Int.J.Curr.Microbiol.App.Sci (2018) *7*(10): 350-357

International Journal of Current Microbiology and Applied Sciences
***ISSN: 2319-7706* Volume 7 Number 10 (2018)**
Journal homepage: http://www.ijcmas.com

Original Research Article https://doi.org/10.20546/ijcmas.2018.710.037

Morphological Characterization of Selected Rice (*Oryza sativa* L.) from Core Germplasm Group of Chhattisgarh Using DUS Descriptors

Suman Rawte* and Ritu R. Saxena

Department of Genetics and Plant Breeding, College of Agriculture, IGKV, Raipur (CG), India

**Corresponding author*

Keywords

Rice, Morphological, DUS, Germplasm

Article Info

Accepted:
04 September 2018
Available Online:
10 October 2018

A B S T R A C T

A hundred landraces of rice (*Oryza sativa* L.), from core group genotypes collected from different parts of Chhattisgarh, were characterized following the guidelines from the Protection of Plant Varieties and Farmers' Rights Authority, GOI. Hundred rice accessions were planted in a randomized block design (RBD). The data were recorded on 30 different agro-morphological traits (19 qualitative and 11 quantitative). The rice germplasm exhibited sufficient genetic variation for most of the qualitative and quantitative traits. Variation was observed for all the qualitative traits except the presence of collar, auricles, and ligule. The descriptors offering the most discrimination were time to 50% heading, time to maturity days, thousand grain weight, stem length, grain length, and width. Out of 30 descriptors studied, five characteristics were found monomorphic rest of the characters show variations among the accessions. The genetic potential of the mentioned accessions for the desired traits can be utilized in future rice breeding programs to get promising results.

Introduction

Rice (*Oryza sativa* L.) is the cereal foodstuff which forms an important part of more than three billion people's diet around the world (Shrivastava *et al.,* 2014).

The potentially yielding ability of currently available rice varieties has to be increased twice by 2020 to meet the existing demand through utilizing valuable yield genes and genes containing resistance to biotic and abiotic stress (Fisher *et al.,* 2012). As a staple cereal crop, rice feeds more than 50% of the world's population (Mather *et al.,* 2007) and is one of the most important components of the human diet in many regions of the world. Rice genotypes have a greater genetic diversity than elite cultivars (or commercial cultivars) and represent an intermediate stage in domestication between wild rice and elite cultivars (Londo *et al.,* 2006), which make it easier to be used in rice breeding than wild rice and at the same time still keeping most of the diversity in rice germplasm resource.

Therefore, mining elite genes within the germplasm of rice landraces is of importance for the improvement of cultivated rice. The landraces are valuable as they possess a huge treasure of genetic material which may prove important in future variety development

programs, Hence, assessment of genetic diversity is very important in rice breeding from the standpoint of selection and conservation of different landraces for further utilization in crop improvement programs (Patra, 2000).

The Government of India enacted a legislation on the "Protection of Plant Varieties and Farmers Act" (PPV&FRA) in 2001 for providing protection to plant varieties based on distinctiveness, uniformity, and stability (DUS) test apart from novelty. This is a unique and model act which gives equal importance to the farmers and breeders and treats them as partners in their efforts for sustainable food security (Patra, 2000). The concept of DUS is thus, fundamental to the characterization of a variety as a unique creation. Registration is allowed for three types of plant varieties that is new varieties bred by breeders, extant varieties and farmer's varieties subject to their fulfilling the conditions of Distinctness, Uniformity and Stability and Novelty in case of breeder's variety.

The uniqueness of a particular variety is to be established by the test called DUS. Almost in all major crop species, morphological and physiological descriptors are available to establish the uniqueness of a variety (Moukoumbi *et al.,* 2011).

Hence, characterization and identification of rice cultivars are crucial for the genetic improvement, release, and seed production programs. Thus, characterization of these varieties will further contribute towards creating a genetic database for breeding programs strategies in the region.

Materials and Methods

The current research study was conducted at Research cum Instructional farm, College of Agriculture, Indira Gandhi Agricultural University, Raipur, Chhattisgarh during *Kharif,* 2017. Hundred rice accessions were characterized using 30 different agro-morphological traits (19 qualitative and 11 quantitative) based on DUS. Rice germplasm accessions used in this study are listed in the table 1. Seeding was done in the well-prepared seedbeds in the last week of June, 2017.

The seedlings were transplanted into well-puddled field twenty-one days after seeding. Each accession was planted in two rows, with a row length of one meter and row-row distance of 25 cm using randomized block design (RBD) with two replications. Measurements of different morphological characteristics of these collected landraces at different stages of growth were recorded following the guidelines of test for Distinctness, Uniformity, and Stability of Rice (*Oryza sativa* L.) (Anonymous, 2007).

The data were collected on five randomly selected plants from each accession. Recommended cultural practices were used for growing rice crop throughout the experiment. The details of the characters and their observed genotypic descriptors are given in table 2.

Results and Discussion

For detailed characterization or to establish distinctiveness among 100 rice landraces, 30 characters have been studied, which includes nineteen qualitative characters and eleven quantitative characters.

For the morphological characterization or identification of landraces of rice, qualitative characters are considered as morphological markers, because they are less influenced by environmental changes (Rao *et al.*, 2013 and Kalyan *et al.*, 2017). The rice landraces under study showed a wide range of distinctiveness

for all most all the morphological traits studied and similar results have been reported by Joshi *et al.,* (2007); Chakrabarty *et al.,* (2012); Tirkey *et al.,* (2013). Frequency distribution for all the characters under study was computed (Table 2). Qualitative and quantitative characters of different agronomic and morphological parameters are given in table 2.

Rice genotypes were characterized for leaf traits at late vegetative and flowering stages and variation was observed among the accessions for coleoptiles color, 30% showed purple color and rest of the 70% accessions showed a green color. Similarly for basal leaf sheath color 10% accession showed purple lines, 12% showed light purple, 6% accessions showed uniform purple, while 72% accessions were showed a green color.

Character leaf intensity of green color 64% accessions had medium green color, 30% had dark green color, while 6% of the accessions showed light intensity, Leaf: Anthocyanin coloration was present in only 34 accessions, while in rest 66% does not have anthocyanin coloration in leaf.

Only 5% accessions showed the presence of anthocyanin coloration in leaf sheath, while 95% accessions do not have this character. Similarly, on Pubescence of blade surface of the leaf, only 8% had a hard surface, 54% showed strong, 3% showed weak and 35% accessions showed medium surface of the leaf blade.

Out of 100 landraces evaluated, all landraces exhibited the presence of leaf auricle, Out of which, 12% genotypes exhibited purple auricles, 9 % accessions exhibited light purple auricles. There was no variation found for the trait presence of collar in the studied rice accessions. All the accessions showed the presence of collar. Out of which, 22% accessions had the presence of anthocyanin color of the collar, while 78% of accessions does not exhibit any coloration on the collar.

For the character leaf ligule, all the landraces recorded for its presence with the split shape of ligule and having 78%, 16% and 6%, white, light purple and purple ligule respectively, Rawte *et al.,* (2017) in their study had also reported 95% of landraces with split shape of ligule.

Culm attitude is an indicator of the growth habit of a particular species. During the current study valuable variation was observed among the accessions for culm angle. 1% accessions were found to have spreading, 90% accessions shows semi-erect attitude, 8% accessions showed open culm angle, whereas 1% accessions were having erect culm angle. For the character flag leaf attitude of the blade, semi-erect type of flag leaf was observed for 41% landraces and 59% landraces are of an erect type. For the character density of pubescence of lemma 44% accessions were fallen in the medium category, 32% fall in weak, 23% were strong and only one genotype had a very strong density of pubescence of lemma.

All the hundred accessions were male fertile and only 40% of accessions had awns, while rest of 60% does not have awns. For the character leaf senescence, 7% were of late, 39% were of medium and 54% were of an early type. For the character's leaf length, 4% landraces exhibited medium leaf type, 96% landraces were of a long type and for the leaf width, 19% landraces recorded narrow type of leaves and 81% accessions recorded medium type of leaves. At an early stage the attitude of the blade of flag leaf only 1% was very short, 4% were short, 35% accessions were medium, 41% accessions were long and 11% of accessions were found to have very long flag leaf.

Table.1 List of hundred rice genotypes for DUS based characterization

S. No.	Name	S. No.	Name	S. No.	Name	S. No.	Name
1	Bagri	26	Kanak	51	Ama jhopa	76	Ram Jira
2	Hardi chudi	27	Mehapal	52	Koudi dhull	77	Bhejari
3	Koto	28	Tebaroo Mundaria	53	Sau pankhi	78	Danwar
4	Kotte (II)	29	Padari dhan IV	54	Dokra Dokri	79	Karhani
5	Satha dhan	30	Budhiya wako	55	Parmal	80	Chiko
6	Karhani	31	BD kankari bija	56	Dokrae mechha	81	Farsa Phool
7	Kohaka	32	Bawati chudi	57	Roti	82	Baila Aankhi
8	Luchai(A)	33	Kalajira	58	Khatia pati	83	Bokra Mundi
9	Angur Guchcha	34	Sonapan	59	Hathi panjra	84	Hunuman Langur
10	Basigal(ii)	35	Bakal	60	CR-1014	85	Jal Ponga
11	Bhejari	36	Cross 116	61	Elayachi	86	Banda
12	Bhulau	37	Deshi lal dhan	62	Tulsi manjari	87	Lanji
13	Bodi	38	IR 42253	63	Shyam jira-1	88	Raja Bangla
14	Peelee Luchai	39	Lalmati	64	Lokti Machhi	89	Bhainsa Mundariya
15	Tulsi Phool	40	Laloo-14	65	Muni Bhog	90	Nariyal Chudi
16	Silipat	41	Jhitpiti	66	Jou Phool	91	Kating
17	Unknown	42	WR99	67	Bhainsa Punchhi	92	Bhamasur
18	Ama Dhul	43	E-1702	68	Bhanta Phool-1	93	Paltu
19	Baisur	44	Chapti gurmatia	69	Lahsun Bhog	94	Sindur senga
20	Bylao	45	Elayachi	70	Ichchawati	95	Swarna
21	Asam Chudi	46	Bisni-I	71	Laxmi Bhog	96	MTU-1010
22	Bhaniya	47	Moroberekan	72	Tulsi Mala	97	IR64
23	Farsa Phool	48	Nagina-22	73	Jou Phool-2	98	R-RF-75
24	Jalle	49	R-RF-75	74	Jeera Phool	99	IGKV R1
25	Kanak Jira	50	Kadam Phool	75	Tulsi Mongra	100	Danteshwari

Table.2 Frequency distribution of landraces of rice for various DUS characters

S. No.	Characteristics	States	Scale	Number of genotypes	Frequency Distribution (%)
1	Coleoptile: Colour	Colourless	1	0	0
		Green	2	70	70
		Purple	3	30	30
2	Basal leaf: Sheath color	Green	1	72	72
		Light purple	2	12	12
		Purple lines	3	10	10
		Uniform purple	4	6	6
3	Leaf: Intensity of green color	Light	3	6	6
		Medium	5	64	64
		Dark	7	30	30
4	Leaf: Anthocyanin coloration	Absent	1	66	66
		Present	9	34	34
5	Leaf Sheath: anthocyanin coloration	Absent	1	95	95
		Present	9	5	5
6	Leaf: Pubescence of blade surface	Absent	1	0	0
		Weak	3	3	3
		Medium	5	35	35
		Strong	7	54	54
		Very strong	9	8	8
7	Leaf: Auricles	Absent	1	0	0
		Present	9	100	100
8	Leaf: Anthocyanin coloration of auricles	Colourless	1	79	79
		Light purple	2	9	9
		Purple	3	12	12
9	Leaf: Collar	Absent	1	0	0
		Present	9	100	100
10	Leaf: Anthocyanin coloration of the collar	Absent	1	78	78
		Present	9	22	22
11	Leaf: Ligule	Absent	1	0	0
		Present	9	100	100
12	Leaf: Shape of ligule	Truncate	1	0	0
		Acute	2	0	0
		Split	3	100	100
13	Leaf: Colour of ligule	White	1	78	78
		Light purple	2	16	16
		Purple	3	6	6
14	Culm: attitude	Erect	1	1	1
		Semi-erect	3	90	90
		Open	5	8	8
		Spreading	7	1	1
15	Flag leaf: Attitude of blade (early observation)	Erect	1	59	59
		Semi-erect	3	41	41
		Horizontal	5	0	0
		Drooping	7	0	0
16	Spikelet: Density of pubescence of lemma	Absent	1	0	0
		Weak	3	32	32
		Medium	5	44	44
		Strong	7	23	23
		Very strong	9	1	1

17	Male sterility	Absent	1	100	100
		Present	9	0	0
18	Panicle: Awns	Absent	1	60	60
		Present	9	40	40
19	Leaf: Senescence	Early	3	54	54
		Medium	5	39	39
		Late	7	7	7
20	Leaf: Length of blade	Short (<30 cm)	3	0	0
		Medium (30-45 cm)	5	4	4
		Long (>45 cm)	7	96	96
21	Leaf: Width of blade	Narrow (<1 cm)	3	19	19
		Medium (1-2 cm)	5	81	81
		Broad (>2 cm)	7	0	0
22	Stem: Thickness	Thin (<0.40 cm)	3	0	0
		Medium (0.40-0.55 cm)	5	10	10
		Thick (>0.55 cm	7	90	90
23	Stem: Length (excluding panicle)	Very short (<91 cm)	1	15	15
		Short (91-110 cm)	3	14	14
		Medium (111-130 cm)	5	37	37
		Long (131-150 cm)	7	23	23
		Very long (>150 cm)	9	11	11
24	Panicle: Length of main axis	Very short (<16 cm)	1	1	1
		Short (16-20 cm)	3	4	4
		Medium (21-25 cm)	5	35	35
		Long (26-30 cm)	7	41	41
		Very long(>30 cm)	9	19	19
25	Panicle: Number per plant	Few (<11)	3	95	95
		Medium (11-20)	5	5	5
		Many (>20)	7	0	0
26	Time of heading (50% of plants with panicles)	Very early (<71 days)	1	1	1
		Early (71-90 days)	3	21	21
		Medium (91-110 days)	5	67	67
		Late (111-130 days)	7	11	11
		Very late (> 131 days)	9	0	0
27	Time maturity (days)	Very early (<100)	1	1	1
		Early (101-120)	3	21	21
		Medium (121-140)	5	67	67
		Late (141-160)	7	11	11
		Very late (>160)	9	0	0
28	Grain: Weight of 1000 fully developed grains	Very low (<15 g)	1	22	22
		Low (15-20 g)	3	16	16
		Medium (21-25 g)	5	28	28
		High (26-30)	7	18	18
		Very high (>30 g)	9	16	16
29	Grain: Length	Very short (<6.0 mm)	1	10	10
		Short (6.1-8.5 mm)	3	46	46
		Medium (8.6-10.5 mm)	5	32	32
		Long (10.6-12.5 mm)	7	10	10
		Very long (>12.5 mm)	9	2	2
30	Grain: Width	Very narrow (<2.0 mm)	1	5	5
		Narrow (2.1-2.5 mm)	3	33	33
		Medium (2.6-3.0 mm)	5	34	34
		Broad (3.1-3.5 mm)	7	26	26
		Very broad (>3.5 mm)	9	2	2

With respect to the stem characters, for the stem length (excluding panicle) 15% landraces were of very short, 14% were of short, 37% were of the medium type, 23% and 11% were of long and very long type respectively. With respect to the thickness of stem, 10% were of medium and 90% were of thick. 95% of accessions had a few numbers of panicles plant^{-1} and 5% accessions fall under the medium category. Coming to the time of heading (50% of plants with panicles) were observed and noticed that 11% landraces were of late-type (111-130 days) and 1% landraces were of very early (<71 days) duration types, 21% landraces were of early-type (71-90 days) and 67% landraces were of medium (91-110 days) duration. For the character time of maturity (days), 1% landraces were of very early (<100 days), 21% landraces were of early (101-120 days), 67% landraces were of medium (121-140 days) and 11% landraces were of late (141-160 days) duration types. Bose and Pradhan (2005) also reported high genetic divergence in days to 50% flowering.

For the character grain weight of 1000 fully developed grains, Highest number of the genotypes (22%) showed very low grain weight (<15 g), followed by 18% genotypes with high (26-30 g) and medium (21-25 g) grain weight, 16% genotypes showed very high (> 31 g) as well as low (15-20 g) grain weight. Thousand grain weights have been used for characterizing rice varieties by several researchers; Joshi *et al.*, (2007) noticed the variability for most of the morphological traits signified their utility in varietal characterization in 19 varieties of rice. For the character grain length, 46% accessions were found under short category followed by 32% medium, 10% under very short and long category and about 2% of accessions were having very long grain length. With the character grain width 34% accessions fall under medium, 33% under narrow, 26% under broad, 5% very narrow and 2% accessions found under the very broad category.

Morphological markers are very important and all breeders are continuously looking for these markers that will enable them to identify specific parental material for specific traits. The present study revealed sufficient genetic variability for various qualitative and quantitative traits. Thus, the various analysis carried out had shown wide variability among the 100 genotypes for the 30 traits. The wide range of variability observed for the characters evaluated may be attributed to the diverse genetic background of the accessions studied and these could be used for selection of the genotypes for crosses.

References

Anonymous, 2007, Guidelines for the Conduct of Test for Distinctiveness, Uniformity and Stability on Rice (*Oryza sativa* L.) PPV & FR Authority, GOI, New Delhi, pp. 5-12.

Bose, L.K and S.K. Pradhan, 2005. Genetic divergence in deep water rice genotypes. Journal of Control, European Agriculture. 6 (4): 635-640.

Chakrabarty, S.K., M.A., Joshi, Y., Singh, A., Maity, V. Vashisht, and M. Dadlani, 2012. Characterization and evaluation of variability in farmers' varieties of rice from West Bengal. Ind. J Gen.; 72: 136-142.

Fischer, K.S., S., Fukai, A., Kumar, H. Leung, and B. Jongdee, 2012. Field phenotyping strategies and breeding for adaptation of rice to drought. Frontiers Physiol. 3: 282.

Joshi, M.A., N.K., Sarao, R.C., Sharma, P. Singh, and T.S. Bharaj, 2007. Varietal characterization of rice (*Oryza sativa* L.) based on morphological descriptors. Seed Res. 35:188-193.

Kalyan, B., K.V.R., Krishna, S.L.V. Rao, 2017. DUS Characterization for Germplasm of Rice. Int. J. Curr. Microbiol. App. Sci. 6:3480-3487.

Londo, J.P., Y.C., Chiang, K.H., Hung, T.Y. Chiang, and B.A. Schaal, 2006. Phylogeography of Asian wild rice, Oryza rufipogon, reveals multiple independent domestications of cultivated rice, *Oryza sativa*. Proc Natl Acad Sci U S A 103: 9578–9583.

Mather, K.A., A.L., Caicedo, N.R., Polato, K.M. Olsen, and S. Mc Couch 2007. The extent of linkage disequilibrium in rice (*Oryza sativa* L.). Genetics 177: 2223– 2232.

Moukoumbi, Y.D., M., Sie, R., Vodouhe, B., Ndri, B., Toulou, S.A. Ogunbayo, and A. Ahanchede, 2011. Assessing phenotypic diversity of interspecific rice varieties using agro-morphological characterization. J Plant Breed Crop Sci. 3(5): 74-86.

Patra, B.C. 2000. Collection and characterization of rice genetic resources from Keonjhar district of Orissa. *Oryza*. 34:324-326.

Rao, S.L.V., G.S., Prasad, M., Chiranjivi, U. Chaitanya, and R. Surendhar, 2013. DUS Characterization for Farmer varieties of rice. IOSR J. Agric. Vet. Sci. 4:35-43.

Rawte, S., R.R., Saxena, H. Sahu, and S.B. Verulkar, 2017. Study of Agromorphological Variation of Rice (*Oryza sativa* L.) Germplasm Collected from Different Parts of Chhattisgarh. Trend. in Biosci. 10(11):2078-2086.

Srivastava, N., S.K. Pathak, S. Gampala, V.J. Singh, B.G. Suresh and G.R. Lavanya. 2014. Evaluation of exotic upland rice germplasm for grain yield and its component characters in rainfed ecosystem (*Oryza sativa* L). Int. J. Food Agri. and Vet. Sci., 4(2): 102-109.

Tirkey, A., A.K., Sarawgi, Rao and S.L. Verma. 2013. Studies on genetic diversity in various qualitative and quantitative characters in rice germplasm. Ind. J Plant. Gen. Res. 26:132-137.

How to cite this article:

Suman Rawte and Ritu R. Saxena. 2018. Morphological Characterization of Selected Rice (*Oryza sativa* L.) from Core Germplasm Group of Chhattisgarh Using DUS Descriptors. *Int.J.Curr.Microbiol.App.Sci.* 7(10): 350-357. doi: https://doi.org/10.20546/ijcmas.2018.710.037