ORIGINAL RESEARCH ARTICLE

Genetic studies of diverse genotypes of blackgram in Kymore plateau district of Madhya Pradesh,India

ABSTRACT

The experiment was conducted involving 96 genotypes of black gram for genetic variability of 13 quantitative traits at Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur. The analysis of variance (ANOVA) revealed existence of significant differences among the genotypes for all the characters studied. Among the genetic parameters phenotypic coefficient of variation (PCV) was higher than genotypic coefficient of variation (GCV) for all the traits indicates the role of environment in expression of the characters. High GCV and PCV were maximum in case of biological yield followed by number of pods per plant, number of pod clusters per plant, harvest index, seed yield per plant and plant height. Characters like plant height, number of pod clusters per plant, number of pods per plant, biological yield, seed yield per plant and harvest index shows high heritability coupled with high genetic advance. Correlation and Path analysis studies revealed that the important yield attributing traits like biological yield, harvest index, number of pods per plant, pod length, 100 seed weight exhibited a highly significant correlation values both at phenotypic and genotypic levels. Further, the same traits also exhibited a higher value of direct effects on seed yield per plant. Hence, these traits should be given the top priority while developing the superior hybrids in blackgram.

Keywords: *Blackgram, genetic variability, correlation, path analysis, seed yield.*

1. INTRODUCTION

Urdbean, scientifically named *Vigna mungo* (L.) Hepper, is classified within the Angiosperms phylum, under the sub-phylum Dicotyledones, Lignosae division, and the Leguminosae family [1]. This legume, known by various regional names such as Biri, Urd, Urad, Urid, Mash, and Mungo with a chromosome count of 2n=22 and an estimated genome size of 574 Mbp [2]. Renowned for its adaptability, Urdbean is cultivated across diverse agroecological conditions, making it a versatile crop in both arid and humid environments. As a self-pollinated, diploid grain legume, it is a significant agricultural staple, particularly in Asian countries, cultivated primarily during the kharif and rabi seasons [2] .

Nutritionally, Urdbean is a powerhouse, offering a high protein content ranging from 20.8 to 30.5%, and carbohydrates between 56.5 to 63.7% [1]. Its protein content is notably higher than cereals, providing about 26% protein, which is almost three times more [3].Its cultivation plays a crucial role in enhancing soil nitrogen content, contributing to soil fertility, especially in the traditional farming regions of Southern Asia, including India, Afghanistan, Pakistan, Myanmar, and Bangladesh.Though, India is the world's largest producer of blackgram, it imports a large amount to meet the growing domestic needs [2]. Blackgram is grown in varying agro- ecological conditions and cropping systems with diverse cultural practices, so it needs appropriate plant type for each growing situation. The breeding progress has been slow and uneven because several desirable traits need to be combined for developing appropriate plant type for a particular growing region and cropping system. Although India is the largest producer of blackgram, However its productivity is lower (469 kg/ha) than the world average. One of the factors responsible for the poor productivity of blackgram is lack of stable cultivars [4].In any crop breeding, selection of promising genotype is important. An association study gives information about the contribution of different characters towards seed yield. Seed yield is a complex trait and is influenced by number of component traits. The study on inter-relationship between the component traits and seed yield will formulate an effective and viable breeding programme for improvement of yield in a short time. Studies on correlation values indicate the intensity and direction of association of a character with yield. Path analysis identifies the yield components with direct and indirect influence on the yield [5].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.

2. MATERIALS AND METHODS

During the *Kharif* season of the year 2023, a total of 96 urdbean genotypes were assessed at breeding farm, Department of Plant Breeding and Genetics, College of Agriculture, Jabalpur (Table 1).

Table 1 List of *Vigna mungo* genotypes used under the study

S. no.	Genotypes	S. no.	Genotypes	S. no.	Genotypes	S. no.	Genotype
1	JU-3	25	TJU 4	49	KUG 1152	73	KUG 1137
2	PDU-1	26	TJU 22	50	KUG 1153	74	KUG 1138
3	TJU45-1	27	TJU 67	51	KUG 1154	75	KUG 1140
4	TU-98-14	28	TJU 24	52	KUG 1155	76	KUG 1141
5	TJU 139	29	TJU 339 (CHECK)	53	KUG 1156	77	KUG 1139
6	TJU 328	30	TJU 130 (CHECK)	54	KUG 1157	78	KUG 1162
7	TJU 213	31	TJU 231	55	KUG 1158	79	KUG 1163
8	TAU 2	32	TJU 48	56	KUG 1159	80	KUG 1164
9	TJU 18	33	TJU 273	57	KUG 1160	81	KUG 1165
10	INDIRA URD 1	34	TJU 111	58	KUG 1121	82	KUG 1167
11	TJU 42	35	TJU 41-1	59	KUG 1122	83	KUG 1168
12	PU 19	36	TJU 84	60	KUG 1123	84	KUG 1169
13	TJU 134	37	PU 35	61	KUG 1124	85	KUG 1170
14	TU 94-2	38	KUG 1149	62	KUG 1125	86	KUG 1171
15	TJU 55	39	MASH 114	63	KUG 1126	87	KUG 1173
16	TJU 24-10	40	MASH 479	64	KUG 1127	88	KUG 1174
17	TJU 41-2	41	MASH1137	65	KUG 1129	89	KUG 1175
18	T 9	42	MASH1008	66	KUG 1130	90	KUG 1176
19	TJU 103	43	KUG 1142	67	KUG 1131	91	KUG 1177
20	TJU 62	44	KUG 1145	68	KUG 1132	92	KUG 1178
21	LBG 20	45	KUG 1146	69	KUG 1133	93	KUG 1179
22	TJU 262	46	KUG 1147	70	KUG 1134	94	KUG 1180
23	URDI LOCAL	47	KUG 1148	71	KUG 1135	95	KUG 1181
24	IPU 2-43	48	KUG 1151	72	KUG 1136	96	MASH 338

The field experiment included two check varieties TJU 130 and TJU 339, under a Randomized Complete Block Design with two replications. Each genotype was methodically planted in two-meter rows with 30 cm and 10 cm spacing between and within rows. The package of practices recommended in the crop production guide was followed. Thirteen traits viz., days to flower initiation, days to 50% flowering, days to maturity, plant height, number of primary branches per plant, number of pod clusters per plant, number of pods per plant, pod length, number of seeds per pod, biological yield per plant, harvest index, 100 seed weight, seed yield per plant were recorded for five randomly selected plants in each of the accessions per replication. Phenotypic and genotypic coefficients of variation were calculated based on the method advocated by Burton [6].Heritability and genetic advance, Genotypic and phenotypic correlation coefficients as percent of mean were estimated as per formula given by Johnson [7]. Path coefficient analysis suggested by Wright [8] and elaborated by Dewey and Lu [9] was used to calculate the direct and indirect contribution of various traits to yield.

3. RESULTS AND DISCUSSION

3.1. Analysis of variance and genetic variability

The genetic characteristics for the characters under study, including mean, range, PCV and GCV, heritability estimates, and anticipated genetic advance as a percentage of mean. In the present

investigation 96 diverse genotypes of blackgram including two check varieties were studied to assess their yield and yield attributing characters. The analysis of variance clearly indicated that there was highly significant differences among the genotypes for all the 13 characters studied (Table 2). Large differences in the mean values for all the traits were observed. The trait days to flower initiation ranged from KUG1132(28 days) to TJU111(38 days), days to 50% flowering ranged from KUG 1151(36 days) to TJU 84(43.50 days) , days to maturity ranged from KUG1142 (64.50 days) to TJU 84(79.80 days),plant height ranged from KUG 1138(15.09cm) to TU-98-14(43.78), number of primary branches per plant TJU 18(6.66) to TJU 84(13.60), number of pod clusters per plant ranged from LBG 20(4.83) to KUG1181 (20.10), number of pods per plant ranged from URDI LOCAL(9.36) to TJU339(49.50), pod length ranged from TJU 48(3.58) to KUG 1181 (4.93), number of seeds per pod ranged from TJU-2 (3.58) to KUG 1132 (7.83), biological yield per plant TJU22 (6.14) to T9 (30.42), seed yield per plant TJU 22(3.32) to TJU339(13.72), harvest index ranged from TJU 262 (21.01) to KUG 1159 (82.25), 100 seed weight ranged from KUG 1146 (2.70) to TJU 62(5.50). In the present study, variation among the characters is estimated by GCV and PCV. The magnitude of phenotypic coefficient of variation was higher than genotypic coefficients for all characters under study, indicating the interaction of genotypes with the environment. High GCV and PCV were maximum in case of biological yield (31.85 and 32.56) followed by number of pods per plant (29.66 and 30.106), number of pod clusters per plant(28.74 and 31.16), harvest index (23.76 and 27.75), seed yield per plant (23.83 and 26.18) and plant height (21.74 and 22.69) (Table 3). Similar findings were reported by Gnanasekaran *et al*. [10], Gomathi *et al.* [11].

Table 2 Analysis of variance for yield traits in Blackgram genotypes

S. No	Source of Variance	df	Mean sum of square											
			DFI	DF	DM	PH (cm)	NPB	NPC	NP	PL (cm)	NS	BY (gm)	SY (gm)	HI (%)	SW (gm)
1	Replication	1	5.33**	4.38**	1.17**	11.03**	1.37**	5.57**	17.13**	0.433**	0.003**	121.47**	27.32**	4.30**	0.45**
2	Genotype	95	11.37**	10.37**	22.19**	80.97**	4.24**	18.25**	119.12**	0.21**	0.984**	49.13**	5.44**	272.85**	0.67**
3	Error	95	2.04	2.46	2.57	3.44	2.37	1.47	1.75	0.11	0.48	1.080	0.509	42.06	0.34

DFI-Days to flower initiation, DF-Days to 50% flowering, DM-Days to maturity, PH-Plant height, NPB-Number of primary branches per plant, NPC-Number of pod clusters per plant, NP-Number of pods per plant, PL-Pod length per plant, NS-Number of seeds per plant, BY-Biological yield per plant, SY-Seed yield per plant, HI-Harvest index, SW-100 seed weight

High heritability in the broad sense is not only enough to make sufficient improvement through selection unless accompanied by the amount of genetic advance. The estimates of heritability (broad sense) was observed for number of pods per plant (97.10%) followed by biological yield per plant(95.70%), plant height(91.80%), number of pod clusters per plant (85.10), seed yield per plant (82.90), days to maturity (79.20), harvest index (73.30), days to flower initiation (69.10) , days to 50% flowering (61.60), indicating preponderance of additive gene action in the expression of these traits and they can be improved through individual plant selection. High heritability coupled with high genetic advance as percent of the mean was recorded for plant height, pod cluster, no. of pods per plant, biological yield, seed yield per plant, harvest index which revealed that selection could be effective for these characters (Table 3). Similar results were observed by Gnanasekaran *et al.* [10].

Table 3 Parameters of genetic variability for grain yield and its attributing traits

S. no.	Traits	Range		Grand Mean	Coefficient of variance		h²(b)%	Genetic advance as % mean
		Minimum	Maximum		GCV%	PCV%		
1.	Days to flower initiation	28	38	30.65	6.99	8.40	69.10	11.97
2.	Days to 50% flowering	36	43.50	38.46	5.16	6.58	61.60	8.35
3.	Days to maturity	64.50	79.80	71.92	4.35	4.89	79.20	7.98
4.	Plant Height (cm)	15.09	43.78	28.63	21.74	22.69	91.80	42.93
5.	Number of Primary branches per plant	6.66	13.60	9.93	9.73	18.32	28.20	10.65
6.	Number of Pod clusters per plant	4.83	20.10	10.07	28.74	31.16	85.10	54.62
7.	Number of Pods per plant	9.36	49.50	25.82	29.66	30.106	97.10	60.21
8.	Pod length(cm)	3.58	4.93	4.28	5.32	9.557	31	6.10
9.	Number of seeds per Pod	4.49	7.83	6.12	8.16	13.99	34.10	9.82
10.	Biological yield per plant	6.14	30.42	15.38	31.85	32.56	95.70	64.19
11	Seed Yield per plant	3.32	13.72	6.58	23.83	26.18	82.90	44.69
12	Harvest Index (%)	21.01	82.25	45.20	23.76	27.75	73.30	41.90
13	100 seed weight	2.70	5.50	4.59	8.79	15.56	31.90	10.24

PCV = Phenotypic coefficient of variation, GCV = Genotypic coefficient of variation

3.2. Correlation and Path coefficient analysis

Correlation studies provide a natural relationship between diverse plant characters on yield and its components on the selection of genotypes for genetic improvement in yield. The genotypic and phenotypic correlations between all possible combinations of characters were estimated. Moreover, genotypic correlation coefficient was higher than their phenotypic correlation coefficient for all characters under study .The phenotypic correlation of seed yield per plant show highly significant and positive correlation with plant height, number of primary branches per plant, number of pod clusters per plant, number of pods per plant, pod length , biological yield , 100 seed weight, and seed yield per plant show significant and positive correlation with harvest index , significant and negative correlation was shown by days to 50% flowering with seed yield per plant (Table 4).

The genotypic correlation of seed yield per plant shows highly significant and positive correlation with days to maturity, plant height, number of primary branches per plant, number of pod clusters per plant, number of pods per plant, pod length, biological yield per plant, 100 seed weight and significant and negative correlation was shown by days to flower initiation and days to 50% flowering (Table 5). Similar results have been published by Priya *et al*. [12], Bharathi *et al.*[13] , Gomathi *et al.* [11] , Narayanan *et al*. [14], Reddy *et al*. [15].The estimation of correlation alone may be often misleading to the mutual cancelation of components characters. So, it is necessary to study path coefficient analysis which provides a degree of relationship. Path coefficient analysis defines partitioning of the correlation coefficient into direct and indirect effect to know the relative importance of the attributing traits. Path coefficient analysis at phenotypic level revealed that biological yield (0.9389) had the maximum positive direct effect on seed yield per plant followed by harvest index (0.7629), number of pods per plant (0.1729), Pod length(0.0609), 100 seed weight(0.0431), number of seed per pod (0.0278), days to flower initiation (0.0095), number of pod cluster per plant (0.0085). While, substantial negative direct effects on seed yield per plant were contributed by number of primary branches per plant (-0.0090), plant height (-0.0232), days to maturity (-0.0229) and days to 50% flowering (-0.0573) (Table 6). Path coefficient analysis at genotypic level revealed that biological yield per plant (0.9050), harvest Index (0.6275), Pod length (0.2290), number of pod clusters per plant (0.1809), number of pods per plant (0.1634), plant height (0.0222), 100 seed weight (0.0190), number of seeds per pod (0.0091), days to 50% flowering (0.0004). While substantial negative direct effects on seed yield per plant was contributed by days to

flower initiation (-0.1312) and number of primary branches per plant (-0.2168) (Table 7). Similar results were reported earlier by Priyanka *et al*. [16], Kumar *et al.* [17].

Table 4 Phenotypic correlation coefficient among the grain yield and its attributing traits

Characters	DFI	DF	DM	PH (cm)	NPB	NPC	NP	PL (cm)	NS	BY (g)	HI (%)	SW (g)	SY
DFI	1.0000	0.8213***	0.0588	-0.0184	-0.1144	-0.1147	-0.0762	-0.0390	-0.1548*	-0.0176	-0.0454	0.1045	-0.1050
DF		1.0000	-0.0480	0.0496	-0.1559*	-0.0647	-0.1237	-0.125	-0.1475*	-0.0947	0.0289	0.0252	-0.1473*
DM			1.0000	0.1188	0.0894	-0.0257	0.2321**	0.0418	-0.0625	0.2937***	-0.1841*	0.1756*	0.1609
PH (cm)				1.0000	0.4533***	0.5268***	0.2828***	0.2231**	0.0359	0.3783***	-0.0705	0.2951*	0.3493**
NPB					1.0000	0.5546***	0.3878***	0.3116***	0.0980	0.3696***	-0.0825	0.1589*	0.3711**
NPC						1.0000	0.6321***	0.2355**	0.0820	0.5000***	-0.1283	0.0276	0.4934**
NP							1.0000	0.2527***	0.1410	0.7155***	-0.2201**	0.0433	0.6946**
PL (cm)								1.0000	0.1321	0.2946***	-0.1368	0.2391***	0.2906**
NS									10000	0.0086	-0.0745	-0.0325	0.0174
BY (g)										1.0000	-0.5923***	0.1740*	0.6273**
HI (%)											1.0000	0.1140	0.1666**
SW (g)												1.0000	0.3022**
SY													1.0000

*significant at 5% level of significance, **significant at 1% level of significance. DFI-Days to flower initiation, DF-Days to 50% flowering, DM-Days to maturity, PH-Plant height, NPB-Number of primary branches per plant, NPC-Number of pod clusters per plant, NP-Number of pods per plant, PL-Pod length per plant, NS-Number of seeds per plant, BY-Biological yield per plant, SY-Seed yield per plant, HI-Harvest index, SW-100 seed weight

Table 5 Genotypic correlation coefficient among the grain yield and its attributing traits

Characters	DFI	DF	DM	PH (cm)	NPB	NPC	NP	PL (cm)	NS	BY (g)	HI (%)	SW (g)	SY
DFI	1.0000	0.8108**	0.0897**	0.0027	-0.1601**	-0.0973	-0.0627*	0.1183	-0.3856	-0.0073	-0.0688	0.1443*	-0.1428*
DF		1.0000	-0.0902	0.0941	-0.1755*	-0.0728	-0.1389	-0.0268	-0.4243*	-0.1130	0.0872	-0.0836	-0.1654*
DM			1.0000	0.1386	0.2531	-0.0396	0.2533	0.1032	-0.1182	0.3502	-0.2619	0.3213	0.2031**
PH (cm)				1.0000	0.8013	0.5661	0.2905	0.3424	0.0466	0.3921	-0.0688	0.5002	0.4052**
NPB					1.0000	0.9585	0.6835	0.5066	-0.1323	0.7205	-0.2922	0.5223	0.7134**
NPC						1.0000	0.6539	0.3181	0.0427	0.5422	-0.1706	0.0200	0.5605**
NP							1.0000	0.4060	0.2345	0.7459	-0.2809	0.0288	0.7555**
PL (cm)								1.0000	0.0082	0.4879	-0.1297	0.5967	0.6119**
NS									1.0000	-0.0447	0.0111	-0.2292	0.0932**
BY (g)										1.0000	-0.6392	0.3884	0.7139**
HI (%)											1.0000	-0.2059	-0.0038**
SW (g)												1.0000	0.2796**
SY													1.0000

*significant at 5% level of significance, **significant at 1% level of significance,

DFI-Days to flower initiation, DF-Days to 50% flowering, DM-Days to maturity, PH-Plant height, NPB-Number of primary branches per plant, NPC-Number of pod clusters per plant, NP-Number of pods per plant, PL-Pod length per plant, NS-Number of seeds per plant, BY-Biological yield per plant, SY-Seed yield per plant, HI-Harvest index, SW-100 seed weight

Table 6 Phenotypic path coefficient analysis for grain yield and its attributing traits

Characters	DFI	DF	DM	PH (cm)	NPB	NPC	NP	PL (cm)	NS	BY (g)	HI (%)	SW (g)	SY
DFI	0.0095	0.0078	0.0006	-0.0002	-0.0011	-0.0011	-0.0007	-0.0004	-0.0015	-0.0002	-0.0004	0.0010	-0.1050
DF	-0.0471	-0.0573	0.0028	-0.0028	0.0092	0.0037	0.0071	0.0069	0.0084	0.0054	-0.0017	-0.0014	-0.1473
DM	-0.0013	0.0011	-0.0224	-0.0027	-0.0020	0.0006	-0.0052	-0.0009	0.0014	-0.0066	0.0041	-0.0039	0.1609
PH (cm)	0.0004	-0.0012	-0.0028	-0.0232	-0.0105	-0.0122	-0.0066	-0.0052	-0.0008	-0.0088	0.0016	-0.0068	0.3493
NPB	0.0010	0.0014	-0.0008	-0.0041	-0.0090	-0.0050	-0.0035	-0.0028	-0.0009	-0.0033	0.0007	-0.0014	0.3711
NPC	-0.0010	-0.0006	-0.0002	0.0046	0.0049	0.0088	0.0056	0.0021	0.0007	0.0044	-0.0011	0.0002	0.4934
NP	-0.0132	-0.0214	0.0401	0.0489	0.0670	0.1093	0.1729	0.0437	0.0244	0.1237	-0.0380	0.0075	0.6946
PL (cm)	-0.0024	-0.0073	0.0025	0.0136	0.0190	0.0144	0.0154	0.0609	0.0081	0.0180	-0.0083	0.0146	0.2906
NS	-0.0043	-0.0041	-0.0017	0.0010	0.0027	0.0023	0.0039	0.0037	0.0278	0.0002	-0.0021	-0.0009	0.0174
BY (g)	-0.0166	-0.0889	0.2757	0.3552	0.3470	0.4694	0.6718	0.2766	0.0080	0.9389	-0.5561	0.1633	0.6273
HI (%)	-0.0346	0.0220	-0.1404	-0.0538	-0.0630	-0.0978	-0.1679	-0.1043	-0.0568	-0.4519	0.7629	0.0870	0.1666
SW (g)	0.0045	0.0011	0.0076	0.0127	0.0069	0.0012	0.0019	0.0103	-0.0014	0.0075	0.0049	0.0431	0.3022

R square = 0.8641 residual effect = 0.3687

DFI-Days to flower initiation, DF-Days to 50% flowering, DM-Days to maturity, PH-Plant height, NPB-Number of primary branches per plant, NPC-Number of pod clusters per plant, NP-Number of pods per plant, PL-Pod length per plant, NS-Number of seeds per plant, BY-Biological yield per plant, SY-Seed yield per plant, HI-Harvest index, SW-100 seed weight

Table 7 Genotypic path coefficient analysis for grain yield and its attributing traits

Characters	DFI	DF	DM	PH (cm)	NPB	NPC	NP	PL (cm)	NS	BY (g)	HI (%)	SW (g)	SY
DFI	-0.1312	-0.1064	-0.0118	-0.0004	0.0210	0.0128	0.0082	-0.0155	0.0506	0.0010	0.0090	-0.0189	-0.1428
DF	0.0004	0.0004	0.0000	0.0000	-0.0001	0.0000	-0.0001	0.0000	-0.0002	-0.0001	0.0000	0.0000	-0.1654
DM	0.0046	-0.0046	0.0512	0.0071	0.0130	-0.0020	0.0130	0.0053	-0.0061	0.0179	-0.0134	0.0164	0.2031
PH (cm)	0.0001	0.0021	0.0031	0.0222	0.0178	0.0126	0.0065	0.0076	0.0010	0.0087	-0.00150	0.0111	0.4052
NPB	0.0347	0.0380	-0.0549	-0.1737	-0.2168	-0.2078	-0.1482	-0.1098	0.0287	-0.1562	0.0634	-0.1132	0.7134
NPC	-0.0176	-0.0132	-0.0072	0.1024	0.1734	0.1809	0.1183	0.0575	0.0077	0.0981	-0.0309	0.0036	0.5605
NP	-0.0102	-0.0227	0.0414	0.0475	0.1117	0.1068	0.1634	0.0663	0.0383	0.1219	-0.0459	0.0047	0.7555
PL (cm)	0.0271	-0.0061	0.0236	0.0784	0.1160	0.0728	0.0930	0.2290	0.0019	0.1117	-0.0297	0.1367	0.6119
NS	-0.0035	-0.0038	-0.0011	0.0004	-0.0012	0.0004	0.0021	0.0001	0.0091	-0.0004	0.0001	-0.0021	0.0932
BY (g)	-0.0066	-0.1023	0.3170	0.3548	0.6520	0.4907	0.6751	0.4415	-0.0405	0.9050	-0.5785	0.3515	0.7139
HI (%)	-0.0432	0.0547	-0.1643	-0.0431	-0.1834	-0.1071	-0.1763	-0.0814	0.0070	-0.4011	0.6275	-0.1292	-0.0038
SW (g)	0.0027	-0.0016	0.0061	0.0095	0.0099	0.0004	0.0005	0.0113	-0.0044	0.0074	-0.0039	0.0190	0.2796

R square = 0.8982 residual effect = 0.3190

DFI-Days to flower initiation, DF-Days to 50% flowering, DM-Days to maturity, PH-Plant height, NPB-Number of primary branches per plant, NPC-Number of pod clusters per plant, NP-Number of pods per plant, PL-Pod length per plant, NS-Number of seeds per plant, BY-Biological yield per plant, SY-Seed yield per plant, HI-Harvest index, SW-100 seed weight

4. CONCLUSION

The study illustrated the existence of wide range of variations for most of the traits among blackgram genotypes. High GCV and PCV were maximum in case of Biological yield (31.85 and 32.56), followed by number of pods per plant (29.66 and 30.106), number of pod clusters per plant (28.74 and 31.16), harvest index (23.76 and 27.75), seed yield per plant (23.83 and 26.18) and plant height (21.74 and 22.69). Characters like plant height, number of pod clusters per plant, number of pods per plant, biological yield, seed yield per plant and harvest index shows high heritability coupled with high genetic advance. Correlation and Path analysis studies revealed that the important yield attributing traits like biological yield, harvest index, number of pods per plant, pod length, 100 seed weight exhibited a highly significant correlation values both at phenotypic and genotypic levels. Further, the same traits also exhibited a higher value of direct effects on seed yield per plant. Hence, these traits should be given the top priority while developing the superior hybrids in blackgram.

AUTHORS' CONTRIBUTIONS

AS and SS designed the study, NP performed statistical analysis, NT and YS managed literature searches, NT and SS edited the manuscript. All authors read and approved the final version of the manuscript.

Disclaimer (Artificial intelligence)
Option 1:
Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.
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Details of the AI usage are given below:
1.
2.
3.

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