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SHORT COMMUNICATION

Morphological Characterization of Rice (*Oryza sativa* L.) Landraces of the Hilly Zone of Karnataka

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Rice landraces of hilly zone of Karnataka were characterized for distinctness and uniformity according to DUS test guidelines of PPV & FR authority. Grain characters *viz.,* hulled and non-hulled, grain length and width exhibited distinctness among the genotypes. The grain yield of *Bangaarugandu*, *Bagyajyothi*, *Ratnachudi*, *Balaji* and *Kempudoddi* landraces was more than check (*Jyothi*). Rice landraces of hilly zone of karnataka evaluated in this study were found to be distinct and uniform with respect to DUS traits and yield characters and hence may be considered for crop improvement programme for various agronomic and quality traits.

Key Words: Local genotypes, DUS test, Anthocyanin, Rice, Yield

India has rich and wide genetic wealth of rice cultivars. It has been estimated from various surveys that nearly 50,000 cultivars of rice is being grown in the country. From the dawn of agriculture, rice is being cultivated by farmers using manually selected seeds. Such an art is still in practice with the rice growing farmers. These varieties are referred to as landraces. The landraces are valuable as they possess a huge treasure of genetic material which may prove valuable in future crop improvement programmes. Landraces or local types have been used as the sources for the characters such as resistance to pest, disease, abiotic stresses and gene sources for some physico-chemical characters. Information regarding such aspects is incomplete and hence it is necessary to collect and conserve landraces of rice (Sinha and Mishra, 2012).

Various types of landraces of rice are available in the major rice growing regions of Karnataka and hence, their characterization and establishment of uniformity is essential to consider them as variety and can be protected under PPV & FR act. More than their registration as a variety, a better performing local type may be utilized in crop improvement programme as genetic resource.

Introduction of high yielding, semi-dwarf and fertilizer responsive verities of rice has ushered green revolution in India with accompanied loss of farmers own local genotypes (Srivastava and Jaffee, 1993). Characterization also serves an important operation of gene bank for better utilization of genotypes. Germplasm with unique traits can serve as good parent for hybridization programme. With the above back ground and scope a study was conducted to characterize the local rice genotypes for their distinctness and uniformity.

Seeds of 49 rice landraces were collected from Organic Farming Research Institute, UAHS, Shivamogga (Table 1). Landraces were evaluated according to 7×7 simple lattice statistical design with two replications during *Kharif*-2013 following 20 cm between rows × 15 cm between plant spacing. Recommended package of practices were followed to grow healthy crop. Ten plants were randomly selected from each landrace in each replication to record the observations on plant characters according to the national DUS test guidelines on rice (Shobarani *et al.*, 2004).

Forty-five plant morphological and 15 quantitative characters were recorded at various stages *viz.,* coleoptiles stage, booting stage, first spikelet of inflorescence just visible stage, half inflorescence emerged stage, beginning of anthesis stage, anthesis half way stage, milk development stage, dough development stage, ripening stage and caryopsis hard stage on single or group plants and measurement of single or group of plants. The data on yield and yield related parameters were analyzed using *SAS v9.2 software*.

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Table 1. Passport data of rice landraces considered in the present study

Code	Genotype	Passport details
L1	Bangaarasanna	Kushi parivara (NGO), Thirthahalli, Shivamogga, Karnataka
L2	Kempujaddu	Kushi parivara (NGO), Thirthahalli, Shivamogga, Karnataka
L3	Kiruvaani	Kushi parivara (NGO), Thirthahalli, Shivamogga, Karnataka
L4	Aaadribatta	Kushi parivara (NGO), Thirthahalli, Shivamogga, Karnataka
L5	Siggikaima	Mruthyunjaya, H. (Farmar), Hugudi, Hosanagara, Karnataka
L6	Beemassale	Mruthyunjaya, H. (Farmar), Hugudi, Hosanagara, Karnataka
L7	Mukkanna	Mruthyunjaya, H. (Farmar), Hugudi, Hosanagara, Karnataka
L8	Bagyajyothi	Basavaraj, A.S. (Farmar), Angerasu, Thirthahalli, Karnataka
L9	Kaalajeera	Basavaraj, A.S. (Farmar), Angerasu, Thirthahalli, Karnataka
L10	Aaravattelu	Basavaraj, A.S. (Farmar), Angerasu, Thirthahalli, Karnataka
L11	Puttabatta	Raju, H.R. (Farmar), Hugudi, Hosanagara, Karnataka
L12	Kaagisaale	Raju, H.R. (Farmar), Hugudi, Hosanagara, Karnataka
L13	Karijaadu	Raju, H.R. (Farmar), Hugudi, Hosanagara, Karnataka
L14	Barathanachudi	Raju, H.R. (Farmar), Hugudi, Hosanagara, Karnataka
L15	Rajbog	Basavaraj, A.S. (Farmar), Angerasu, Thirthahalli, Karnataka
L16	Raychursanna	Mruthyunjaya, H. (Farmar), Hugudi, Hosanagara, Karnataka
L17	Kichadisaayi	Mruthyunjaya, H. (Farmar), Hugudi, Hosanagara, Karnataka
L18	Sugandi	Kushi parivara (NGO), Thirthahalli, Shivamogga, Karnataka
L19	Kerekaaqlumuttiga	Kushi parivara (NGO), Thirthahalli, Shivamogga, Karnataka
L20	Bangaarugandu	Kushi parivara (NGO), Thirthahalli, Shivamogga, Karnataka
L21	Yelatakkigidda	Mruthyunjaya, H. (Farmar), Hugudi, Hosanagara, Karnataka
L22	Kempukaaru	Mruthyunjaya, H. (Farmar), Hugudi, Hosanagara, Karnataka
L23	Aaanekombinabatta	Basavaraj, A.S. (Farmar), Angerasu, Thirthahalli, Karnataka
L24	Sannakki	Raju, H.R. (Farmar), Hugudi, Hosanagara, Karnataka
L25	Gajagunda	Raju, H.R. (Farmar), Hugudi, Hosanagara, Karnataka
L26	Balaji	Raju, H.R. (Farmar), Hugudi, Hosanagara, Karnataka
L27	Holesaalachipiga	Mruthyunjaya, H. (Farmar), Hugudi, Hosanagara, Karnataka
L28	Dappabatta	Basavaraj, A.S. (Farmar), Angerasu, Thirthahalli, Karnataka
L29	Misebatta	Basavaraj, A.S. (Farmar), Angerasu, Thirthahalli, Karnataka
L30	Ippattu	Kushi parivara (NGO), Thirthahalli, Shivamogga, Karnataka
L32	Kanadathumba	Kushi parivara (NGO), Thirthahalli, Shivamogga, Karnataka
L32	Ratnachudi	Kushi parivara (NGO), Thirthahalli, Shivamogga, Karnataka
L33	Jeerigesamba	Kushi parivara (NGO), Thirthahalli, Shivamogga, Karnataka
L34	Kempudoddi	Raju, H.R. (Farmar), Hugudi, Hosanagara, Karnataka
L35	Mullubatta	Raju, H.R. (Farmar), Hugudi, Hosanagara, Karnataka
L36	Bilijaadu	Raju, H.R. (Farmar), Hugudi, Hosanagara, Karnataka
L37	Nirgulebatta	Raju, H.R. (Farmar), Hugudi, Hosanagara, Karnataka
L38	Naagabatta	Raju, H.R. (Farmar), Hugudi, Hosanagara, Karnataka
L39	Doddataikallu	Mruthyunjaya, H. (Farmar), Hugudi, Hosanagara, Karnataka
L40	Maranellu	Mruthyunjaya, H. (Farmar), Hugudi, Hosanagara, Karnataka
L41	Nettibatta	Basavaraj, A.S. (Farmar), Angerasu, Thirthahalli, Karnataka
L42	Buddabatta	Mruthyunjaya, H. (Farmar), Hugudi, Hosanagara, Karnataka
L43	Siddisanna	Raju, H.R. (Farmar), Hugudi, Hosanagara, Karnataka
L44	Gourisanna	Raju, H.R. (Farmar), Hugudi, Hosanagara, Karnataka
L45	Karimunduga	Basavaraj, A.S. (Farmar), Angerasu, Thirthahalli, Karnataka
L46	Kempudoddagidda	Basavaraj, A.S. (Farmar), Angerasu, Thirthahalli, Karnataka
L47	Bangarukaddi	Kushi parivara (NGO), Thirthahalli, Shivamogga, Karnataka
L48	Padmarekha	Kushi parivara (NGO), Thirthahalli, Shivamogga, Karnataka
L49	Jyothi (Check)	high yielding, local check variety

Various qualitative characters studied ware related to color of coleoptile, basal leaf sheath, ligule, stigma, lemma, palea, awns, sterile lemma and hulled grain. Similarly, anthocyanin color on leaves, leaf sheath, auricles, collar, lemma and stem were recorded visually by comparing with *Munson and Leaf color charts*. Lengths of the awns, hulled and non-hulled grain length and width were measured using Graph sheet. Pubescence on leaf blade and lemma were observed using light operated magnifying lances. Presence or absence of leaf auricles, collar, ligule, awns and secondary branching in panicle were recorded visually by observing individual plants. Male sterility in each genotype was estimated by observing microscopic fields of pollen grains stained with Acetocarmine. Angular characters such as culm attitude, flag leaf attitude, curvature of main axis of panicle and attitude of panicle branches were recorded by comparing with the photographs published in guidelines for conduct of test for DUS on rice (Shobharani *et al.,* 2004).

Quantitative characters like time of heading, number of panicles per plant, days to maturity, and test weight were measured manually. Whereas characters like, length and width of leaf blade, hulled and non hulled grains were measured using graph sheets and length of panicle using scale. A qualitative character of grain such as grain aroma was smelled by boiling the hulled grain taken in test tube using water bath. Amylase content was estimated according to Julino's standard method (Juliano, 1971) using commercial amylose as standard. Phenol reaction was estimated by following the Chang and Bordens method (Chang and Bardens,1965)

The estimates of genetic parameters such as mean, range, phenotypic coefficient of variability (PCV), genotypic coefficient of variability (GCV), heritability (h^2) and genetic advance over mean (GAM) are presented in Table 2. The PCV was found to be higher than GCV but the difference between these two was very less, may be due to the influence of genetic effect at the same time a comparable effect of environment. Hence selection of these characters and evaluation under one more location is advisable. Higher heritability coupled with higher GAM was recorded for eleven yields related characters inferring the role of additive genes in controlling such characters and hence selection for such characters is recommended for improvement of the traits.

The local rice genotypes in this study showed distinctness and uniformity for all the morpho-quantitative traits studied. Out of forty five morphological traits, color characters *viz.,* coleoptiles color, basal leaf sheath colour, leaf colour, leaf ligule color, stigma color, lemma and palea color and decorticated grain color were highly distinct and uniform. As majority of genotypes were found to possess purple coleoptiles (55.10%), green basal leaf sheath (67.35%), medium green leaf (40.82%), white ligule (87.76%), white stigma (48.98%), straw colored lemma and palea (89.80%), straw colored sterile lemma (81.63%), yellowish white awns in four out of ten genotypes which had awns. Decorticated grain color showed white (57.14%), dark brown (26.54%) and 8.16% of genotypes had variegated and dark brown each. The present findings are on par with the reports of Subbarao *et al.* (2013).

Table 2. Estimates of mean, range, variability, heritability and genetic advance for 14 characters in local rice genotypes

S. No.	Character	Mean± SE	Range	PCV (%)	GCV (%)	H^2 Broad Sense (%)	GAM (%)
1	Days to 50% flowering	108.10 ± 0.29	86.15 - 131.00	11.19	11.19	99.94	31.83
2	Plant height	137.57 ± 3.64	94.66 - 162.60	11.74	11.44	94.92	31.84
3	Panicle length	22.99 ± 1.31	17.90 - 27.00	9.83	08.01	66.52	18.77
4	Number of tillers	13.91 ± 1.01	10.50 - 20.50	16.94	15.30	81.59	39.25
5	No. productive tillers	12.19 ± 1.34	7.80 - 16.20	18.87	15.32	65.93	35.82
6	Panicle exertion	9.05 ± 0.65	6.35 - 12.80	18.29	16.83	84.62	45.05
7	No of spikelets /panicle	97.57 ± 7.02	75.00 - 188.00	19.94	18.60	86.98	49.23
8	No of grains per panicle	67.80 ± 6.98	43.87 - 98.35	19.95	16.56	72.11	40.45
9	Panicle fertility (%)	71.12 ± 6.63	47.10 - 90.16	14.23	10.73	56.96	23.89
10	Test weight	22.65 ± 0.84	17.05 - 33.61	19.02	18.65	96.15	52.17
11	Straw yield / plant	42.19 ± 1.97	31.5 - 67.00	19.43	18.86	94.22	52.10
12	Days to maturity	144.46 ± 0.74	123 - 160.00	12.66	12.65	99.83	25.47
13	Harvest index	0.71 ± 0.04	0.46 - 0.94	19.33	18.29	89.44	49.95
14	Grain yield / plant	21.67 ± 0.61	10.1 - 32.70	17.70	17.47	97.49	49.12

Anthocyanin coloration in various plant parts was also distinct across the genotypes where, 22.45% of genotypes had leaf anthocyanin color while leaf sheath anthocyanin color is present only in 12.25% of genotypes. Similarly anthocyanin coloration of collor was absent in majority of genotypes (91.84%). In lemma anthocyanin coloration of area below apex was recorded in 57.14, while apex coloration noted in 58.40% of genotypes. Anthocyanin coloration in nodes was observed in only 16.33 % of genotypes with strong intensity. Density of pubescence on leaf was medium (36.73%), weak (30.61%), strong (22.45%) and very strong only in rest (10.21%) of genotypes. Similarly pubescence of spikelets among the genotypes was strong (44.90%), medium (42.86%) and weak (12.24%).

Culm attitude was observed as erect in 67.35%, semi-erect in 30.61% and horizontal only in 2.04 % of genotypes. Flag leaf attitude was semi-straight in most of the genotypes (65.31%). Curvature of main axis was drooping-deflexed (44.90%), straight (28.57%), deflexed-drooping (18.37%) and only 8.16 % of genotypes had semi-straightness. Similarly attitude of panicle branches were erect in majority (65.31%) of genotypes. On the basis of panicle exertion character, most of the genotypes were found to be well exerted (65.31 %) followed by mostly exerted (20.41%) and partly exerted (14.28%).

Among the fifteen quantitative characters studied, all showed distinctness and uniformity over the genotypes. Most of the genotypes exhibited, long leaf blade with medium width (67.35%), medium days to heading (55.11%), thick stem (40.81%), short stem length (46.94%), medium panicle length (69.38%), medium number of panicles per plant (59.19%) and late to maturity (53.06%). Quantitative traits of grains *viz.*, length and width of both hulled and non hulled, shape and test weight were recorded as, short grain length in 89.79% of genotypes while broad width in 46.94% of genotypes whereas, decorticated grain length was, short (67.35%), medium (28.57%) and long in 4.08% of genotypes. Similarly, width of decorticated grain was broad (55.11%), medium (38.77%) and narrow in 6.12% of genotypes. Decorticated grain shape was short bold in majority of genotypes (89.79%) whereas, test weight of grain showed five distinct classes like, medium (53.06%), low (24.49%), very high (10.21%) and very low in 8.16% of genotypes.

Chemical character *viz.,* Aroma, amylase content and gelatinization tempateture showed less variation across the genotypes evaluated where, none of the genotype had aroma and all had low amylase content. While gelatinization temperature was low in majority of genotypes (83.67%) and rest had exhibited medium temperature (16.33%). All the above results were on par with the characterization studies conducted by Sinha and Mittra (2013).

Thus, all the forty nine local genotypes of rice considered in the present study were found to be distinctive on the basis of 45 qualitative and 15 quantitative characters. The local rice genotypes possess high amount of genetic variability for the yield and its associated traits. We suggest distinct, uniform and better performing genotypes may be used as genetic resource for crop improvement in agronomic and nutritional characters.

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