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CORRELATION AND PATH ANALYSIS FOR YIELD AND YIELD COMPONENTS IN BLACKGRAM (*VIGNA MUNGO*)

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ABSTRACT
The present investigation was carried out with 30 blackgram genotypes grown in Kharif 2016 following randomized block design with three replications at Allahabad (U.P.) for correlations, and direct and indirect effects of twelve quantitative characters. Correlation studies revealed that grain yield per plant at genotypic and phenotypic level was significant and positively correlated with clusters per plant, pods per plant, biological yield per plant and harvest index. Path coefficients revealed that harvest index, biological yield per plant, pods per plant and seeds per pod had high positive direct effect on grain yield at both genotypic and phenotypic level. These characters could be further evaluated and can be used as donor parents for various traits of interest in future breeding programmes.

KEYWORDS: Blackgram (*Vigna mungo*), Correlation, Path analysis.

INTRODUCTION

Pulses are "nutritional powerhouse", rich in protein, high in fibre content and provide ample quantity of vitamins and minerals. Keeping in view large benefits of pulses for human health, the United Nations has proclaimed 2016 as the "International Year of Pulses". India is having the largest shares about 25% production, about 33% acreage and about 27% consuming of total pulses of the world. Blackgram (*Vigna mungo* (L). Hepper) also known as urdbean, is a self pollinating diploid grain legume (2n=2x=22) belonging to the Leguminaceae family and has genome size of 560mb (Arumuganath and Earle, 1991). It is a staple crop in the Central and South East Asia; however it is extensively used only in India and now grown in the Southern United States, West Indies, Japan and other tropics and subtropics (Delic *et al*., 2009). Blackgram is native to India (Vavilov, 1926). The progenitor of blackgram is believed to be *Vigna mungo var. silvestris*, which grows wild in India (Lukoki *et al*., 1980). Proximate composition of blackgram grain (per 100g) is energy (346 Kcal), protein (24g), fat (1.6g), carbohydrate (63.4g) and total dietary fibre (16.2) (Pulses for Human Health & Nutrition, IIPR). In India, blackgram is cultivated in an area of 3.06 million hectares with an average productivity of 555 kg/ha and production 1.70 million tonnes. In India, Madhya Pradesh is the leading producer of blackgram, cultivated in an area of 0.602mha with production 0.226mt and average productivity of 376kg/ha. Correlation coefficient studies provide an opportunity to study the magnitude and direction of association of yield with its components and also among various components (Panigrahi *et al.*, 2014). Path coefficient analysis is an efficient statistical technique specially designed to quantify the interrelationship of different components and their direct and indirect effects on seed yield (Pushpa Reni *et al*., 2013) Lack of stable varieties giving higher yield, because of technological stagnations is the major bottleneck for growing of this crop to serve as a commercial crop the plant type should be determinate, photo insensitive, early maturing with high harvest index and should have reasonable seed yield. For that, selection of promising plant is important. So this research effort is undertaken to ascertain the association between seed yield and its related components among thirty different blackgram genotypes for evolving the superior high yielding ones.

MATERIALS AND METHODS

The experimental materials consisted of 30 blackgram genotypes obtained from the Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad (U.P.) during *Kharif*-2016 raised in Randomized Block Design with three replications in the spacing of 30 cm x 10 cm at the field experimentation center of the Department of Genetics and Plant Breeding, and the recommended cultural practices were followed. Observations were recorded on five randomly taken plants from each replication for twelve quantitative traits *viz.*, days to 50% flowering, days to maturity, plant height, number of primary branches per plant, number of clusters per plant, number of pods per plant, number of seeds per pod, pod length, biological yield per plant, seed yield per plant, 100 seed weight and harvest index. The genetic association among the traits was estimated according to the formulae described by Al-Jibouri (1968). The path coefficient analysis was done according to Dewey and Lu (1959) for assessing the direct and indirect effects of each trait on grain yield.

RESULTS & DISCUSSION

The estimates of genotypic and phenotypic correlation coefficients among yield and yield attributing traits are presented in Table 1 and 2.in the present investigation.

TABLE 1: Correlation coefficient between yield and its related traits in 30 black gram genotypes at genotypic level

S.N.	Characters	Days to 50% Flowering	Days to maturity	Plant height	Number of branches/plant	Clusters/ plant	Pods/ plant	Seeds/ Pod	Pod length	Biological yield	Harvest Index	100-Seed Weight	Seed yield/ plant
1	Days to 50% Flowering	1.000	0.496**	-0.056	0.164	0.126	0.216	-0.082	0.039	0.225*	0.296*	0.232	0.311
2	Days to maturity		1.000	0.028	-0.158	0.033	0.028	-0.115	0.342**	0.029	-0.048	0.028	-0.004
3	Plant height			1.000	-0.346	0.170	0.214	0.186	-0.109	-0.118	-0.044	0.105	-0.142
4	Number of primary branches/plant				1.000	-0.127	-0.073	0.081	-0.22	0.133	0.103	-0.199	0.086
5	Clusters/plant					1.000	0.033	-0.251	-0.133	0.378	0.656**	0.598**	0.685**
6	Pods/plant						1.000	-0.361**	-0.005	0.349	0.631**	0.504**	0.614**
7	Seeds/pod							1.000	-0.387	-0.423	-0.349**	-0.116	-0.406**
8	Pod length								1.000	0.091	-0.198	0.006	-0.179
9	Biological yield									1.000	0.738**	0.119	0.841**
10	Harvest Index										1.000	0.103	0.045**
11	100 seed weight											1.000	0.161
12	Seed yield/plant												1.000

TABLE 2: Correlation coefficient between yield and its related traits in 30 black gram genotypes at phenotypic level

S.N.	Characters	Days to 50% Flowering	Days to maturity	Plant height	Number of branches/plant	Clusters/ plant	Pods/ plant	Seeds/ Pod	Pod length	Biological yield	Harvest Index	100-Seed Weight	Seed yield/ plant
1	Days to 50% Flowering	1.000	0.289**	-0.048	0.122	0.123	0.181	-0.047	0.048	0.214*	0.242*	0.187	0.195
2	Days to maturity		1.000	0.027	-0.123	0.006	0.005	-0.053	0.297**	0.001	-0.055	0.065	-0.054
3	Plant height			1.000	-0.299	0.127	0.188	0.153	-0.100	-0.118	-0.036	0.102	-0.121
4	Number of primary branches/plant				1.000	-0.073	-0.069	0.046	-0.207	0.088	0.089	-0.145	0.057
5	Clusters/plant					1.000	0.788	-0.342	-0.121	0.308**	0.53**	0.45**	0.493**
6	Pods/plant						1.000	-0.301**	0.002	0.326**	0.551**	0.413**	0.492**
7	Seeds/pod							1.000	-0.342	-0.363**	-0.311**	-0.079	-0.300**
8	Pod length								1.000	0.094	-0.193	-0.002	-0.132
9	Biological yield									1.000	0.69**	0.092	0.675**
10	Harvest Index										1.000	0.085	0.829**
11	100 seed weight											1.000	0.084
12	Seed yield/plant												1.000

TABLE 3: Direct and indirect effects of yield component characters on seed yield in black gram at genotypic level

No	Character	Days to Maturity	Days to 50% Flowering	Primary Branches	Plant Height cm	Pod Length cm	Clusters/ Plant	Pods/ Plant	Seeds/ Pod	100 seed Weight	Biological Yield/ Plant	Harvest Index
1.	Days to Maturity	0.100	0.050	-0.016	0.003	0.034	0.003	0.003	-0.012	0.003	0.003	-0.005
2.	Days to 50% flowering	-0.042	-0.085	-0.014	0.005	-0.003	-0.011	-0.018	0.007	-0.020	-0.019	-0.025
3.	Primary Branches	0.007	-0.008	-0.048	0.017	0.011	0.006	0.003	-0.004	0.009	-0.006	-0.005
4.	Plant Height cm	-0.003	0.006	0.039	-0.113	0.012	-0.019	-0.024	-0.021	-0.012	0.013	0.005
5.	Pod Length cm	-0.020	-0.002	0.013	0.006	-0.058	0.008	0.000	0.022	-0.000	-0.005	0.012
6.	Clusters/ Plant	-0.004	-0.017	0.017	-0.023	0.018	-0.133	-0.137	0.033	-0.079	-0.050	-0.087
7.	Pods/ Plant	0.001	0.009	-0.003	0.009	-0.000	0.043	0.042	-0.015	0.021	0.015	0.026
8.	Seeds/ Pod	-0.001	-0.001	0.001	0.001	-0.003	-0.002	-0.003	0.007	-0.001	-0.003	-0.003
9.	100 seed Weight	0.003	0.028	-0.024	0.013	0.001	0.072	0.060	-0.014	0.119	0.014	0.012
10.	Biological Yield per plant	0.003	0.029	0.017	-0.015	0.012	0.048	0.044	-0.054	0.015	0.127	0.094
11.	Harvest Index	-0.049	0.302	0.105	-0.045	-0.202	0.669	0.643	-0.356	0.105	0.753	1.020
12.	Seed Yield/ Plant	-0.004	0.311	0.087	-0.142	-0.179	0.685	0.615	-0.406	0.161	0.842	1.045

TABLE 4: Direct and indirect effects of yield component characters on seed yield in black gram at phenotypic level

No	Character	Days to Maturity	Days to 50% Flowering	Primary Branches	Plant Height cm	Pod Length cm	Clusters/ Plant	Pods/ Plant	Seeds/ Pod	100 seed Weight	Biological Yield/ Plant	Harvest Index
1.	Days to Maturity	-0.008	-0.002	0.001	-0.000	-0.002	0.000	0.000	0.001	-0.001	0.000	0.000
2.	Days to 50% flowering	-0.000	-0.002	-0.000	0.000	-0.000	-0.000	-0.000	0.000	-0.000	-0.000	-0.000
3.	Primary Branches	0.007	-0.007	-0.057	0.017	0.012	0.004	0.004	-0.003	0.008	-0.005	-0.005
4.	Plant Height cm	-0.003	0.005	0.034	-0.113	0.011	-0.014	-0.021	-0.017	-0.012	0.013	0.004
5.	Pod Length cm	-0.014	-0.002	0.010	0.005	-0.049	0.006	-0.000	0.016	0.000	-0.005	0.010
6.	Clusters/ Plant	0.001	0.011	-0.006	0.011	-0.010	0.086	0.067	-0.016	0.038	0.026	0.046
7.	Pods/ Plant	0.000	0.012	-0.004	0.012	0.000	0.050	0.064	-0.019	0.026	0.021	0.035
8.	Seeds/ Pod	0.000	0.000	-0.000	-0.000	0.001	0.001	0.001	-0.003	0.000	0.001	0.001
9.	100 seed Weight	-0.003	-0.009	0.007	-0.005	0.000	-0.021	-0.019	0.004	-0.048	-0.004	-0.004
10.	Biological Yield per plant	0.000	0.046	0.019	-0.025	0.020	0.067	0.071	-0.078	0.020	0.216	0.150
11.	Harvest Index	-0.033	0.144	0.053	-0.021	-0.114	0.315	0.326	-0.185	0.051	0.412	0.593
12.	Seed Yield/ Plant	-0.054	0.195	0.057	-0.121	-0.132	0.493	0.492	-0.301	0.084	0.676	0.829

The results showed that the value of genotypic correlation coefficient were higher than that of phenotypic correlation coefficient. The interrelationships were, therefore, strongly inherent and low phenotypic expression were due to environmental factors. Genotypic and phenotypic correlation coefficient analysis revealed that seed yield per plant exhibited positive and significant correlation with clusters per plant (0.685), pods per plant (0.614), biological yield per plant (0.841) and harvest index (0.914). Similar kind of positive significant association of all four characters are reported earlier by Chauhan *et al.* (2007); Parveen *et al.* (2011) for clusters per plant, pods per plant and harvest index. Negative significant correlation exhibited by seeds per pod (-0.406).Similar kind of negative and significant association of components with seed yield as observed for characters in present study was also reported earlier by Panigrahi *et al.* (2014). Positive non-significant correlation shown by days to 50% flowering (0.311), primary branches per plant (0.086) and 100 seed weight (0.161) Punia *et al.* (2014) also reported the same for primary branches per plant and finally, negative non-significant correlation exhibited by days to maturity (-0.004), plant height (-0.142) and pod length (-0.179); Netam *et al.* (2010) also reported negative non-significant correlation for pod length.

Path analysis furnishes the cause and effect of different yield components which would provide better index for selection rather than mere correlation coefficients. Correlation gives only the relation between two variables whereas path coefficient analysis allows separation of the direct effect and their indirect effects through other attributes by partitioning the correlation (Wright, 1921). Path coefficient analysis (Table 3 and 4) results showed that positive direct effect on grain yield was exhibited by biological yield per plant (0.127), 100 seed weight (0.119), days to maturity (0.100), pods per plant (0.042) and seeds per pod (0.007). Hence, selection based on these traits would be effective in increasing the seed yield. Conversely, the other characters *viz.*, plant height (-0.113), clusters per plant (-0.133), primary branches (-0.048), pod length (-0.058), and days to 50% flowering (-0.085) revealed negative direct effect of given magnitudes towards seed yield per plant. The characters harvest index (1.020) recorded the maximum and positive magnitude of direct effect on seed yield per plant and their association with seed yield was also highly significant and positive followed by biological yield per plant (0.127) and pods per plant (0.042). However, the clusters per plant (-0.133) had negative direct effect but positive and significant association with seed yield per plant whereas seeds per pod (0.007) also recorded positive direct effect but significantly negative correlation association with seed yield per plant. The observation showed the extent of reliability of these traits as a good selection index for grain yield. So direct selection for these traits can help to improve blackgram seed yield per unit area. Correlation coefficient and path coefficient analysis showed direct effect and significant positive association with pods per plant, biological yield per plant, harvest index which indicates that these characters can be used as selection parameters for black gram improvement.

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