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CORRELATION AND PATH COEFFICIENT ANALYSIS STUDIES IN MUNGBEAN *(VIGNA RADIATA (L.) WILCZEK*

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F_2 and their respective F_1 and parental generations of four mungbean crosses namely MG-50-10-A(G) x No.6601; MG-50-10-A(G) x No.15227; CES-59 x No.661 and PHLV-18 x ML-62 were studied to estimate phenotypic and genotypic association and direct and indirect influence of some commercially important characters on yield. Plant height was positively correlated with all the characters studied except seed weight. Positive association was found between number of branches per plant and number of pods per plant, number of seeds per pod and seed yield and in turn these characters were also positively interrelated. Seed weight was negatively associated with all the characters except number of seeds per pod. Path analysis showed that number of pods per plant and number of seeds per pod were the major components influencing the yield. In general genotypic correlations were found to be higher than the phenotypic correlations.

INTRODUCTION

Information regarding the association of phenotypic and genotypic variances and covariances in respect of quantitatively inherited attributes and their direct and indirect influences on yield may be useful as a tool for improving the efficiency of selection in segregating populations.

Gupta and Singh (1969) performed correlation studies on green gram and reported that number of pods and seed weight were the main components of yield, although number of branches exhibited simple positive correlation. Singh and Malhotra (1970) studied mungbean and reported that seed yield was positively associated with branches per plant, pod length and seeds per pod whereas pods per plant was the most important character determining yield. Aggarwal and Singh (1973) recorded significant and positive correlations between grain yield and number of pods per plant, number of seeds per pod whereas 100-seed weight was negatively correlated with number of pods per plant and number of seeds per pod.

Joshi and Kabaria (1973) reported that yield was positively and significantly correlated with number of pods per plant and number of seeds per pod. These characters also showed significant correlation between each other. Tomar *et.al* (1973) also indicated that yield was positively associated with pod number per plant, seed number per pod and 100-seed weight.

Malhotra *et.al* (1974) reported in green gram that yield was highly correlated with number of branches per plant, number of pods per plant and seeds per pod and these characters were also correlated among themselves. Ko and Chang (1975) studied different morphological characters in mungbean and reported that yield was highly significant and positively correlated with number of branches and number of pods while negative correlation was found between yield and 100-seed weight.

Aggarwal and Kang (1976) reported that the correlations of grain yield with pods per plant, 100-grain weight, plant height and number of branches were significant. They concluded that pods per plant could be used to select for higher yield. Bhaumik and Jha (1976) observed that the indirect effect of number of primary branches on seed yield was through the number of pods per plant whereas yield was negatively correlated with height both directly and indirectly.

The present investigation was undertaken to study the agronomic characters of commercial importance and their interrelationships in mungbean. An attempt was also made to estimate genotypic variance in the characters studied and the extent of genetic association among them from P_1, P_2, F_1 and F_2 data.

MATERIALS AND METHODS

The present investigations were carried out at the University of Agriculture, Faisalabad during summer, 1980. The experimental material consisted of parents, F_1 and F_2

populations of four mungbean crosses namely MG-50-10-A(G) x No.6601; MG-50-10-A(G) x No.15227; CES-59 x No.6601 and PHLV-18 x ML-62. The material was sown in rows, six meters long spaced at 60 cms. with plant spacing of 15 cms. Two, one and five rows were assigned to each parental, F_1 and F_2 generations. Two seeds per hill were dibbled on March 15, 1980 and were thinned to one plant per hill afterwards. Twenty equally spaced plants from each parent and the entire population of F_1 and F_2 generations were studied. Eight plants of each F_1 and 78, 144, 94 and 113 plants for F_2 generations of the four crosses were available for data recording on the following plant characters:

1. Plant height - measured in cms at maturity.
2. Number of branches per plant - counted at maturity.
3. Number of pods per plant.
4. Number of seeds per plant – Seeds from five randomly selected pods from each plant were counted and averaged.
5. Seed weight – Recorded in gs per 100 whole seeds from each plant harvested.
6. Yield – All plants were harvested and threshed individually and the air dried seed yield recorded in gs.

F_2 genotypic variance for each character was calculated by substracting the environmental variance from the total F_2 variance. Environmental variance for each character was calculated as the geometric mean of the parental and F_1 variances. Environmental and F_2 genotypic covariances for each pair of characters were also calculated in the same manner. The phenotypic and genotypic variances and the respective covariances so calculated were utilized for estimating phenotypic and genotypic association between the characters noted above. Average genotypic correlations of the four crosses were utilized for the sake of path analysis wherein the direct effects were computed by solution of simultaneous equations through elimination procedure.

RESULTS

Plant height was positively associated phenotypically as well as genotypically with number of branches per plant in the crosses MG-50-10-A(G) x No.6601, MG-50-10-A(G) x No.15227 and CES-59 x No.6601 whereas this relationship turned negative in cross PHLV-18 x ML-62 (Table 1). Similar results were obtained for plant height and seed yield. Positive relationships were observed between plant height and number of pods per plant and number of seeds per pod in all the four crosses. The results obtained between plant height and seed weight were more dynamic. Positive association was observed in the cross CES-59 x No.6601; negative in the cross MG-50-10-A(G) x No.6601 whereas in the remaining two crosses positive phenotypic relationship became negative genotypic relationships.

Phenotypic and genotypic correlations were found positive between number of branches per plant and number of pods per plant. Relationship between number of branches and number of seeds per pod was observed positive in two crosses and negative in one cross. Here again the positive phenotypic correlation became negative genotypic correlation in the combination MG-50-10-A(G) x No.6601. Negative genotypic correlations were observed between number of branches per plant and seed weight in all the four cross combinations whereas phenotypically the characters were associated positively in two of the four crosses. Branches were positively correlated with seed yield in all the four crosses. Here in one cross combination MG-50-10-A(G) x No.15227 the genotypic coefficient of correlation exceeded unity.

Number of pods per plant was positively correlated with number of seeds per pod in three crosses whereas in one cross combination MG-50-10-A(G) x No.15227 the relationship was found negative. A similar but opposite results were obtained for pods per plant and seed weight. Pods per plant showed positive correlations with seed yield in all the four crosses but, here, again one cross combination CES-59 x No.6601 showed genotypic coefficient of correlation beyond unity.

Number of seeds per pod showed positive relationship with seed weight in two crosses whereas the other two cross combinations showed negative association. Positive relationship was observed between number of seeds per pod and seed yield except the cross MG-50-10-A(G) x No.6601 which showed negative phenotypic association.

Seed weight and seed yield were positively correlated in two crosses whereas in the other two crosses the association was found negative. Again in this case one cross combination MG-50-10-A(G) x No.6601 showed genotypic correlation coefficient beyond unity.

On the average plant height was positively correlated with all the characters studied except seed weight in which negative genotypic correlation was found. Positive association was found between number of branches per plant and number of pods per plant, number of seeds per pod and seed yield and in turn those characters were also positively interrelated. Seed weight was negatively associated with all the characters except that positive phenotypic relationship with plant height and positive genotypic association with number of seeds per pod were found. In general the genotypic correlations were found to be higher than the pheno-

Table 1. Phenotypic and genotypic correlation coefficients between characters in four mungbean crosses.

Characters	Correlation Coefficients								Average of four crosses	
	MG-50-10-A(G) x No.6601		MG-50-10-A(G) x No.15227		CES-59 x No.6601		PHLV-18xMl-62			
	Pheno-typic	Geno-typic	Pheno-typic	Geno-typic	Pheno-typic	Geno-typic	Pheno-typic	Geno-typic	Pheno-typic	Geno-typic
Plant height and										
Branches per plant	0.284	0.320	0.141	0.087	0.295	0.474	–0.020	–0.039	0.175	0.210
Pods per plant	0.383	0.598	0.228	0.230	0.205	0.354	0.285	0.467	0.275	0.412
Seeds per pod	0.317	0.307	0.271	0.584	0.359	0.597	0.037	0.026	0.246	0.378
Seed weight	–0.402	–0.612	0.165	–0.004	0.253	0.040	0.070	–0.051	0.021	–0.157
Seed yield	–0.028	–0.177	0.330	0.300	0.202	0.218	0.258	0.390	0.190	0..83
Branches per plant and										
Pods per plant	0.255	0.501	0.451	0.827	0.470	0.604	0.323	0.373	0.375	0.576
Seeds per pod	0.037	–0.004	0.255	0.677	0.113	0.225	–0.106	–0.251	0.075	0.162
Seed weight	–0.305	–0.345	0.065	–0.366	0.121	–0.318	–0.041	–0.109	–0.040	–0.284
Seed yield	0.032	0.227	0.530	1.019	0.406	0.588	0.250	0.240	0.304	0.518
Pods per plant and										
Seeds per pod	0.174	0.360	–0.143	–0.366	0.165	0.370	0.018	0.173	0.053	0.134
Seed weight	–0.196	–0.354	–0.137	–0.241	0.183	0.794	–0.147	–0.148	–0.074	0.013
Seed yield	0.311	0.084	0.832	0.827	0.928	1.011	0.869	0.885	0.735	0.702
Seeds per pod and										
Seed weight	–0.162	–0.282	0.037	0.786	0.098	0.906	–0.099	–0.547	–0.031	0.216
Seed yield	–0.167	0.124	0.150	0.247	0.251	0.471	0.056	0.196	0.072	0.259
Seed weight and										
Seed yield	–0.494	–1.140	0.113	0.709	0.272	0.738	–0.168	–0.681	–0.069	–0.093
Levels of significance for phenotypic correlation at 5 %	0.220		0.163		0.200		0.184			
1 %	0.287		0.213		0.262		0.240			

Table 2. Direct and indirect effects of plant characters on yield in four mungbean crosses

Characters	Plant height	Branches per plant	Pods per plant	Seeds per pod	Seed weight	Seed yield	Total effects	Genotypic correlation with yield
Plant height		0.006	0.314	0.115	0.032	–0.284	0.183	0.183
Branches per plant	–0.059		0.439	0.049	0.058	0.031	0.518	0.518
Pods per plant	–0.117	0.018		0.041	–0.003	0.763	0.702	0.702
Seeds per pod	–0.107	0.005	0.102		–0.044	0.303	0.259	0.259
Seed weight	0.045	–0.009	0.010	0.065		–0.204	–0.093	–0.093

typic correlations.

Path coefficients (Table 2) indicated that plant height had negative direct effect on yield but this negative effect was masked by indirect effects through number of pods per plant and number of seeds per pod. Positive association between number of branches per plant and seed yield may also be attributed to the indirect effect of number of pods per plant. Number of pods per plant and number of seeds per pod were the major components influencing yield. The negative effect of seed weight on yield was partly covered up by the additive effect of other components.

It may be concluded that selection for high yield may be effective by choosing plants with more branches per plant, more pods per plant and more seeds per pod.

DISCUSSION

A great variability in the association between characters was observed in different genotype combinations. Moreover, some paradoxic genotypic associations were also observed. This may be attributed to low plant population of non-segregating generations and indicate the need for better control of environmental variance and genotype-environmental interaction. It may also be due to the fact that the environmental variances and covariances based on non-segregating generations might not be equivalent to the environmental variances and covariances in a segregating generation.

Plant height was positively associated with all the characters studied except seed weight in which negative genotypic correlation was observed. Negative direct effect of height on yield was masked by positive additive effect of other components. Aggarwal and Kang (1976) reported positive correlation between height and yield whereas negative association between these characters were found by Bhaumik and Jha (1976).

Positive association was observed between number of branches per plant, number of pods per plant, number of seeds per pod and seed yield. Branches per plant had indirect effect through number of pods whereas number of pods per plant and seeds per pod were found the major components having direct bearing on yield. These studies confirmed the views reported by many workers like Joshi and Kabaria (1973), Malhotra *et.al* (1974) Ko and Chang (1975), Aggarwal and Kang (1976), and Bhaumik and Jha (1976).

Aggarwal and Singh (1973), and Aggarwal and Kang (1976) reported that 100-seed weight was negatively correlated with number of pods per plant and number of seeds per pod. Positive correlation between yield and 100-seed weight was reported by Tomar *et. al* (1973) whereas Ko and Chang (1975) found this relationship as negative. The present investigations indicated negative association between seed weight and yield and most of other yield components, thus confirming the views of Aggarwal and Singh (1973), and Aggarwal and Kang (1976).

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