DOI: https://doi.org/10.36094/sc.v89.2023.Folk_Rice_Landraces_from_Koraput_Valley.Panda_Behera.364

Research Communication

Sci. and Cult. 89 (9–10) : 364-367 (2023)

Folk Rice Landraces from Koraput Valley of Eastern Ghats of India Improving Tribal Food and Nutritional Security

***Abstract*: Diversity of folk rice varieties (also called rice landraces) and its wild relatives provides the bedrock of evolution for cultivated rice. Koraput valley of Eastern Ghats is well known for its rich human cultural diversity along with home to large number of folk rice varieties.The last five decades have witnessed a rapid decline in the genetic diversity of rice in this region because of so-called Green Revolution, when most of the traditional folk varieties were replaced with a handful of modern cultivars. The remaining folk varieties are still surviving on marginal farms and tribal families are testimony to the amazing capacity for adaptation of local landraces to different abiotic and biotic environmental conditions to contain sources of useful genes. They also embody the remote history of farmers' selection of genotypes to suit diverse cultural preferences, diverse nutraceutical propertiesand good quality traits. In the present paper an effort has been made to highlight the rice genetic resources of Koraput for improving food and nutritional security and their livelihood implications in the era of climate change.**

Keywords: Climate resilience; Food security; Nutritional security; Traditional rice

Koraput (part of Eastern Ghats of India) is a land of topographical and ecological diversity with rich assembly of unique flora and fauna. The plant genetic repository of the region is of great significance in the global context and notably it is one of the centres of diversity for many food crops including rice[1,2]. Recently, Koraput has been declared by Food and Agriculture Organisation (FAO) as the global agricultural heritage site[3]. It is inhabited by some of the most ancient tribes, including the tribes of Austro-Asiatic origin and is an agriculturally important region that has contributed to early agriculture in India[4]. Approximately 62 tribal communities are inhabitants of this region constituting 50.6% of the total tribal population of district who are traditionally ingenious rice cultivators[2]. Recently, PPVFRA identified the district as an agrobiodiversity hotspot[3]. This region, with its diverse altitude range and unique rainfed agro-climatic conditions, aids in the cultivation of many folk rice landraces[5]. These rice landraces are considered as valuable assets for tribal communities because of their distinct aroma, flavour and cultural significance[6]. Rice being cultivated in four broad categories of land types such as donger-the hilly slopes used in the past for shifting cultivation; bunded or un-bunded upland fields called dhepa, irrigated or rainfed medium elevation land Bhatta, lowlands named khala and deep lowlands marshy plains called jhola[2]. Different varieties of rice are cultivated in each of the land type, which are mainly for their importance to culinary and cultural purposes[3]. With modernization and settled agriculture, the traditional knowledge is becoming lost, a trend that may lead to decreased diversity of indigenous crops, diets and poorer nutrition. The last five decades have witnessed a rapid decline in the genetic diversity of various indigenous and folk rice in the region[7]. Though these are useful genetic resources for tribal community but largely ignored by researchers, breeders and policy makers. Therefore, the focus of the paper is to highlight the climate resilience traits and nutritional value of selectedrice landraces of Koraput for conservation and further utilization. A mixed method of review approach was employed, comprising different research outcomes of the traditional rice landraces of Koraput used by tribal people.

Rice Diversity in Koraput for Food and Nutritional Security: The Koraput district of Odisha (part of Eastern Ghats of India) is considered as the secondary centre of origin of Asian cultivated rice *i.e.* Aus ecotype[6] (Fig. 1). These indigenous rice landraces are intermediate between wild rice and modern varieties that show many primitive features and are traditionally cultivated and maintained by farmers[8,9]. Moreover, these landraces possess good quality grains with better cooking, nutritive and milling

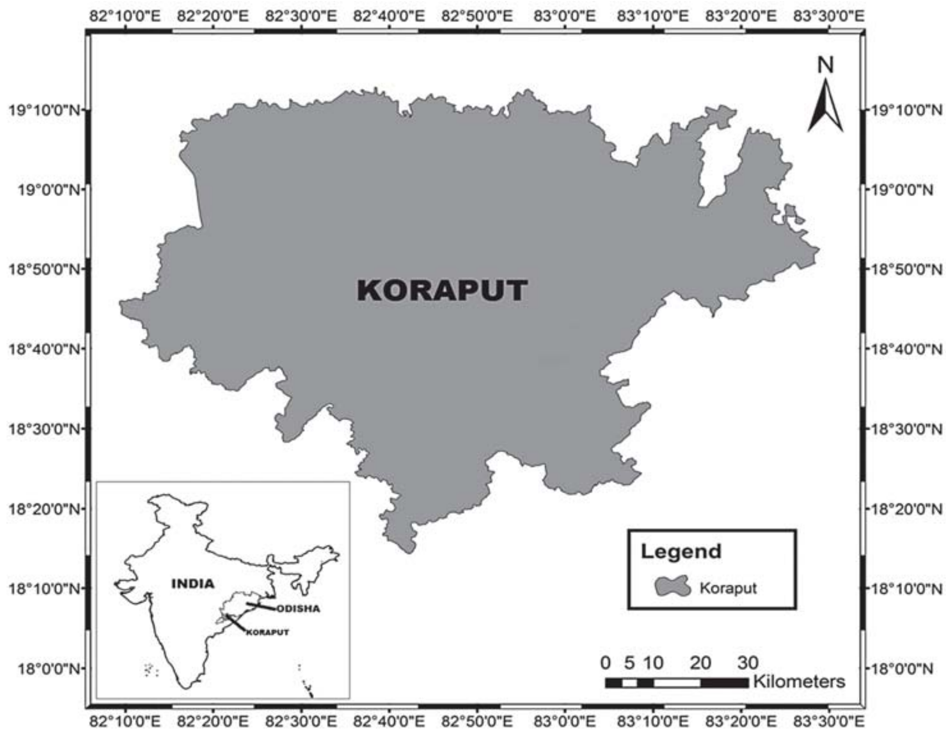

Fig. 1 Map of Study Site Koraput District of Odisha a Part of Eastern Ghats of India.

qualities. Most importantly these are low input varieties with a stable yield potential under adverse climatic conditions. These landraces are claimed to contain sources of useful genes for tolerance to physiological and ecological stress, disease and pest resistance and good quality traits[8]. During 1955-59, the Central Rice Research Institute (CRRI), Cuttack collected 1,754 germplasm accessions of cultivated rice and 150 accessions of wild rice from Jeypore tract of Odisha under a project Jeypore Botanical Survey[10]. After 40 years, M. S. Swaminathan Research Foundation (MSSRF), Chennai resurveyed the major part of the Jeypore tract in 1995-96 for documentation of Intellectual property study, only 256 accessions were available[8]. CRRI Cuttack and National Bureau of Plant Genetic Resources (NBPGR), New Delhi jointly explored the undivided Koraput district (1995-96) for rice germplasm. In all 318 accessions were collected, of which 120 were upland varieties and 198 were medium land and low land, which were less than one third of the collections made during the Jeypore Botanical Survey in the late 1950s[5]. Realizing the rapid loss of genetic and species diversity, M.S. Swaminathan Research Foundation (MSSRF) Chennai, initiated its work in Koraput in 1995 with rice genetic resources in a participatory mode to revive and conserve rice genetic resources for enhancement and sustainable utilization[8]. In spite of erosion of a number of rice landraces, Koraput district of Odisha is still today a rich source of indigenous rice lines having the hidden genetic potential that needs to be explored.As per the 14 Carbon (C^{14}) dating of fossil grains and other evidences[11], the Saura and Gadaba were the first rice cultivators. It is believed that Sauras, Gadabas and Bondos improved the cultivation of wild rice gradually[12]. Recently characterisation for climate resilience traits such as drought tolerance, flooding tolerance and multiple stress tolerance of this landraces are carried out at the Dept. of Biodiversity and Conservation of Natural Resources, Central University of Odisha for identifying new donors (genetic resources), thus is highly desirable to achieve success in this field for the development of stress tolerant variety for improving the food and livelihood security of the tribal people.

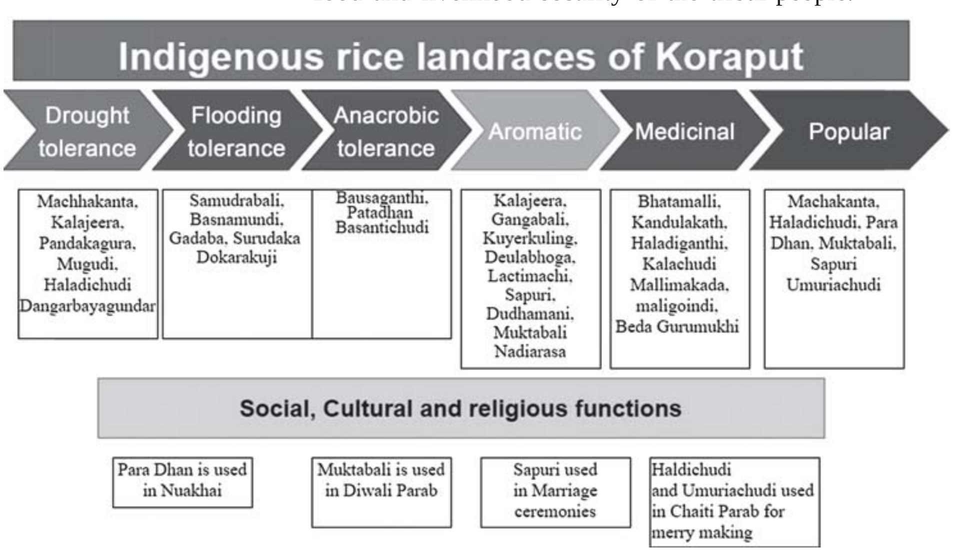

Fig. 2 Indigenous Rice landraces of Koraput for Food Security and Nutritional Security

Different traditional rice landraces of Koraput for climatic resilience and their social and cultural importance was presented in Fig. 3. Mishra and Chaudhury[2] reported some of the indigenous rice landraces such as Machhakanta, Haladichudi, Para Dhan, Muktabali, Sapuri and Umuriachudipossess good quality grains with better cooking, nutritive and milling qualities. Arunachalam et al.[9] and Roy et al.[3] studied different aromatic rice landraces such as Kalajeera, Gangabali, Kuyerkuling, Deulabhoga, Lactimachi, Sapuri, Dudhamani, Muktabali and Nadiarasa of this region and claimed to have superior aroma along with grain quality traits. Ample of genotypic variation of seed quality traits was observed among these landraces notable Kalajeera variety showed highest protein, Fe, Zn and antioxidants compared to other variety. Edwina et al.[13] studied the biochemical and antioxidant activities of several popular pigmented rice landraces such as Bhatamalli, Kandulakath, Haladiganthi, Kalachudi, Mallimakada, Maligoindi, Beda Gurumukhi of Koraput. These landraces contain higher content of total anthocyanin, total phenol and polyphenol which signifies high antioxidant potential and can serve to enhance the nutritive and health promoting potential of rice-based diets. On the basis of physiological introspection, three landraces (Haldichudi, Kalajeera and Machhakanta) showed superior photosynthesis and maintenance of higher water use efficiency under drought condition than the tolerant check variety N22[14]. This result supplemented with molecular characterization based on drought tolerance QTL linked SSR markers revealed that these landraces are more diverse, and the presence of oneor more drought-tolerance-linked QTL. In addition todrought tolerance, these landraces showed higher degreeof tolerance to multiple stresses like salinity and floodingstress[15]. After a rapid flooding tolerancescreening of more than 88 lowland rice landraces from Koraput region, Basnamundi, Gadaba, Dokarakuji,Samudrabali and Surudaka were identified as the flooding-tolerant varieties of the region[16]. It has also been revealed by molecular genotyping studies that these landraces contain flooding tolerance gene *Sub 1* as in FR13A. Along with the flooding tolerance, three rice landraces (Basantichudi, Bausaganthi and Patadhan) have been identified as having superior anaerobic germination potential[17]. Recently Behera et al.[18] studiedstress tolerance index and population structure of indigenous rice landraces to multiple stress tolerance. Based on the study, these variety contain one or more stress tolerance gene to drought, flooding and salinity and can be suitable for the cultivation in rainfed agroclimatic conditions [18]. Despite their poor phenotypes, these folk rice landraces are identified as potential genetic resources for climate resilient breeding programmes and can be popularized globally.

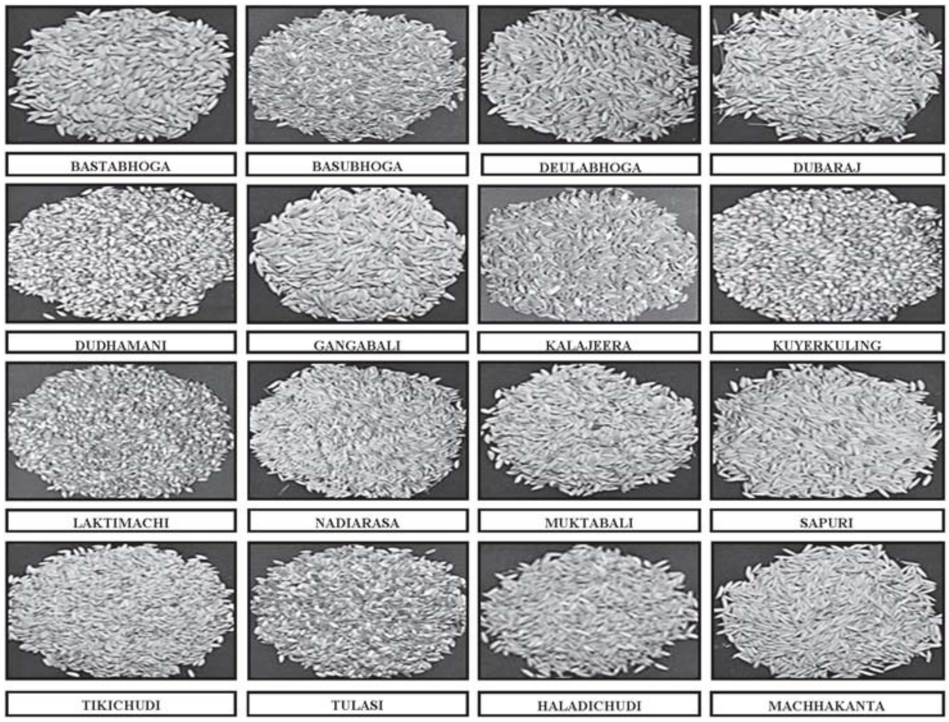

Fig. 3. Grain morphology of different folk rice landraces from Koraput.

Conclusion: We are living at a time, when, climate change is affecting monsoonal pattern thereby affecting our agriculture and livelihood. It is evident from the present study that tribal communities of Koraput largely cultivate and depend on traditional rice for their food and livelihood. The superior indigenous gene pool of rice identified should be popularized for climate resilient breeding programmes. For alleviating hunger and malnutrition, the traditional rice should be cultivated and conserved. A strategy to promote commercial production of these indigenous rice is required to boost the local economy by initiating processing, value addition and creating a market so as to reach more consumers. Above all, we must create mass awareness on the importance of indigenous rice landraces of Koraput and their conservation for a sustainable future. ❐

DEBABRATA PANDA*
PRAFULLA K. BEHERA

Department of Biodiversity and Conservation of Natural Resources, Central University of Odisha,
Koraput-763004, Odisha, India

* Corresponding author: dpanda80@gmail.com

1. S. Mishra, S. Swain, S.S. Chaudhury and T. Ray, *Plant Genetic Resources Newsletter*, 156, 63-67 (2008).
2. S. Mishra, and S.S. Chaudhury,*Genetic Resources and Crop Evolution*, 59, 793–804. (2012)
3. P.S. Roy, A. Patnaik, G.J.N. Rao, S.S.C. Patnaik, S.S. Chaudhury and S.G. Sharma, *Agroecology and Sustainable Food System*, *41*(2), 167-185 (2016).
4. T.S. Singhand H.O. Sharma. Int J Agric Sci, 10(1):4983–4986 (2018)
5. B.C. Patra andS. R. Dhua,*Genetic Resources and Crop Evolution*, *50*(8), 825-828 (2003).
6. D. Panda and S.K. Palita, *Curr. Sci.* 120, 989-996 (2021).
7. M.P. Nayar, A.K. Singh and K.N. Nair, Protection of Plant Varieties & Farmers' Rights Authority, NewDelhi,p. 217, (2009).
8. S. Tripathy, P. Gurung and S.D. Sharma, *Plant Genetic Resources Newsletter*, 141, 70-73 (2005).
9. V. Arunachalam, S.S. Chaudhury, S.K. Sarangi, T. Ray, B.P. Mohanty, V. A. Nambi, and S. Mishra,Rising on rice: The story of Jeypore. *Chennai: MS Swaminathan Research Foundation*, *1*, 39 (2006).
10. S. Govindaswamiand A. Krishnamurty. Rice News Teller, 7(3/4), 12-15 (1959).
11. D. Lenka. Agriculture in Orissa. Kalyani Publishers, Cuttack, Orissa, India. 538 pp. (2001).
12. B. Sahu, Dhana. (In Oriya) Orissa Sahitya Academy, Cuttack, Orissa, India. 120 pp. (1965).
13. P Edwina, C. Ajitha, P. Eganathan, S. Gayathri, J. Saranya, V. Arivudai Nambi, M. Smita and C. Susanta Sekhar,*Int. Food Res. J.* 21(5), 1941-1949 (2014)
14. S.S. Mishra, P.K. Behera S.K., Lenka and D. Panda, *Physiol. Mol. Biol. Plants*, 24(6), 1035-1046 (2018)
15. D. Panda, B. Mohanty, P.K. Behera, J.Barik and S.S. Mishra, *Funct. Plant Biol.*,47, 99–111. (2020)
16. J. Barik, V. Kumar, S.K. Lenka and D. Panda, *Plant Physiol.Rep.*, 24(2), 249–261 (2019).
17. J. Barik, D. Panda, S. Mohanthy and S.K. Lenka, *Physiol. Mol. Biol. Plants*, ***25***(4), 847–863. (2019)
18. P.K. Behera, V. Kumar, S.S. Sharma, S.K. Lenka and D. Panda, *Curr. Plant Biol.**33***, 100269. (2023).