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Morphological characterization of popular rice varietiesof Zone VIII and Zone IX of Karnataka State

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ABSTRACT
The present investigation was carried out during Kharif 2016 at AICRIP, Agricultural Research Station, Mugad, UAS Dharwad. Among 56 characters studied, the variation was observed in37 characters viz., Coleoptile colour, Basal leafsheath colour, intensity of green colour, Leaf sheath colouration, Leaf sheath: intensity anthocyanin colouration, Leaf: pubescence of blade surface, Leaf: anthocyanin colouration of auricles, Leaf: colour of ligule, Leaf: length of blade, Leaf: width of blade, Culm: attitude, Time of heading, Flag leaf: attitude of blade, Lemma: anthocyanin colouration of apex, Spikelet: colour of stigma, Stem: thickness, Stem: length and anthocyanin colouration of internodes,Panicle: length of main axis, Flag leaf: attitude of blade (late observation), Panicle: curvature of main axis, Panicle: number per plant, Lemma and palea: colour, Panicle: awns, Panicle: colour of awns (late observation), Panicle: length of longest awn, Panicle: distribution of awns, Panicle: presence of secondary branching, Panicle: attitude of branches, Panicle: exertion, Time maturity (days), Grain: weight of 1000 fully developed grains, Grain: length, Grain: width, Decorticated grain: length, Decorticated grain: width, Decorticated grain: shape (in lateral view), Decorticated grain: aroma.
Keywords: *Morphological characters, Intan, Abhilash, Hemavathi, MGD 101, Mugad suganda, SIRI 1253, Asha and PSB 68*

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INTRODUCTION

Rice (*Oryza sativa* L.) is one of the most important crops in the world. Due to the emphasis placed on early planting, rapid and uniform emergence, the quality of seed production is an important issue in rice (Wang *et al.,* 2010; Cheng *et al*., 2013). Seed development, maturity and harvest management are critical considerations for maintaining high seed quality (Bewley *et al*., 2013).The need for improving rice production does not only depend on rice crop and management technologies, but also on the suitability of rice varieties, which must be drawn from existing germplasm that has been collected and conserved by national, regional or international genetic resource centers. Detailed evaluation and characterization of available rice genotypes is one of the main prerequisites in conservation and sustainable utilization of rice genetic resources. This ensures that maximum variation is captured in designing breeding strategies aimed at increasing productivity.

As the existing UPOV models of plant variety protection were not suitable for Indian requirements, 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 distinctness, uniformity and stability are thus fundamental to the characterization of a variety as a unique creation. Registration is allowed for three types of plant varieties 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 programmes. Thus characterization of these varieties will further contribute towards creating genetic database for breeding programmes strategies in the region.

MATERIALS AND METHODS

The field experiment in 2016 was laid out at Agricultural Research Station, Mugad. It is situated at North latitude of 15^0 50 and the East longitude of 75^0 40, with an altitude of 697 m above mean sea level. The experimental material comprised of eight rice genotypes (Intan, Abhilash, Hemavathi, MGD 101, Mugad suganda, SIRI 1253, Asha and PSB 68). Eight genotypes were used as experimental material; the details of the material used are mentioned in table 1. The crops were grown in a randomized complete block design with two replications to conduct DUS characterization during *kharif,* 2016, at All India Co-ordinate Rice improvement Project (AICRIP), University of Agricultural Sciences, Dharwad. Each entry was sown in three rows of 2m length at spacing of 20 cm between rows and 15 cm between plants. Crop was raised following recommended package of practices. Observations were recorded on five randomly chosen plants of each genotype per replication for 56 morphological traits.

RESULTS AND DISCUSSION

Qualitative and quantitative characters of eight rice varieties at seedlings stage are presented in table (2). Among eight rice genotypes variation was observed, the characters coleoptile: colour was purple in Intan and Asha. Green in case of Abhilash, Hemavathi, MGD 101, Mugad suganda, SIRI 1253 and PSB 68. Basal leaf: sheath colour was light purple in Intan and Asha. Green in Abhilash, Hemavathi, MGD 101, Mugad suganda, SIRI 1253 and PSB 68.Graham (1913) classified the Indian rice varieties based on leaf sheath colour and then on grain dimensions. Leaf: intensity of green colour was medium in Intan, Abhilash, Hemavathi, MGD 101, Mugad suganda, SIRI 1253, PSB 68 and dark in Asha.Leaf sheath: anthocyanin colouration was present in Intan and Asha but absent in remaining six genotypes. Leaf sheath: intensity anthocyanin colouration was medium in Intan strong in Asha. Leaf: pubescence of blade surface was medium in Intan, Hemavathi, MGD 101 and Asha. But strong in Abhilash, Mugad suganda, SIRI 1253 and PSB 68. Leaf: anthocyanin colouration of auricles was light purple in Intan, purple in Asha and colourless in Abhilash, Hemavathi, MGD 101, Mugad suganda, SIRI 1253 and PSB 68. Leaf: colour of ligule was light purple in Intan and Asha. Remaining genotypes were white in colour. Leaf: length of blade was medium (30-45cm) in Intan andall other genotypes were long (>45cm). Leaf: width of blade was narrow (<1cm) in Intan and Asha. Medium (1-2cm) in Abhilash, Hemavathi, MGD 101, Mugad suganda, SIRI 1253 and PSB 68. Culm: attitude semi erect in Intan, Hemavathi and Asha. Open in Abhilash, MGD 101, Mugad suganda, SIRI 1253 and PSB 68. Time of heading (50% of plants with panicles) was late (111-130 days) in Abhilash, MGD 101, Mugad suganda,SIRI 1253 andvery late (>131 days) in case of Intan, Hemavathi, Asha, PSB 68. Flag leaf: attitude of blade (early observation) was erect in Abhilash, semi erect in other seven genotypes. Lemma: anthocyanin colouration of apex was strong in Intan, medium in Asha and absent in remaining genotypes. Spikelet: colour of stigma was purple in Intan, Asha and remaining genotypes were white. Stem: thickness was medium (0.40-0.55cm) in Mugad suganda, SIRI 1253, Asha and PSB 68 and thick (>0.55cm) in Intan, Abhilash Hemavathi and MGD 101. Stem: length (excluding panicle; excluding floating rice) was very short in (<91 cm) in SIRI 1253, Asha. Short (91-110 cm) in Mugad suganda, PSB 68.Medium (111-130 cm) in Intan, Hemavathi, MGD 101 and long (131-150 cm) in Abhilash.This was in accordance with Siddiqui *et al*. (2007) who reported that the Pakistan rice genetic resources showed a great diversity for all the measured grain morphological characters. The level of demarcation was high in this quantitative grain characters compared to qualitative characters. Since in qualitative characters there is a high chance of merging of their states of expression as they are continuous or discrete giving room for human error.

There was no variation observed with respect to Leaf: anthocyanin colouration was absent in all eight genotypes. Leaf: distribution of anthocyanin colour was not observed in case of all genotypes, Leaf: auricles, Leaf: collar was present in all genotypes. Leaf: anthocyanin colouration of collar was absent in all genotypes. Leaf: ligule was present in eight genotypes. Leaf: shape of ligule split ligule was observed in all genotypes. Spikelet: density of pubescence of lemma was weak in all eight rice genotypes. Male sterility, Lemma: anthocyanin colouration of keel, Lemma: anthocyanin colouration of area below apex, Stem: anthocyanin colourarion of nodes was absent in all eight rice genotypes Stem: Intensity of anothocyanin colouration of nodes was not observed in all genotypes. Stem: anthocyanin colourarion of internodes was absent in all genotypes.

Qualitative and quantitative characters of eight rice genotypes at maturity stage are presented in table (3).Among eight rice genotypes variations were observed, the characters panicle: length of main axis was medium (21-25cm) in Abhilash, MGD 101, Mugad suganda, SIRI 1253, Asha, PSB 68 and long (26-30cm)

panicle in Intan and Hemavathi. Flag leaf: attitude of blade (late observation) of which erect in PSB 68, semi-erect in Intan, Hemavathi, MGD 101, Mugad suganda, SIRI 1253, Asha and Horizontal in Abhilash. Panicle: curvature of main axis was deflexed in Intan, Abhilash, Hemavathi, MGD 101, Mugad suganda, SIRI 1253, Asha and Dropping in PSB 68. Kumar *et al.* (1997) studied the variability in 112 samples of wild rice varieties to their habitat and grouped into four categories *viz*., erect, semi erect, semi spreading and spreading types. Panicle: number per plant was Few (<11) in Intan, Mugad suganda, Asha and Medium (11-20) in Abhilash, Hemavathi, MGD 101, SIRI 1253, PSB 68. Lemma and palea: colour was straw in Intan, MGD 101, Mugad suganda, SIRI 1253, Asha, PSB 68 and gold and gold furrows on straw background in Abhilash, Hemavathi. Panicle: awns was absent in Intan, Abhilash, Hemavathi, MGD 101, SIRI 1253, Asha, PSB 68 and present in Mugad suganda. Panicle: colour of awns (late observation) was yellowish white in Mugad suganda. Panicle: length of longest awn was medium in Mugad suganda. Panicle: distribution of awns was observed on tip only in Mugad suganda. Panicle: secondary branching was strong in Intan, Hemavathi, MGD 101, SIRI 1253, Mugad suganda, Asha, PSB 68 and clustered in Abhilash. Panicle: attitude of branches was semi-erect in Intan, Abhilash, Hemavathi, MGD 101, SIRI 1253, Mugad suganda, PSB 68 and Semi-erect to spreading in PSB 68. Panicle: exertion was partly exerted in SIRI 1253, Mugad suganda, PSB 68, mostly exerted in Abhilash, Hemavathi, Asha and well exerted in MGD101. Time maturity (days) was late (141-160) in Intan, Abhilash, MGD 101, SIRI 1253, Mugad suganda, PSB 68 and very late (>160) in Hemavathi, Asha.Shrivastava *et al.*(2015) studied on characterization of thirty lines of rice for morphological and agronomical characters namely, leaf-pubescence on blade surface, culm attitude, time of heading, spikelet density of pubescence of lemma, spikelet: colour of stigma, stem length, panicle: length of main axis, flag leaf attitude of blade (late observation), panicle: curvature of main axis, panicle number per plant, spikelet-colour of tip of lemma, lemma and palea colour, panicle awns, panicle: colour of awns, panicle: distribution of awns, panicle secondary branching, panicle: attitude of branches, panicle exertion, time-maturity, grain weight of 1000 fully developed grains, grain length and grain width genotypes showed distinctiveness. \

Grain: weight of 1000 fully developed grains was very low (<15 g) in SIRI 1253, low (15-20 g) in Intan, Asha, medium (21-25 g) in Hemavathi, Mugad suganda, high (26-30) in Abhilash, MGD101, PSB 68. Grain: length was short (6.1-8.5 mm) in SIRI 1253, Asha, medium (8.6-10.5 mm) in Intan, Abhilash, Hemavathi, MGD 101, SIRI 1253, Mugad suganda, PSB 68 and long in Mugad suganda. Grain: width was narrow (2.1-2.5 mm) in Intan, Abhilash, Hemavathi, SIRI 1253, Mugad suganda, Asha, PSB 68, medium (2.6-3.0 mm) in MGD 101. Decorticated grain: length was short in SIRI 1253, medium in Intan, Abhilash, Hemavathi, Asha, and long in Mugad suganda, PSB 68. Decorticated grain: width was medium (2.0-2.5 mm) in Intan, Abhilash, Hemavathi, SIRI 1253, Mugad suganda, Asha, PSB 68 and Broad (>2.5 mm) in MGD 101. Decorticated grain: shape (in lateral view) was short slender in SIRI 1253, medium slender in Intan, Abhilash, Hemavathi, SIRI 1253, Asha, PSB 68 and long slender in Mugad suganda. Decorticated grain: aroma was present in Mugad suganda but absent in all other genotypes. Rimpi *et al.* (2008) characterized 12 rice varieties on the basis of hulled and un-hulled grain characters like grain length, grain colour, grain width, decorticated grain length, decorticated grain width, decorticated grain colour L/B ratio and 1000 grain weight. Vigneshwari *et al.* (2014) studied on morphological characterization of 13 paddy varieties using 31 morphological traits. The results of morphological characterization clearly indicated that the plant characters showed no variation among the varieties, while the grain characters showed clear variation among the varieties.

Spikelet: colour of tip of lemma was brown in all eight genotypes. Panicle: presence of secondary branching was present in all genotypes. Leaf: senescence was late in all genotypes. Sterile lemma:colour was straw in all eight genotypes. There was no variation observed with respect to decorticated grain: colour in all genotypes.

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Table 1. Genotypes used and its salient features

Sl. No.	Genotypes	Duration (days)	Salient features	Average Yield	Suitable zone
1.	Intan	160-170	Resistant to blast disease	50-55q/ha	Northern transition zone and hill zone
2.	Abhilash	155-165	High yielding, tolerant to cold. Moderately resistant to stem borer, bacterial leaf blight and blast. Suitable for summer planting.	55-60 q/ha	Northern transition zone and hill zone (lowland)
3.	Hemavathi	160-170	Tolerant to leaf and neck blast. Grain is white and medium fine similar to Intan and has better cooking quality than Intan	50-55q/ha	Hill zone
4.	MGD 101	125-130	Semi dwarf (100-110cm), grains-MB, resistant to leaf blast, neck blast, moderate resistance to LF.	38-45 q/ha	Karnataka (upland)
5.	Mugad suganda	130-135	Dwarf (65cm), grains-long slender, moderate resistant to blast, neck blast and BPH. Moderate tolerant to LR.	32-35 q/ha	Midland
6.	SIRI 1253	135-140	Semi dwarf (80-85cm), grains-MB, resistant to leaf blast, neck blast and BPH. High yielding and fine grained; good quality.	45-50 q/ha	Karnataka (lowland)
7.	Asha	160-165	Suitable for par boiling, puffing and flaking. This new variety (Asha IET 9926) is tolerant to blast, Brown Plant Hopper (BPH) and also multiple pest-resistant.	60-65 q/ha	Hilly Zone, heavy rainfall area (lowland)
8.	PSB 68	140-145	High yielding suitable for puffing and flaking	50-55 q/ha	Lowland

Table 2. Qualitative and quantitative characters of eightrice genotypes at seedlings stage

SN	Genotype	Coleoptile: Colour	Basal Leaf: Sheath	Leaf: Intensity of green	Leaf: Anthocyanin colouration	Leaf: Distribution of anthocyanin colour	Leaf Sheath: Anothhocyanin colouration	Leaf sheath: Intensity of anthocyanin colouration	Leaf: Pubescence of blade surface	Leaf: Auricles	Leaf: anthocyanin colouration of auricles	Leaf: collar	Leaf: Anthocyanin colouration of collar	Leaf: Ligule	Leaf: Shape of ligule	Leaf: Colour of ligule	Leaf: Length of blade	Leaf: Width of blade	Culm: attitude	Time of heading (50% of plants with panicles) days	Flag leaf: Attitude of blade (early observation)	Spikelet: Density of pubiscence of lemma	Male sterility	Lemma: Anthocyanin colouration of keel	Lemma: Anthocyanin colouration of area below apex	Lemma: Anthocyanin colouration of apex	Spikelet: Colour of stigma	Stem: Thickness	Stem: Length (excluding panicle; excluding floating rice)	Stem: Anthocyanin colouration of nodes	Stem: Intensity of anothocyanin colouration of nodes	Stem : Anthocyanin colouration of internodes
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
1	Intan	3	2	5	1	-	9	5	5	9	2	9	1	9	3	2	5	3	3	9	3	3	1	1	1	7	5	7	5	1	-	1
2	Abhilash	2	1	5	1	-	1	-	7	9	1	9	1	9	3	1	7	5	5	7	1	3	1	1	1	1	1	7	7	1	-	1
3	Hemavathi	2	1	5	1	-	1	-	5	9	1	9	1	9	3	1	7	5	3	9	3	3	1	1	1	1	1	7	5	1	-	1
4	MGD 101	2	1	5	1	-	1	-	5	9	1	9	1	9	3	1	7	5	5	7	3	3	1	1	1	1	1	7	5	1	-	1
5	Mugad suganda	2	1	5	1	-	1	-	7	9	1	9	1	9	3	1	7	5	5	7	3	3	1	1	1	1	1	5	3	1	-	1
6	SIRI 1253	2	1	5	1	-	1	-	7	9	1	9	1	9	3	1	7	5	5	7	3	3	1	1	1	1	1	5	1	1	-	1
7	Asha	3	2	7	1	-	9	7	5	9	3	9	1	9	3	2	7	3	3	9	3	3	1	1	1	5	5	5	1	1	-	1
8	PSB 68	2	1	5	1	-	1	-	7	9	1	9	1	9	3	1	7	5	5	9	3	3	1	1	1	1	1	5	3	1	-	1

Table 3. Qualitative and quantitative characters of eightrice genotypes at maturity stage

SN	Genotype	Panicle: length of main axis	)bservation)Flag leaf : attitude of blade (late	Panicle: curvature of main axis	Panicle: number per plant	Spikelet: colour of tip of lemma	Lemma and palea: colour	Panicle: awns	Panicle: colour of awns (late observation)	Panicle: length of longest awn	Panicle: distribution of awns	Panicle: presence of secondary branching	Panicle: secondary branching	Panicle: attitude of branches	Panicle: exsertion	Time maturity (days)	Leaf: senescence	Sterile lemma: colour	grainsGrain: weight of 1000 fully developed	Grain: length	Grain: width	Decorticated gran: length	Decorticated gran: width	Decorticated grain: shape (in lateral view)	Decorticated grain: colour	Decorticated grain: aroma
		32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56
1	Intan	7	3	5	3	3	1	1	-	-	-	9	2	5	7	7	7	1	3	5	3	3	5	3	1	1
2	Abhilash	5	5	5	5	3	2	1	-	-	-	9	3	5	5	7	7	1	7	5	3	3	5	3	1	1
3	Hemavathi	7	3	5	5	3	2	1	-	-	-	9	2	5	5	9	7	1	5	5	3	3	5	3	1	1
4	MGD101	5	3	5	5	3	1	1	-	-	-	9	2	5	7	7	7	1	7	5	5	3	7	3	1	1
5	Mugad Suganda	5	3	5	3	3	1	9	1	3	1	9	2	5	3	7	7	1	5	7	3	5	5	5	1	9
6	SIRI 1253	5	3	5	5	3	1	1	-	-	-	9	2	5	3	7	7	1	1	3	3	1	5	1	1	1
7	Asha	5	3	5	3	3	1	1	-	-	-	9	2	5	5	9	7	1	3	3	3	3	5	3	1	1
8	PSB 68	5	1	7	5	3	1	1	-	-	-	9	2	7	3	7	7	1	7	5	3	5	5	3	1	1

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