Website : www.ssdatmeerut.in
Progressive Research : An International Journal
Vol 16 (2) : 115-119 (July-2021), Print ISSN : 0973-6417, Online ISSN : 2454-6003
Society for Scientific Development in Agriculture and Technology, Meerut (U.P.) India

Character Association and Path Coefficient Analysis in Blackgram [*Vigna mungo* (L.) Hepper] during Summer Season

Parmar J.G.[1]*, Javia R.M.[1], Sharma L.K.[1], Vala J.P.[1], Nayee S.J.[1] and Singh S.P.[2]
[1]*Pulses Research Station, Junagadh Agricultural University, Junagadh*
[2]*CSAUAT-Agriculture Research Station, Kalai, Aligarh, U.P.*
[*]*Corresponding Author's Address : Dept. of GPB, JAU, Junagadh, Email : jaydeepparmar3442@gmail.com*

Abstract

Investigation was conducted to assess genetic variability, character association and path coefficient analysis in Blackgram [*Vigna mungo* (L.) Hepper] with a set of 50 genotypes in Randomized Block Design (RBD) at Pulses Research Station, JAU, Junagadh during *summer* 2019. The data were recorded on 11 quantitative traits. The analysis of variance revealed that mean square due to genotypes was highly significant for all the characters studied. A wide range of variation was observed for seed yield per plant, plant height, number of clusters per plant, number of pods per plant, 100-seed weight and reproductive phase duration. The magnitude of phenotypic coefficient of variation was higher than corresponding genotypic coefficient of variation for all the characters studied. High values of GCV and PCV were observed for seed yield per plant, plant height, number of clusters per plant and number of pods per plant. High heritability coupled with high genetic advance as per cent of mean was recorded for seed yield per plant followed by plant height, number of clusters per plant and number of pods per plant may be govern through additive gene action. So, selection should be done considering these characters as important yield attributing characters. Seed yield per plant had highly significant and positive correlation with number of pods per plant, number of clusters per plant, 100-seed weight, pod length, days to 50% flowering, days to maturity, plant height and number of braches per plant at both genotypic and phenotypic levels. Number of pods per plant and 100-seed weight exhibited positive and high direct effects on seed yield per plant. While number of clusters per plant exhibited positive and moderate direct effect on seed yield per plant. Number of pods per plant had positive and high indirect effect on seed yield per plant through number of clusters per plant. Seed yield per plant will improved in blackgram by selection based on these characters.

Key words : *Blackgram, variability, correlation, path analysis.*

Introduction

Blackgram [*Vigna mungo* (L.) Hepper] is commercially known as urdbean. India is primary centre of origin of blackgram and Central Asia is secondary centre (1). Blackgram comes under *fabaceae* family with chromosome number 2n=22 and 24.In India major blackgram producing states are Orissa, Madhya Pradesh, Rajasthan, Maharashtra, Gujarat and Bihar. In India blackgram grown in 56.02 lakh hacters and production is 30.59 lakh tones with average productivity of 546 kg ha^{-1} (2). Blackgram is fully exploited as it was totally neglected and has received relatively less attention for all aspects of genetic studies. Hence, efforts should make to produce stable and high yielding varieties. There is an ample scope for improvement in this crop very scanty information was recorded at world level and limited planned work has been done in India. Blackgram is traditionally grown as *kharif* season crop. It has also shown good performance under *summer* season. So, it is necessary to evaluate different genotypes available for their suitability under *summer* situation also. The present-day cultivars exhibit lower productivity, non-synchronous flowering and fruiting, non-response to high doses of inputs like fertilizers, irrigation, tillage *etc.,* non-suitability of the various cropping systems, lodging, shattering susceptible, long duration, complete or partial absence of genetic resistance to major pests and diseases. Development of cultivars with early maturity, acceptable grain quality, resistance to some important diseases and pests can increase the yield. Yield being a complex trait, is influenced by many other important yield contributing characters controlled by polygenes and also environmental factors (3). So, in these characters, observed variability is the sum total of hereditary effects of concerned genes plus the influence of the environment.

Materials and Methods

The present investigation was carried out with 50 blackgram genotypes were sown in a Randomized Block Design (RBD) with three replications during *summer* 2019 at Pulses Research Station, JAU, Junagadh. Each genotype was accommodated in a single row of 4 m length with a spacing of 45cm × 10cm. The recommended agronomical practices and plant protection measures were followed for the successful raising of the crop. The

Received : June-2021 Revised : July-2021 Accepted : July-2021

Table-1 : Analysis of variance showing mean squares for various characters in 50 genotypes of blackgram.

Source	d.f.	Mean squares										
		Seed yield per plant (g)	Days to 50% flowering	Days to maturity	Reproductive phase duration (days)	Plant height (cm)	Number of branches per plant	Number of clusters per plant	Number of pods per plant	Pod length (cm)	Number of seeds per pod	100-seed weight (g)
Replication	2	0.20	11.08	39.14	2.18	10.80	0.06	0.59	2.34	0.08	0.01	0.10
Genotypes	49	9.26**	94.54**	35.17**	39.33**	236.55**	0.84**	13.21**	99.57**	0.93**	1.11**	0.93**
Error	98	0.18	6.69	13.35	3.00	6.77	0.08	0.58	4.39	0.06	0.11	0.05

*, ** Significant at 5% and 1% levels, respectively.

observations were recorded on five randomly selected plants in each genotype from each replication except days to 50% flowering which was calculated on plant basis and their replication wise mean values were used for the statistical analysis. Analysis of variance for randomized block design (RBD) was done as per (4), phenotypic co-efficient of variation and genotypic co-efficient of variation was calculated as per the formula suggested by (5), heritability and genetic advance was estimated using the formula suggested by (6) phenotypic and genotypic correlation coefficients of all the characters were worked-out as per (7) and path coefficient analysis was carried-out as per the method suggested by (8).

Results and Discussion

Analysis of variance revealed that mean square due to genotypes were found highly significant for the all the characters included in this study suggesting the availability of sufficient genetic variability among the genetic material tested in the present experiment shown in (Table-1).

The estimates of genotypic and phenotypic coefficients of variation indicated that the values of phenotypic coefficients of variation were higher than corresponding genotypic coefficients of variation for all the traits due to partly interaction of the genotypes with the environment or other environmental factors influencing the expression of these characters given in table-2. Narrow differences observed between the phenotypic coefficients of variation and genotypic coefficients of variation in certain cases indicated that these characters were less influenced by the environment. The highest value of genotypic and phenotypic coefficients of variation was observed for seed yield per plant followed by plant height, numbers of cluster per plant and number of pods per plant. High magnitude of genotypic coefficients of variation indicated the presence of wide variation for the characters under study to allow further improvement by selection of the individual trait. High estimates of genotypic coefficients of variation for seed yield per plant reported by (9,10). Moderate values of genotypic and phenotypic coefficients of variation were observed for reproductive phase duration, number of branches per plant, pod length, 100-seed weight, number of seeds per pod and days to 50% flowering. Similar result reported by (11).

(5) suggested that genotypic coefficient of variation together with heritability estimate would give the best picture for selection. The maximum heritability was observed for seed yield per plant followed by plant height, number of pods per plant, number of clusters per plant, 100-seed weight, pod length, days to 50% flowering, reproductive phase duration, number of branches per plant, number of seeds per pod and days to maturity. High heritability estimates indicated that the characters were least influenced by the environmental factors and high capacity of the characters for transmission to subsequent generation. The high magnitude of heritability in blackgram has also been reported by (9,10).

(12) suggested that the heritability estimate along with genetic advance is more useful than the heritability alone in predicting the resultant effect of selection. High estimates of heritability coupled with high genetic advance expressed as percentage of mean were observed for seed yield per plant followed by plant height, number of clusters per plant and number of pods per plant. This may be attributed to the preponderance of additive gene action and possess high selective value and thus, selection pressure could profitably be applied on these characters for their rationale improvement.

Correlation coefficients at genotypic and phenotypic level among the seed yield and its component characters have been worked out in study (Table-3). In general, the values of genotypic correlation were higher than their corresponding phenotypic correlation in the present investigation. This indicated that though there was high degree of association between two variables at genotypic level, its phenotypic expression was deflated by the influence of environment. In the present study, seed yield per plant was found to be highly significant and positively correlated with days to 50% flowering, days to maturity,

Table-2 : Phenotypic range, coefficient of range, phenotypic and genotypic coefficient of variance, heritability, genetic advance and genetic advance expressed as per cent of mean for various characters of blackgram.

Characters	Phenotypic range of variation	Coefficient of range (%)	Mean ± S.Em	Genotypic coefficient of variation (%)	Phenotypic coefficient of variation (%)	Heritability in broad sense (%)	Genetic advance	Genetic advance expressed as per cent of mean
Seed yield per plant (g)	1.60 - 10.55	73.66	4.43 ± 0.24	39.22	39.61	98.01	3.54	79.98
Days to 50% flowering	38.33 - 57.00	19.58	47.51 ± 1.49	11.38	11.81	92.91	10.74	22.61
Days to maturity	63.33 - 78.00	10.38	69.71 ± 2.11	3.86	4.91	62.02	4.37	6.27
Reproductive phase duration (days)	15.33 - 29.00	30.84	22.68 ± 1.00	15.34	15.96	92.35	6.88	30.37
Plant height(cm)	14.08 - 49.00	55.36	30.39 ± 1.50	28.79	29.21	97.14	17.76	58.45
Number of branches per plant	2.53 - 4.66	29.62	3.75 ± 0.16	13.37	14.09	90.03	0.98	26.13
Number of clusters per plant	4.20 - 12.60	50.00	7.21 ± 0.44	28.43	29.09	95.54	4.13	57.25
Number of pods per plant	12.13 - 38.40	51.99	21.47 ± 1.21	26.23	26.83	95.58	11.34	52.83
Pod length (cm)	3.06 - 5.23	25.91	4.10 ± 0.14	13.08	13.56	92.98	1.06	25.99
Number of seeds per pod	3.33 - 5.90	27.84	4.86 ± 0.19	11.83	12.51	89.45	1.12	23.06
100-seed weight (g)	3.30 - 6.26	30.96	4.54 ± 0.13	11.91	12.28	94.08	1.08	23.80

Table-3 : Genotypic (r_g) and phenotypic (r_p) correlation coefficient among 11 characters in 50 genotypes of blackgram.

Characters		Days to 50% flowering	Days to maturity	Reproductive phase duration (days)	Plant height (cm)	Number of branches per plant	Number of clusters per plant	Number of pods per plant	Pod length (cm)	Number of seeds per pod	100-seed weight (g)	Seed yield per plant (g)
Days to 50% flowering	r_g	1.00	0.9647**	-0.8166**	0.6884**	0.5503**	0.3715**	0.4697**	0.5279**	0.2175	0.4899**	0.4968**
	r_p	1.00	0.7274**	-0.7881**	0.6545**	0.4976**	0.3335*	0.4372**	0.4705**	0.2008	0.4632**	0.4653**
Days to maturity	r_g		1.00	-0.4498**	0.8196**	0.6674**	0.3706**	0.4347**	0.4360**	0.1887	0.6903**	0.5283**
	r_p		1.00	-0.3150*	0.6442**	0.5283**	0.2854*	0.3386*	0.3437*	0.1141	0.5499**	0.4133**
Reproductive phase duration (days)	r_g			1.00	-0.4107**	-0.2804*	-0.2523	-0.4239**	-0.4386**	-0.0826	-0.2665	-0.4471**
	r_p			1.00	-0.3960**	-0.2599	-0.2359	-0.3910**	-0.4019**	-0.0894	-0.2631	-0.4186**
Plant height (cm)	r_g				1.00	0.5471**	0.5728**	0.5685**	0.4873**	0.3845**	0.5358**	0.5252**
	r_p				1.00	0.5165**	0.5582**	0.5510**	0.4590**	0.3597*	0.5136**	0.5136**
Number of branches per plant	r_g					1.00	0.3931**	0.4124**	0.5482**	0.2372	0.3553*	0.4871**
	r_p					1.00	0.3685**	0.3926**	0.5001**	0.2264	0.3401*	0.4570**
Number of clusters per plant	r_g						1.00	0.8858**	0.4753**	0.3729**	0.4783**	0.8122**
	r_p						1.00	0.8626**	0.4524**	0.3486*	0.4519**	0.8012**
Number of pods per plant	r_g							1.00	0.6266**	0.3419*	0.5815**	0.8953**
	r_p							1.00	0.5865**	0.3104*	0.5425**	0.8787**
Pod length(cm)	r_g								1.00	0.4319**	0.4107**	0.5863**
	r_p								1.00	0.3941**	0.3902**	0.5573**
Number of seeds per pod	r_g									1.00	0.1501	0.2832*
	r_p									1.00	0.1444	0.2638
100-seed weight (g)	r_g										1.00	0.7118**
	r_p										1.00	0.6794**

*,** Significant at 5% and 1 % respectively

Table-4 : Phenotypic path coefficient analysis showing direct (diagonal and bold) and indirect effects of different characters on seed yield per plant in blackgram.

Characters	Days to 50% flowering	Days to maturity	Reproductive phase duration (days)	Plant height (cm)	Number of branches per plant	Number of clusters per plant	Number of pods per plant	Pod length (cm)	Number of seeds per pod	100-seed weight (g)	Phenotypic correlation with seed yield (g)
Days to 50% flowering	-0.2522	-0.1835	0.1988	-0.1651	-0.1255	-0.0841	-0.1103	-0.1187	-0.0507	-0.1168	0.4653**
Days to maturity	0.1010	0.1389	-0.0438	0.0895	0.0734	0.0396	0.0470	0.0477	0.0158	0.0764	0.4133**
Reproductive phase duration (days)	0.2175	0.0869	-0.2760	0.1093	0.0717	0.0651	0.1079	0.1109	0.0247	0.0726	-0.4186**
Plant height(cm)	-0.1053	-0.1037	0.0637	-0.1609	-0.0831	-0.0898	-0.0887	-0.0739	-0.0579	-0.0826	0.5136**
Number of branches per plant	0.0624	0.0662	-0.0326	0.0647	0.1253	0.0462	0.0492	0.0627	0.0284	0.0426	0.4570**
Number of clusters per plant	0.0977	0.0836	-0.0691	0.1635	0.1079	0.2929	0.2527	0.1325	0.1021	0.1324	0.8072**
Number of pods per plant	0.1937	0.1500	-0.1732	0.2441	0.1739	0.3821	0.4430	0.2598	0.1375	0.2403	0.8787**
Pod length(cm)	0.0045	0.0033	-0.0039	0.0044	0.0048	0.0044	0.0057	0.0097	0.0038	0.0038	0.5553**
Number of seeds per pod	0.0031	0.0018	-0.0014	0.0056	0.0035	0.0054	0.0048	0.0061	0.0155	0.0022	0.2638
100-seed weight (g)	0.1429	0.1697	-0.0812	0.1585	0.1050	0.1394	0.1674	0.1204	0.0446	0.3086	0.6794**

*,** Significant at 5 % and 1% levels, respectively, Residual effect, R=0.356

plant height, number of branches per plant, number of clusters per plant, number of pods per plant, pod length and 100-seed weight at both genotypic and phenotypic level. The positive genotypic association has been reported between seed yield per plant and days to 50% flowering, number of pods per plant, number of clusters per plant, 100-seed weight by (13); days to maturity, plant height, number of branches per plant and pod length. Thus, on the basis of correlations, the character's number of pods per plant, number of clusters per plant, 100-seed weight and pod length proved to be the outstanding characters influencing seed yield in blackgram and needs to be given importance in selection to achieve higher seed yield. Reproductive phase duration had negative and highly significant correlation with seed yield per plant.

In the present study, the path coefficient analysis (Table-4) revealed that number of pods per plant and 100-seed weight had positive and high direct effect on seed yield per plant. Similar results were reported by (14,15) Whereas, number of clusters per plant had positive and moderate direct effect on seed yield per plant (16). Thus, these characters turned-out to be the major components of seed yield and direct selection for these traits will be rewarding for yield improvement.

Number of pods per plant had high and positive indirect effect to seed yield per plant through number of clusters per plant. Number of pods per plant had moderate and positive indirect effect on seed yield through plant height, pod length and 100-seed weight. Similar results were reported by (13,17). These characters also turned-out to be the major components of seed yield and direct selection for these traits will be rewarding for yield improvement.

Days to maturity, number of branches per plant, pod length and number of seeds per pod had positive and low direct effect to seed yield per plant. Whereas, days to 50% flowering and reproductive phase duration had moderate and negative direct effect to seed yield per plant.

The residual effect was moderate magnitude suggesting that the some of the yield attributes had not been included in the path analysis. It was apparent from the path analysis that higher direct effects were exerted by number of pods per plant and 100-seed weight. These both characters also exhibited significant and positive correlation with seed yield per plant and hence, these may be considered as most important yield contributing characters and due emphasis should be placed on these components while breeding for high seed yield in blackgram.

Conclusions

It can be concluded from variability parameters that additive gene action was operating for seed yield per plant, plant height, number of clusters per plant and number of pods per plant. Correlation study revealed that number of pods per plant, number of clusters per plant, 100-seed weight were highly significant and positively correlated with seed yield per plant and path analysis also revealed that these characters had high to moderate direct effect on seed yield per plant, therefore, due weightage should be given to these traits for selection in blackgram for summer season.

References

1. Vavilov N.I. (1926). Studies on origin of cultivated plant. *Chron. Bot.,* 13: 1949-1950.
2. Anonymous (2019). Directorate of Economics and Statistics. *Ministry of Agriculture and Farmer's Welfare,* pp-1.
3. Nath A., Maloo S.R. and Nath S. (2020). Heterosis for grain yield and quality traits in Greengram [*Vigna radiata* (L.) Wilczek]. *Progressive Research-An International Journal,* 15(1): 19-25.
4. Panse V.G. and Sukhatme P.V. (1985). *Statistical methods for agricultural workers* (second addition), *I.C.A.R.,* New Delhi.
5. Burton G.W. (1952). Quantitative inheritance in grasses. *Proc. 6th Int. Grassland Cong., held at Pennsylvania State College,* 1: 277-283.
6. Allard R.W. (1960). *Principles of Plant Breeding. John Wiley and Sons*, New York.
7. Al-Jibouri H.A., Miller P.A. and Robinson H.F. (1958). Genotypic and environmental variances in upland cotton cross of inter specific origin. *Agron. J.*, 50: 633-635.
8. Dewey D.R. and Lu K.H. (1959). A correlation and path coefficient analysis of components of crested wheat grass seed production. *Agron. J.*, 51: 511-518.
9. Sowmini K. and Jayamani P. (2013). Genetic variability studies for yield and its component traits in RIL population of blackgram [*Vigna mungo* (L.) Hepper]. *Elect. J. Pl. Breed.*, 4(1): 1050-1055.
10. Reni Y.P., Rao Y.K., Satish Y. and Babu S.J. (2013). Estimates of genetic parameters and path analysis in blackgram [*Vigna mungo* (L.) Hepper]. *Int. J. Pl. Ani. and Env. Sci.*, 3(4): 231-234.
11. Konda C.R., Salimath P.M. and Mishra M.N. (2009). Genetic variability studies for productivity and its components in blackgram [*Vigna mungo* (L.) Hepper]. *Legume Res.*, 32(1): 59-61.
12. Johnson H.W., Robinson H.F. and Compstock R.E. (1955). Estimates of genetic and environmental variability in soyabean. *Agron. J.*, 47: 314-318.
13. Parveen S.I., Reddy S.M., Reddy D.M. and Sudhakar P. (2011). Correlation and path coefficient analysis for yield and yield components in blackgram [*Vigna mungo* (L.) Hepper]. *Int. J. App. Bio.Pharm. Tech.,* 2(3): 619-625.
14. Panigrahi K.K., Mohanty A. and Baisakh B. (2014). Genetic divergence, variability and character association in landraces of blackgram [*Vigna mungo* (L.) Hepper] from Odisha. *J. Crop and Weed,* 10(2): 155-165.
15. Yashoda, Gowda T.H. Vishnutej E. and Swetha. (2016). Genetic variability and character association for yield and its components in blackgram [*Vigna mungo* (L.) Hepper]. *The Bioscan.*, 11(2): 1059-1063.
16. Shivade H.A., Rewale A.P. and Patil S.B. (2011). Correlation and path analysis for yield and yield components in blackgram [*Vigna mungo* (L.) Hepper]. *Legume Res.*, 34(3): 178-183.
17. Rajmohan S. (2015). Association analysis for yield and its components in urdbean (*Vigna mungo* L.) genotypes. *The Bioscan*, 10(4): 2121-2124.