

## DUS CHARACTERIZATION OF MEGA RICE VARIETIES AND LANDRACES OF INDIA

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### ABSTRACT

*Characterization of twenty (ten mega varieties and ten landraces) varieties of rice was done using twenty three morphological traits following Distinctiveness, Uniformity and Stability test (DUS) during kharif season of 2011 at the field experimentation centre of Division of Genetics, IARI, New Delhi. Among the 23 DUS characters utilized in the characterization of twenty rice genotypes, six character viz., the basal leaf sheath colour, colour of ligule, shape of ligule, auricles, anthocyanin colouration of auricles and anthocyanin colouration of nodes showed no variation and found distinctive among all the cultivars. Maximum variability was recorded with respect to panicle- length of main axis, Spikelet-Colour of tip of lemma and Panicle- Attitude of branches among all the cultivars. Cultivars Bindli, TilakChandan, Pusa Sughandh-5, Pusa Basmati-1 and Improved Pusa Basmati-1 can be identify based on presence of Awns. Peeli Badam and Jaiphula were found with light purple stigma while Swarna and Swarna Sub-1 with yellow stigma. Variety Bindli, Jeerag Sambha, Dhanaprasad and Pusa Basmati-1 can be identify based on semi-erect flag leaf where rest of all found Erect flag leaf. It is concluded that many varieties with distinct and distinguishable characteristics and better economic and genetic values can be registered for their protection under the PPV&FR Act, 2001 and can be used in the breeding programmes.*

**Key word:** DUS test, mega rice varieties, landraces, PPV&FR Act.

### INTRODUCTION

Rice is the staple food crop for more than 60% of the world's population (Singh *et al.*, 2008) and about 90% of all rice grown in the world is produced and consumed in Asia. Being one of the centers of origin for rice, a large number of native varieties and landraces having unique characteristics and great adaptability, are grown in different agro climatic zones. About 425,500 rice accessions conserved in various gene banks of the world are potential gene sources for directed crop improvement. These not only include sources for simply inherited traits such as resistance or tolerance against biotic and abiotic stresses, but also provide genes for complex traits for further improvement of grain quality and yield. India has one of the richest rice germplasm collections, with more than 60,000 accessions (Chakrabarty *et al.*, 2012). With the introduction of high yielding varieties a new technologies become a great threat to the security of the age-old practice of growing traditional varieties and landraces which may have immense potential for different important traits (Song *et al.*, 1999). The information regarding Novelty, distinctness, uniformity and stability are the basic mandates for protection under the Protection of Plant Varieties and Farmers' Rights Act (PPVFRA), 2001, which is a unique and model act which gives equal importance to the breeders and treats them as partners in their efforts for sustainable food security (Patra *et al.*, 2000). Hence, Morphological characterization of the released varieties and

landraces helps in developing the database based on which new varieties developed can be distinguished and the characterization would also help in assessment of genetic diversity existing in the landraces and released varieties. Internationally, DUS testing is co-ordinated by the International Union for the Protection of New Varieties of Plants (UPOV), which produces Guidelines detailing lists of characters to be used for examination of different species. The ability to distinguish and clearly identify the varieties of cultivated species is fundamental for the operational aspects in the seed trade. The new varieties developed in agricultural and horticultural crops should be distinct from other varieties, with the introduction of Indian legislation on 'The Protection of Plant Varieties and Farmer's Rights (PPV & FR) Act, 2001'. The present study is conducted to characterize the rice genotypes based on DUS characters.

### MATERIALS AND METHODS

For the purpose of DUS characterization, ten mega rice varieties as per their popularity assessed by the breeder seed indent of 2010 (DRR, 2010) and ten landraces which may be valuable genotypes for the novel genes and traits was collected from the Division of Genetics, Indian Agriculture Research Institute, New Delhi (Table 1). Twenty varieties were grown in randomized block design with three replication in kharif 2011 at the field experimentation centre of the Division of Genetics, IARI, New Delhi. The experiment was laid down in RBD with 20 rice

genotypes at spacing of 20 cm between rows and 15 cm between plants. Observations were recorded on five randomly chosen plants of each genotypes per replication for 23 morphological traits according to the National test guidelines for DUS test in rice which was developed by Directorate of Rice Research Rajendarnagar, Hyderabad (Shobha Rani *et al.*, 2004). The observation of various characterizations was recorded at different stage of growth with appropriate procedures as per the DUS test guidelines of PPV & FR Act, 2001.

Table 1: List of 20 rice varieties and landraces used for morphological characterization

S. No.	Rice varieties	S. No.	Aromatic landraces
1	Swarna Sub-1	11	PeeliBadam
2	Swarna	12	Jaiphula
3	Pusa Basmati-1	13	Acharmati
4	Improved Pusa Basmati-1	14	Chinikamini
5	PR113	15	Bindli
6	Pusa Basmati-1121	16	TilakChandan
7	Pusa Sugandh-5	17	CRRI Black Aroma
8	Pusa 1401	18	ChiniSakkar
9	IR64	19	JeeragSambha
10	MTU1010	20	Dhama Prasad

## RESULTS AND DISCUSSION

Qualitative characters are considered as marker characters in the identification of landraces of rice, which are less influenced by environmental fluctuations. The work on inheritance and Linkage

studies of qualitative characters were reviewed by Raut (2003). Twenty three morphological traits were recorded on twenty rice genotypes. Among the 23 DUS characters utilized in the characterization of twenty rice genotypes, six character viz., the basal leaf sheath colour, colour of ligule, shape of ligule, auricles, anthocyanin colouration of auricles and anthocyanin colouration of nodes showed no variation. Maximum variability was recorded with respect to Panicle- length of main axis, Spikelet- Colour of tip of lemma and Panicle- Attitude of branches among all the cultivars. The basal leaf sheath colour for all the rice genotypes were green in colour and did not show any variation. However, Pubescence of blade surface was found to be weak in eleven genotypes (Swarna, Swarna Sub-1, PR-113, MTU1010, IR-64, Chinikamini, Bindli, Tilakchandan, CRRI Black Aroma, Chinisakkar and Jeerag Sambha). The pubescence was found to be medium for Pusa Basmati-1, Improved Pusabasmati-1, Pusa Basmati-1121, Pusa 1401 and Pusa Sugandh-5. Whereas, the rest of genotypes (Peeli Badam, Jaiphula, Acharmati and Dhanaprasad) showed pubescence of blade surface. Leaf auricles were present in all genotypes studied (Subba Rao, 2013). The auricles were colourless for the character anthocyanin colouration of auricles. The shape of ligule is found split. Same results were reported by Chakravorty and Ghosh (2012). Where colour of ligule also did not show any variation and found to be split and green respectively for all the genotypes.

Table 2: Characters studied

S. No.	Characters	S. No	Characters
1	Basal leaf: Sheath colour	13	Stem: Anthocyanin colouration of nodes
2	Leaf: Pubescence of blade surface	14	Panicle: Length of main axis
3	Leaf: Auricles	15	Flag leaf: Attitude of blade (lateobservation)
4	Leaf: Anthocyanin colouration of auricles	16	Panicle: Curvature of main axis
5	Leaf: Shape of Ligule	17	Spikelet: Colour of tip of lemma
6	Leaf: Colour of ligule	18	Panicle: Awns
7	Time of heading (50% of Plant with panicles)	19	Panicle: Colour of awn (late observation)
8	Flag leaf: Attitude of blade (early observation)	20	Panicle: Distribution of awns
9	Spikelet: Density of pubescence of lemma	21	Panicle: Attitude of branches
10	Lemma: Anthocyanin colouration of apex	22	Panicle: Exertion
11	Spikelet: Colour of stigma	23	Sterile lemma: colour
12	Stem: Length (excluding panicle; excluding floating rice)		

The days to heading varied among the genotypes under study. The genotypes MTU1010, IR-64, Pusabasmati-1, Improved Pusabasmati-1, Bindli and Dhana Prasad were early with the duration ranging from 71 to 90 days. The genotypes PR-113, Pusa Basmati-1121, Pusa 1401, Pusa Sugandh-5, Peeli Badam, Jaiphula, Acharmati, Chinikamini, Tilak chandan, CRRI Black Aroma, Chinisakkar and

Jeerag Sambha were medium with 91-110 days. The remaining genotypes Swarna and Swarna Sub-1 were found to be late with 111-130 days for heading. The early observation on attitude of flag leaf and late observation of the flag leaf revealed that seventeen genotypes were erect (Swarna, Swarna Sub-1, PR-113, MTU1010, IR-64, Pusabasmati-1, Improved Pusabasmati-1, Pusabasmati-1121, Pusa 1401, Pusa

Sugandh-5, Peeli Badam, Jaiphula, Acharmati, Chinikamini, Tilak chandan, CRRI Black Aroma and Chinisakkar . While, the two genotypes Bindli and Dhana Prasad were found to possess semi erect leaf attitude during both early as well as early observation of flag leaf. However, the genotype Jeerag Sambha was found to possess erect flag leaf during early observation, while, during late observation it was found to possess semi erect flag leaf. The density of

pubescence on lemma was found to be weak in the genotypes Swarna, Swarna Sub-1, PR-113, MTU1010, IR-64, Jaiphula, Chinikamini, Bindli, Tilak chandan and Jeerag Sambha. However, the genotypes Pusabasmati-1, Improved Pusabasmati-1, Pusabasmati-1121, Pusa 1401, Pusa Sugandh-5, Peeli Badam, Acharmati, CRRI Black Aroma, Chinisakkar and Dhana Prasad were found to possess medium pubescence on lemma.

Table 3: Rice varieties having common essential characetrs

Varieties	Traits	Descriptive Code
All (1 to 20)	Basal leaf: Sheath colour	1
1,2,3,4,5,14,15 and 19	Leaf: Pubescence of blade surface	3
All (1 to 20)	Leaf: Auricles	9
All (1 to 20)	Leaf: Anthocyanin colouration of auricles	1
All (1 to 20)	Leaf: Shape of Ligule	3
All (1 to 20)	Leaf: Colour of ligule	1
3,8,9,10,11,12,13,14,16,17,18 and 19	Time of heading (50% of Plant with panicles)	5
1,2,3,4,5,6,7,8,9,10,11,12,13,14,16,17,18 and 19	Flag leaf: Attitude of blade (early observation)	1
1,2,3,4,5,8,9,10,11,13,17,18 and 20	Spikelet: Density of pubescence of lemma	5
1,2,3,4,5,6,7,8,9,10,11,12,13,14,19 and 20	Lemma: Anthocyanin colouration of apex	1
3,4,5,6,7,8,9,10,13,14,15,16,17,18,19 and 20	Spikelet: Colour of stigma	1
1,2,3,4,5,6,7,8,9,10,15,16 and 18	Stem: Length (excluding panicle; excluding floating rice)	1
All (1 to 20)	Stem: Anthocyanin colouration of nodes	1
1,7,8,9,10,13,14,18 and 19	Panicle: Length of main axis	7
1,2,3,4,5,6,7,8,9,10,11,12,13,14,16,17 and 18	Flag leaf: Attitude of blade (late observation)	1
5,7,9,15,16 and 17	Panicle: Curvature of main axis	7
3,6,7,8,9,10,11,12,13 and 14	Spikelet: Colour of tip of lemma	1
1,2,3,4,5,8,9,11,12,13,14,17,18,19 and 20	Panicle: Awns	1
-	Panicle: Colour of awn (late observation)	-
-	Panicle: Distribution of awns	-
3,4,5,6,7,8,11,12,13,14,15 and 20	Panicle: Attitude of branches	7
1,2,4,5,6,7,8,9,10,15,17 and 19	Panicle: Exertion	5
2,3,4,5,6,7,8,9,10,11,12,13,14,15,16,18,19 and 20	Sterile lemma: colour	1

The anthocyanin colouration of apex of lemma was strong while CRRI Black Aroma and Chinisakkar and the colouration were found to be weak in the genotypes Bindli and Tilak chandan. While, the remaining genotypes Swarna, Swarna Sub-1, PR-113, MTU1010, IR-64, Pusa Basmati-1, Improved Pusabasmati-1, Pusabasmati-1121, Pusa 1401, Pusa Sugandh-5, Peeli Badam, Jaiphula, Acharmati, Chinikamini, Jeerag Sambha and Dhana Prasad possessed no colouration. The colour of stigma was light purple in the genotypes Peeli Badam and Jaiphula, yellow in Swarna and Swarna –Sub 1 remaining genotypes possessed white coloured stigma. The stem length excluding panicle was found to be medium (111-130 cm) in the genotypes Peeli Badam, Jaiphula, Acharmati, Chinikamini, CRRI Black Aroma, Jeerag Sambha and Dhana Prasad, hence a score of 5 was given. The remaining genotypes Swarna, Swarna Sub-1, PR-113, MTU1010, IR-64, Pusabasmati-1, Improved Pusabasmati-1, Pusabasmati-1121, Pusa 1401, Pusa Sugandh-5, Bindli, Tilak chandan and Chinisakkar

were recorded to be <91 cm. There was no anthocyanin colouration in the nodes in all the genotypes under study. Panicle-length of main axis was found to be very long in the genotypes Pusa Basmati-1, Peeli Badam, Jaiphula, CRRI Black Aroma and Dhana Prasad and was long in the genotypes Improved Pusabasmati-1, Pusabasmati-1121, Pusa 1401, Pusa Sugandh-5, Acharmati, Chinikamini, Chinisakkar and Jeerag Sambha. The genotypes PR-113, IR-64, Bindli and Tilak chandan possessed medium panicle length and the genotypes Swarna, Swarna *Sub-1* and MTU1010 possessed short panicle length. The panicle curvature of main axis was straight in five genotypes (PR-113, Acharmati, Chinikamini, Chinisakkar and Dhana Prasad), semi straight in six genotypes (Swarna, Swarna Sub-1, Pusa Sugandh-5, Peeli Badam, Jaiphula, Jeerag Sambha), drooping in three genotypes (MTU1010, Pusabasmati-1 and Pusabasmati-1121) and deflexed in the remaining seven genotypes (IR-64, Improved Pusabasmati-1, Pusa 1401, Bindli, Tilak chandan and CRRI Black Aroma). The tip colour of lemma was

black in two genotypes (CRRI Black Aroma and Dhana Prasad), red in genotype Bindli, brown in three genotypes (Swarna, Swarna *Sub-1* and Tilak chandan), yellow in four genotypes MTU1010, IR-64, Chinisakkar and Jeerag Sambha and was white in remaining ten genotypes (PR-113, Pusabasmati-1, Improved Pusabasmati-1, Pusabasmati-1121, Pusa 1401, Pusa Sugandh-5, Peeli Badam, Jaiphula, Acharmati and Chinikamini). Similar observations were made by Subba Rao (2013). Awns were present in five genotypes viz., Pusabasmati-1, Improved Pusabasmati-1, Pusa Sugandh-5, Bindli and Tilak chandan. However, the genotypes Pusa Basmati-1, Improved Pusabasmati-1 and Pusa Sugandh-5 possessed yellowish white awns, while, the other two genotypes Bindli and Tilak chandan possessed reddish brown awns. There was variation in the distribution of awns in the panicle, i.e., in the genotypes Pusa Basmati-1, Improved Pusabasmati-1, Bindli and Tilak chandan awns were present on the upper half of the spikelets. While, in genotype Pusa Sugandh-5, awns were present only at the tip. However, remaining fifteen genotypes were devoid of awns. Panicle attitude of branches was erect in the genotypes Chinikamini and Chinisakkar, erect to semi erect attitude was observed in PR-113, Acharmati and Tilakchandan. Semi erect branching of panicle was found in the genotypes Swarna, Swarna *Sub-1*,

MTU1010, IR-64, Pusabasmati-1, Improved Pusa Basmati-1, Pusa Basmati-1121, Pusa 1401, Pusa Sugandh-5, Bindli, CRRI Black Aroma and Jeerag Sambha. While the genotypes Peeli Badam, Jaiphula and Dhana Prasad were observed to fall in the category of semi erect to spreading type of panicle attitude. (Chakrabarty *et al.* 2012). Partly exerted panicle was observed in Pusa Sugandh-5, Chinikamini and Chinisakkar. Exserted panicle was found in Swarna, Swarna *Sub-1*, Pusa 1401, Acharmati and Jeerag Sambha. Well exerted panicles were observed in the genotypes PR-113, MTU1010, IR-64, Pusa Basmati-1, Improved Pusa Basmati-1, Pusa Basmati-1121, Peeli Badam, Jaiphula, Bindli, Tilak chandan, CRRI Black Aroma and Dhana Prasad. The colour of sterile lemma was purple in the genotype CRRI Black Aroma, gold colour in the genotype Swarna while remaining genotypes possessed straw colour sterile lemma.

Among the 23 DUS characters utilized in the characterization of twenty rice genotypes, six character viz., the basal leaf sheath colour, colour of ligule, shape of ligule, auricles, anthocyanin colouration of auricles and anthocyanin colouration of nodes showed no variation and found distinctive. This study will be useful for breeders, researchers and farmers to identify the varieties and conservation of beneficial genes for crop improvement.

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