Madras Agric. J., 101 (1-3): 12-15, March 2014

Characterization of Blackgram Genotypes based on Qualitative Traits (*Vigna mungo L.* Hepper)

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Blackgram (*Vigna mungo* L. Hepper) is an important pulse crop, which is widely cultivated and consumed in India. Qualitative characters are important for plant description. In the present regime of Intellectual Property Rights, the distinctness of a candidate variety from all other varieties is an important criterion for granting protection of Plant Breeders Rights. Keeping this in view, forty six genotypes of blackgram were evaluated to determine the extent of genetic variation for sixteen morphological traits. A good level of variability was observed for terminal leaflet shape, petiole colour, pod pubescence and seed colour and a considerable level of variability was observed for growth habit, stem colour, leaf pubescence, leaf colour, leafiness and calyx colour. For corolla colour and luster on seed surface, no variability was observed. For the other traits *viz*., immature pod colour, colour of ventral suture immature pod, pod beak shape and twining tendency, low level of variability was observed. Morphological traits are related to biotic and abiotic stresses. Prostrate plant type is preferred for planting under rainfed conditions as it facilitates moisture conservation. Plant with lanceolate leaf shape in most cases is drought tolerant; hence, these characters may be utilized for breeding blackgram for rainfed conditions. A good level of variability was observed among the accession of *Vigna mungo* var. *silvestris* for various morphological traits, which could be used in crossing programme to improve blackgram.

Key words: Blackgram, Qualitative traits, Descriptors, Genetic characterization

Blackgram (*Vigna mungo* (L.) Hepper), popularly known as urdbean or mash, is a grain legume domesticated from *V. mungo* var *silvestris*. Blackgram is a rich source of protein (20.8 to 30.5 per cent) with total carbohydrates ranging from 56.5 to 63.7 per cent. It is also a good source of phosphoric acid and calcium. It contains a wide variety of nutrients and is popular for its fermenting action and largely used for making fermented foods. Blackgram, is the fourth important pulse crop cultivated in India as a sole crop or as an intercrop, covering an area of about 3.24 million hectares. The total production of the crop during 2010 was 1.46 million tons and the average productivity was 526 kg / ha (AICRP Annual Report, 2010). India is the largest producer and consumer of blackgram in the world. The domestic demand of this pulse makes India, the largest importer as well. The major constraints in achieving higher yield are lack of exploitable genetic variability, absence of suitable ideotype for different cropping system, poor harvest index, susceptibility to biotic and abiotic stresses, non-availability of quality seeds of improved varieties and narrow genetic base due to repeated usage of few parents with high degree of relatedness in crossing programme.

Limited variability has been exploited in varietal development programmes in Blackgram. Pedigree analysis of the released cultivars indicated that small number of parents with high degree of relatedness were repeatedly used in crossing programmes. The variety, T9 is the most frequently used ancestor appearing in 64 per cent of the varieties. This indicated very narrow genetic base of the released varieties of Blackgram (Kumar *et al*. 2004). Many breeding efforts have been carried out to improve the yield level of this crop and to break the yield plateau. Genetic diversity is an important factor and also a prerequisite in any hybridization programme. Inclusion of diverse parents in hybridization programme saves the purpose of combining desirable recombination. Qualitative characters are important for plant description (Kurlovich, 1998). Characterization of blackgram genotypes is required for their protection under Plant Variety Protection (PVP) legislation, because varietal testing for distinctness, uniformity and stability (DUS) are the minimum criterion for the grant of protection of new plant varieties under Protection of Plant Varieties and Farmers Rights (PPV & FR). DUS testing is done based on morphological traits; and are controlled by one or few genes compared to biometrical traits, normally controlled by many genes. No influence of environment on morphological traits exhibited discontinuous variation whereas, biometrical traits exhibited continuous variation, and are influenced by environment. Therefore, an attempt has been made in the present investigation with a view to estimate genetic characters of a set of forty six genotypes for sixteen different morphological traits in blackgram.

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Table 1. List of genotypes used for morphological variability studies

S.No	Name of accession	S.No	Name of the accession	S.No	Name of the accession
1.	*Vigna mungo var silvestris* /1	17.	*Vigna mungo var silvestris* 22/3	33.	P-307/1-1
2.	*Vigna mungo var silvestris* /2	18.	*Vigna mungo var silvestris* 22/4	34.	PLS 364/92
3.	*Vigna mungo var silvestris* /3	19.	*Vigna mungo var silvestris* 22/5	35.	AC-43
4.	*Vigna mungo var silvestris* /4	20.	*Vigna mungo var silvestris* 22/6	36.	AC-305
5.	*Vigna mungo var silvestris* /6	21.	*Vigna mungo var silvestris* 22/7	37.	Co-02/103
6.	*Vigna mungo var silvestris* /8	22.	*Vigna mungo var silvestris* 24/1	38.	Cotton leaf - 32
7.	*Vigna mungo var silvestris* /19	23.	*Vigna mungo var silvestris* 24/2	39.	K 951
8.	*Vigna mungo var silvestris* /20	24.	*Vigna mungo var silvestris* 24/3	40.	PLS-44
9.	*Vigna mungo var silvestris* /26	25.	*Vigna mungo var silvestris* 42 /1	41.	VBN 3
10.	*Vigna mungo var silvestris* /28	26.	*Vigna mungo var silvestris* 22 /10	42.	VBN (Bg) 4
11.	*Vigna mungo var silvestris* /37	27.	P-123	43.	VBN (Bg) 5
12.	*Vigna mungo var silvestris* /38	28.	P 133/13	44.	Co 5
13.	*Vigna mungo var silvestris* /47	29.	P-153	45.	CBG 757
14.	*Vigna mungo var silvestris* /35	30.	P-169	46.	T9
15.	*Vigna mungo var silvestris* 22/1	31.	P-202		
16.	*Vigna mungo var silvestris* 22/2	32.	P-226		

Materials and Methods

Seeds of 46 accessions of blackgram were collected from the Department of Pulses, Tamil Nadu Agricultural University, Coimbatore and used in the study. These included 26 accessions of *Vigna mungo* var *silvestris,* 14 germplasm accessions and 6 cultivated varieties of blackgram, the details are presented in Table 1. All the forty six accessions

Table 2. Characterization of blackgram genotypes for morphological traits as per the minimal descriptors (IBPGR)

S. No.	Growth habit	Stem colour	Terminal leaflet shape	Leaf pubescence	Leaf colour	Petiole olour	Leafiness	Calyx colour	Corolla colour	Immature pod colour	Colour of the ventral suture on immature pod	Pod beak shape	Pod pubescence	Twining tendency	Seed colour	Luster on seed surface
1.	2	3	3	1	3	3	5	1	1	2	2	1	5	2	3	0
2.	2	3	3	1	5	4	7	1	1	2	2	2	7	0	6	0
3.	2	4	2	1	5	3	7	1	1	2	2	1	7	0	3	0
4.	2	4	4	1	7	5	5	2	1	1	2	1	7	0	3	0
5.	2	4	2	3	5	3	7	2	1	1	2	1	7	0	3	0
6.	2	3	2	1	5	2	7	1	1	2	2	1	7	2	5	0
7.	2	4	3	1	3	4	5	1	1	1	2	1	7	2	3	0
8.	2	4	2	1	3	5	7	1	1	2	2	1	7	2	3	0
9.	2	3	3	5	7	2	7	1	1	2	2	2	7	2	5	0
10.	1	4	2	3	5	5	0	3	1	1	2	1	7	2	4	0
11.	2	3	2	1	5	4	7	2	1	2	2	1	5	2	5	0
12.	2	3	2	1	5	4	7	1	1	2	2	2	3	2	5	0
13.	2	4	2	1	3	3	7	1	1	2	2	2	5	2	5	0
14.	2	4	2	1	3	2	7	1	1	1	2	2	3	0	5	0
15.	1	4	3	1	3	5	5	2	1	2	2	1	3	2	5	0
16.	2	3	2	1	5	5	7	1	1	1	2	2	5	2	3	0
17.	2	3	2	3	5	5	5	1	1	1	2	2	3	2	3	0
18.	1	3	3	1	3	2	7	2	1	1	2	2	5	2	3	0
19.	2	4	2	1	3	5	0	2	1	1	1	1	3	2	6	0
20.	2	4	2	1	3	2	7	2	1	1	2	1	5	2	3	0
21.	2	4	2	1	3	2	0	2	1	1	1	1	3	2	3	0
22.	3	4	2	1	5	4	5	1	1	1	2	1	5	2	5	0
23.	1	4	2	1	5	4	0	2	1	1	2	1	5	2	3	0
24.	1	4	2	3	5	2	0	1	1	1	2	1	7	2	5	0
25.	2	4	2	1	5	4	0	3	1	1	1	1	5	2	4	0
26.	3	3	5	1	3	2	5	1	1	1	2	1	5	2	6	0
27.	1	3	2	1	5	3	5	1	1	1	2	1	5	0	5	0
28.	1	2	2	1	3	1	5	1	1	1	2	1	7	0	5	0
29.	1	3	2	1	5	2	7	1	1	1	2	1	7	0	5	0
30.	1	3	2	1	5	1	7	1	1	1	2	1	3	0	5	0
31.	1	3	2	1	3	1	7	1	1	1	4	1	5	2	5	0
32.	1	4	2	3	3	2	7	1	1	1	2	2	7	0	3	0
33.	2	4	2	1	5	1	7	1	1	1	2	2	5	0	3	0
34.	2	4	2	3	3	3	7	1	1	1	2	1	7	0	6	0
35.	1	4	2	3	5	1	7	1	1	2	2	2	5	0	5	0
36.	2	3	2	1	5	2	0	1	1	2	2	2	7	0	5	0
37.	2	3	3	1	3	2	5	1	1	1	2	1	5	2	5	0
38.	1	2	4	1	5	2	5	1	1	1	2	1	7	2	5	0
39.	2	3	2	3	5	3	5	1	1	1	2	1	7	2	5	0
40.	2	3	2	3	5	2	7	1	1	1	2	1	7	2	5	0
41.	1	3	1	3	5	2	7	1	1	2	2	1	7	2	5	0
42.	1	3	5	3	5	3	7	2	1	1	1	1	3	2	5	0
43.	2	2	2	5	5	2	7	2	1	1	2	1	7	2	5	0
44.	1	3	2	3	5	3	7	1	1	1	2	1	5	2	5	0
45.	2	2	4	1	5	2	5	3	1	1	1	2	0	2	5	0
46.	2	3	2	1	5	2	5	1	1	1	2	1	7	2	3	0

NOTE: For code number details refer Table 3

were raised in a randomized block design with two replications. Each genotype was sown in a two rows of four meter length with a spacing of 30 x 10 cm. All packages of practice were followed to raise a healthy crop. In each genotype / replication five randomly selected plants were observed for sixteen morphological traits listed in the IBPGR (IBPGR, 1985) minimal descriptors for blackgram.

Results and Discussion

Among forty six genotypes studied, considerable level of variation was observed for all the important traits under study except for corolla colour and luster on seed surface (Table 2). Limited variation for these two traits was observed by Ghafoor *et al*. (2001), Selvi *et al*. (2003) and Kanimozhi, (2008). Among the 46 genotypes, 58.70 per cent showed semi-erect growth habit, 36.96 per cent exhibited erect growth habit and 4.35 per cent exhibited spreading type of growth habit (Table 3). The stem colour varied from dark green, light purple and dark purple. Genotypes showing light purple, dark purple and dark green stem colour were 47.83 per cent, 43.48 per cent and 8.7 per cent, respectively. A total of 71.74 per cent genotypes exhibited ovate, 15.22 per cent showed ovate-lanceolate, 6.52 per cent showed lanceolate, 4.35 per cent showed rhombic and 2.17 per cent showed deltate type of terminal leaflet. The pubescence ranged from very sparsely pubescent to moderate pubescence. Among the genotypes, 69.57 per cent showed very sparse pubescence, 26.09 per cent exhibited sparse pubescence and 4.35 per cent showed moderate pubescence. The genotypes with intermediate green leaves were 60.87 per cent and those with light green leaves were 34.78 per cent while, genotypes with dark green leaves represented 4.35 per cent. A total of 39.13 per cent genotypes exhibited green colour petiole with purple spots, 17.39 per cent exhibited greenish purple and dark purple petiole colour, 15.22 per cent exhibited purple colour and 10.87 per cent of the genotypes showed green coloured petiole. A total of 52.17 per cent genotypes showed dense leafiness, 32.61 per cent genotypes showed intermediate leafiness and 15.22 per cent showed sparse leafiness. A total of 69.57 per cent genotypes showed green coloured calyx while, 23.91 per cent and 6.52 per cent genotypes showed greenish purple and purplish green coloured calyx, respectively. All the genotypes showed yellow coloured corolla.

The immature pod colour showed only two variations namely, light green and dark green colour. Almost 71.74 per cent of genotypes showed light green pods and 28.26 per cent showed dark green pods (Table 3). There was a bimodal distribution for this trait. Genotypes showing dark green and light green colour of ventral suture on immature pods were 89.13 per cent and 10.87 per cent, respectively. There were two beak shape namely, hook and knob. Hook type of pods were observed in 71.74 per cent of genotypes while, 28.26 per cent showed knob type of pods. A total of 45.65 per cent genotypes showed dense pubescence; 34.78 per cent showed moderate pubescence; 17.39 per cent exhibited sparse pubescence and 2.17 per cent of the genotypes were glabrous. A total of 30.43 per cent genotypes showed twining tendency while, the remaining 69.57 per cent genotypes did not show twining. A total of 54.35 per cent of genotypes had black seeds; 32.61

Table 3. Grouping of accessions based on morphological traits

Character	Code number as per IBPGR	Number of genotypes	Percentage of genotypes
Growth habit			
Erect	1	17	36.96
Semi erect	2	27	58.70
Spreading	3	2	4.35
Stem colour			
Dark green	2	4	8.70
Light purple	3	22	47.83
Dark purple	4	20	43.48
Terminal leaflet shape			
Deltate	1	1	2..17
Ovate	2	33	71.74
Ovate-lanceolate	3	7	15.22
Lanceolate	4	3	6.52
Rhomic	5	2	4.35
Leaf pubescence			
Very sparsely pubescence	1	32	69.52
Sparsely pubescence	3	12	26.09
Moderately pubescence	5	2	4.35
Leaf colour			
Light green	3	16	34.78
Intermediate green	5	28	60.87
Dark green	7	2	4.35
Petiole colour			
Green	1	5	10.87
Green with purple spot	2	18	`39.13
Greenish purple	3	8	17.39
Purple	4	7	15.22
Dark purple	5	8	17.39
Leafiness			
Sparse	0	7	15.22
Intermediate	5	15	32.61
Abundant	7	24	52.17
Calyx colour			
Green	1	32	69.57
Purplish green	2	11	6.52
Greenish purple	3	3	23.91
Corolla colour			
Yellow	1	46	100.00
Immature pod colour			
Light green	1	33	71.74
Dark green	2	13	28.26
Colour of the ventral suture on immature pod			
Light green	1	5	10.87
Dark green	2	41	89.13
Pod beak shape			
Hook	1	33	71.74
Knob	2	13	28.26
Pod pubescence			
Glabrous	0	1	2.17
Sparsely pubescence	3	8	17.39
Moderately pubescence	5	16	34.78
Densely pubescence	7	21	45.65
Twining tendency			
Present	0	14	30.43
Absent	2	32	69.57
Seed coat colour			
Brown	3	15	32.61
Chocolate	4	2	4.35
Black	5	25	54.35
Mottled	6	4	8.70
Luster on seed surface			
Absent	0	46	100.00

per cent genotypes possessed brown seeds; 8.7 per cent exhibited mottled seeds and 4.35 per cent had chocolate coloured seeds. Cent per cent of the genotypes exhibited dull luster. Among 46 accessions studied, none of the genotype contained shiny seeds.

In the present study, good level of variability was observed among the accessions of *Vigna mungo* var. *silvestris* for various morphological traits. In general *Vigna mungo* var. *silvestris* is known to have brown seed coat. But, in this study, it showed four different seed coat colours *viz*., brown, chocolate, black and mottled. This may be due to natural outcrossing with black seeded cultivated types. The accessions of *Vigna mungo* var. *silvestris*, a progenitor of cultivated blackgram could be used in the hybridization programme to develop desirable plant types to improve the yield and other attributes.

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Received: April 12, 2013; Accepted: July 15, 2013