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Studies on Correlation and Path Analysis in Blackgram (*Vigna mungo* (L.) Hepper)

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A B S T R A C T

The present experiment was conducted at Field Experimentation Centre, Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad during *Kharif* 2016 in Randomized Block Design with three replications. The study was undertaken on the 14 blackgram genotypes along with one check (T-9) to study the correlation and path analysis. Analysis of variance showed highly significant differences among (14+1check) blackgram genotypes for 13 quantitative characters studies. Correlation coefficient studies revealed that Seed yield per plant has showed positive and highly significant association with number of pods per plant, pod length(cm), number of clusters per plant, biological yield at both phenotypic and genotypic levels. Path Coefficient analysis revealed that biological yield is the most important yield component character at both genotypic and phenotypic levels that can be used as selection indices for the yield improvement in balckgram.

Introduction

Blackgram (Vigna mungo (L). Hepper, 2n=22), known as urdbean, is an important grain legumes for its nutritional quality and the suitability to any cropping system. Blackgram has the potential of supplying a major portion of protein demand and restoring the soil health at the same time. Blackgram is the cheapest source of protein for the poor and has long been known as the poor men's meat (Main, 1976). Pulses contain a remarkable amount of proteins, minerals, vitamins and carbohydrates. Among the various pulses, blackgram is an important one which contains approximately 25-28% protein, 4.5-5.5% ash, 0.5-1.5% oil, 3.5-4.5% fibre and 6265% carbohydrate on dry weight basis (Kaul, 1982).The knowledge on interrelationship of plant characters with seed yield and among themselves is of paramount importance to the breeder for making importance in complex character like seed yield, for which direct selection is not much effective. Correlation measures the degree and direction of association between two or more variables. Path coefficient analysis is simply a standardized partial regression coefficient

which splits the correlation coefficient into the measures of direct and indirect effects. In other words, it measures the direct and indirect contribution of various independent characters on a dependent character. The correlation and path coefficient analysis provide information about the relative importance of various yield components in the expression of yield and thus, help in formation of appropriate selection strategy.

Materials and Methods

Plant materials

The experiment has been conducted in the experimentation centre of Sam Higginbottom University of Agriculture and Technological sciences, Allahabad in *kharif* 2016. Fourteen blackgram genotypes were taken as materials with one nationally released variety which is used as check T-9. Each row of 1 m length consists of 10 plants with a spacing of 10cm between the plants and 30 cm between two rows was maintained. The observations were recorded on days to 50% flowering, days to 50% pod setting, days to 50% maturity, plant height (cm), number of branches per plant, clusters per plant, pods per plant, pod length (cm), seeds per pod, seeds per plant, 100 seed weight (g/pl), biological index (g) seed yield (g/pl) and harvest index (%) at harvest stage. The statistical analysis and variance due to different sources was worked out according to Panse and Sukhatme (1967 Genotypic and phenotypic correlation (Al Jibouri *et al.*, 1958). Path coefficient analysis (Dewey and Lu, 1959).

Results and Discussion

Analysis of variance was carried out for 13 characters in blackgram genotypes and the results are presented in Table 1. The variance due to treatment was significant for all thirteen characters. This gives the evidence of magnitude of genetic variability among genotypes were differed significantly. Genotypic correlation coefficient revealed that Seed yield per plant inhibited significant positive correlation at genotypic level with biological yield (0.949), number of clusters per plant (0.755), followed by, Number of seed per pod (0.710), pod length (0.687), number of pods per plant (0.531), Seed index(0.469),Number of primary branches (0.459), Harvesting index (0.406). it has also depicted negative and significant association with Days to 50% pod setting (-0.437) and Days to 50% flowering(-0.345)and it has also depicted positive and non significant association with plant height (0.065) and negative and non significant with Days to 50% maturity (-0.043) with the seed yield at genotypic level Table 2. These results are in agreement with the findings of Umadevi and Ganesan (2006) conducted a study on correlation for yield and yield influencing characters of black gram the association study of different characters indicated that grain yield was significantly associated with the number of clusters per plant, number of pods per plant, pod length and number of seeds per pod. phenotypic correlation co efficient revealed that seed yield per plant exhibited positive and significant association at phenotypic level with Biological yield (0.926), number of clusters per plant (0.702), number of pods per plant (0.499), followed by Pod length (cm) (0.465), number of primary branches (0.376), number of seeds per pod, (0.368), seed index (0.358), Harvesting index (0.310). These results are in agreement with the findings of Umadevi and Ganesan (2006) and Biradar *et al.*, (2007) conducted a study on correlation for yield and yield influencing characters of black gram the association study of different characters indicated that grain yield was significantly associated with the number of clusters per plant, number of pods per plant, pod length and number of seeds per pod and 100 – seed weight.

Table.1 Analysis of variance for 13 different quantitative characters of 15 black gram genotypes

Source of variation	d.f.	Days to 50% flowering	Days to 50% maturity	Days to 50% pod setting	Plant height	Primary branches/ plant	Clusters/ plant	Pods/ plant	Pod length	Seeds/ pod	Seed index	Biological yield/ plant	Harvest index	Seed yield/ plant
Replications	2	23.822	124.156	72.622	47.539	0.453	0.054	5.956	0.042	0.153	1.041	0.045	0.974	0.109
Treatments	14	36.184*	32.898*	51.689*	120.168*	5.874*	121.294*	173. 184*	0.190*	1.610*	903. 987*	0.400*	20.369*	13.034*
Error	28	8.560	14.156	24.956	29.662	0.757	1.164	3.937	0.054	0.751	166.575	0.093	0.345	0.043

- * significant at 5% probability level.

Table.2 Correlation coefficient between yield and its related traits in 15 blackgram genotypes at both genotypic and phenotypic levels

Characters		Days to 50% flowering	Days to 50% maturity	Days to 50% pod setting	Plant height	Primary branches /plant	Clusters/ plant	Pods/ plant	Pod length	Seeds/ pod	Seed index	Biological yield	Harvest index	Seed yield/ plant
Days to 50% flowering	r_g	1.00	0.791**	0.772**	0.317*	-0.636**	-0.479**	-0.306*	-0.499**	-0.351*	0.195	-0.490**	-517**	-0.345*
	r_p	1.00	0.632**	0.713**	0.102	-0.355*	-0.322*	-0.229	-0.168	0.006	0.019	--0.231	-0.433**	-0.232
Days to 50% maturity	r_g		1.00	0.887**	0.696**	-0.254	0.059	0.164	-0.214	0.196	0.406**	-0.071	-0.491**	-0.043
	r_p		1.00	0.713**	0.114	-0.030	0.018	0.157	-0.019	0.022	0.088	-0.002	-0.351*	-0.015
Days to 50% pod setting	r_g			1.00	0.217	-0.670**	-0.402**	-0.205	-0.776**	-0.222	-0.075	-0.482**	-0.769**	-0.437**
	r_p			1.00	-0.008	-0.368*	-0.293	-0.094	-0.334*	-0.200	-0.088	-0.335*	-0.526**	-0.337*
Primary branches/plant	r_g				1.00	0.265	0.398**	0.369*	0.298*	0.668**	0.547**	0.093	0.388**	0.065
	r_p				1.00	0.053	0.236	0.212	0.144	0.253	0.384**	0.058	0.0294*	0.063
Clusters/ plant	r_g					1.00	0.883**	0.844**	0.955**	0.529**	0.696**	0.595**	0.611**	0.459**
	r_p					1.00	0.660**	0.795**	0.523**	0.414**	0.625**	0.472**	0.396**	0.376*
Pods/ plant	r_g						1.00	0.927**	0.704**	0.815**	0.823**	0.820**	0.550**	0.755**
	r_p						1.00	0.798**	0.527**	0.348*	0.650**	0.718**	0.432**	0.702**
Pod length	r_g							1.00	0.656**	0.809**	0.906**	0.645**	0.434**	0.531**
	r_p							1.00	0.447**	0.414**	0.722**	0.572**	0.303*	0.499**
Seeds/ pod	r_g								1.00	1.144**	0.674**	0.757**	0.971**	0.687**
	r_p									0.503**	0.366*	0.476**	0.296*	0.465**
Seed index	r_g									1.00	0.711**	0.717**	0.998**	0.710**
	r_p									1.00	0.489**	0.419**	0.412**	0.368*
Biological yield	r_g										1.00	0.531**	0.369*	0/469**
	r_p										1.00	0.345*	0.436**	0.358*
Harvest index	r_g											1.00	0.530**	0.949**
	r_p											1.00	338*	0.926**
Seed yield/ plant	r_g												1.00	0.406**
	r_p												1.00	0.310*

- * significant at 5% probability level ** significant at 1% probability level.

Table.3 Direct and indirect effects between yield and its related traits in 15 blackgram genotypes at genotypic level and phenotypic levels

Characters		Days to 50% flowering	Days to 50% maturity	Days to 50% pod setting	Plant height	Primary branches /plant	Clusters/ plant	Pods/ plant	Pod length	Seeds/ pod	Seed index	Biological yield	Harvest index
Days to 50% flowering	G	**0.239**	-0.211	-0.278	0.372	-0.121	1.501	-0.796	0.342	0.290	-0.120	-1.358	-0.204
	P	**-0.121**	0.060	-0.060	-0.005	0.083	-0.032	0.028	-0.011	0.000	0.005	-0.208	0.031
Days to 50% maturity	G	0.189	**-0.267**	-0.320	0.817	-0.048	-0.184	0.427	0.147	-0.162	-0.250	-0.198	-0.193
	P	-0.076	**0.095**	-0.060	-0.005	0.007	0.002	-0.019	-0.001	-0.001	0.021	-0.002	0.025
Days to 50% pod setting	G	0.185	-0.237	**-0.361**	0.254	-0.128	1.261	-0.534	0.531	0.183	0.046	-1.337	-0.303
	P	-0.086	0.068	**-0.085**	0.000	0.086	-0.028	0.011	-0.022	0.006	-0.021	-0.302	0.037
Plant height	G	0.076	-0.186	-0.078	**1.173**	0.051	-1.248	0.961	-0.204	-0.552	-0.337	0.257	0.153
	P	-0.012	0.011	0.001	**-0.048**	-0.012	0.023	-0.025	0.010	-0.007	0.093	0.053	-0.021
Primary branches/plant	G	-0.152	0.068	0.241	0.311	**0.191**	-2.768	2.199	-0.654	-0.438	-0.429	1.649	0.240
	P	0.043	-0.003	0.031	-0.003	**-0.233**	0.064	-0.095	0.035	-0.012	0.151	0.426	-0.028
Clusters/ plant	G	-0.115	-0.016	0.145	0.467	0.168	**-3.135**	2.415	-0.481	-0.674	-0.507	2.271	0.217
	P	0.040	0.002	0.025	-0.011	-0.154	**0.097**	-0.096	0.035	-0.010	0.157	0.648	-0.031
Pods/ plant	G	-0.073	-0.044	0.074	0.433	0.161	-2.907	**2.604**	-0.449	-0.669	-0.558	1.788	0.171
	P	0.028	0.015	0.008	-0.010	-0.185	0.078	**-0.120**	0.030	-0.012	0.174	0.516	-0.021
Pod length	G	-0.119	0.057	0.280	0.349	0.182	-2.206	1.709	**-0.684**	-0.946	-0.415	2.097	0.382
	P	0.020	-0.002	0.028	-0.007	-0.122	0.051	-0.054	**0.066**	-0.014	0.088	0.430	-0.021
Seeds/ pod	G	-0.084	-0.052	0.080	0.783	0.101	-2.556	2.106	-0.782	**-0.827**	-0.438	1.987	0.393
	P	0.001	0.002	0.017	-0.012	-0.096	0.034	-0.050	0.033	**-0.028**	0.118	0.378	-0.029
Seed index	G	0.047	-0.108	0.027	0.641	0.133	-2.580	2.358	-0.461	-0.588	**-0.616**	1.472	0.145
	P	-0.002	0.008	0.007	-0.018	-0.145	0.063	-0.087	0.024	-0.014	**0.241**	0.311	-0.031
Biological yield	G	-0.117	0.019	0.174	0.109	0.114	-2.570	1.681	-0.518	-0.593	-0.327	**2.770**	0.209
	P	0.028	0.000	0.028	-0.003	-0.110	0.070	-0.069	0.032	-0.012	0.083	**0.902**	-0.024
Harvest index	G	-0.124	0.131	0.277	0.455	0.116	-1.724	1.130	-0.664	-0.825	-0.227	1.468	**0.394**
	P	0.052	-0.033	0.045	-0.014	-0.092	0.042	-0.036	0.020	-0.012	0.105	0.305	**-0.071**

Residual effect at genotypic level=0.29051 Residual effect at phenotypic level =0.10646

The estimates of correlation coefficients revealed only the relationship between yield components, but did not show the direct and indirect effects of different traits on yield are presented in Table 2. This is because; the attributes which are in association do not exist by themselves, but are linked to other components. In order to get yield, yield components and quality traits were investigated through path coefficient analysis (Table 3) revealed that characters biological yield (2.770), number of pods per plant (2.604), plant height (1.173), harvesting index (0.394), days to 50% flowering (0.239), number of primary branches (0.191), have positive direct effect on seed yield per plant. While the characters number of clusters per plant (-3.135), number of seeds per pod (-0.827), pod length (cm) (-0.684), seed index (-0.616,), days to 50% pod setting (-0.361), days to 50% maturity (-0.276) have negative direct effect on the seed yield per plant at genotypic level. These results are in agreement with the findings of Priti *et al.*, (2003) reported biological yield /plant followed by harvest index and pods/plant showed high positive direct effect on seed yield/plant in blackgram. Phenotypic path in Table 3 revealed that revealed that character biological yield (0.902), seed index (0.241), number of clusters per plant (0.097) days to 50%maturity (0.095), have positive direct effect. Number of primary branches (-0.233), days to 50% flowering (-0.121) number of pods per plant (-0.120), pod length (cm) (-0.120), days to 50% pod setting (-0.085), harvesting index (-0.071), plant height (cm) (-0.048) number of seeds per pod (-0.028) have negative direct effect on seed yield per plant. In plant breeding it is very difficult to have complete knowledge of all components character on yield. The residual effect observed in present study 0.10646 for phenotypic path coefficient analysis other remaining character can be further studied.

In the present study, biological yield per plant to have maximum positive direct effect towards seed yield per plant. Hence it is suggested that more emphasis should be given on biological yield per plant while executing the selection for genetic enhancement of seed yield in blackgram (Parveen *et al.*, 2011).

In conclusion, the correlation and Path analysis revealed that number of cluster per plant, number of pods plant, pod length, biological yield were the most important yield component character that can be used as selection criteria for yield improvement in blackgram.

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