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Characterization and grouping of indigenous rice lines based on Dus test for different qualitative differentials

Lokesh Gour, GK Koutu, Yogendra Singh and SK Singh

Abstract
Distinctness, Uniformity and Stability test are now become a important tool for cataloguing the germplasm and utilization of differentials for breeding programme. A total of 83 indigenous rice germplasm were characterized to test the divergence and related qualitative difference present among the lines. Thirty one morphological characters were observed. Basal leaf sheath colour, colour of tip of lemma, lemma & palea colour found highest variation in germplasm. Straw coloured sterile lemma found in 78 lines whereas purple colour found in 04 lines and most unique gold colour found in 01 line. On the basis of pigment distribution in 13 plant parts, the entire germplasm was classified into 23 groups as per DUS guideline. Last XXIII group included four germplasms R-652, R-671, R-714, Shymla which has pigmentation in overall 10 parts (colour of tip of lemma, colour of awns, anthocynin coloration of apex, lemma & palea colour, basal leaf sheath colour, leaf sheath anthocynin coloration, color of stigma, auricle colour, ligule colour, sterile lemma colour). The unique germplasms were found; chhatry germplasm has purple colour of tip of lemma, black colour of tip of lemma has rani kajar, surajone and white colour of tip of lemma has lakna. More study required on those germplasms for pointing out which are the traits that may be particularly referred to as indicators to determine an unstable expression of the phenotype of candidate variety.

Keywords: Characterization, qualitative traits, DUS, rice, morphological, agronomical traits, candidate variety

Introduction
Rice is one of the most important crops and a major source of nutrition for about 2.5 billion people around the globe that belongs to Poaceae family (Aiswariya KS, 2016) [2]. India has a rich and wide range of genetic wealth of rice. It is estimated from various surveys that India has over 70,000 accessions of rice germplasm and with a sizable number of wild forms still to be collected and conserved (Siddiq, 1992) [15].

With the introduction of high yielding varieties and 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 QJ, 1999) [16]. Caldo *et al.* (1996) [4] also reported that rice genetic resources including landraces and traditional varieties are a good source of important alleles to develop new rice varieties. Repeated use of selected rice breeding lines in various breeding programs not only limits the genetic basis but also develop susceptibility to the various abiotic and biotic stresses (Aiswariya KS, 2016) [2].

The conservation and characterization of these genetic resources is a necessity not only for posterity, but also for utilization in different improvement programs (Ahmed *et al.* 2016) [1]. These will be useful for breeders, researchers and farmers to identify and choose the restoration and conservation of beneficial genes (Rao *et al.*, 2013) [12].

Therefore, systematic attempts have to be made to make a total inventory of this valuable gene pool for quantifying the availability of new useful genes of this source. Qualitative characters are considered as morphological markers in the identification of landraces of rice, because they are less influenced by environmental changes (Raut, 2003) [13] and the most common approach utilized to estimate relationships between genotypes.

The rice pure lines which possess exclusive variability and unique features need safe conservation and sustainable utilization in future rice varieties development for issues like intellectual property rights. As the existing UPOV models of plant variety protection were not suitable for Indian requirements (Rao LVS, 2013) [12], the Government of India enacted our own 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, which 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 BC. 2000) [10]. The uniqueness of a particular variety is to be established by DUS test.

In this context, an attempt was made to characterize a set of Eighty Three varieties of rice and local germplasm of Madhya Pradesh for different morphological traits and identify the variability available in the collection then grouping were also applied.

Material and method

Exploration and collection of rice cultivars

In this research focus were on basmati, non-basmati aromatic rice and non aromatic rice lines also. Under this activity large number of local land races was used which are from rice growing regions of the state like Dindori, Mandla, Umaria, Katni, Shehdol, Raisen and Hoshangabad. Whole the material was taken from Department of Plant Breeding and Genetics, COA, Jabalpur (M.P.), India.

Evaluation of Rice germplasms

Eighty Three germplasm lines and released varieties of rice were planted during *kharif* season at the Seed Breeding Farm, Department of Plant Breeding and Genetics, COA, Jabalpur (M.P.), India. The material was grown in a complete randomized block design with three replications. Each entry was sown in three rows of 2 m length at spacing of 20 cm between rows and 20 cm between plants. The observation of various characteristics was recorded at different stages of growth with appropriate procedures as per the DUS test guidelines of PPV & FR Act, 2001 are given here.

MG: Measurement by a single observation of a group of plants or parts of plants.

MS: Measurement of a number of individual plants or parts of plants.

VG: Visual assessment by a single observation of a group of plants or parts of plants.

VS: Visual assessment by observation of individual plant or parts of plants.

Characterization of germplasm for Qualitative traits

Twenty nine morphological traits on five randomly chosen plants of each line per replication were observed and characterized as per their note number given according to the National Test Guidelines for DUS test in rice (table 1), which was developed by Directorate of Rice Research, Rajendranagar, Hyderabad (Shobha Rani *et al*., 2006).

The candidate lines for DUS testing were divided into groups to facilitate the assessment of distinctness. On the basis of pigment distribution in 13 plant parts, the entire germplasm was classified into some of groups; this will help in identification and further selection of lines for pigmentation study because it is rarely known that pigment has linkage with some of important yield and quality related traits. Unique accessions are identified as per their pigmentation found in specific parts.

Table 1: Essential characters along with descriptor.

S. No.	Characteristics	Strategies								
1	Basal leaf : sheath colour	Green (1)	Light purple (2)	Purple lines (3)	Uniform purple (4)					
2	Leaf sheath : anthocyanin colouration	Absent (1)	Present (9)							
3	Leaf : pubescence of blade surface	Absent (1)	Weak (3)	Medium (5)	Strong (7)	Very strong (9)				
4	Leaf : auricle	Absent (1)	Present (9)							
5	Leaf : anthocyanin colouration of auricle	Colourless (1)	Light purple (2)	Purple (3)						
6	Leaf : collar	Absent (1)	Present (9)							
7	Leaf : anthocyanin colouration of collar	Absent (1)								
8	Leaf : ligule	Absent (1)	Present (9)							
9	Leaf : shape of ligule	Truncate (1)	Acute (2)	Split (3)						
10	Leaf : colour of ligule	White (1)	Light purple (2)	Purple (3)						
11	Culm : attitude	Erect (1)	Semi erect (3)	Open (5)	Spreading (7)					
12	Flag leaf : attitude of blade (early observation)	Erect (1)	Semi erect (3)	Horizontal (5)	Drooping (7)					
13	Spikelet : density of pubescence of lemma	Absent (1)	Weak (3)	Medium (5)	Strong (7)	Very strong (9)				
14	Lemma : anthocyanin colouration of keel	Absent/very weak (1)	Weak (3)	Medium (5)	Strong (7)	Very strong (9)				
15	Lemma : anthocyanin colouration of area below apex	Absent/ very weak (1)	Weak (3)	Medium (5)	Strong (7)	Very strong (9)				
16	Lemma : anthocyanin colouration of apex	Absent/ very weak (1)	Weak (3)	Medium (5)	Strong (7)	Very strong (9)				
17	Spikelet : colour of stigma	White (1)	Light green (2)	Yellow (3)	Light purple	Purple (5)				
18	Stem : anthocyanin colouration of nodes	Absent (1)	Present (9)							
19	Panicle : length of main axis	Very short (1)	Short (3)	Medium (5)	Long (7)	Very long (9)				
20	Flag leaf : attitude of blade (late observation)	Erect (1)	Semi erect (3)	Horizontal (5)	Drooping (7)					
21	Panicle : curvature of	Straight (1)	Semi straight (3)	Deflexed (5)	Drooping					

	main axis				(9)					
22	Spikelet : colour of tip of lemma	White (1)	Yellowish (2) Brown (3)	Red (4)	Purple (5)	Black (6)				
23	Lemma and palea : colour	Straw (1)	Gold and gold furrow on straw background (2)	Brown spot on straw (3)	Brown furrow on straw (4)	Brown (tawny) (5)	Reddish to light purple (6)	Purple spot/furrow on straw (7)	Purple (8)	Black (9)
24	Panicle : awns	Absent (1)	Present (9)							
25	Panicle : colour of awns	Yellowish White (1)	Yellowish brown (2)	Brown (3)	Reddish brown (4)	Light red (5)	Red (6)	Light purple (7)	Purple (8)	Black (9)
26	Panicle: distribution of awns	Tip only (1)	Upper half only (3)	Whole length (5)						
27	Panicle: presence of secondary branches	Absent (1)	Present (9)							
28	Panicle: secondary branches	Weak (1)	Strong (2)	Clustered (3)						
29	Panicle: attitude of branches	Erect (1)	Erect to semi erect (3)	Semi erect (5)	Semi erect to spreading (7)					
30	Panicle: exsertion	Partly exserted (3)	Mostly exserted (3)	Well exserted (5)						
31	Sterile lemma : colour	Straw (1)	Gold (2)	Red (3)	Purple (4)					

Results and discussion

Morphological and agronomical characterization is an important and basic methodology to establish distinctiveness among the genotypes. Twenty nine traits were observed in eighty three germplasm to establish distinctiveness among germplasm and these morphological traits play key role in varietal identification.

Characterization of the Qualitative Characters

Observations for leaf traits were recorded as such, for basal leaf sheath colour 68 lines were green, 06 were purple lines, 04 were light purple and 05 were purple whereas 04 lines were weak, 76 were medium and 03 were strong in case of leaf pubescence of blade surface, out of 83 lines 9 were having leaf sheath anthocyanin colouration (table 2). The leaf pubescence restricts the insect landing on the leaves (Shrivastava *et al*. 2015) [14].

All 83 lines showed presence of auricles, out of which only 6 showed presence of purple & 03 showed anthocyanin colouration (picture 2), similarly all lines exhibited presence of collar. Ligule was present in 67 lines with split shape whereas 16 with acute shape and colour of ligule were 04 purple, 03 light purple and 76 white.

Culm attitude were found erect in 35 lines and semi erect in 48 lines. Stem anthocyanin coloration of nodes were found absent in 82 lines but present in only one unique line. Internode colour (IC) often shows variation on colour depending on the age of the plants and the soil fertility conditions. Plants usually present a dark green tonality on high soil fertility and a light green one on low soil fertility (Fonseca *et al*., 2002) [7].

The trait flag leaf attitude of blade was taken on two stages early and late. It is observed that 51 lines found erect flag leaf attitude at early stage but only 37 lines found erect at late observation. Similarly 32 lines found semi erect at early stage but 42 lines found semi erect at late stage. At late stage 04 deflexed lines also found which were not seen in early stage.

In case of spikelet related traits first one is the the density of pubescence of lemma out of 83 lines weak in 23 lines, medium in 50 lines and strong in 10 lines were observed respectively. Herewith anthocyanin coloration of keel were found absent in all 83 lines but anthocyanin coloration of area below apex were found strong in 02 lines and rest of 81 lines found absent for the trait (table 2). Similarly anthocyanin coloration of apex observed strong in 04 lines, medium in 10 lines, weak in 04 lines rest of 65 lines observed absent.

The trait colour of stigma observed purple in 15 lines, light purple colour in 02 lines, light green colour in 01 line and white colour in 65 lines (Picture 1). Nascimento *et al.* (2011) [8] observed white colour of stigma and presence of the glumella pubescence as dominant types on upland rice of 146 accessions. Colour of tip of lemma found black in 02 lines, purple in only 01 line, white in 06 lines, brown in 14 lines and yellowish in rest of 60 lines. The trait lemma & palea colour observed in all 83 lines with straw colour in 54 lines, brown spots on straw in 13 lines, brown furrows on straw in 06 lines, reddish to light purple 04 lines, gold & gold furrows on straw background found in 03 lines, but black colour found in 02 lines and brown (tawny) in 01 (table 2) (picture 3). Straw coloured sterile lemma found in 78 lines whereas purple colour found in 04 lines and most unique gold colour found in 01 line. During the process of evolution, the coloured genotypes evolved to lighter colour like straw and yellow. Further as the process of evolution goes on the coloured genotypes changes to white type (Watt, 1892) [17].

Awns were found present in only 24 lines from which 22 lines showed yellowish white and only two lines found yellowish brown. Whereas awn distributed on tip only in 11 lines, upper half only in 06 lines and whole length distribution found in 07 lines. In relation to presence and distribution of awn per panicle, while the awn is present its length should be influenced by the soil fertilization and plant density (Fonseca *et al*., 2002) [7]. The awned genotypes are primitive and well adapted to adverse environment factors *viz.*, drought, salinity and low temperature as reported by Chandraratna (1964) [10].

Now traits in relation with panicle in which first trait is panicle curvature of main axis found semi straight in 69 lines, deflexed curvature found in 13 lines and last one line has straight curvature. Secondary branching in panicle was present in all 83 lines whereas weak secondary branching of panicle found in 37 lines, strong in 34 lines and last 12 lines found clustered secondary branching. The attitude of panicle branches found semi-erect to spreading in 61 lines, spreading attitude found in 11 lines, semi-erect attitude found in 08

lines, erect attitude of panicle branches found in 02 lines and erect to semi-erect attitude were found in only one unique line. Bonow *et al*., 2007 [3] stated that panicle type (PT) is generally affected by water deficiency before flowering, because this condition changes the angle of the panicle branches and the density of the grains. Well exserted panicle observed in 63 lines whereas mostly exserted panicle found in 10 lines and partly exserted panicle seen in 07 lines. At the reproductive stage, cold stress inhibited panicle exsertion and strongly reduced yields (Ndour *et al*., 2016) [9].

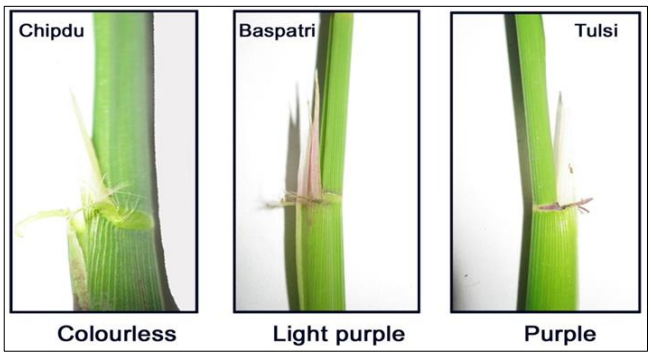
Table 2: Characterization table of eighty thirty varieties as per note number given in DUS Guideline

S. No.	Name Of Lines	2	6	8	9	10	11	13	14	15	19	21	22	24	25	26	27	30	34	35	37	38	39	40	42	43	44	45	46	49
1	IR-36	1	1	5	9	1	9	9	2	1	1	1	3	1	1	1	1	1	3	3	2	1	9	2	3	9	1	7	5	1
2	IR-64	1	1	5	9	1	9	9	2	1	1	1	3	1	1	1	1	1	1	3	2	1	9	1	1	9	1	7	7	1
3	Kranti	1	1	5	9	1	9	9	3	1	3	1	5	1	1	1	1	1	1	3	2	1	1	1	1	9	1	5	7	1
4	Mahamaya	3	9	5	9	3	9	9	3	1	3	1	3	1	1	5	4	1	1	3	3	1	9	1	3	9	1	9	7	1
5	R-650	1	1	5	9	1	9	9	3	1	1	3	3	1	1	1	1	1	3	3	2	1	1	1	1	9	1	7	7	1
6	R-548	1	1	5	9	1	9	9	3	1	1	1	5	1	1	1	1	1	1	3	2	1	1	1	1	9	2	7	7	1
7	R-704 (Tall)	1	1	5	9	1	9	9	3	1	1	3	5	1	1	1	1	1	1	5	2	1	1	1	1	9	3	7	7	1
8	R-704 (Dwarf)	1	1	5	9	1	9	9	3	1	1	1	3	1	1	1	1	1	3	3	2	1	1	1	1	9	2	7	7	1
9	Abhya	1	1	5	9	1	9	9	3	1	1	3	3	1	1	1	1	1	3	3	2	1	1	1	1	9	1	7	7	1
10	R-321	1	1	5	9	1	9	9	3	1	1	1	5	1	1	1	1	1	3	3	3	1	1	1	1	9	3	7	7	1
11	R-652	4	9	5	9	3	9	9	3	3	1	1	7	1	1	3	5	1	3	3	3	6	9	1	1	9	1	9	7	4
12	Shri Ram (Mandla)	1	1	5	9	1	9	9	3	1	3	1	5	1	1	1	1	1	1	3	2	1	1	1	1	9	1	7	7	1
13	R-296	2	9	5	9	1	9	9	3	1	3	3	5	1	1	3	1	1	3	3	2	1	1	1	1	9	3	7	7	1
14	R-712	1	1	5	9	1	9	9	3	1	3	3	5	1	1	1	1	1	3	3	2	1	1	1	1	9	3	7	7	1
15	R-435	1	1	5	9	1	9	9	2	1	3	1	5	1	1	1	1	1	1	3	2	1	1	1	1	9	2	9	7	1
16	R-671	4	9	5	9	3	9	9	3	3	1	1	5	1	1	3	5	1	1	3	3	6	9	1	3	9	1	7	7	4
17	R-710	1	1	5	9	1	9	9	3	1	3	1	5	1	1	1	1	1	1	3	2	1	9	1	1	9	3	7	7	1
18	R-820	1	1	5	9	1	9	9	3	1	3	1	5	1	1	1	1	1	3	3	2	1	1	1	1	9	2	7	7	1
19	R-304	1	1	5	9	1	9	9	2	1	1	3	5	1	1	1	1	1	3	3	2	3	1	1	1	9	2	7	7	1
20	Shymla	4	9	5	9	3	9	9	3	3	1	1	5	1	1	5	5	1	1	3	3	6	9	2	3	9	2	7	7	4
21	Ruchi	1	1	5	9	1	9	9	3	1	1	1	3	1	1	1	1	1	1	3	2	1	9	1	1	9	1	7	7	1
22	R-714	4	9	5	9	3	9	9	2	3	3	1	3	1	1	3	5	1	1	3	3	6	9	1	1	9	2	7	7	4
23	TRC-87	1	1	5	9	1	9	9	3	1	1	3	5	1	1	1	1	1	3	3	2	2	1	1	1	9	3	7	7	1
24	Pusa-150	1	1	5	9	1	9	9	3	1	1	1	3	1	1	1	1	1	1	3	2	3	1	1	1	9	2	7	7	1
25	H.M.T.	1	1	5	9	1	9	9	3	1	3	1	5	1	1	1	1	1	1	3	2	1	9	1	1	9	3	7	7	1
26	B.G.-380	1	1	5	9	1	9	9	3	1	1	1	5	1	1	1	1	1	1	3	2	1	9	1	1	9	1	7	5	1
27	IR-54896	1	1	5	9	1	9	9	3	1	1	3	5	1	1	1	1	1	3	3	2	3	9	1	3	9	3	7	7	1
28	IR-42221	1	1	5	9	1	9	9	3	1	3	3	5	1	1	1	1	1	3	3	2	1	1	1	1	9	2	7	7	1
29	IR-42342	1	1	5	9	1	9	9	3	1	1	3	5	1	1	1	1	1	3	3	2	3	9	1	5	9	1	9	7	1
30	IR-54742	1	1	5	9	1	9	9	3	1	1	3	7	1	1	1	1	1	1	3	2	3	9	1	3	9	2	7	5	1
31	Madhuri	1	1	5	9	1	9	9	3	1	3	3	7	1	1	1	1	1	3	3	1	1	9	1	5	9	2	7	5	1
32	Pusa Basmati-1	1	1	5	9	1	9	9	3	1	1	3	5	1	1	1	1	1	3	5	2	1	9	1	5	9	2	7	7	1
33	Tarrori Basmati	1	1	5	9	1	9	9	3	1	1	1	5	1	1	1	1	1	3	5	2	1	9	1	5	9	1	9	7	1
34	Safari-17	1	1	5	9	1	9	9	2	1	3	1	7	1	1	1	1	1	1	3	2	1	1	1	1	9	2	7	7	1
35	Chhatry	1	1	5	9	1	9	9	2	1	3	3	7	1	5	5	4	1	3	3	5	3	1	1	1	9	1	5	7	2
36	Luchi	1	1	5	9	1	9	9	2	1	3	3	3	1	1	1	5	1	3	3	2	3	1	1	1	9	1	7	7	1
37	JR-353	1	1	5	9	1	9	9	3	1	3	3	5	1	1	1	1	1	3	3	2	1	9	1	1	9	2	5	7	1
38	JR-75	1	1	5	9	1	9	9	3	1	3	3	5	1	1	1	1	1	1	3	2	1	1	1	1	9	3	7	5	1
39	JR-201	1	1	5	9	1	9	9	3	1	3	1	5	1	1	1	1	1	1	1	3	3	1	1	1	9	1	1	7	1
40	JR-199	1	1	5	9	1	9	9	3	1	1	1	5	1	5	7	1	1	1	3	3	1	1	1	1	9	1	7	7	1
41	JR-82	1	1	5	9	1	9	9	3	1	1	1	5	1	1	1	1	1	3	3	2	1	1	1	1	9	2	9	7	1
42	R 302-111	1	1	5	9	1	9	9	2	1	3	1	3	1	1	1	1	1	1	3	2	1	1	1	1	9	1	9	7	1
43	OR 1045-1-6	1	1	5	9	1	9	9	2	1	3	3	5	1	1	1	1	1	1	3	2	1	1	1	1	9	1	7	7	1
44	Poornnima	1	1	5	9	1	9	9	3	1	3	1	3	1	1	1	1	1	1	3	2	1	1	1	1	9	1	9	7	1
45	OR 1045-1-2	1	1	5	9	1	9	9	2	1	3	1	3	1	1	1	1	1	1	3	2	1	9	1	1	9	1	7	5	1
46	JR-3-45	1	1	5	9	1	9	9	3	1	1	1	7	1	1	1	1	1	1	3	2	1	1	1	1	9	2	7	7	1
47	JR-503	1	1	5	9	1	9	9	3	1	3	1	3	1	1	1	1	1	1	3	2	1	9	1	1	9	1	7	7	1
48	SPS-71	1	1	5	9	1	9	9	2	1	3	3	5	1	1	1	2	1	3	3	2	4	1	1	1	9	2	7	3	1
49	Kathra	1	1	5	9	1	9	9	2	1	3	1	3	1	1	1	1	1	1	3	2	1	1	1	1	9	3	7	7	1
50	Sulux Ponni	1	1	5	9	1	9	9	3	1	1	3	5	1	1	1	1	1	3	3	2	1	1	1	1	9	2	7	7	1
51	Sugandha-2	1	1	5	9	1	9	9	2	1	1	1	5	1	1	1	1	1	3	3	1	1	1	1	1	9	1	9	7	1
52	Sugandha-3	1	1	5	9	1	9	9	3	1	3	1	5	1	1	1	1	1	3	3	1	1	1	1	1	9	2	7	7	1
53	Tulsi	2	1	5	9	1	9	9	3	1	3	1	5	1	1	5	5	1	3	3	2	3	1	1	1	9	1	9	7	1
54	Govinda	4	1	5	9	1	9	9	3	1	3	1	3	1	1	1	1	1	3	3	2	1	9	1	5	9	2	7	5	1
55	JR 82-1-10	1	1	5	9	1	9	9	3	1	3	1	5	1	1	1	1	1	1	3	2	1	1	1	1	9	1	7	7	1
56	Vanprabha	1	1	5	9	1	9	9	3	1	1	1	3	1	1	1	1	1	1	3	2	3	1	1	1	9	2	9	7	1
57	JR-305-7	1	1	7	9	1	9	9	3	1	1	3	5	1	1	1	1	1	3	3	2	1	9	1	1	9	3	3	7	1
58	P-677	1	1	5	9	1	9	9	3	1	3	1	5	1	1	1	1	1	3	3	2	1	1	1	1	9	1	7	7	1
59	P-364	1	1	5	9	1	9	9	3	1	1	3	5	1	1	1	1	1	3	5	2	1	1	1	1	9	2	7	7	1

60	Masuri	1	1	7	9	1	9	9	3	1	3	3	3	1	1	1	1	1	3	3	2	4	1	1	1	9	2	5	7	1
61	Karnal Basmati	1	1	7	9	1	9	9	3	1	1	1	5	1	1	1	1	1	7	5	2	1	9	1	5	9	1	7	7	1
62	Safad Luchai-1	1	1	5	9	1	9	9	3	1	3	1	5	1	1	1	1	1	3	3	2	2	1	1	1	9	2	7	7	1
63	safad Luchai-2	1	1	5	9	1	9	9	3	1	1	3	3	1	1	1	1	1	3	3	2	1	1	1	1	9	1	7	7	1
64	Pili Luchai-1	1	1	5	9	1	9	9	3	1	1	1	3	1	1	1	1	1	1	3	2	1	1	1	1	9	1	7	7	1
65	Pili Luchai-2	1	1	5	9	1	9	9	3	1	3	1	5	1	1	1	1	1	1	5	2	2	1	1	1	9	2	7	7	1
66	Badi Luchai	1	1	5	9	1	9	9	3	1	3	1	7	1	1	1	1	1	1	5	2	4	1	1	1	9	2	7	7	1
67	Balaghat Luchai	1	1	5	9	1	9	9	3	1	3	1	5	1	1	1	1	1	1	3	3	4	1	1	1	9	2	7	7	1
68	Nungi	1	1	3	9	1	9	9	3	1	3	1	3	1	1	1	1	1	1	5	1	1	1	1	1	9	1	5	7	1
69	Suraniat	1	1	5	9	1	9	9	3	1	3	3	5	1	1	5	5	1	1	3	3	1	1	1	1	9	1	5	5	1
70	Sulehdas	3	1	5	9	1	9	9	3	1	3	1	5	1	1	7	5	1	3	3	3	4	1	1	1	9	1	7	7	1
71	Baspatri	3	9	5	9	2	9	9	3	2	3	3	5	1	1	5	5	1	3	3	2	1	1	1	1	9	2	7	3	1
72	Kakeria	3	9	5	9	2	9	9	3	1	3	1	7	1	1	7	5	1	3	3	2	1	1	1	1	9	1	7	7	1
73	Kardhana	3	9	5	9	2	9	9	2	2	3	3	5	1	1	5	5	9	3	3	3	1	1	1	1	9	3	7	3	1
74	Amachur	2	1	3	9	1	9	9	3	1	1	1	7	1	1	1	1	1	3	3	2	4	1	1	1	9	2	1	3	1
75	Sorna	1	1	5	9	1	9	9	3	1	3	1	5	1	1	1	1	1	3	3	1	3	1	1	1	9	1	7	7	1
76	Surajone	1	1	5	9	1	9	9	3	1	3	1	5	1	1	5	5	1	7	5	6	9	1	1	1	9	1	7	5	1
77	Rani Kajar	1	1	3	9	1	9	9	2	1	3	3	5	1	1	7	5	1	7	5	6	9	1	1	1	9	2	7	5	1
78	Ram Ker -1	3	1	5	9	1	9	9	3	1	3	3	5	1	1	5	5	1	3	3	3	1	1	1	1	9	1	5	7	1
79	Ram Ker -2	1	1	5	9	1	9	9	3	1	3	1	7	1	1	5	5	1	7	5	3	5	1	1	1	9	2	7	7	1
80	Chipdu	2	1	5	9	1	9	9	3	1	1	1	5	1	1	1	1	1	1	3	2	1	1	1	1	9	2	7	7	1
81	Lakna	1	1	3	9	1	9	9	3	2	1	3	3	1	1	1	1	1	1	3	1	3	1	1	1	9	2	7	3	1
82	Dugsuchia	1	1	5	9	1	9	9	3	1	3	3	3	1	1	1	1	1	3	5	2	3	1	1	1	9	2	5	3	1
83	Jeera Shankar	1	1	5	9	1	9	9	3	1	3	3	5	1	1	1	1	1	3	5	2	1	9	1	5	9	1	7	3	1

1-Basal leaf: sheath colour, 2-Leaf: intensity of green colour, 3- Leaf: anthocynin colouration, 4- Leaf: distribution of anthocyanin colouration, 5- Leaf sheath: anthocyanin colouration, 6- Leaf sheath: intensity of anthocyanin colouration, 7- Leaf: pubescence of blade surface, 8- Leaf: auricles, 9- Leaf: anthocyanin colouration of auricles, 10- Leaf : collar, 11- Leaf: anthocyanin colouration of collar, 12- Leaf: ligule, 13- Leaf: shape of ligule, 14- Leaf: colour of ligule, 15- Leaf: length of blade, 16- Leaf: width of blade, 17- Culm : attitude, 18-Time of heading, 19- Flag leaf attitude of blade (early observation), 20- Spikelet: density of pubescence of lemma, 21- Lemma: anthocyanin colouration of keel, 22- Lemma: anthocyanin colouration of area below apex, 23- Lemma: anthocyanin colouration of apex, 24- Spikelet: colour of stigma, 25- Stem: thickness, 26- Stem: length (excluding panicle), 27- Stem: anthocyanin colouration of nodes, 28- Stem: intensity of anthocyanin colouration of nodes, 29- Stem: anthocyanin colouration of internodes, 30- Panicle: length of main axis (cm), 31- Panicle: curvature of main axis, 32- Panicle: number per plant, 33- Spikelet: colour of tip of lemma, 34- Lemma and palea: colour, 35- Panicle: awns, 36- Panicle: colour of awns, 37- Panicle: distribution of awns, 38- Panicle: presence of secondary branching, 39- Panicle: secondary branching, 40- Panicle: attitude of branches, 41- Panicle: exsertion, 42- Sterile lemma colour, 43- Grain weight of 1000 fully developed grains.

Pic 1: Stigma colour



Pic 2: Auricle colour

Pic 3: Lemma-Palea colour

Grouping of Germplasms in respect of Pigmentation in Plant Parts

Variations in degree of pigmentation suggest few or more gene controlling above traits (Shrivastava *et al*. 2015) [14]. Some genotypes clearly differ from one another, for their pigmentation. On the basis of pigment distribution in 13 plant parts, the entire germplasm was classified into 23 groups, with group I having pigmentation in 1 plant part and group XXIII with pigmentation in 10 plant parts (table 3).

Group I included 29 germplasm having colour in only one plant part called colour of tip of lemma. Last XXIII group included four germplasms R-652, R-671, R-714, Shymla which has pigmentation in overall 10 parts (colour of tip of lemma, colour of awns, anthocynin coloration of apex, lemma & palea colour, basal leaf sheath colour, leaf sheath anthocynin coloration, color of stigma, auricle colour, ligule colour, sterile lemma colour).

Total 16 groups have only 1 germplasm each including only one or few traits. Group II included 12 germplasms having colour in 2 plant parts as colour of tip of lemma, lemma & palea colour whereas group III also included 15 germplasms having colour in 2 plant parts as colour of tip of lemma, colour of awns. Group X & XIV has only 2 germplasm each whereas group VII has included 3 germplasms. Chang (1979) [6] also suggest that purple pigmentation of rice plants had been lost during the process of evolution and genotypes with green types were evolved ones.

Table 3: Grouping of rice germplasm in respect of pigmentation in plant parts.

Group	CTL	CAN	ACA	LPC	BLSC	LSAC	SC	AC	LC	SLC	ACABA	SACN	ACL	Total no. of entries
I	+	-	-	-	-	-	-	-	-	-	-	-	-	29
II	+	-	-	+	-	-	-	-	-	-	-	-	-	12
III	+	+	-	-	-	-	-	-	-	-	-	-	-	15
IV	+	-	-	-	+	-	-	-	-	-	-	-	-	1
V	+	-	-	+	+	-	-	-	-	-	-	-	-	1
VI	+	+	-	-	+	-	-	-	-	-	-	-	-	1
VII	+	+	-	+	-	-	-	-	-	-	-	-	-	3
VIII	+	-	+	-	-	-	-	-	-	-	+	-	-	1
XI	+	-	-	+	-	-	-	-	+	-	-	-	-	1
X	+	-	-	+	-	-	+	-	-	-	-	-	-	2
XI	+	-	+	-	-	-	+	-	-	-	-	-	-	1
XII	+	-	+	-	+	+	-	-	-	-	-	-	-	1
XIII	+	-	+	-	+	-	+	-	-	-	-	-	-	1
XIV	+	-	+	+	-	-	+	-	-	-	-	-	-	2
XV	+	-	+	+	+	-	+	-	-	-	-	-	-	1
XVI	+	-	+	+	-	-	+	-	-	+	-	-	-	1
XVII	+	-	+	+	-	-	+	-	-	+	+	-	-	1
XVIII	+	-	+	+	+	-	+	+	-	-	-	-	-	1
XIX	+	-	+	-	+	+	+	+	-	-	-	-	-	1
XX	+	+	+	-	+	+	+	+	-	-	-	-	-	1
XXI	+	-	+	-	+	+	+	+	+	-	-	-	-	1
XXII	+	-	+	-	+	+	+	+	+	-	-	+	-	1
XXIII	+	+	+	+	+	+	+	+	+	+	-	-	-	4

+ Pigmenmted, - Non-pigmented Colour of tip of lemma (CTL), colour of awns (CAN), anthocynin coloration of apex (ACA), lemma & palea colour (LPC), basal leaf: sheath colour (BLSC), leaf sheath anthocynin coloration (LSAC), stigma colour (SC), auricle colour (AC), ligule colour (LC), sterile lemma colour (SLC), anthocynin coloration area below apex (ACABA), stem anthocynin color of nodes (SACN), anthocynin coloration of keel (ACL)

Unique Identified Rice Germplasms

The studied qualitative agro-morphological characters showed wide degree of variations among the pure lines. Each of the studied characters showed different types of variations. Out of 83 germplasm, awns were present in 24 germplasm and yellowish brown colour of awns was present on IR-36, shymla (table 4). The rest of the 22 genotypes had yellowish white coloration of awns. As regards the colour of the awns purple colour may be primitive traits which gradually changed during the course of evolution from red to gold and straw (Chang, 1979) [6].

The white sterile lemma colour present in surajone and gold sterile lemma colour present in chhatry. Towny (brown) lemma & palea colour present in ramker -2 and black lemma & palea colour present in rani kajar, surajone germplasm. Chhatry germplasm has purple colour of tip of lemma, black colour of tip of lemma has rani kajar, surajone and white colour of tip of lemma has lakna. Medium anthocynin coloration of apex was found in Shymla only. Light green colour of stigma found in SPS-71. Stem anthocynin colour of nodes were present in Kardhana. Plants usually present a dark green colour on high soil fertility and a light green one on low soil fertility (Fonseca *et al*., 2002) [7], but kardhana germplasm having colour on node showing some different result in such condition. Medium anthocynin coloration area below apex was found in JR-199 and chhatry.

More study required on those germplasms for pointing out which are the traits that may be particularly referred to as indicators to determine an unstable expression of the phenotype of candidate variety (DUS guideline).

Table 4: Unique identified rice germplasms.

Qualitative characteristics	Index value/ Note Number*	Unique pure lines
Colour of tip of lemma	Purple	Chhatry
	Black	Rani Kajar,
	White	Surajone Lakna
Colour of awns	Yellowish Brown	IR-36, Shymla
Anthocynin Coloration of Apex	Medium	Shymla
Lemma & palea colour	Towny Black	Ram Ker -2 Rani Kajar, Surajone
Color of stigma	Light Green	SPS-71
Sterile lemma colour	White	Surajone
	Gold	Chhatry
Stem anthocynin colour of nodes	Present	Kardhana
Anthocynin coloration area below apex	Medium	JR-199, Chhatry

* According to DUS Test Guidelines for Rice in India by DRR, Hyderabad

Conclusion

The unique pure lines possessed exclusive variability and unique features which need safe conservation and sustainable utilization in future rice varieties development for issues like intellectual property rights. Further, the identified variability and unique features can be selected for developing varieties with unique identification, diverse traits and broaden genetic base. Besides, identified qualitative traits like dark green color leaf, strong pubescence on the surface of the leaf blade or purple margin leaf blade etc. can be utilized for developing rice varieties with tolerant to leaf surface related insects and diseases.

Agricultural production emphasizing agro biodiversity can help in utilizing and protecting centuries-old traditions and is a powerful tool to nurture the cultural identity of farmers and indigenous varieties. Above study revealed the distinct characteristics of varieties and indicated that morphological variations exist in collected varieties due to variation in genetic makeup and could be better utilized by breeders in the selection based on their specific requirement for breeding programme along with that this is highly useful study for varietal identification and conservation.

References

1. Ahmed MSU, Bashar MK, Wazuddin M, Shamsuddin AKM. Agro-morphological qualitative characterization of Jesso-Balam rice (*Oryza sativa* L.) accessions in Bangladesh. International Journal of Agronomy and Agricultural Research (IJAAR). 2016; 8(1):50-58.
2. Aiswariya KS, Thomas GE. Characterization of five rice varieties using morphological traits and seed storage protein profiling. South Indian Journal of Biological Sciences. 2016; 2(1):152-161.
3. Bonow S, Pinho EVRV, Soares AA, Júnior SS. Morphological characteristics of rice cultivars application for variety purity certifi cation. Ciência Agrotecnológica. 2007; 31:619-627. (in Portuguese, with abstract in English).
4. Caldo R, Sebastian L, Hernandez J. Morphology-based genetic diversity analysis of ancestral lines of Philippine rice cultivars. Philippine Journal Crop Science. 1996; 21:86-92.
5. Chandraratna MF. Genetics and breeding of rice. Longmans Green and Co. Ltd., Grosvenor Street, London. W-1, 1964, 143-45.
6. Chang TT. Rice, *O. sativa* and *O. glaberrima* (Graminae-Oryzeae) Evolution of crop plants. Longmans Ltd. W-7, Edi. N.W. Simonds, 1979, 98-104.
7. Fonseca JR, Cutrim VA, Rangel PHN. Morpho-Agronomic Descriptors and Phenology of the Lowland Rice Cultivars. Embrapa, Brasília, DF, Brazil (in Portuguese), 2002.
8. Nascimento WF, Silva EF, Veasey EA. Agro-morphological characterization of upland rice accessions. Scientific Agriculture (Piracicaba Braz.). 2011; 68(6):652-60.
9. Ndour D, Diouf D, Bimpong IK, Sow A, Kanfany G, Manneh B. Agro-Morphological Evaluation of Rice (Oryza sativa L.) for Seasonal Adaptation in the Sahelian Environment. Agronomy. 2016; 6(8).
10. Patra BC. Collection and characterization of rice genetic resources from Keonjhar district of Orissa. Oryza. 2000; 34:324-326.
11. Rani S, Rao LVS, Viraktamath BC. National Guidelines for the Conduct of Tests for Distinctiveness, Uniformity and Stability. Directorate of Rice Research, 2006, 8-15.
12. Rao LVS, Prasad GS, Chiranjivi M, Chaitanya U, Surendhar R. DUS Characterization for Farmer varieties of rice. IOSR Journal of Agriculture and Veterinary Science (IOSR-JAVS). 2013; 5(4):35-43.
13. Raut VM. Qualitative genetics of Soyabean-a review. Soybean Research. 2003; 1:1-28.
14. Shrivastava A, Koutu GK, Mishra DK, Singh SK. Characterization of JNPT lines of rice (*Oryza sativa* L.). Plant Archives. 2015; 15(1):397-403.
15. Siddiq EA. Rice in India- potential areas for research and development. Oryza. 1992; 29:1-68.
16. Song QJ, Quigley CV, Nelson RL, Carter TE, Boerma HR, Strachan JL *et al*. A selected set of trinucleotide simple sequence repeat markers for soybean cultivar identification. Plant Var. Seeds. 1999; 12:207-220.
17. Watt G. Rice In: Dictionary of Economic Products of India Superintendent, Govt. printing Calcutta. 1982; 5:498-653.