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CORRELATION AND PATH COEFFICIENT ANALYSIS FOR YIELD AND YIELD COMPONENTS IN BLACKGRAM (*VIGNA MUNGO* (L.) HEPPER)

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ABSTRACT :Correlation coefficient and path analysis studies was conducted with eight parents and their 28 F1 crosses for twelve component characters including seed yield and revealed significant positive association of pods per plant, harvest index and clusters per plant with seed yield in parental generation whereas in F1 generation, significant positive association of clusters per plant, pods per plant, days to maturity, days to 50% flowering, pods per cluster and 100-seed weight with seed yield was observed. Further, it was found that number of seeds per pod, harvest index, pods per plant and number of primary branches per plant showed high positive direct effects on seed yield in parents whereas in crosses, seeds per pod, pods per plant, harvest index and days to maturity showed high positive direct effect on seed yield. Hence selection based on these traits would be effective in increasing the seed yield.

Key words: Blackgram, Correlation, path analysis, yield components.

INTRODUCTION

Blackgram (*Vigna mungo* L. Hepper, 2n=22) is one of the nutritious pulse crops, popularly known as urdbean. It is an important short duration pulse crop and self pollinated grain legume grown in many parts of India. This crop is grown in cropping systems as a mixed crop, catch crop, sequential crop besides growing as sole crop under residual moisture conditions after the harvest of rice and also before and after the harvest of other summer crops under semi irrigated and dryland conditions. Its seeds are highly nutritious with protein (25-26%), carbohydrates (60%), fat (1.5%), minerals, aminoacids and vitamins. Like other pulses, it also enriches the soil fertility, improves the soil structure and used as green fodder for cattle. Lack of stable varieties for higher yield is a major bottleneck for growing of this crop. For breeding of any crop plant, selection of promising plant is important. Association studies give an idea about the contribution of different characters towards seed yield and it reveals the type, nature and magnitude of correlation between yield components with yield and among themselves. Genotypic correlation is the correlation of breeding values *i.e.,* (Additive + Additive gene action). A knowledge of inter-relationships existing among yield components is essential when selection for improvement is to be effective. Path analysis identifies the yield components which directly and indirectly influence the yield. Hence, the present research work was carried out to study the correlation coefficients and path coefficients in order to formulate selection criteria for evolving high yielding genotypes in blackgram.

MATERIALS AND METHODS

Each of eight parents was grown in two rows of 5 m length, each with two staggered sowings at 15 days interval to obtain synchronization in flowering. Crosses were effected in all possible combinations among eight parents excluding reciprocals. A row spacing of 60 cm was kept to facilitate easy handling while effecting crosses. Hybridization was carried out by evening emasculation (4.00-6.00 P.M.) and followed by morning pollination (6.30-8.00 A.M.) using ring cut method followed by brush pollination respectively. The hybridization was continued for about 60 days to obtain sufficient seed in each combination. The crossed seed of each combination was collected separately as an individual matured pods. All 36 entries comprising of eight parents and 28 F_1s were sown on 26th November, 2010 in a randomized block design which was replicated three times. Each entry was grown in three rows of 2 m length. The spacing adopted between rows was 30 cm and 10 cm within the row. About 1-2 seeds per hill were sown and later, thinned out to a single seedling per hill. Border rows were planted to eliminate border effect. In parents and F_1s, five plants were tagged randomly for recording observations in each replication for the characters, plant height, days to 50% flowering, days to maturity, number of primary branches per plant, number of clusters per plant, number of pods per cluster, number of pods per plant, pod length, number of seeds per pod, hundred seed weight, seed yield per plant and harvest index. The phenotypic and genotypic correlation coefficients were calculated using the method given by Johnson *et al*. (1955) and path coefficient analysis were worked as suggested by Dewey and Lu (1959).

RESULTS AND DISCUSSION

The analysis of variance revealed the existence of significant differences among the genotypes for all the traits. The data on all the twelve traits which showed significant differences among the entries were subjected to statistical analysis and the results on correlation analysis in parental generation indicated that significant positive phenotypic and large genotypic association of pods per plant (r_p = 0.7966**, r_g = 0.8248), harvest index (r_p = 0.5804**, r_g = 0.5689) and clusters per plant (r_p = 0.4967*, r_g = 0.5284) were observed with seed yield per plant (Table 1). Hence, these traits could be utilized in indirect selection so as to improve the seed yield per plant. Similar kind of positive association of pods per plant, harvest index and clusters per plant with seed yield was reported earlier by Chauhan *et al.* (2007) and Veeranjaneyulu *et al.* (2007).

Similarly, plant height showed significant positive association with pod length (r_p = 0.8619**, r_g = 0.8869), seeds per pod (r_p = 0.7467**, r_g = 0.7596), hundred seed weight (r_p = 0.5831**, r_g = 0.5927) and days to maturity (r_p = 0.4786*, r_g = 0.6332). It indicates that selection of the tall plants could result in attaining longer pods with more number of seeds, increased seed weight and also increase in days to maturity. On contrary, plant height showed highly significant negative association with harvest index (r_p = - 0.5326**, r_g = -0.5408) indicating that selection of tall plants reduces the harvest index. Similar kind of significant positive association of plant height with pod length was reported earlier by Goud *et al.* (1977), with seeds per pod (Santha and Paramasivam, 1999), with 100-seed weight (Natarajan and Rathinaswamy, 1999) and with days to maturity (Nagarjuna Sagar and Reddi Sekhar, 2001). Clusters per plant exhibited highly significant positive association with pods per plant (r_p = 0.6390**, r_g = 0.7165) and harvest index (r_p = 0.5607**, r_g = 0.6377) which indicated that selection of the plants with more number of clusters may increase the number of pods per plant and harvest index in a linear fashion. On contrary, highly significant negative association was observed with number of seeds per pod (r_p = -0.5406**, r_g = -0.6299) which reveals that selection for more number of clusters lead to decrease in the number of seeds per pod, therefore, it forms a set back in further increase of seed yield. Similar kind of significant positive association of clusters per plant with pods per plant was reported earlier by Gopi Krishnan *et al.* (2002) while with harvest index was reported by Veeranjaneyulu *et al.* (2007) and corroborates the results of present study.

TABLE (1): CHARACTER ASSOCIATIONS IN PARENTAL GENERATION FOR SEED YIELD AND ITS COMPONENTS IN URDBEAN

Character		DF	DM	PB	CP	PC	PP	PL	SP	HSW	HI	Correlation with SYP
PH	r_p	0.2993	0.4786*	-0.1215	-0.2477	0.3358	0.2196	0.8619**	0.7467**	0.5831**	-0.5326**	0.1670
	r_g	-0.5079	0.6332	-0.1605	-0.2780	0.3588	0.2341	0.8869	0.7596	0.5927	-0.5408	0.1822
DF	r_p		0.1434	-0.1655	-0.0043	0.2918	0.0423	0.1869	0.1432	0.0689	-0.0787	0.0326
	r_g		-0.2785	-0.3337	0.0387	-0.5027	-0.2581	-0.4033	-0.2396	-0.1357	0.1805	0.0192
DM	r_p			-0.3812	0.2451	0.3803	0.3266	0.4840*	0.2819	-0.0192	-0.3052	0.1281
	r_g			-0.6575	0.3578	0.5354	0.4725	0.7258	0.3837	-0.0673	-0.4953	0.0624
PB	r_p				-0.2771	-0.3224	-0.4664*	-0.3837	-0.3664	0.2103	0.3505	-0.0716
	r_g				-0.3022	-0.4695	-0.5169	-0.4393	-0.4075	0.2684	0.4319	-0.0717
CP	r_p					0.3089	0.6390**	-0.3108	-0.5406**	-0.2307	0.5607**	0.4967*
	r_g					0.3726	0.7165	-0.3497	-0.6299	-0.2500	0.6377	0.5284
PC	r_p						0.6826**	0.2745	0.1129	-0.3471	-0.0024	0.3639
	r_g						0.7870	0.3539	0.1148	-0.3744	0.0162	0.3854
PP	r_p							0.1874	-0.0610	-0.0684	0.3237	0.7966**
	r_g							0.1950	-0.0506	-0.0792	0.3187	0.8248
PL	r_p								0.9038**	0.4096*	-0.7776**	-0.0267
	r_g								0.9280	0.4237	-0.8027	0.0048
SP	r_p									0.4299*	-0.8792**	-0.1997
	r_g									0.4408	-0.8880	-0.1927
HSW	r_p										-0.1478	0.2215
	r_g										-0.1656	0.2218
HI	r_p											0.5804**
	r_g											0.5689

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

PH=Plant Height DF=Days to 50% Flowering M= Days to Maturity PB= No. of Primary Branches per Plant
CP =No. of Clusters per Plant PC =No. of Pods per Cluster PP = No. of Pods per PlantPL = Pod Length
SP = No. of Seeds per Pod HSW = Hundred Seed Weight SYP = Seed Yield per PlantHI = Harvest Index

TABLE (2): CHARACTER ASSOCIATIONS IN F_1 GENERATION FOR SEED YIELD AND ITS COMPONENTS IN URDBEAN

Character		DF	DM	PB	CP	PC	PP	PL	SP	HSW	HI	Correlation with SYP
PH	r_p	0.1691	-0.1981	-0.0397	-0.0876	-0.4082**	-0.3657**	0.8063**	0.8255**	0.5736**	-0.7714**	0.0935
	r_g	0.1766	-0.2117	-0.0447	-0.0932	-0.4744	-0.3819	0.8227	0.8321	0.5815	-0.7775	0.0942
DF	r_p		0.3401**	-0.1766	0.1846	-0.2836**	0.1363	0.3778**	0.4912**	0.0839	-0.3993**	0.312**
	r_g		0.3769	-0.2077	0.1985	-0.3156	0.1540	0.4110	0.5260	0.0880	-0.4210	0.3292
DM	r_p			-0.0959	0.2042	-0.0749	0.2408*	-0.1492	-0.0638	-0.2790*	-0.0455	0.3877**
	r_g			-0.1078	0.2185	-0.0607	0.2697	-0.1572	-0.0736	-0.2814	-0.0522	0.4083
PB	r_p				0.1460	0.2400*	0.1634	0.0345	-0.0945	0.0878	0.2379*	0.0073
	r_g				0.1296	0.3020	0.1639	0.0377	-0.1012	0.0958	0.2473	0.0084
CP	r_p					0.0258	0.8776**	-0.0340	0.1087	0.1398	0.1289	0.5865**
	r_g					0.0804	0.9241	-0.0339	0.1102	0.1461	0.1355	0.6145
PC	r_p						0.2557*	-0.1687	-0.3109**	-0.5067**	0.2857**	0.2948**
	r_g						0.2868	-0.1867	-0.3622	-0.5786	0.3316	-0.3587
PP	r_p							-0.2144	-0.1044	-0.1227	0.3136**	0.5297**
	r_g							-0.2186	-0.1116	-0.1292	0.3387	0.5597
PL	r_p								0.9270**	0.4228**	-0.8563**	0.0112
	r_g								0.9403	0.4349	-0.8742	0.0094
SP	r_p									0.4356**	-0.8739**	0.2044
	r_g									0.4444	-0.8824	0.2051
HSW	r_p										-0.3546**	0.2852**
	r_g										-0.3586	0.2912
HI	r_p											0.0076
	r_g											0.0015

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

PH=Plant Height DF=Days to 50% Flowering DM= Days to Maturity PB= No. of Primary Branches per Plant
CP =No. of Clusters per Plant PC =No. of Pods per Cluster PP = No. of Pods per PlantPL = Pod Length
SP = No. of Seeds per Pod HSW = Hundred Seed Weight SYP = Seed Yield per Plant HI = Harvest Index

In F_1 generation, clusters per plant (r_p = 0.5865**, r_g = 0.6145), pods per plant (r_p = 0.5297**, r_g = 0.5597), days to maturity (r_p = 0.3877**, r_g = 0.4083), days to 50% flowering (r_p = 0.3120**, r_g = 0.3292), pods per cluster (r_p = 0.2948**, r_g = -0.3587) and 100-seed weight (r_p = 0.2852**, r_g = 0.2912) showed highly significant and positive association with seed yield per plant (Table 2). Hence these traits could be selected indirectly in order to improve the seed yield per plant. Similar kind of significant positive association of clusters per plant and pods per plant with seed yield was reported earlier in urdbean by Patel and Shah (1982), Natarajan and Rathinaswamy (1999), Umadevi and Meenakshi Ganesan (2005) and Chauhan *et al.* (2007). Similarly, Soundarapandian *et al.* (1976) and Veeranjaneyulu *et al.* (2007) revealed significant positive association of days to 50% flowering and days to maturity with seed yield per plant. Whereas, Wanjari (1988), Ramesh Babu (1998) and Chauhan *et al.* (2007) revealed significant positive association of pods per cluster with seed yield while, Patil and Deshmukh (1989), Pooran Chand and Rabhunanda Rao (2002) and Rameshwari Netam Netam *et al.* (2010) found significant positive association of 100-seed weight with seed yield and corroborated the findings of present study.

TABLE (3): PHENOTYPIC (P) AND GENOTYPIC (G) PATH COEFFICIENTS AMONG GRAIN YIELD AND ITS COMPONENTS IN PARENTAL GENERATION OF URDBEAN

Character		PH	DF	DM	PB	CP	PC	PP	PL	SP	HSW	HI	Correlation with SYP
PH	P	**0.1223**	0.0245	0.0810	-0.0333	-0.0017	-0.1231	0.1928	-0.2957	0.8373	-0.0975	-0.5396	0.1670
	G	**0.3060**	-0.0539	0.4029	-0.1068	0.1130	-0.7398	0.3856	0.7901	1.5752	-0.9796	-1.5106	0.1822
DF	P	0.0366	**0.0817**	0.0243	-0.0453	0.0000	-0.1070	0.0371	-0.0641	0.1606	-0.0115	-0.0797	0.0326
	G	-0.1554	**0.1060**	-0.1772	-0.2220	-0.0157	1.0365	-0.4252	-0.3593	-0.4968	0.2243	0.5041	0.0192
DM	P	0.0585	0.0117	**0.1692**	-0.1043	0.0017	-0.1394	0.2867	-0.1660	0.3161	0.0032	-0.3093	0.1281
	G	0.1938	-0.0295	**0.6364**	-0.4375	-0.1454	-1.1039	0.7785	0.6466	0.7957	0.1112	-1.3834	0.0624
PB	P	-0.0149	-0.0135	-0.0645	**0.2738**	-0.0019	0.1182	-0.4095	0.1316	-0.4109	-0.0352	0.3551	-0.0716
	G	-0.0491	-0.0354	-0.4184	**0.6653**	0.1228	0.9680	-0.8516	-0.3913	-0.8450	-0.4436	1.2065	-0.0717
CP	P	-0.0303	-0.0003	0.0415	-0.0759	**0.0068**	-0.1132	0.5611	0.1066	-0.6062	0.0386	0.5681	0.4967*
	G	-0.0851	0.0041	0.2277	-0.2011	**-0.4064**	-0.7682	1.1805	-0.3116	-1.3061	0.4131	1.7814	0.5284
PC	P	0.0411	0.0239	0.0643	-0.0883	0.0021	**-0.3666**	0.5993	-0.0942	0.1266	0.0580	-0.0024	0.3639
	G	0.1098	-0.0533	0.3407	-0.3123	-0.1514	**-2.0619**	1.2966	0.3153	0.2380	0.6187	0.0452	0.3854
PP	P	0.0269	0.0035	0.0552	-0.1277	0.0043	-0.2502	**0.8780**	-0.0643	-0.0685	0.0114	0.3280	0.7966**
	G	0.0716	-0.0274	0.3007	-0.3439	-0.2912	-1.6226	**1.6476**	0.1738	-0.1049	0.1308	0.8903	0.8248
PL	P	0.1054	0.0153	0.0819	-0.1050	-0.0021	-0.1006	0.1646	**-0.3431**	1.0134	-0.0685	-0.7879	-0.0267
	G	0.2714	-0.0428	0.4618	-0.2922	0.1421	-0.7297	0.3213	**0.8909**	1.9243	-0.7002	-2.2422	0.0048
SP	P	0.0913	0.0117	0.0477	-0.1003	-0.0037	-0.0414	-0.0536	-0.3101	**1.1213**	-0.0719	-0.8909	-0.1997
	G	0.2325	-0.0254	0.2442	-0.2711	0.2560	-0.2367	-0.0833	0.8267	**2.0736**	-0.7286	-2.4805	-0.1927
HSW	P	0.0713	0.0056	-0.0033	0.0576	-0.0016	0.1272	-0.0600	-0.1405	0.4820	**-0.1672**	0.0247	0.2215
	G	0.1814	-0.0144	-0.0428	0.1785	0.1016	0.7719	-0.1304	0.3774	0.9141	**-1.6528**	-0.4626	0.2218
HI	P	-0.0652	-0.0064	-0.0516	0.0959	0.0038	0.0009	0.2842	0.2668	-0.9859	-0.1498	**1.0132**	0.5804**
	G	-0.1655	0.0191	-0.3152	0.2873	-0.2592	-0.0334	0.5251	-0.7151	-1.8414	0.2737	**2.7933**	0.5689

* Significant at 5% level;** Significant at 1% level Diagonals = Direct effect ; Off diagonals = Indirect effects.

Residual Effect (Phenotypic) = 0.2630; Residual Effect (Genotypic) = SQRT (1-1.2262).

PH=Plant Height DF=Days to 50% Flowering DM= Days to Maturity PB= No. of Primary Branches per Plant
CP =No. of Clusters per Plant PC =No. of Pods per Cluster PP = No. of Pods per Plant PL = Pod Length
SP = No. of Seeds per Pod HSW = Hundred Seed Weight SYP = Seed Yield per Plant HI = Harvest Index

The path coefficient analysis furnishing the cause and effect of different yield components would provide better index for selection rather than mere correlation coefficients. The results on path coefficient analysis in parental generation indicated that the highest positive direct effect on seed yield per plant was shown by number of seeds per pod (P = 1.1213, G = 2.0736) followed by harvest index (P = 1.0132, G = 2.7933), number of pods per plant (P = 0.878, G = 1.6476), number of primary branches per plant (P=0.2738, G=0.6653), days to maturity (P = 0.1692, G = 0.6364), plant height (P = 0.1220, G = 0.3060), days to 50% flowering (P = 0.0817, G = 0.1060) and number of clusters per plant (P = 0.0068, G = -0.4064) (Table 3).

Hence selection based on these traits would be effective in increasing the seed yield. These positive direct effects observed with seed yield were in accordance with the reports of Patil and Deshmukh (1989), Govindaraj and Subramanian (2001) for seeds per pod, Patil and Deshmukh (1989) and Umadevi and Meenakshi Ganesan (2005) for pods per plant and Chauhan *et al.* (2007) for harvest index. On contrary, number of pods per cluster recorded negative direct effect on seed yield followed by pod length and 100-seed weight. These findings were in accordance with the reports of Gopikrishnan *et al.* (2002) and Chauhan *et al.* (2007) for pods per cluster and Umadevi and Meenakshi Ganesan (2005) and Veeranjaneyulu *et al.* (2007) for 100-seed weight. Though, pods per cluster had negative direct effect on seed yield but, it influenced the seed yield through its high positive indirect effects via pods per plant, seeds per pod, days to maturity and registered positive association with seed yield whereas 100-seed weight influenced the seed yield through its high positive indirect effects via seeds per pod, pods per cluster and plant height to register positive association with seed yield per plant and it was revealed that high positive direct effect on seed yield was exerted by number of seeds per pod followed by harvest index, number of pods per plant, number of primary branches per plant, days to maturity and plant height in the decreasing order of magnitude. Hence for increasing the seed yield in parental generation, direct selection based on these traits would be rewarding.

TABLE (4): PHENOTYPIC (P) AND GENOTYPIC (G) PATH COEFFICIENTS AMONG GRAIN YIELD AND ITS COMPONENTS IN F_1 GENERATION OF URDBEAN

Character		PH	DF	DM	PB	CP	PC	PP	PL	SP	HSW	HI	Correlation with SYP
PH	P	**0.2320**	-0.0015	-0.0876	0.0019	0.0225	0.0328	-0.2223	-0.4357	0.7941	0.2113	-0.4539	0.0935
	G	**0.7601**	-0.0026	-0.1024	-0.0007	0.1700	-0.0876	-0.8172	-1.4810	1.4776	0.4343	0.0942	0.0942
DF	P	0.0392	**-0.0087**	0.1504	0.0085	-0.0474	0.0228	0.0829	-0.2042	0.4725	0.0309	-0.2349	0.312**
	G	0.1342	**-0.0145**	0.1823	-0.0033	-0.3618	-0.0583	0.3297	-0.7399	0.9339	0.0657	0.3292	0.3292
DM	P	-0.0459	-0.0030	**0.4423**	0.0046	-0.0524	0.0060	0.1464	0.0806	-0.0614	-0.1028	-0.0268	0.3877**
	G	-0.1609	-0.0055	**0.4836**	-0.0017	-0.3982	-0.0112	0.5771	0.2831	-0.1306	-0.2102	0.4083	0.4083
PB	P	-0.0092	0.0015	-0.0424	**-0.0480**	-0.0375	-0.0193	0.0994	-0.0187	-0.0909	0.0323	0.1400	0.0073
	G	-0.0340	0.0030	-0.0522	**0.0157**	-0.2362	0.0558	0.3507	-0.0679	-0.1797	0.0716	0.0084	0.0084
CP	P	-0.0203	-0.0016	0.0903	-0.0070	**-0.2566**	-0.0021	0.5336	0.0184	0.1045	0.0515	0.0758	0.5865**
	G	-0.0709	-0.0029	0.1056	0.0020	**-1.8226**	0.0149	1.9777	0.0611	0.1957	0.1091	0.6145	0.6145
PC	P	-0.0947	0.0025	-0.0331	-0.0115	-0.0066	**-0.0803**	0.1554	0.0912	-0.2990	-0.1866	0.1681	0.2948**
	G	-0.3606	0.0046	-0.0293	0.0047	-0.1466	**0.1847**	0.6139	0.3361	-0.6432	-0.4322	-0.3587	-0.3587
PP	P	-0.0848	-0.0012	0.1065	-0.0078	-0.2252	-0.0205	**0.6080**	0.1159	-0.1004	-0.0452	0.1845	0.5297**
	G	-0.2903	-0.0022	0.1304	0.0026	-1.6843	0.0530	**2.1401**	0.3935	-0.1982	-0.0965	0.5597	0.5597
PL	P	0.1871	-0.0033	-0.0660	-0.0017	0.0087	0.0135	-0.1304	**-0.5404**	0.8917	0.1557	-0.5038	0.0112
	G	0.6254	-0.0060	-0.0760	0.0006	0.0618	-0.0345	-0.4678	**-1.8001**	1.6696	0.3249	0.0094	0.0094
SP	P	0.1915	-0.0043	-0.0282	0.0045	-0.0279	0.0250	-0.0635	-0.5010	**0.9619**	0.1605	-0.5141	0.2044
	G	0.6325	-0.0076	-0.0356	-0.0016	-0.2009	-0.0669	-0.2388	-1.6926	**1.7756**	0.3319	0.2051	0.2051
HSW	P	0.1331	-0.0007	-0.1234	-0.0042	-0.0359	0.0407	-0.0746	-0.2285	0.4190	**0.3683**	-0.2086	0.2852**
	G	0.4420	-0.0013	-0.1361	0.0015	-0.2663	-0.1068	-0.2766	-0.7829	0.7890	**0.7469**	0.2912	0.2912
HI	P	-0.1790	0.0035	-0.0201	-0.0114	-0.0331	-0.0229	0.1907	0.4628	-0.8406	-0.1306	**0.5884**	0.0076
	G	-0.5910	0.0061	-0.0253	0.0039	-0.2470	0.0612	0.7248	1.5737	-1.5668	-0.2679	**0.0015**	0.0015

** Significant at 1% level Diagonals = Direct effect ; Off diagonals = Indirect effects.
Residual Effect (Phenotypic) = 0.5609; Residual Effect (Genotypic) = 0.3983

PH=Plant Height DF=Days to 50% Flowering DM= Days to Maturity PB= No. of Primary Branches per Plant
CP =No. of Clusters per Plant PC =No. of Pods per Cluster PP = No. of Pods per Plant PL = Pod Length
SP = No. of Seeds per Pod HSW = Hundred Seed Weight SYP = Seed Yield per Plant HI = Harvest Index

In F_1 generation, number of seeds per pod exerted the highest positive direct effect on seed yield (P = 0.9619, G = 1.7756), followed by pods per plant (P = 0.6080, G = 2.1401), harvest index (P = 0.5884, G = 0.0015), days to maturity (P = 0.4423, G = 0.4836), 100-seed weight (P = 0.3683, G = 0.7469) and plant height (P = 0.2320, G = 0.7600) (Table 4). This positive direct effect of seeds per pod on seed yield was in conformity with the reports of Govindaraj and Subramanian (2001) whereas the direct effect of pods per plant on grain yield was reported earlier by Patil and Deshmukh (1989) and Umadevi and Meenakshi Ganesan (2005). Similarly, the direct effect of harvest index on seed yield was reported by Chauhan *et al.* (2007) while Konda *et al.* (2008) for days to maturity and Das (1978) and Usha Rani and Sakharam Rao (1981) for 100-seed weight.

On contrary, negative direct effects were recorded by days to 50% flowering, number of primary branches per plant, number of pods per cluster, number of clusters per plant and pod length. These results were in accordance with the reports of Pooran Chand and Rabhunandha Rao (2002) and Sunil Kumar *et al*. (2003) for days to 50% flowering, Nagarjunasagar and Reddi Sekhar (2001) and Chauhan *et al.* (2007) for number of primary branches and number of pods per cluster and Santha and Paramasivam (1999b) and Govindaraj and Subramanian (2001) for number of clusters per plant and pod length.

Path coefficient analysis in F_1 generation revealed that highest positive direct effect on seed yield per plant was exerted by number of seeds per pod followed by pods per plant, harvest index, 100-seed weight and plant height in decreasing order of magnitude. Hence indirect selection based on these traits would be effective in F_1 generation crosses for increasing the seed yield in urdbean.

REFERENCES

M.P. Chauhan, A.C. Mishra and Ashok Kumar Singh (2007). Correlation and path analysis in urdbean. Legume Research. 30(3): 205-208.

P.K. Das (1978). Genetic estimates, correlations, path coefficients and their implications of discriminant function for selection in black gram (*Phaseolus mungo L.*). Indian Agriculturist. 22(4): 227-236.

D.R Dewey and K.H. Lu (1959). A correlation and path coefficient analysis of components of crested wheat grass seed production. Agronomy Journal. 51: 515-518.

A. Gopi Krishnan, M. Reddisekhar, K. Raja Reddy, and K. Subramanyam Reddy (2002). Character association and path analysis in urdbean (*Vigna mungo* L. Hepper). Madras Agricultural Journal. 89(4-6): 315-318.

J.V. Goud, B.C. Viraktamath, and P.V. Laxmi (1977). Variability and correlation studies in blackgram (*Phaseolus mungo* L.). Mysore Journal of Agricultural Sciences. 11: 322-325.

P Govindaraj and M.Subramanian (2001). Association analysis in black gram (*Vigna mungo* L. Hepper). Madras Agricultural Journal. 88(4-6): 240-242.

H.W. Johnson, H.F Robinson and R.E. Comstock (1955). Estimation of genetic and environmental variability in soybean. Agronomy Journal. 47: 314-318.

C.R. Konda, P.M Salimath and M.N. Mishra (2008). Correlation and path coefficient analysis in black gram (*Vigna mungo* L. Hepper). Legume Research. 31(3): 202-205.

M. Nagarjuna Sagar and M. Reddi Sekhar (2001). Character association studies in black gram (*Vigna mungo* L. Hepper). Madras Agricultural Journal. 88(4-6): 222-224.

C. Natarajan and R. Rathinaswamy (1999). Genetic variability and path coefficient analysis in black gram. Madras Agricultural Journal. 86(4-6): 228-231.

S.T. Patel and R.M. Shah (1982). Genetic parameters association and path analysis in black gram (*Vigna mungo* L. Hepper). Madras Agricultural journal. 69(8): 535-538.

H.S. Patil and R.B. Deshmukh (1989). Correlation and path analysis in black gram. Journal of Maharashtra Agricultural University.14(3): 310-312.

Pooran Chand and C. Rabhunandha Rao (2002). Breakage of undesirable correlations in black gram (*Vigna mungo* L. Hepper). Legume Research. 25(1): 37-40.

Ramesh Babu (1998). Studies on genetic divergence by D^2 statistic and Metroglyph analysis in black gram (*Vigna mungo* L. Hepper). M.Sc.(Ag.) Thesis. Acharya N G Ranga Agricultural University, Hyderabad, India.

C.R. Rameshwari Netam Netam, R.L. Pandey, and R.U. Khan (2010). Estimation of relationship of seed yield with its attributing traits in urdbean (*Vigna mungo* L. Hepper). Advances in Plant Sciences. 23(1): 97-100.

S. Santha, and K. Paramasivam (1999). Correlation and path analysis in rice fallow blackgram (*Vigna mungo*). Madras Agricultural Journal. 86 (7-9): 397-400.

G. Soundarapandian, R. Nagarajan, K. Madhudeswaram, and D.V. Marappan (1976). Genotypic and phenotypic correlation and path analysis in black gram. Madras Agricultural Journal. 63: 141-147.

B. Sunil Kumar, S. Padmavathi, M. Prakash and J. Ganesan (2003). Correlation and path analysis in black gram (*Vigna mungo* L. Hepper). Legume Research. 26(1): 75-76.

M. Umadevi and N. Meenakshi Ganesan (2005). Correlation and path analysis for yield and yield components in black gram (*Vigna mungo* L. Hepper). Madras Agricultural Journal. 92(10-12): 731-734.

Y. Usha Rani and J. Sakharam Rao (1981). Path analysis of yield components in black gram. Indian Journal of Agricultural Sciences. 51(6): 378-381.

A. Veeranjaneyulu, K.B. Eswari, V. Srinivasa Rao and J.V. Ramana (2007). Association analysis for yield and its components in black gram (*Vigna mungo* L. Hepper). The Andhra Agricultural Journal. 54(3&4): 134-138.

K.B. Wanjari (1988). Variability and character association in black gram (*Vigna mungo* L. Hepper). Indian Journal of Agricultural Sciences. 58(1): 48-51.