

Regular Article

Agro-morphological characterization of rice landraces variety (*Oryza sativa* L.) of Bankura district of West Bengal

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Rice is the major food grain of India and is being cultivated on 36.95 million ha. land and present productivity is about 120.6 million tons per year. Agriculture in West Bengal is the means of livelihood of about 65% of the population of the state living in villages with over 95% as small and marginal farmers. West Bengal is great reservoir of rice. There are 5,556 rice varieties were recorded in the year 1975 from this state. Bankura district of West Bengal is also a great producer of rice. There are so many rice landraces were cultivated in this district in near past. But in present situation rice cultivation is restricted to 5-10 high yielding variety and few landraces varieties. In this study characterization of twenty landraces of rice presently available in this district was performed using DUS testing protocol. Agro-morphic characterization of these twenty landraces was done during 2011-12 & 2012-13 kharif session at the Village of Ranbahal, PO- Amarkanan of this District. In this study we observed that out of the 20 investigated varieties 11 varieties are distinctive according to the five essential and the eighteen additional characters proposed by the DUS guideline. The present work is so much important in respect to the present scenario of agro-biodiversity of this region as well as identification, conservation and documentation of landraces variety for future crop improvement.

Keywords: Conservation, Rice, Landraces, Bankura District, DUS test

Rice is staple food grain of India and is cultivated on 36.95 million hector of land almost throughout the year. Annually approximate 120.6 million tons of rice is being produced and on the basis of production it occupies second position in the world (Food and Agriculture Statistics, 2010). India is centre of origin and as per rice is concerned all together this country proudly possess 88,681 different variety of rice, out of that 55,615 are landraces, 1,171 are wild races and 32,895 are other varieties. Green revolution is considerably held to improve production of food grains in our country and its role in achieving

status of self sufficiency in food grain is beyond any doubt. But high yielding varieties, which are the back bone of green revolution have indirectly stimulated erosion of landraces and wild varieties of rice. Presently more than 90% of rice cultivation is being done using high yielding varieties only. The situation is fast eroding indigenous cultivars of rice. Another serious factor is changing climatic condition of this region. The climatic condition adversely affects maturation and reproductive cycle of plants. Keeping the severity of situation an attempt is being made to collect, document and conserve indigenous varieties of rice which are fast

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disappearing from villages of Bankura district of West Bengal. Obviously landraces are disappeared fast. Importance of landraces is larger than life in agriculture system, because improvement in existing variety depends upon desirable gene which are possibly present in landraces and wild varieties only.

Bankura district is located in the western part of the State of West Bengal. It is a part of Bardhaman Division of the State and included in the area known as "Rarh" in Bengal. It ranks 4th according to Population and literacy rate of 2001 Census in the State. The District Bankura is bounded by latitude 22°38' N and longitude 86°36' E to 87°47' E. River Damodar flows along the northern boundary of the district. The adjacent districts are Bardhaman in the north, Purulia in the west and Paschim Medinapure in the south. The Survey of India (SOI) top sheets covering the district are 73I, 73J, 73M and 73N. Net cultivable area of the District is 4.30 lac ha. and no of Cultivator is 4.47 lac and per cultivator availability of net shown area comes to 1.02 ha. Due to continuous division and fragmentation of cultivated land Agriculture is becoming less remunerative. About 46% of the net cropped area is under irrigation. The gross cropped area is about 6 lac ha. and cropping intensity is 147%.

Material and Methods

Extensive survey was conducted in remote villages of Bankura District and almost all villages of the district was visited and farmers were consulted about the local varieties they have and they plant in their field during our collection. Rice landraces (folk rice varieties) are collected from farmers of remote villages of Bankura district. The following landraces varieties were collected in the year 2010-11 from different rice growing region of Bankura district (Table-1).

The present investigation was carried out at the village of Ranbahal (22°38'N latitude and 86°36'E-87°47'E longitude with an altitude of 78 meters

above sea level). The soil reaction gives a slightly acidic pH of 5.2, with low soluble salts (EC of 0.0.06 dS m⁻¹), medium organic carbon content (0.49%), Total N (0.051%), medium in available P (45 kg ha⁻¹) and K (210 kg ha⁻¹).

Table-1. List of various landraces of rice with their code

Code	Name of the Landraces
V01	CHOTODIDI
V02	FULKHAR
V03	MIHIDANA
V04	BHADOI
V05	KALOBAYAR
V06	BYAMAJHUPI
V07	SINDURMUKHI
V08	MUKTA
V09	DUDHARSAR
V10	BHURI
V11	MALABATI
V12	PATNAI-23
V13	JAMAINADU
V14	LANGAL MURA
V15	MARICHSAL
V16	BADAMSARU
V17	DANGAPATNAI
V18	TALMUGUR
V19	URI
V20	JHARA

Collected Seeds of local landraces were planted on small study plots with suitable and uniform spacing in between two plants (20cm in a row and 25cm in a Colum) in control condition without giving any synthetic agrochemical manure. Measurements of different physical, agronomic and morphological characteristics of these collected landraces at different stages of growth were recorded following National guidelines for the conduct of Test for Distinctness, Uniformity and Stability of Rice (*Oryza sativa* L.). INDIA. ITG/01 Date: 03/09/2003, Annexure-I (Shoba Rani *et al*,2004).In this study we observe 34 characteristics (Table 2 and Table 3) of the indigenous rice varieties at different growth stage. Among the 34 agro-morphological characters 22 are qualitative characters (Table 2) and 12 characters are quantitative (Table 3). The details of the qualitative and the quantitative characters and their

observed genotypic descriptors and their evaluation phase are given in the Table 2 and Table 3. These parameters provided morphological, agronomic characteristics as well as physiological characteristics of landraces of rice variety.

Table 2. Qualitative Character along with their descriptors of 20 landraces of rice variety of Bankura District

Qualitative traits	Descriptors	Evaluation phase
Coleoptile colour (CC)	1. colourless; 2. green; 3. purple	First leaf through coleoptile
Basal leaf sheath colour (BS)	1. green; 2. light purple; 3. Purple line; 4. Purple	Booting stage (early)
Pubescence of leaf (PB)	1. absent; 2. Weak; 3. medium; 4. strong; 5. very strong	Booting stage (early)
Leaf collar (LC)	1. present; 2. absent	Booting stage (early)
Leaf ligule (LLi)	1. absent; 2. present;	Booting stage (early)
Shape of ligule (LS)	1. truncate; 2. acute; 3. split;	Booting stage (early)
Culm attitude (CA)	1. erect; 2. semi-erect; 3. open; 4. spreading	Booting stage (early)
Flag leaf attitude (FLA)	1. erect; 2. semi-erect; 3. horizontal; 4. deflexed	Beginning of anthesis
Lemma-Anthocyanin colouration of keel (LAC)	1. absent; 2. weak; 3. medium; 4. strong; 5. very strong	Anthesis half way
Anthocyanin colour of internode (IC)	1. absent; 2. present;	Milk development
Anthocyanin colour of node (NC)	1. absent; 2. present;	Milk development
Panicle curvature (PX)	1. straight; 2. semi-straight; 3. drooping; 4. deflexed;	Ripening (terminal spikelets ripened).
Panicle attitude of branching (PAB)	1. erect; 2. erect-semierect; 3. semierect; 4. spreading	Ripening
Panicle exertion (PE)	1. partly exerted; 2. exerted; 3. well exerted;	Ripening
Panicle secondary branching (PSB)	1. absent; 2. present;	Ripening
Panicle secondary branching (SB)	1. weak; 2. strong; 3. clustered	Ripening
Awning (AW)	1. present; e. absent	Ripening
Colour of awn (AC)	1. yellowish white; 2. yellowish brown; 3. brown; 4. reddish brown; 5. light red; 6. red; 7. light purple; 8. purple; 9. black.	Ripening
Grain lemma and palea colour (LP)	1. straw; 2. gold and gold furrows on straw; 3. brown furrows on straw; 4. reddish to light purple; 5. purple furrows on straw; 6. purple; 7. black	Ripening
Decorticated grain colour (DC)	1. white; 2. light brown; 3. dark brown; 4. light red; 5. red; 6. purple	Caryopsis hard
Grain aroma (DA)	1. present; 2. absent	Caryopsis hard
Sterile lemma colour (SLC)	1. straw; 2. gold; 3. red; 4. purple	Caryopsis hard

Table 3. Quantitative Characters along with their descriptors of 20 landraces of rice variety of Bankura District

Quantitative characters	Observed phenotypic class	Evaluation phase
Leaf length	Arithmetic means of the five random sample	Booting stage(early)
Leaf width	Arithmetic means of the five random sample	Booting stage(early)
Leaf length width ratio	Arithmetic means of the five random sample	Booting stage(early)
Plant height	Arithmetic means of the five random sample	Milk development
Panicle length	Arithmetic means of the five random sample	Milk development
1000 grain weight	Arithmetic means of the five random sample	Caryopsis hard
Grain length	Arithmetic means of the five random sample	Caryopsis hard
Grain width	Arithmetic means of the five random sample	Caryopsis hard
Decorticated grain length	Arithmetic means of the five random sample	Caryopsis hard
Decorticated length width	Arithmetic means of the five random sample	Caryopsis hard
50% flowering	No. of days from plant germination until 50% of the plants in each plot flowered;	After flowering
Total maturity	Number of days until 50% of the panicles were mature	After maturation

Results and Discussions

In this work agro-morphic study were performed on- Chotodidi, Fulkhar, Jhara, Mihidana, Bhadoi, Kalobayar, Baymajhupi, Uri, Sindurmukhi, Mukta, Dudhersar, Bhuri, Malabati, Patnai-23, Jamaynar, Langalmura, Marichsal, Badamsaru, Danga-patnai and Talmugur variety. Qualitative and quantitative characters of different Agronomic and morphological parameters are represented in Table- 4 to Table 7.

Qualitative characters

Among the investigated thirty seven agro-morphic characters 23 characters were qualitative. Qualitative characters are important in respect to the identification and the characterization of landraces of rice

varieties because it was observed that these characters are less influenced by the various environmental conditions. Different qualitative characters of 20 investigated landraces are given in Table- 4 and Table- 5. Polymorphism was found in 18 out of 23 qualitative traits. The non polymorphic traits were the coleoptile colour, presence of leaf collar, presence of leaf ligule, shape of ligule and present of secondary branching in panicle. 100% of the total varieties show colourless coleoptiles (CC), presence of leaf collar (LC), presence of leaf ligule (LLi) and presence of secondary branching in panicle (SB). Character basal leaf sheath colour (BS) 65% varieties shows green, 5% varieties shows light purple, 20% shows purple line and 5% varieties shows purple colouration.

Table 4. Qualitative characterization of 20 investigated landraces of rice variety according to DUS testing guidelines

Name of Landraces	CC	BS	PB	LA	LC	LLi	LS	CA	PE	PSB	SB	AW
CHOTODIDI	1	1	3	2	1	2	3	1	1	1	2	2
FULKHAR	1	1	3	1	1	2	3	1	2	1	2	1
JHARA(SADA)**	1	1	3	2	1	2	3	1	1	1	1	1
MIHIDANA	1	1	3	1	1	2	3	1	3	1	2	2
BHADOI	1	2	4	1	1	2	2	1	3	1	1	2
KALOBAYAR	1	3	4	2	1	2	3	1	2	1	2	2
BYAMAJHUPI	1	4	4	1	1	2	3	1	1	1	3	1
URI**	1	1	5	2	1	2	3	2	2	1	2	1
SINDURMUKHI	1	3	4	1	1	2	3	4	2	1	2	2
MUKTA	1	1	3	1	1	2	3	1	2	1	2	2
DUDHARSAR	1	1	3	2	1	2	3	3	2	1	2	2
BHURI	1	1	3	1	1	2	3	3	2	1	1	2
MALABATI	1	3	3	1	1	2	3	3	2	1	2	2
PATNAI-23	1	1	3	1	1	2	3	3	2	1	2	2
JAMAYNARU	1	1	3	1	1	2	3	1	2	1	2	2
LANGALMURA	1	1	4	1	1	2	3	1	1	1	3	2
MARICHSAL	1	1	2	1	1	2	3	1	1	1	2	1
BADAMSARU	1	3	4	1	1	2	3	1	3	1	1	1
DANGAPATNAI	1	1	5	1	1	2	3	1	2	1	2	2
TALMUGUR	1	1	3	1	1	2	3	1	3	1	2	1

** - non cultivated variety

LEGENDS- CC- Coleoptile colour: 1.colourless 2. green 3. purple, BS- Basal leaf sheath colour-1.green 2.light purple 3.purple line 4.purple, PB- Pubescence of leaf blade surface- 1.absent 2.weak 3.medium 4.strong 5.very strong, LA- Leaf: Auricle- 1. present 2. absent; LC- Leaf: Collar- 1. present 2. absent; LLi- Leaf: ligule- 1.absent 2.present; LS- Leaf: shape of ligule- 1.truncate 2. acute 3.split; CA- Culm: attitude- 1.erect 2.semi-erect 3.open 4.spreading; PE- Panicle: exertion- 1. partly exerted 2.exerted 3. well exerted; PSB- Panicle: secondary branching- 1. present 2.absent; SB- secondary branching-1. weak 2.strong 3.clustered; AW- Panicle: awn-1. present 2.absent;

Regarding the leaf characteristics pubescence of leaf surface (PB) showing higher variability where 55% varieties shows medium pubescence, 20% strong, 20% weak and 5% varieties shows very strong pubescence. For the character leaf auricle (LA), anthocyanin colouration of internode (IC), awning of panicle (AW) and decorticated grain aroma (DA) two alternative forms of characters were observed. Presence (75%) and absence (25%) genotypes were observed for auricles

(LA), in case of anthocyanin colouration of internode (IC) 20% varieties shows present and 80% varieties shows without colouration. 80% of the varieties consist of awn and 20% varieties lack awn (AN) while presence (10%) and absence (90%) of the aroma in decorticated grain were found (DA). Character culm attitude (CA) 70% varieties shows erect, 20% shows open and 5% varieties shows semi-erect and open culm attitude respectively.

Table 5. Qualitative characterization of 20 investigated landraces of rice variety according to DUS testing guidelines

Name of Landraces	FLA (60)	LAC (65)	IC (70)	NC (70)	PX (90)	PAB (90)	AC (90)	LP (92)	DC (92)	DA (92)	SLC (92)
CHOTODIDI	1	1	1	2	1	1	-	1	4	2	1
FULKHAR	1	1	1	2	1	1	1	1	1	2	1
JHARA (SADA)*	1	1	1	2	1	1	1	1	2	2	1
MIHIDANA	1	1	1	2	3	1	-	1	1	1	1
BHADOI	1	1	1	2	1	2	-	3	4	2	1
KALOBAYAR	1	5	2	2	2	2	-	7	2	2	4
BAYAMAJHUPI	1	1	1	1	1	5	1	1	1	2	1
URI**	1	3	1	1	1	2	3	7	2	2	1
SINDURMUKHI	1	1	1	2	3	4	-	3	2	2	1
MUKTA	1	1	1	2	1	1	-	1	1	2	1
DUDHERSAR	1	1	1	1	1	1	-	1	1	1	1
BHURI	3	4	2	2	1	1	-	3	5	2	1
MALABATI	1	4	1	1	1	1	-	3	2	2	1
PATNAI-23	1	1	1	2	3	2	-	1	1	1	1
JAMAYNARU	2	3	2	2	3	2	-	1	1	2	1
LANGALMURA	1	1	1	2	3	5	-	1	6	2	1
MARICHSAL	1	1	1	2	2	1	2	1	1	2	1
BADAMSARU	1	1	1	2	4	1	1	2	1	2	1
DANGAPATNAI	2	1	1	2	3	4	-	1	1	2	1
TALMUGUR	1	1	1	2	3	1	1	1	3	2	1

**-. non cultivated variety

LEGENDS- FLA- Flag leaf: attitude of blade- 1.erect 2.semi-erect 3.horizontal 4.deflexed; LAC- Lemma: anthocyanin colouration of keel- 1. absent or very weak 2.weak 3.medium 4.strong 5. very strong; IC- Stem: anthocyanin colouration of internode- 1.absent 2. present; NC- Stem: anthocyanin colouration of node- 1. present 2.absent; PX- Panicle: curvature of main axis-1. straight 2. semi-straight 3.drooping 4. deflexed; PAB- Panicle: attitude of branching-1.erect 2.erect to semi erect 3.semi-erect 4. semi-erect to spreading 5. Spreading, AC- Colour of awn: 1.yellowish white 2.yellowish brown 3. brown 4.reddish brown 5.light red 6.light purple; LP- Grain: lemma and palea colour- 1. straw 2.gold and gold furrows on straw 3.brown furrows on straw 4.reddish to light purple 5.purple furrows on straw 6. Purple 7.black; DC- Decorticated grain: colour-1.white 2.light brown 3.dark brown 4.light red 5.red 6.purple; DA- Decorticated grain: aroma-1.present 2.absent; SLC- Sterile lemma colour: 1.straw 2.gold 3.red 4.purple.

The character (Table-5) showing higher variability where flag leaf attitude (FLA) (90% erect, 5% semi-erect, 5% horizontal), anthocyanin colouration of keel of lemma (LAC) (75% absent or very weak, 10% medium, 10% strong, 5% very strong), panicle curvature of main axis, (PX) (50% straight, 10% semi-straight, 35% drooping, 5% deflexed), panicle attitude of branching, (PAB) (55% erect, 25% erect of semi-erect, 10% semi-erect to spreading, 10% spreading), panicle exertion, (PE) (25%

partly exerted, 55% exerted, 20% well exerted), panicle secondary branching, (SB) (20% weak, 70% strong, 10% very strong), lemma and palea colour of grain, (LP) (65% straw, 5% gold and gold furrows on straw, 20% brown furrows on straw, 10% black), and decorticated colour of grain, DC (50% white, 25% light brown, 5% dark brown, 10% light red, 5% red, 5% purple). Character sterile lemma colour of grain (SLC) showing lowest variability (5% purple and 95% straw).

Table 6. Quantitative characterization of 20 investigated landraces of rice variety according to DUS testing guidelines

Name of Landraces	LL (40)	LW (40)	LL/LW (40)	HT (70)	PL (70-90)	AL (90)	GWt (92)	PN (80-90)
CHOTODIDI	60.0	1.2	50	140	23	-	29.5	16
FULKHAR	41.5	0.9	46.1	109	14.5	1	28.2	11
JHARA (SADA)*	39.0	1.1	35.45	161	22	7	30.2	09
MIHIDANA	48.0	1.0	48	106	28	-	11.6	12
BHADOI	19.0	1.1	17.27	74	21.2	-	28.6	03
KALOBAYAR	41.0	1.5	27.33	170	26	-	24.5	10
BAYAMAJHUPI	55.0	1.0	55	122	28.5	1.1	22.4	15
URI**	63.0	1.02	61.76	135	25	7.0	20.5	9
SINDURMUKHI	55.0	0.9	61.11	149	24.5	-	24.5	17
MUKTA	50.8	1.0	50.8	144	23	-	19.5	10
DUDHERSAR	35.2	0.9	39.11	139	22.5	-	23	15
BHURI	45.5	1.1	41.36	165	24.5	-	28.5	16
MALABATI	54.0	1.2	45	157	23.8	-	27	15
PATNAI-23	57.5	1.2	47.91	155	25.3	-	27.8	15
JAMAYNARU	62.5	1.1	56.81	146	22.5	-	23.5	22
LANGALMURA	61.5	1.8	34.16	167	25.5	-	30.3	12
MARICHSAL	70	1.6	43.75	152	25	0.5	21.3	12
BADAMSARU	68.2	1.3	52.46	168	25	7.5	18.9	13
DANGAPATNAI	63.7	1.3	49	131	24	-	30.2	14
TALMUGUR	58	1.5	38.66	172	25	0.4	32.5	10

LEGENDS- LL- Leaf: length of blade (cm); LW- Leaf: width of blade (cm); LL/LW- Leaf length & width ratio; HT- Plant height (cm); PL- Panicle: length of main axis(cm); AL- Panicle: length of longest awn(cm); GWt- Grain: weight of 1000 fully developed grains(gm); GL- Grain length(mm); PN- Panicle: number per plant

Quantitative characters

Among the investigated thirty seven agromorphic characters 14 characters are quantitative and are represented into the Table-6 and Table-7. Among the

quantitative characters of these landraces varieties, length of leaf was ranged in between 19 cm to the 70 cm. Maximum length of leaf was obtained in Marichsal and minimum length was observed in

Bhadoi variety. Maximum leaf length breadth ratio was observed in Uri variety and the minimum ratio was observed in Marichsal variety. Maximum plant height was observed on Talmugur variety and the minimum plant height was noticed on Bhadoi variety. The panicle length of the variety was range from 28.5 cm to 21.2 cm. The maximum and minimum length of the panicle was observed on Bayamajhupi and Bhadoi variety respectively. Grain characters is the most important characters for the characterization of a particular variety. 1000 grains weight, grain length,

grain width, grain length width ratio, decorticated grain length, breadth and length breadth ratios are important yield attribute characters. Grain characters are given in Table 7. 50% flowering and total maturity days are also noticed. 50% flowering of these varieties range from maximum 128 days (Marichsal variety) to the minimum of 55 days (Bhadoi variety) and the total maturity days ranged from 150 to 70 days. Maximum maturity period was observed in Badamsaru variety and minimum maturity duration was noticed in Bhadoi variety.

Table 7. Quantitative characterization of 20 investigated landraces of rice variety according to DUS testing guidelines

Name of Landraces	GL (92)	GW (92)	DL (92)	DW (92)	50% FLA (55)	TM (90)
CHOTODIDI	8.4	3.4	6.0	2.8	100	135
FULKHAR	9.2	2.8	6.8	2.2	73	100
JHARA (SADA)*	7.8	3.0	5.8	2.4	112	134
MIHIDANA	6.3	2.2	4.6	1.8	100	130
BHADOI	8.4	3.2	6.2	2.6	55	70
KALOBAYAR	7.66	3.33	5.66	3.0	125	157
BAYAMAJHUPI	8.8	2.6	6.2	2.1	73	110
URI**	7.8	3.2	6.6	2.6	94	120
SINDURMUKHI	9.2	2.8	6.8	2.3	106	132
MUKTA	8.1	2.3	5.9	2.0	124	168
DUDHERSAR	8.4	2.2	6.2	1.8	115	142
BHURI	8.0	3.4	6.0	2.8	120	145
MALABATI	8.8	3.1	6.4	2.6	125	156
PATNAI-23	11.2	2.8	8.3	2.2	116	145
JAMAYNARU	8.6	3.0	6.6	2.3	113	149
LANGALMURA	8.6	4.0	7.0	3.0	227	154
MARICHSAL	6.6	3.0	4.7	3.0	128	180
BADAMSARU	9.0	2.3	6.3	2.6	114	150
DANGAPATNAI	11.3	2.7	8.5	2.5	112	148
TALMUGUR	9.0	3.3	6.6	2.3	115	145

LEGENDS : GL- Grain length (mm); GW- Grain width (mm); DL- Decorticated grain: length (mm); DW- Decorticated grain: width (mm); 50% FLA- 50% flowering (in days); TM- Total maturity duration (in days).

Among the eight evaluated qualitative characters maximum variation observed on Plant height (HT), followed by

maturity time (TM) and 50% flowering time (50% FLW). The least variable trait was the width of the leaf blade (LW) followed by

the decorticated grain width (DW). Maximum and minimum variable of other investigated traits given in Table 8.

Among the investigated twenty three qualitative and quantitative characters Basal leaf sheath colour (BS), Time of heading (50% of plants with panicle) (50%FLW), Stem length (HT), Decorticated grain length (DL), Decorticated grain colour (DC), Decorticated grain shape and the presence of Aroma in decorticated grain are the essential characters which are used for the grouping of variety according to the DUS guideline. In this study we observed that out of the 20 investigated varieties 11 varieties are distinctive according to the five essential and the eighteen additional characters.

Sinha and Mishra (2012, 2013) has studied various local varieties prevalent in Bankura district of West Bengal and stressed upon need of their conservation. Agnihotri (2001) has also studied

ecophysiology of local rice varieties of Kumaun district. Singh and Singh (1997) have studied local varieties of aromatic rice. Patra (2000) has studied on Collection and characterization of rice genetic resources from Keonjhar district of Orissa. The present study adds a new dimension confining itself to Bankura district of West Bengal. Importance these varieties are immense keeping their gene pool in mind. In present era when much stress is being laid on conservation of landraces, we cannot afford to lose landraces of rice varieties. Another important issue is sustainable agriculture in present situation where climate change is adversely affecting agricultural productivity. Beyond any doubt, local varieties which have sustained in particular climatic condition since thousands of years back are better suited as compared to HYVs. So, proper solution of climate change vis-a-vis agriculture is in conserving landraces of rice varieties.

Table 8. Extent of variability on quantitative traits

Variable	Minimum	Maximum	Mean	Std. deviation	P-value	Significance
Length of leaf (LL)	19.000	70.000	52.420	12.617	0.203	0.05
Width of leaf (LW)	0.900	1.800	1.186	0.249	0.039	0.05
Leaf length width ratio (LL/LW)	17.270	61.760	45.052	11.022	0.551	0.05
Plant height (HT)	74.000	172.000	143.100	25.137	0.040	0.05
Panicle length (PL)	14.500	28.500	23.940	2.877	0.005	0.05
1000 grain weight (GWt)	11.600	32.500	25.125	5.130	0.173	0.05
Grain length (GL)	6.300	11.300	8.555	1.202	0.062	0.05
Grain width (GW)	2.200	4.000	2.930	0.466	0.431	0.05
Grain length width ratio (GL/GW)	2.150	4.180	2.984	0.643	0.119	0.05
Kernel length (DL)	4.600	8.500	6.355	0.935	0.085	0.05
Kernel width (DW)	1.800	3.000	2.415	0.382	0.348	0.05
Kernel length width ratio (DL/DW)	1.560	3.770	2.687	0.552	0.984	0.05
50% flowering time (50% FLW)	55.000	128.000	106.850	19.567	0.003	0.05
Maturity time (TM)	70.000	180.000	138.500	24.526	0.095	0.05

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