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GERMPLASM CHARACTERIZATION IN INDIGENOUS BLACKGRAM (*Vigna mungo* (L) HEPPER)

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Three hundred twenty indigenous accessions of *Vigna mungo* collected from diversity zones of Uttar Pradesh, were evaluated for 10 quantitative and 25 visual characters in incomplete block design, augmented with 4 checks. The characters, seed yield per m^2 pods per cluster and pods per plant exhibited high variability while the remaining seven traits, plant height, pod length, 100- seed weight, seeds per pod, days to flowering, relative chlorophyll index and days to maturity showed moderate to low variability. Full range of variability was observed for all the visual characters. About 60 and 10% accessions exhibited resistance reaction to yellow mosaic and leaf crinkle virus diseases, respectively.

Key words : Blackgram, germplasm, characterization

Blackgram or uridbean (*Vigna mungo* (L.) Hepper) is a major pulse crop in Asiatic region. Being a primary centre of origin, the diversity of this crop is found maximum in India. The productivity of this crop has been far from satisfactory, thus genetic improvement through exploitation of germplasm can be a priority area for vertical and horizontal expansion of this crop. A thrust for germplasm collection and evaluation is of utmost significance to have a dynamic breeding programme. The superior donor parents are urgently required for incorporating desirable characters in the plant type (Paroda, 1990).

The exploitations were carried out in diversity zones viz., Hardoi, Bareilly, Barabanki, Sitapur and Kumaun and Garhwal Districts of Uttar Pradesh. The collections were also obtained from NBPGR, New Delhi for field evaluation purpose. These accessions were evaluated under field condition to characterize for 10 quantitative and 25 visual characters including diseases like yellow mosaic and leaf crinkle viruses.

MATERIALS AND METHODS

Three hundred twenty accessions along with 4 checks Narendra Urid-1, Type-9, Pant Urid-19 and Pant Urid-35 were sown at Crop Research Centre, Pantnagar in an augmented block design with 16 blocks having 20 plots each in *Kharif* 1998. The check varieties were randomly replicated alongwith the test genotypes within the block and replicated as many times as the number of blocks. Each accessions had two row plot of 4 m length, with row to row and plot to plant distance of 30 cm and 10 cm, respectively. The trial was unprotected for diseases. The data on 10 quantitative and 25 visual characters were recorded as per IBPGR (1985) descriptor list.

The data obtained were subjected to statistical analysis following Federer and Raghav Rao (1975) and Peterson (1985) for 10 quantitative characters. The values of accession means were adjusted for the block effects as measured by check plots. The mean values for all characters were utilized for estimation of mean, variance and range. The visual

characters have been reported as such and their frequencies were only calculated.

RESULTS AND DISCUSSION

Mean and least significant differences of accessions and checks and range of accessions are presented in Table 1 on the basis of block errors, the mean values for characters were 55 days for 50 per cent flowering and 93 days for maturity. The mean value for plant height was 97.47 cm. The mean pods per plant came out to be 27.05, pods per cluster, 3.34, pod length 4.71, seeds per pod 6.51, 100-seed weight 3.03, seed yield per m^2 84.24g and relative chlorophyll index as 36.29.

The maximum values of check means for seed yield per m^2 (149.72 g) was recorded for Type-9. The highest mean values of checks were observed for days to 50 per cent flowering (51) and days to maturity (87) in case of Pant Urid-35 whereas Pant Urid-19 had maximum plant height (123.76 cm). Check variety, Narendra Urid-1 had highest number of pods per plant (38.36), pods per cluster (3.68), pod length (5.00 cm), seeds per pod (6.66) and 100-seed weight (3.43 g).

Table 1. Mean, range and leafs significant differences in uridbean accessions and checks

Characters	Accessions	Checks				Coefficient of variation (%)	Least significant difference			
		Check 1 Narendra Urid-1	Check-2 Type-9	Check-3 plant Urid-19	Check-4 Pant Urid-35		CM	AVSB	AVDB	AVAC
Days to 50% flowering	55.00 (41-73)	46	47	48	51	4.47	1.49	5.94	6.64	4.84
Days to maturity	93.00 (67-130)	85	84	86	87	3.63	2.15	8.61	9.62	7.01
Plant height (cm)	97.47 (34.90-197.62)	107.04	118.99	123.76	109.81	9.08	7.23	28.92	32.33	23.57
Pods per plant	27.05 (2.18-76.95)	38.36	31.30	27.79	33.26	19.70	4.46	17.84	19.94	14.54
Pods per cluster	3.34 (1.77-6.97)	3.68	3.62	3.68	3.29	21.55	0.53	2.13	2.38	1.74
Pod length (c,)	4.71 (334-6.22)	5.00	4.73	4.83	4.80	7.83	0.26	1.05	1.18	0.86
Seeds per pod	6.51 (4.29-12.44)	6.66	6.58	6.48	6.62	5.98	0.27	1.09	1.22	0.89
100-seed weight (g)	3.03 (1.87-4.90)	3.43	3.28	3.14	2.94	6.07	0.13	0.54	0.60	0.44
Seed yield per m^2 (g)	84.24 (0.33-395.57)	121.34	149.72	115.74	120.68	36.87	32.41	129.65	144.94	105.65
Relative chlorophyll index	36.29 (13.50-54.60)	42.30	40.71	39.54	39.45	4.16	1.17	4.66	5.22	3.80

Note : Range given in parentheses ( ), CM = Between check means, AVSB = Between adjusted mean of two test genotypes in the same block, AVDB = Between adjusted mean of two test genotypes in different blocks, AVAC = Between an adjusted mean of a test genotypes against check mean

Table 2. Classification of uridbean germplasm on the basis of visual characters

Sl. No.	Character	Scale	No. of entry	Percentage of entry
1.	**Hypocotyl colour**			
	- Green	1	88	27.16
	- Green-purple	2	207	63.89
	- Purple	3	29	8.95
	- Dark purple	4	-	0.00
	- Mixed	5	-	0.00
2.	**Seedling vigour**			
	- Poor	3	11	3.40
	- Intermediate	5	247	76.23
	- Vigorous	7	66	20.37
3.	**Growth habit**			
	- Erect	1	16	4.94
	- Semi-erect	2	266	82.10
	- Spreading	3	42	12.96
4.	**Growth pattern**			
	- Determinate	1	145	44.75
	- Intermediate	2	179	55.25
5.	**Branching pattern**			
	- Basal	1	56	17.28
	- Central	2	228	70.37
	- Top	3	35	10.80
	- All over	4	5	1.54
6.	**Primary leaf shop**			
	- Ovate-lanceolate	1	323	99.69
	- Lanceolate	2	-	0.00
	- Apple shape	3	1	0.31
7.	**Terminal leaflet shape**			
	- Dentate	1	20	6.17
	- Ovate	2	299	92.28
	- Ovate-lanceolate	3	2	0.62
	- Lanceolate	4	2	0.62
	- Rhombic	5	-	0.00
	- Obvoate	6	-	0.00
	- Apple shape	7	1	0.31
8.	**Leaf pubescence**			
	- Glabrous	0	1	0.31
	- Very sparsely pubescent	1	266	82.10
	- Puberulent	3	43	13.27
	- Moderately pubescent	5	13	4.01
	- Densely pubescent	7	1	0.31
9.	**Leaf colour**			
	- Light green	3	47	14.51
	- Intermediate green	5	249	76.85
	- Dark green	7	28	8.64
10.	**Leafiness**			
	- Sparse	3	9	2.78
	- Intermediate green	5	86	26.54
	- Abundant	7	229	70.68
11.	**Terminal leaflet length**			
	- Short	3	5	1.54
	- Intermediate	5	239	73.77
	- Long	7	30	24.69
12.	**Terminal leaflet width**			
	- Narrow	3	4	1.24
	- Intermediate	5	232	71.60
	- Broad	7	88	27.16
13.	**Leaf senescence**			
	- No visible senescence	0	4	1.23
	- Slight visible senescence	3	218	67.28
	- Moderate senescence	5	85	26.23
	- Conspicuous concurrent senescence	7	17	5.25
14.	**Petiole colour**			
	- Green	1	37	11.42
	- Green with purple spots	2	144	44.44
	- Greenish purple	3	140	43.21
	- Purple	4	3	0.93
	- Dark purple	5	-	0.00
15.	**Stem colour**			
	- Light green	1	8	2.47

	- Dark green	2	42	12.96
	- Light purple	3	193	59.57
	- Dark purple	4	81	25.00
16.	**Pod attachment to peduncle**			
	- Penchant	3	9	2.78
	- Sub-erect	5	293	90.43
	- Erect	7	22	6.79
17.	**Immature pod colour**			
	- Light green	1	292	90.12
	- Dark green	2	32	9.88
18.	**Mature pod colour**			
	- Straw	1	8	2.47
	- Tan	2	1	0.31
	- Brown	3	47	14.51
	- Brown and black	4	229	70.68
	- Black	5	39	12.04
19.	**Pod pubescence**			
	- Glabrous	0	1	0.31
	- Puberulent	3	97	29.94
	- Moderately pubescent	5	222	68.52
	- Densely pubescent	7	4	1.23
20.	**Pod shattering in field**			
	- Absent	0	319	98.46
	- Present	1	5	1.54
21.	**Seed shape**			
	- Globose	1	37	11.42
	- Ovoid	2	149	45.99
	- Drum-shaped	3	138	42.59
22.	**Seed colour**			
	- Light green	1	11	3.40
	- Green brown	2	51	15.74
	- Brown	3	108	33.33
	- Chocolate	4	28	8.64
	- Black	5	63	19.44
	- Mottled	6	63	19.44
23.	**Hilum**			
	- Concave	1	-	0.00
	- Non-concave	2	324	100.00
24.	**Disease reaction**			
	(i) Yellow mosaic virus			
	- Resistance	1	195	60.19
	- Low susceptibility	3	55	16.98
	- Medium susceptibility	5	25	7.77
	- High susceptibility	7	17	5.25
	- Susceptible	9	32	9.88
	(ii) Leaf crinkle virus			
	- Resistance	1	33	10.18
	- Low susceptibility	3	79	24.38
	- Medium susceptibility	5	113	34.88
	- High susceptibility	7	81	25.00
	- Susceptible	9	18	5.55

The high variability among accessions was observed for seed yield per m^2 (cv = 36.87 per cent; range 0.33 to 395.57 g), pods per cluster (cv = 21.54 %; range 1.77 to 6.97) and pods per plant (cv = 19.10 %; range 2.18 to 76.95). Minimum variability was observed for days to maturity (cv = 3.63 %; range 67 to 130), followed by relative chlorophyll index (cv = 4.15 %; range 13.50 to 54.60), days to 50% flowering (cv = 4.45; range 41 to 73). Moderate variability was observed for seeds per pod (cv = 5.98 %; range 4.29 to. 12.44), 100-seed weight (cv = 6.07 %; range 1.87 to 4.90 g), pod length (cv = 7.83 %; range 3.34 to 6.22 cm) and for plant height (cv = 9.08 %; range 34.90 to 197.62 cm).

Accessions ShU9626 and ShU9630 showed flowering in 41 days and were earlier than all the checks. Similar was the pattern for days to maturity where the minimum days (67) were observed in Shu9608 which was significantly earlier than the earliest check Type-9 (84 days). This was a collection from village Tursapathi in Bareilly district of Uttar Pradesh.

The range for various characters in the present collection indicates the presence of extreme types of all characters indicating high variability. The

late maturing types (130 days) were distinct in their growth habit also. Similarly the seeds per pod upto 12.44 suggests an ample scope of variability utilization. The shortest plants were found in accession SDI-43 and ShU9621 with mean value 34 and 35 cm. The tallest genotype recorded was IC 201886 with height of 197.62 cm. The accession ShU9534 which is a collection from Baniganj in Hardoi district of Uttar Pradesh had highest number of pods per plant (76.95) which is significantly higher than all other genotypes followed by ShU9508 (68.82). The minimum number of pods per plant (2.18) was obtained in PLU-270 which had high foliage with less pods. The accession GV-400 had 6.97 pod per cluster followed by PLU-11300 (6.47) and PLU-1149 (6.14).

The largest pods were recorded in ShU9640 with average pod size of 6.22 cm, followed by NIC14632 (6.02 cm). The highest number of seeds per pod recorded was 12.44 in IC 201893 which had an entirely different plant type and very small seed size. It had trifoliate, apple shaped *leaves. The plant remained green with shattering* habit of pods. Among the typical urdbean genotypes the highest seed per pod were found in NIC 14632 (8.99) followed by PLU-360 (8.59) and ShU9736 (8.09). The boldest grain were recorded in ShU9606 which is a collection from Shergarh area in Bareilly district. The seed size recorded was 4.90 g per 100 seeds. The highest chlorophyll index was recorded for SD-1-61 (54.60).

The high yielding genotypes like PLU-289 and ShU9682 with yields 395.57 g and 376.83 g, respectively were indicative of the facts that higher yielding germplasm are still available. Further testing of such accessions in wide areas will be needed. The evaluation data for quantitative characters clearly suggests the richness of variability in existing collection and scope of improvement over existing checks. Hawkes (1981) and Sharma *et al.* (1981) also emphasized the need of evaluation and use of diverse germplasm in crop plant.

The range and frequency of visual characters obtained in uridbean germplasm are presented in Table 2. It showed enough range of variation for visual characters also. Intermediate seedling vigour was obtained for 76.23 per cent accessions while vigorous seedlings were observed in 20.37 per cent accessions. Poor seedling vigour was recorded for 3.40 per cent accessions. Pod pubescence and leaf pubescence are thought to play a major role in insect resistance. Full range of variation for it was present in the germplasm studied. Majority of accessions (82.10%) showed very sparse pubescent leaves while glabrous leaves was observed for one accession i.e., IC 201893 (0.31%) Accession 2183-37 showed dense pubescent leaves. Moderate pod pubescence was recorded for 68.52% accessions while glabrous type pod pubescence was lowest in frequency (0.31 per cent). Being monogenic and dominant nature of pubescent character (Pathak and Singh, 1961 and Dwivedi and Singh, 1986) can be transferred *easily into cultivated variety from the characterize* germplasm lines. In majority of accessions (98.46%), pod shattering in field was absent, only 1.54% accessions showed pod shattering in the field which is an undesirable character.

More than half of accessions (67.28%) showed slight visible senescence including ShU9514, ShU9515 and 5.25 per cent accessions including ShU9501, ShU9505, IC-201893 were found non-senescence which can be utilized in breeding programme to breed photoinsensitive lines. Ovoid seed shape was observed for 45.99 per cent accession whereas globose and drum-shaped seed was obtained for 11.42 per cent and 45.99 per cent accessions, respectively. Full range of variation for seed colour was present but majority of accessions (33.33%) showed brown colour of seeds. The light green colour was obtained in 3.04 per cent of accessions. All

Table 3. Genetic donors for different characters

1. Days to 50 % flowering	
(a) Early type:	ShU9523, ShU9524, ShU9607, ShU9608, Shu9612, ShU9614, ShU9615, ShU9617, ShU9618, ShU9626, ShU9630, PLU-289 and PLU-317
(b) Late type :	ShU9508, ShU96126, PLU-305, PLU-346, PLU-346, PLU- 1292, IC-37176,I C-38676, IC-38987, NIC-15271-1, NIC-15274, NIC-16446- A, NIC-16446-B, SD-3765, DPU-256, DPU-1018, NC-61003, H-6838, NKG-43
2. Days to maturity	
(a) Early type :	ShU9503, ShU9504, ShU9506, ShU9507, ShU9508, ShU9509, ShU9511, ShU9517, ShU9518, ShU9520, ShU9521, ShU9522, ShU9524, ShU9527, ShU9528, ShU9529, ShU9537, ShU9538, ShU9539, ShU9540, ShU9604, ShU9606, ShU9607, ShU9608, ShU9611, ShU9612, ShU9613, ShU9615, ShU9618, ShU9622, ShU9626, ShU9629, ShU9630, ShU9636, ShU9639, ShU9641, ShU9642, ShU9643, ShU9644, ShU9645, ShU9667, ShU96115, PLU-289, PLU-1278, IC-15270, IC-201889, INC-14632, NIC-16447-A, JBI-1133, JBT-2154, N-55, Type-9, VL-310.
(b) Late type :	ShU9501, PLU-36, PLU-73, PLU-94, PLU-168, PLU- 169, PLU-185, PLU-187, PLU-118, PLU-189, PLU-190, PLU-199, PLU-205, PLU- 226, PLU-227, PLU-257, PLU-271, PLU-285, PLU-286, PLU-300, PLU-305, PLU- 309, PLU-317, PLU-329, PLU-336, PLU-341, PLU-342, PLU-346, PLU-360, PLU- 366, PLU-369, IC-37176, IC-38676, NIC-15271-1, NIC-15274, DPU-5, DPU-87- 14, DPU-88-5, DPU-256, DPU-1018, SDI-29, 2183-32, SV-2445, JV-566 and NE-15266.
3. Plant Height	
(a) Tall :	ShU9633, ShU96127, ShU9724, ShU9727, PLU-169, PLU- 257, PLU-297, PLU-360, PLU-1040, IC-73264, NIC-23231, K-6113
(b) Dwarf :	ShU9618, ShU9621, SDI-43
4. Pods per plant	ShU9502, ShU9505, ShU9508, ShU9534, ShU9543, ShU9606, ShU96100, ShU9724, PLU-384.
5. Pods per cluster	PLU-297, PLU-1149, PLU-11300, NIC-16446-A, GV-400
6. Pod length	ShU9508, ShU9509, ShU9518, ShU9598, ShU9603, ShU9604, ShU9606, ShU9607, ShU9617, ShU9627, ShU9628, ShU9633, ShU9634, ShU9639, ShU9640, ShU9641, ShU9642, ShU9645, ShU9667, ShU9682, ShU96129, PLU-433, 2183-32, NIC-14632.
7. Seeds per pod	ShU9503, ShU9677, ShU9685, ShU96100, ShU96109, ShU96110, ShU96113, ShU96114, ShU9724, ShU9727, ShU9736, PLU-227, PLU-228, PLU-279, PLU-285, PLU-286, PLU-309, PLU-347, PLU-360, PLU-433, IC-16048, IC-23231, IC-38987, IC-201893 (with 12.436 seeds/pod) NIC 14361, NIC 14632, NIC 15724, 2183-32, 7PU-3.
8. 100-seed weight	ShU9509, ShU9505, ShU9518, ShU9606, ShU9612, ShU9632, ShU9680, PLU- 277, PLU-433, IC-292, IC-110649, K-61113, K-73302, JBT-9193, JBT- 17152A, SDI-428-1, BDJ-85, VKP-574, 7PU-3, Pusa-105.
9. Seed yield per m^2	ShU9609, ShU9627, ShU9630, ShU9637, ShU9677, ShU9681, ShU9682, ShU9684, ShU96100, ShU96109, ShU96133, ShU9723, ShU9724, PLU-26, PLU-224, PLU-228, PLU-237, PLU-251, PLU-277, PLU-279, PLU-289, PLU-317, PLU-363, PLU-433, PLU-1278, IC-292, IC-110649, IC-38987, IC-73301, IC-201887, IC-201893, NIC-14361, SD-1-61, K-61113, H-61, H-68, H-68, JBT-9193, SDI-428-1.
10. Relative chlorophyll index	ShU9502, ShU9503, ShU9513, ShU9709, ShU9716, PLU-188, PLU-199, PLU- 228, PLU-260, PLU-261, PLU-264, PLU-270, PLU-271, PLU-285, PLU-360, PLU- 603, PLU-731, IC-16048, IC-223231, IC-201893, SD-1-61, K-2543, K-10- 51, K-19-45, H-61, SDI-43, BDJ-116, N-832, Pusa-105.
11. Resistant genotype to yellow mosaic and leaf crinkle virus diseases	ShU9511, ShU9513, ShU9603, ShU9606, ShU9612, ShU9614, ShU9621, ShU9716, ShU9727, ShU9736, PLU-289.

accessions (100%) had protruded hilum on the seed. Majority of accessions (60.19%) showed resistance against yellow mosaic virus while high susceptibility was observed only in 15.13 per cent accessions. About 25 per cent accessions showed low to medium susceptibility to yellow mosaic viruses (Table 2). About 10 per cent accessions were found resistant to leaf crinkle virus while majority of accessions (59.26%) showed low to medium susceptibility against leaf crinkle virus disease. About 31 per cent accessions were found highly susceptible to leaf crinkle virus disease (4.3). Accessions ShU9511, ShU9513, ShU9603, ShU9606, ShU9612, ShU9621, ShU9716, ShU9727, ShU9736 and PLU-289 were found resistant to yellow mosaic and leaf crinkle virus diseases both and can be utilized in the disease resistance breeding programme.

Based on the screening of different quantitative and visual characters of 320 accessions, some of the accessions were identified as donor for desirable character presented in Table 3, can be utilized in breeding programme for improvement of a particular character. The seed of all these accessions will be deposited at National Gene Bank at NBPGR for long term conservation and utilization.

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