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Association of heritability, genetic advance and genetic advance present among the various characters in black gram (*Vigna mungo* (L) Hepper)

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Abstract

The present investigation entitled, Association of heritability, genetic advance and genetic advance present among the various characters in black gram (*Vigna mungo* (L) Hepper) were grown during Kharif 2017-2018 in RBD with 3 replications at the Horticulture Research farm, Dep't. Of Genetics and Plant Breeding, Institute of Agricultural Sciences, Bundelkhand University, Jhansi. Observations were recorded on single plant basis. The observations were recorded on the genetic variability Phenotypic and genotypic of variation, Heritability characters viz., days to 50% flowering, plant height, number of primary branches per plant, days maturity, Clusters Per Plant, number of pod Per Clusters, Pod Per Plant, Pod Length (cm), biological yield per plant, Seeds Per 10 Pods test weight, and seed yield.

Keywords: Black gram, Heritability, Phenotypic and genotypic etc.

Introduction

Pulses are the major source of dietary protein. Blackgram (*Vigna mungo* (L.) Hepper), popularly known as urdbean in India, is an important short duration pulse crop and self-pollinating diploid ($2n=22$) with a small genome size estimated to be 0.56pg/1C (574 Mbp) (Gupta *et al.* 2008) [1]. According to Vavilov (1926) black gram has originated from Indian subcontinent. Though it is grown in different countries of South and South East Asia, India is the most important producer of blackgram. India is the largest producer and consumer of blackgram cultivated in an area about million hectares with a production of 1.92 million tonnes (AICRP report, 2016). Besides Gujarat, Andhra Pradesh is one of the major blackgram producing state grown in an area about 4.49 million hectares with a Productivity of 651kg ha⁻¹. The study of inheritance of various developmental and productive traits through the estimation of different genetic parameters like components of variances, genotypic and phenotypic coefficients of variability, heritability and genetic advance is helpful for framing the effective breeding programme. (Pushpa *et al.* 2013) [4, 5].

Materials and Methods

The experimental material includes 25 genotypes (TU-22, PU-10-23, NDUK-16, MU-46, JU05-1, KU14-1, LBG752, TU-94-2, KU96-7, CaB410-06, LBG645, VBG11-031, TU13, DKU98, GBBL, Azad-1, Shikhar-2, ADBG13-004, TBG-645, COBG11-03, IPU10-26, TBG104, KU16-04, KU16-07, Shikhar-1) were grown during Kharif 2017-2018 in RBD with 3 replications at the Horticulture Research farm, Deptt. Of Genetics and Plant Breeding, Institute of Agricultural Sciences, Bundelkhand University, Jhansi. situated at a Latitude: 25°27'31" N. Longitude: 78°34'47" E. The latitude level of BU Jhansi is about 285 m above mean sea level. It is characterized by semi-arid and sub-tropical climate. While minimum day temperature is usually recorded in the month of January. Weekly distributions of rainfall, temperature RH, per day of winter season 2017-2018. The observations were recorded on the, genetic variability Phenotypic and genotypic coefficient of variation, Heritability characters viz., days to 50% flowering, plant height, number of primary branches per plant, days maturity, Clusters Per Plant, number of pod Per Clusters, Pod Per Plant, Pod Length (cm), biological yield per plant, Seeds Per 10 Pods test weight, and seed yield.

Analysis of Variance

Analysis of variance showed highly significant differences among all twelve traits under study that is, days to 50% flowering plant height (cm), number of primary branches per plant, days

to 50% maturity, no. cluster per plant, plant, number of pods per cluster, number of pods per plant, pods per plant, pod length (cm), biological yield per plant (g), seed yield per plant (g) test weight (Table-1)

Parameters of Genetic Variability

The genetic variability parameters namely, mean, range, phenotypic coefficients of variation (PCV), genotypic coefficients of variation (GCV), heritability in broad sense (%), genetic advance and expected genetic advance (as per cent of mean) for all the twelve characters were estimated and have been presented in Table-4.2. The results obtained have been described below:

Mean performance and range

The present study revealed that among the characters studied, most of the characters showed uniform distribution of values at both side of mean and thus follow normal distribution for all the traits under study

- 1. Days to 50% flowering:** days to 50% flowering was ranged from 40.00 days (JU05-1) to 45.00 days (TU-22) with grand mean of 42.30 days. Further, 13 genotypes showed earliness in days to 50% flowering
- 2. Plant height (cm):** The plant height was ranged from 33.46 to 59.33 (with mean plant height of 46.4347 cm. Further, Genotype TU-94-2 (59.33) was recorded the maximum plant height and MU-46(33.46) minimum plant heights.
- 3. Number of primary branches per plant:** The number of primary branches ranged from 3.30 (TU22,) to 5.56 (DKU98) with mean of 4.50 number of primary branches per plant. Further genotypes (DKU98) 5.56 cm was recorded maximum number of primary branches per plant and TU22 3.30 minimum primary braches per plant
- 4. Days to maturity:** This trait was ranged from 61.00 days (TU-22) to 66.33 days (TU-94-2) with grand mean of 63.38 days to maturity.
- 5. Number of cluster per plant:** The mean values for clusters per plant ranged from 7.70 (TU-22) to 28.86 (shikhar-2) with a grand mean of 19.57.cluster per plants.

- 6. Number of pods per cluster:** The mean values for pods per cluster ranged from 1.733 (TU-94-2) to 3.30 (IPU10-26) with a grand mean of 2.66. Pods per cluster. The maximum no of pods per cluster (3.30) in genotypes (IPU10-26) maximum and minimum (1.73) in genotypes (tu-94-2) pods per cluster.
- 7. Number of pods per plant:** number of pods per plant was ranged from 16.96 (MU-46) to to 60.73 (TBG-104) with mean of 38.63 pods per plant, the maximum number of pods per plant recorded maximum 60.73 in genotypes (TBG-104)maximum and minimum (16.96) in genotypes MU-46 pods per plant.
- 8. Pod length:** Pod length ranged from from 3.50 (TU-22) to 4.40 (Shikhar-2). The mean value was (3.98) cm pod length. The maximum pod length recorded maximum (4.40) in genotypes (Shikhar-2) maximum and minimum (3.50) in genotypes TU-22-46 pod length.
- 9. Biological yield per plant (g):** biological yield per plant was ranged from 56.26 g (MU-46) to 162.50 g (Azad-1) with mean of 98.94 g, the maximum biological yield per plant recorded maximum (162.50)g in genotypes(Azad-1)maximum and minimum (56.26) in genotypes MU-46 biological yield per plant.
- 10. Number of seeds per 10 pod:** number of seeds per 10 pos was ranged from 4.13 (TU-22) to 6.73 (DKU-98) with mean of 5.86 seeds per 10 pod, the maximum number of seeds 10pods recorded maximum (6.73) in genotyps (DKU-98) maximum and minimum (4.13) in genotypes TU-22 number of seed per 10 pods.
- 11. Seed yield per plant (g):** seed yield per plant (g) ranged from 4.68 g (TU-22) to 33.61 g (Azad-1) with mean of 20.7329 g. the minimum seed yield per plant (g) was recorded (4.68) in genotypes (TU-22) and while the genotypes (Azad-1) required(33.13) maximum seed yield per plant
- 12. Test weight (g):** test weight was ranged from 14.75g (DKU-98) to 19.89 g (shikhar-1) with mean of 17.33 g. the minimum test weight (g) was recorded (14.75g) in genotypes (DKU-98) and while the genotypes (shikhar 1) (33.13) maximum test weight.

Table 1(a): Mean performance of blackgram genotypes for yield and attributing characters.

Character	Days to 50% Flowering	Plant Height (cm)	Primary Branches Per Plant	Days to 50% Maturity	Clusters Per Plant	No. of pod / clusters	Pod Per Plant	Pod Length (cm)	Biological Yield Per Plant (g)	Seeds Per 10 Pod	Seed Yield Per Plant (g)	Test Weight (g)
TU-22	45.00	41.00	3.30	61.00	7.70	2.37	17.20	3.50	63.30	41.33	4.68	15.03
PU-10-23	41.33	46.20	4.30	63.67	25.07	3.03	33.80	3.73	92.23	59.00	20.54	15.19
NDUK-16	43.33	49.40	4.37	64.00	17.67	2.53	31.23	3.70	72.17	51.33	13.79	19.90
MU-46	43.67	33.47	3.57	64.00	12.37	2.57	16.97	3.87	56.27	56.00	19.94	16.67
JU05-1	40.00	46.17	3.97	63.67	21.87	3.27	41.13	4.23	86.13	64.67	16.79	17.91
KU14-1	43.00	51.73	4.47	62.67	23.73	2.77	38.07	4.27	98.50	59.33	15.14	16.61
LBG752	42.67	46.27	4.33	63.67	13.67	2.80	37.07	3.97	74.90	60.33	23.27	18.18
TU-94-2	42.67	59.33	4.60	66.33	12.77	1.73	20.23	4.13	96.33	61.33	19.67	19.47
KU96-7	43.33	44.97	4.43	64.00	14.97	2.17	34.40	4.00	109.90	62.33	31.30	16.98
CaB410-06	41.00	45.40	5.03	63.33	14.04	2.67	32.80	3.77	72.90	62.00	13.39	15.85
LBG645	41.00	43.73	3.77	63.33	17.87	2.67	38.87	3.63	139.93	63.67	19.90	18.64
VBG11-031	41.67	48.17	4.60	62.67	24.30	2.33	47.87	4.03	97.37	61.33	20.45	16.87
TU13	42.00	46.23	5.33	63.67	19.33	2.50	41.40	4.13	63.63	49.67	19.19	17.26
DKU98	43.33	45.53	5.57	62.33	27.27	2.80	48.20	4.30	73.87	67.33	12.91	14.76
GBBL	42.00	46.73	5.47	63.00	15.60	2.53	32.20	4.13	123.13	55.33	23.61	16.14
Azad-1	43.00	48.07	5.47	63.67	24.07	3.03	42.43	4.37	162.50	66.67	33.61	16.07
Shikhar-2	43.33	50.93	5.17	63.00	28.87	2.50	59.23	4.40	140.37	50.33	33.15	17.25
ADBG13-004	42.33	41.77	4.73	63.67	20.87	2.77	51.30	4.23	102.87	60.67	15.68	16.96
TBG-645	41.67	43.83	4.77	65.00	24.00	2.50	42.40	3.67	102.90	55.00	17.55	18.08
COBG11-03	41.00	45.30	3.87	63.00	20.17	2.57	50.67	4.03	106.33	58.33	22.91	19.54
IPU10-26	41.00	51.40	4.27	64.33	18.83	3.30	41.23	4.03	151.77	59.00	30.35	18.00

TBG104	40.67	49.47	4.23	63.00	28.77	2.70	60.73	3.83	115.17	60.67	31.47	18.18
KU16-04	41.33	44.13	4.87	62.00	20.03	3.03	50.97	3.87	104.17	58.00	25.27	17.37
KU16-07	43.00	46.60	4.00	61.67	19.07	3.03	34.17	3.63	103.93	56.67	12.24	16.58
Shikhar-1	44.33	45.03	4.07	64.00	16.47	2.57	21.40	4.17	62.97	66.67	21.53	19.88
Mean	42.31	46.43	4.50	63.39	19.57	2.67	38.64	3.99	98.94	58.68	20.73	17.33
C.V.	2.99	7.57	14.63	1.78	16.89	11.98	5.02	6.52	3.28	41.91	10.44	10.65
S.E.	0.73	2.03	0.38	0.65	1.91	0.18	1.12	0.15	1.87	1.42	1.25	1.07
C.D. 5%	2.08	5.77	1.08	1.85	5.43	0.52	3.18	0.43	5.33	4.04	3.55	3.03
Range Lowest	40.00	33.47	3.30	61.00	7.70	1.73	16.97	3.50	56.27	41.33	4.68	14.76
Range Highest	45.00	59.33	5.57	66.33	28.87	3.30	60.73	4.40	162.50	67.33	33.61	19.90

Phenotypic and genotypic coefficient of variation

The phenotypic and genotypic coefficients of variation were estimated from the corresponding variances and were used for the assessment of genetic variability among the characters studied. Phenotypic coefficient of variation (PCV) and genotypic coefficients of variation (GCV) were worked out for all the characters under study and have been presented in (Table 2). The GCV and PCV are categorized as low (10%>), moderate (10-20%) and high (20%<) as suggested by Burton and Devana (1953). The estimated GCV and PCV helped in getting a clear understanding of the variability present among various genotypes. The GCV values were lower than PCV values for all the characters under study. The high GCV of (34.43%) was recorded for seed yield per plant, followed by, number of pods per plant (30.46%), biological yield per plant (28.96%) and number of cluster per plant (25.93%). The moderate GCV was observed for number of pod per cluster, (10.84%), number of primary branches per (10.56%), number of seed per 10 pod (9.88%) and plant height (8.91%). The low GCV was showed for test weight (5.71%), pod length cm

(5.16%), days to 50% flowering (2.37%) and days to 50% maturity (1.34%). The high PCV value was observed for seed yield per plant (35.98%), followed by, number of cluster per plant (30.95%), number of pods per plant (30.87%), biological yield per plant (29.14%) number of primary branch per plant (18.05%). The moderate PCV for number of pod per cluster (16.5%), test weight (12.09%) and plant height (11.69%). The low PCV for number of seeds per 10 pod (10.73%), days to 50% flowering (3.82%) and days to maturity (2.23%). The difference between PCV and GCV was moderate to high for all the traits under study. Maximum difference between PCV and GCV values was recorded for number of primary branch per plant (7.49%), followed by, test weight (6.58%), number of pod per cluster (5.31%), cluster per plant (5.02%), Pod length cm (3.15%) and plant height cm (2.78), seed yield per plant (1.55%), while for days to 50% flowering (1.45%), days to 50% maturity (0.89%), and number of pod per plant (0.41.01%) showed low gap between PCV and GCV. Sharma *et al* (2006) ^[6] Pushpa *et al* (2013) ^[4], ^[5] Parameswarappa, *et al* (2005) ^[3], Kuma *et al* (1986) ^[2]

Table 2(b): Genetic Parameters of blackgram

	Days to 50% Flowering	Plant Height (cm)	Primary Branches Per Plant	Days to 50% Maturity	Clusters Per Plant	Clusters Per Pod	Pod Per Plant	Pod Length (cm)	Biological Yield Per Plant (g)	Seeds Per 10 Pod	Seed Yield Per Plant (g)	Test Weight (g)
Var Environmental	1.60	12.36	0.43	1.27	10.94	0.10	3.76	0.07	10.54	0.06	4.68	3.41
ECV	2.99	7.57	14.63	1.78	16.89	11.97	5.02	6.52	3.28	4.19	10.44	10.65
Var Genotypical	1.00	17.11	0.23	0.72	25.77	0.08	138.53	0.04	820.89	0.34	50.96	0.98
GCV	2.37	8.91	10.56	1.34	25.93	10.84	30.46	5.16	28.96	9.88	34.43	5.71
Var Phenotypical	2.61	29.47	0.66	1.99	36.71	0.19	142.29	0.11	831.43	0.40	55.65	4.39
PCV	3.82	11.69	18.05	2.23	30.95	16.15	30.87	8.31	29.14	10.73	35.98	12.09
h ² (Broad Sense)	0.38	0.58	0.34	0.36	0.70	0.45	0.97	0.39	0.99	0.85	0.92	0.22
Genetic Advancement 5%	1.28	6.49	0.57	1.05	8.76	0.40	23.92	0.26	58.65	1.10	14.07	0.96
Genetic Advancement 1%	1.64	8.32	0.73	1.35	11.23	0.51	30.66	0.34	75.16	1.41	18.04	1.23
Gen. Adv as% of Mean 5%	3.02	13.98	12.74	1.66	44.77	14.98	61.92	6.59	59.27	18.74	67.88	5.55
Gen. Adv as% of Mean 1%	3.87	17.92	16.33	2.13	57.37	19.20	79.35	8.45	75.96	24.01	86.99	7.11
General Mean	42.31	46.43	4.50	63.39	19.57	2.67	38.64	3.99	98.94	5.87	20.73	17.33
Exp Mean next Generation	43.58	52.93	5.07	64.44	28.34	3.07	62.56	4.25	157.59	6.97	34.81	18.30

Heritability estimates

The estimates of heritability in broad sense for yield and attributing characters have been presented in Table 4.2. The prediction regarding heritability in broad sense was made as suggested by Robinson (1951) as low (<50%), moderate (50-70%) and high (>70%). In present investigation high heritability was reported for the character *viz.*, biological yield per plant (0.99%). The moderate heritability was observed for the characters *viz.*, number of pod per plant (0.97%), seed yield per plant (0.92%), number of seed per pod (10pods (0.85), and cluster per plant(0.70%). The characters namely, plant height(0.58%), number of pod per cluster(0.45%), pod length(0.39%), days to 50% flowering(0.38%), Days to 50% maturity (0.36.0) number of primary branches per plant (0.34%), test weight (0.22%) were recorded with low heritability. Veeramani *et al* (2005) ^[8], Sharma *et al.* (1988) ^[7]

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