

RICE (*ORYZA SATIVA* L.) GERMPLASM DIVERSITY FROM A TRIBAL DISTRICT IN MAHARASHTRA STATE

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Landraces of rice from a tribal district Nandurbar in Maharashtra state were reported for the first time. Diversity in agro-genetic, morphogenetic and grain characteristics of rice were investigated. The sustainable methods of cultivation of this landraces by tribals in different agro ecosystems were discussed. The collection includes scented grain, long and bold grain, low carbohydrate and high protein and less water requiring cultivars. The cultivars Guida and Taichun are grown as both in Kharif and Rabi season under irrigated conditions. They are specially consumed on fasting days and also by nursing mothers. Five cultivars formed very less number of tillers. Ropnya, ambamor, mothilhal, guaida, taichun, ekdandi, dodihal and kamod, may be further analyzed for their utility as donors in future rice breeding programme.

Keywords : Diversity; Rice landraces.

Introduction

Considerably high genetic erosion had occurred in rice due to fast replacement of landraces/traditional cultivars by high yielding varieties (HYV). Nearly 74% of cropped area under rainfed agroecosystem is occupied by HYV and it could be even higher in irrigated ecosystems¹. There is an urgent need to collect, evaluate and conserve the genetic resources from the fields where primitive cultivation is still found². Such collections form valuable genetic materials for plant breeding and studies in evolutionary genetics. Impressive landrace diversity still exists in stress environments such as rainfed agro ecosystems and areas inhabited by tribals and various ethnic groups. The collection of traditional cultivars of rice from such environments and their evaluation are being pursued by several rice workers³⁻⁷. While these reports are from the states of Bihar, Orissa, Andhra Pradesh and Madhya Pradesh, similar reports from Maharashtra state are meager. In the present paper 28 landraces of rice from a predominately tribal district Nandurbar in Maharashtra have been reported for the first time.

Material and Method

Area of exploration : Nandurbar is a newly constituted tribal district in the West Khandesh region of North Maharashtra. It forms border with Gujarat in the West and Madhya Pradesh in the East and North directions. Satpura hill ranges, sub tropical climate, two west ward flowing rivers Tapi and Narmada and tribal population to the extent of 70% make the district geographically distinct. At least two talukas namely Dhadgaon and Akalkuwa fall in Satpura hills making much of the area inaccessible. 90% of population in these talukas is of tribes; chiefly pawara and

bhills and to a lesser extent konkni and mavchi tribes.

Survey and collection : Ethnobotanical principles were followed for collection of rice germplasm from different parts of the district while Sakari taluka of Dhule district is also explored. Accession numbers were given to all sample and their passport information was recorded separately. The agro-genetic and morphogenetic characteristics were recorded by maintaining separate plots adjoining the standing crops. The length and breadth of grains were measured using travelling microscope. Total carbohydrates were extracted by the method of Hegde and Hofreiter⁸ and estimated employing the method of McCredy *et al.*⁹. The grain proteins were precipitated in TCA, dissolved in 0.05 N NaOH and measured as per Lowry *et al.*¹⁰ All the 28 accessions, along with their passport information were deposited at Botany department, P.S.G.V.P. Mandal's Arts, Science & Commerce College, Shahada.

Results and Discussion

The local name, village, agro ecosystem and distinct features of the rice landraces are given in Table 1. Only guida (R-1203) and taichun (R-1204) cultivars are grown in both kharif and rabi seasons under irrigated conditions. In hill agro ecosystem they are grown in nalas where they runoff and gathered by erecting temporary bunds and waterlogged conditions are created. Grains of these two cultivars are consumed on fasting days by Hindus in the the district. The bhat (pudding) prepared is given to nursing mothers. They believe that guida and taichun stimulate mammary glands in nursing period. Accessions R-1129, 1135, 1141, 1158, 1163, 1198, 1200 and 1202 are scented rice cultivars. As drought tolerant cultivars, tribals prefer accessions R-1135, 1139, 1148, 1151, 1194 and 1201.

Table 1. Area wise collection of local cultivars of rice from Nandurbar district.

Accession No.	Local Name	Village	Agro ecosystem	Remarks
R-1129	Gorya	Nimdarda	Rainfed	Scented, better yield
R-1135	Hatdya	Nimdarda	Rainfed	Scented, better yield, better for storage, drought tolerant
R-1139	Dodi Hal	Lakkadkot	Rainfed	Diseases not found, drought tolerant
R-1140	Chirli	Morkaranja	Rainfed	Better yield
R-1141	Sathi Hal	Itwai	Rainfed	Scented, early maturing, drought tolerant
R-1143	Rati Hal	Amlibari	Rainfed	Diseases not found
R-1148	Zanjarya	Khoksa	Rainfed	Drought tolerant
R-1149	Kabridula	Haldani	Rainfed	Disease not found
R-1150	Tulsula	Khoksa	Rainfed	Early maturing
R-1151	Fatakdyia	Khoksa	Rainfed	Early maturing, drought tolerant
R-1158	Kamod	Toranmal	Hill/Irrigated	Scented, high yield, cultivated in nalas, riverbeds
R-1162	Dhawadya	Daliamba	Irrigated	Kernel yellow, better yield
R-1163	Kolam	Molgi	Hill/Irrigated	Scented, high yield, cultivated in nalas, river beds.
R-1180	Ropnya	Sutarpada	Irrigated	Cultivated in nalas riverbeds, gullies or in irrigated flooded field.
R-1185	Kaldangrya	Nimdarda	Rainfed	Hard to digest
R-1192	Foknya	Basrawal	Irrigated	Broadcasted in forest area like nalas, riverbeds, gullies.
R-1193	Kali Hal	Itwai	Rainfed	Disease not found
R-1194	Bardya	Torankudi	Hill	Broadcsting along hill slopes, diseases not found, drought tolerant.
R-1195	Kalazanjarya	Torankudi	Hill	Kenel blackish, diseases not found
R-1196	Mothi Hal	Ranipur	Irrigated	More yield, need more water
R-1197	Ekadandi	Basrawal	Rainfed	Stem is stout, only one seedling is used for transplantation
R-1198	Ambamor	Lakkadkot	Rainfed	Scented, grain short & thin
R-1199	Hawya	Khairkhunta	Rainfed	Very rare, less yield.
R-1200	Sukwel	Amlia	Rainfed/irrigated	Scented, high yield
R-1201	Dashrya	Torankudi	Rainfed	Disease not found, drought tolerant
R-1202	Torna	Kamad	Rainfed	Scented, drought tolerant
R-1203	Guida	Bilgawan	Irrigated	Cultivated in nalas, river bes as rabi & in rainy season in flooded field area used in fast especially on 'Rishi panchami' and for lactating mothers for good lactation.
R-1204	Taichun	Bilgawan	Irrigated	Cultivated in nalas, river beds as rabi, in rainy season in flooded field areas. Given for lactating mothers for good lactation and used during fast.

Table 2. Agro morphological characters of traditional rice cultivars from Nandurbar district.

Accession No.	Method of cultivation	Days to maturity	No. of tillers	Grain colour	Grain type	Remarks
R-1129	Transplantation	135	6	White	Long & bold	
R-1135	Transplantation	140	12	White	Long & bold	
R-1139	Line sowing	112	19	White	Short & bold	Kernel white, more tillering
R-1140	Line sowing	135	8	White	Short & bold	
R-1141	Line sowing/ Transplantation \Broadcasting	95	2	White	Long & bold	Panicle more branched.
R-1143	Line sowing	110	17	White	Long & Bold	Kernel red
R-1148	Line sowing/ Transplantation	110	3	White /Red	Long & bold	
R-1149	Transplantation	125	10	Reddish	Long & bold	Kernel blackish
R-1150	Line sowing	105	18	White	Long & thin	Panicle scattered, more tillering
R-1151	Transplantation	85	7	White	Long & thin	Panicle scattered, early maturing
R-1158	Transplantation	175	21	White	Long & thin	Panicle more branched, more tillering
R-1162	Transplantation/ line sowing	95	8	White/ Reddish	Long & bold	Panicle more branched.
R-1163	Transplantation	175	12	White	Long & thin	Kernel white
R-1180	Transplantation	135	6	White	Long & bold	
R-1185	Line sowing	140	12	Red	Long & bold	Kernel blackish
R-1192	Broadcasting	120	5	White	Long & bold	
R-1193	Broadcasting	120	2	Red	Short & bold	Kernel black
R-1194	Broadcasting/ Line sowing	85	3	Red	Short & bold	
R-1195	Line sowing	115	8	Reddish	Long & bold	Kernel blackish
R-1196	Line sowing	165	11	White	Long & bold	Kernel yellowish
R-1197	Transplantation	110	20	White	Long & bold	Stem stout, grain long
R-1198	Transplantation /Line sowing	170	8	White	Long & bold	
R-1199	Transplantation	135	6	White	Short & bold	
R-1200	Transplantation	130	11	White	Long & bold	
R-1201	Line sowing	86	18	Reddish	Long & bold	Kernel blackish, more tillering
R-1202	Line sowing	86	5	White	Short & bold	
R-1203	Transplantation	175	12	White	Long & bold	
R-1204	Transplantation	176	22	White	Long & bold	

Table 3. The range of diversity in morphogenetic and biochemical characters of rice cultivars.

Sr. No.	Character	Maximum	Minimum	Mean	Accession useful in future breeding programme
1.	Plant height (cm)	205	52	104.75	R-1150, R-1140, R-1185
2.	Days to 50% flowering	108	38	65.89	
3.	Panicle length (cm)	32	8	17.30	R-1158, R-1185
4.	100 grain weight (g)	3.711	1.487	2.523	R-1202
5.	Kernel length (mm)	9.606	6.560	7.822	R-1151
6.	Length : Breedth (L:B) Ratio	3.466	1.138	2.595	R-1158, R-1199
7.	Total carbohydrate content (g/100 g)	75.00	33.00	52.11	R-1202, R-1158
8.	Total Protein content (g/100 g)	9.440	4.560	6.833	R-1180, R-1198, R-1196

Kaldangrya (R-1185) is hard to digest. The tribal farmers consider R-1139, 1143, 1149, 1193, 1194, 1195 and 1201 as disease resistant varieties. These agro genetic characters reveal the genetic diversity present among these 28 landraces of rice from Nandurbar district. Detailed scientific investigations, however, are needed to ascertain each and every character. Three landraces namely dhawadya (R-1162), dodi hal (R-1139) and kamod (R-1158) were reported to be grown by Mahadhevkoli tribe in Western Ghats¹¹. They also mentioned a landrace called kal bhat which may be similar to kali hal (R-1193) of the present study. The tribals in Maharashtra refer rice as hal or bhat.

Table 2 shows the cultivation practices, days to maturity, tillers / plant, grain colour and grain type. The cultivation practices differ in different area of the district. In rainfed ecosystems, the sowing is by broadcast method in some areas and by line sowing method in some other areas. The line sowing method is laborious and time consuming but, the farmers in low lying areas prefer it to allow rain water to stand in field for as much time as possible. In hill ecosystem, transplantation method is followed in area with plenty of water (tanks and lakes) and in nalas. Water logged conditions are created in nalas by plugging the flow of water at select points. Due to this, the soil eroded along with run off water from hill slopes will get deposited in the rice fields in nalas, providing nutrients and strength to the root system. Thus, the tribals take advantage of rainwater running down along the slopes to grow rice crop. This practice also helps them in preventing soil erosion during rainy season. Such traditional practices of agriculture with better utilization of the prevailing environmental conditions have helped them to save the agro biodiversity of the region. However, the tribals living in Satpura hill in Nandurbar district do not practice terrace farming. It certainly leads to choking of nalas and

degradation of soil during heavy rains.

The genetic diversity in days to maturity varies from 85 to 176. Accessions R-1141, 1148, 1151, 1162, 1194, 1201 and 1202 are very short duration cultivars. The variation in grain colour shows white, red and yellow colours. Number of tillers / plant also varies to a great extent. Accessions R-1141, 1148, 1151, 1162, 1180, 1182, 1192, 1193, 1194, 1195, 1198, 1199 and 1202 produce less than 10 tillers. Among these R-1141, 1194 and 1202 produce only two, three and five tillers respectively. The farmers consider all these as drought tolerant cultivars. Recently, less number of tillers per plant was correlated with high drought tolerance capacity in rice plant¹². Hence, these traditional cultivars of Nandurbar may be useful as drought tolerant lines. Variation in days to maturity, grain colour and number of tillers were reported among rice landraces collected from other states¹³⁻¹⁵.

Table 3 shows only range of diversity in morpho genetic characters and content of total carbohydrates and proteins of the grain. Values of these character for every individual landrace are not shown. The results indicate that the accessions R-1140, 1150, 1185 are short, while the plant height is more than 100 cm for others. The average kernel length is 7.8 mm with maximum of 9.6 mm (R-1151) and a minimum of 6.50 mm (R-1202). The length : breadth (L : B) ratio is 2.5. Thus these landraces from Nandurbar can be categorized as long and bold type. The range of carbohydrate content of the grain is from 33% to 85%. Low levels of carbohydrate in certain landraces indicate less starchy and glutinous endosperm. This endosperm character is rare among indica rice and is the character of japonica rice. Chauhan *et al.*¹ and Nayak *et al.*¹⁵, have screened several collections from Bihar and Orissa for amylose content and found the presence of both sticky and non sticky cultivars. A detailed analysis of the ratio of

amylose and amylopectin of these cultivars will through more light about their endosperm character and genetic diversity. Rice landraces of Nandurbar also show higher protein content with a range of 4.5 to 9.4% (Table 3). The average protein content of indica rice is 6%. An analysis of 124 landraces from Orissa showed that the yield in terms of grain weight is coheritable with characters like plant height, grain length and panicle length¹⁶. In consideration of this view, the promising accessions from the present collection which may be used as donors for specific morphogenetic character are mentioned in Table 3. The low carbohydrate and high protein content and their drought tolerance, short crop duration, long and scented grain make these rice landraces of Nandurbar an important germplasm collection for future rice breeding programme.

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