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Research Article

Study of morphological diversity of rice landraces (*Oryza sativa*.L)

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Abstract
An investigation was carried out to characterize 97 rice (*Oryza sativa* L.) land races for 24 different morphological traits using DUS (Distinctiveness, Uniformity, Stability) characters. A total of three characters *viz*., leaf auricles, leaf ligules and leaf shape of ligule were found to be monomorphic. The characters namely leaf anthocyanin colouration, leaf sheath anthocyanin colouration, panicle awns, panicle distribution of awns and leaf pubescence of blade surface were recorded as dimorphic. Seven traits *viz*., coleoptile colour, leaf intensity of green colour, ligule colour, leaf anthocyanin colouration of auricles, panicle exertion, leaf length of blade and leaf width of blade were of trimorphic. Five traits namely basal leaf sheath colour, culm attitude, flag leaf attitude of blade (early and late observation), panicle curvature of main axis were recorded four states of expression. The traits *viz*., spikelet colour of stigma, stem length, days to 50% flowering and time to maturity were showed five states of expression. The DUS characterization for these characters will be useful for rice breeders to restore the superior genes and use it in crop improvement programmes. Presence of uniform purple colour in whole plant incluing ligule and auricles was observed in purple puttu and chitansamba and can be used as morphological markers. The land races namely Ayyan samba and red sirumani were found to be the early maturity types. The short stem length and erect culms were observed in senthooram and seevansamba and these genotypes withstand lodging. Hence, these land races would be used as donors for the development of short duration and lodging resistance respectively in rice improvement programme.

Keywords
Rice, landraces, diversity, DUS characterization

INTRODUCTION

Rice is a major food crop for half of the world's population. The *Oryza sativa,* cultivated rice originated in South East Asia in humid tropical climate under the influence of local environment and farmers need, have evolved into 88,681 different variety, out of that 55,615 are landraces, 1,171 are wild races and 32,895 are other varieties (Sinha and Mishra, 2012). India is a primary centre of origin and diversity for rice according to N.I.Vavilov and is bestowed with tremendous variability both in terms of qualitative and quantitative traits and also for sources of resistance to different biotic and abiotic stresses. The farming groups have contributed significantly in the origin, evolution and accumulation of significant diversity in several landraces through selection process over a longer period of domestication (Pandravada *et al,* 2017). Although, an enormous diversity of rice germplasm is being conserved at International Rice Research Institute, Philippines (1,27,916 accessions) and National Bureau of Plant Genetic Resources, New Delhi (1,01,112 accessions) (Shobha Rani *et al*, 2014). Some landraces are still cultivated locally by farmers but most of the landraces are rapidly replaced by high yielding varieties, which are the back bone of green revolution of rice (Sinha and Mishra, 2013). Hence, the characterization and 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 programmes (Patra and Duha, 2003). The landraces are valuable as they possess a huge treasure of genetic material which may prove important in future variety development programmes. With this objective, the present study was carried out to characterize the available rice land races for the important morphological traits.

MATERIALS AND METHODS

A total of 97 rice landraces (**Table 1)** collected from Ramiah gene bank and Dept. of Rice were sown separately in a raised bed nursery in Department of Rice, Tamil Nadu Agricultural University Coimbatore during *Kharif* 2019. Thirty days old seedlings of each entry were planted in three rows of 2.4m row length by adopting a spacing of 20cm x 20cm. The recommended packages of practices for rice were followed for the proper establishment and growth of the crop. Observations were recorded on five randomly tagged plants in each genotype in each replication for morphological characters *viz*., coleoptile colour, basal leaf sheath colour, leaf intensity of green colour, leaf anthocyanin colouration, leaf sheath anthocyanin colouration, leaf pubescence of blade surface, leaf anthocyanin colouration of auricles, leaf shape of ligule, colour of ligule, culm attitude, flag leaf attitude of blade (early and late observation), spikelet colour of stigma, panicle curvature of main axis, distribution of awns in panicle, panicle exertion, stem length, leaf length of blade and leaf width of blade, days to 50% flowering and time to maturity whereas the presence of leaf auricles, leaf ligules and panicle awns were recorded manually by observing individual plants.

RESULTS AND DISCUSSION

The presence of morpho-genetic variation in agronomic characters of a crop would be of useful to choose the best method to improve the yield in rice. The qualitative characters which are less influenced by the environmental factors are used as morphological markers for the identification of rice land races (Rao *et al*., 2013; Kalyan *et al*., 2017). Frequency distribution (**Table 2**) for all the charaters under the study was calculated and the agro- morphological parameters for DUS characterization are given in **Table 3**. The characters *viz*., coleoptile colour,

Table 1. List of landraces used for DUS characterization.

S.No	Name of land races	S.No	Name of land races	S.No	Name of land races
1	Sornavari	**34**	Salem – 3	**67**	Periya Sandigar
2	Periya samba	**35**	Chinthamani	**68**	Kattuyanam
3	Sarapilli samba	**36**	Varigarudan samba	**69**	Varakkal
4	Manaparai	**37**	Arasamba	**70**	Kaviya Samba
5	Manavari	**38**	Ariyan red	**71**	Thillainayagam
6	Arupatham kuruvai	**39**	Pamani samba	**72**	Norungan
7	Panamara samba	**40**	Jeeraga Samba	**73**	Kavuni
8	Vellai samba	**41**	Vaanginathan	**74**	Senkar
9	Thooyala	**42**	Salem	**75**	Murugankar
10	Arupatham samba	**43**	Vellai Chithiraikar	**76**	Kudaivazhai
11	Mattaikar	**44**	Ponkambi samba	**77**	Kuruvai Kalanjiyam
12	Kallurundai kar	**45**	Kaar	**78**	Palkachaka
13	Senthooram	**46**	Varigamban samba	**79**	Sorna kuruvai
14	Purple Puttu	**47**	Korangu samba	**80**	Thogai Samba
15	Chennangi	**48**	Uppu molagi	**81**	Malayalathan Samba
16	Vellaigundu samba	**49**	Chetty samba	**82**	Kattikar
17	Godumarai samba	**50**	Chittan samba	**83**	Kaatu ponni
18	Ayyan samba	**51**	Puluthi perattai kar	**84**	Kalarkar
19	Arupatham vellai	**52**	Karthigai samba	**85**	Rama kuruvaikar
20	Puthupatty samba	**53**	Alther samba	**86**	Aarkadu kichili
21	Mangam samba	**54**	Val samba	**87**	Matta kuruvai
22	Poongar	**55**	Sembili piriyan	**88**	Karuthakar
23	Shenmolagi	**56**	Senthi nayagam	**89**	Katta Samba
24	Sadai samba	**57**	Mapillai samba	**90**	Red Sirumani
25	Vellai kuruvai	**58**	White paddy	**91**	Ponmani Samba
26	Rangoon samba	**59**	Thattan samba	**92**	Kaliyan Samba
27	Nellore samba	**60**	Anai komban	**93**	Kalli madaiyan
28	Vadakkathi kar	**61**	Koolavalai	**94**	Karungan
29	Muthuvellai	**62**	Valasamudon	**95**	Mikuruvai
30	Sembalai	**63**	Gandhasala	**96**	Vellaikudai vazhai
31	Seevan samba	**64**	Manimenikki	**97**	Vadakkathi Samba
32	Moshanam	**65**	Salem – 9		
33	Kappikar	**66**	Chinna Adukku Nell		

Table 2. Frequency distribution of rice land races for various morphological characters

S.No.	Characteristics	States	Note	Number of genotypes	Frequency distribution (%)
1	Coleoptile colour	Colourless	1	31	31.96
		Green	2	31	31.96
		Purple	3	35	36.08
2	Basal leaf: sheath colour	Green	1	58	59.79
		Light purple	2	8	8.25
		Purple lines	3	26	26.80
		Uniform Purple	4	5	5.15
3	Leaf: intensity of green colour	Light	3	40	41.24
		Medium	5	30	30.93
		Dark	7	27	27.84
4	Leaf: anthocyanin colouration	Absent	1	89	91.75
		Present	9	8	8.25
5	Leaf sheath: anthocyanin colouration	Absent	1	88	90.72
		Present	9	9	9.28
6	Leaf: pubescence of blade surface	Absent	1	89	91.75
		Weak	3	8	8.25
		Medium	5	0	0
		Strong	7	0	0
		Very strong	9	0	0
7	Leaf: auricles	Absent	1	0	0
		Present	9	97	100.00
8	Leaf: anthocyanin colouration of auricles	Colourless	1	85	87.63
		Light Purple	2	7	7.22
		Purple	3	5	5.15
9	Leaf: ligule	Absent	1	0	0.00
		Present	9	97	100
10	Leaf: shape of Ligule	Truncate	1	0	0
		Acute	2	0	0
		Split	3	97	100
11	Leaf: colour of Ligule	White	1	88	90.72
		Light purple	2	6	6.19
		Purple	3	3	3.09
12	Culm: attitude	Erect	1	30	30.93
		Semi erect	3	28	28.87
		Open	5	36	37.11
		Spreading	7	3	3.09
13	Flag leaf: attitude of blade (early observation)	Erect	1	44	45.36
		Semi erect	3	37	38.14
		Horizontal	5	11	11.34
		Drooping	7	5	5.15
14	Spikelet: colour of stigma	White	1	48	49.48
		Light green	2	4	4.12
		Yellow	3	9	9.28
		Light Purple	4	14	14.43
		Purple	5	22	22.68
15	Flag leaf: attitude of blade (late observation)	Erect	1	32	32.99
		Semi-erect	3	44	45.36
		Horizontal	5	16	16.49
		Deflexed	7	5	5.15
16	Panicle: curvature of main axis	Straight	1	16	16.49
		Semi-straight	3	35	36.08
		Deflexed	5	34	35.05
		Dropping	7	12	12.37
17	Panicle: awns	Absent	1	93	95.88
		Present	9	4	4.12
18	Panicle: distribution of awns	Tip only	1	0	0
		Upper half only	3	0	0
		Absent	-	93	95.88
		Whole length	5	4	4.12
19	Panicle: exertion	Partly exerted	3	32	32.99
		Mostly exerted	5	37	38.14
		Well exerted	7	28	28.87
20	Stem: length (excluding panicle)	Very short (<91)	1	3	3.09
		Short (91-110)	3	4	4.12
		Medium (111-130)	5	7	7.22
		Long (131-150)	7	23	23.71
		Very long (>150)	9	60	61.86
21	Leaf: length of blade	Short (<30)	3	8	8.25
		Medium (30-45)	5	60	61.86
		Long (>45)	7	29	29.90
22	Leaf: width of blade	Narrow (<1)	3	11	11.34
		Medium (1-2)	5	85	87.63
		Broad (>2)	7	1	1.03
23	Time of heading (50% of plants with panicles) (days)	Very early (<71)	1	2	2.06
		Early (71-90)	3	39	40.21
		Medium (91-110)	5	52	53.61
		Late (111-130)	7	3	3.09
		Very late (>131)	9	1	1.03
24	Time maturity (days)	Very early (<100)	1	2	2.06
		Early (101-120)	3	39	40.21
		Medium (121-140)	5	52	53.61
		Late (141-160)	7	3	3.09
		Very late (>160)	9	1	1.03

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Table 3. Characterization of rice landracds based on DUS guidelines

S.No	Genotype	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X
1	Sornavari	3	4	5	9	1	1	9	2	9	3	2	3	3	5	3	3	0	0	3	55.26	2.02	73	103	149.2
2	Periya samba	3	1	3	1	1	1	9	1	9	3	1	3	3	4	5	5	0	0	7	45.0	1.08	77	111	145.6
3	Sarapilli samba	2	1	3	1	1	1	9	1	9	3	1	1	1	1	5	5	0	0	5	52.8	1.00	89	119	132.82
4	Manaparai	3	1	7	1	1	1	9	1	9	3	1	1	1	4	1	5	0	0	5	55.4	0.88	89	120	146.1
5	Manavari	2	4	5	9	9	1	9	2	9	3	2	3	3	4	3	3	0	0	3	46.6	1.04	79	108	131.6
6	Arupatham Kuruvai	2	3	3	1	1	1	9	1	9	3	1	5	3	1	3	1	0	0	3	33.0	1.00	93	125	157.2
7	Panamara samba	2	1	5	1	1	1	9	1	9	3	1	5	1	1	5	5	0	0	5	48.8	0.96	80	110	48.8
8	Vellai samba	3	1	5	1	1	1	9	1	9	3	1	3	3	1	3	1	0	0	3	35.6	0.98	89	117	171.6
9	Thooyala	3	3	5	1	1	1	9	1	9	3	1	3	1	1	1	7	0	0	5	52.4	1.02	74	106	52.46
10	Arupatham samba	3	1	7	1	1	1	9	1	9	3	1	5	1	1	3	1	0	0	3	52.6	1.08	93	124	52.6
11	Mattaikar	2	3	5	1	1	1	9	1	9	3	1	1	1	1	1	7	0	0	7	53.2	0.96	79	110	137
12	Kallurundaikar	3	3	3	1	1	1	9	3	9	3	1	5	3	1	3	1	0	0	7	39.5	1.45	93	123	166
13	Senthooram	2	1	7	1	1	3	9	1	9	3	1	1	1	1	1	1	0	0	5	42.0	1.02	89	119	93.4
14	Purple Puttu	3	4	3	9	9	1	9	3	9	3	3	7	3	1	3	7	0	0	7	40.6	1.54	89	119	148.6
15	Chennangi	3	1	3	1	1	1	9	1	9	3	1	3	3	1	5	7	0	0	7	35.4	1.18	88	118	158.0
16	Vellaigundu samba	2	1	3	1	1	1	9	1	9	3	1	1	3	1	3	5	9	5	7	33.4	1.22	81	112	155.4
17	Godumarai samba	2	1	5	1	1	1	9	1	9	3	1	5	3	4	3	7	0	0	7	50.0	1.06	80	110	124.0
18	Ayyan samba	2	1	5	1	1	1	9	1	9	3	1	1	1	1	5	1	0	0	5	33.8	1.10	67	97	169.6
19	Arupatham vellai	2	1	3	1	1	1	9	1	9	3	1	1	1	1	3	3	0	0	3	48.8	1.28	93	124	135.0
20	Puthupatty samba	2	1	3	1	1	1	9	1	9	3	1	5	1	5	3	1	0	0	3	42.6	1.10	94	125	125.8
21	Mangam samba	2	2	3	9	1	1	9	2	9	3	2	3	3	1	3	3	0	0	5	30.8	1.46	93	123	146.8
22	Poongar	1	1	5	1	1	1	9	1	9	3	1	3	1	1	1	1	0	0	3	36.4	1.02	90	120	187.4
23	Shenmolagi	1	1	3	1	1	1	9	1	9	3	1	1	1	1	1	3	0	0	3	31.6	1.36	89	119	167.6
24	Sadai samba	1	1	7	1	1	1	9	1	9	3	1	3	3	4	3	7	0	0	7	56.4	1.32	87	117	141.6
25	Vellai kuruvai	1	1	3	1	1	3	9	1	9	3	1	5	3	1	3	5	0	0	5	38.4	1.00	97	130	168.0
26	Rangoon samba	1	3	5	1	1	1	9	1	9	3	1	5	1	1	1	3	0	0	5	57.0	1.08	81	113	144.2
27	Nellore samba	2	1	5	1	1	1	9	1	9	3	1	1	5	3	5	3	0	0	3	59.0	1.10	108	138	146.4
28	Vadakkathikar	3	2	7	1	1	1	9	1	9	3	1	7	1	4	3	5	0	0	7	43.9	1.10	108	138	159.4
29	Muthuvellai	2	1	5	1	1	1	9	1	9	3	1	5	3	1	3	1	0	0	5	43.8	1.10	110	140	192.6
30	Kappikar	3	1	5	1	1	1	9	2	9	3	1	1	1	3	1	1	0	0	7	35.2	1.00	91	120	172.6
31	Sembalai	1	1	5	1	1	1	9	1	9	3	1	1	1	1	3	1	0	0	5	41.6	1.08	95	125	173.0
32	Seevan samba	2	1	3	1	1	1	9	1	9	3	1	1	3	1	3	1	0	0	5	29.8	1.18	89	119	110.0
33	Moshanam	2	1	7	1	1	3	9	1	9	3	1	5	1	1	3	5	0	0	7	59	1.14	90	119	150.0

34	Salem - 3	2	1	3	1	1	1	9	1	9	3	1	1	1	1	1	5	0	0	7	59.6	1.22	90	121	151.24
35	Chinthamani	2	1	7	1	1	1	9	1	9	3	1	1	3	4	3	3	0	0	3	32.6	1.02	87	118	162.16
36	Varigarudan samba	2	1	5	1	1	1	9	1	9	3	1	1	1	5	1	3	0	0	7	32.8	1.00	101	131	161.6
37	Arasamba	2	1	5	1	1	1	9	1	9	3	1	3	1	3	1	3	0	0	7	39.2	1.00	93	123	164.2
38	Ariyan Red	2	1	5	1	1	1	9	1	9	3	1	1	1	1	1	3	9	5	5	34.2	1.00	95	125	150.84
39	Pamani samba	1	1	3	1	1	1	9	1	9	3	1	3	3	1	3	5	0	0	7	48.8	0.90	95	125	139.0
40	Jeeraga Samba	3	1	3	1	1	1	9	1	9	3	1	5	3	3	3	3	0	0	5	26.4	0.94	89	119	143.2
41	Vaanginathan	2	2	3	1	1	1	9	1	9	3	1	5	3	4	3	7	0	0	3	46.0	1.20	89	119	170.0
42	Salem	1	1	7	1	1	1	9	1	9	3	1	5	7	5	7	3	0	0	3	36.0	1.00	82	112	100.0
43	Vellai Chithiraikar	2	1	3	1	1	1	9	1	9	3	1	3	5	5	5	5	0	0	5	30.0	1.50	141	171	173.52
44	Ponkambi samba	2	1	7	1	1	1	9	1	9	3	1	1	1	2	1	5	0	0	5	38.4	1.32	87	118	114.88
45	Kaar	3	3	3	1	1	1	9	1	9	3	1	5	3	5	3	7	0	0	7	47.4	0.86	81	112	138.94
46	Varigamban samba	1	1	5	1	1	1	9	1	9	3	1	1	5	1	5	3	0	0	7	46.0	1.00	102	132	178.54
47	Korangu samba	3	1	3	1	1	1	9	1	9	3	1	1	1	3	1	5	0	0	7	42.6	1.00	81	111	148.16
48	Uppu molagi	2	1	3	1	1	1	9	1	9	3	1	5	1	3	1	3	0	0	7	38.6	1.26	101	131	175.74
49	Chetty samba	1	1	7	1	1	1	9	1	9	3	1	1	3	4	3	5	0	0	5	43.8	0.88	79	109	141.36
50	Chittan samba	3	4	3	9	9	3	9	3	9	3	3	7	3	4	3	1	0	0	3	50.6	1.28	81	111	167.02
51	Puluthi perattai kar	1	1	3	1	1	1	9	1	9	3	1	5	1	1	3	1	0	0	5	63.2	1.04	100	130	156.76
52	Karthigai samba	1	1	5	1	1	1	9	1	9	3	1	3	7	1	7	3	0	0	5	29.4	1.00	100	131	212.5
53	Alther samba	2	1	3	1	1	1	9	1	9	3	1	5	1	1	1	5	0	0	7	35.8	0.98	100	130	164.8
54	Val samba	1	1	3	1	1	1	9	1	9	3	1	5	1	1	1	7	9	5	7	38.7	1.08	100	130	175.8
55	Sembili piriyan	3	1	5	1	1	3	9	1	9	3	1	1	7	1	7	3	0	0	5	52.4	1.26	106	136	184.6
56	Senthi nayagam	1	1	3	1	1	1	9	1	9	3	1	5	3	1	3	1	0	0	3	49.8	1.00	101	131	172.14
57	Mappillai samba	1	1	7	1	1	1	9	1	9	3	1	3	7	1	7	5	0	0	5	38.0	1.00	110	139	179.84
58	White paddy	1	1	7	1	1	1	9	1	9	3	1	3	3	1	3	5	0	0	5	28.6	1.00	100	134	161.4
59	Thattan samba	2	1	3	1	1	1	9	1	9	3	1	3	1	1	1	3	0	0	5	45.0	1.66	101	131	185.2
60	Anaikomban	1	1	7	1	1	1	9	1	9	3	1	5	1	1	1	3	0	0	3	44.6	1.30	102	132	166.78
61	Koolavalai	1	1	3	1	1	1	9	1	9	3	1	1	1	1	1	5	0	0	7	38.4	1.12	102	132	184.68
62	Valasamudon	2	1	5	1	1	1	9	1	9	3	1	1	1	4	3	5	0	0	5	23.4	1.46	101	133	115.04
63	Gandhasala	1	1	3	1	1	1	9	1	9	3	1	1	1	1	1	7	0	0	3	35.0	1.14	93	123	160.42
64	Manimenikki	3	1	5	1	1	3	9	1	9	3	1	3	1	1	1	5	0	0	3	38.2	1.00	99	129	160.14
65	Salem – 9	1	1	3	1	1	1	9	1	9	3	1	1	1	4	1	3	0	0	5	37.8	1.08	109	141	158.84
66	Chinna Adukku Nell	1	2	3	1	1	1	9	1	9	3	1	5	5	5	5	5	0	0	5	38.6	1.06	109	139	171.08

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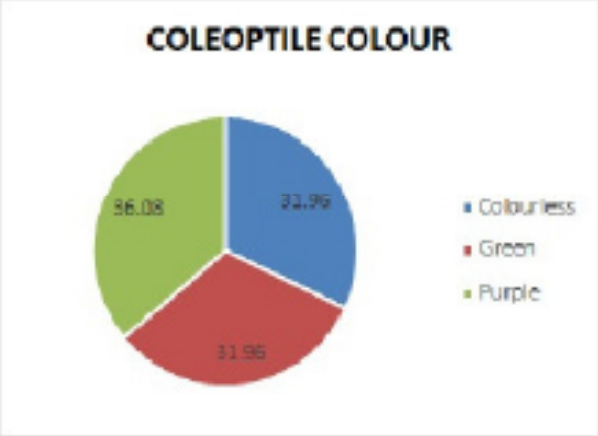
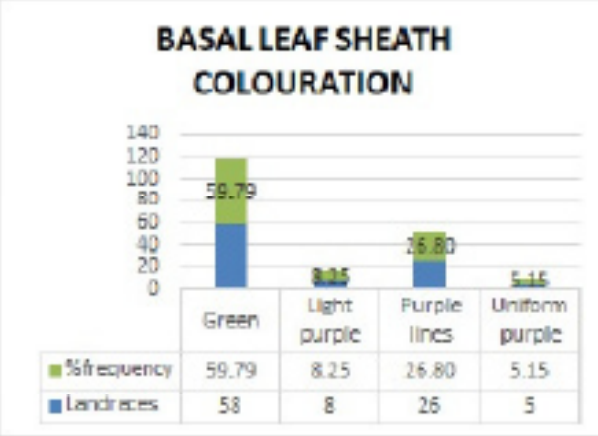
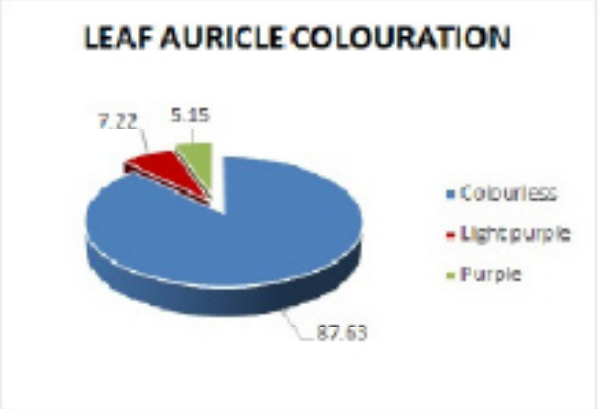
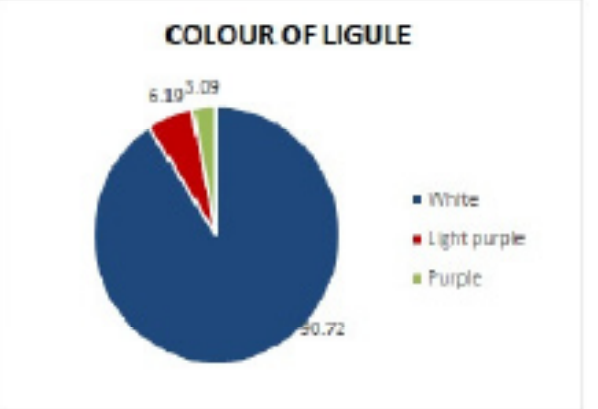
67	Periya Sandigar	3	2	3	9	9	1	9	1	9	3	1	3	1	5	1	7	0	0	3	48.2	1.24	102	132	177.2
68	Kattuyanam	1	2	3	9	9	1	9	1	9	3	1	5	5	1	5	3	0	0	5	44.0	1.10	108	138	147.9
69	Varakkal	1	3	7	1	1	1	9	1	9	3	1	3	3	5	3	3	0	0	7	38.6	1.08	93	123	162.24
70	Kaviya Samba	1	1	3	1	1	3	9	1	9	3	1	3	5	2	5	5	0	0	7	36.0	1.16	111	141	168.3
71	Thillainayagam	3	1	5	1	1	1	9	1	9	3	1	5	5	2	5	5	0	0	3	39.0	1.00	106	136	163.4
78	Norungan	3	3	7	1	1	1	9	1	9	3	1	3	1	4	1	5	0	0	5	48.6	0.96	110	140	143.18
73	Kavuni	3	4	3	9	9	1	9	3	9	3	3	3	5	4	5	5	0	0	5	34.2	1.12	115	145	156.4
74	Senkar	1	3	3	1	1	1	9	1	9	3	1	5	1	1	1	3	0	0	5	30.4	1.00	93	123	138.43
75	Murugankar	3	3	7	1	1	1	9	1	9	3	1	5	3	5	3	3	0	0	3	35.2	1.00	92	122	153.6
76	Kudaivazhai	3	1	5	1	1	1	9	1	9	3	1	5	1	5	1	3	0	0	3	27.6	1.00	93	123	171.4
77	Kuruvai Kalanjiyam	3	3	5	1	1	1	9	2	9	3	2	5	1	5	1	3	0	0	7	35.6	1.00	90	120	158.8
78	Palkachaka	1	1	7	1	1	1	9	1	9	3	1	3	1	1	1	3	0	0	3	40.4	1.26	101	131	
79	Sorna kuruvai	3	3	5	1	1	1	9	1	9	3	1	1	7	5	7	3	0	0	7	37.5	1.00	102	132	188.2
80	Thogai Samba	1	3	7	1	1	3	9	1	9	3	1	1	3	1	3	5	0	0	3	35.6	1.00	94	124	163.4
81	Malayalathan Samba	2	3	5	1	1	1	9	1	9	3	1	3	1	4	1	5	0	0	5	40.2	1.00	101	132	140.6
82	Kattikar	2	3	3	1	1	1	9	1	9	3	1	3	5	1	5	3	0	0	5	37.6	1.26	103	133	177.4
83	Kaatu ponni	3	1	7	1	1	1	9	1	9	3	1	5	1	5	1	5	0	0	3	36.6	1.00	94	124	182.8
84	Kalarkar	1	1	3	1	1	1	9	1	9	3	1	3	3	1	3	5	0	0	5	41.4	1.00	88	118	153.4
85	Rama kuruvaikar	3	3	7	1	9	1	9	1	9	3	1	5	3	5	3	5	0	0	3	31.0	1.00	74	104	152.0
86	Aarkadu kichili	3	2	5	1	1	1	9	1	9	3	1	5	3	5	3	3	0	0	3	50.0	0.98	101	131	106.2
87	Matta kuruvai	3	3	7	1	1	1	9	1	9	3	1	3	1	5	5	3	0	0	3	30.8	1.00	82	112	158.0
88	Karuthakar	1	3	7	1	9	1	9	1	9	3	1	5	3	1	3	3	0	0	5	35.4	1.08	79	109	171.2
89	Katta Samba	3	2	3	1	1	1	9	2	9	3	1	1	3	5	3	5	0	0	3	51.2	1.12	80	110	129.8
90	Red Sirumani	3	3	5	1	1	1	9	1	9	3	1	5	5	4	5	5	0	0	5	46.6	1.00	64	94	125.6
91	Ponmani Samba	3	3	7	1	1	1	9	1	9	3	1	1	3	5	3	5	0	0	7	29.0	1.00	90	120	177.6
92	Kaliyan Samba	1	3	7	1	1	1	9	1	9	3	1	5	3	5	3	3	0	0	7	41.8	1.00	108	138	175.9
93	Kalli madaiyan	3	3	7	1	1	1	9	1	9	3	1	5	3	5	3	5	0	0	3	45.6	1.08	82	112	127.52
94	Karungan	2	3	3	1	9	1	9	1	9	3	1	1	3	5	3	3	9	5	5	48.6	1.02	82	112	138.82
95	Mikuruvai	3	3	5	1	1	1	9	1	9	3	1	3	3	5	3	3	0	0	5	33.6	1.00	100	132	180.4
96	Vellaikudai vazhai	3	3	7	1	1	1	9	1	9	3	2	5	5	4	3	7	0	0	3	57.6	1.42	108	138	198.8
97	Vadakathi Samba	1	3	7	1	1	1	9	3	9	3	2	1	1	3	1	1	0	0	3	43.8	1.74	94	124	174.6

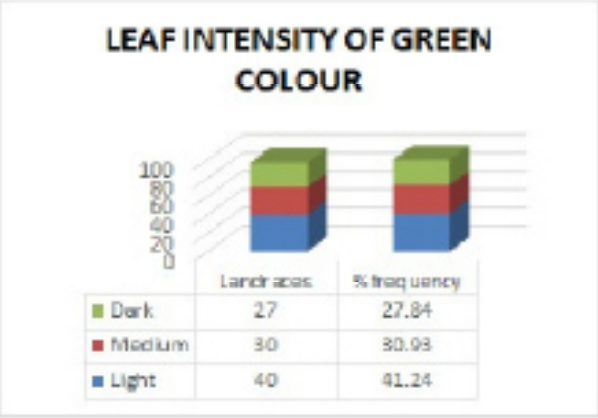
(A) Coleoptile, (B) Basal leaf: Sheath colour, (C). Leaf: intensity of green colour, (D) Leaf :Anthocyanin colouration,(E). Leaf sheath: anthocyanin colouration, (F) Leaf: Pubescence of blade surface, (G) Leaf: auricles, (H) Leaf: anthocyanin colouration of auricles, (I) Leaf:ligule, (J) Leaf : shape of ligule, (K) Leaf : colour of ligule, (L) Culm: attitude, (M) Flag leaf : attitude of blade (early observation), (N) Spikelet: Colour of stigma, (O) Flag leaf : attitude of blade (late observation), (P) Panicle : curvature of main axis, (Q) Panicle : awns, (R) Panicle : distribution of awns, (S) panicle : exertion, (T) Leaf: length of blade (U) Leaf: length of width, (V) Time of heading (50% of plants with panicle), (W) Time maturity, (X) Stem: length

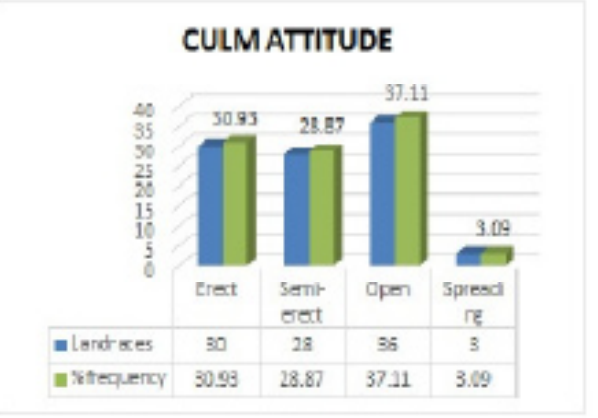

COLEOPTILE COLOUR
33.99
31.96
34.08
Colourless
Green
Purple

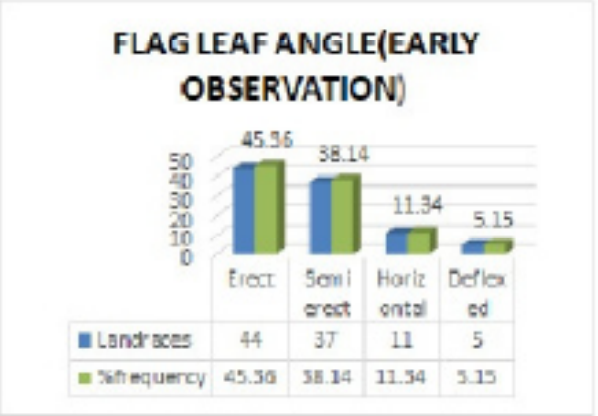

BASAL LEAF SHEATH COLOURATION
140
120
100
80
60
40
20
0
59.79
8.25
26.80
5.15
Green
Light purple
Purple lines
Uniform purple
%frequency 59.79 8.25 26.80 5.15
Landraces 58 8 26 5


LEAF AURICLE COLOURATION
7.22
5.15
87.63
Colourless
Light purple
Purple


COLOUR OF LIGULE
6.19
3.09
90.72
White
Light purple
Purple


LEAF INTENSITY OF GREEN COLOUR
100
80
60
40
20
0
Landraces
%frequency
Dark 27 27.84
Medium 30 30.93
Light 40 41.24


CULM ATTITUDE
40
35
30
25
20
15
10
5
0
30.93
28.87
37.11
3.09
Erect
Semi-erect
Open
Spreading
Landraces 30 28 36 3
%frequency 30.93 28.87 37.11 3.09


FLAG LEAF ANGLE(EARLY OBSERVATION)
50
40
30
20
10
0
45.36
38.14
11.34
5.15
Erect
Semi erect
Horizontal
Deflexed
Landraces 44 37 11 5
%frequency 45.36 38.14 11.34 5.15

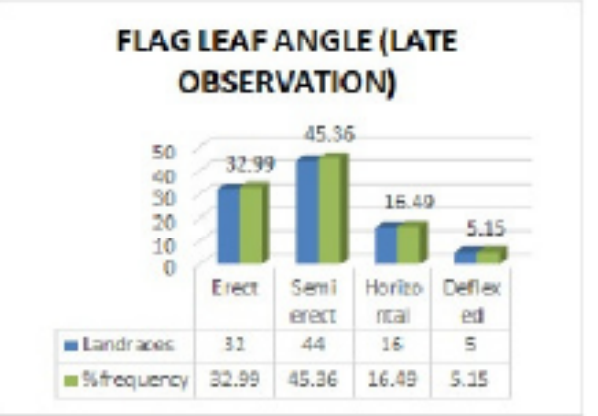

FLAG LEAF ANGLE (LATE OBSERVATION)
50
40
30
20
10
0
32.99
45.36
16.49
5.15
Erect
Semi erect
Horizontal
Deflexed
Landraces 33 44 16 5
%frequency 32.99 45.36 16.49 5.15

Fig 1. Characterization of rice landraces based on DUS guidelines

basal leaf sheath colouration, leaf- colour of auricle, leaf-ligule and leaf intensity of green colour, culm attitude, flag leaf attitude, panicle exsertion, panicle curvature, stem length, days to heading and time of maturity were represented in graphical form in **Fig.1**. Out of 97 landraces studied, 36.08 % landraces recorded purple coloured coleoptile and 31.96 % were colourless and 31.96% were green in colour. The basal leaf sheath colour was present in 56.79% of land races with green, 40.21% of landraces which are varied from light purple to purple with 8.25% light purples, 26.80% possessing purple lines and 5.16% landraces with uniform purple colour. With respect to the leaf intensity of green colour, 41.24% of landraces exhibited light green colour, 30.93% landraces observed medium intensity for green colour and 27.84% showed dark green colour. Lahkar and Tanti (2017) also reported similar results in landraces. Leaf anthocyanin colouration was present only in eight landraces, in which two landraces had shown purple colouration in whole plant (Purple puttu and Chittan samba) while six landraces had shown anthocyanin only on leaf blade. Similar result was reported earlier by Umarani *et al.* (2017). Regarding the leaf pubescence of blade surface, only 8.25% landraces were pubescent whereas remaining 91.75% were glabrous. Leaf auricles were present in all the landraces and kallurundaikar, purple puttu, vadakathisamba, chittan

samba and kavuni had uniform purple coloured auricles and 7.22% landraces exhibited light purple and it was akin with earlier reports of Sakthi Avinash *et al.* (2019). In case of leaf ligule, all the landraces recorded for its presence with split shape ligule. White coloured ligule occurred in most of the landraces and six landraces had light purple colour ligule and three landraces *viz*., purple puttu, chittan samba and salem had an uniform purple coloured ligule.

Pertaining to the spikelet colour of stigma, 49.48% of genotypes had white colour, 4.12% light green colour where as in the remaining genotypes, 9.28%, 14.43%, 22.68% for yellow, light purple, and purple coloured stigma respectively. Similar report was also given earlier by Sakthi Avinash *et al*. (2019). Wide variation has been recorded among the genotypes for the trait, flag leaf attitude of blade in early observation, with 45.36% erect type; 38.14% semi erect type; 11.34% horizontal type and 5.15% of landraces deflexed type. In late observation, 32.99% erect type, 45.36% semi erect type, 16.49% horizontal type and 5.15% drooping type while Kalyan *et al.* (2017) reported 85.71% as erect and 14.29% as semi erect. In case of panicle exertion, 32.99% were partially exerted, 38.14% mostly exerted and 28.87% well exerted type. Similar results were reported earlier by Sakthi Avinash *et al.* (2019). The genotypes namely vellaigundu samba, ariyan red, valsamba and karungan exhibited the presence of awns which are distributed in whole length of the panicle. Manjunatha *et al.* 2018) also reported the absence of awns in most of the genotypes taken for the study whereas Chakravorty and Ghosh (2012) reported panicle distribution of awns at tip only in most of the germplasm studied. For the character culm attitude, 30.93% landraces were erect type, 28.87% semi erect type, 37.11% open type, 3.09% were spreading type. Keerthivarman *et al.* (2019) reported that 51.35% landraces were of semi erect type, 32.43% were open type and 16.21% were erect type.

In case of stem length, 3.09% landraces were very short, 4.12% short, 7.22% medium, 23.71% were long and 61.86% were very long type. Panamara samba (48.8cm) recorded very short stem length followed by Thooyala (52.4cm) and arupatham samba (52.6cm) whereas the longest stem length was observed in karthigai samba (212.5cm). The genotypes *viz*., senthooram (93.4cm) and Seevnsamba (110cm) recorded a short stem length with erect culm and these genotypes can be used as donor for lodging resistance in rice improvement programme. Similar reports were earlier reported by Kumaresan and Manonmani (2019). The trait leaf length of blade, 8.25% land races were of short, 61.86% of medium and 29.90 % of long leaf type. With respect to the leaf width of blade 11.34% were narrow, 87.63% were medium and 1.03% was broad leaf type. The time of heading (50% of flowering) was observed on plot basis in which two landraces *viz*., red sirumani (64 days) and ayyan samba (67 days) were found to be very early (<71days) and one landrace was very late type (>131days). In the remaining, 40.21% were early (71-90 days), 53.61% were medium (91-110) and 3.09% were late (111-130days) duration types. Efendi *et a.l* (2015) also reported wide variation in heading from 63.2 to 108.2days. For the character time of maturity, two land races *viz*., red sirumani (94 days) and ayyan samba (97 days) were matured in <100 days, 40.21% landraces were early (101-120 days), 53.61% were medium (121-140 days), 3.09% were late (141-160 days) and one landrace vellaichithiraikar (171 days) was very late (>160 days) duration type. In the present study, it was concluded that the land races ayyan samba and red sirumani may be used as a donor for the development of short duration; senthooram and seevan samba for dwarf and lodging resistance in rice breeding programme. The genotypes purple puttu and chitan samba had uniform purple colour in whole plants are used as morphological marker in rice improvement programme.

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