

# Correlation analysis for quantitative traits in blackgram (*Vigna mungo* (L.) Hepper) in different seasons

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**Abstract-** A field experiment comprised of 14 lines, three testers and 42 F<sub>1</sub> hybrids of blackgram was conducted to assess the magnitude of relationship of important plant traits with seed yield during three seasons viz., *kharif*, *rabi* and *summer*. Out of fourteen characters studied, seven viz., branches per plant, pods per plant, seeds per pod, seeds per plant, 100 seed weight pod weight and harvest index were highly significant and positively correlated with seed yield at both phenotypic and genotypic level in all three seasons and pooled over seasons. However four characters viz., seed yield, branches per plant, pods per plant and seeds per plant were highly significantly and positively correlated among themselves revealing their significant influence on seed yield. Selection of these traits are expected to lead positive results in improvement of seed yield in blackgram.

**Index Terms-** Blackgram, correlation, seed yield, quantitative traits, seasons

## I. INTRODUCTION

Blackgram (*Vigna mungo* (L.) Hepper) is one of the important pulse crop grown in India. It is an important source of proteins, carbohydrates, vitamins and minerals as well as of dietary fibers. Yield is a complex trait determined by several component traits, hence selection for yield should take into account related traits as well. So the knowledge of correlation between yield and its component traits is essential for seed yield improvement through selection programs. The objective of the present study was to determine the association of different traits with seed yield in blackgram during three diverse seasons.

## II. MATERIALS AND METHODS

Fourteen blackgram genotypes obtained from NBPGR Regional Centre, Hyderabad which were originally collected from different agro-climatic zones of Andhra Pradesh were used as lines viz., IC587753, IC436720, IC436519, IC343947, IC519805, IC343952, IC587752, IC587751, IC282009, IC436753, IC436610, IC436665, IC398971 and IC281987 and three nationally released varieties were used as testers viz., PU-19, LBG-20 and T-9. With fourteen lines and three testers, 42 crosses were made in a line × tester mating design as proposed by Kempthorne (1957). The F<sub>1</sub> hybrid seeds along with parental lines were sown in randomized complete block design with three replications during *Kharif*, *Rabi* and *Summer* in 2013-14, at Hayathnagar Research Farm, CRIDA, Hyderabad. Each row of 1m length consists of 10 plants with a spacing of 10cm between the plants and 30cm between two rows was maintained. The

observations were recorded on plant height (cm), days to 50% flowering, number of branches per plant, clusters per plant, pods per plant, pod length (cm), seeds per pod, seeds per plant, pod weight (g/pl), fodder biomass (g/pl), total biomass (g/pl), 100 seed weight (g/pl), seed yield (g/pl) and harvest index (%) during three seasons. The phenotypic and genotypic correlation coefficients were calculated as per method developed by Johanson *et al.* (1955).

## III. RESULTS AND DISCUSSION

### Analysis of variance

Analysis of variance was carried out for fourteen characters in parents and F<sub>1</sub> hybrids during three different seasons and the results were presented in Table 1. The analysis of variance revealed highly significant differences among hybrids, lines and testers for all the characters indicating the presence of wide variability among the 59 genotypes. The significant variability due to treatment was observed for all the fourteen characters in three seasons viz., *kharif*, *rabi*, *summer* and pooled data. The significant variation in parents and lines was observed for three characters viz., seed yield, days to 50% flowering and 100 seed weight in all three seasons and pooled whereas testers showed significant differences for only days to 50% flowering in all three seasons and pooled data. There was significant difference between parents i.e. lines vs testers for five characters viz., plant height, days to 50% flowering, pod length, 100 seed weight and fodder biomass. The variability between three environment viz., *kharif*, *rabi* and *summer* showed significant differences for all the fourteen characters studied.

During *kharif*, correlation analysis revealed that seed yield showed positive and significant phenotypic and genotypic correlation with all quantitative traits except days to 50% flowering (Table 2). Positive and significant phenotypic and genotypic correlation during *kharif* was observed for seed yield per plant with pod weight ( $r_p=0.936$ ,  $r_g=0.991$ ), number of seeds per plant ( $r_p=0.925$ ,  $r_g=0.919$ ), number of pods per plant ( $r_p=0.877$ ,  $r_g=0.896$ ), number of clusters per plant ( $r_p=0.689$ ,  $r_g=0.624$ ), total biomass ( $r_p=0.634$ ,  $r_g=0.864$ ), number of branches ( $r_p=0.419$ ,  $r_g=0.967$ ), harvest index ( $r_p=0.386$ ,  $r_g=0.563$ ), 100 seed weight ( $r_p=0.269$ ,  $r_g=0.299$ ), pod length ( $r_p=0.243$ ,  $r_g=0.596$ ), fodder biomass ( $r_p=0.225$ ,  $r_g=0.360$ ), plant height ( $r_p=0.221$ ,  $r_g=0.346$ ) and number of seeds per pod ( $r_p=0.201$ ,  $r_g=0.406$ ). During *rabi* season, positive and significant phenotypic and genotypic correlation for seed yield with all traits except two viz., number of clusters per plant and days to 50% flowering (Table 3). Positive and significant phenotypic and genotypic correlation was observed with pod weight ( $r_p=0.751$ ,

$r_g=0.871$ ), number of seeds per plant ( $r_p=0.665$ ,  $r_g=0.731$ ), harvest index ( $r_p=0.674$ ,  $r_g=0.611$ ), number of pods per plant ( $r_p=0.555$ ,  $r_g=0.669$ ), total biomass ( $r_p=0.481$ ,  $r_g=0.752$ ), fodder biomass ( $r_p=0.450$ ,  $r_g=0.559$ ), number of seeds per pod ( $r_p=0.422$ ,  $r_g=0.700$ ), 100 seed weight ( $r_p=0.368$ ,  $r_g=0.389$ ), number of branches ( $r_p=0.238$ ,  $r_g=0.927$ ), plant height ( $r_p=0.221$ ,  $r_g=0.333$ ), pod length ( $r_p=0.180$ ,  $r_g=0.147$ ). In *summer* season, positive and significant phenotypic and genotypic correlation was observed with seed yield with number of seeds per plant ( $r_p=0.870$ ,  $r_g=0.927$ ), harvest index ( $r_p=0.853$ ,  $r_g=0.982$ ), number of pods per plant ( $r_p=0.653$ ,  $r_g=0.710$ ), number of clusters per plant ( $r_p=0.485$ ,  $r_g=0.555$ ), 100 seed weight ( $r_p=0.403$ ,  $r_g=0.474$ ), pod weight ( $r_p=0.281$ ,  $r_g=0.224$ ), number of branches per plant ( $r_p=0.217$ ,  $r_g=0.306$ ), number of seeds per pod ( $r_p=0.213$ ,  $r_g=0.675$ ) and total biomass ( $r_p=0.076$ ,  $r_g=0.290$ ). However, days to 50% flowering ( $r_p=-0.188$ ,  $r_g=-0.249$ ) was negatively and significantly correlated with seed yield during *summer* (Table 4). While the correlation analysis for pooled data over three seasons revealed that seed yield showed positive significant phenotypic and genotypic correlation with all traits except with days to 50% flowering (Table 5). Positive and significant phenotypic and genotypic correlation of seed yield per plant with number of seeds per plant ( $r_p=0.822$ ,  $r_g=0.928$ ), number of pods per plant ( $r_p=0.705$ ,  $r_g=0.840$ ), pod weight ( $r_p=0.638$ ,  $r_g=0.757$ ), harvest index ( $r_p=0.596$ ,  $r_g=0.715$ ), total biomass ( $r_p=0.568$ ,  $r_g=0.673$ ), number of clusters per plant ( $r_p=0.476$ ,  $r_g=0.919$ ), number of branches ( $r_p=0.340$ ,  $r_g=0.769$ ), 100 seed weight ( $r_p=0.333$ ,  $r_g=0.371$ ), number of seeds per pod ( $r_p=0.271$ ,  $r_g=0.644$ ), fodder biomass ( $r_p=0.242$ ,  $r_g=0.355$ ), plant height ( $r_p=0.174$ ,  $r_g=0.198$ ) and pod length ( $r_p=0.153$ ,  $r_g=0.201$ ).

The results showed that the genotypic correlations of seed yield were higher than phenotypic ones with majority of the characters studied. The seed yield recorded positive and significant phenotypic and genotypic correlation with all quantitative characters except days to 50% flowering during all the three seasons and in pooled over seasons, however seven characters out of fourteen *viz.*, branches per plant, pods per plant, seeds per pod, seeds per plant, 100 seed weight pod weight and harvest index were highly significantly and positively correlated with seed yield at both phenotypic and genotypic level in all three seasons studied and pooled over seasons (Table 6), indicating that these seven traits could be important for improving the seed yield in blackgram. Similar positive and significant correlation of seed yield with different quantitative traits were reported in blackgram by Chauhan *et al.* (2007), Veeranjaneyulu *et al.* (2007), Isha Perveen *et al.* (2011) and Pushpa Reni *et al.* (2013), Vijay Kumar *et al.* (2014) and Bharti *et al.* (2014). Branches per plant were highly correlated at both phenotypic and genotypic level with following six characters *viz.*, seed yield, clusters per plant, pods per plant, seeds per plant, total biomass and pod weight. Similar results of branches per plant correlated with pods per plant, seeds per plant were reported earlier by Shivade *et al.* (2011) in blackgram and Ahmad *et al.* (2013) in mungbean. It is prominent to observe that the correlation of branches per plant with plant height was non-significant in all the seasons and pooled over seasons. Pods per plant was correlated with seeds per plant, seeds per pod, total biomass and pod weight. Significant and positive correlation of

pods per plant with seeds per plant, seeds per pod, total biomass and pod weight was reported by Suresh *et al.* (2013), Momin and Misra (2004) in greengram. Seeds per pod was correlated with pods per plant, pod length and pod weight. Umadevi and Meenakshi (2005) earlier reported that the seeds per pod in blackgram showed positive and highly significant correlation with pods per plant. Seeds per plant was correlated with branches per plant, clusters per plant, pods per plant, total biomass, pod weight, harvest index and seeds per pod. Ahmad *et al.* (2013) reported that seeds per plant in mungbean had significant and positive genotypic and phenotypic correlation with clusters per plant, branches per plant, pods per plant, pod length and seed yield. Pod weight was correlated with branches per plant, pods per plant, seeds per pod, seeds per plant and harvest index while 100 seed weight was highly correlated with harvest index. Both phenotypic and genotypic correlation of harvest index with seeds per plant, pod weight, 100 seed weight and seed yield was recorded. Chauhan *et al.* (2007), Veeranjaneyulu *et al.* (2007), Gul *et al.* (2008) and Isha Parveen *et al.* (2011) also reported that the harvest index had positive correlation with seeds per plant, pod weight, 100 seed weight and seed yield in blackgram.

#### IV. CONCLUSION

Out of fourteen quantitative characters, seven characters *viz.*, branches per plant, pods per plant, seeds per pod, seeds per plant, 100 seed weight, pod weight and harvest index were highly significant and positively correlated with seed yield at both phenotypic and genotypic level in all three seasons and pooled over seasons. The traits *viz.*, seed yield, branches per plant, pods per plant and seeds per plant were highly significantly and positively correlated among themselves Hence, these traits could be utilized in direct selection so as to improve the seed yield in blackgram.

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**Table 1. Analysis of variance for quantitative characters of blackgram- Pooled over seasons**

Source of Variations	df	Plant height (cm)	Days to 50% flowering	No. of branches/pl	No. of clusters/pl	No. of pods/pl	Seed s/pod	No. of seeds/pl	Pod length (cm)	Pod wt. (g/pl)	100 seed wt. (g)	Seed yield (g/pl)	Total biomass (g/pl)	Fodder biomass (g/pl)	HI (%)
Replicates	2	2.23	0.49	0.7	3.13	7.74	0.23	1480.3	0	0.78	0.58**	2.38	47.38**	4.52	125.97
Environments	2	6677.37*	735.03**	37.84**	207.12*	1586.39**	13.45**	54297.82**	6.26*	71.85**	10.91**	242.61**	3429**	255.23**	3477.8**
Rep × Env.	4	7.77	1.03	1.18	24.24**	189.08*	0.23	7435.84*	0.03	29.1**	0.07	17.27**	57.8**	4.82	21.11
Treatments	58	64.84**	36.1**	1.98**	25.32**	292.05*	1.29**	8689.67*	0.47*	58.47**	0.65**	20.49**	49.25**	18.14**	190.23**
Parents	16	56.66**	37.6**	0.48	12.03**	74.07**	0.42	5856.02*	0.73*	11.54**	1.11**	11.32**	39.35**	8.44**	139.95**
Parents (Line)	13	31.72**	36.93**	0.39	8.89**	67.37**	0.43	5950.99*	0.63*	10.51**	1.03**	9.53**	44.81**	8.56**	103.14*
Parents(Testers)	2	120.28**	47.78**	0.84	38.11**	150.73*	0.59	7448.06*	1.03*	23.75**	0.81**	28.59**	6.84	2.76	420.75**
Parents (L vs T)	1	253.73**	26.03**	0.99	0.74	7.91	0.07	1437.4	1.37*	0.5	2.65**	0.05	33.51	18.36**	56.93
Parent vs Crosses	1	30.77*	53.86**	62.51**	413.83*	6418.18**	45.73**	112504.46**	0.16	1138.82**	3.56**	190.07**	501.34**	126.03**	2.92
Env × Treat	116	22.09**	4.66**	1.25**	20.64**	118.49*	0.59**	3887.28*	0.39*	44.06**	0.35**	10.52**	31.64**	7.24**	115.41**
Env × Parents	32	23.37**	4.04**	0.86	7.54**	34.09	0.34	1394.08	0.2*	5.64	0.2**	2.89	37.93**	3.57*	79.06
Env × Parents (L)	26	11.85*	4.53**	0.89	8.02**	41.08*	0.34	1683.73	0.21*	6.48*	0.23**	3.38	44.7**	3.99**	82.43
Env × Parents (T)	4	51.64**	0.88	0.75	8.15*	5.23	0.17	101.17	0.17	2.78	0.04	0.57	3.28	0.06	35.97
Env × PAR (L vs T)	2	116.62**	4.07**	0.58	0.11	0.97	0.64	214.46	0.02	0.39	0.1	1.13	19.33	5.04	121.49
Env × Parent vs Cross	2	11.61	15.95**	17.23**	413.46*	640.24*	10.1**	44682.25**	2.14*	185.45**	0.11	29.15**	133.87**	32.33**	32.05
Error	348	6.92	0.65	0.6	2.9	23.09	0.32	1229.67	0.13	3.92	0.1	2.7	9.99	2.19	57.09

\* Significant at 5% level, \*\* Significant at 1% level

**Table 2. Phenotypic and genotypic correlation of quantitative characters of blackgram during *Kharif* season**

Character		Branches/ plant	Clusters/ plant	Pods/ plant	Pod length (cm)	Seeds/ Pod	Seeds/ plant	Days to 50% flowering	Total biomass (g/pl)	Fodder biomass (g/pl)	Pod weight (g/pl)	100 Seed Wt. (g)	HI (%)	Seed yield (g/pl)
Plant height (cm)	$r_p$	0.116	0.144	0.174*	0.170*	0.256**	0.161*	0.387**	0.477**	0.718**	0.186*	0.231**	-0.288**	<b>0.221**</b>
	$r_g$	-0.097	0.078	0.199**	-0.041	0.193*	0.245**	0.596**	0.699**	0.703**	0.260**	0.380**	-0.321**	<b>0.346**</b>
No. of branches	$r_p$		0.430**	0.466**	0.198**	0.103	0.417**	-0.142	0.412**	0.238**	0.428**	0.07	0.075	<b>0.419**</b>
	$r_g$		0.745**	0.938**	0.420**	0.059	0.911**	-0.219**	0.812**	0.403**	0.904**	0.185*	0.237**	<b>0.967**</b>
No. of clusters	$r_p$			0.777**	0.262**	0.195**	0.691**	-0.012	0.469**	0.204**	0.678**	0.015	0.172*	<b>0.689**</b>
	$r_g$			0.712**	0.532**	0.356**	0.611**	-0.03	0.498**	0.213**	0.604**	0.048	0.320**	<b>0.624**</b>
No. of pods/pl	$r_p$				0.259**	0.159*	0.922**	-0.042	0.597**	0.214**	0.902**	-0.01	0.272**	<b>0.877**</b>
	$r_g$				0.530**	0.290**	0.940**	-0.082	0.815**	0.319**	0.917**	-0.036	0.376**	<b>0.896**</b>
Pod length(cm)	$r_p$					0.565**	0.261**	-0.181*	0.181*	0.047	0.293**	0.053	0.038	<b>0.243**</b>
	$r_g$					0.414**	0.536**	-0.424**	0.178*	-0.210**	0.624**	0.206**	0.742**	<b>0.596**</b>
No. of Seeds /pod	$r_p$						0.146	0.045	0.134	0.123	0.233**	0.207**	0.068	<b>0.201**</b>
	$r_g$						0.253**	0.025	0.03	-0.045	0.384**	0.359**	0.729**	<b>0.406**</b>
No. of seeds/ pl	$r_p$							-0.042	0.612**	0.206**	0.914**	-0.02	0.328**	<b>0.925**</b>
	$r_g$							-0.103	0.870**	0.329**	0.974**	-0.126	0.407**	<b>0.919**</b>
Days to 50% flowering	$r_p$								0.155*	0.318**	-0.106	-0.038	-0.214**	<b>-0.083</b>
	$r_g$								0.269**	0.505**	-0.187*	-0.057	-0.561**	<b>-0.155*</b>
Total biomass (g/pl)	$r_p$									0.660**	0.635**	0.188*	-0.280**	<b>0.634**</b>
	$r_g$									0.916**	0.834**	0.141	-0.164	<b>0.864**</b>
Fodder biomass (g/pl)	$r_p$										0.216**	0.109	-0.519**	<b>0.225**</b>
	$r_g$										0.318**	0.160*	-0.650**	<b>0.360**</b>
Pod wt. (g/pl)	$r_p$											0.125**	0.324**	<b>0.936**</b>
	$r_g$											0.119	0.530**	<b>0.991**</b>
100 seed wt (g)	$r_p$												0.178*	<b>0.269**</b>
	$r_g$												0.284**	<b>0.299**</b>
HI (%)	$r_p$													<b>0.386**</b>
	$r_g$													<b>0.563**</b>

\* Significant at 5% level, \*\* Significant at 1% level

**Table 3. Phenotypic and genotypic correlation of quantitative characters of blackgram during Rabi season**

\* Significant at 5% level, \*\* Significant at 1% level

Character		Branches/ plant	Clusters / plant	Pods/ plant	Pod length (cm)	Seeds/ Pod	Seeds/ plant	Days to 50% flowering	Total biomass (g/pl)	Fodder biomass (g/pl)	Pod weight (g/pl)	100 Seed Wt. (g)	HI (%)	Seed yield (g/pl)
Plant height(cm)	r <sub>D</sub>	0.067	0.118	0.237**	0.275**	0.340**	0.208**	0.433**	0.534**	0.404**	0.445**	0.034	-0.185*	<b>0.221**</b>
	r <sub>G</sub>	-0.056	0.193**	0.365**	0.472**	0.574**	0.309**	0.510**	0.601**	0.425**	0.539**	0.147*	-0.187*	<b>0.333**</b>
Branches/ plant	r <sub>D</sub>		0.124	0.154*	0.091	0.076	0.192*	0.014	0.153*	0.077	0.210**	-0.090	0.119	<b>0.238**</b>
	r <sub>G</sub>		0.291**	0.485**	0.002	0.464**	0.712**	0.046	0.374**	0.178*	0.798**	0.132	0.929**	<b>0.927**</b>
Clusters/ plant	r <sub>D</sub>			0.401**	0.320**	0.001	0.225**	0.281**	-0.104	-0.189*	0.067	-0.187*	0.206**	<b>0.095</b>
	r <sub>G</sub>			0.299**	0.364**	-0.071	0.173*	0.388**	-0.103	-0.337**	0.043	-0.345**	0.109	<b>-0.031</b>
Pods/ plant	r <sub>D</sub>				0.054	0.475**	0.711**	0.097	0.541**	0.347**	0.575**	-0.056	0.155*	<b>0.555**</b>
	r <sub>G</sub>				-0.047	0.818**	1.000**	0.109	0.759**	0.445**	0.693**	-0.116	0.132	<b>0.669**</b>
Pod length(cm)	r <sub>D</sub>					0.202**	0.162*	0.199**	-0.093	-0.073	0.133	0.091	0.308**	<b>0.180*</b>
	r <sub>G</sub>					0.241**	0.038	0.282**	-0.067	-0.150*	0.158*	0.199**	0.329**	<b>0.147*</b>
Seeds/ Pod	r <sub>D</sub>						0.561**	0.022	0.488**	0.399**	0.496**	0.019	0.085	<b>0.422**</b>
	r <sub>G</sub>						0.923**	-0.025	0.844**	0.622**	0.756**	0.238**	0.075	<b>0.700**</b>
Seeds/ plant	r <sub>D</sub>							0.043	0.485**	0.370**	0.574**	-0.006	0.324**	<b>0.665**</b>
	r <sub>G</sub>							0.087	0.776**	0.504**	0.692**	0.028	0.178*	<b>0.731**</b>
Days to 50% flowering	r <sub>D</sub>								0.148*	0.222**	0.034	0.001	-0.032	<b>0.074</b>
	r <sub>G</sub>								0.190*	0.283**	0.046	0.021	-0.067	<b>0.108</b>
Total biomass (g/pl)	r <sub>D</sub>									0.721**	0.740**	-0.010	-0.305	<b>0.481**</b>
	r <sub>G</sub>									0.799**	0.811**	0.143	-0.058	<b>0.752**</b>
Fodder biomass (g/pl)	r <sub>D</sub>										0.337**	0.074	-0.110	<b>0.450**</b>
	r <sub>G</sub>										0.405**	0.147	-0.103	<b>0.559**</b>
Pod weight (g/pl)	r <sub>D</sub>											0.210**	0.192*	<b>0.751**</b>
	r <sub>G</sub>											0.253**	0.340**	<b>0.871**</b>
100 Seed weight (g)	r <sub>D</sub>												0.394**	<b>0.368**</b>
	r <sub>G</sub>												0.421**	<b>0.389**</b>
HI (%)	r <sub>D</sub>													<b>0.674**</b>
	r <sub>G</sub>													<b>0.611**</b>



**Table 4. Phenotypic and genotypic correlation of quantitative characters of blackgram during *Summer* season**

Character		Branches/ plant	Cluster s/ plant	Pods/ plant	Pod length (cm)	Seeds/ Pod	Seeds/ plant	Days to 50% flowering	Total biomas s (g/pl)	Fodder biomass (g/pl)	Pod weight (g/pl)	100 Seed Wt. (g)	HI (%)	Seed yield (g/pl)
Plant height(cm)	$r_D$	0.112	0.048	-0.033	-0.024	0.081	0.002	0.419**	0.628**	0.876**	0.168*	0.027	-0.283**	<b>-0.021</b>
	$r_g$	0.101	0.055	-0.050	-0.059	0.265**	-0.033	0.707**	0.481**	0.839**	0.032	-0.021	-0.291**	<b>-0.082</b>
Branches/ plant	$r_D$		0.567**	0.435**	0.178*	0.273**	0.302**	-0.126	0.122	0.149*	0.397**	0.039	0.153*	<b>0.217**</b>
	$r_g$		0.878**	0.674**	0.582**	0.996**	0.467**	-0.198**	0.361**	0.223**	0.585**	0.052	0.156*	<b>0.306**</b>
Clusters/ plant	$r_D$			0.801**	0.215**	0.345**	0.592**	-0.086	0.238**	0.143	0.428**	0.044	0.341**	<b>0.485**</b>
	$r_g$			0.867**	0.381**	1.000**	0.741**	-0.111	0.420**	0.212**	0.470**	0.016	0.451**	<b>0.555**</b>
Pods/ plant	$r_D$				0.136	0.239**	0.798**	-0.226**	0.276**	0.065	0.330**	-0.021	0.492**	<b>0.658**</b>
	$r_g$				0.217**	0.842**	0.895**	-0.276**	0.476**	0.107	0.323**	-0.067	0.579**	<b>0.710**</b>
Pod length(cm)	$r_D$					0.171*	0.146*	0.069	-0.053	0.065	0.133	-0.140	0.086	<b>0.040</b>
	$r_g$					0.560**	0.105	0.053	-0.021	0.081	0.191*	-0.289**	-0.074	<b>-0.047</b>
Seeds/ Pod	$r_D$						0.259**	0.067	0.026	0.069	0.282**	0.022	0.192*	<b>0.213**</b>
	$r_g$						0.817**	0.131	0.112	0.231**	0.731**	0.233**	0.691**	<b>0.675**</b>
Seeds/ plant	$r_D$							-0.141	0.152*	0.001	0.349**	0.032	0.766**	<b>0.870**</b>
	$r_g$							-0.225**	0.420**	-0.032	0.334**	0.087	0.798**	<b>0.927**</b>
Days to 50% flowering	$r_D$								0.264**	0.422**	-0.124	-0.095	-0.252**	<b>-0.188*</b>
	$r_g$								0.425**	0.599**	-0.139	-0.123	-0.419**	<b>-0.249**</b>
Total biomass (g/pl)	$r_D$									0.749**	-0.093	-0.050	-0.379**	<b>0.076</b>
	$r_g$									0.769**	-0.354**	0.041	-0.041	<b>0.290**</b>
Fodder biomass (g/pl)	$r_D$										-0.077	-0.027	-0.375**	<b>-0.062</b>
	$r_g$										-0.260**	-0.059	-0.440**	<b>-0.120</b>
Pod weight (g/pl)	$r_D$											-0.004	0.285**	<b>0.281**</b>
	$r_g$											-0.071	0.357**	<b>0.224**</b>
100 Seed weight (g)	$r_D$												0.391**	<b>0.403**</b>
	$r_g$												0.455**	<b>0.474**</b>
HI (%)	$r_D$													<b>0.853**</b>
	$r_g$													<b>0.982**</b>

\* Significant at 5% level, \*\* Significant at 1% level

**Table 5. Phenotypic and genotypic correlation in blackgram - pooled over three seasons**

Character		Branches/ plant	Clusters/ plant	Pods/ plant	Pod length (cm)	Seeds/ Pod	Seeds/ plant	Days to 50% flowerin g	Total biomass (g/pl)	Fodder biomass (g/pl)	Pod weight (g/pl)	100 Seed Wt. (g)	HI (%)	Seed yield (g/pl)
Plant height (cm)	r <sub>p</sub>	0.102	0.100	0.142	0.133	0.214**	0.144	0.394**	0.505**	0.655**	0.242**	0.116	-0.244**	<b>0.174*</b>
	r <sub>g</sub>	0.065	0.207**	0.199**	0.207**	0.271**	0.188*	0.838**	0.800**	0.893**	0.244**	0.096	-0.441**	<b>0.198**</b>
No. of branches	r <sub>p</sub>		0.468**	0.382**	0.150*	0.150*	0.337**	-0.089	0.279**	0.164*	0.387**	0.017	0.117	<b>0.340**</b>
	r <sub>g</sub>		0.931**	0.966**	0.268**	1.091**	0.907**	-0.151*	0.597**	0.287**	1.019	0.239**	0.409**	<b>0.769**</b>
No. of clusters	r <sub>p</sub>			0.644**	0.249**	0.167*	0.508**	0.042	0.294**	0.084	0.416**	-0.024	0.260**	<b>0.474**</b>
	r <sub>g</sub>			0.989**	0.350**	0.979**	1.042**	0.070	0.732**	0.415**	1.034**	0.122	0.525**	<b>0.919**</b>
No. of pods/pl	r <sub>p</sub>				0.129	0.328**	0.809**	-0.040	0.515**	0.225**	0.575**	-0.032	0.297**	<b>0.705**</b>
	r <sub>g</sub>				0.252**	0.815**	0.944**	-0.008	0.729**	0.422**	0.929**	0.067	0.406**	<b>0.840**</b>
Pod length(cm)	r <sub>p</sub>					0.249**	0.175*	0.073	0.045	0.004	0.169*	0.003	0.165*	<b>0.153*</b>
	r <sub>g</sub>					0.457**	0.336**	0.266**	0.306**	0.148*	0.290**	-0.204**	0.077	<b>0.201**</b>
No. of Seeds /pod	r <sub>p</sub>						0.356**	0.040	0.200**	0.195**	0.349**	0.062	0.118	<b>0.271**</b>
	r <sub>g</sub>						0.748**	0.088	0.715**	0.531**	0.798**	0.320**	0.155*	<b>0.644**</b>
No. of seeds/ pl	r <sub>p</sub>							-0.039	0.533**	0.225**	0.596**	-0.006	0.445**	<b>0.822**</b>
	r <sub>g</sub>							0.054	0.729**	0.395**	0.945**	0.093	0.565**	<b>0.928**</b>
Days to 50% flowering	r <sub>p</sub>								0.136	0.277**	-0.068	-0.041	-0.157*	<b>-0.061</b>
	r <sub>g</sub>								0.577**	0.722**	0.023	-0.092	-0.460**	<b>0.002</b>
Total biomass (g/pl)	r <sub>p</sub>									0.694**	0.455**	0.089	-0.263**	<b>0.568**</b>
	r <sub>g</sub>									0.903**	0.735**	0.171*	-0.023	<b>0.673**</b>
Fodder biomass (g/pl)	r <sub>p</sub>										0.165*	0.070	-0.314**	<b>0.242**</b>
	r <sub>g</sub>										0.384	0.129	-0.339**	<b>0.355**</b>
Pod wt. (g/pl)	r <sub>p</sub>											0.102	0.269**	<b>0.638**</b>
	r <sub>g</sub>											0.254**	0.296**	<b>0.757**</b>
100 seed wt (g)	r <sub>p</sub>												0.326**	<b>0.333**</b>
	r <sub>g</sub>												0.298**	<b>0.371**</b>
HI (%)	r <sub>p</sub>													<b>0.596**</b>
	r <sub>g</sub>													<b>0.715**</b>



**\* Significant at 5% level, \*\* Significant at 1% level**

**Table 6. Phenotypic ( $r_p$ ) and genotypic ( $r_g$ ) correlation for seed yield in blackgram during three seasons and pooled over seasons**

Characters		Kharif	Rabi	Summer	Pooled
Branches/pl	$r_p$	0.419**	0.238**	0.217**	0.340**
	$r_g$	0.967**	0.927**	0.306**	0.769**
Pods/plant	$r_p$	0.877**	0.555**	0.658**	0.705**
	$r_g$	0.896**	0.669**	0.710**	0.840**
Seeds/pod	$r_p$	0.201**	0.422**	0.213**	0.271**
	$r_g$	0.406**	0.700**	0.675**	0.644**
Seeds/plant	$r_p$	0.925**	0.665**	0.870**	0.822**
	$r_g$	0.919**	0.731**	0.927**	0.928**
Pod weight	$r_p$	0.936**	0.751**	0.281**	0.638**
	$r_g$	0.991**	0.871**	0.224**	0.757**
100 seed weight	$r_p$	0.269**	0.368**	0.403**	0.333**
	$r_g$	0.299**	0.389**	0.474**	0.371**
Harvest index	$r_p$	0.386**	0.674**	0.853**	0.596**
	$r_g$	0.563**	0.611**	0.982**	0.715**

\* Significant at 5% level, \*\* Significant at 1% level