

Varietal characterization of urdbean for distinctiveness, uniformity and stability

P. K. KATIYAR, G.P. DIXIT and B.B. SINGH

Indian Institute of Pulses Research, Kanpur – 208 024, Uttar Pradesh, India; Email: goldikatiyar@yahoo.com

(Received: July, 2009; Accepted: October, 2010)

ABSTRACT

Morphological characterization of urdbean varieties is essential for their protection under Plant Variety Protection (PVP) legislation, because varietal testing for Distinctness, Uniformity and Stability (DUS) are the basis for granting protection of new variety under PPV&FR Act, 2001. Keeping this in view, a total of 46 released varieties of urdbean were grouped for various agro-morphological descriptors. All the varieties showed similar expression for each character over the years depicting the stability of varieties. None of the attribute showed intra-varietal variation. On the basis of 21 descriptors, varieties were grouped into different categories for each character and may be used as reference varieties.

Key words : Characterization, Cultivars, Urdbean, *Vigna radiata*

Urdbean [*Vigna mungo* (L.) Hepper] is the third most important pulse crops of India and is grown primarily as inter-crop with jowar, bajra, pigeonpea, etc., during *kharif* and as sole crop during of *rabi* and spring seasons. On account of its short duration, photo-insensitivity and dense crop canopy, it assumes special significance in crop intensification and diversification, conservation of natural resources and sustainability of production systems. Improvement in urdbean was initiated during 1950s, when breeders mostly applied pureline selections from land races and after multilocational testing, superior genotypes were recommended as improved varieties. With the inception of AICRP in sixties, collective efforts were diverted by the breeders to develop high yielding varieties through hybridization and mutation breeding which led to increase in area and production. Further, varietal testing for Distinctness, Uniformity and Stability (DUS) is the basis for grant of protection of new plant varieties under the protection of Plant Varieties and Farmer's right Act, 2001 (PPV & FR, 2001) as the act has provision to compare the candidate variety with the varieties of common knowledge on a set of relevant characteristics prescribed in the Draft National Test Guidelines for DUS testing of urdbean and commonly accepted for this purpose at the time of filling of application. Therefore, the present study was undertaken with the objective to characterize 46 released varieties of urdbean on the basis of qualitative morphological characters and to establish distinctiveness of the candidate variety from all other varieties including extant varieties developed in India.

MATERIALS AND METHODS

A total of forty six urdbean varieties viz., 'Azad Urd 1', 'Azad Urd 2', 'AKU 4', 'CO 5', 'GU 1', 'JU 2', 'KU 96-3', 'LGB

20', 'LGB 17', 'LGB 611', 'LGB 623', 'LGB 645', 'LGB 648', 'LGB 685', 'LGB 402', 'Manikya', 'Mash 1', 'Mash 2', 'Mash 414', 'Naveen', 'NDU 1', 'PDU 1', 'RBU 38', 'Sekhar U 1', 'Sekhar U 2', 'Sekhar U 3', 'Sarla', 'TU 94-2', 'TAU 1', 'TAU 2', 'T 9', 'TMV 1', 'TPU 4', 'Uttara', 'UG 218', 'Vamban 1', 'Vamban 2', 'WBU 108', 'G 338', 'Mash 1008', 'Pragya', 'Pant U 19', 'Pant U 30', 'Pant U 35', 'Pant U 31', and 'Pant U 40' released and notified in India were evaluated during *kharif* season, at Indian Institute of Pulses Research, Kanpur in a Completely Randomized Block Design with three replications over three years (2006 to 2008). Each plot consisted of four rows of 5 m length, spaced 45 cm apart with interplant distance of 15 cm. Varieties were evaluated for 21 characters viz., anthocyanin colour, growth habit, plant habit, stem colour, stem pubescence, plant height, leaf shape (terminal), leaf colour, leaf pubescence, vein colour, petiole colour, peduncle length, days to 50% flowering, pre-mature pod colour, mature pod colour, pod pubescence, mature pod length, seed colour, seed coat lusture, seed shape and seed size. These descriptors were recorded as per IBPGR (IBPGR, 1992).

The observations were recorded on 10 plants in each replication at specified stages of crop growth period when the characters under study had full expression. Anthocyanin colour was observed at cotyledons unfolded stage whereas time of flowering was observed on 50% plants with atleast one open flower. Nine characters viz., time of flowering, growth habit, plant habit, stem colour, stem pubescence, leaf shape (terminal), foliage colour, leaf vein colour and leaf pubescence were observed at 50% flowering. Similarly, petiole colour, colour of pre-mature pod and pod pubescence were observed at fully developed green pods while plant height, peduncle length, pod colour and pod length were observed at maturity. Further, four attributes, viz., seed colour, seed lusture, seed shape and seed size were recorded of mature seeds.

RESULTS AND DISCUSSION

Among the 46 urdbean varieties studied, considerable variation was observed for all the important attributes under study except for anthocyanin colour, stem pubescence, leaf pubescence, petiole colour, peduncle length, and seed size. The characterization of blackgram varieties under study is presented in Table 1 and frequency distribution of each descriptor of released varieties alongwith example varieties is depicted in Table 2.

Three types of growth habit (erect, semi-spreading and spreading) are seen in the Indian varieties. The erect type

Table 1. Characterization of urdbean varieties

Genotype	Antocyanin colour	Plant Growth habit	Plant habit	Stem colour	Stem Pubescence	Plant height	Leaflet (terminal) shape	Leaf colour	Petiole colour	Peduncle length	Leaf vein colour	Leaf pubescence	Time of flowering	Premature pod colour	Mature pod colour	Pubescence on pod	Pod length	Seed colour	Seed coat lusture	Seed shape	Seed size
Azad U 1	9	3	2	2	9	3	3	1	2	5	1	9	3	3	1	9	3	4	2	2	5
Azad U 2	9	5	2	4	9	3	3	1	2	5	2	9	3	7	1	9	3	4	2	2	5
AKU 4	9	3	2	2	9	5	3	1	2	5	1	9	3	7	3	1	3	4	2	2	5
CO 5	9	3	2	2	9	5	2	1	2	5	2	9	7	7	3	9	3	4	2	2	5
Gujarat U 1	9	5	2	2	9	3	3	1	2	5	1	9	5	3	1	9	3	4	2	2	5
JU 2	9	5	2	2	9	3	3	1	2	5	1	9	5	3	2	9	3	2	2	2	5
KU 96-3	9	3	2	2	9	3	3	1	2	5	2	9	5	5	1	9	3	4	2	3	5
LBG 17	9	5	2	2	9	3	2	1	2	5	1	9	7	7	3	9	3	2	1	2	5
LBG 611	9	3	2	2	9	3	2	1	2	5	2	9	7	7	3	9	3	2	2	3	5
LBG 623	9	3	2	2	9	5	2	1	2	5	1	9	5	5	2	9	3	4	1	3	5
LBG 645	9	3	2	2	9	5	2	1	2	5	2	9	7	7	2	9	3	4	1	2	5
LBG 648	9	3	2	2	9	3	2	1	2	5	2	9	7	7	2	9	3	2	1	3	5
LBG 685	9	3	2	2	9	3	2	1	2	5	2	9	7	7	2	9	3	2	1	2	5
LBG 402	9	3	2	2	9	5	2	1	2	5	2	9	7	7	2	9	3	4	2	2	5
Manikaya	9	3	2	2	9	3	3	2	2	5	1	9	7	3	1	9	3	4	2	2	5
Mash 2	9	3	2	2	9	5	2	1	2	5	1	9	7	5	1	9	3	4	2	3	5
Naveen	9	7	2	2	9	5	2	1	2	5	1	9	7	5	1	9	3	2	2	3	5
NDU 1	9	5	2	2	9	3	3	2	2	5	1	9	5	5	1	9	3	4	2	2	5
PDU 1	9	3	2	4	9	5	3	1	2	5	2	9	5	3	1	9	3	4	2	2	5
Pant U 19	9	3	1	2	9	3	3	1	2	5	1	9	3	5	1	9	3	2	2	2	5
Pant U 30	9	3	1	4	9	7	3	1	2	5	1	9	5	3	2	9	3	2	2	2	5
Pant U 35	9	5	2	2	9	3	3	1	2	5	1	9	5	3	1	9	3	2	2	2	5
RBU 38	9	3	2	2	9	7	3	1	2	5	1	9	5	3	1	9	3	2	2	3	5
Sekhar U 1	9	3	2	2	9	5	3	1	2	5	1	9	5	3	1	9	3	1	2	2	5
Sekhar U 2	9	3	2	2	9	5	3	1	2	5	1	9	5	3	2	9	5	1	2	2	5
Sekhar U 3	9	3	2	2	9	7	2	1	2	5	1	9	5	5	2	9	5	2	2	2	5
Sarla	9	5	2	2	9	3	3	1	2	5	1	9	5	3	1	9	5	2	2	2	5
TU 94-2	9	7	2	2	9	7	3	1	2	5	1	9	5	3	2	9	3	4	2	2	5
TAU 1	9	3	2	2	9	5	3	1	2	5	1	9	7	5	3	9	3	4	2	2	5
TAU 2	9	3	2	2	9	5	3	1	2	5	2	9	7	3	3	1	3	4	2	2	5
T 9	9	3	1	2	9	3	3	1	2	5	1	9	3	5	3	1	3	2	2	2	5
TMV 1	9	3	2	2	9	5	3	1	2	5	1	9	5	3	1	9	3	4	2	3	5
TPU 4	9	5	2	2	9	5	3	1	2	5	1	9	5	3	1	9	3	4	2	3	5
Uttara	9	3	1	4	9	5	2	2	2	5	2	9	5	7	3	9	3	4	2	2	5
UG 218	9	3	1	2	9	3	3	2	2	5	1	9	3	3	1	9	3	4	2	2	5
Vambn 2	9	7	2	2	9	3	3	1	2	5	1	9	7	3	3	9	3	4	2	3	5
Vamban 1	9	7	2	2	9	7	4	1	2	5	1	9	5	3	1	9	3	4	2	2	5
WBU 108	9	5	2	2	9	3	3	1	2	5	1	9	5	3	1	9	3	2	2	2	5
G 338	9	3	1	2	9	3	3	1	2	5	1	9	3	5	3	9	3	4	2	2	5
LBG 20	9	3	2	2	9	5	2	1	2	5	1	9	7	5	3	1	3	4	1	2	5
Mash 1	9	5	2	2	9	7	2	1	2	5	1	9	7	5	1	9	3	4	2	3	5
Mash 414	9	5	2	2	9	5	2	1	2	5	1	9	7	5	1	9	3	4	2	3	5
UG 1008	9	3	2	2	9	5	3	1	2	5	1	9	7	3	3	9	3	4	2	2	5
Pragaya	9	3	2	1	9	7	2	2	2	5	2	9	7	7	1	9	3	4	2	2	5
Pant U 40	9	7	2	2	9	5	3	1	2	5	1	9	5	3	3	9	3	4	2	2	5
Pant U 31	9	3	1	2	9	3	3	1	2	5	1	9	3	5	3	9	3	4	2	2	5

State of characteristics according to national test guidelines

1=Absent, 9=Present

3=erect, 5=semi-erect, 7=spreading

1=determinate, 2=indeterminate

1=green, 2=greenish purple, 4=purple

1=absent, 9=present

3=short, 5=medium, 7=long

1=deltoid, 2=ovate, 3=lanceolate, 4=cunrate

1=green, 2=dark green

1=green, 2=green with purple splashes, 3=purple

3=short, 5=medium, 7=long

1=green, 2=purple

1=absent, 9=present

3=early, 5=medium, 7=late

3=yellowish green, 5=green, 7=dark green

1=buff, 2=brown, 3=black

1=absent, 9=present

3=small, 5=medium, 7=long

1=green, 2=greenish brown, 3=brown, 4=black, 5=mottled

1=shiny, 2=dull

1=globose, 2=oval, 3=drum

3=small, 5=medium, 7=large

Table 2. Frequency distribution and example varieties of some important attributes of 46 released varieties of urdbean

Plant descriptors	Range in expression	No. of varieties	Example varieties
Anthocyanin colour	Absent	0	Nil
	Present	46	IPU 94-1, Pant U 35
Time of flowering	Early (< 40 days)	8	Pant U 19, T 9
	Medium (40-50 days)	20	Sekhar U 3
	Late (>50 days)	18	LBG 17, LBG 402
Plant growth habit	Erect	30	T 9, TAU 1
	Semi-erect	11	Pant U 35, NDU 1
	Spreading	5	Vamban 1, Naveen
Plant habit	Determinate	7	T 9, Pant U 19
	Indeterminate	39	Vamban 1
Stem pubescence	Absent	0	-
	Present	46	NDU 1, RBU 38
Leaflet (terminal) shape	Deltoid	0	-
	Ovate	16	CO 5
	Lanceolate	29	Pant U 19, WBU 108
	Cunata	1	Vamban 1
Foliage colour	Green	41	PDU 1, Mash 1
	Dark green	5	Uttara, NDU 1
Leaf vein colour	Green	34	Pant U 19, NDU 1
	Purple	12	Pragya
Leaf pubescence	Absent	0	Nil
	Present	46	KU 96-3, WBU 108
Petiole colour	Green	0	Nil
	Green with Purple splashes	46	NDU 1, RBU 38
	Purple	0	Nil
Pod colour (Premature pod)	Yellowish Green	22	PDU 1, Sekhar U 2
	Green	13	Pant U 19, T 9
	Dark Green	11	Uttara
Pod pubescence	Absent	4	T 9, TAU 2
	Present	42	Pant U 19, NDU 1
Peduncle length	Short (<5 cm)	0	Nil
	Medium (5-10 cm)	46	NDU 1, PDU 1
	Long (> 10 cm)	0	Nil
Pod length	Small (< 5 cm)	43	Azad U 2
	Medium (5-7 cm)	3	Sekhar U 2
	Long (> 7 cm)	0	Nil
Pod colour (mature)	Buff (Off-white)	22	PDU 1
	Brown	10	Sekhar U 2, TU 94-2
	Black	14	Uttara, TAU 1
Seed lusture	Shiny	6	LBG 17
	Dull	40	Uttara, NDU 1
Plant height	Short (<45 cm)	20	T 9, WBU 108
	Medium (45-60 cm)	19	Sekhar U 1
	Long (>60 cm)	7	PU 30, RBU 38
Seed colour	Green	2	Sekhar U 2
	Greenish Brown	13	JU 2
	Black	31	Uttara
Seed size	Small (<3 g)	-	Nil
	Medium (3-5 g)	46	Uttara, Pant U 30
	Large (>5 g)	-	Nil

generally have a determinate growth habit while others have indeterminate growth habit (Singh 1997). It is generally believed that evolution has been from indeterminate spreading to determinate upright plant types (Smartt 1985, Smartt 1990, Steele and Mehra 1980). Early selections from the landraces ('T 27', 'T 77', 'T 65', 'Gwalior 2', 'BR 68', etc.) are indeterminate spreading types and have been in cultivation predominantly as intercrop with cotton, sugarcane, pigeonpea, sorghum, etc. Cultivation of erect and determinate types have been

increasing steadily for the past three decades because of the ease in cultivation in sole cropping system and their ability to avoid some diseases. In the present study, all the varieties of determinate types viz., 'Pant U 19', 'Pant U 30', 'T 9', 'Uttara', 'UL 338', 'UG 218', 'G 338' and 'Pant U 31' were also erect in growth habit. Further, the urdbean crop is a tropical one but it is grown in *kharif*, *rabi* and *summer* season in India. An indeterminate plant type of 50-60 cm height (Pant U 40 and Shekhar U 1) may be desirable for the *kharif* season (Singh

1997) whereas, determinate growth habit with 30 cm plant height and greater early vigour are desirable for spring/summer/*rabi* season. Among the cultivars studied, 'T 9' is the only variety suitable for spring season. Further, reduced plant height is also an important attribute and majority of the varieties *viz.*, 'Azad Urd 1', 'Azad Urd 2', 'GU 1', 'JU 2', 'KU 96-3', 'LBG 611', 'LBG 648', 'LBG 685', 'LBG 17', 'NDU 1', 'Pant U 35', 'Sarla', 'UG 218', 'T9', 'UL 338', 'Vamban 2', 'WBU 108', 'G 338', 'Pant U 31', 'Manikya' and 'Pant U 19' were observed under this category. Seven varieties exhibited plant height more than 60 cm whereas the remaining had height between 45 to 60 cm. The urdbean varieties were largely of medium to late flowering except some spring season varieties which belong to early flowering category. Short duration varieties are often less sensitive to photoperiod than the late maturing ones. Earliness and photo-insensitivity are recessive traits and under the control of major gene (Singh and Dhaliwal 1971, Sinha 1988, Tiwari and Ramanujam 1976), and thus can be manipulated with relative ease. Early maturing types are dwarf due to short internodes and tend to mature after the first flush of flowers (Singh 1997). Therefore, in selecting early maturing genotypes, early vigour is an important component.

Foliage colour varied from light green to dark green in the varieties studied *eg.* 'Uttara', 'NDU 1', 'Manikya', 'UL 338' and 'Pragaya' exhibited dark green colour and rest showed light green foliage colour. Considerable variation was also observed for leaflet (terminal) shape. Varieties like 'CO 5', 'LBG 17', 'LBG 611', 'LBG 645', 'LBG 623', 'LBG 648', 'LBG 685', 'LBG 402', 'Mash 2', 'Uttara', 'LBG 20', 'Mash 414', 'Pragaya', 'Naveen', 'Mash 1-1' and 'Sekhar U3' were of ovate types while 'Vamban 1' showed cunate leaf shape. Rest varieties showed lanceolate leaf shape. Leaf vein colour is another character with sufficient variability in urdbean varieties. Purple leaf vein colour was observed in 12 varieties *viz.*, 'Uttara', 'Azad U2', 'CO 5', 'KU 96-3', 'LBG 611', 'LBG 645', 'LBG 685', 'LBG 402', 'LBG 648', 'PDU 1', 'TAU 2' and 'Pragaya' and the other varieties depicted green leaf vein colour.

Plants bearing more pods along with more seeds/pod would be desirable as the number of pods/plant has the highest positive and significant correlation with yield (Singh 1997). In the present study, only four attributes related to pods *viz.*, pod colour (premature pod), pod pubescence, pod length and pod colour (mature pod) were studied. The trait premature pod colour was categorized into three categories namely, yellowish green, green and dark green. For example 13 varieties depicted green colour, 11 showed dark green and the remaining showed yellowish green. Pod pubescence was noticed in all the varieties except for 'AKU 9904', 'TAU 2', 'T 9' and 'LBG 20'. On the basis of pod length, urdbean varieties can be classified into three categories *viz.*, short (< 5 cm), medium (5-7 cm) and long (> 7 cm). However in the present study, only three varieties *i.e.* 'Sekhar U 1', 'Sekhar U 2' and 'Sekhar U 3' had medium pod length while rest of cultivars showed short pod length. In respect of pod colour, 14 varieties depicted black pod colour, 10 varieties with brown and rest showed buff (off-white) pod colour.

Attractive seed colour has been the consumer preference as they offer good market price. In certain pockets, green seed varieties are preferred over black seeded types. The green seeded varieties are generally grown as mixed crop with sorghum, pigeonpea and cotton and popular among consumers of certain areas of the country (Singh 1997). In the present study, seeds were classified into three groups, namely green, black and greenish brown. Thirty one cultivars are of black seeded types, 13 greenish brown and two ('Sekhar U 1' and 'Sekhar U 2') are green types. Further, six cultivars, *viz.*, 'LBG 623', 'LBG 20', 'LBG 645', 'LBG 17', 'LBG 685' and 'LBG 648' exhibited lustrous seed and the remaining showed dull seed. In relation to seed shape, twelve varieties depicted drum shape seed and others were oval. Seed size of urdbean cultivars may be grouped into three categories *viz.*, small (< 3 g / 100-seed), medium (3 to 5 g / 100-seed) and large seeded (> 5 g / 100-seed). In the present study, all the cultivars belong to medium category.

On the basis of present preliminary characterization, these varieties were grouped into different categories for each character and may be used as reference cultivars. In the past breeding efforts in the development of varieties have utilized only a fraction of the vast available diversity as was evident from their pedigree. While 30 parents involved in the ancestry of 32 cultivars developed through hybridization, only a few were frequently utilized with specific objectives such as incorporation of earliness, diseases and pest resistance. Pre-breeding or genetic enhancement needs emphasis for transfer or introgression of genes and gene combinations from unadapted sources into more usable breeding material. There are indications that novel and useful traits can be successfully combined from related species.

REFERENCES

- IBPGR. 1992. Descriptor of *Vigna* sp. International Plant Genetic Resources Institute, Rome, Italy.
- PPV & FR. 2001. Protection of Plant Varieties and Farmer's Right Act (No. 53 of 2001). Dept. of Agriculture and Cooperation, Ministry of Agriculture, Gov. of India, Krishi Bhavan, New Delhi.
- Singh, DP. 1997. Tailoring the plant type in pulse crop. *Plant Breeding Abstracts* 67(9): 1213-1220.
- Singh KB and Dhaliwal HS. 1971. Combining ability and genetic of days to 50% flowering in blackgram. *Indian Journal of Agricultural Sciences* 41: 719-723.
- Sinha RP. 1988. Early maturity, dwarf mutant of urdbean. *Journal of Nuclear Agriculture and Biology* 17: 61-62.
- Smartt J. 1985. Evolution of grain legume III. Pulses in the genus *vigna*. *Experimental Agriculture* 21: 87-100.
- Smartt J. 1990. The evolution of agriculturally significant legumes. *Plant Breeding Abstracts* 60: 725-731.
- Steele WM and Mehra KL. 1980. Structure, evolution and adaptation to farming system and environment in *Vigna*. In: RJ Summerfield and AH Bunting (eds), HMSO London, UK. Pp. 393-404.
- Tiwari AS and Ramanujam S. 1976. Genetics of flowering response in mungbean. *Indian Journal of Genetics* 36: 418-419.