

GENETIC DIVERSITY IN ORYZA AND ITS UTILIZATION

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Abstract: The Western Ghats region of South India is rich in genetic diversity of *Oryza*, particularly asian cultivated species and is considered as a centre of origin of rice. This rich diversity of land races and wild species, harbours many dominant genes, including genes for resistance to diseases, insect pests, physiological stress situations as well as characters of nutritive quality. The plant genetic resource includes primitive cultivars, traditional land races, farmer's varieties, released varieties, genetic stocks, parental lines, agro biodiversity etc. Kerala holds a special place in biodiversity with a wide range of indigenous varieties and with different agroecological situations. There are special land races particularly in certain regions such as saline tolerant varieties, scented or aromatic rice, medicinal rice, organic rice etc. with high protein, high amylase and mineral.

Key words: Rice, Genetic resources, Evolution, Wild species, Land races, Indigenous varieties

INTRODUCTION

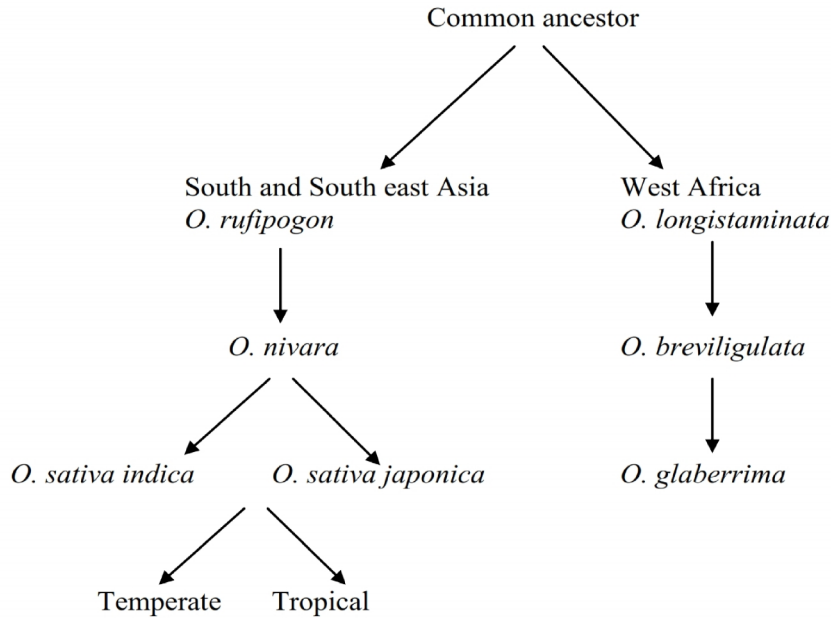
The domestication of rice dates back to antiquity, although the precise time and place of its domestication may never be known. The general consensus, however, is that domestication took place independently in China, India and Indonesia, giving rise to Asia's three varietal groups: japonica, indica and javanica. Indian gene sources provided worldwide gains in production and productivity in both tropical and temperate rice before high-yielding varieties were even introduced. The popular varieties of Indonesia (Intan, Peta and Mas) are derivatives of a cross between the Indian variety Latisail and the Chinese variety Cina. Peta is one of the parents of IR 8, the variety which revolutionized rice production in tropical Asia. IR 8 is the most widely-used parent in several crosses in tropical Asia. More than 35 varieties released by IRRI and grown in several tropical Asian countries have one or another Indian variety or wild species in their ancestry. GEB-24, Ptb 18, Ptb 21 and CO-18, are few such internationally accepted varieties. An Indian accession of the wild species, *O. nivara* is the only source of resistance for grassy stunt virus.

Classification of *Oryza*

Kerala is internationally recognized as a hotspot of biodiversity, its efforts in sustainable development, gender equality initiatives and achievements in developmental studies. The state of Kerala is divisible into three major regions namely highlands, midlands and lowlands. The altitudinal diversity of Kerala ranging 0- 2694m above the sea level, two distinct monsoon seasons providing an average rainfall of 3100 mm per annum., 44 perennial rivers, 590 km long coastline are responsible for the diverse ecosystems of Kerala. The diverse ecosystems support unique assemblage of biological communities with remarkable array of species and genetic diversity (Eizenga *et al.*, 2008).

The genus *Oryza* consists of approximately 23 wild and two cultivated species in the tribe Oryzeae, within the subfamily Bambusoideae, native to tropical and subtropical regions of Asia, Northern Australia and Africa. The wild *Oryza* species can offer valuable genetic resources for rice improvement programmes (McCouch *et al.*, 2012).

Parallel evolution of cultivated Rice



Parallel evolution of cultivated Rice

O. glaberrima (African rices) have excellent vegetative growth. The African rice compete well with weeds and are drought tolerance. It also provide resistance to the most devastating disease rice blast caused by *Pyricularia oryzae*. *O. rufipogon* L. (wild rice.) is a source of water-saving and drought-resistant rice (WDR).

Some of these wild species even provide cytoplasm for male sterility, which is now economically used in hybrid rice production. CMS systems represent a valuable tool in the production of hybrid seed in self-pollinating crop species (Chase and Babay-Laughnan, 2004; Hanson and Bentolila, 2004). CMS-WA (wild abortive) rice was developed in *indica* rice cultivars from a male-sterile plant found in a natural population of the wild rice *Oryza rufipogon* Griff. CMS-Boro II rice arose from a wide cross based on the cytoplasm of Chinsurah Boro II (*O. sativa* subsp *indica*) and the nucleus of Taichung 65 (subsp *japonica*).

The Western Ghats region of South India is rich in genetic diversity of *Oryza* and has *O. rufipogon*, *O. nivara*, *O. granulata* and *O. officinalis*. The International Rice Research

Institute (IRRI) has identified the Bhoothathankettu, Parambikulam and Karulai forest reserve along the Western Ghats in Kerala for *in situ* conservation of these species. In 1958 a tetraploid wild rice, *Oryza malampuzhaensis*, closely resembling the diploid *O. officinalis* was reported from two localities in Malampuzha in Kerala

The two cultivated species, *Oryza glaberrima* and *O. sativa* are believed to be evolved with common ancestors, though these species show several negative characteristics with respect to shattering, brittle grain and poor milling quality. More importantly, African rice consistently shows lower yields than the asian counterpart, but African rice often shows more tolerance to fluctuations in water depth, iron toxicity, infertile soils, severe climatic conditions and human neglect, and exhibits better resistance to various pests and diseases, such as nematodes (*Heterodera sacchari* and *Meloidogyne* spp.), African gall midge, RSNV, rice yellow mottle virus and the parasitic plants *Striga* (Kovach and McCouch, 2008; Xu *et al.*, 2011).

The cultivated rice (*Oryza sativa* L.) originated from the wild rice (*Oryza ruffipogon* L.) in the swamp areas with wet and dry alternation, adapted to both water and less-watered (Mackill *et al.*, 2012). Long-term evolution led to two different ecological types according to the water requirements (Luo *et al.*, 2002). One is the paddy rice adapted to the aquatic environment; the other is the upland rice needing dry conditions to complete its growth and development. According to Ding (1957)'s classification of cultivated rice, rice and upland rice in botany and biology were not significantly different; the difference lies in their ecological adaptations. The upland rice has higher drought resistance, while paddy rice is much more sensitive to drought (Vange, 2009).

Rice Genetic Resources

The genetic diversity available in the Asian cultivated rice *Oryza sativa* L. is quite impressive when compared with any other crop plants. South east India is considered as a centre of origin of rice, and is home for a rich diversity of land races, which harbours many dominant genes, including genes for resistance to diseases, insect pests, physiological stress situations as well as characters of nutritive quality. The plant genetic resource includes primitive cultivars, traditional land races, farmer's varieties, released varieties, genetic stocks, parental lines, agro biodiversity etc.

The rich tradition of Kerala in the rice genetic resources and its cultivation is uncomparable. There are special land races particularly in certain regions such as saline tolerant varieties, scented or aromatic rice, medicinal rice, organic rice etc. Some of the high protein, high amylase and mineral rich rice from Kerala can be a wonderful restorative food for many health problems like diabetes, cancer, mineral deficiencies etc.

In Kerala, there are some areas with atypical coastal line extending over two districts, Ernakulam and Alappuzha, which experiences frequent tidal forces and there by inundation of saline sea water. Here farmers prefer salt tolerant traditional rice varieties (Karthikeyan, *et al.*, 2010). Kaipad is the saline prone rice production tract of North Kerala, like Pokkali

tract of South Kerala. The soil type of Kaipad is saline hydromorphic. Further, the land races of Pokkali and Kaipad tracts are different. The Kaipad system of rice cultivation like Pokkali system is an integrated organic farming system in which rice cultivation and aquaculture go together in coastal brackish water marshes which is rich in organic matter.

Scented/ aromatic rice is special group of rice which is considered best in quality. These are famous for their characteristic fragrance when cooked. These varieties are very popular in Asia and has gained wider acceptance in rest of world. Because of their aroma, flavour and texture they command a higher price in the rice market than non aromatic varieties.

Medicinal rice are varieties which are used either as medicine or as ingredient in ayurvedic preparation. Njavara is a unique medicinal rice variety of Kerala. This is other wise known as 'Shashtikam' in Ayurvedic books referring to the duration of the crop. This is an extra short duration variety matures in about 60-70 days. In ayurveda, this is used along with Kurunthotti, milk etc for various treatments. There are mainly two types of Njavara, golden yellow glumed and black glumed.

CONCLUSIONS

In order to sustain the wetland ecosystem the traditional knowhow along with rice field conservation activities are to be strengthened. It is highly reassuring the implementation of the Coastal Zone Regulation Act and Rules to prevent conservation of rice fields provide a legal support to protect mangroves and wetlands. Campaigns also needed to bring all the fallow rice fields back to cultivation. This will not only help in attaining the food security but also for the sustainability of Aquatic ecosystem.

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