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Association analysis of seed yield and its attributing traits in black gram [*Vigna mungo* (L.) Hepper]

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ABSTRACT

An experiment was conducted in the year 2009 to estimate genotypic and phenotypic correlations in all possible combinations for seventy five accessions of black gram with the object to get the information on relative importance of various yield contributing characters and thus increase the efficiency of selection for higher yield based on yield components. The characters, plant height, number of primary branches per plant, number of pods per plant, number of seeds per plant, number of seeds per pod and 1000-seed weight showed positive correlation with seed yield both at phenotypic and genotypic level. The magnitude of genotypic correlation was higher than phenotypic correlation indicating that the association of traits with seed yield controlled by genetic factors like linkage and/ or pleiotropism. Path coefficient analysis indicated that characters namely number of seeds per plant and 1000-seed weight had high magnitude and positive direct effect on seed yield.

Key words: Black gram, Correlation, GCV, Path analysis, PCV.

INTRODUCTION

It is important to know the association of seed yield and its components in order to identify a suitable plant type. At the same time, knowledge about causes of genetic correlation will also give an idea about the extent of possible improvement of the character. The important causes underlined genetic correlations are linkage, pleiotropy, physiological association and heterozygosity. Correlated characters are of much interest because the change in one character brought about by selection, can bring simultaneous change in other character. Path coefficient is standardized partial regression coefficient. In biological system, the relationships may exist in a very complex form and the correlation coefficients are only the indications of simple associations between variable. The magnitude of association between two variables is always proved to effect and simultaneous variability in other related characters looking to above fact present investigation was carried out in black gram which is one of the major self-pollinated annual pulse crops and its average yield can be increased by framing suitable breeding strategies using association and path coefficient analysis which is based on seed yield and its components.

MATERIALS AND METHODS

Seventy five genotypes of black gram [*Vigna mungo* (L.) Hepper] were grown in *Kharif* 2009-10 and evaluated in a randomized block design with two replications at Regional Research Centre on Pulses, College of Agriculture, Indore (M.P.). All the recommended package of practices were followed for raising healthy crop.

Observations were recorded on, plot as well as single plant basis. Observations on plot basis were recorded for days to 50% flowering and days to maturity. For recording single plant observations, five competitive plants from each plot were randomly selected. Average of these five plants with respect to plant height, number of primary branches per plant, number of pods per plant, number of seeds per plant, number of seeds per pod, 1000-seed weight and seed yield per plant was used for statistical analysis. Correlation coefficients among seed yield and its components were calculated at phenotypic, genotypic level with the help of procedure adopted by Miller *et al.* (1958).

RESULTS AND DISCUSSION

Path coefficient analysis was carried out at combined level by taking seed yield per plant as a dependent variable in order to see the causal factors and to identify the common components, which is responsible for seed yield.

The correlation coefficients are given in Table 1. Correlation studies showed that for most of the character pairs, genotypic and phenotypic associations were in the same direction and the genotypic estimates were higher than the phenotypic ones, indicating an inherited association between the characters.

Seed yield per plant, the most important economic trait, exhibited positive association with plant height, number

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Table 1: Estimates of phenotypic and genotypic correlation coefficients in black gram

Characters		Days to maturity	Plant height (cm)	Number of primary branches /plant	Number of pods/ plant	Number of seeds/ plant	Number of seeds/ pod	1000 seed weight (g)	Seed yield/ plant (g)
Days to 50% flowering	P	0.058	-0.179*	-0.149	0.313**	0.125	-0.197*	-0.206**	0.012
	G	0.090	-0.192	-0.206	0.442	0.183	-0.240	-0.275	0.018
Days to maturity	P		-0.004	-0.046	0.073	0.086	0.029	0.163*	0.147
	G		0.028	-0.102	0.171	0.293	0.129	0.364	0.414
Plant height (cm)	P			0.314**	0.041	0.043	0.047	0.311**	0.168*
	G			0.358	0.040	0.038	0.043	0.332	0.179
Number of primary branches/plant	P				0.310**	0.325**	0.042	0.200*	0.344**
	G				0.377	0.365	0.042	0.226	0.384
Number of pods/plant	P					0.333**	-0.519**	0.175*	0.338**
	G					0.459	-0.388	0.200	0.466
Number of seeds/plant	P						0.576**	0.214**	0.900**
	G						0.646	0.255	0.887
Number of seeds/pod	P							0.070	0.496**
	G							0.101	0.533
Thousand-seed weight (g)	P								0.609**
	G								0.667

* - Significant at p =0.05   ** - Significant at p = 0.01

of primary branches per plant, number of pods per plant, number of seeds per plant, number of seeds per pod and 1000-seed weight both at phenotypic and genotypic level. Positive association of plant height, number of primary branches per plant, number of pods per plant, number of seeds per plant, number of seeds per pod and 1000-seed weight with seed yield per plant have also been reported by Patil and Deshmukh (1989) ; Pooranchand and Raghubandan Rao (2002); Parameswarappa and Lamani (2005) ; Revanappa *et al.*, (2004); Sharma *et al.*, (2005); Sharma *et al.*, (2006); Amarah *et al.*, (2006); Chauhan *et al.*, (2007); Veeranjaneyulu *et al.*, (2007); Konda *et al.*, (2008); Rameshwaram Netam Netam *et al.*, (2010); Isha *et al.*, (2011); Shivade *et al.*, (2011); Pushpa Reni *et al.*, (2013); Bharti *et al.*, (2014); Kumar *et al.*, (2014) and Kumar *et al.*, (2015). These results suggested that the characters plant height, number of primary branches per plant, number of pods per plant, number of seeds per plant, number of seeds per pod and 1000-seed weight are positively correlated with seed yield. In addition to this, number of primary branches per plant, number of pods per plant and number of seeds per plant also showed positive correlations among themselves. These results indicated that simultaneous improvement of number of primary branches per plant, number of pods per plant and number of seeds per plant could be achieved within a short period of time by selection.

Non-significant association of days to 50% flowering and days to maturity with seed yield per plant provides ample scope for developing early as well as late maturing genotypes.

Correlation of days to 50% flowering with number of primary branches per plant and number of seeds per plant, days to maturity with number of pods per plant, number of seeds per plant and seed yield per plant, which were missing at phenotypic level, was apparent at genotypic level. The appearance of correlation at genotypic level indicated that these characters were highly influenced by the environment. Such characters need to be carefully included in selection indices to exploit correlated response.

Hence, on the basis of correlation studies it is obvious that among the characters studied number of primary branches per plant, number of pods per plant and number of seeds per plant are positively correlated with seed yield and also one another indicating to their utility in selection programme for improving seed yield potential of population.

Path coeffient analysis studied at both genotypic and phenotypic level as presented in Table-2 & 3, respectively. As the results based on genotypic path analysis in the present study, it was revealed that number of seeds per plant followed by 1000-seed weight exhibited the highest direct effect on seed yield per plant this result were in conformity with the findings of Sharma *et al.* (2005);

TABLE 2: Direct and indirect effects through Genotypic path coefficient to growth characters and yield attributing characters on seed yield in black gram

Characters	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of primary branches/plant	Number of pods/ plant	Number of seeds / plant	No. of seeds / pod	1000 seed weight (g)	Genotypic correlation with yield
Days to 50% flowering	**-0.044**	0.000	-0.003	0.008	-0.110	0.207	0.084	-0.125	0.018
Days to maturity	-0.004	**0.004**	0.000	0.004	-0.043	0.332	-0.045	0.165	0.414
Plant height (cm)	0.008	0.000	**0.016**	-0.014	-0.010	0.043	-0.015	0.150	0.179
Number of primary branches/plant	0.009	0.000	0.006	**-0.038**	-0.094	0.413	-0.015	0.103	0.384
Number of pods/plant	-0.020	0.001	0.001	-0.014	**-0.249**	0.520	0.137	0.091	0.466
Number of seeds/ plant	-0.008	0.001	0.001	-0.014	-0.114	**1.133**	-0.228	0.116	0.887
Number of seeds/pod	0.011	0.001	0.001	-0.002	0.096	0.733	**-0.352**	0.046	0.533
Thousand-seed weight (g)	0.012	0.000	0.005	-0.009	-0.050	0.289	-0.035	**0.453**	0.667

Residual = 0.0065

Note: Underlined and bold values denote direct effect

TABLE 3: Direct and indirect effects through Phenotypic path coefficient to growth characters and yield attributing characters on seed yield in black gram

Characters	Days to 50% flowering	Days to maturity	Plant height (cm)	Number of primary branches/plant	Number of pods/ plant	Number of seeds / plant	No. of seeds / pod	1000 seed weight (g)	Phenotypic correlation with yield
Days to 50% flowering	**0.000**	0.000	0.000	0.000	-0.013	0.106	0.008	-0.090	0.012
Days to maturity	0.000	**0.007**	0.000	0.000	-0.003	0.073	-0.001	0.071	0.147
Plant height (cm)	0.000	0.000	**0.000**	-0.001	-0.002	0.037	-0.002	0.136	0.168
Number of primary branches/plant	0.000	0.000	0.000	**-0.003**	-0.013	0.275	-0.002	0.088	0.344
Number of pods/plant	0.000	0.001	0.000	-0.001	**-0.041**	0.281	0.022	0.077	0.338
Number of seeds/ plant	0.000	0.001	0.000	-0.001	-0.014	**0.845**	-0.025	0.094	0.900
Number of seeds/pod	0.000	0.000	0.000	0.000	0.021	0.487	**-0.043**	0.030	0.496
Thousand-seed weight (g)	0.000	0.001	0.000	-0.001	-0.007	0.181	-0.003	**0.437**	0.609

Residual = 0.0086

Note: Underlined and bold values denote direct effect

Amarah *et al*.,(2006); Singh *et al*.,(2007) and Kumar *et al*., (2014) while, the correlation of these two traits with seed yield per plant was also positive. Therefore, a true relationship exists between number of seeds per plant and seed yield per plant and between 1000-seed weight and seed yield per plant.

Number of pods per plant and number of seeds per pod, showed positive correlation with seed yield, exhibited considerable negative direct contribution. This showed negative direct contribution was converted into positive correlation mainly due to its positive indirect effects *via* number of seeds per plant. This result were supported by Kumar *et al*., (2014)

While, days to maturity, plant height and number of primary branches per plant had positive correlation with seed yield per plant; its direct effect was negligible. Its indirect effect seems to be the cause of positive correlation, since these characters show indirect positive effect through number of seeds per plant and 1000-seed weight.

The other character *viz.*, days to 50% flowering, which did not show correlation with seed yield per plant, also did not exhibit direct effect.

The results obtained from genotypic correlation coefficient and path analysis indicated that the characters namely number of seeds per plant and 1000-seed weight had strong positive correlation and high magnitude of positive direct effects on seed yield. Moreover, the indirect effects of most of the characters via number of seeds per plant and 1000-seed weight were positive and considerable. Hence, it is suggested that while exercising selection index more weightage should be given to number of seeds per plant and 1000-seed weight and they could be regarded as important components influencing seed yield of black gram. Correlation analysis at both phenotypic and genotypic levels indicated that number of primary branches per plant and number of pods per plant positively correlated with seed yield per plant and also with number of seeds per plant. It is therefore suggested that preference should also be given to number of primary branches per plant and number of pods per plant in selection programme to isolate superior strains with genetic potentiality for higher seed yield.

The residual effects were reported to be negligible at both phenotypic and genotypic levels. This indicated that most of the components, which contribute for seed yield, have already been included in the present investigation.

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