

Full Length Research Paper

Rice landraces of Kerala State of India: A documentation

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Rice landraces of Kerala State of India are named based on cropping season, growing conditions, crop duration, morphological features, color of seed and other specific traits, if any. The collections of landraces of Kerala are classified as rare, very rare and common. A part of these collected accessions have been characterized. DIVA-GIS was used to map the collection site, which showed that the collections made are well distributed throughout Kerala but very meager collections are represented from Thiruvananthapuram and Pathanamthitta Districts. Till about 20 years back, all the paddy fields in Kerala were being cultivated with various landraces of rice during the southwest and northeast monsoon seasons. Currently, these paddy fields are being progressively filled with soil transported from other places and converted into building sites or sites for growing other upland crops. As a result of this, a large number of primitive cultivars and local landraces of rice have been lost. Genetic erosion can be assessed and target areas for collection in diversity rich area can be predicted based on resurvey of the collection localities and mapping the collection localities using DIVA-GIS tool. The present paper describes the rice landraces of Kerala with their specific location from where they have been collected.

Key words: Rice, landraces, Kerala, DIVA GIS.

INTRODUCTION

The narrow western part of peninsular India, including the coast, spread north south between the river Tapti and Kanyakumari, and comprises the erstwhile Malabar province. Within this narrow geographical area, and arising abruptly from the coast, is the more or less continuous chain of hills, called the Western Ghats. This region of India is unique in its flora and fauna. Throughout its length, of nearly 1600 km it passes through six states viz., Gujarat, Maharashtra, Goa, Karnataka, Kerala and Tamil Nadu. Topographically, the southern half of the Western Ghats is more varied and biologically enriched. The widest gap of Western Ghats is at Palakkad in Kerala adjoining Tamil Nadu. Kerala lies in the south-western corner of the Indian peninsular region.

Kerala is a narrow strip of land, situated in the southern part of the Western Ghats adjoining Tamil Nadu and Karnataka in the east and north-east, and joined by the Arabian Sea in the west. Kerala State is divided into 14 districts viz., Alappuzha (ALP), Ernakulam (EKM), Idukki (IDK), Kannur (KNR), Kasargod (KSD), Kottayam (KTM), Kollam (KLM), Kozhikode (KKD), Palakkad (PKD), Pathanamthitta (PTA), Malappuram (MPM), Thrissur (TSR), Thiruvananthapuram (TVM) and Wynad (WYD). Except Idukki, Kottayam, Palakkad, Pathanamthitta and Wyanad and all other districts have coastal areas. Wyanad (Lakkidi) receives the highest rainfall, whereas Palakkad receives the lowest rainfall among the districts. Rice cultivation in Kerala dates back to 3000 B.C. (Manilal, 1991). Vast diversity of germplasm is available both in wild and cultivated rice. Hence the objective of the present study was to analyze the landraces of Kerala collected so far by this station and map the collection

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Table 1. Cultivated rice collected from Kerala.

District	Number of accessions
Alappuzha	53
Ernakulam	113
Idukki	15
Kannur	83
Kasaragod	40
Kollam	10
Kottayam	4
Kozhikode	30
Malappuram	144
Palakkad	42
Pathanamthitta	1
Thiruvananthapuram	6
Thrissur	63
Wayanad	106

localities using DIVA Geographic Information System (GIS). Seven explorations and collection missions were conducted during the period 1990 to 2010 exclusively for rice in all the districts of Kerala. The sampling strategy followed was bulking of seed samples either in farmers' field or store. The information gathered from the farmers and tribals during various exploration missions on landraces of rice were recorded together with germplasm and compiled.

MATERIALS AND METHODS

Seven explorations and collection missions were conducted during the period of 1990 to 2010 exclusively for rice in all the districts of Kerala. The sampling strategy followed was bulking of seed samples either in farmer's field or store. The information gathered from the farmers and tribals during various exploration missions on landraces of rice were recorded together with germplasm and compiled. DIVA GIS is a Geographic Information System designed to assist Plant Genetic Resources and biodiversity communities to map the range of distribution of species (Hijmans et al., 2002). DIVA-GIS Software (Version 7.2, www.diva-gis.org) was used to map the landraces collected from Kerala and analyzing the gap.

RESULTS AND DISCUSSION

NBPGR Regional Station at Thrissur, Kerala has collected a total of 855 accessions belonging to rice and wild rice during various exploration and collection missions carried out up to 2010. This included 710 accessions of cultivated (Table 1) and 145 of wild rice (Table 2).

The majority of germplasm is from Malappuram (144), Ernakulam (113), Wayanad (106), Kannur (83), Thrissur (63) and Alappuzha (53) districts. The first documented account of association of tribals with the conservation of landraces in Kerala is that of Manilal (1991). The tribal

people of Kerala practice subsistence farming but ten distinct tribes of Malabar region are agriculturists who cultivate 22 primitive named landraces in North Kerala (Manilal, 1991). Joseph and Nizar (1998) documented the collection of 60 landraces of rice in Malabar and adjoining areas, classifying them into 4 categories.

Landraces of Kerala are named based on cropping season, growing condition of the crop, crop duration, morphological features, color of seed and specific uses as detailed below.

Categories of landraces

Among the cereals, rice is a major crop of this region with considerable variability in duration, adapting to various agro-climatic and cultural situations and seasons, seed coat colour, shape, size, pigmentation of plant parts, plant height, tillering, lodging, grain, cooking quality and aroma.

Names associated with season

In Kerala, rice has been grown in three seasons namely *Virippu* (April-May to September-October), *Mundakan* (September-October to December-January) and *Puncha* (December-January to March-April).

Names associated with growing condition

Rice is grown in widely different regions from deeply submerged areas which are below sea level extended to high altitudes. The rice varieties adapted for sowing in submerged areas with 1 to 5 m water are called shallow water or deep water or floating varieties and also locally called *Pokkali* rice. They are long duration, photo-period sensitive and have rapidly elongating internodes. The varieties which are adapted to high altitudes are normally referred to as high altitude varieties or locally as *Malanellu* or *Malabarian* rice. Varieties grown in dry situations are called upland varieties or *Modon* (Figure 2 and 3). *Kaima* is the most popular red bold rice of irrigated transplanted belt (Joseph John and Abdul Nizar, 1998).

Names associated with crop duration/maturity

Rice varieties can be classified as early, medium and late according to the length of time required to reach maturity. The duration of early maturing varieties is from 90 to 105 and that of late maturing is more than 140 days. *Thonnuran* means variety maturing in 90 days (early duration).

Names linked to plant height

Rice varieties may be classified into dwarf, semi-dwarf and

Table 2. Wild rice collected from Kerala.

Taxa	District	No. of accessions
<i>O. sativa f. spontanea</i>	Alappuzha	7
	Ernakulam	2
	Kannur	5
	Kasaragod	7
	Kollam	4
	Kozhikode	10
	Malappuram	8
	Palakkad	2
<i>O. meyeriana</i> subsp. <i>granulata</i>	Thrissur	12
	Kollam	3
	Malappuram	12
	Palakkad	12
	Pathanamthitta	3
	Trivandrum	3
	Thrissur	1
Wyanad	1	
<i>O. nivara</i>	Kozhikode	1
	Malappuram	2
	Palakkad	5
	Thrissur	2
<i>O. officinalis</i> ssp. <i>malampuzhaensis</i>	Ernakulam	1
	Malappuram	15
	Palakkad	6
<i>O. rufipogon</i>	Thrissur	5
	Ernakulam	1
	Kozhikode	2
	Malappuram	4
	Palakkad	2
	Thrissur	3
	Trivandrum	3
Kollam	1	

and tall based on their height. Dwarf and semi-dwarf are short stature, lodging resistant and named as *Kutta* or *Katta*. Thus *Kattamoda* all denotes dwarf and semi-dwarf varieties. Likewise, tall varieties are named as *Kodior* *Kodiyar* as they tend to lodge. Thus *Kodivellai* or *Kodiyar* describe tall *indica* forms.

Names associated with morphotypical features

Awn

Awn is the outgrowth of lemma. Most *indica* varieties are awnless, hence easy to handle during harvesting, thresh-

ing and cleaning where these operations are done manually as in India. *Mullanchenna* is an awned landrace from Wyanad.

Grain shape

Rice grains of different varieties can be classified into long, medium and short, according to the length of grain; bold, medium and slender according to the ratio of length and width. Long slender varieties with a uniform translucency in the endosperm and bright lusture are locally referred to as *Channa*, medium bold grains as *Matta* and long bold as *Thondi*.

Names associated with specific use

Various kinds of special purpose rice have been in use in India from time past. The rice flavour of certain glutinous types is used for various kinds of pastry products. Similarly, specific types of rice are used for puffed rice, popped rice and avul. These varieties are locally called by various names. For example *Varukunnanellu* is used for preparing popped rice. Njavara is cultivated for its medicinal properties and is an important ingredient of *navarakkizhi* in Ayurvedic treatment. It is also used as weaning food (Joseph John and Abdul Nizar, 1998). *Chennellu*, another landrace of medicinal value grown by Mavilan tribe who administer popped rice soaked in water to diarrhea patients (Joseph and Nizar, 1998).

Names associated with colour of milled rice

Ancient literatures show that rice was classified by the Malabar ayurvedics into two broad groups *Saali* which are white rices and *Vreethi*, which are red rices (Manilal, 1991). *Varinellu*, *Chennellu* and *Kalamappari* are white rices and *Njavara*, *Karimkuruva*, *Karinellu*, *Chitteni* and *Modan* are red rice.

Names associated with colour of husks

The colour of husk varies from straw to black through brown to purple like *Karuthanjavara* and *veluthanjavara* are referred to the husk colour (Figure 4 and 5).

Names associated with aroma

Very fine seed size and scent add to the quality of rice used for delicious preparations like pulav and pudding. Scent or aroma is a special genetic trait, restricted to certain varieties only. Such scented rice varieties fetch premium price in the market and are known in trade as *Jeeragasala*, *Gandagasala*, *Briyaniari* (suitable for prepa-

ring briyanni), *Kitchadi samba* (suitable for preparing *kitchadi*). Table 3 represents the different landraces meant for their characteristic features

During the 7 specific collection missions, 623 different named landraces of Kerala were collected, out of these 256 landraces are classified as very rare (Table 4), which were collected from one district only; 46 as rare (Table 5) which were collected from two or three districts and landraces namely *Arikarayi*, *Aryan*, *Chambavu*, *Jeerakasala*, *Kaima*, *Kuruva*, *Mundakan*, *Njavara*, *Karuthanjavara* and *Chittenias* very common occurring in 4 to 6 districts which are spread throughout with the exception of Thiruvananthapuram, Pathanamthitta and Kottayam districts. Out of the named landraces, 532 accessions have been characterized and conserved in the seed bank of National Gene Bank, National Bureau of Plant Genetic Resources, New Delhi. The qualitative characters showed majority of landraces with certain characteristic features – leaf pubescence either intermediate (51.66%) or pubescent (47.24%) indicating less chances of pest and disease attack; absence of awning (78.45%) and white apiculous color (93.65%); well exerted panicle (62.71%); red seed coat color (92.27%); and straw colored hull (39.23%). The quantitative characters showed wide variation in leaf length, culm length, number of effective tillers and grain yield per plant which indicated that morphological variation among the landraces is immense. The variability in grain length and grain width was low indicating that all have the same type of grain shape.

Utility of DIVA-GIS tool

DIVA GIS a Geographic Information System designed to assist Plant Genetic Resources and biodiversity communities to map the range of distribution of species (Hijmans et al., 2002). DIVA-GIS Software (Version 7.2, www.diva-gis.org) was used to map the landraces collected from Kerala and analyzing the gap. It is an excellent and simple mapping tool for documentation, diversity analysis and location of collection sites. Hence this tool was used to map the collection localities of rice from 339 sites in Kerala. This showed that the collections made are distributed throughout Kerala and very meagre collections are represented from Thiruvananthapuram and Pathanamthitta districts (Figure 1). Now the situation of occurrence of named landraces in their known localities is alarming. Till 20 years back, all the paddy fields in Kerala were being cultivated with various land-races of rice during the southwest and northeast monsoon seasons. In uplands, different upland varieties of rice were grown during the southwest monsoon season and sesame, horsegram, greengram and blackgram were grown in the northeast monsoon seasons. But today in most of the places both in the plains and uplands, these crops are not being cultivated as it used to be. Instead, paddy fields

are being progressively filled with soil transported from other places and converted in to building sites or sites for growing other crops like banana ("*nenthran*" variety), coconut, arecanut, cassava, betel leaves, ginger and in some places aquaculture of prawns and exotic fishes are being carried out. As a result of this, a large number of primitive cultivars and local landraces of rice, sesame, horsegram, greengram and blackgram have been lost. With the conversion of paddy fields for the cultivation of other crops or for housing there is threat of genetic erosion to most of the *Oryza* species and landraces. Moreover, human population pressure due to building of dams for hydroelectric power projects are great in Kerala and the resultant habitat destruction has undoubtedly reduced the range of distribution of *Oryza* species. Genetic erosion can be assessed and target areas for collection in diversity rich areas can be predicted based on resurvey of the collection localities and mapping of the collection localities using DIVA-GIS tool.

Conclusion

Ecologically, Kerala is bestowed with suitable features that can promote variability. In addition, dispersed village settlements, and ethnic and cultural diversity have demanded varying requirements at different times and these might have incorporated variability. The factors, which might have operated to create intra-varietal differences in the cultivated rice of Kerala are: 1. Long history of cultivation of rice in Kerala, under widely different ecological conditions, during which period, multitude of forms and varieties would have been developed, leading to conscious or unconscious selection by farmers/breeders to suit their specific needs, thus culminating in the present day numerous local forms; 2. Slope and terrace cultivation in high altitude areas which are dry or semi-dry, requiring upland varieties; in irrigated conditions of the plains a different set of suitable varieties are needed; in the coastal areas where the principal soil type is acid, saline or acid sulphate, *pokkali* cultivation is being practiced with a set of suitable varieties; in the interior areas of Palakkad and Thiruvananthapuram districts, the soil is neutral requiring varieties suitable for fresh water wetland conditions; in the cole areas (post monsoon cultivation in the submerged areas) of Thrissur district, another set of submergent tolerant varieties are needed. Considering all these specific agro-ecological conditions within the humid tropical situations, specific varieties adapted to each of these varied conditions are required. Varietal requirement for different seasons, areas, water regimes, input supply, pests and pathogens, farmers/consumers preferences is distinct in different regions. Hence, no single variety can suit all the needs and solve the problems associated with rice cultivation in Kerala which has resulted in the large number of landraces occurring or reported to occur in Kerala.

Table 3. Landraces and their characteristic feature.

S/N	Characteristic feature	Name of landraces	Districts
1	Aromatic	Gandhakasala, Jeerakachampav, Mullanchanna	Wyanad, Idukki
2	Awned	Komban	Idukki
3	Cold tolerant	<i>Chettuveliyan, Koduveliyan, Raajani</i>	Wyanad
4	Colour	<i>Chomala, Choman, Chuvannachoman, Chuvannakuruka, Chuvannaponmani, Chuvannaitti, Chuvanthutti, Chuvappan, Karimutty, Karuthachoman, Karuthakuruka, Karuthakutti, Karuthavattan, Karuthavelliyan, Karuthavithu, Karuthacheera, Karuthadukkan, Karuthamundakan, Karutharikannan, Vellachettadi, Vellachitterni, Vellakaravala, Vellakattan, Vellakkoli, Vellakuttadan</i>	Alappuzha, Ernakulam, Idukki Kannur, Kasargod, Kottayam, Kozhikode, Malappuram, Thrissur, Thiruvananthapuram, Wynad
5	Height	<i>Kalakodiyam, Kodian, Pookilakodiyam, Thondi, Thonnuranthondi, Veliyan, Vellakkodiyam</i>	Thrissur, Wynad, Malappuram
6	Medicinal properties	<i>Njavara (Brown), Njavara (Red), Njavara (Uden), Njavara (White), Njavaruvithu</i>	Kannur, Kozhikode, Malappuram, Thrissur
7	Suitable for saline deep water ecosystem	<i>Anakodan, Ayyampillypökkali, Cherayipökkali, CheriyaOrpandy, Chootupökkali, Elamkulampökkali, Kadamakudipökkali, Karunagapallipökkali, Khuzhippallypökkali, Kozhippillipökkali, Kulapandi, Kuthirunellu, Kuzhippullipökkali, Nedungodupökkali, Odachan, Oorpandy, Orkyma, Orumundakan (black), Pallipurampökkali, Vadanakkudipökkali, Vellapökkali, Vettakkalchettivirippu</i>	Alapuzha, Kannur, Kasarakod, Kozhikode, Ernakulam, Thrissur
8	Seasonal specific	<i>Cherumundakan, Cheruvirippu, CheruvirippuVettakkal, Kamanalichettivirippu, Karamundakan, Karimundakan, Kochumundon, Koorimundakan, Koottumundakan, Malmoodan, Mundakacheera, Mundakan (white), Mundakavella, Mundodan, Puncha, Punchanellu, Punchaparuthu, Punjakayama, Vellamundakan, Veluthamundodan, Virippu (Koothumundakan), Virippu –Kottuvalli, Vrischikapandi</i>	Alappuzha, Ernakulam, Kannur, Kasargod, Kollam, Kottayam, Kozhikode, Malappuram, Wynad
9	Special purpose	<i>Nagari, Varukkunnanelu</i>	Kasarakod
10	Upland ecosystem	<i>Adimodan, Ambaladan, Buluginellu, Chingappadan, Erinellu, Kallarikkoyala, Karakkozhivalan, Karanellu, Karavala, Karavalakochuvithu, Karimodan, Keeripallan, Keeriputhada, Kurumkaima, Kururkaima, Metariyan, Modan, Mullankkoyala, Palkaima, Peruvayan, Peruvazha, Poothakali, Thalanellu, Thalavirichankaruthothu, Thuvinnellu, Vellakoyala, Vellamodan, Vellaperuvalan, Vellapperuvasan, Veluthakoyala</i>	Alappuzha, Idukki, Kannur, Kasargod, Kollam, Malappuram, Palakkad, Thrissur

Table 4. District wise collections of very rare rice landraces of Kerala, India.

Cultivar/Landrace name	Number of accessions collected	District(s) of collection
<i>Adhiyan</i>	3	TSR
<i>Adimodan</i>	1	PKD
<i>Adukkkan</i>	3	WYD
<i>Aiyirammeni</i>	2	MPM
<i>Amankari</i>	1	MPM
<i>Ambaladan</i>	1	KNR
<i>Arupathamkuruva</i>	1	KKD
<i>Aryankali</i>	1	MPM
<i>Ayyampillypökkali</i>	2	EKM
<i>Bolangatti Kayama</i>	1	KNR
<i>Buluginellu</i>	1	PKD
<i>Cheera</i>	4	TSR
<i>Cheerachamban</i>	1	MPM
<i>Chendamani</i>	1	MPM
<i>Chennavella</i>	1	TVM
<i>Chennelthondi</i>	1	WYD
<i>Chenthadi</i>	5	WYD
<i>Cherady</i>	1	KSD
<i>Cherayipökkali</i>	1	EKM
<i>Cheriyaryan</i>	1	MPM
<i>Cheriyarpany</i>	1	EKM
<i>Cheriyachitteri</i>	1	PKD
<i>Cheruvellari</i>	2	MPM
<i>Cheruchitteri</i>	1	KKD
<i>Cherukumbalam</i>	1	PKD
<i>Cherumallaran</i>	1	KLM
<i>Cherumundakan</i>	1	ALP
<i>Cheruvatta</i>	1	WYD
<i>Cheruvirippu</i>	1	EKM
<i>CheruvirippuVettakkal</i>	1	EKM
<i>Chettivirippu Kannamali</i>	1	EKM
<i>Chettuveliyan</i>	1	WYD
<i>Chindinellu</i>	1	TSR
<i>Chingappadan</i>	1	KNR
<i>Chomala</i>	6	WYD
<i>Choman</i>	1	KSD
<i>Choorappandy</i>	1	WYD
<i>Chootupökkali</i>	1	EKM
<i>Chowri</i>	1	WYD
<i>Chunkayama</i>	1	MPM
<i>Chuvannachittadan</i>	1	MPM
<i>Chuvannachoman</i>	1	KSD
<i>Chuvannakuruka</i>	1	MPM
<i>Chuvannaponmani</i>	1	EKM
<i>Chuvannaitti</i>	1	WYD
<i>Chuvanthurtti</i>	1	MPM
<i>Chuvappan</i>	1	MPM
<i>Elamkulampökkali</i>	2	EKM
<i>Ennappatta</i>	3	MPM

Table 4. Contd.

<i>Erinellu</i>	1	PKD
<i>Eruvakkali</i>	1	MPM
<i>Gandhakasala</i>	13	WYD
<i>Ittikandappan</i>	1	WYD
<i>Jeerakachampav</i>	1	IDK
<i>Kadamakudipokkali</i>	2	EKM
<i>Kalakodiyar</i>	1	TSR
<i>Kalathekkan</i>	1	KKD
<i>Kallarikkoyala</i>	1	KNR
<i>Kalluruli</i>	1	MPM
<i>Kamanalichettivirippu</i>	1	EKM
<i>Kanali</i>	1	WYD
<i>Karakkozhivalan</i>	1	KNR
<i>Karamundakan</i>	2	ALP
<i>Karanellu</i>	1	PKD
<i>Karavala</i>	2	ALP
<i>Karavalakochuvithu</i>	1	KLM
<i>Karikagga</i>	1	EKM
<i>Karimodan</i>	1	PKD
<i>Karimundakan</i>	1	KTM
<i>Karimutty</i>	1	WYD
<i>Karinjan</i>	1	KNR
<i>Karivalan</i>	1	KNR
<i>Karuka</i>	1	EKM
<i>Karunagapallipokkali</i>	1	EKM
<i>Karuthachoman</i>	1	KSD
<i>Karuthakuruka</i>	2	EKM
<i>Karuthakutti</i>	1	MPM
<i>Karuthavattan</i>	1	MPM
<i>Karuthavelliyan</i>	1	MPM
<i>Karuthavithu</i>	1	TVM
<i>Karuthacheera</i>	1	KTM
<i>Karuthadukkan</i>	1	KNR
<i>Karuthamundakan</i>	1	ALP
<i>Karutharikannan</i>	1	KSD
<i>Keeripallan</i>	1	KSD
<i>Keeriputhada</i>	1	KNR
<i>Khuzhippallypokkali</i>	1	EKM
<i>Kochithonnuran</i>	1	MPM
<i>Kochumundon</i>	1	WYD
<i>Kodian</i>	1	TSR
<i>Koduveliyan</i>	1	WYD
<i>Kolathari</i>	1	PKD
<i>Komban</i>	1	IDK
<i>Konna</i>	2	MPM
<i>Kookavalan</i>	1	TVM
<i>Koorimundakan</i>	1	ALP
<i>Koottumundakan</i>	1	KKD
<i>Kothampalarikayama</i>	1	PKD
<i>Kottakkadan</i>	1	TSR
<i>Kotti</i>	1	MPM
<i>Kozhippillipokkali</i>	1	EKM

Table 4. Contd.

<i>Kulapandi</i>	1	TSR
<i>Kumbalavan</i>	3	MPM
<i>Kunjikannan</i>	1	EKM
<i>kunjikuruvi</i>	1	EKM
<i>Kunjuvithu</i>	1	KNR
<i>Kuroorai</i>	1	KNR
<i>Kurumkaima</i>	1	KNR
<i>Kuruppan</i>	1	PKD
<i>Kururai</i>	1	KNR
<i>Kururkaima</i>	1	KSD
<i>Kutchadi</i>	1	MPM
<i>Kuthalam</i>	1	IDK
<i>Kuthirunellu</i>	1	KSD
<i>Kuthur</i>	2	KNR
<i>Kuttikandappan</i>	1	KNR
<i>Kuttiveliyan</i>	1	WYD
<i>Kuzhippulipokkali</i>	2	EKM
<i>Malakkariadukkan</i>	1	KNR
<i>Malamutti</i>	1	MPM
<i>Malanji</i>	1	MPM
<i>Malappuram</i>	1	MPM
<i>Malayidumban</i>	1	KSD
<i>Mallikuruva</i>	2	WYD
<i>Malmoodan</i>	1	EKM
<i>Mangalapuram</i>	1	KKD
<i>Manjaparivithu</i>	1	TSR
<i>Mannuvelian</i>	1	WYD
<i>Mattakuruva</i>	1	TVM
<i>Mattathondi</i>	1	WYD
<i>Mattikkaran</i>	1	KNR
<i>Mekkancheera</i>	1	MPM
<i>Metariyan</i>	1	TSR
<i>Modan</i>	1	MPM
<i>Mulaki</i>	1	IDK
<i>Mullanchanna</i>	2	WYD
<i>Mullankoyala</i>	1	KNR
<i>Mundakacheera</i>	2	MPM
<i>Mundakan (white)</i>	1	KLM
<i>Mundakavella</i>	2	MPM
<i>Mundodan</i>	2	KSD
<i>Mundonkutti</i>	1	PKD
<i>Munduvella</i>	1	KLM
<i>Muthu</i>	1	KNR
<i>Mysori</i>	1	MPM
<i>Nagari</i>	1	KSD
<i>Nambiaparamban</i>	1	ALP
<i>Nayarambalam</i>	1	EKM
<i>Nayaruvella</i>	1	MPM
<i>Nayiruvithu</i>	1	KKD
<i>Nedungodupokkali</i>	1	EKM
<i>Neycheera</i>	1	KKD
<i>Nityakalyani</i>	1	ALP

Table 4. Contd.

<i>Njavara (Brown)</i>	1	TSR
<i>Njavara (Red)</i>	1	MPM
<i>Njavara (Uden)</i>	1	TSR
<i>Njavara (White)</i>	1	KNR
<i>Njaruvithu</i>	1	KKD
<i>Nooranvella</i>	1	ALP
<i>Odachan</i>	1	KNR
<i>Olantha</i>	2	MPM
<i>Omanakkuttan</i>	3	MPM
<i>Oorpandy</i>	1	KKD
<i>Orkyma</i>	2	KNR
<i>Orumundakan (black)</i>	1	ALP
<i>Orumundakan (white)</i>	1	ALP
<i>Otta</i>	1	KKD
<i>Ottacheera</i>	1	KNR
<i>Padannavella</i>	2	MPM
<i>Palakkadan</i>	1	ALP
<i>Palakkadan (black)</i>	1	ALP
<i>Palakkadanmatta</i>	1	MPM
<i>Palakkadanvedandam</i>	1	KKD
<i>Palkaima</i>	1	KNR
<i>Pallipurampokkali</i>	3	EKM
<i>pandichambavu</i>	1	TVM
<i>Pandivella</i>	1	ALP
<i>Paramchitterni</i>	2	MPM
<i>Parambucheera</i>	1	MPM
<i>Parapilarppan</i>	1	TVM
<i>Pathonpatahra</i>	1	TSR
<i>Peruvayan</i>	1	TSR
<i>Peruvazha</i>	1	TSR
<i>Ponkuruka</i>	3	EKM
<i>Poochempan</i>	1	TSR
<i>Pookilakodiyar</i>	1	TSR
<i>Pookkulathari</i>	1	PKD
<i>Poothakali</i>	1	TSR
<i>Puncha</i>	1	KSD
<i>Punchanellu</i>	1	KNR
<i>Punchaparuthu</i>	1	KKD
<i>Punjakayama</i>	1	WYD
<i>Raajani</i>	2	WYD
<i>Redponmani</i>	1	PKD
<i>Rocket</i>	2	MPM
<i>Rosematta</i>	1	KNR
<i>Sundari</i>	1	WYD
<i>Swarnavalan</i>	1	IDK
<i>Thaithigham</i>	1	WYD
<i>Thalanellu</i>	1	TSR
<i>Thalavirichanvella</i>	1	PKD
<i>Thalavirichankaruthothu</i>	1	PKD
<i>Thondi</i>	6	WYD
<i>Thonnuranthondi</i>	1	WYD
<i>Thottathavalakkannan</i>	1	KSD

Table 4. Contd.

<i>Thottathilvithu</i>	1	KSD
<i>Thouvvan</i>	1	KSD
<i>Thuvinellu</i>	1	PKD
<i>Tiruvonam</i>	1	ALP
<i>Undachitterni</i>	2	TSR
<i>Undakaima</i>	4	KSD
<i>Undakkunji</i>	1	KNR
<i>Undamashuri</i>	2	PKD
<i>Urunikaima</i>	2	WYD
<i>Vadanakkudipokkali</i>	1	EKM
<i>Valeecha</i>	1	WYD
<i>Valiavattan</i>	2	MPM
<i>Valiyaittikannan</i>	1	EKM
<i>Varukkunnanellu</i>	2	KSD
<i>Vasaramundan</i>	1	ALP
<i>Vayalithoova</i>	1	ALP
<i>Veliyan</i>	7	WYD
<i>Vella</i>	1	MPM
<i>Vellachettadi</i>	1	MPM
<i>Vellachitterni</i>	1	TSR
<i>Vellakaravala</i>	1	ALP
<i>Vellakattan</i>	1	MPM
<i>Vellakkodiyan</i>	1	MPM
<i>Vellakkoli</i>	1	TSR
<i>Vellakoyala</i>	1	KNR
<i>Vellakuttadan</i>	1	KKD
<i>Vellamthangi</i>	1	MPM
<i>Vellama</i>	1	TSR
<i>Vellamodan</i>	1	PKD
<i>Vellamthangi</i>	1	TSR
<i>Vellamundakan</i>	1	KTM
<i>Vellapandi</i>	2	TSR
<i>Vellaperuvalan</i>	1	KNR
<i>Vellapokkali</i>	1	EKM
<i>Vellapperuvasan</i>	1	IDK
<i>Vellaryan</i>	2	MPM
<i>Velumbazha</i>	1	WYD
<i>Velutha</i>	1	MPM
<i>Veluthakalluruli</i>	1	MPM
<i>Veluthamundodan</i>	1	KSD
<i>Veluthavattan</i>	1	MPM
<i>Veluthadichal</i>	1	KSD
<i>Veluthakoyyala</i>	1	KNR
<i>Veluthon</i>	1	KNR
<i>Venda</i>	1	MPM
<i>Vettakkalchettivirippu</i>	2	EKM
<i>Vetteri</i>	1	PKD
<i>Virippu (Koothumundakan)</i>	1	ALP
<i>Virippu -Kottuvalli</i>	1	EKM
<i>Vrischikapandi</i>	2	MPM
<i>Vytilakuruka</i>	2	EKM

Table 5. District wise collections of rare rice landraces of Kerala, India.

Cultivar name	No. of accessions collected	District(s) of collection
<i>Allikkannan</i>	2	KNR, KSD
<i>Anakkodan</i>	4	EKM,PKD,TSR
<i>Aruvakkali</i>	3	MPM, PKD
<i>Chemban</i>	2	PKD, TSR
<i>Chenkayama</i>	4	KSD, MPM, PKD
<i>Chennellu</i>	9	KNR, KSD, WYD
<i>Cherumani</i>	2	ALP, MPM
<i>Chettadi</i>	5	KKD, MPM, PKD
<i>Chettvirippu</i>	14	ALP, EKM
<i>chuvannachitteni</i>	4	EKM, MPM,PKD
<i>Karuthachitteni</i>	2	MPM, PKD
<i>Kattamodan</i>	5	MPM, TSR
<i>Kochuvithu</i>	2	ALP, KLM
<i>Kothambarikaima</i>	2	KNR, KSD
<i>Kunjinellu</i>	8	KNR, KSD, WYD
<i>Kunjukunju</i>	3	EKM, IDK, MPM
<i>Kuruka</i>	5	ALP, EKM
<i>Kuttadan</i>	4	MPM, TSR
<i>Marathondi</i>	3	IDK, WYD
<i>Mashuri</i>	2	KNR, PKD
<i>Moonnamvila</i>	3	KNR, WYD
<i>Munda</i>	3	KKD, WYD
<i>Mundakakkutty</i>	2	KKD, PKD
<i>Mundakan (black)</i>	2	KLM, TSR
<i>Mundon</i>	4	KNR, WYD
<i>Nambiarvattam</i>	2	ALP, KNR
<i>Onavattan</i>	3	KSD, WYD
<i>Palthondy</i>	2	IDK, WYD
<i>Pandi</i>	3	MPM, TSR
<i>Parambuvattan</i>	3	MPM, TSR
<i>Pokkali</i>	31	ALP, EKM
<i>Ponnaryan</i>	4	EKM, MPM,PKD
<i>Rajakaima</i>	2	KNR, KSD
<i>Thavalakkannan</i>	6	MPM, TSR, WYD
<i>Thekkan</i>	3	KSD, MPM
<i>Thekkancheera</i>	3	KNR, MPM, TSR
<i>Thonnuran</i>	6	KNR, KSD, MPM
<i>Vaikatharyan</i>	2	ALP, PTA
<i>Valichoori</i>	4	EKM, WYD
<i>Varinellu</i>	2	KNR, TSR
<i>Vattan</i>	3	MPM, TSR
<i>Vellakaima</i>	2	KNR, TSR
<i>Vellakkokkan</i>	2	MPM, PKD
<i>Vellapponni</i>	3	IDK, PKD
<i>Vellari</i>	4	KKD, MPM
<i>Virippu</i>	4	ALP, EKM

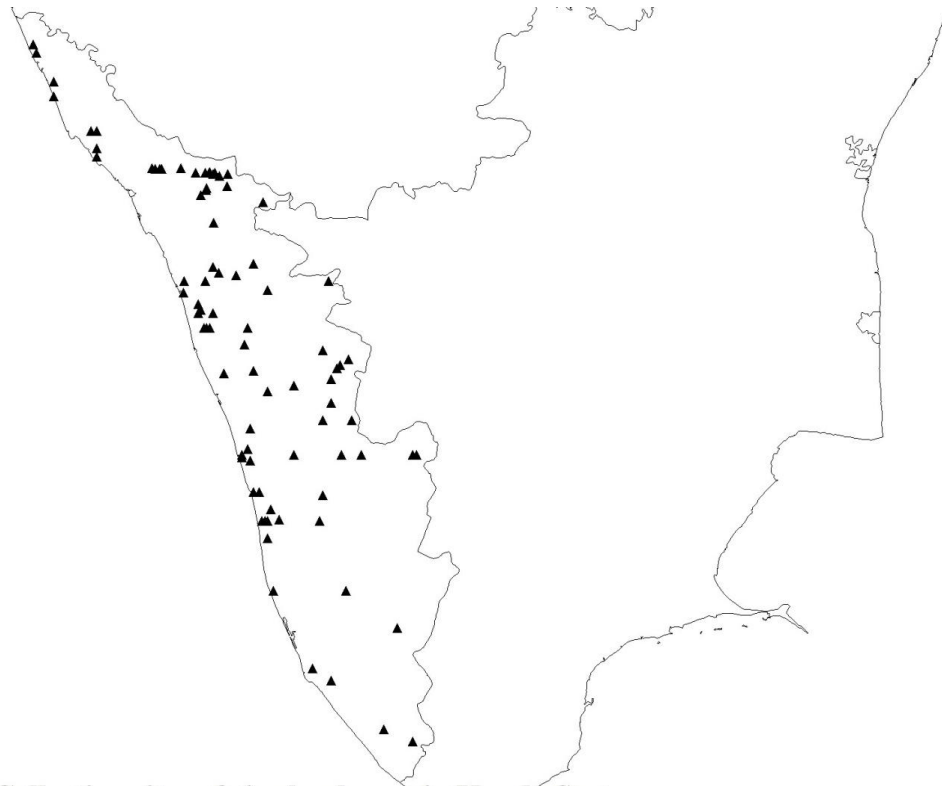


Figure 1. Collection sites of rice landraces in Kerala State.



Figure 2 Panicle variability in upland rice landraces



Figure 3 Grain variability in upland rice landraces

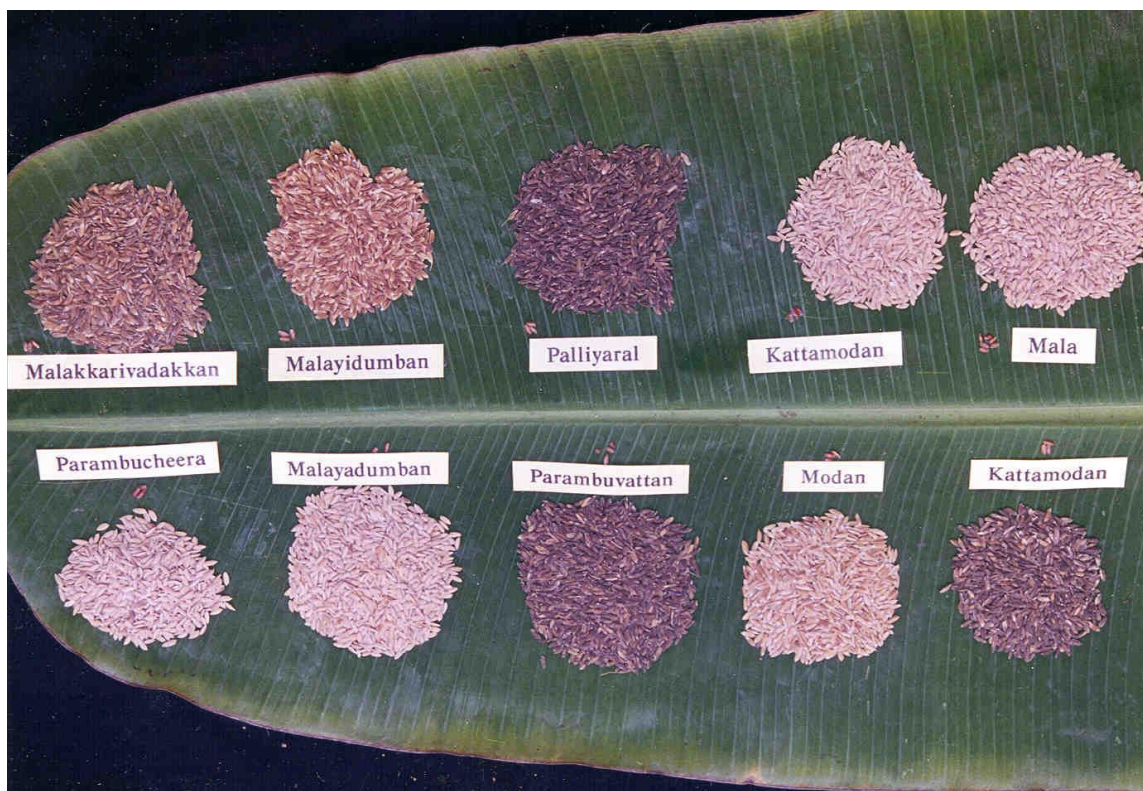


Figure 4 Variability in husk colour in rice landraces



Figure 5 Variability in husk colour in rice landraces collected from Wyanad district of Kerala

If South Asia region is the primary centre of diversity for rice with seven species of *Oryza* (Chang, 1975, 1976; Kwangtung Agricultural and Forestry College, 1975) and the Jeypore tract (Orissa) is the secondary centre of diversity for rice and its close wild relatives (Sampath and Govindaswamy, 1958), then certainly, the humid tropical coastal and mid-lands of Kerala in the southern Western Ghats can be considered as one of the secondary centres of diversity for rice and its close wild relatives in addition to the existence of 623 named landraces.

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