



ON-FARM CONSERVATION STATUS OF TRADITIONAL RICE VARIETIES IN THE EASTERN GHATS, INDIA

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ARTICLE INFO	ABSTRACT
Received 13th March, 2017 Received in revised form 20th April, 2017 Accepted 10th May, 2017 Published online 28th June, 2017	Traditional rice varieties and its related agro-ecosystems in the Eastern Ghats observed to be preserved through the on farm conservation by smallholder farmers of the region. These varieties faced increasing vulnerability, due to monsoon failure, climate change, production cost and resource scarcity. We assessed the current status of traditional rice diversity and on-farm conservation in developed and developing regions of Eastern Ghats through on-farm interviews using semi-structured questionnaires, focused group discussions, and key-informant farmers. Traditional rice cultivation in the developing region based on subsistence agriculture than the livelihood. Negotiation of traditional rice cultivation directly affected the food security of under-developed farmers' subsistence and further resulted in the cohesion loss of traditional agro-ecosystems in the Eastern Ghats. These conditions led to a decline in richness of traditional rice varieties of developing region compared to diversity in developed zones. Basic infrastructure facility and farmer skill developments were needed in the developing regions of the Eastern Ghats to sustain the traditional rice agrobiodiversity conservation. Value-addition process for traditional rice varieties could improve the status of the developing farmers and safeguard the existing traditional food security and livelihood in the Eastern Ghats.
Keywords: Agro-Ecosystems, Traditional Rice, Farmers, Livelihood, Food Security, Eastern Ghats	

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INTRODUCTION

Agriculture is the essential source for the small farmers around the world for their livelihood and food security (WB, 2008). The conservation of traditional agricultural systems and biodiversity is main buffering system for the future of agriculture, global food supply and food security. This has kindled a lot of researchers to collect a large number of traditional varieties and species, which results in development of research centers, gene and germplasm banks (Bellon et al., 2011). Crop varieties are grown and established through all the evolutionary changes are called as traditional varieties or land races (Harlan, 1993). Smallholder farmers are the major conservative persons for these types of the traditional crop genetic resources through proper selection and maintenance (Morton and Easterling, 2007). They help in continuous preservation of traditional agro ecosystems during all the climate change vulnerability (Chentoufi et al., 2014). The Eastern Ghats have known to be rich in valuable medicinal plants as well as traditional rice varieties. Present research work is the documentation of on-farm conservation practice of traditional rice by smallholder farmers in some region of the Eastern Ghats, such as Yercaud, Kalrayan hills, Pachai malai, Kolli hills, Salem and Attur plains.

METHODOLOGY

Survey area details

The study has been designed with semi-structured questionnaires of farm interviews on the traditional rice ecosystem located in and around Salem and neighbouring which includes a part of Namakkal, Dharmapuri, Villupuram and Tiruchy and Perambular districts of state Tamil Nadu, India. The extensive survey was carried out from January to December, 2014 which consists of 114 field days. Data about medicinal uses of traditional rice varieties were collected by survey questionnaire, personal interview and focus group discussions with pre-identified informants. Voucher specimens were collected with the help of informants, processed into seed banks, identified with the help of pertinent rice varieties for future references. Survey design and details of the zones were illustrated in Table. 1. We carried out preface tours in the study area with farmer's club and federation presidents (Federation for Improvement in Agriculture and Education, Salem, Tamil Nadu, India), to identify the particular villages, small communities and hamlets, where farmers still cultivate traditional paddy varieties for self-consumption as well as the commercial purpose. The informants were interviewed as two groups; i) key-informant farmer, ii) focused group discussion

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(i.e.) group of farmers. In each study area, geographically close villages were grouped as zones. Based on the topology and urbanization level, we grouped eight study areas as **developed** (AT1, AK1 and AY1) and **developing** (AK2, AP1, AC1, AM1 and AM2), mapped in Fig.1. AT1 located in and around Salem and Attur belt. AY1, AK1 and AK2 situated in Shevaroy's, Kolli and Bodamalai hills, respectively. The Kalrayan hilly region is divided into two zones, PeriyaKalrayan hills (AP1) and ChinnaKalrayan hills (AC1). AM1 and AM2 study zones were located in Pachaimalai hills. We visited 103 villages and totally 253 farmers were interviewed during the survey in all the eight zones.

Table 1 Outline of study area design

Study area	Zone	Number of Villages/ hamlets	Number of Interviewed farmers
Salem and Attur	AT1	15	31
Yercaud hills	AY1	5	35
Kolli hills	AK1	9	28
Developed region total		29	94
Boda malai	AK2	3	23
Kalrayan hills	AP1	32	47
	AC1	21	40
Pachai Malai	AM1	6	23
	AM2	12	26
Developing region total		74	159

We prepared questionnaires, comprising of (i) personal and household details, (ii) represent their farm level characteristics, (iii) traditional rice varieties and its details, other commercial crop cultivation and agricultural practices. Based on the questionnaire information, we collected the details regarding farm area, number of plots and crop species, relationship with agriculture offices and distance to local market.

Developed region

The developed study area comprised of Salem and Attur, Yercaud and Kolli hills zones. Yercaud is a part of shevroys hills which situated in Eastern ghat hills (11.4 to 11.5 N) of Tamil Nadu, covers a total area of 382.7 sq.km, with 67 villages and 25 hamlets. It is characterized by hill topography and altitude ranges from 1000-1650 m above MSL, which makes reason for its pleasant weather for all the year round (TNAU Status report, 2001). The second study area is Kolli hills, which is a part of talaghat stretch, situated on the south eastern side of the Salem District. It lies between longitude of 78° 20' to 78° 30'E and a latitude of 11° 10' to 11° 30' N. The total area of the kolli hills block is 22,793ha. Of which forest constitutes about 4688 ha, with 14 villages and 247 hamlets. These hills have deep ravines and also high peaks and its altitude ranges from 1000-1350m, which have similar weather as like in shevroys. The highest precipitation was recorded as 1440mm fairly distributed during two seasons, i.e., North-east and South-west monsoons.

Developing regions

The developing study area comprised of Bodamalai, Kalrayan hills, Pachaimalai. Kalarayan hills extends 16 miles from North to South and 23 miles from East to west over a total area of

854.63 sq.km, and encompasses 79 revenue villages. The southern side of these hills lies in North eastern part of the Salem district, while the Northern part lies in Cuddalore District. Both are respectively called as chinnakalrayan and Periyakalrayan hills. It lies within 78°31 Longitude to 11°51 latitude. The entire hill region is divided into two by a valley running eastward to pappanaickanpatti. The Chinnakalrayan forms a similar pattern which is cut into two by a lofty ridge. The northwest portion of the hills is called Melnadu and Southwest portion is called Kilnadu. The elevation of the kalrayan hills ranges between 760m - 1370m above mean sea level. Of the total geographical area, forest land accounts for about 42.02% while the net cultivated area comes to about 21.42%.

In the study areas, we conducted preliminary tours with farmer's club association members to identify the specific villages, small communities and hamlets where farmers still cultivate traditional paddy varieties for self-consumption as well commercial purpose. In each village, farmers are advised to form the farmer's club to market their products and educate them to get training to add value to that. In each study area, geographically close villages are grouped as zones. AY1 located in the yercaud hills. AY1 comprise of villages namely Belakkadu, Arangam, Senthithu, Madhur and Periya madhur.

AP1 and AC1 are situated in the Periya Kalrayan and Chinna Kalrayan hills respectively. AP1 study area consists of villages namely Thalvallam, Melvallam, Kalakampaddi and Modhur. AC1 study area includes villages and hamlets which belong to Kelnadu region namely Mannur, Soolankuruchi, Thalakarai and Pachadu. Mannur is reserved from other villages in this hill, without basic human needs like road and transport facility, electricity and water. Probably a Primary or secondary school is available at each village or revenue village. AK1, AK2 are located in Kolli hills and Bhoodha malai; AM1 and AM2 are situated in Pachai malai. AT1 situated in Salem, Attur plain and Thamaiyanur region and farmers are interviewed in and around Salem zone (Fig.1).

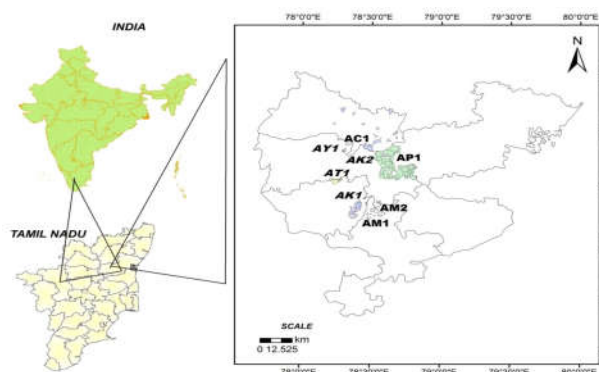


Fig 1 Geographical location of study zones with respect to Tamil Nadu regional state in India

Data analysis

Data collected from all the three questionnaires were analyzed, separately and as well in a cluster to support our on-farm conservation hypothesis. To test our assumptions dealt with on-

farm conservation of traditional rice cultivation practices in Eastern Ghats during climate- change, we used statistical methods to uphold our information collected from survey and interviews. We analyzed farm level characteristics with one-way ANOVAs, whereas Fisher exact tests for frequencies. We computed the mean geographical distance among farmers growing that specific variety and the bary centre (geographical dispersion) of all farmers growing the same particular variety. Average, frequencies, ANOVAs and F-test were done using the GraphPad Prism Software. The study area map was drawn using RGS software.

RESULTS AND DISCUSSIONS

Survey area was divided into two study regions using the basic and development facilities as main criterion.

Farm level characteristics such as mean farm area ($F=15.36$, $df=4$, $r^2=0.28$, $p<0.0001$) and number of plots ($F=11.50$, $df=4$, $r^2=0.23$, $p<0.0001$) found to be more in AK2 zone. Number of crop species cultivated for self-consumption differs from 1 to 33, with a mode around 6 & 8, significant variation observed between zones in the developed region ($F=11.54$, $df=4$, $r^2=0.23$, $p<0.0001$). Farmers grown several main crop species for self-consumption as well as for commercial purpose and the variation between two different regions are compiled. The commercial crops such as jackfruit, tapioca were cultivated predominantly by developed region farmers, whereas developing zone farmers grew crops primarily for their self-consumption. In the developing regions, AK2 found to be different from other zones.

Table2 Average values of farm level characteristics in the sampling area

Study area	Farm area in ha [sd, min-max]	No. of plots in farm area [sd]	No. of crop species [sd]	Modernization rank [range]	Association with AO	Distance to local market [km]
AT1	6.19 [4.16, 1.5-20]	8.4 [7.35]	9.22 [4.68]	4.7 [2-5]	75.74	9.7 [5-25]
AY1	3.31 [1.89, 0.22-8.09]	4.54 [2.21]	7.11 [2.63]	2.48 [0-5]	65.42	35.08 [30-42]
AK1	4.23 [3.50, 0.22-14.56]	5.14 [3.97]	7.93 [5.46]	3.1 [1-5]	70.89	45.14 [10-80]
Total	4.57 [1.47, 0.22-20]	6.02 [2.07]	8.08 [1.06]	3.42 [0-5]	70.68	29.97 [5-80]
AK2	7.68 [3.84, 0.75-15]	8.60 [4.40]	8.69 [1.86]	0.08 [0-1]	0	15 [15]
AP1	5.23 [3.46, 0.5-15]	6.31 [4.32]	5.7 [2.58]	2.14 [0-4]	31.85	56.31 [30-75]
AC1	7.31 [2.92, 1.5-14]	7.15 [3.46]	6.85 [1.90]	1.8 [0-4]	38.8	53.1 [40-65]
AM1	3.03 [1.76, 0.4-8.09]	3.65 [1.94]	4.86 [1.74]	1.08 [0-2]	25.13	39.34 [30-50]
AM2	2.96 [1.93, 1-8]	3.5 [2.53]	5.69 [2.31]	1.46 [0-3]	21.34	32.88 [20-45]
Total	5.32 [2.37, 0.4-15]	5.84 [2.22]	6.35 [1.48]	1.31 [0-4]	23.42	39.32 [20-75]

Table 3 Demographic profile of the informants in the survey regions

Study area	Age				Experience in Agriculture (Years)				Educational Qualifications					
	Under 30		Under 50		Above 50		Under 20		Above 20		Illiterate		Literate	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
AT1	1	3.22	15	48.38	15	48.38	11	35.4	20	64.5	8	25.80	23	74.19
AY1	1	2.85	11	31.4	23	65.7	8	22.85	27	77.14	15	42.85	20	57.14
AK1	0	0	16	57.14	12	42.85	6	21.4	22	78.57	13	46.42	15	65.21
Total	2	3.03	42	45.68	50	52.31	25	26.55	69	73.4	36	38.35	58	65.51
AK2	1	4.34	8	34.7	14	60.86	8	34.78	15	65.21	13	56.52	10	43.47
AP1	5	10.6	21	44.68	21	44.68	34	72.34	13	27.65	24	51.06	23	48.93
AC1	0	0	15	37.5	25	62.5	8	20	32	80	26	65	14	35
AM1	0	0	7	30.4	16	69.56	0	0	23	100	15	65.21	8	34.78
AM2	1	3.84	13	50	12	46.15	7	26.9	19	73.07	12	46.15	14	53.84
Total	7	6.26	64	39.45	88	56.75	57	38.5	102	69.18	90	56.78	69	43.02

Salem, Thamiyanoor, Attur plains, Yercaud and Kolli hills are the five major areas, where abovesaid basic facilities and development opportunities observed to be better than the other regions (Table 2). Region 2 comprises of Bodamalai, Kalrayan hills and Pachai malai, where lack of basic needs such as road transport, electricity and drinking water facilities. Average values for farm characteristics were calculated and tabulated in the Table.2, which describes about farm area, plot number, crop species. Development based scrutinization has been explained with modernization score, association with agriculture office and distance to local market. Farming was preferentially oriented to subsistence. What-ever the crop, there was always a portion of self-consumption. This found similar to the results described in the case of traditional durum wheat and barley in Morocco (Chentoufi *et al.*, 2014)(Jensen *et al.*, 2013) and a variety of crops around the world (Jarvis *et al.*, 2008).

Though there are several crop species being cultivated, traditional rice varieties scored more proportion for their self-consumption. This found to be comparable with durum wheat farm production in Morocco (Chentoufi *et al.*, 2014).

Traditional rice varieties were cited as important in area in both regions. In the developing region, the rate of self-consumption for the main crops was higher than 90%, except other species. The relationship with the agriculture extension office was relatively scarce in developing region, where observed parallel with results of Chentoufi *et al.*, (Chentoufi *et al.*, 2014).

Study area AK2 was varied in the crop species cultivation, where the range of small millets and pulses cultivation as well self-consumption rate observed to be higher than other study areas in sampled regions. It was evident in AT1 (developed) and AK2 (developing region), where a gradient is observed for many variables such as education, agriculture experience,

modernization, altitude, distance to reach a town or city-transport facilities (Table 3). Lack of basic transportation/road facilities in AK2 zone led the farmers to cultivate crops only for their own-consumption.

Traditional rice citation in studied region

Seventeen different traditional rice varieties were cited in the developed region and 9 in the developing region, with highly uneven relative frequencies (Table.4). Two special upland traditional rice varieties such as Sempalai and Puzhuthikar were grown on more than 75% of the surveyed area and by 80% of farmers; the same relative area was covered by only 2 varieties in the developing region, grown by 60% of farmers. But this observation was mostly due to AK2, where only two varieties were identified, and where farm areas were much larger than in the other areas: in AT1 to AK1. In both study regions, the names of traditional varieties referred to morphological characters like kernel and grain color or agronomic traits or to provenance, which were comparable with the previous reports (Chentoufi *et al.*, 2014)(Dyer *et al.*, 2014).

CONCLUSION

The high degree of consensus among the informants suggests that current use and knowledge are still strong, and thus the preservation of today's knowledge shows good foresight in acting before much has been lost. The connections between rice variety usage and conservation are also important ones, especially as the authors note that neither the local inhabitants nor the government is addressing the potential loss of valuable species in this region. Thus, this survey revealed us a lesson that on-farm conservation of traditional rice varieties and status reports of all crops should be updated annually, which can highly affect the livelihood and food security of study area and maintaining agrobiodiversity in the Eastern Ghats region.

Conflict of interests

The authors declare that they have no conflict of interests.

Table 4 Traditional rice varieties citation in each region

Study area	Paddy variety	Total no. of citations	Status	Translation/Meaning	Percentage of farmers	Percentage of area devoted to traditional rice varieties	Geographical distribution of study site	
Developed Region	Sempalai	36	traditional landrace	Red variety grows in rainfed conditions	38.2	46.9	AY1, AK1	
	Puzhuthikar (PTR)	74	traditional landrace	Grows in rainfed conditions	78.7	13	AT1, AY1, AK1	
	White PTR	6	traditional landrace	White variety, Grows in rainfed conditions	6.3	1.3	AK1	
	Red kar	8	traditional landrace	Red, grows in Summer season	8.5	2.1	AK1	
	Mattai Kar	12	traditional landrace	Red Bold variety, grows in Summer season	12.7	6.7	AK1	
	Kalli madaiyan	3	traditional	Yellow bold	3.1	0.7	AK1	
	Mapillai Samba	10	traditional landrace	Given to newly married guys	10.6	8	AT1	
	Ezhupaipoo Samba	4	traditional	Resemble smell of Elupaipoo during maturation	4.2	1.4	AT1	
	Seeraga Samba	7	traditional landrace	Rice or paddy Resemble like Cumin seeds, scented	7.4	5.6	AT1	
	Kavuni	5	traditional landrace	Highly pigmented, purple	5.3	2.38	AT1	
	Kichili Samba	2	traditional landrace	White, Slender, Medium	2.1	1.1	AT1	
	Kulla kar	5	traditional landrace	Short variety grows in Summer season	5.3	3.7	AT1	
	Valan	1	traditional landrace	Having long tail like awn as such in wheat	1.0	0.14	AT1	
	Thenkaipoo samba	2	traditional landrace	Resemble like coconut flower	2.1	0.29	AT1	
	Thuya mallee	5	traditional landrace	Rice look like Jasmine flower	5.3	2.6	AT1	
	Developing Region	Kattuyanam	1	traditional landrace	Look like a dense forest	1.0	0.4	AT1
		Karung kuruvai	3	traditional landrace	Short duration, Appear red	3.1	2.9	AT1
Sempalai		70	Traditional landrace	Red variety grows in rainfed conditions	44	20.4	AK2, AP1, AC1, AM1, AM2	
Puzhuthikar		79	traditional landrace	Grows in rainfed conditions	49.6	35.9	AK2, AP1, AC1, AM1, AM2	
Malai nel		18	traditional landrace	Grows in hilly region	11.3	2.4	AM1, AM2	
Mara nel		11	traditional landrace	Resemble like tanny brown tree colour	6.91	1.8	AM1, AM2	
Thungara nel		11	traditional landrace	Paddy grows for longer period	6.91	1.3	AM1, AM2	
Seeraga Samba		29	traditional landrace	Rice or paddy Resemble like Cumin seeds	18.2	18.45	AC1, AM1	
Kallimadaiyan		35	traditional	Yellow bold	22	9.2	AP1, AC1, AM1, AM2	
Kar paddy		15		Paddy grows in summer season	9.4	5.4	AP1, AC1	
Red paddy	13		Red and bold variety	8.17	4.8	AP1		

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