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Genetic Association Analysis for Yield, Physiological and Drought Contributing Traits in Mungbean (*Vigna radiata* (L.) Wilczek)

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ABSTRACT

Correlation and path analyses were carried out with thirty one genotypes of mungbean for different yield, physiological and drought contributing traits. Highly significant positive correlation of seed yield was observed with days to maturity, clusters per plant, pods per plant, seeds per pod, 100 seed weight, harvest index, SCMR and SLA. Path co-efficient analysis revealed that harvest index exhibited maximum direct effect followed by days to maturity and SCMR on grain yield. Hence selection based on these characters would be highly useful for the selection of high yielding and drought tolerant lines in mungbean.

Key words : Correlation, Mungbean, Path analysis, Physiological traits.

Mungbean (*Vigna radiata* (L.) Wilczek) is one of the most important crops of global economic importance after bengalgram and arhar occupying an area of 37.8 lakh hectares with a production of 16.6 lakh tonnes and productivity of 439 kg/ha (AICRP on MULLARP Annual Report, 2010-2011). It is prized among the pulse species as its seeds are high in essential dietary protein, easily digestable and low production of flatulence when consumed as food (Lakhanpaul and Bhat, 2000). Despite, its suitability to various niches and different cropping systems, the production potential of this crop is being hampered by abiotic stress like drought, which effects the yield drastically. Many breeding programmes have been initiated to develop drought tolerant/ resistant varieties in mungbean, however the progress is not significant as the drought is a complex phenomenon and always coupled with moisture and high temperature stresses. Therefore systematic efforts are needed to breed the cultivars by thorough understanding of the mechanisms of drought at various developmental, physiological, biochemical and molecular levels. Hence, the knowledge of the association coupled with cause and effect of yield component traits with yield and drought component traits is highly essential.

Keeping these in view, the study was conducted to assess the inter relationship among various yield, physiological and drought contributing traits and to partition the correlation into its direct and indirect effects, so that appropriate weightage could be given to each character at the time of selection.

MATERIAL AND METHODS

The research was conducted at S.V.Agricultural College, Tirupati during *kharif* 2012. The experiment was laid in RBD with three replications with spacing of 30cm between rows and 15cm between plants. Five plants were selected at random from each replication and data were recorded on days to 50% flowering, plant height, days to maturity, number of clusters per plant, number of pods per cluster, number of pods per plant, number of seeds per pod, 100 seed weight, harvest index, SPAD Chlorophyll Meter Reading (SCMR), Relative Water Content (RWC), Relative Injury percentage (RI), Chlorophyll Stability Index (CSI) and Specific Leaf Area (SLA). The data were statistically analyzed to estimate genotypic and phenotypic correlation coefficients (Falconer, 1964) and path coefficient analysis (Dewey and Lu, 1959).

RESULTS AND DISCUSSION

The analysis of variance indicated significant differences among the genotypes for all the characters. The phenotypic and genotypic correlations among the characters showed almost similar trend of association between the character pairs, the later values being little higher in most

Table 1. Phenotypic (r_p) and genotypic (r_g) correlation coefficients among seventeen characters in thirty one genotypes of greengram.

Character		Plant height (cm)	Days to Maturity	No. of clusters/ plant	No. of pods/ cluster	No. of Pods/ plant	No. of seeds/ pod	100 seed weight (g)	Harvest index (%)	SCMR	Relative water content (%)	Relative injury (%)	Chlorophyll stability index	Specific leaf area ($cm^2 g^{-1}$)	Seed yield/ plant (g)
Days to 50%	r_p	0.6783**	0.5373**	-0.0833	0.1144	0.0592	0.2989**	-0.3736**	-0.5185**	-0.3696**	-0.1520	0.0853	-0.2649*	0.3197**	-0.1091
Flowering	r_g	0.7530	0.5942	-0.0407	0.1600	0.0715	0.5888	-0.3909	-0.5626	-0.4480	-0.2867	0.0874	-0.2865	0.3515	-0.1263
Plant height (cm)	r_p		0.4986**	-0.0663	0.1587	0.0546	0.3078**	-0.1729	-0.3482**	-0.4105**	-0.1160	-0.0378	-0.3687**	0.5148**	0.0771
	r_g		0.5519	-0.0534	0.2066	0.0784	0.5885	-0.1964	-0.3654	-0.5253	-0.1779	-0.0445	-0.3727	0.5628	0.0770
Days to	r_p			-0.0710	-0.0123	-0.0107	0.3956**	0.0020	-0.1149	-0.2783**	-0.1941	0.1953	0.0872	0.2136*	0.3212**
Maturity	r_g			-0.1315	-0.0186	-0.0131	0.7365	0.0192	-0.1096	-0.3013	-0.2967	0.2081	0.0968	0.2238	0.3401
Clusters/ plant	r_p				-0.3250**	0.3569**	-0.0408	0.0540	0.1908	0.0303	-0.0847	0.3467**	-0.1862	0.2548*	0.2115**
(No)	r_g				-0.4470	0.4717	0.0307	0.0593	0.2604	-0.0110	-0.2349	0.4627	-0.2847	0.3845	0.2968
Pods/ cluster	r_p					-0.3639**	-0.0905	-0.2228*	-0.2972**	-0.1429	0.1333	-0.2532*	-0.0114	-0.1381	-0.3058**
(No)	r_g					-0.4311	-0.0826	-0.2549	-0.3263	-0.1427	0.1101	-0.2855	-0.0191	-0.1628	-0.3314
Pods/ plant (No)	r_p						-0.0645	-0.0275	0.0806	0.0869	0.0563	-0.0691	-0.1272	0.1680	0.2989**
	r_g						-0.2664	-0.0301	0.0838	0.1187	0.0824	-0.0705	-0.1466	0.1885	0.3055
Seeds/ pod (No)	r_p							-0.2202*	-0.0278	-0.3129**	-0.1340	0.1257	0.0452	0.3140**	0.2639**
	r_g							-0.4141	-0.0683	-0.6744	-0.2536	0.2668	0.1506	0.6212	0.3921
100 seed weight	r_p								0.4505**	0.4177**	-0.0769	-0.0887	0.0200	-0.1291	0.3031**
(g)	r_g								0.4697	0.5131	-0.1526	-0.0938	0.0187	-0.1251	0.3191
Harvest index	r_p									0.3177**	0.1055	-0.0607	0.0766	0.0518	0.6617**
(%)	r_g									0.3550	0.1784	-0.0588	0.0805	0.0561	0.6698
SCMR	r_p										-0.0040	-0.1647	-0.1751	-0.1611	0.3041**
	r_g										0.0919	-0.1977	-0.2213	-0.2203	0.3384
Relative water	r_p											-0.0209	0.0941	-0.1548	-0.0066
content (%)	r_g											-0.0207	0.1650	-0.2626	-0.0061
Relative injury	r_p												0.2790**	0.0833	0.0534
(%)	r_g												0.2920**	0.0720	0.0519
Chlorophyll	r_p													-0.5732**	-0.0409
stability index	r_g													-0.6041	-0.0375
Specific leaf	r_p														0.2757**
area($cm^2 g^{-1}$)	r_g														0.2850

* Significant at 5% level; ** Significant at 1% level

Table 2. Phenotypic (p) and genotypic (g) path coefficients among grain yield per plant and other yield components in greengram.

Character		Days to Maturity	No. of clusters/ plant	No. of pods/ cluster	No. of Pods/ plant	No. of seeds/ pod	100 seed weight (g)	Harvest index (%)	SCMR	Specific leaf area (cm^2 g^{-1})	Seed yield/ plant (g)
Days to	r_p	**0.3730**	-0.0265	-0.0046	-0.0040	0.1476	0.0008	-0.0429	-0.1038	0.0797	**0.3212****
Maturity	r_g	**1.2292**	-0.1617	-0.0229	-0.0161	0.9053	0.0236	-0.1347	-0.3704	0.2751	**0.3401**
Clusters/	r_p	-0.0020	**0.0276**	-0.0090	0.0099	-0.0011	0.0015	0.0053	0.0008	0.0070	**0.2115***
plant(No)	r_g	-0.0165	**0.1253**	-0.0560	0.0591	0.0038	0.0074	0.0326	-0.0014	0.0482	**0.2968**
Pods/	r_p	-0.0005	-0.0138	**0.0426**	-0.0155	-0.0039	-0.0095	-0.0127	-0.0061	-0.0059	**-0.3058****
cluster(No)	r_g	0.0056	0.1353	**-0.3026**	0.1304	0.0250	0.0771	0.0987	0.0432	0.0492	**-0.3314**
Pods/	r_p	-0.0025	0.0819	-0.0835	**0.2295**	-0.0148	-0.0063	0.0185	0.0199	0.0386	**0.2989****
plant(No)	r_g	0.0054	-0.1939	0.1773	**-0.4111**	0.1095	0.0124	-0.0345	-0.0488	-0.0775	**0.3055**
Seeds/	r_p	0.0817	-0.0084	-0.0187	-0.0133	**0.2064**	-0.0454	-0.0057	-0.0646	0.0648	**0.2639****
pod(No)	r_g	-0.8931	-0.0372	0.1002	0.3230	**-1.2126**	0.5022	0.0828	0.8178	-0.7533	**0.3921**
100 seed	r_p	0.0000	-0.0011	0.0046	0.0006	0.0045	**-0.0205**	-0.0092	-0.0086	0.0026	**0.3031****
weight (g)	r_g	-0.0130	-0.0401	0.1722	0.0203	0.2797	**-0.6753**	-0.3172	-0.3465	0.0845	**0.3191**
Harvest	r_p	-0.0702	0.1166	-0.1816	0.0493	-0.0170	0.2753	**0.6112**	0.1942	0.0317	**0.6617****
index(%)	r_g	-0.0967	0.2298	-0.2880	0.0740	-0.0602	0.4146	**0.8826**	0.3134	0.0495	**0.6698**
SCMR	r_p	-0.0804	0.0088	-0.0413	0.0251	-0.0904	0.1207	0.0918	**0.2889**	-0.0465	**0.3041****
	r_g	-0.0207	-0.0008	-0.0098	0.0082	-0.0463	0.0352	0.0244	**0.0687**	-0.0151	**0.3384**
Specific leaf	r_p	0.0222	0.0264	-0.0143	0.0174	0.0326	-0.0134	0.0054	-0.0167	**0.1037**	**0.2757****
area (cm^2 g^{-1})	r_g	0.1397	0.2401	-0.1016	0.1177	0.3879	-0.0781	0.0350	-0.1376	**0.6245**	**0.2850**

Residual effect (Phenotypic) : 0.499; Residual effect (Genotypic) : 0.684

Bold Direct effects; Normal: Indirect effects

* Significant at P = 0.05; ** Significant at P = 0.01 level

cases, indicating the prepondance of genetic variance in the expression of different characters (Table 1).

Positive and significant association of seed yield was observed with harvest index, days to maturity, SPAD Chlorophyll Meter Reading (SCMR), 100 seed weight, pods per plant, specific leaf area (SLA), seeds per pod and clusters per plant. Similar results were also reported earlier by Vinay *et al.* (2010) for pods per plant and harvest index; Parinya *et al.* (2011) for pods per plant, clusters per plant and seeds per pod; Renganayaki and Sreerengaswamy (1993) and Islam and Razzaque (2010) for SLA; Chakraborty *et al.* (2011) for SCMR. In contrast seed yield per plant exhibited negative significant association with pods per clusters, which is in agreement with the findings of Vinay *et al.* (2010).

The inter-se correlations among yield and drought contributing traits revealed that, days to 50% flowering showed positive association with plant height, days to maturity, SLA and seeds per pod. Similarly, plant height with SLA, days to maturity and seeds per pod; days to maturity with seeds per pod and SLA, clusters per plant with pods per plant, Relative injury and SLA; seeds per pod with SLA; 100 seed weight with harvest index and SCMR and Relative injury with CSI, showed positive and significant association suggesting the interdependency of these characters on each other.

All those characters that registered significant association with seed yield were subjected to path analysis to know their direct and indirect effects on seed yield (Table 2). Path analysis revealed that harvest index and days to maturity had high direct effect on seed yield there by indicating a true correlation and could be taken as components for the improvement of yield. Similar findings were also reported by Manish *et al.* (2007) for harvest index. It is interesting to note that 100 seed weight had negative direct effect on seed yield but, its association with seed yield was found to be positive and significant which could be attributed to the indirect influence through harvest index and days to maturity which were found to be positive and high resulting in mutual cancellation of their negative effects. Hence, while selection process due importance may be given to harvest index and days to maturity to improve the seed weight.

The residual effect recorded was higher indicating the impartance of other traits which were not emcluded in the present study.

Thus, it is clearly evident that the characters harvest index, days to maturity and SCMR had high association with the seed yield. Hence due emphasis should be given to of these traits in selection to develop desirable drought tolerant and high yielding genotypes in mungbean.

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