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Research Note

DUS characterization of rice (*Oryza sativa* L.) germplsm

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Abstract
Thirty six traditional rice cultivars conserved in germplasm collection of Regional Agricultural Research Station, Nandyal, Acharya N. G. Ranga Agricultural University were characterized for 23 qualitative and six quantitative characters following the Distinctiveness, Uniformity and Stability (DUS) descriptors, as per PPV & FRA, 2007 during *kharif* 2020. Out of 29 characters studied five characteristics were found monophormic, ten were dimorphic, five were of trimorphic, seven were tetramorphic and decorticated grain shape recorded five states of expression. This study will be useful for farmers for identification of varieties and researchers for selecting desirable genotypes for breeding programmes and also to register varieties under PPV & FR Act of 2001. Hybridization between parents selected from cluster III and cluster IV followed by cluster I and cluster IV and cluster II and cluster IV with the importance to traits like stem length, test weight and decorticated grain length in segregating populations can be suggested for development of better varieties from this 36 genotypes.

Keywords: Rice germplasm, Characterization, DUS test , PPV & FR Act.

Rice is the world's most important food crop existing with wide range of genetic diversity in India than that of other crops. Genetic diversity in a crop species is essential to sustain high levels of productivity. Success of any breeding programme depends on selection of parents and this is possible only when array of donors are maintained in the research station. Germplasm pool will contain different gene donors for different situations which in turn can be utilized for further breeding activities. Evolving better varieties than the existing one is a continuous process. This involves pyramiding of elite genes for pest and disease resistance, agronomic traits and quality parameters. Collection, evaluation and maintenance of donors having above traits is quite necessary to utilize them in the breeding programs. PPV & FR Act was introduced in 2001 to protect the interest of breeders, researchers and farmers with respect to plant varieties based on DUS (Distinctiveness, Uniformity and Stability) characters of the variety. These DUS characters are fundamental for identification of a variety which are unique for a particular variety. DUS tests are prerequisite for implication of PPV and FR Act. Hence, the study was conducted with 36 genotypes of rice germplasm for variability in the collection by studying different morphological and agronomic traits.

During *kharif* 2020, 36 genotypes of rice **(Table 1)** were grown in an observation plot in three replications with a row length of 5 meters with 20 cm × 15 cm spacing in three rows with an isolation distance of one meter between entries at Regional Agricultural Research Station, ANGRAU, Nandyal and recommended agronomic practices were followed.

Observations on 29 morphological and agronomic traits were recorded on five randomly selected plants of each genotype at different growth stages following DUS test guidelines of PPV & FRA 2007. The qualitative traits studied were leaf basal leaf sheath colour, pubescence of blade surface, leaf auricles, anthocyanin colouration of auricles, shape of ligule, colour of ligule, time of heading (50 percent plants with panicles), flag leaf

Table 1. List of genotypes studied for DUS characters

S.No.	Name of the genotype	S.No.	Name of the genotype
1	Nandyalasona	19	Sonasali
2	Nandyalasannalu	20	Sugandhmathi
3	Ajaya	21	Suraksha
4	Akshayadhan	22	Swarnadhan
5	Kasturi	23	Aditya
6	Jaya	24	Shireen
7	Manasasarovar	25	Govind
8	MandyaVijaya	26	Triguna
9	MugadhSugandh	27	Tulasi
10	Nidhi	28	Vardhan
11	Phalguna	29	Vasumathi
12	Prasanna	30	Taramathi
13	Rasi	31	Janani
14	Ravi	32	Krishna
15	Shalivahana	33	Sumathi
16	Sasyasree	34	Indursamba
17	Shanthi	35	Varsha
18	Sona	36	Pelelavadlu

attitude of blade (both early and late observation), density of pubescence of lemma of spikelet, anthocyanin colouration of lemma apex, colour of stigma, stem length, anthocyanin colouration of nodes, length of main axis of panicle, curvature of main axis of the panicle, colour of tip of lemma, panicle awns, colour of awns, distribution of awns,attitude of branches in panicle, panicle exertion, sterile lemma colour, test weight (1000 seed weight) decorticated grain length, decorticated grain width, decorticated grain shape (in lateral view), decorticated grain colour, and decorticated grain aroma.

Observations were also recorded on six yield and yield attributing characters *viz*., days to 50 percent flowering, stem length, panicle length, test weight, decorticated grain length and decorticated grain width and observations were subjected to genetic diversity analysis. The genetic distance between the genotypes was worked out using Mahalanobis D^2 analysis (1936) and grouping of varieties into clusters was done following the Tocher's method (Rao, 1952).

Thirty six rice genotypes were studied for DUS characterization. Distinctiveness between genotypes was recorded using 29 characters which include 23 qualitative and six quantitative characters. Analysis of variance showed significant differences for all the six quantitative characters studied among the 36 genotypes. The farmers varieties under study recorded wide range of distinct characters for majority of the qualitative traits (except for basal sheath colour, ligule colour, curvature of main axis of panicle and colour of awns in the panicle) and similar reports were recorded by Biswajit Mondal *et al.* (2014), Preeti Massey *et al.* (2016), Kalyan *et al.* (2017), Manjunatha *et al.* (2018) and Deepak Sharma and Sathyapal Singh (2018). Frequency distribution of the characters studied are presented in **Table 2** and qualitative and quantitative parameters recorded are presented in **Table 3**.

Qualitative characters are considered as morphological markers in the identification of rice because they are less influenced by environmental changes (Raut, 2003). The basal leaf sheath was green in all 36 genotypes (100%). Pubescence of leaf blade surface was weak for 16 genotypes (44.44%) and strong for 5 genotypes (13.89%) . Strong pubescence could be a factor restricting the insect landing on the leaves (Shrivastava *et al*., 2015). Leaf auricles were present only in nine genotypes (25%) and anthocyanin colouration of auricles for these nine genotypes is colourless. Shape of ligule was acute in eight genotypes (22.22%) and split in 28 genotypes (77.78%) and ligule colour was white in all 36 (100%) genotypes studied.

Attitude of blade of flag leaf at early observation was semi erect for 24 genotypes (66.67%) and erect for 12 genotypes (33.33%). In spikelet, density of pubescence of lemma was absent in 33 genotypes (91.67%) and weak for three genotypes (8.33%). Variations in degree of pigmentation suggests few or more gene controlling above traits (Shrivastava *et al.,* 2015). Anthocyanin colouration of apex of lemma is absent in 31 genotypes (86.11%), weak in two (5.56%) genotypes and medium

Table 2. Frequency distribution of Rice genotypes for various DUS characters

S.No.	Character	States	Note	Number of genotypes	Frequency distribution (%)
1	Basal leaf: sheath colour	Green	1	36	100.0
		Light purple	2	--	--
		purplelines	3	--	--
		Purple	4	--	--
2	Leaf: pubescence of blade surface	Absent	1	14	38.90
		Weak	3	16	44.44
		Medium	5	1	2.77
		Strong	7	5	13.89
		Very strong	9	--	--
3	Leaf:auricles	Absent	1	27	75.0
		Present	9	9	25.0
4	Leaf: anthocyanin colouration of auricles	Colourless	1	9	25.0
		Light purple	2	-	-
		Purple	3	-	-
5	Leaf: shape of ligule	Truncate	1	-	-
		Acute	2	8	22.22
		Split	3	28	77.78
6	Leaf: colour of ligule	White	1	36	100.0
		Light purple	2	-	-
		Purple	3	-	-
7	Time of heading(50%ofplantswith panicles)	very early(<71days)	1	-	-
		early (71-90days)	3	3	8.33
		medium (91-110days)	5	30	83.33
		late(111-130days)	7	3	8.33
		very late(>130days	9	-	-
8	Flag leaf: attitude of blade (early observation)	Erect	1	12	33.33
		semi-erect	3	24	66.67
		Horizontal	5	-	-
		Drooping	7	-	-
9	Spikelet: density of pubescence of lemma	Absent	1	33	91.67
		Weak	3	3	8.33
		Medium	5	-	-
		Strong	7	-	-
		verystrong	9	-	-
10	Lemma: anthocyanin colouration of apex	Absent	1	31	86.11
		Weak	3	2	5.56
		Medium	5	2	5.56
		Strong	7	1	2.77
		verystrong	9	-	-
11	Spikelet: colour of stigma	White	1	25	69.44
		lightgreen	2	6	16.68
		Yellow	3	4	11.11
		lightpurple	4	-	-
		Purple	5	1	2.77
12	Stem:length (excludingpanicle)	veryshort(<91cm)	1	24	66.67
		short (91-110cm)	3	9	25.0
		medium (111-130cm)	5	2	5.56
		long(131-150cm)	7	1	2.77
		very long(>150cm)	9	-	-
13	Stem: anthocyanin colouration of nodes	Absent	1	34	94.44
		Present	9	2	5.56

Table 2. Continued..

	Character	States	Note	Number of genotypes	Frequency distribution (%)
14	Panicle: length of main axis	veryshort(<16cm)	1	-	-
		short (16-20cm)	3	1	2.77
		medium (21-25cm)	5	27	75.0
		long (26-30cm)	7	7	19.46
		very long(>30cm)	9	1	2.77
15	Flag leaf :attitude of blade (late observation)	Erect	1	10	27.78
		semi-erect	3	26	72.22
		Horizontal	5	-	-
		Deflexed	7	-	-
16	Panicle: curvature of main axis	Straight	1	-	-
		semi-straight	3	-	-
		Deflexed	5	-	-
		Drooping	7	36	100.0
17	Spikelet: colour of tip oflemma	White	1	6	16.67
		Yellowish	2	-	-
		Brown	3	25	69.44
		Red,	4	-	-
		Purple	5	5	13.89
		Black	6	-	-
18	Panicle:awns	Absent	1	30	83.33
		Present	9	6	16.67
19	Panicle: colour of awns (late observation)	Yellowish white	1	-	-
		Yellowish brown	2	-	-
		Brown	3	6	16.67
		Reddish brown	4	-	-
		Light red	5	-	-
		Red	6	-	-
		Light purple	7	-	-
		Purple	8	-	-
		Black	9	-	
20	Panicle: distribution of awns	tip only	1	5	13.89
		upper halfonly	3	-	-
		wholelength	5	1	2.77
21	Panicle: attitude ofbranches	Erect	1	-	-
		Erect tosemi-erect	3	1	2.77
		Semi-erect	5	-	-
		Semi-erect to spreading	7	8	22.22
		Spreading	9	27	75.0
22	Panicle: exsertion	Partly exserted	3	3	8.33
		Mostly Exserted	5	11	30.56
		Well Exserted	7	22	61.11
23	Sterile lemma: colour	Straw	1	31	86.11
		Gold	2	3	8.33
		Red	3	--	--
		Purple	4	-	-
		White	5	2	5.56
24	Grain weight of 1000 fully developed grains	Very low (<15 g)	1	25	69.44
		Low (15-20 g)	3	4	11.11
		Medium (21-25 g)	5	7	19.44
		High (26-30 g)	7	-	-
		Very high (> 30 g)	9	-	-

Table 2. Continued..

	Character	States	Note	Number of genotypes	Frequency distribution (%)
25	Decorticated grain: Length	Short (< 6 mm)	1	6	16.68
		Medium (6.1-8.5 mm)	3	25	69.44
		Long(8.6-10.5 mm)	5	4	11.11
		Very long10.6-12.5)	7	1	2.77
		Extra long (. 12.5 mm)	9	-	-
26	Decorticated grain:width	narrow(<2.0 mm)	3	4	11.11
		medium(2.0-2.5 mm)	5	29	80.56
		broad(>2.5 mm)	7	3	8.33
27	Decorticated grain:shape	Short slender	1	6	16.67
		shortbold	2	6	16.67
		Medium slender	3	9	25.0
		longslender	4	3	8.33
		longbold	5	12	33.33
		extralong slender	6	-	-
28	Decorticated grain: colour	white	1	15	41.66
		lightbrown	2	16	44.44
		variegated brown	3	2	5.55
		darkbrown	4	3	8.35
		lightred	5	-	-
		red	6	-	-
		variegated purple	7	-	-
		purple	8	-	-
		darkpurple	9	-	-
29	Decorticated grain:aroma	absent	1	33	91.67
		present	9	3	8.33

(5.56%) in two genotypes *viz,* Suraksha, Swarnadhan and strong in one genotype (2.77%). Colour of stigma was white in 25 genotypes (69.44%), light green in six genotypes (16.68%), yellow for four (11.11%) and purple for one (2.77%) genotype. Nascimento *et al*. (2011) observed white colour of stigma as dominant types in upland rice. Anthocyanin colouration of nodes in stem was observed only for two genotypes *viz.,* Sugandhamathi and Suraksha. Attitude of blade of flag leaf in late observation is semi erect for 26 genotypes (72.22%) and erect for ten genotypes (27.78%). Panicle curvature of main axis is drooping in all 36 genotypes (100%). Tip of lemma colour of spikelet was brown in 25 genotypes (69.44%), white in six genotypes (16.67%) and purple in five genotypes (13.89%). Bonow *et al*. (2007) stated that panicle type is generally affected by water deficiency before flowering, because this condition changes the angle of the panicle. Awns in the panicle were present for six genotypes (16.67%) which were brown in colour (Kasturi, Mugadhsugandh, Nidhi, Sasyasree, Shanthi and Govind). The awned genotypes are primitive and well adapted to adverse environment factors *viz*., drought, salinity and low temperature as reported by Chandraratna (1964). Panicle distribution of awns is at tip only in five genotypes (13.89%) *viz.,* Kasturi, Mugadh Sugandh, Nidhi, Sasyasree and Shanthi and for whole length in one genotype (2.77) *viz*.,Govind. Panicle attitude of branches was spreading in 27 genotypes (75.0%) and semi erect to spreading in eight genotypes (22.22%) and erect to semi erect in one genotype *viz.,*Sasyasree. Panicle exertion was well exerted in 22 (61.11%) genotypes, mostly exerted in 11 (30.36%) and partly exerted in three (8.33%) (Ajaya, Rasi and Ravi). Sterile lemma colour was straw in majority 31 (86.11%) and gold in three (8.33%) (Kasturi, Sumathi, Pelalavadlu) and white in two genotypes *viz.,* Shireen and Taramathi (5.56%).

With reference to quantitative characters for time of heading in 30 genotypes (83.33%) recorded medium duration, three genotypes (8.33%) were of late duration and three genotypes (8.33%) were of early duration. Stem length is very short for 24 genotypes (66.67%), short for nine (25.0%), medium for two (5.56%) and long for one genotype *viz.,*Govind. Panicle length of main axis was found to be medium for 27 genotypes (75.0%) and long for seven genotypes (19.46%).

The test weight (1000 seed weight) was very low in 25 (69.44%), low in four (11.11%) and medium in seven (19.44%) genotypes. Decorticated grain length in 25 genotypes was medium (69.44%) and decorticated grain width was medium in 29 (80.56%) genotypes. Decorticated grain shape ranged from long slender in three genotypes (8.33%), long bold in 12 (33.33%),

Table 3. Characterization of 36 rice cultivars as per DUS guide lines

S. No.	Cultivar	A	b	c	d	e	f	g	h	i	j	k	l	m	N	o	p	q	r	s	t	u	v	w	x	y	Z	aa	ab	Ac
1	Nandyala sona	1	1	1	-	2	1	5	3	1	1	3	1	1	5	3	7	3	1	-	-	7	7	1	1	3	5	1	1	1
2	Nandyala sannalu	1	5	1	-	2	1	5	3	1	1	3	1	1	5	3	7	3	1	-	-	9	7	1	1	1	5	3	1	1
3	Ajaya	1	3	9	1	3	1	5	3	3	1	1	1	1	5	3	7	3	1	-	-	9	3	1	1	1	5	3	4	1
4	Akshayadhan	1	3	1	-	3	1	5	3	3	3	1	1	1	5	3	7	3	1	-	-	9	5	1	1	5	5	1	2	1
5	Kasturi	1	3	1	-	3	1	5	3	1	1	2	1	1	5	3	7	3	9	3	1	9	5	2	1	3	5	3	1	1
6	Jaya	1	7	9	1	3	1	5	3	1	1	1	1	1	5	3	7	3	1	-	-	9	7	1	1	1	5	1	2	1
7	Manasasarovar	1	1	9	1	3	1	5	3	1	1	2	1	1	7	3	7	3	1	-	-	9	7	1	1	1	5	3	2	1
8	MandyaVijaya	1	3	1	-	3	1	5	3	1	3	1	3	1	5	3	7	3	1	-	-	9	7	1	1	1	5	1	2	1
9	Mugadh Sugandh	1	3	1	-	2	1	5	3	1	1	1	1	1	5	3	7	3	9	3	1	9	7	1	1	5	5	5	1	9
10	Nidhi	1	3	1	-	3	1	5	3	1	1	1	1	1	5	3	7	3	9	3	1	9	7	1	1	3	3	5	2	1
11	Phalguna	1	3	1	-	3	1	5	3	1	1	1	1	1	5	3	7	3	1	-	-	9	5	1	1	3	3	4	1	1
12	Prasanna	1	7	1	-	3	1	5	3	1	1	1	1	1	7	3	7	3	1	-	-	9	7	1	1	3	7	3	1	1
13	Rasi	1	3	9	1	3	1	5	1	1	7	5	1	1	5	1	7	5	1	-	-	9	3	1	1	3	3	2	2	1
14	Ravi	1	3	9	1	3	1	5	1	1	1	2	1	1	5	1	7	3	1	-	-	9	3	1	1	3	5	4	2	1
15	Shalivahana	1	3	1	-	3	1	5	3	1	1	1	1	1	5	3	7	3	1	-	-	9	5	1	1	3	5	2	2	1
16	Sasyasree	1	7	1	-	3	1	5	3	1	1	1	1	1	5	3	7	3	9	3	1	3	5	1	1	3	5	2	3	1
17	Shanthi	1	3	1	-	3	1	5	1	1	1	1	1	1	5	1	7	3	9	3	1	9	5	1	1	3	5	5	2	1
18	Sona	1	3	9	1	3	1	5	1	1	1	1	1	1	5	1	7	5	1	-	-	9	5	1	1	3	5	2	2	1
19	Sonasali	1	7	9	1	2	1	5	1	1	1	2	1	1	5	3	7	3	1	-	-	9	5	1	1	3	5	1	2	1
20	Sugandhmathi	1	3	1	-	3	1	5	3	1	1	1	1	9	5	3	7	5	1	-	-	9	5	1	1	5	5	5	1	9
21	Suraksha	1	7	1	-	3	1	5	1	1	5	2	1	9	5	1	7	5	1	-	-	9	5	1	1	3	5	2	2	1
22	Swarnadhan	1	3	1	-	3	1	5	3	3	5	1	1	1	5	3	7	5	1	-	-	9	7	1	1	3	7	3	1	1
23	Aditya	1	1	1	-	3	1	3	1	1	1	1	1	1	3	1	7	1	1	-	-	9	7	1	1	3	5	1	1	1
24	Shireen	1	1	1	-	3	1	3	1	1	1	1	3	1	5	3	7	1	1	-	-	9	7	5	1	3	5	5	1	1
25	Govind	1	1	1	-	3	1	7	3	1	1	3	7	1	9	3	7	1	9	3	5	9	7	1	5	3	5	4	2	1
26	Triguna	1	1	1	-	3	1	5	1	1	1	1	3	1	7	1	7	3	1	-	-	9	7	1	5	3	5	3	2	1
27	Tulasi	1	3	1	-	3	1	5	3	1	1	1	1	1	5	3	7	3	1	-	-	9	7	1	5	3	5	5	2	1
28	Vardhan	1	1	1	-	3	1	5	3	1	1	1	3	1	5	3	7	3	1	-	-	7	7	1	3	3	7	2	3	1
29	Vasumathi	1	1	1	-	3	1	7	3	1	1	1	3	1	7	3	7	1	1	-	-	7	7	1	3	7	3	5	1	9
30	Taramathi	1	1	1	-	2	1	5	1	1	1	1	3	1	5	1	7	3	1	-	-	9	7	5	5	5	5	5	2	1
31	Janani	1	3	9	1	2	1	5	1	1	1	2	3	1	5	1	7	3	1	-	-	7	5	1	1	3	5	3	1	1
32	Krishna	1	1	1	-	2	1	5	1	1	1	1	5	1	7	1	7	3	1	-	-	9	7	1	3	3	5	5	1	1
33	Sumathi	1	1	1	-	3	1	3	3	1	1	1	5	1	7	3	7	3	1	-	-	7	7	2	5	3	5	5	1	1
34	Indursamba	1	1	9	1	3	1	5	3	1	1	1	1	1	5	3	7	1	1	-	-	7	7	1	5	1	5	3	4	1
35	Varsha	1	1	1	-	2	1	7	3	1	1	3	3	1	7	3	7	1	1	-	-	7	7	1	5	3	5	5	4	1
36	Pelelavadlu	1	1	1	-	3	1	5	3	1	1	1	3	1	5	3	7	3	1	-	-	7	7	2	3	3	5	5	1	1

a.Basal leaf sheath colour, b. Leaf pubescence of blade surface, c. Leaf auricles, d. Leaf anthocyanin colouration of auricles, e. Leaf shape of ligule, f. Leafcolour of ligule, g. Time of heading (50% of plants with panicles), h. Flag leaf attitude of blade (early observation), i. Spikelet density of pubescence of lemma, j. Lemma anthocyanin colouration of apex, k. Spikelet colour of stigma, l. Stem length (excluding panicle; excluding floating rice), m. Stem anthocyanin colouration of nodes, n. Panicle length of main axis, o. Flag leaf attitude of blade (late observation), p. Panicle curvature of main axis, q. Spikelet colour of tip oflemma, r. Panicle awns, s. Panicle colour of awns (late observation), t. Panicle distribution of awns, u. Panicleattitude of branches, v. Panicle exsertion, w.Sterile lemma colour, x. test weight 1000 seed weight) y.Decorticated grain length, z. Decorticated grain width, aa. Decorticated grain shape (in lateral view), ab. Decorticated grain colour, and ac. Decorticated grain aroma

medium slender in nine (25%), short bold in six (16.67%) and short slender in six (16.67%) genotypes. Decorticated grain colour recorded white for 15 (41.66%) genotypes , light brown in 16 (44.44%) genotypes ,variegated brown in two (5.55%) genotypes *viz.,* (Sasyasree and Vardhan) and dark brown in three genotypes (8.33%) *viz.,* Ajaya, Indursamba and Varsha. Decorticated grain aroma is present in three genotypes (8.33%) *viz.,* Mugadh Sugandh, Sugandhamathi and Vasumathi.

Genetic diversity analysis of quantitative traits helps to explore the variability present in rice germplasm for identification of desirable agronomic attributes. Analysis of variance showed significant differences for all the six quantitative characters (days to 50 percent flowering, stem length, panicle length, decorticated grain length and decorticated grain width) studied among 36 genotypes based on D^2 analysis. Thirty six genotypes were divided into seven clusters (**Table 4**). Maximum number of genotypes (13 genotypes) were grouped in cluster II followed by cluster I and cluster III with six genotypes. Cluster VI had five genotypes while the remaining clusters were represented by two genotypes each. Clustering pattern represented that genotypes collected from the same geographic origin were distributed in different clusters (Vennila *et al.,*2011).

The inter and intra cluster distances are presented in **Table 5.** Inter cluster distance was higher than intra cluster distance indicating wider genetic diversity among the genotypes. The maximum inter cluster distance was observed between cluster III and cluster IV(11741.75) followed by cluster I and cluster IV (10440.44), cluster II and cluster IV (7346.83), cluster I and cluster VI (5662.24), cluster III and cluster VI (5356.75), cluster III and cluster V (5278.85), cluster IV and cluster VII (4506.91) and cluster I and cluster V(3979.91) indicating wider genetic diversity of the genotypes between the groups. Hybrids developed by selecting parents from these groups would result in beneficial segregants. The minimum inter cluster distance was recorded between cluster I and cluster II (789.95) and cluster I and cluster III(886.05) indicating the genotypes in these cluster are genetically very close and hence hybridization between these groups is not desirable.

The maximum intra cluster distance was observed in cluster VII (768.39) followed by IV (756.49). Hence, selection within these clusters may be exercised based on the highest areas of desirable traits by making use the method of improvement through inter varietal hybridization. Minimum intracluster distance was observed in cluster I (230.92) followed by cluster VI (358.89). Similar results were reported by Mamata Kumari *et al.* (2016) and Maumita *et al.* (2019).

The cluster means presented in **Table 6** revealed that cluster IV with two genotypes recorded highest mean value for stem length (138.73 cm), panicle length (30.28 cm) and test weight (23.58,g). Cluster VI, cluster VII and cluster IV recorded more number of days to 50 percent flowering (103 and 100 days, respectively) and cluster VI recorded highest mean value of stem length (138.73cm).

Table 4. Clustering pattern of 36 genotypes

Cluster	Number of genotypes	Name of genotypes
I	6	Kasturi,Ravi,Sasyasree,Shanthi,Sona,Suraksha
II	13	Nandyalsona,Nandyalsannalu, Ajaya,Akshayadhan,Jaya,Manasasarovar,Nidhi, Phal guna,Prasanna,Rasi<Sonasali,Swaranadhan,Aditya
III	6	Mandyavijaya,Shalivahana,Shireen,Vardhan,Janani,Pelalavadlu
IV	2	Mugadhsugandh, Sugandhmathi
V	2	Govind,Sumathi
VI	5	Triguna,Vasumathi,Taramathi,Krishna,Varsha
VII	2	Tulasi,Indursamba

Table 5. Intra and inter cluster average of quantitative traits in 36 rice genotypes

	I	II	III	IV	V	VI	VII
I	230.94	789.96	886.05	10440.44	3979.92	5662.25	2584.32
II		521.76	1204.71	7346.83	2736.82	3603.66	1231.76
III			492.48	11741.75	5278.85	5356.76	3150.12
IV				756.49	2504.42	2670.61	4506.92
V					576.71	1601.54	2272.68
VI						358.89	2828.23
VII							768.39

Table 6. Cluster means of quantitative traits in 36 rice genotypes

Cluster	Daysto50% flowering	Stem length (cm)	Paniclelength (cm)	Test weight (g)	Decorticated grain length (mm)	Decorticated grain width (mm)
I	99.28	56.77	23.65	13.45	5.62	2.07
II	99.04	77.46	24.15	14.22	6.44	2.24
III	99.56	58.37	24.03	12.39	7.89	2.07
IV	100.67	138.73	30.28	23.58	6.62	2.07
V	96.50	92.39	25.97	21.59	6.08	2.08
VI	103.50	104.80	26.95	21.35	9.60	2.05
VII	100.40	105.42	25.00	14.74	6.34	2.30

Table 7. Percentage of contribution of each character towards total divergence.

Character	Times ranked 1st	Contribution %
Days to 50% flowering	7	1.11
Stem length	241	38.25
Panicle length	1	1.16
Test weight (1000 seed weight)	237	37.62
Decorticated grain length	126	20
Decorticated grain width	18	2.86

Early flowering genotypes were grouped in cluster V (96 days) and tall genotypes in cluster IV(138.73cm). Cluster I recorded minimum values for stem length (56.77 cm), panicle length (23.65 cm) and decorticated grain length (5.6 mm). Cluster III (12.39g) followed by cluster I (13.45g) and cluster II (14.2 g) recorded less test weight (1000 grain weight) indicating fine grain varieties.

None of the clusters contained the genotypes with all the desirable characters which can be directly selected and utilized. All the minimum and maximum cluster mean values were distributed in relatively distinct clusters. However, the cluster IV recorded relatively desirable mean values for stem length (138.73 cm), panicle length (30.28 cm) and test weight (23.58 g).Similar results were reported by Bhanumurthy *et al.* (2010) indicating that hybridization between divergent cluster genotypes is necessary to develop desirable genotypes .Based on the performance of the genotypes with in the cluster better genotypes can be neither directly selected nor used as potential parents in hybridization programme.

Percent contribution of each character to total divergence is presented in **Table 7**. Among six traits stem length contributed maximum divergence (38.25%), test weight (37.62%) followed by decorticated grain length (20%). The minimum percentage of contribution was by days to 50% flowering (1.11%) followed by panicle length (1.16%).The traits like stem length , test weight and decorticated grain length contributed 95.87 percent toward total divergence inferring that these traits could be focused for selection while improving quantitative traits.

Thus it can be concluded that 36 traditional rice genotypes under cultivation by farmers were distinctive for 27 essential characteristics. Five characteristics *viz*., basal leaf sheath colour, anthocyanin colouration of leaf auricles, colour of leaf ligule, curvature of panical main axis, colour of awns in the panicle were found monophormic. Ten characteristics *viz*., leaf auricles, shape of ligule, attitude of flag leaf blade both at early and late observations, density of pubescence of spikelet lemma, anthocyanin colouration of stem nodes, awns of panicle and distribution of awns in the panicle, sterile lemma colour and decorticated grain aroma were dimorphic. Five characteristics *viz*., time of heading, colour of tip of spikelet lemma, attitude of branches in panicle, panicle exertion, 1000 grain weight and decorticated grain width were of trimorphic. Seven characteristics *viz*., pubescence of leaf blade surface, anthocyanin colouration of lemma apex, stigma colour of spikelet, stem length, length of panicle main axis, decorticated grain length and decorticated grain colour were found tetramorphic. Decorticated grain shape recorded five expressions *viz*., short slender, short bold, medium slender, long slender and long bold. This study will be useful both for farmers to identify the varieties and to select beneficial genotypes for breeders and researchers to use in crop improvement programme. The hybridization between parents selected from cluster III and cluster IV followed by cluster I and cluster IV and cluster II and cluster IV with the importance to traits like stem length, test weight and decorticated grain length in segregating populations can be suggested for development of better varieties from this 36 genotypes.

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