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Studies on the Generalized Distance Among Blackgram (*Vigna mungo* L.) Genotypes

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ABSTRACT

Genetic diversity among ninety six genotypes of blackgram collected from various parts of India was evaluated using Mahalanobis' D^2 statistic, based on 10 morphological characters *viz.,* days to 50 per cent flowering, plant height, number of branches per plant, number of clusters per plant, number of pods per cluster, number of pods per plant, pod length, number of seeds per pod, hundred seed weight and seed yield per plant. Ninety six genotypes were grouped into eleven clusters. There was no parallelism between genetic and geographical diversity. The intra-cluster distance was maximum (D^2=1418.34) with cluster III. The maximum inter-cluster distance (D^2 = 2194.45) was recorded between clusters VI and XI. The genotypes grouped in these clusters may be used to evolve superior segregants. Seed yield per plant followed by plant height contributed maximum to the total genetic diversity. These traits could be declared as choice of traits and the genotypes namely, G_{93}, G_{68} and G_{35} could be declared as choice of parents.

Key words: *Geographical diversity, Genetic diversity, Blackgram.*

Introduction

Blackgram is an important self pollinated crop. It is cultivated in Tamilnadu, Uttar Pradesh, Maharashtra, Madhya Pradesh, Karnataka, Odisha, Chhattisgarh and Telangana. The cultivated area is more in Uttar Pradesh. Blackgram is cultivated in 32 lakh hectares in India with the production of 22 lakh tones. In Tamilnadu it is cultivated in an area of 402.14 thousand hectares with the production of 224.97 thousand tonnes (GoI, 2023). Blackgram is cultivated mostly as a rice fallow pulse in Tamilnadu. It is mainly used as a major protein supplement for the vegetarians. The available quantity of blackgram is not sufficient to meet out the demands. Hence, it is imported from foreign countries, mainly from Myanmar. The puffing of the blackgram from Myanmar is not appreciable. Hence, blackgram from Myanmar is mixed with Indian blackgram to meet out the demand. Hence, it is necessary to increase the productivity of blackgram in India.

An increase in productivity needs intensive research and it can be increased by improving the genetic architecture through hybridization (Mahalanobis, 1936). Mahalanobis' D^2 statistic is used for the identification of genetically divergent parents to include in the recombination breeding programme. As the genetically divergent parents are likely to give superior segregants in the segregating generations, the present inquiry would be useful in the choice of parents as well as choice of traits for further improvement.

Materials and Methods

Ninety six genotypes of blackgram (Table 1) were obtained from different sources (New Delhi, Vamban and Kanpur). The experiment was conducted at Plant Breeding Farm, Department of Genetics and Plant Breeding, Faculty of Agriculture, Annamalai University during June-August, 2021.

Table 1. List of Genotypes used in studies

S. No.	Genotypes	Source	S. No	Genotypes	Source
1	ADT3	NPRC, Vamban	49	IC-281995	NBPGR, New Delhi
2	ADT5	NPRC, Vamban	50	IC-470241	NBPGR, New Delhi
3	APK1	NPRC, Vamban	51	IC-519619	NBPGR, New Delhi
4	BGP247	NPRC, Vamban	52	IC-281981	NBPGR, New Delhi
5	CB-P.131	NPRC, Vamban	53	IC-519768	NBPGR, New Delhi
6	CB-P.133/18	NPRC, Vamban	54	IC-519685	NBPGR, New Delhi
7	CB-P.30/1	NPRC, Vamban	55	IC-519678	NBPGR, New Delhi
8	CO5	NPRC, Vamban	56	IC-519801	NBPGR, New Delhi
9	CO6	NPRC, Vamban	57	IPU99-12	IIPR, Kanpur
10	DDU-8	NBPGR, New Delhi	58	IPU99-232	IIPR, Kanpur
11	IC-261171	NBPGR, New Delhi	59	IPU99-43	IIPR, Kanpur
12	IC-261172	NBPGR, New Delhi	60	IPU99-6	IIPR, Kanpur
13	IC-261181	NBPGR, New Delhi	61	LBG17	IIPR, Kanpur
14	IC-261182	NBPGR, New Delhi	62	LBG623	IIPR, Kanpur
15	IC-281975	NBPGR, New Delhi	63	LBG648	IIPR, Kanpur
16	IC-519620	NBPGR, New Delhi	64	LBG752	IIPR, Kanpur
17	IC-281986	NBPGR, New Delhi	65	LBG787	IIPR, Kanpur
18	IC-281987	NBPGR, New Delhi	66	MDU1	NPRC, Vamban
19	IC-281989	NBPGR, New Delhi	67	NANDI	NRI agritechPvt. Ltd
20	PKGU 1	NBPGR, New Delhi	68	ADT6	NPRC, Vamban
21	IC-281991	NBPGR, New Delhi	69	NPU-180	NBPGR, New Delhi
22	IC-281993	NBPGR, New Delhi	70	NUL7	NBPGR, New Delhi
23	IC-281994	NBPGR, New Delhi	71	IC-281990	NBPGR, New Delhi
24	IC-436946	NBPGR, New Delhi	72	PLU703	NBPGR, New Delhi
25	IC-281996	NBPGR, New Delhi	73	PU31	NBPGR, New Delhi
26	IC-281998	NBPGR, New Delhi	74	SRI	NRI agritechPvt. Ltd
27	IC-282000	NBPGR, New Delhi	75	T9	NBPGR, New Delhi
28	IC-282002	NBPGR, New Delhi	76	TBG-104	NBPGR, New Delhi
29	VBN7	NPRC, Vamban	77	TMV1	NBPGR, New Delhi
30	IC-282004	NBPGR, New Delhi	78	TU-68	NBPGR, New Delhi
31	IC-282009	NBPGR, New Delhi	79	TU94-2	NBPGR, New Delhi
32	IC-398989	NBPGR, New Delhi	80	VBG-10.010	NPRC, Vamban
33	IC-413309	NBPGR, New Delhi	81	VBG-11.027	NPRC, Vamban
34	IC-426769	NBPGR, New Delhi	82	VBG-13.017	NPRC, Vamban
35	VBN 10	NPRC, Vamban	83	VBN1	NPRC, Vamban
36	IC-436612	NBPGR, New Delhi	84	VBN2	NPRC, Vamban
37	IC-436610	NBPGR, New Delhi	85	VBN3	NPRC, Vamban
38	IC-436678	NBPGR, New Delhi	86	VBN4	NPRC, Vamban
39	IC-436715	NBPGR, New Delhi	87	VBN5	NPRC, Vamban
40	IC-436717	NBPGR, New Delhi	88	VBN6	NPRC, Vamban
41	IC-436720	NBPGR, New Delhi	89	IC- 282003	NBPGR, New Delhi
42	IC-436736	NBPGR, New Delhi	90	IC-436750	NBPGR, New Delhi
43	IC-436747	NBPGR, New Delhi	91	VBN11	NPRC, Vamban
44	VBN 9	NPRC, Vamban	92	IC 436647	NPRC, Vamban
45	IC-436753	NBPGR, New Delhi	93	VBN8	NPRC, Vamban
46	IC-436765	NBPGR, New Delhi	94	NIRMAL	NPRC, Vamban
47	IC-436882	NBPGR, New Delhi	95	Paiyur 1	KVK, Paiyur
48	IC-436922	NBPGR, New Delhi	96	U23	NBPGR, New Delhi

The selfed seeds of the ninety six genotypes were raised in Randomized Block Design (RBD) with three replications. Each genotype was grown in a single row of 3 meter length with a spacing of 30×10 cm. Five randomly selected competing plants were observed for ten quantitative traits *viz.*, days to 50 per cent flowering, plant height, number of branches per plant, number of clusters per plant, number of pods per cluster, number of pods per plant, pod length, number of seeds per pod, hundred seed weight and seed yield per plant. The data were subjected to D^2 analysis as per the procedure outlined by Mahalanobis (1936) and Rao (1952). Recommended agronomic practices and need based plant production measures were judiciously followed.

Results and Discussion

The analysis of variance indicated a significant variation among the ninety six genotypes for all the characters studied (Table 2). These findings are in conformity with that of Priyanka *et al.* (2016) and Pratap *et al.* (2020).

Mean performance of the ninety six genotypes for ten traits of interest is furnished in Table 3. Seed yield per plant was higher and significant for the genotypes *viz.*, G_{93}, G_{68} and G_{35} (Table 3). These genotypes also recorded less number of days to 50 per cent flowering.

D^2 analysis confirmed the presence of higher genetic diversity among the ninety six genotypes by resolving into as many as eleven clusters (Table 4). Cluster I with forty six genotypes was the largest cluster followed by cluster XI with thirteen genotypes. The genotypes hailing from different ecogeographical regions were grouped into the same cluster as well as in different clusters. Thus, there were no parallelism between genetical and geographical diversity. Such result are earlier reported by Pallavi and Lal (2021) in blackgram.

The intra-cluster distance was maximum with cluster III (D^2 = 1418.34) (Table 5). Cluster III encomposed eight genotypes. These genotypes may have different genetic background. The intra-cluster distance was minimum with the cluster II (D^2 = 21.11). It was composed of two genotypes. They may have similar genotypes. The results were in agreement with that of Chippy *et al.* (2021). The inter-cluster distance was maximum between clusters VI and XI (D^2 = 2194.45). Cluster XI had thirteen genotypes and cluster VI had three genotypes.

The cluster mean was comparatively higher for seed yield per plant with cluster X (Table 6). Cluster X recorded higher mean value for number of clusters per plant, number of pods per cluster, number of pods per plant, pod length and seed yield per plant. Hence, crossing among these genotypes may result in yielding superior transgressive segregants. The result is in agreement with the Jayamani and Sathya (2013), Gowsalya *et al.* (2017), Rao *et al.* (2019) and Chandrakar *et al.* (2020).

Seed yield per plant contributed maximum to the total genetic divergence followed plant height (Table 7). Similar findings was reported by Vidhya *et al.* (2018); Senthamizhselvi *et al.* (2019) and Punithavathy *et al.* (2020). These traits could be declared as choice of traits. Hence, selection of the above characters would be more rewarding to bring genetic improvement in blackgram breeding programme.

References

Chandrakar, D., Sao, A. and Gauraha, D. 2020. Study on

Table 2. Analysis of variance for 96 blackgram genotypes for various characters

Source	df	MSS									
		DFF (Days)	PH (cm)	NBP	NCP	NPC	NPP	PL (cm)	NSP	HSW (g)	SYP (g)
Replication	2	0.8438	2.1901	0.3035	0.2926	0.0976	4.1935	0.0815	0.1677	0.0174	0.0667
Treatment	95	30.5891**	404.5662**	0.9482**	8.8450**	1.6678**	136.1768**	0.5390**	2.0110**	2.3176**	25.5792**
Error	190	0.7069	0.8217	0.1106	0.1228	0.1489	1.6286	0.1026	0.1616	0.0080	0.0408

**Significant at 1 per cent level

DFF : Days to fifty percent flowering (days)
PH : Plant height (cm)
NBP : Number of branches per plant
NCP : Number of cluster per plant
NPC : Number of pods per cluster
NPP : Number of pods per plant
PL : Pod length (cm)
NSP : Number of seeds per pod
HSW : Hundred seed weight (g)
SYP : Seed yield per plant (g)

Table 3. Mean performance of 96 genotypes for various characters in blackgram

S. No.	Genotypes	DFF (Days)	PH (cm)	NBP	NCP	NPC	NPP	PL(cm)	NSP	HSW (g)	SYP (g)
1	G1	36.67 **	50.80	2.47	8.60 **	3.40	23.27 **	4.67	6.40 **	4.32	7.49 **
2	G2	39.33	45.93	2.67	5.33	3.73	23.33 **	4.07	6.23 *	4.93 **	8.84 **
3	G3	39.00 **	47.40	2.60	5.40	3.73	26.93 **	4.47	4.20	4.36	6.57
4	G4	41.00	22.47 **	2.67	4.80	4.00	11.73	4.47	5.87	4.25	5.45
5	G5	41.33	40.93	2.80	5.60	4.27 *	22.67*	4.20	6.53 **	4.45 **	7.63 **
6	G6	44.33	26.87	3.20	4.20	3.47	18.27	5.53	4.93	3.82	6.24
7	G7	45.33	50.13	3.00	5.13	3.30	20.73	4.87	5.93	3.82	10.89 **
8	G8	37.00 **	68.40	3.53 *	4.93	4.47**	22.13	4.27	5.20	5.83 **	8.71 **
9	G9	36.33 **	40.00	3.60 **	5.53	3.73	25.13 **	5.00 *	6.27 **	5.16 **	8.59 **
10	G10	38.33 **	26.93 **	2.73	4.93	3.20	22.73 *	5.20 **	4.93	4.68 **	4.80
11	G11	39.67	32.27	2.60	9.73 **	2.93	28.00 **	4.47	5.60	4.26	8.60 **
12	G12	40.67	39.07	3.67 **	7.87 **	4.00	24.53	4.53	6.40	3.51	5.89
13	G13	38.33 **	36.13	2.93	6.60 **	4.13	15.93	4.07	6.13 *	3.45	4.28
14	G14	37.33 **	25.47 **	1.67	5.40	3.00	9.53	5.47 **	4.93	4.66 **	5.34
15	G15	36.33 **	29.40 **	3.40 *	6.80 **	4.33 **	26.07 **	4.93	5.13	3.58	7.38 **
16	G16	39.00 *	26.47 **	2.47	5.80	4.43 **	33.93 **	3.93	6.40 **	4.60 **	10.24 **
17	G17	37.67 **	60.00	2.93	4.93	3.47	15.67	4.80	4.47	5.78 **	5.62
18	G18	42.00	18.53 **	1.73	4.47	2.80	16.73	4.47	5.07	3.64	4.49
19	G19	42.67	45.73	3.13	7.80 **	3.67	13.93	4.53	6.27 **	5.69 **	6.66
20	G20	40.67	37.33	3.87 **	3.40	3.93	17.13	4.53	6.33 **	3.53	10.44 **
21	G21	39.67	33.40 *	2.93	6.53 **	3.80	27.20 **	4.13	4.40	4.35	7.66 **
22	G22	40.33	31.60 **	1.47	5.40	3.73	14.40	4.07	5.80	4.34	5.39
23	G23	38.67 **	18.67 **	2.33	3.53	2.47	13.93	4.13	5.67	4.56 **	3.72
24	G24	40.00	65.07	2.80	11.80 **	3.40	25.73 **	4.50	5.47	4.58 **	8.27 **
25	G25	42.33	27.27 **	2.67	6.13	2.73	16.27	4.73	6.53 **	4.40*	6.68
26	G26	42.67	29.07	3.20	4.07	2.93	16.87	4.73	6.33	3.67	2.64
27	G27	40.00	29.60 **	4.87 **	4.40	2.87	11.73	3.87	4.27	3.44	4.24
28	G28	43.33	27.00 **	2.27	4.60	2.20	15.20	4.00	4.60	3.66	4.20
29	G29	38.00 **	43.33	3.33	8.00 **	4.47 **	25.47 **	3.93	5.53	5.35 **	11.48 **
30	G30	49.33	41.93	2.80	8.00 **	4.33*	17.80	5.00 *	6.40**	5.54 **	7.15
31	G31	36.67 **	23.80**	2.67	3.87	2.20	10.13	4.73	4.80	5.52 **	2.43
32	G32	37.67 **	23.27 **	2.53	4.80	4.33 *	15.73	4.87	5.73	4.25	7.54 **
33	G33	40.67	31.67 **	2.67	5.13	2.80	11.80	4.47	4.73	4.27	4.62
34	G34	40.67	22.67 **	2.40	4.33	2.27	8.67	4.20	4.80	3.72	2.86
35	G35	37.33 **	33.60 *	3.00	5.00	3.53	17.87	4.00	6.67 **	3.64	12.32 **
36	G36	38.33 **	32.07 **	2.47	4.00	3.80	12.40	4.47	5.33	4.35	8.51 **
37	G37	41.67	23.53 **	2.87	4.80	4.80 **	22.93 *	4.93	5.67	3.84	7.48 **
38	G38	37.33 **	29.20 **	3.13	5.93	4.67 **	33.67 **	5.27 **	6.40 **	4.24	11.85 **
39	G39	42.00	26.33 **	2.87	5.40	3.87	14.07	4.67	4.93	5.60 **	4.59
40	G40	41.00	28.80 **	4.40 **	4.93	4.93 **	20.93	4.20	4.13	3.78	4.87
41	G41	38.33 **	30.47 **	2.67	7.67 **	4.07	34.67 **	3.87	6.20 *	3.75	11.87 **
42	G42	40.00	32.00 **	2.07	4.20	3.13	14.13	3.80	4.33	3.61	2.05
43	G43	38.00 **	31.20 **	2.73	3.53	2.27	8.13	4.40	5.73	3.14	3.13
44	G44	41.00	25.80 **	3.40 *	4.87	3.93	34.53 **	4.13	4.73	6.24 **	10.40 **
45	G45	39.00 *	59.93	2.73	5.13	2.53	10.33	4.00	4.80	6.41 **	2.87
46	G46	38.33 **	29.67 **	2.20	4.80	5.87	21.60	4.27	4.33	5.32 **	6.48
47	G47	40.67	29.27 **	1.80	4.33	4.47 **	22.33	4.07	6.07 *	2.51	4.47
48	G48	38.33 **	27.80 **	2.47	5.47	2.60	8.47	4.20	6.33 **	5.89 **	5.83
49	G49	39.67	24.93 **	3.27	5.00	3.40	24.47 **	4.00	6.07 *	5.86 **	10.87 **
50	G50	38.33 **	57.13	2.80	4.73	3.33	11.60	3.73	6.20 *	4.25	3.09
51	G51	40.00	34.20	3.87 **	4.00	3.80	25.73 **	4.27	6.13 *	3.76	7.53**
52	G52	41.33	78.40	3.07	4.73	4.40 *	27.67 **	4.39	6.07 *	3.93	7.90 **

Table 3. *Continued ...*

S. No.	Genotypes	DFF (Days)	PH (cm)	NBP	NCP	NPC	NPP	PL(cm)	NSP	HSW (g)	SYP (g)
53	G53	40.00	18.67 **	2.60	4.67	3.87	8.80	5.00 *	6.40	5.43 **	3.67
54	G54	48.33	25.80 **	2.53	4.40	3.73	22.93 *	5.00 *	4.87	5.44 **	4.72
55	G55	45.00	44.93	3.07	4.53	3.60	29.53 **	5.00 *	4.73	3.35	9.52**
56	G56	40.67	32.60 **	3.00	6.33 *	3.80	26.93 **	4.37	6.20 *	5.77 **	11.00 **
57	G57	41.33	26.67 **	3.13	5.13	3.27	14.67	4.87	4.13	3.26	2.78
58	G58	48.33	33.87	2.67	5.07	3.07	18.33	5.06 *	6.47 **	3.85	3.68
59	G59	41.33	25.00 **	3.47 *	5.47	3.00	20.67	4.79	6.27 **	3.46	4.79
60	G60	47.33	27.47 **	2.80	4.20	2.73	27.00 **	4.00	4.47	3.59	3.65
61	G61	41.00	48.60	2.73	4.00	2.80	11.87	4.59	6.00	4.32	4.64
62	G62	38.00 **	37.20	3.20	6.00	3.80	10.13	4.69	6.40 **	4.63 **	3.40
63	G63	39.67	41.93	2.93	3.27	3.73	11.20	4.33	3.73	5.91 **	4.39
64	G64	38.67 **	61.07	2.80	8.67 **	3.13	23.47 **	4.73	5.93	4.61 **	5.62
65	G65	40.67	53.33	3.13	6.67 **	2.67	18.80	4.53	4.47	3.16	4.42
66	G66	41.00	31.47 **	3.27	6.20 *	3.73	23.33 **	4.53	6.20 *	5.87 **	10.48 **
67	G67	44.00	35.20	3.13	6.47 **	4.20	24.47 **	4.93	6.07 *	4.10	5.63
68	G68	37.67 **	62.47	2.87	7.73 **	4.27 **	31.47 **	4.80	5.80	4.43 **	12.57 **
69	G69	42.00	25.67	1.93	6.67 **	3.80	22.40	5.20 **	4.13	4.55 **	3.65
70	G70	35.67 **	32.20 **	2.33	9.67 **	3.47	30.73 **	5.47 **	5.60	3.80	10.48 **
71	G71	42.00	31.67 **	1.87	4.93	3.87	19.93	4.93	6.27 **	3.40	9.82**
72	G72	48.67	22.20 **	3.20	4.67	3.67	18.07	4.53	4.13	2.59	3.85
73	G73	39.33	35.33	2.53	6.60 **	4.33 *	25.67 **	4.67	6.27 **	3.36	5.57
74	G74	42.67	37.67	3.67 **	7.80 **	4.53 **	30.60 **	5.13 *	6.20*	3.77	11.33 **
75	G75	37.33 **	36.47	2.67	6.47 **	3.80	24.93 **	4.67	4.50	3.84	8.48 **
76	G76	35.33 **	30.27 **	3.00	9.60 **	2.40	28.40 **	4.00	5.40	2.94	8.10 **
77	G77	40.67	45.40	2.53	4.53	3.67	14.93	4.40	4.93	4.23	5.88
78	G78	40.33	36.13	3.33	4.87	3.73	23.60 **	4.53	5.53	3.82	5.82
79	G79	38.33 *	31.67 **	2.47	4.80	3.20	19.27	4.20	5.07	4.50 **	5.59
80	G80	38.67 **	32.07 **	2.00	4.80	2.73	15.60	3.93	4.93	3.17	3.76
81	G81	37.33 **	36.53	3.40 *	4.33	2.93	19.27	4.20	5.67	3.22	5.46
82	G82	36.67 **	40.33	2.87	5.87	2.60	13.73	4.20	3.40	3.46	5.56
83	G83	40.00	21.93 **	2.80	5.73	2.27	23.67 **	4.00	4.27	3.42	5.55
84	G84	38.67 **	27.67 **	3.40 *	4.80	3.13	14.53	4.20	5.93	4.61 **	5.96
85	G85	40.67	27.47 **	1.80	4.73	2.20	15.47	4.67	5.33	3.55	5.47
86	G86	41.00	25.80 **	2.33	5.00	4.13	25.07 **	4.53	5.07	2.94	6.59
87	G87	39.67	29.33 **	2.73	4.87	4.07	18.87	4.67	5.13	5.20 **	7.73 **
88	G88	38.67 **	40.73	3.07	4.80	4.13	24.47 **	4.33	6.00	3.51	11.40 **
89	G89	40.00	38.07	3.67 **	5.87	3.67	23.60 **	4.13	5.47	3.23	11.28**
90	G90	39.00 *	34.07	2.87	3.53	4.13	20.07	4.47	5.93	3.79	12.07 **
91	G91	43.00	28.60 **	2.80	9.60 **	4.87 **	23.20 *	4.53	4.47	3.74	11.81 **
92	G92	40.00	44.73	2.87	8.60 **	4.67 **	28.53 **	4.73	4.80	3.87	12.17 **
93	G93	37.67 **	29.47 **	2.93	11.00 **	4.93 **	34.40 **	4.80	5.67	4.56 **	12.62 **
94	G94	47.33	34.27	3.40 *	4.53	4.73 **	26.60 **	4.00	4.40	4.39 **	10.48 **
95	G95	48.67	29.33 **	1.80	4.27	3.27	22.07	3.67	4.07	3.72	8.35 **
96	G96	51.00	31.80 **	2.47	4.13	3.00	23.73 *	3.60	3.93	3.15	3.66
General Mean		40.48	35.17	2.83	5.65	3.59	20.52	4.48	5.41	4.23	6.90
S.Ed		0.48	0.52	0.19	0.20	0.22	0.73	0.18	0.23	0.05	0.11
CD 5%		1.34	1.45	0.53	0.56	0.61	2.04	0.51	0.64	0.14	0.32
CD 1%		1.77	1.90	0.70	0.73	0.81	2.68	0.67	0.84	0.18	0.42

*Significant at 5 percent level
** Significant at 1 percent level

Table 4. Composition of D^2 clusters in blackgram

Cluster	Number of Genotypes	Name of Genotypes
I	46	G1, G2, G3, G4, G5, G6, G7, G8, G9, G10, G11, G12, G13, G14, G15, G16, G17, G18, G19, G20, G21, G22, G23, G24, G25, G26, G27, G28, G29, G30, G31, G32, G33, G34, G35, G36, G37, G38, G39, G40, G41, G42, G43, G44, G56, G66
II	2	G51, G78
III	8	G45, G46, G47, G48, G49, G50, G79, G84
IV	2	G81, G89
V	2	G71, G85
VI	3	G52, G61, G77
VII	10	G53, G54, G55, G57, G58, G59, G60, G62, G63, G83
VIII	6	G64, G65, G67, G68, G73, G75
IX	2	G88, G90
X	2	G74, G92
XI	13	G69, G70, G72, G76, G80, G82, G86, G87, G91, G93, G94, G95, G96

Table 5. Average inter (D^2) and intra (diagonal) cluster distance for blackgram

Cluster	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
I	1133.83 (33.67)	681.59 (26.11)	1262.00 (35.53)	848.64 (29.13)	787.38 (28.06)	1823.98 (42.71)	1103.80 (33.22)	1453.06 (38.11)	1263.17 (35.54)	1411.40 (37.57)	1158.78 (34.04)
II		21.11 (4.60)	842.35 (29.02)	89.56 (9.46)	142.08 (11.92)	1253.96 (35.41)	469.32 (21.66)	1076.51 (32.81)	959.70 (30.98)	1175.50 (34.29)	658.17 (25.65)
III			1418.34 (37.66)	1037.72 (32.21)	977.54 (31.27)	1794.29 (42.36)	1126.98 (33.57)	1779.30 (42.18)	1759.40 (41.95)	1975.56 (44.45)	1475.51 (38.41)
IV				47.55 (6.90)	169.00 (13.00	1216.39 (34.88)	595.12 (24.40)	1129.85 (33.61)	1100.89 (33.18)	1329.52 (36.46)	765.88 (27.67)
V					71.77 (8.47)	1645.45 (40.56)	458.06 (21.40)	1376.62 (37.10)	1141.40 (33.79)	1451.12 (38.09)	652.21 (25.54)
VI						1172.39 (34.24)	1910.47 (43.70)	1408.91 (37.54)	1900.63 (43.60)	1960.93 (44.28)	2194.45 (46.85)
VII							670.27 (25.89)	1937.09 (44.01)	1931.01 (43.94)	2187.39 (46.77)	1122.94 (33.51)
VIII								1087.11 (32.97)	837.20 (28.94)	736.98 (27.15)	1501.20 (38.74)
IX									105.60 (10.28)	258.64 (16.08)	1154.39 (33.98)
X										116.97 (10.82)	1269.12 (35.63)
XI											1049.53 (32.40)

Table 6. Cluster means of various characters in blackgram

Clusters	DFF(Days)	PH(cm)	NBP	NCP	NPC	NPP	PL(cm)	SPP	HSW(g)	SYP(g)
I	39.99	34.30	2.88	5.67	3.59	19.85	4.49	5.54	4.43	6.99
II	40.17	35.17	3.60	4.43	3.77	24.67	4.40	5.83	3.79	6.68
III	38.92	35.97	2.64	4.88	3.57	16.58	4.08	5.60	4.92	5.65
IV	38.67	37.30	3.53	5.10	3.30	21.43	4.17	5.57	3.22	8.37
V	41.33	29.57	1.83	4.83	3.03	17.70	4.80	5.80	3.48	7.67
VI	41.00	57.47	2.78	4.42	3.62	18.16	4.46	5.67	4.16	6.14
VII	42.93	30.35	2.92	4.85	3.31	18.69	4.67	5.17	4.23	4.63
VIII	39.61	47.36	2.86	7.10	3.73	24.80	4.72	5.51	3.92	7.06
IX	38.83	37.40	2.97	4.17	4.13	22.27	4.40	5.97	3.65	11.73
X	41.33	41.20	3.27	8.20	4.60	29.57	4.93	5.50	3.82	11.75
XI	41.95	30.10	2.60	6.51	3.67	23.29	4.40	4.64	3.71	7.43
Grand Mean	40.48	35.17	2.83	5.65	3.59	20.52	4.48	5.41	4.23	6.90

Table 7. Contribution of different characters to genetic divergence

S. No.	Characters	Percent contribution
1	Days to fifty per cent flowerings	0.53
2	Plant height (cm)	16.86
3	Number of branches per plant	0.37
5	Number of cluster per plant	1.32
4	Number of pods per cluster	0.02
6	Number of pods per plant	2.54
7	Pod length (cm)	0.26
8	Number of seeds per pod	0.44
9	Hundred seed weight (g)	16.45
10	Seed yield per plant (g)	61.21

genetic diversity for yield and yield contributing traits in blackgram (*Vigna mungo* L.). *Int. J. Curr. Microbiology and Applied Science.* 9(07): 2316-2319.

Chippy, A.K., Arumugam Pillai, M. and Shoba, D. 2021. Genetic diversity analysis in blackgram (*Vigna mungo* (L.) Hepper). *Electronic Journal of Plant Breeding.* 12(1): 37-45.

GOI. 2023. India Stat Focused on Facts. Ministry of Agriculture and Farmers Welfare.

Gowsalya, P., D. Kumaresan, D. Pakiaraj and J.R.K. Bapu. 2017. Genetic divergence in blackgram (*Vigna mungo* (L.) Hepper). *Indian Journal of Agricultural Research.* **51(2):** 184-187.

Jayamani, P. and M. Sathya. 2013. Genetic diversity in pod character of blackgram (*Vigna mungo* (L.) Hepper). *Legume Research.* 36: 220-223.

Mahalanobis, P.C. 1936. On the generalized distance in spastics. *Proceeding National Science India.* 2: 49-55.

Pallavi, B. and Lal, G.M. 2021. Genetic diversity for yield and its component traits in blackgram (*Vigna mungo* (L.) Hepper). *International Journal of Plant Soil Science.* 33(21): 208-214.

Pratap, B., Kumar, M., Singh, S.K., Chand, P. and Singh, P.K. 2020. Studies on genetic diversity analysis in blackgram (*Vigna mungo* (L.) Hepper). *International Journal of Plant Soil Science.* 33(21): 208-214.

Priyanka, G., Suhel, M., Kumar, G. and Lal, G.M. 2016. Genetic divergence study in blackgram. *International Journal of Agricultural Science.* 8(49): 2056-2058.

Punithavathy, P., N. Manivannan, A. Subramanian, P. Shanthi and V. Babu Rajendra Prasad. 2020. Genetic divergence of blackgram genotype (*Vigna mungo* (L.) Hepper). *Electronic Journal of Plant Breeding.* 11(1): 156-159.

Rao, C.R. 1952. Advanced statistical method in biometrical research. *John Wiley and Sons Inc.,* New York.

Rao, K.N., Bandi, H.R.K., Srinivasalu, K., Padmavathi, J. and Krishna, K.V. 2019. Genetic diversity for yield and yield component character in rice fallow blackgram (*Vigna mungo* (L.) Hepper). *Journal of Food Legumes.* 32(1): 57-59.

Senthamizhselvi, A., Muthuswamy, N. Shanmugavalli. 2019. Genetic divergence studies in blackgram. *Electronic Journal of Plant Breeding.* 10(4): 1606-1611.

Vidhya, S., Sabesan, T. and Saravanan, K. 2018. Genetic divergence studies in blackgram (*Vigna mungo* L.) for yield and quantitative traits. *Journal of Phytology.* 10: 24-26.