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Correlation and Path Analysis in Blackgram [*Vigna mungo* (L.) Hepper]

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A B S T R A C T

The experimental material was consisting of 38 Blackgram genotypes, including T9, AZAD-1 checks which were obtained from Department of Genetics and Plant Breeding, SHUATS, Allahabad. The experiment was laid out in Randomised Block Design with 3 replications. The observations were logged on five randomly taken plants to each treatment and replication for 13 quantitative characters *viz.* Days to 50% flowering, days to 50% pod setting, 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, 100 seed weight, biological yield, harvest index and seed yield per plant to estimate the Correlation and Path analysis. The correlation analysis indicated that harvest index, number of pods per plant, pod length, number of primary branches per plant and biological yield, plant height displayed significant positive association with seed yield per plant in phenotypic and genotypic level. Path analysis revealed that the characters days to 50% pod setting, number of primary branches per plant, number of pods per plant, biological yield, harvest index exhibited positive direct effect on seed yield at phenotypic and genotypic level.

Introduction

Pulses are indispensable source of protein for predominantly vegetarian population of our country and they constitute a major part in our daily diet. Pulses are also known to increase the soil fertility and productivity of succeeding crop. The domestication and cultivation of staple food crops received more attention than pulses. Pulses are being ceaselessly grown under marginal lands of low fertility and moisture stress conditions hence genotypes are more adoptable to poor management which registers limited yield, this does not reflect low genetic potential but they may have higher genetic potential than cereals. Blackgram (*Vigna mungo* L. Hepper) is commonly known as urad, mesh or kalai. India is primary center of origin of Blackgram and Central Asia is a secondary center of origin. It is one of the most important legumes of India which belongs to family leguminosae. Being the seed yield as the complex character requires a knowledge of other yield contributing characters. Correlation coefficient indicates the interrelationship among the characters where as the path analysis splits the correlation into direct and indirect effects of

related characters (Wright, 1921). Hence, the present research work was undertaken to assess the correlation and path coefficients estimates of economically important plant characteristics and to determine the characteristics contributing to seed yield in blackgram.

Materials and Methods

The present investigation is carried out for 13 characters of Blackgram (*Vigna mungo* L. Hepper) on 38 genotypes (14 parents and their 22 F_1 hybrids including T9, AZAD-1 checks). *Kharif*, 2017 in randomized block design with a spacing of 30x10 cm replicated thrice at field experimentation centre, Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, U.P. The genotypes were sown by hand dibbling in each plot by imposing randomisation in each replication along with check T-9, AZAD-1. Each plot has 4 rows with the spacing of row to row 30 cm and plant to plant 10 cm. The fertiliser dose of N:P:K @20:40:40 kg/ha is applied as Nitrogen as two splits, phosphorus and potassium as basal dose. All recommended package of practices were followed during the cropping period to raise a good crop. The observations were recorded in each plot and replication by taking 5 plants selected for quantitative characters Days to 50% flowering, days to 50% pod setting, 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, 100 seed weight, biological yield, harvest index and seed yield per plant were recorded on plot bases. The data was subjected to the statistical analysis the correlation coefficients are estimated as suggested by Al Jibouri *et al.,* (1958) and the path analysis was calculated as suggested by Dewey and Lu (1959). The analysis was done by using statistical package WINDOSTAT 9.3 version.

Results and Discussion

Correlation studies in the breeding material will help in developing a selection scheme, which would help in enhancing the genetic potential of a crop. It also provides reliable information in nature extent and the direction of the selection especially when the breeder needs to combine high yield potential with desirable traits and seed quality characters.

The genotypic and phenotypic correlation coefficients were computed among 13 characters (Table 1). The harvest index, number of pods per plant, pod length, number of primary branches per plant and biological yield, plant height displayed significant positive association with seed yield per plant in phenotypic and genotypic level. Therefore, these characters appeared as greatest important associates of seed yield per plant and have also been observed by preceding workers Lad *et al.,* (2011), Rajasekhar *et al.,* (2017), Konda *et al.,* (2008), Mehra *et al.,* (2016), Kumar *et al.,* (2015), Gupta *et al.,* (2003), Punia *et al.,* (2014), Usharani *et al.,* (2015), Bharti *et al.,* (2014).

The correlation values provided only nature and degree of relationship of yield contributing characters on seed yield. Path coefficient analysis is a statistical technique to split the observed correlation coefficients into direct and indirect effects of independent variables on the dependent variable. In the present study, path coefficient analysis was carried out using genotypic and phenotypic correlation matrix of 13 characters (Table 1 and 2).

Path analysis revealed that the characters days to 50% pod setting, number of primary branches per plant, number of pods per plant, biological yield, harvest index exhibited positive direct effect on seed yield at phenotypic and genotypic level.

Table.1 Correlation coefficient between yield and its related traits in 38 black gram genotypes at genotypic level

S.No	Character	Days to 50% Pods Setting	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	100 Seed Weight	Biological Yield	Harvest Index	Seed Yield Per Plant (g)
	Days to 50% Flowering	0.934**	0.450**	-0.189	-0.069	0.258**	0.272**	-0.239*	0.008	0.218*	-0.082	-0.094	-0.058
	Days to 50% Pods Setting	**1.000**	0.572**	-0.062	-0.233*	0.307**	0.197	-0.115	-0.191	0.227*	-0.049	-0.099	-0.022
	Days to Maturity		**1.000**	-0.055	-0.171	-0.011	0.329**	0.304**	-0.074	0.494**	-0.095	0.138	0.188
	Plant Height			**1.000**	0.301**	-0.256**	-0.104	0.093	0.274**	-0.047	0.461**	-0.116	0.237*
	Number of Primary branches Per Plant				**1.000**	-0.046	0.191	-0.113	0.648**	-0.183	0.580**	-0.068	0.430**
	Number of Clusters Per Plant					**1.000**	0.417**	0.377**	-0.043	0.431**	-0.206*	0.039	-0.056
	Number of Pods Per Plant						**1.000**	0.068	0.243*	0.410**	-0.040	0.436**	0.526**
	Number of Seeds Per Pod							**1.000**	0.394**	0.469**	0.045	-0.018	0.037
	Pod Length								**1.000**	-0.190	0.641**	-0.037	0.502**
	100 Seed Weight									**1.000**	-0.137	-0.025	-0.077
	Biological Yield										**1.000**	-0.520**	0.355**
	Harvest Index											**1.000**	0.580**

* Significance at 5% level, ** Significance at 1% level

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

S.No	Character	Days to 50% Pods Setting	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	100 Seed Weight	Biological Yield	Harvest Index	Seed Yield Per Plant
	Days to 50% Flowering	0.8181**	0.4518**	-0.1580	-0.1091	0.2685**	0.2215*	-0.0320	0.0442	0.1095	-0.0357	-0.0893	-0.0509
	Days to 50% Pods Setting	**1.0000**	0.5236**	-0.0735	-0.2020*	0.2463*	0.1771	-0.0291	-0.0664	0.0915	-0.0150	-0.0810	-0.0060
	Days to Maturity		**1.0000**	-0.0659	-0.1660	0.0200	0.2449*	0.2026*	-0.0679	0.2688**	-0.0493	0.0832	0.1451
	Plant Height			**1.0000**	0.2922	-0.2044*	-0.0976	0.0226	0.1335	0.0097	0.4072**	-0.0869	0.2233*
	Number of Primary branches Per Plant				**1.0000**	-0.0687	0.1457	-0.0830	0.3887**	-0.0784	0.4361**	-0.0231	0.3512**
	Number of Clusters Per Plant					**1.0000**	0.3470**	0.2148*	-0.0368	0.3413**	-0.1352	0.0153	-0.0410
	Number of Pods Per Plant						**1.0000**	0.0393	0.1828	0.1876	-0.0010	0.3571**	0.4948**
	Number of Seeds Per Pod							**1.0000**	0.1818	0.0067	-0.0153	-0.0057	-0.0117
	Pod Length								**1.0000**	-0.1628	0.3120**	-0.0202	0.2506**
	100 Seed Weight									**1.0000**	-0.0354	-0.0929	-0.0496
	Biological Yield										**1.0000**	-0.5413**	0.3149**
	Harvest Index											**1.0000**	0.5719**

*Significance at 5% level, ** Significance at 1% level

Table.3 Direct and indirect effects between yield and its related traits in 38 Black gram genotypes at genotypic level

Character	Days to 50% Flowering	Days to 50% Pods Setting	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	100 Seed Weight	Biological Yield	Harvest Index	Seed Yield Per Plant
Days to 50% Flowering	**-0.2686**	-0.2508	-0.1210	0.0507	0.0186	-0.0692	-0.0731	0.0641	-0.0022	-0.0585	0.0220	0.0252	-0.0583
Days to 50% Pods Setting	0.3798	**0.4067**	0.2325	-0.0253	-0.0949	0.1248	0.0801	-0.0467	-0.0775	0.0922	-0.0200	-0.0403	-0.0223
Days to Maturity	-0.0193	-0.0245	**-0.0428**	0.0024	0.0073	0.0005	-0.0141	-0.0130	0.0032	-0.0212	0.0040	-0.0059	0.1876
Plant Height	0.0201	0.0066	0.0059	**-0.1064**	-0.0320	0.0273	0.0111	-0.0099	-0.0292	0.0050	-0.0490	0.0123	0.2373
Number of Branches Per Plant	-0.0071	-0.0238	-0.0174	0.0306	**0.1019**	-0.0046	0.0195	-0.0115	0.0660	-0.0186	0.0591	-0.0069	0.4303
Number of Clusters Per Plant	-0.0226	-0.0270	0.0009	0.0225	0.0040	**-0.0878**	-0.0366	-0.0331	0.0038	-0.0378	0.0181	-0.0034	-0.0558
Number of Pods Per Plant	0.0422	0.0305	0.0509	-0.0162	0.0296	0.0645	**0.1549**	0.0105	0.0377	0.0636	-0.0062	0.0675	0.5264
Number of Seeds Per Pod	-0.0183	-0.0088	0.0233	0.0071	-0.0087	0.0289	0.0052	**0.0766**	0.0302	0.0359	0.0035	-0.0014	0.0365
Pod Length	-0.0004	0.0096	0.0037	-0.0138	-0.0327	0.0022	-0.0123	-0.0199	**-0.0505**	0.0096	-0.0324	0.0018	0.5015
100 Seed Weight	-0.0009	-0.0009	-0.0020	0.0002	0.0007	-0.0017	-0.0017	-0.0019	0.0008	**-0.0041**	0.0006	0.0001	-0.0765
Biological Yield	-0.0711	-0.0427	-0.0819	0.3990	0.5028	-0.1784	-0.0348	0.0392	0.5551	-0.1183	**0.8662**	-0.4506	0.3553
Harvest Index	-0.0921	-0.0974	0.1354	-0.1135	-0.0664	0.0379	0.4281	-0.0179	-0.0359	-0.0243	-0.5106	**0.9816**	0.5802

RESIDUAL EFFECT = 0.2033

Table.4 Direct and indirect effects between yield and its related traits in 38 Black gram genotypes at phenotypic level

Character	Days to 50% Flowering	Days to 50% Pods Setting	Days to Maturity	Plant Height	Number of Primarybranches Per Plant	Number of Clusters Per Plant	Number of Pods Per Plant	Number of Seeds Per Pod	Pod Length	100 Seed Weight	Biological Yield	Harvest Index	Seed Yield Per Plant
Days to 50% Flowering	**-0.0520**	-0.0425	-0.0235	0.0082	0.0057	-0.0140	-0.0115	0.0017	-0.0023	-0.0057	0.0019	0.0046	-0.0509
Days to 50% Pods Setting	0.0691	**0.0844**	0.0442	-0.0062	-0.0171	0.0208	0.0150	-0.0025	-0.0056	0.0077	-0.0013	-0.0068	-0.0060
Days to Maturity	0.0202	0.0234	**0.0447**	-0.0029	-0.0074	0.0009	0.0109	0.0090	-0.0030	0.0120	-0.0022	0.0037	0.1451
Plant Height	0.0058	0.0027	0.0024	**-0.0368**	-0.0108	0.0075	0.0036	-0.0008	-0.0049	-0.0004	-0.0150	0.0032	0.2233
Number of Branches Per Plant	-0.0013	-0.0023	-0.0019	0.0034	**0.0115**	-0.0008	0.0017	-0.0010	0.0045	-0.0009	0.0050	-0.0003	0.3512
Number of Clusters Per Plant	-0.0017	-0.0015	-0.0001	0.0013	0.0004	**-0.0062**	-0.0022	-0.0013	0.0002	-0.0021	0.0008	-0.0001	-0.0410
Number of Pods Per Plant	0.0250	0.0200	0.0277	-0.0110	0.0165	0.0392	**0.1129**	0.0044	0.0206	0.0212	-0.0001	0.0403	0.4948
Number of Seeds Per Pod	0.0001	0.0001	-0.0004	0.0000	0.0002	-0.0004	-0.0001	**-0.0019**	-0.0003	0.0000	0.0000	0.0000	-0.0117
Pod Length	-0.0001	0.0002	0.0002	-0.0004	-0.0012	0.0001	-0.0006	-0.0006	**-0.0031**	0.0005	-0.0010	0.0001	0.2506
100 Seed Weight	0.0046	0.0038	0.0113	0.0004	-0.0033	0.0143	0.0079	0.0003	-0.0068	**0.0420**	-0.0015	-0.0039	-0.0496
Biological Yield	-0.0311	-0.0130	-0.0429	0.3546	0.3798	-0.1178	-0.0009	-0.0134	0.2717	-0.0308	**0.8708**	-0.4714	0.3149
Harvest Index	-0.0896	-0.0812	0.0834	-0.0871	-0.0232	0.0153	0.3580	-0.0058	-0.0203	-0.0931	-0.5427	**1.0024**	0.5719

RESIDUAL EFFECT = **0.3078**

These results were in accordance with the findings of Usharani *et al.*, (2015), Lad *et al.*, (2011) Rajasekhar *et al.*, (2017), Gupta *et al.*, (2003), Konda *et al.*, (2008), Mehra *et al.*, (2016), Kumar *et al.*, (2015), Punia *et al.*, (2014), Bharti *et al.*, (2014). By considering the nature and extent of correlation coefficients and their direct and indirect effects it can be concluded that improvement of Blackgram seed yield is brought through simultaneous selection primary branches per plant, clusters per plant, biological yield and harvest index (Table 3 and 4).

In conclusion, the correlation analysis indicated that with harvest index, number of pods per plant, pod length, number of primary branches per plant and biological yield, plant height displayed significant positive association with seed yield per plant in phenotypic and genotypic level. Path analysis revealed that the characters days to 50% pod setting, number of primary branches per plant, number of pods per plant, biological yield, harvest index exhibited positive direct effect on seed yield at phenotypic and genotypic level.

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