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Variability Studies in Local Rice Genotypes Using Agro-Morphological Characterization

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A B S T R A C T

The present study was conducted at Research cum Instructional Farm, S.G. College of Agriculture and Research Station, Kumhrawand, Jagdalpur, Bastar, Chhattisgarh, India. One hundred and four rice genotypes lines were planted in three rows in two replication with four checks viz.,MTU 1010, Karma Masuri, Dub- raj Selection and HMTin Randomized Complete Block Design. Agro-morphological characters Plant height, Flag leaf length, Flag leaf width, Panicle length, grain yield per plant, number of panicles, Test weight, Days to 50% flowering, Days to harvesting days, Root length, Shoot length, Days to maturity, genotypes lines were found promising with respect to yield. One hundred and four rice germplasm lines were grouped into five clusters out of five clusters the cluster III constituted of 33 genotypes, forming the largest cluster. The estimates of heritability in broad sense andgenetic advance as percentage of mean were found high for trait gel consistency.Yield per plant was highly significantly and positively correlated with grain breadth, Volume expansion ratio, grain length breadth ratio, kernel breadth, days to maturity while significant negative correlated with days to 50% flowering and Shoot length.

Introduction

Rice is the world's most important staple food crop and is a primary food source for about half the world's population. It is cultivated in a wide range of ecosystem under varying climatic conditions. (Varietal improvement still remains the major strategy for increasing production). Also agronomic value of rice variety depends on many characteristics. The most important characteristics include Plant height, Flag leaf length, Flag leaf width, Panicle length, grain yield per plant, The number of panicles,Test weight, Days to 50% flowering, Days to harvesting, Root length, Shoot length, Days to maturity. Asian

countries are the main rice producer, with its rice production accounting for nearly 92% of the world's total production It is cultivated in more than 112 countries. It has also been used as an important source of income and employment for rural masses as well as foreign exchange earning commodity and hence named "Golden Grain of Pakistan" (Ohtsubo *et al.,* 2005).

In Bastar region of Chhattisgarh rice is grown predominantly during *kharif* season as rainfed crop having 2.39 million hectare area but the productivity of this crop is very low, 08.53 qt/ha. Rice based cropping systems are in existence and farmers raise traditional rice varieties and still adopt organic farming. Safari, Gurmatia, Sathka, BhataMokdo, ChudiDhan etc. are among these traditional varieties. According to the traditional healers of Bastar region many of these medicinal rice varieties are used in traditional medicine system for treatment of rheumatism, skin infections, paralysis, diabetes etc. (Oudhia, 2006).Chhattisgarh is traditionally known as the Rice Bowl of India. Over 20,000 rice varieties have been recorded in the region. These are a result of centuries of rice farming by indigenous communities through selection and adaptation to a variety of soil, water and micro-ecosystems conditions including predators. The Chhattisgarh region and adjoining area of Orissa are considered to be the store house of vast genetic variability and where varietal patterns change at every 250 hectaresof land due to extreme variation in the agro and eco-climate conditions, season, topography, altitude, soils, and moisture stress factors coupled with variation in the cultivars heritage of the inhabitant (Richhariya, 1979).

Characterized forty rice accessions using fourteen agro-botanical traits. Number of effective tillers and total number of tillers as well as heading and maturity dates were observed to greatly influence grain yield. Significant block effects were observed for flowering date, maturity day and plant height whereas block effects were non-significant for the other traits meaning that blocking was not important for the eleven traits that showed non-significant block effects (Ogunbayo *et al.,* 2005). Evaluated correlation between some traits and yield components of 6 aromatic rice varieties and also determined the most effective factors on its yield. Among 6 varieties Badshabhog was the top most yielder followed by Kataribhog, Chinigura, Radhunipagal, Begunbichi and Kalozira.

Analysis of variability parameters revealed that the phenotypic coefficients of variation were higher than genotypic coefficient of variation for all the characters studied. The spike lets per panicle and 1000 grain weight showed high heritability and effective tillers per hill showed low heritability. Yield has positive significant correlation with days to maturity, spikelet length and 1000-grain weight. Negative significant correlation was found with plant height and sterility% and non-significant correlation with other characters (Mishu *et al.,* 2015)

Materials and Methods

The present study was conducted using around one hundred four local germplam of rice with four popular standard checks, MTU 1010, Karma Masuri, Dub- raj Selection and HMT. Raised nursery seed bed was prepared for placing of seeds. Nurseries were raised by taking seeds from single panicle in single row for each Genotype. Twenty three days old seedlings were subsequently transplanted in to the field in Randomized complete block design. The experimental material was planted in three rows in two replication with four checks. Spacing of 25 cm between rows and 15 cm between plants were kept. The checks varieties were randomized within block. Gap filling was done within a week in

order to maintain uniform plant population. The NPK fertilizer was applied @ 120:60:60 kg/ha, respectively with full dose of P and K and 1/3rd of as basal, 1/3rd of N at 30 DAT and remaining at 45 DAT. The standard agronomic practices were adopted for normal crop growth.

Agronomical characters

Rice accessions were evaluated for 12 agronomical traits viz, Plant height, Harvesting date, Days to 50 % flowering, Panicle length, Flag leaf width, Flag leaf length, Days to Maturity, Number of effective tillers, Test weight, Grain yield per plant, root length, shoot length.

Results and Discussion

Agronomical characters

Table 1 revealed that most of the morphological characters showed variation in from five competitive plants of middle row of each entry. Plant height ranged from 80.01 cm (safedumari) to 132.50 cm (huldichudi) with a mean value of 104.73 cm, flag leaf length ranged from 20.41 cm (Madraschudi) to 45.50 cm (Pakhiyadhan) with a mean value of 26.37 cm,flag leaf width ranged from 0.94 cm (Kalakuriya) to 2.01cm (Pankiguda) with a mean value of 1.55 cm, Flag leaf length ranged from 20.41 cm (Madraschudi) to 45.50 cm (Pakhiyadhan) with a mean value of 26.37 cm, flag leaf width ranged from 0.94 cm (Kalakuriya) to 2.01cm (Pankiguda) with a mean value of 1.55 cm, panicle length ranged from 7.15 cm (Bariyadhan) to 27.22 cm (Limchudi)with a mean value of 17 cm, grain yield per plant varied from 16.15 g (Karigrass) to 32.25 g. (Karinarangis) with mean value of 21.28 g, Effective no of tillers varied from 7.80(Ajamlali) to 15.40. (Hathipanjro) with mean value of 10.48 g, test weight ranged from 11.20 g (Thapaful) to 30.70 g (Umaridhan) with an average of 21.12, days to 50% flowering ranged from 80.00 cm (pandriluchai) to 122.00 cm (rangovati) with a mean value of 95.92 cm,days to harvesting varied from lowest 114.50 days (Adgadhan) and highest 158 days (Kalamati) and their mean value is 144.15 days, root length ranged from 2.16 cm (Kusumjhopa) to 11.96 cm (Kata nakti) with a mean value of 6.56 cm, shoot length ranged from 10.9 cm (Mayurfada) to 30.94 cm (Limchudi) with a mean value of 20.44 cm,days to maturity ranged from 106 days (Pandriluchai) to 143 days (Rangovati, Huldichudi, Kalamati) with a mean value of 130.26 days.

Present finding are corroborate with Patil *et al.,* (2009) who reported that genotypes exhibited significant variability in flag leaf length, plant height, panicle length. Kumar *et al.,* (2015).studied in 25 rice hybrids and observed significant differences for thirteen yield contributing traits viz., plant height (cm), flag leaf length (cm), 81 flag leaf width (cm), number of panicles per hill, panicle length (cm). This indicated the presence of substantial amount of genetic variability in the study material and there is ample scope for selection. Similarly, Ali *et al.,* (2000) also observed relatively greater range in plant height than the other characters. Plant height in rice is a complex character and is the end product of several genetically controlled factors called internodes (Cheema *et al.*, 1987). Some studies have reported on the considerable genetic variability that is available for producing differences in the morphological traits that govern root architecture, e.g., spatial configuration of the root system, number and length of laterals (Mouchel *et al.*, 2004; Fitz Gerald *et al.*, 2006).One important agronomic trait in the direct seeding is the long shoot length, because short shoots could not emerge from paddy water surface, which cause the seedling

mortality (Peterson *et al.,* 1978).

The estimates of heritability in broad sense were found high in days to maturity (97.80%), days to 50% flowering (96.26%), test weight (95.78%), plant height (92.41%), root length (90.73%), days to harvesting (90.17%). The estimates of heritability in broad sense were found moderate for yield per plant (75.38), shoot length (73.12%).The estimates of heritabilityin broad sense were found low for panicle length (39.69%),flag leaf length (30.32%), effective number of tillers (27.29%), flag leaf breadth (22.51%).

Similarly results observed large amount of variability in 1000 seed weight, alkali spreading value, brown kernel L/B ratio and moderate variability in brown and cooked kernel length, amylose content and kernel elongation index. High heritability and genetic advance were noted for 1000 seed weight, amylose content, alkali spreading value and brown kernel L/B, implying the potential of these parameters to be used in breeding programme (Roy *et al.*2009). Studied variability and heritability for seven important physico-chemical traits *viz*., kernel length, kernel breadth, length/breadth ratio, kernel length after cooking, elongation ratio, alkali spreading value and amylose content. Low to moderate estimates of variability (both at genotypic and phenotypic level), moderate to high heritability and low expected genetic advance for all the characters indicated the preponderance of both additive and non-additive gene effects in conditioning these traits (Veni and Rani 2006).

Highest estimates of genetic advance as percentage of mean were observed for root length (80.95%), yield per plant (51.22%), test weight (46.07%), shoot length (41.88%). Moderate estimates of genetic advance as percentage of mean were observed for plant height (25.66%). Low estimate of genetic advance as percentage of mean were observed for days to 50% flowering (17.66%) followed by days to maturity (17.21%), effective number of tillers (14.06%), panicle length (13.06%),days to harvesting (11.71%) flag leaf length (10.95%), and flag leaf breadth (7.01%).

Yadav 2000, studied genetic variability in rice and observed appreciable amount of genotypic coefficient of variation, heritability and genetic advance for total grains per panicle, fertile grains per panicle and grain yield per plant. Selvaraj *et al.,* 2011, reported that phenotypic coefficient of variation (PCV) values were slightly greater than genotypic coefficient of variation (GCV), revealing negligible influence of environment in character expression. Lingaiah *et al.,* 2015 conducted experiment to estimate the genetic variability parameters for the quantitative characters in mid early group genotypes of rice cultivars. The analysis of variance revealed significant difference among the genotypes for the traits studied indicating that a large amount of variability was present in the material. The magnitude of phenotypic co-efficient of variation was higher to genotypic co-efficient of variation for all the traits.

Yield per plant was highly significantly and positively correlated with grain breadth (0.78**), Volume expansion ratio (0.48**), grain length breadth ratio (0.37**), kernel breadth (0.22**), days to maturity (0.20**). However significant negative correlated with days to 50% flowering(-0.26**)and Shoot length (-0.26**) was observed.

Sarawagi *et al., (*1997), reported that biological yield per plant (0.7062)followed by harvest index (%) (0.6794), panicle bearing tillers/plant, test weight (g) (0.4230), spikelet fertility (%)(0.4210) and spikelet/panicle (0.3775); w hile negative and significant correlation was observed with L/B ratio and

grain chalkiness. Agahi *et al.*, (2007) estimated correlations among the traits to find out association and showed that the grain yield was significantly correlated with days to heading, total tillers, number of productive tillers, days to maturity, number of grains per panicle and plant height. Chakraborty *et al.*, (2010), revealed significant positive correlation of grain yield per plant with plant height, number of panicles per plant, panicle length, number of filled grains per panicle and harvest index.

Table.1 List of one hundred and four local germplasm of rice with four popular standard checks used in the present study

Entry No.	Genotype Name	Entry No.	Genotype Name
1	Rangovati	45	Kabrodhan
2	Jeeradhan	46	Badshabhog
3	Pakhiyadhan	47	Masuridesi
4	Masurdhan	48	Karmaribhog
5	Kandai	49	Mokdodhan
6	Mesodhan	50	Sonasari
7	Lodhiyari	51	Bhaiyakhuta
8	Jhodranakti	52	Ganga baru
9	Loktimachhi	53	Kurlukabri
10	Pandariluchai	54	Huldigadi
11	Kusumjhopa	55	Huldichudi
12	Pandarisatka	56	Sargiful
13	Motilure	57	Kursobhog
14	Chairadhan	58	Muthiya
15	Kala umari	59	Mayufada
16	Baghelbijo	60	Olesar
17	Kata barangi	61	Milkormel
18	Umaridhan	62	Baundri
19	Hardiful	63	Kumhadaful
20	Farsaful	64	Aajamlali
21	Ram laxman	65	Gogal
22	Dumarful	66	Madraschudi
23	Sendursenga	67	Jhumradhan

24	Tikichudi	68	Kanidhan
25	Bhatakandai	69	Faradhan
26	Gadakhuta	70	Degichudi
27	Goyadi	71	Katakdhan
28	Kata nakti	72	Garegadhan
29	Bhatamokdo	73	Halkalalsatka
30	Kukdamudi	74	Kasi Kaman
31	Haldighati	75	Thapaful
32	Tama koni	76	Kala kuriya
33	Nanichudi	77	Parvatibhog
34	Kalmati	78	Borgum
35	Mohadhan	79	Asamiyadhan
36	Kari narangi	80	Limchudi
37	Dandkar	81	Karigrass
38	Bhaispat	82	Bhyardhan
39	Keraful	83	Chatiyadhan
40	Dhotiyadhan	84	Luchaidhan
41	Gadursela	85	Dokramecha
42	Altimijo	86	Kata mehr
43	Safedumari	87	Bariyadhaan
44	hadhardhan	88	Hathipanjaro
89	Cheptikhuji	97	Baiganidhaan
90	Rambhog	98	Pankiguda
91	HiranBako	99	Dongarkabri
92	Surmutiya	100	Kharlamahu
93	Chindjhopa	101	TemruMudi
94	Baktichudi	102	Hansadubraj
95	Adgadhan	103	Lakhechi
96	Aajandhaan	104	Shivnath

CH1 MTU 1010, CH2 Karma Masuri, CH3 Dubraj Selection, CH4 HMT. Note: CH=check variety.

Table.2 Mean, Range, coefficient of variation % (CV %), Heritability (h2), and genetic advance as per cent of mean (GA as % of mean) for different characters.

S.N.	Traits	Mean	Range	Maxi.	Mini.	CV%	h2 (BS) % GA	GA as % of Mean
1	PH (cm)	104.73±1.07	72.29	132.50	80.01	2.94	92.41	25.66
2	FLL (cm)	26.37±0.29	25.09	45.50	20.41	11.59	30.32	10.95
3	FLW (cm)	1.55±0.01	1.07	2.01	0.94	10.54	22.51	7.013
4	PL (cm)	17.28±0.22	16.10	27.22	7.15	9.89	39.69	13.06
5	PPY (cm)	21.28±0.5	16.1	57.07	10.38	12.96	75.38	51.22
6	ENT	10.48±0.16	7.60	32.25	16.15	16.89	27.29	14.06
7	TW (g)	21.12±0.47	19.50	30.70	11.20	3.79	95.78	46.07
9	HD	144.1538	43.50	158.00	114.50	1.56	90.17	11.71
10	RL (cm)	6.56±0.22	9.80	11.96	2.16	10.44	90.73	80.95
11	SL (cm)	20.44±0.4	20.04	30.94	10.9	11.42	73.12	41.88
12	MD	130.2692308	37.00	143.00	106	1.00	97.80	17.21

PH: Plant height(cm), FLL: Flag leaf length(cm), FLW: Flag leaf width (cm), PL: Panicle length(cm), PPY: Yield Per plant (g), ENT: Effective no of tillers, TW: Test weight(g,) DTF: Days of 50% flowering, HD: Harvesting date, RL: Root length(cm), SL: Shoot length(cm), MD: Maturity date.

Table.3 Genotypic correlation coefficient for quantitative traits

characters	PH	FLL	FLB	PL	PPY	ENT	TW	DLF	RL	SL	MD
PH	1	-0.019	-0.001	0.121	0.254**	0.142*	0.637**	-0.198**	0.042	0.412**	-0.580**
FLL			-0.128	-0.092	0.024	0.151*	0.078	-0.188**	0.785**	-0.492**	0.190**
FLB				0.281**	-0.078	0.751**	0.176*	-0.088	-0.164*	0.644**	0.750**
PL					-0.127	-0.139*	0.868**	-0.160*	-0.143*	-0.329**	-0.324**
PPY						-0.027	0.042	-0.268**	0.024	-0.263**	0.203**
ENT							-0.027	0.025	-0.133	-0.110	0.148*
TW								0.063	-0.229**	-0.305**	0.103
DLF									0.108	-0.343**	0.132
HD									-0.031	0.002	0.205**
RL										-0.141*	0.094
SL											-0.010
MD											

PH: Plant height (cm), FLL: Flag leaf length (cm), FLW: Flag leaf breadth (cm), PL: Panicle length (cm), PPY: Yield Per plant (g), ENT: Effective no of tillers, TW: Test weight (g,), Days of 50% flowering, HD: Harvesting date, RL: Root length (cm), SL: Shoot length(cm), MD: Maturity date

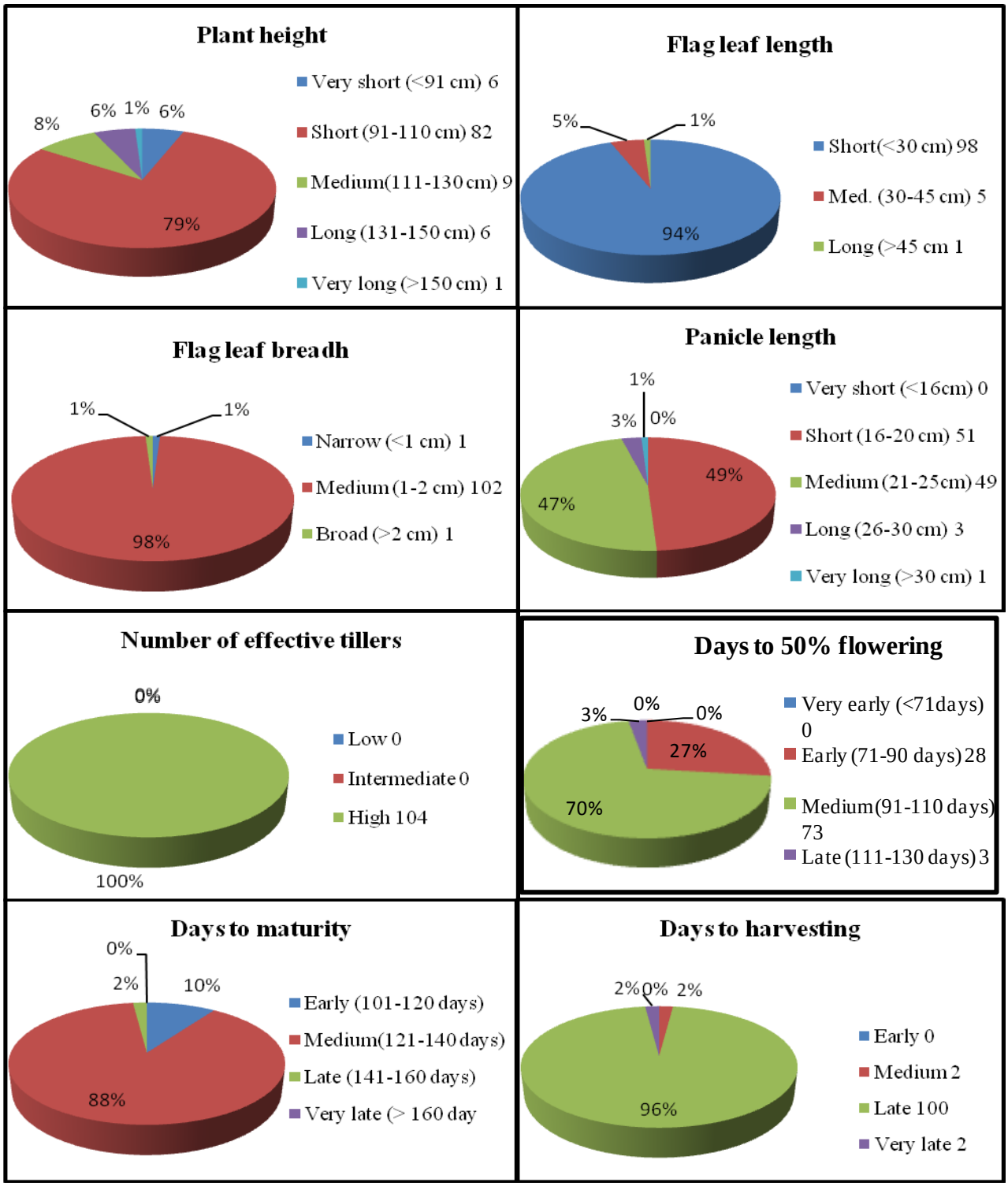

Fig.1 Frequency distribution of important morphological characters

Table.4 Phenotypic Correlation for quantitative traits

characters	PH	FLL	FLB	PL	PPY	ENT	TW	DLF	RL	SL	MD
PH		-0.015	-0.002	0.104	0.223**	0.125	0.588**	-0.189**	0.040	0.401**	-0.597**
FLL			-0.074	-0.080	0.022	0.120	0.073	-0.178*	0.773**	-0.473**	0.181**
FLB				0.060	-0.074	0.718**	0.147*	-0.084	-0.158*	0.625**	0.708**
PL					-0.075	-0.131	0.841**	-0.117	-0.135	-0.311**	-0.315**
PPY						-0.013	0.042	-0.258**	0.023	-0.245**	0.185**
ENT							0.006	0.024	-0.108	-0.097	0.134
TW								0.047	-0.225**	-0.257**	0.083
DLF									0.107	-0.332**	0.107
HD									-0.015	0.003	0.194**
RL										-0.092	0.091
SL											0.001
MD											

PH: Plant height (cm), FLL: Flag leaf length (cm), FLW: Flag leaf breadth (cm), PL: Panicle length (cm), PPY: Yield Per plant (g), ENT: Effective no of tillers, TW: Test weight (g,), Days of 50% flowering, HD: Harvesting date, RL: Root length (cm), SL: Shoot length(cm), MD: Maturity date,

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