

Are the Indian Rice Landraces a Heritage of Biodiversity to Reminisce their Past or to Reinvent for Future?

A Sathya

Centre for Advanced Research in Environment (CARE), School of Civil Engineering, SASTRA University, Thanjavur 613402, Tamil Nadu, India (email: sathyaalbert@gmail.com)

Abstract

The accretion of data from various handwritten manuscripts, printed texts, holy Vedas, sacred books, relevant and significant literature have been coherently analyzed to give a trajectory overview on the ample ancient varietal choices of the significant cereal, rice, in the day to day life of people of yester years. This article gives a trailing account on the antiquity of rice in the context of diversity of its ancient varieties, their medicinal and secular usage by the ancient people, both in North and South India. The Samaveda, Atharvaveda, and Yajurveda refer to Krisanam Vrthina (black rice), Asunam Vrihina (swift growing rice), Naivaram (wild rice), Mahavrithinam (large rice), and Sukla Vrihi (white rice) as different traditional varieties of cultivated rice highlighting their diversity in size and color. Hill paddy and deep water rice landraces are mentioned in Jatakas. Yajurveda and Atharvaveda outline the various forms of rice offerings to different gods and goddesses including Sun God, Annalakshmi, and Dhanyalakshmi in India. Pathartha Kunapadam claims the therapeutic potential of South Indian rice landraces which needs to be clinically validated. Moreover, Susruta Samhita, rightly refers rice as 'Aushadh' based on the medicinal qualities of different types of rice landraces. Focus on the past has been shifted to bring to the limelight to realize their present day utility and face the challenges of food security and sustainability. Moreover, breeding protocols for present demand and conservation for future food security need to be planned meticulously, so as to access these potential landraces with simple means by local farmers. The wisdom of rice landraces excerpted from ancient texts can rightly guide planning and implementing scientifically validated choices of traditional varieties against the race of climate change, nutritional balance, and food security.

The necessity for agriculture generally is associated with the receding glaciers of last ice age more than 10,000 years ago, the subsequent modernization of climate, and the demise and retreat of large animal species to most of the northern regions. The scarcity of game forced humans into

more intensive reliance on wild than on domesticated grains and foodstuff. The most widely consumed of all human foods – rice (*Oryza sativa*) – deserves a prominent place in history (Dethloff, 1988). During the long period of history, rice has been intensively grown under conditions favorable for

development of local forms, with the result that the crop is now a vast complex of forms, showing large variations in morphological and physiological characters. Based on the reviews of De Candolle (1886), Watt (1892), Chatterjee (1947), and Ramiah and Ghose (1951), though the ancestry and origin of rice cannot be fixed with certainty, Indo-China region might well be the origin of *O. sativa*. Chang (1976) states that the prototype of *O. sativa* quickly differentiated into the present cultigen mainly in the area bordering India, Burma (Myanmar), and China during the Neothermal period about 15,000 to 10,000 years ago.

The varietal diversity of rice is nowhere as great as in India. These traditional varieties and landraces evolved with minimal human interventions subduing to traditional agrotechniques alone. Landrace populations are highly variable in appearance, but are identifiable morphologically and possess certain levels of genetic integrity. Indigenous cultivars or landraces are known to be highly polymorphic within populations in contrast to modern improved varieties, which are nearly pure genetically (Hiroko Morishima *et al.*, 1992). Farmers usually give them local names. Landraces have specific properties or characteristics.

Ethnobotany of rice landraces in ancient sacred works and literature

Literary works are mirrors reflecting the custom, culture, and condition of a society. There are so many notes and clues about numerous rice landraces in ancient Tamil literature. The sacred four Vedas – Rigveda,

Yajurveda, Samaveda, and Atharvaveda are the taproots for many beliefs and cultural customs still extant in India. The mention of rice and its varieties in these holy Vedas throws light on the antiquity of rice and its varieties in India. Starting from Vedas to the twin epics Ramayana and Mahabharata, one of the notable historical writers on rice, Ms Tuk-Tuk Kumar has clearly outlined about the literature coverage in these ancient scripts which wraps up all the literary evidences on rice and an attempt has been made to highlight salient features of these references. The key words *yava*, *anna*, and *dhana* in the Rigveda are the earliest literary record in India which denote rice (Monier-Williams, 1899). Tuk-Tuk Kumar (1988) suggests that the Rigveda is familiar with rice and that rice is an important crop in the later Vedic literature which suggests a long ancestry of rice cultivation. According to Tuk-Tuk Kumar (1988), in the *Taittiriya Samhita* of the Black (Krishna) Yajurveda, the key words are *vrihi* (rice) and *nivara* (wild rice). The varieties of rice mentioned are black rice, swift growing rice, large rice (I.8.10), and white rice (II.3.10.). The Samaveda, Atharvaveda, and Yajurveda mention about *Krisanam Vrthina* (black rice), *Asunam Vrihina* (swift growing rice), *Naivaram* (wild rice), *Mahavrithinam* (large rice), and *Sukla Vrihi* (white rice) which are different ancient landraces of cultivated rice named after their size and color. Jatakas mention about hill paddy and deep water rice landraces.

Tuk-Tuk Kumar (1988) also refers to *Sutra* literature and *Vinaya Pitaka*, particularly the *Srauta*, *Grihya*, and *Dharma sutras* which are full of references to rice in rituals,

its varieties and preparations. The latter mentions two varieties of rice – *Vrihi* and *Sali*. According to Suryakanta (1975), *Sali* is supposed to be sown in rainy season and harvested in winter.

In India culture is a composite of food, recipes, and Gods and Goddesses of Food in religious rituals, which becomes part of everyday life. Scriptures of Hindu religion highlight many references to rice. According to Yajurveda (Devi Chand, 1980), rice cakes were presented as ritual offering. ‘Healing Balm’ is the description quoted for rice in the *Atharvaveda*. Sweet rice made as ‘*Payasa Annam*’ is offered as favorite food to Goddess Devi Lalithambika as noted in *Smritis*. Generally, food grains have been divided into two kinds – one is with awns and the other is with legumes. Of the first kind the most important was rice which is subdivided into three main varieties – *Vrihi* ripening in autumn, *Sali* ripening in winter, and *Sastika* ripening in sixty days in summer. *Sali* and *Sastika* are superior to *Vrihi*. The most popular varieties of *Sali* rice were *Raktasali*, *Mahasali*, and *Kalama*; the black variety of *Vrihi* rice called *Krisnavrihi* was also popular.

Rice is washed and cooked in water or milk with meat, fruits, tubers, or pulses. Gruels have been named according to the proportion of water they contained. They are either drunk or licked. One of the tasty soups is prepared with parched rice. In *Sutras*, the daily offerings mentioned were made with rice and barley and not wheat. *Hayana*, a red variety of rice is mentioned in Yajurveda. *Panini* mentioned a kind of rice growing in winter which is replanted and is called

Jadahan. He also mentioned *Sastika* (*Sathi* in Hindi), a variety of rice which took sixty days to ripen. It is probably the *asudhanya* of the Yajurveda (Om Prakash, 1987). Even in the basic Hindu rituals husked rice is included as a component of offering.

Indeed, it is not a big rise from rice the most basic food to rice the most sanctified symbol of auspiciousness and fertility. Rice is also regarded and revered as ‘Annalakshmi’; the word ‘*anna*’ means ‘food’ and ‘Lakshmi’ denotes the Hindu goddess. Moreover, Indians worship ‘Dhanya Lakshmi’ who is portrayed with rice sheaves in the hand. The maiden food fed to an infant is rice. It is a blessed custom in the state of Rajasthan in India, for the bride to scatter the rice heap in a bowl as she enters her husband’s house symbolizing entry of prosperity and happiness into the house. ‘*Mangal akshadai*’, showered over newlyweds in South India, is a mixture of raw rice and ‘*kumkum*’ to add red color to the sanctified mix as pure blessing. Moreover, in South India, especially in Tamil Nadu, a special harvest festival is celebrated as ‘*Thai Pongal*’, on the first day of the first month of the Tamil calendar. It is a custom in Tamil Nadu to cook rice with milk and jaggery and offer as a thanksgiving ceremony to ‘Sun God’ and Nature spirits.

These samples of practices and cultural customs give an obvious understanding about the ethnobotanical role of rice in day

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to day life of Indians in different parts of India not merely as food but as ‘taste of life’.

Medicinal clues of rice landraces in ancient texts and other references

Rice is perceived not only as a commodity of food but also as a life saving ‘*Aushadh*’ – the medicine in all ages. The *Susruta Samhita* (Bhishagratna, 1963) is a representative work of Ayurveda. It is claimed that two centuries before the birth of the Buddha, the original *Samhita* was written while its final recension was made about the second century BC. The chapter on food and drink is extremely important for our purpose.

The *Susruta Samhita* mentions about the following landraces of rice: *Lohitaka*, *Sali*, *Kalama*, *Kardamaka*, *Panduka*, *Sugandhaka*, *Shakunahrita*, *Pushpandaka*, *Pundarika*, *Mahasali*, *Shita-bhiruka*, *Rodhra*, *Pushpaka*, *Dirghashuka*, *Kanchanaka*, *Mahishn-mastaka*, *Hayanka*, *Dushaka*, and *Mahadushaka* and their medicinal properties. These landraces subdue the *pitham* and slightly generate *vayu* and *kapham*.

Susruta states that “the several species of *Sali* are sweet in taste, cooling in potency, light for digestion and impart strength to those who use them.” He claims that they restrain *pitham* and mildly generate *kapham* and *vayu*. Also they may lead to constipation of bowels reducing faecal matter as they are demulcent. Among these, the red species (*Lohitaka*) is believed to be the most efficacious as it checks deranged humors.

It is medically diuretic, spermatopietic, refrigerant, eye invigoratory, cosmetic, and tonic. It tunes the voice. In case of fever and ulcer, its potential efficacy is remarkable. It is a good disinfectant and an appropriate antitoxin. *Sastika* rice has been recommended for daily consumption because of its nourishing nature.

The following species belong to the *Sastika* group: *Shastika*, *Kanguka*, *Mukundaka*, *Peetaka*, *Promodaka*, *Kakalaka*, *Asana*, *Pushpaka*, *Maha-Shastika*, *Churnaka*, *Kuravaka*, and *Kedaraka*. They are sweet in taste and can subdue *vayu* and *kapham*. They leave an astringent after-taste in the mouth. They are slightly demulcent and add strength and sturdiness to the body. The several species of *Vrihi* are as follows: *Sali-Kukha*, *Jatumukha*, *Nandhimukha*, *Larakshaka*, *Taritaka*, *Kukk-tandaka*, *Paravataka*, and *Patala*. These antique varieties possess sweet and astringent taste. They are hot in their potencies. They tend to mildly increase the secretions of the internal organs and lead to constipation of the bowels.

About the genus *Kudhanya*, the following varieties and their characters are quoted: *Koradushaka*, *Shyamaka*, *Nivara*, *Shantanu*, *Varaka*, *Uddalaka*, *Priyangu*, *Madhulika*, *Nandimukhi*, *Kuravinda*, *Gavedhuka*,

Rice is subdivided into three main varieties – Vrihi ripening in autumn, Sali ripening in winter, and Sastika ripening in sixty days in summer. Sali and Sastika are superior to Vrihi.

Varuka, Todaparni, Mukundaka, and Venuyava. Most of these varieties have the capability to generate heat, and possess a sweet and astringent taste. They are parchifying and pacify the *kapham*, which leads to retention of the urine, enraging the bodily *vayu* and *pitham*.

Charaka Samhita (Ray and Gupta, 1965) mentions fifteen good varieties of *Sali* rice – *Raktasali, Mahasali, Kalama, Sakunahrta, Turnaka, Dirghasuka, Gaura, Panduka langula, Sugandhika, Lohavala, Sariva, Pramodaka, Patanga, and Tapaniya* (Charaka.Su.27.7-8). The five inferior varieties of *Sali* rice are *Yavaka, Hayana, Pamsu, Vapya, and Naisadhaka* (Charaka.Su.27.11). Besides the two varieties of *Sastika* rice, one white and the other blackish white, Charaka mentions *Varaka Uddalaka, Cina, Sarada, Ujjvala, Dardura, Gandhala, and Kuruvinda* in this category. *Nivara* or the wild rice plant was used in haemotoria. *Tandula* was generally used as a “vitalizer” and roborant.

Kappa kar is served in the ceremony of “*Seemantham*” (a ritual conducted during 7th or 9th month of pregnancy of women). The straw of *Kulla kar* is preferred as a roofing material. ‘*Seeraga samba*’ has a pleasant aroma and is fine and rich in taste. Hence, it is used in the recipes of ‘*Biryani*’ (a special expensive rich, spicy, and tasty food of South India). Though the yield is

very low, but due to its taste and flavor, it costs high amongst all conventional rice varieties of Tamil Nadu (Arumugasamy *et al.*, 2001).

Ancient Tamil literary works and scriptures incorporate the remarkable medicinal qualities of different traditional rice varieties of those days. The medicinal clues of ‘Siddhas’ inscribed in the palm leaves, which are available at Saraswathi Mahal Library of King Serfoji at Thanjavur have been transformed into printed forms. Few medicinal traits of some of the ancient traditional varieties of rice are listed in the medicinal notes of “Pathartha Kunapadam” of yogis and Siddhas (Sourirajan, 2000). For example, *Kar arici* imparts strength, *Karunguruvai* could be used as antidiuretic, *Puzhugu samba* quenches intense thirst, *Vaikarai samba* gives strength, *Senchamba* increases appetite, and *Kodai samba* reduces rheumatic pain.

Medicinal properties of the traditional varieties cultivated in West Bengal and Orissa are also enlisted by Debal Deb (2000). He highlights about *Bhat moori*, which enhances blood circulation, and also states that *Parmal-sal* improves strength and *Kabiraj-sal* quickens recovery of convalescing patients.

India is abode to a number of rice varieties that are claimed to possess medicinal properties and befittingly called ‘nutraceutical’ in modern as well as old concepts. With respect to medicinal properties, Ahuja *et al.* (2008) have cited many traditional varieties having numerous medicinal properties that are available and adopted in India through

Indians worship ‘Dhanya Lakshmi’ who is portrayed with rice sheaves in the hand.

ages. According to Das and Oudhia (2001), about 50 rice varieties have been recorded during a survey in Madhya Pradesh to possess various medicinal properties.

Biodiversity status of rice landraces in the past

Jayashankar *et al.* (2002) declares that paddy can grow even in certain environmental conditions where other crops cannot grow. In India, there are many varieties of paddy, which can be cultivated throughout the year. Paddy can grow at an altitude of 7000 feet above sea level. It can also grow at an altitude of 10 feet below sea level. There are paddy varieties, which can grow even if the annual rainfall is 500 mm. There are also paddy varieties that can withstand 5000 mm of annual rainfall.

Samhitas of the Yajurveda mention about different varieties of grains such as *Vrihi*, *Yava*, *Masha*, *Tila*, *Mudga*, *Khalavarsha*, *Godhuma*, *Masura*, *Syamaka*, *Priyangu*, *Menava*, and *Nivara*.

Regarding the other varieties of rice mentioned, prominent are hill paddy and deep water red rice varieties as mentioned in the Jatakas (Cowell, 1957). *Udaraka* and *Varaka* are two new varieties of rice introduced during Mauryan rule (Om Prakash, 1961 in Tuk-Tuk Kumar, 1988).

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This detail is available in Kautilya's Arthashastra (Kangle, 1963 in Tuk-Tuk Kumar, 1988).

Prominent Indian rice scientists Richharia and Govindasamy (1990), in their book "Rices of India", cited Vedic and present day literature evidence to show that the country teemed with more than 200,000 rice varieties, a rich biodiversity unlike any other country in the world. This means that even if a person is to eat a new rice variety everyday of the year, he is expected to live for over 500 years without reusing a variety. In the Chattisgarh region alone, Dr Richharia identified more than 20,000 rice varieties.

Nearly 400 varieties of landraces of paddy had been in vogue during olden days in Tamil Nadu. *Pallu pattu*, an ancient Tamil literary work on peasants, refers to about 150 varieties of paddy. According to Stuart (1895), more than one hundred different varieties of rice had prevailed in North Arcot district of Tamil Nadu alone. The remarkable kind of paddy in North Arcot district which warrants a special mention is *Munagada* (submerged). It has been grown in a few localities, in the beds of tanks before they are covered with water. As soon as it has sprouted well, it can survive though submerged below water as much as 3 feet. The stem is as thick and strong as a stalk of *cholum* (sorghum) but the grain is coarser and hence has not been preferred for consumption.

Arumugasamy *et al.* (2001) lists some of the special features of few traditional varieties of rice in Tamil Nadu. *Vaigunda* is a fast growing traditional rice surpassing weeds

in the field. It has a dual nature to adapt to waterlogged and drought prone areas in Tamil Nadu. Another landrace, *Sigappu kuruvikar*, resists the infestation of brown plant hopper and case worm.

Debal Deb (2005) in his famous book entitled “Seeds of Tradition, Seeds of Future” provided detailed morphological descriptions of 416 Indian folk (traditional) rice varieties, which are on the verge of extinction from farmers’ fields. Cowel (1957), Kangle (1966) in Tuk-Tuk Kumar (1988), Keith (1967), Cleveland *et al.* (1993, 2000), Arumugasamy *et al.* (2006), and Sathya *et al.* (2007) had recorded large numbers of traditional rice varieties found in different parts of India and their adaptation to specific conditions. With reference to the Biodiversity, Use and Conservation in Asia Program (BUCAP) 2003, it is estimated that India at the beginning of 20th century gave refuge to some 100,000 varieties of rice. Today these are only less than 15,000.

Rana (1994) stated that the Indian subcontinent has been well recognized since long as an important center of origin and diversity of more than 20 major agri-horticultural crops. Nearly 160 domesticated species of economic importance and over 325 species of their wild forms and close relatives are native to this region and constitute an invaluable reservoir of genes that are needed for development of new varieties.

From past memories to present realities and needs

The ancient texts and literature cited above are only handful representations depicting

the depth of traditional roots of rice in Indian soil. But, as we slowly recollect the glorious history of rice in India, we need to realize some critical present day facts.

Although the yield capacity of traditional varieties is limited this is compensated by other appreciable characters such as high nutritional value, good cooking qualities including pleasurable aroma, and sufficient volume of cooked meal with less quantity of raw rice. These varieties cater to the requirements of specific consumers and customers. They are hard and sturdy against nature’s vagaries, and pathological and entomological threats. They survive and thrive well with carbonic fertilizer. The shelf life of storage of cooked rice of traditional varieties is remarkable without deterioration.

On farm and in market management responsiveness of landraces and high-yielding traditional varieties is about 30–35% more than modern varieties. The seed of traditional varieties costs 2.5 times lesser than that of modern varieties. Hybrids fetch low values than the conventional high-yielding varieties. The input cost of hybrid seed is high and it demands high doses of chemical-based fertilizers and pesticide application and moreover it cannot be used to raise a second crop. Hybrid seed production involves good technical skills to obtain an acceptable output grain yield of 1 to 1.5 tons per hectare. Conserving biological diversity within food crops such as rice is crucial for sustaining agricultural systems and for maintaining global food security. Often, the genetic diversity of important food crops is under heavy threat

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from various sources. The 20th century has seen the replacement of a multitude of local varieties by a limited number of high-yielding varieties.

There are too many references both in ancient and recent literature which highlight several merits of rice landraces, but still one can feel certainly a gap exists in adoption in the present day agriculture. As rightly quoted by Nene (2005), our future research endeavors should take their lead and link from traditional skills and knowledge.

Strocchi and Levitt (1991), Gore *et al.* (1992), Goldberg and Saltzman (1996), and Zhang *et al.* (2005) have carried out crucial research with findings pointing to the therapeutic potential of this staple food. But still, Ahuja *et al.* (2008) stress the need for clinical validation of medicinal value of these precious landraces and traditional varieties so as to establish a niche in the world market. Especially, efforts in evaluating the medicinal properties of landraces are scarce owing to their disappearance and non-availability. The support and protection to this Indian heritage of traditional varieties as a 'health food' is significant in order to curtail the assault of lifestyle-related diseases.

The Food and Agriculture Organization of the United Nations (FAO) has projected that since the onset of 20th century, about 75 per cent of the genetic pool diversity of agrarian crops has vanished. In the past few decades, the Green Revolution brought by high-yielding varieties of crops developed by the Indian and global agricultural research organizations have quickly banished the huge montage of traditional and native crop varieties in many developing countries (Maheshwari, 1997). But there are numerous research articles which show the advances in breeding strategies built on the foundation of landraces as parental strains. The primeval cultivars cultivated by farmers are rich sources of gene pool for advanced plant breeding. For example, IR72, a modern released variety of paddy, was developed by crossbreeding 22 landraces from 7 nations namely, India, Indonesia, Malaysia, China, Philippines, Vietnam, and Thailand (Table 1). IR72 was released in India in 1990.

Many such researches have been undertaken in the field of plant breeding and genetics at global and national levels in successfully

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Table 1. Pedigree of IR72, a modern released variety of rice developed from 22 landraces.¹

Country	Landraces
India	<i>Oryza nivara</i>
	<i>Arikarai</i>
	<i>Eravampandi</i>
	<i>Gowdalu</i>
	<i>Kitchilli samba</i>
	<i>Latisail</i>
	<i>Mudgo</i>
	<i>Thekkan</i>
	<i>Vellaikar</i>
	Unknown variety
Unknown variety	
Indonesia	Benong
Malaysia	Seroup besai
China	Cina
	DGWG
	Pa Chiam
	Tsai Yuan Chan
Philippines	Marong paroc
	Sinawpagh
	Tadukkan
Vietnam	Tetep
Thailand	Germ pai

1. Source: International Rice Research Institute (IRRI), Philippines.

planning, implementing, creating, and propagating hundreds of modern varieties and hybrids using the genetic stock of traditional varieties as parental base. For example, *Kitchilli samba* is a well known landrace of Tamil Nadu, and the parentage exists in the released varieties GEB 24, IR20, IR24, IR26, IR28, IR29, IR30, IR32,

IR34, IR36, IR38, IR40, IR42, IR43, IR44, IR45, IR46, IR48, IR50, IR52, IR54, IR56, IR58, IR60, IR62, IR64, IR65, IR66, IR68, IR70, and IR74 (Arumugasamy *et al.*, 2001).

Each hybrid and released variety evolved out of sheer breeding efforts are claimed to possess special and unique agronomic, economic, and sustainable characters inherited from their potential parents of traditional origin. But these traditional varieties are disappearing before all their salient properties could be identified, documented, and justifiably used in constructive breeding programs.

Moreover, in the face of climate change, none can underestimate the role of untapped potentials of these landraces still waiting to save humankind. It is a bitter truth that climate unpredictability is expected to increase with floods, cyclones, and droughts; also the climate is less suitable to the so far known and developed management strategies adopted in agriculture. The past victory of the Green Revolution and other innovative agricultural technologies in mitigating the food demands are not adequate to meet the needs of estimated expected world population of 9 billion in 2050 (Lindsay Falvey, 2011).

What are the choices left for us now? Taking cues from the past reviews and researches on the capability, these potentially viable but traditional varieties which are not easily available in adequate quantities, need to be combed for and their secret sustainable qualities need to be tagged, documented, and researched upon. Although many

explorative efforts have been launched in the past by the Indian government, once again keeping in view the threats of drought, flood, and salinity posed by climate change, a fresh government initiative or a program needs to be launched for an explorative effort to search, identify, and collect such potential landraces of rice which can help us combat these challenges of climate change. Arumugasamy *et al.* (2001) and Debal Deb (2005) have highlighted many such climate adaptable and tolerant varieties in Central and South India. Yet, there are many more landraces still extant but are not documented. The next crucial step is to evaluate truthfully their potential on farm level via scientific research stations or NGOs. A shift in stress is considered necessary in collection, characterization, and use of the diversity of landraces and wild relatives of rice on which people in developing nations and bypassed areas rely upon (FAO, 2010a).

But, at this point of endeavor, a slippery ground which leads us to lose these precious varieties is in the guise of 'Seed Banks'. Rather than collecting and storing these varieties in cold shelves, which is economically expensive, these varieties can be distributed to interested progressive farmers who are willing to evaluate their unknown potentials and propagate them through 'community seed banks' or government agencies. Moreover, the retrieval of varieties available with such national and international seed repositories are often unknown to the richly experienced farmers in farming, who are in need of specific variety that can be acquiescent to his/her location.

The International Rice Research Institute (IRRI) located at Los Baños, Philippines has a collection of 109,136 samples of rice varieties, while gene banks in India and China have 86,119 and 70,104 samples of rice accessions respectively (FAO, 2010b). But how many of this genetic stock are reachable to an illiterate farmer? It is rather a difficult question to answer. Yet seed banks need to be promoted with more transparency and simple accessibility methods and procedures to the farmers.

Conclusion

The knowledge on the heritage of traditional varieties of rice and rice landraces could well be the foundation for future research endeavors in medicinal, nutritional, and especially agricultural disciplines for authenticated results. The ancient writings, sayings, and paintings articulate about the glory of antique varieties of rice. Extinction is an inevitable process of nature's revival. These rice landraces should be identified before they disappear. Knowing their existence and significance through ancient literature could pave way for fruitful venture in collection and characterization of these traditional rice varieties.

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