) –0.049	(G) –0.242	(G) 0.527*	(G)–0.283	(G) 0.080
(cm)	(P) 0.426	(P) 0.210	(P) 0.178	(P) –0.001	(P) -0.162	(P) 0.363	(P)–0.170	(P) 0.115
No. of branches		(G) 0.556*	(G) 0.321	(G) 0.572**	(G) 0.280	(G) 0.555*	(G) 0.222	(G) 0.513*
per plant		(P) 0.378	(P) 0.290	(P) 0.454*	(P) 0.042	(P) 0.356	(P) 0.148	(P) 0.411
Days to flowering			(G) 0.380	(G) 0.395	(G) 0.492*	(G) 0.710**	(G)–0.090	(G) 0.339
			(P) 0.187	(P) 0.295	(P) 0.104	(P) 0.460	(P) 0.032	(P) 0.315
No. of pods per plant				(G) 0.324	(G) 0.242	(G) 0.654**	(G) 0.600**	(G) 0.853**
				(P) 0.281	(P) –0.160	(P) 0.575**	(P) 0.329	(P) 0.720**
No. of seeds per pod					(G) 0.384	(G) 0.344	(G) 0.435	(G) 0.563**
					(P) 0.089	(P) 0.332	(P) 0.360	(P) 0.460*
100-grain weight (g)						(G) –0.129	(G) 0.238	(G) 0.071
						(P) -0.106	(P) 0.194	(P) 0.054
Biological yield per plant (g)							(G) 0.050	(G) 0.638**
							(P)–0.220	(P) 0.407
Harvest index (%)								(G) 0.801**
								(P) 0.692**

Table 3: Direct (highlighted) and indirect effects of different characters on grain yield per plant in mungbean (*Vigna radiata* L.) genotypes

Parameters	Plant height (cm)	No. of branches per plant	Days to flowering	No. of pods per plant	No. of seeds per pod	100-grains weight (g)	Biological yield per plant (g)	Harvest index (%)	Genotypic correlation with grain yield r(G)
Plant height (cm)	**-0.081**	0.037	-0.011	0.002	-0.002	0.015	0.312	-0.200	0.080
No. of branches per plant	-0.038	**0.078**	-0.026	0.003	0.027	-0.017	0.329	0.185	0.513*
Days to flowering	-0.018	0.044	**-0.047**	0.004	0.019	-0.030	0.420	-0.064	0.339
No. of pods per plant	-0.015	0.025	-0.018	**0.011**	0.015	0.015	0.387	0.424	0.853**
No. of seeds per pod	0.004	0.045	-0.019	0.003	**0.048**	-0.023	0.204	0.308	0.563**
100-grain weight (g)	0.020	0.022	-0.023	-0.003	0.018	**-0.061**	-0.076	0.168	0.071
Biological yield per plant (g)	-0.043	0.043	-0.034	0.007	0.016	0.008	**0.592**	0.035	0.638**
Harvest index (%)	0.022	0.017	0.004	0.006	0.021	-0.014	0.029	**0.708**	0.801**

* : $p < 0.05$ ** : $p < 0.01$

indirect effects via harvest index and biological yield resulted in their highly significant correlation with grain yield. The results are in harmony with those of Zubair and Srinives (1986). Similarly in case of number of branches per plant, credit of significant correlation goes to indirect effects via harvest index and biological yield because direct effect of this character was meager. Plant height, days to flowering and 100-grain weight had negative direct effect on grain yield. However, greater positive indirect effect via biological yield in case of plant height and days to flowering had converted the correlation coefficient into positive. Results deviated from that of Yaqoob *et al.* (1997). 100-grain weight also contributed positively through harvest index making the correlation with grain yield positive.

All the above facts indicate clearly and emphatically that biological yield and harvest index should be given maximum importance with close consideration of number of pods per plant, number of seeds per pod and number of branches per plant during the selection procedure aimed at improvement of mungbean crop.

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