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Character association and Path analysis of Seed Yield and its Yield Components in Black gram (*Vigna mungo* (L.) Hepper)

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ABSTRACT: An experiment was carried out to estimate the genetic parameters like variability, heritability and genetic advance, character association and path analysis for six quantitative characters *viz.*, plant height, number of branches per plant, number of pods per plant, number of seeds per pod, length of the pod and seed yield in 12 genotypes of Black gram (*Vigna mungo* (L.) Hepper). The genotypic coefficients of variation for all the characters studied were lesser than the phenotypic coefficients of variation indicating the interaction of genotypes with environment. High heritability coupled with high genetic advance was observed for number of pods per plant and seed yield indicating the importance of additive gene action in governing the inheritance of these traits. Hence, simple selection is effective to improve the respected trait. Association studies revealed that, number of pods per plant shows significant positive correlation with seed yield per plot at genotypic and phenotypic levels and number of seeds per pod shows significant positive correlation with seed yield per plot at genotypic level and plant height, number of seeds per plant and length of pod shows positive association with seed yield at phenotypic level. Path analysis studies revealed that number of pods per plant showed true relationship by establishing positive association and direct effect on seed yield both at genotypic and phenotypic levels and plant height and length of pod at phenotypic level and number of seeds per pod at genotypic level.

Key words: Genetic variability, Heritability, Genetic advance, Character association, Path analysis, Black gram, Direct and indirect effects.

I. INTRODUCTION

Black gram (*Vigna mungo* (L.) Hepper) is an important pulse crop of India. It is a cheap source of dietary protein (24 per cent), which also contains 67 per cent carbohydrates, 3-5 per cent fibre and 1.74 per cent fat. It also contributes a major portion of lysine in the vegetarian diet and fairly good source of vitamins like thiamine, niacin, riboflavin and much needed iron and phosphorus. It also has a wide range of economic value. It is well known that 50 g pulses/person /day should be consumed in addition to other sources of protein such as cereals, milk, meat and egg which is a very difficult task to achieve as the production and productivity of pulse crop including black gram is very low. To improve such important pulse crop through breeding, study on genetic variability of important traits responsible for seed yield. Knowledge on heritability and genetic advance of the character indicate the scope for the improvement of a trait through selection. Heritability estimates along with genetic advance are also helpful in predicting the gain under selection (Johnson *et al.,* 1955) [3]. Seed yield being a complex character is very difficult to improve by selecting the genotypes for yield, therefore identifying the characters which are closely related and have contributed to yield becomes highly essential. The estimates of correlation coefficients mostly indicate the inter-relationships of the characters whereas path analysis permits the understanding of the cause and effect of related characters (Wright, 1921) [7]. The path analysis reveals whether the association of characters with yield is due to their direct effect on yield or is a consequence of their indirect effects via other component characters. Therefore, the present study was conducted in black gram to study the genetic parameters like variability, heritability & genetic advance, correlation and path coefficient effects of different yield components on seed yield.

II. MATERIAL AND METHODS

The field experiment was conducted at Agricultural Research Station, Vizianagaram during *Kharif* 2014. The design adopted was Randomised Block Design with three replications. Each plot consisted of ten rows of 3 meters length with a spacing of 30 × 10 cm. The fertilizer dose of 25:50:25kg NPK/ha (50% N in + Full P and K at the time of sowing) was applied at the time of sowing seed and seeds were sown by hand dibbling.

The remaining 50% N was applied after three weeks of sowing. Standard pest management measures were taken during the crop growth period as and when required. Observations were recorded on five plants for six quantitative characters *viz.*, plant height, number of branches per plant, number of pods per plant, number of seeds per pod, length of the pod and seed yield. The data was subjected to statistical analysis and estimates of correlation coefficients were worked out as per Snedecor and Cochran, (1967) [6], direct and indirect effects of yield components on yield were calculated as suggested by Dewey and Lu (1959) [1].

III. RESULTS AND DISCUSSION

The analysis of variance revealed significant difference among the genotypes for all the six characters studied (Table 1). In the present study, the variation among genotypes was estimated as coefficient of variation and the phenotypic coefficient of variance (PCV) was slightly higher in magnitude than genotypic coefficient of variance (GCV) for all the characters studied indicating the interaction of genotypes with environment (Table 2). High PCV and GCV were recorded for seed yield indicating sufficient variation among the genotypes studied. Heritability is a measure of genetic relationship between parents and progeny. In the present study, heritability estimates were high for number of pods per plant (70.90%) and seed yield (81.80%). High heritability alone is not sufficient enough to exercise selection unless the information is accompanied with substantial amount of genetic advance. Thus genetic advance is another important selection parameter which is exploited along with heritability to predict the genetic advance of the trait. High heritability coupled with high genetic advance was observed for number of pods per plant and seed yield indicating the importance of additive gene action in governing the inheritance of these traits. These results were in accordance with findings of Shivade *et al*. (2011) [4], Isha *et al.* (2011) [2] and Shridevi *et al*. (2011) [5].

Genotypic correlations were higher than the corresponding phenotypic correlations, low phenotypic correlations can be explained due to masking or modifying effects of environment on genetic association between characters. Number of pods per plant shows significant positive correlation with seed yield per plot at genotypic and phenotypic levels and number of seeds per pod shows significant positive correlation with seed yield per plot at genotypic level and plant height, number of seeds per plant and length of pod shows positive association with seed yield at henotypic level (Table 3). These results were in accordance with the findings of Shivade *et al*. (2011) [5], Isha *et al.* (2011) [2] and Sridevi *et al*. (2011) [4]. This suggests selecting for the characters with high positive correlation would improve the seed yield in Black gram.

Table 1: Analysis of variance (mean sum of squares) for yield and yield component characters in Blackgram (*Vigna mungo* L.).

Source of variations	d.f.	Plant height	Number of branches per plant	Number of pods per plant	Number of seeds per pod	Length of pod	Seed yield
Replications	2	35.248	0.034	1.248	0.360	0.004	0.001
Genotypes	11	23.473	0.832	18.528	0.737	0.194	0.023
Error	22	4.715	0.173	2.231	0.138	0.059	0.002

**Significant at 1% level.

Table 2: Estimates of variability, heritability and genetic advance as per cent of mean for seed yield and yield components in Black gram (*Vigna mungo* L.).

S. No.	Character	Mean	Range		Coefficient of variation		Heritability (broad sense)	Genetic advance as per cent of mean
			Minimum	Maximum	PCV (%)	GCV (%)		
1.	**Plant height**	18.528	13.933	23.400	17.874	13.496	57.00	20.993
2.	**Number of branches per plant**	5.178	4.333	6.133	12.100	9.057	56.00	13.964
3.	**Number of pods per plant**	12.872	8.800	16.467	21.505	18.166	70.90	31.404
4.	**Number of seeds per pod**	6.117	5.133	6.933	9.503	7.306	59.10	11.570
5.	**Length of pod**	3.886	3.433	4.367	8.303	5.443	43.00	7.351
6.	**Seed yield**	0.381	0.246	0.578	25.245	22.839	81.80	42.563

Table 3: Phenotypic and genotypic correlation coefficient in 12 genotypes of Black gram (*Vigna mungo* L.).

S. No	Characters		Plant height	Number of branches per plant	Number of pods per plant	Number of seeds per pod	Length of pod	Seed yield
1.	Plant height	r_p	1	0.692**	0.306**	0.094	0.392**	0.012
		r_g	1	0.927**	0.415**	0.429**	0.245**	-0.079
2.	Number of branches per plant	r_p		1	0.446**	0.046	0.237**	-0.052
		r_g		1	0.455**	0.174	0.407**	-0.135
3.	Number of pods per plant	r_p			1	0.385**	0.223**	0.484**
		r_g			1	0.614**	0.291**	0.581**
4.	Number of seeds per pod	r_p				1	0.559**	0.127
		r_g				1	0.836**	0.275**
5.	Length of pod	r_p					1	0.039
		r_g					1	-0.057
6.	Seed yield	r_p						1
		r_g						1

r_p = Phenotypic correlation coefficient. *Significant at 5% level, r_g = Genotypic correlation coefficient. **Significant at 1% level

Table 4: Path coefficients of yield and yield components of Black gram (*Vigna mungo* L.).

S. No	Characters		Plant height	Number of branches per plant	Number of pods per plant	Number of seeds per pod	Length of pod	Seed yield
1.	Plant height	P	**0.099**	0.068	0.030	0.009	0.039	0.012
		G	**-0.166**	-0.154	-0.068	-0.071	-0.041	-0.079
2.	Number of branches per plant	P	-0.297	**-0.429**	-0.191	-0.019	-0.102	-0.052
		G	-0.222	**-0.239**	-0.109	-0.042	-0.097	-0.135
3.	Number of pods per plant	P	0.212	0.309	**0.694**	0.267	0.155	0.484**
		G	0.308	0.338	**0.743**	0.456	0.217	0.581**
4.	Number of seeds per pod	P	-0.014	-0.007	-0.056	**-0.145**	-0.081	0.127
		G	0.064	0.026	0.092	**0.149**	0.125	0.275**
5.	Length of pod	P	0.011	0.007	0.006	0.015	**0.027**	0.039
		G	-0.064	-0.106	-0.076	-0.218	**-0.261**	-0.057

Bold are direct effects, P: Phenotypic path coefficient, Residual effects (P): 0.811G: Genotypic path coefficient (G):0.683

Path analysis revealed that number of pods per plant showed true relationship by establishing positive association and direct effect on seed yield both at genotypic and phenotypic levels and plant height and length of pod at phenotypic level and number of seeds per pod at genotypic level (Table 4). These results were in accordance with findings of Shivade *et al*. (2011) [4], Isha *et al.* (2011) [2] and Shridevi *et al*. (2011) [5]. Considering the nature and magnitude of character association and their direct and indirect effects, it can be inferred that improvement of seed yield is possible through simultaneous manifestation of number of pods per plant, plant height, number of seeds per plant and length of pod.

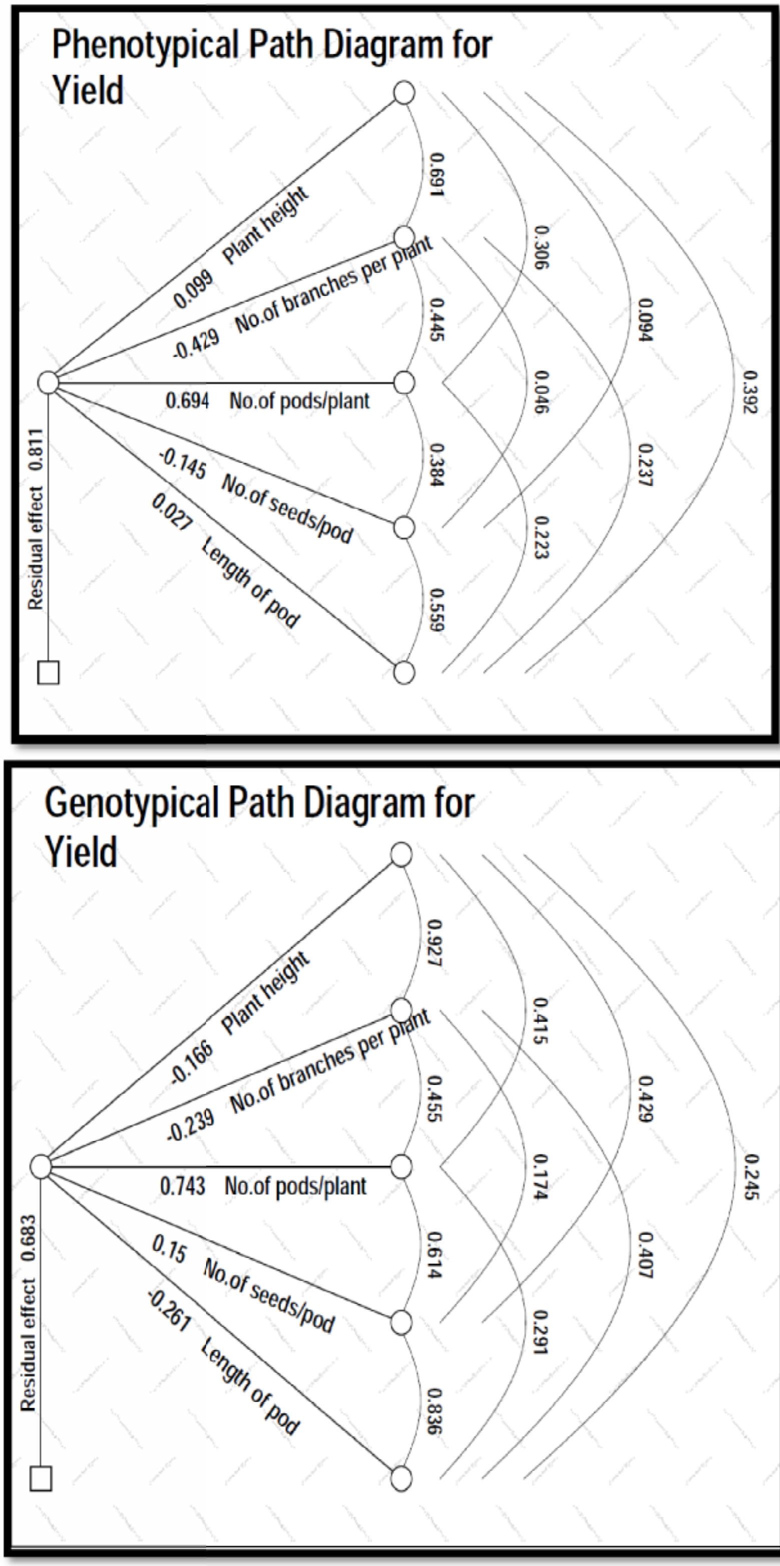

Fig. 1. Phenotypic and genotypic path diagrams showing cause-effect relationship of yield components with seed yield per plot of Blackgram.

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