



ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(12): 5998-6004
© 2022 TPI
www.thepharmajournal.com
Received: 20-10-2022
Accepted: 24-11-2022

Srividhya S
Scientist, ICAR- Central
Agricultural Research Institute,
Port Blair, Andaman & Nicobar
Islands, India

Gautam RK
Principal Scientist, ICAR-
Central Agricultural Research
Institute, Port Blair, Andaman
& Nicobar Islands, India

Conservation of traditional rice culture by the Karen community after 90 years of migration from Myanmar to Andaman & Nicobar Islands

Srividhya S and Gautam RK

Abstract

The key aspect of this paper is to establish the importance of conservation of traditional rice culture of the Karen community. Recently, considerable literature has grown up around the theme of preservation of traditional agricultural practices. There is very little published research on the agricultural, traditional management and conservation practices of the Karen community. This paper outlines the need to preserve the rice cultures, and robust efforts for long term conservation at gene bank for *ex situ* conservation whilst the climatic adversity and on-farm conservation constraints. This study also highlights the need to bridge genetic diversity characterization and genetic purification efforts to conserve the rice cultures both *in-situ* and *ex-situ*.

Keywords: Karen community, traditional rice cultures, conservation, indigenous use, genetic purification

Introduction

The Mayabunder district of the Andaman and Nicobar Islands, located at a latitude of 12.91°N and longitude 92.897°E, is enclosed within the moist deciduous and evergreen forests. Amidst this serene and lush tropical forest, Webigram meaning a 'hidden village' preserves one of the most important and lone cultural community called the *Karens (Kaylin in Burmese)*. Karen called the '*pwa-kanyaw*' has a literal meaning for 'polite and kind hearted people suiting to their nature. Dating back to the history, the Karen people were migrants from Myanmar in 1925 to the A&N islands of India that is otherwise home to almost 572 islands. Andaman and Nicobar Islands is almost at a distance of 1200 km away from the mainland of India. Although their roots belong to Mongolia (Smith, 1991) [3], the Karens originally settled and made their niche in these islands during the British occupation for their livelihood. Today the community encompasses a population of nearly 2500 people, with people being a closely knit family. They are distributed in nearby villages of the Mayabunder district in Middle Andaman.

Unlike other communities, they have a spiritual way towards preserving their indigenous yet unique cultures, forests, sea and several traditional herbs (Chander, 2015) [6]. This distinct preserved society of the Karen once less sociable, now strive to make their identity visible. They were initially brought here to work as forest labourers and guards. Their migratory route traces back 90 years from Mongolia to Southeast Turkistan and China between B.C. 2017-2013 and then to Tibet in B.C. 1864. Persistent sufferings and ill treatment forced them to migrate again during B.C. 1125 and settle along the hilly tracts of Burma (now acquainted Myanmar). Later in 1925, on learning the settlement scheme at the Andaman and Nicobar Islands, Dr. H.I. Marshall (principal of Karen Theological Seminary) extended help to the Karens for a peaceful settlement to earn their livelihood. Having obtained the Indian citizenship, they are now predominantly making their livelihood through fishing and Agriculture.

The Karen community is largely patriarchal and bilateral (Maiti, 2004) [1]. Men and women being considered as equal in status, they are allowed to work on political counsels and organisations. Earlier reports (Singh, 1994) [8] claim that they existed as two groups based on the language differences although they had no social restrictions and hierarchy among them. However, today the Karens of Andamans belonging to the *Sgaw* group, they speak their indigenous '*Karen*' dialect and use the Burmese Script for the literatures. Their subsistence is largely dependent on agriculture primarily, although fishing is considered the next traditional and economic activity. Fishing is actively carried out by every household in their indigenous '*dungi*' boat constructed by themselves for harvesting sea foods.

Corresponding Author:
Srividhya S
Scientist, ICAR- Central
Agricultural Research Institute,
Port Blair, Andaman & Nicobar
Islands, India

Their agricultural property and tradition is regarded as their greatest economic asset they own.

They are short and can be identified by their attires, as women wear 'ochiyabo (blouse)' and 'nee (wraparound skirt)' and men dress up in 'ochitaaso (skirt)' and 'theku (lungi)' with a 'koh Khu (a hat made out of cane and palm leaves)'. During their traditional ceremony 'taatka' their outfit includes 'seymot' (black blouse with red embroidery) and 'keyjhonne' (red skirt and white embroidery) for women; while men can be seen in red 'ochi' and blue 'theku' weaved by themselves. However, the advent of modernity has brought changes in the attire of the recent generations. They reside in the 'Koh Hee' (home they call) and an important part of their culture, identity and heritage is a wide menu of traditional karen foods, most interestingly the rice-based dishes from their own traditional and nutritious rice cultures, which is discussed in detail below.

When talking of their traditional rice cultures, the Karen community embraces six ethnic and unique rice landraces namely the *Khushbuya*, *Black Burma*, *White Burma*, *Red Burma*, *Mushely* and *Nyaw-in (Yaeon)*. Even today, they strongly adapt these paddy landraces owing to their unique traits like nutritious and high yielding, tolerance to adverse weather conditions and less management practices. They store the rice grains in their yet again indigenous storing barns (*Phow sei*) that can contain up to 700 kg of rice. Hence, karens consume rice as their staple diet and the cultivation of these indigenous rice varieties has a primary purpose of self-subsistence. Only few studies have reported on the existence of these rice cultures for scientific research, some referring only to 'Burma Dhan' (Gautam *et al.*, 2014; weblink²)^[4]. It

was only during 2011 when the scientists of ICAR-CIARI at Port Blair took the initiative to recognize and document the traditional knowledge on paddy culture of the Karen.

On a broader note, slightly deviating from the Karens, rice cultivation is one of the most important food crops of the Andaman and Nicobar Islands that still supports the economy of islanders, even after the post tsunami devastation during 2004. It is cultivated in an area of about 8390 ha, with a total production of 23,916 tonnes with a net productivity of 2.85 tonnes/ha

(ESI, 2010). It has been reported by Gautam *et al.*, 2014^[4], that major constraint for paddy cultivation in the islands is the availability of fertilizers. Moreover, efforts in introducing high yielding varieties other than traditional landraces of the islands have been less adapted or in vain. Interestingly, more than 50% of the area under paddy cultivation is occupied by landraces native to this place. However, there are limited studies on the conservation of traditional rice cultures (Rana *et al.*, 2007; Adoukonou-Sagbadja *et al.*, 2006)^[10, 9].

For a deeper insight/preview, the paper will hereon focus into the study conducted on the issues of the agricultural practices followed by the Karens of Andamans, intervention of agricultural scientists for recognition to the people and preservation of these unique rice cultures by traditional breeding methods. The purpose was to understand the agricultural, traditional management and conservation practices of the karens; the landraces diversity and their characterization, vernacular names of karen rice varieties and their constraints. This study also formed the base for genetic diversity characterization and genetic purification efforts to conserve the rice cultures both *in-situ* and *ex-situ*.

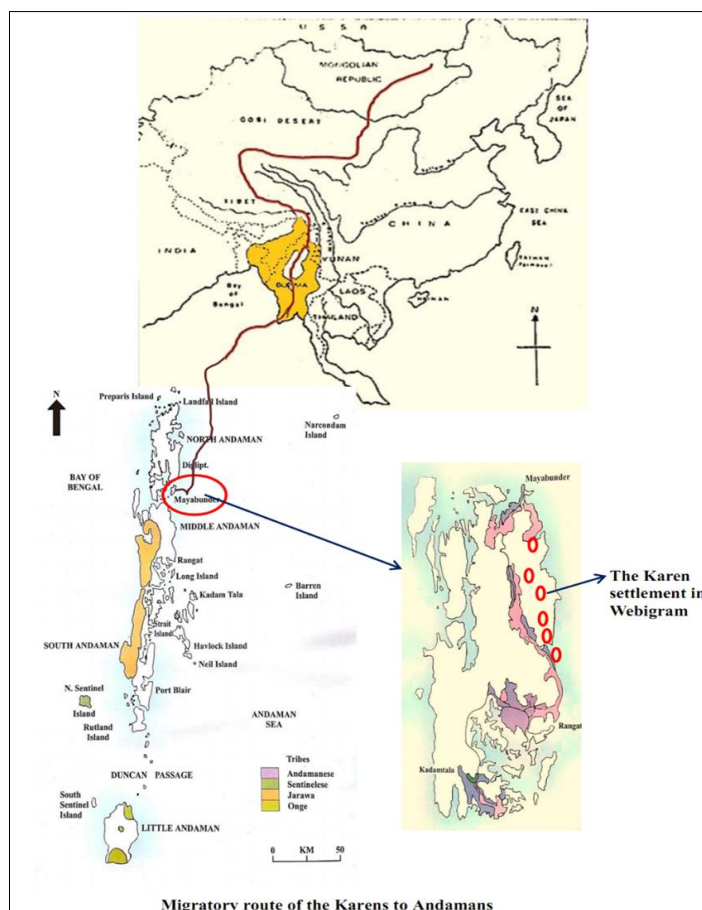


Fig 1: The migratory route of Karens

Methodology

A participatory approach consisting of field exploration through social and agro-ecological surveys was accomplished during 2011-2016 through farmers' interaction via community leaders in Karen occupied villages of Middle Andaman. Comprehensive data were collected on the landraces like: growing practices, landraces description (vernacular names and salient features), land allocation and dominance (*i.e.* area under landraces), productivity, constraints faced, agronomic or religious, cultural preference and values, recipes of the traditional rice based foods, traditional conservation practices adopted were the basic parameters used for the study. Prior Informed Consent (PIC) was also recorded following the methods of Singh *et al.*, 2013 [7].

The on-farm research experiments were conducted at CIARI Bloomsdale Farm, Port Blair included collection of seeds of the landraces, evaluation and characterization for specific traits as recommended by Protection of Plant Varieties and Farmers' Rights Authority for rice crop, at different phenophases to identify their minute phenotypic details (Gautam *et al.*, unpublished) [4]. One of the most prominent initiatives was aimed to document the traditional knowledge of the Karen community with PPFVRA.

Findings from the study

The exploration study was conducted on the basis of socio-economic characteristics through Participatory Research Appraisal (PRA) tools and techniques (identification of key informants and custodian farmers, direct observation, individual and group discussions, field visits, administration of questionnaire etc.). The key informants and custodian farmers who had the knowledge of the history were interviewed on introduction on these unique cum ethnic landraces of rice and their cultivation methods. Key resource persons from Webigram, Mr. Saw Robert Pee and Saw Andrew who belong to the Karen ancestry served as main informants.

The study revealed that their traditional rice cultures like Khushbuya (*Choi-chi-mannai*), Black Burma, White Burma, Mushley, Yaeon etc. were originally brought by their forefathers around 1925 during migration from Burma to suit to their taste and other special features. These rice landraces have specific growing requirements. These landraces have a significant role in the livelihood and culture of the Karen community. As per the data derived from the interviews, some of the special features of these rice varieties are mentioned in Table 1 and pictorially represented below.

Table 1: The popular rice landraces including the Karen* rice cultures that originated in Burma, still grown in Andaman & Nicobar Islands

Land race	Salient features and unique traits
Khushbuya*	Also called as " <i>Choi-chi-mannai</i> which in Burmese means it can grow without manure. It is nutritive, gives high yield and used for lunch. Medium duration crop (125 days), tall, white rice, moderately scented
White Burma*	Sticky when cooked and used for <i>Lassa</i> /breakfast and gives energy for long time. Long duration crop (175 days), white rice
Black Burma*	It is sticky when cooked and 'halwa' is prepared from its flour which is better than 'maida' and used for breakfast. It has low grain yield. Long duration crop (190 days), tall, creamy white rice, high amylose content.
Mushley*	It is used for both lunch and dinner. It has high yield, small grains and good taste. Long duration crop (175 days), bold, white grains
Yaeon*	It is best in terms of taste, quality and soft like basmati rice. It is used for both lunch and dinner preparation but has low yield. Long duration crop (175 days).
Gol Burma*	Low yield, suitable for traditional recipes, long duration (135 Days), whitish green rice
Red Burma*	Violet colored rice, suitable for lunch, long duration (145 Days), violet rice
Ameta	Medium duration (130 days), white rice
Khochi	Medium duration (<130 days), white rice adapted and preferred to Mayabunder area of North Andaman
White Jeera	Slender white rice grains, long duration (145 days) crop

* As told by key informants Saw Robert Pee and Saw Andrew and also documented by Gautam *et al.*, 2014 [4]

Agricultural practices of the Karens in preserving the landraces

The agricultural practices of the Karen communities endorse a long history of cultivation and tradition influenced strongly by the socio-cultural and religious values like the landrace used for preparing a special dish and often considered to be have high medicinal and nutritional values (Chander *et al.*, 2015) [6]. The custodian farmers claimed that these indigenous rice cultures are also valuable genetic resources that can meet the climatic challenges in near future. The sowing time depends on the onset of the rainy season. Seed broadcast is the sowing method followed by the Karen farmers. No fertilizers and pesticides are used by the as they are well adapted to the soil and are in general, resistant to pests and diseases. The harvest activities using traditional tools (sickles) are done by the both men and women, while storage is mostly undertaken by the women. The major production constraints reported by farmers are the proper storage facilities, unavailability of the modern equipment and poor market. The recent interest of the younger generation towards other occupation also poses a

problem in preserving these rice landraces. Owing to the highly nutritious and most preferred for consumption accompanied with the above-mentioned traits, the Karens have more preference to Khushbuya and Black Burma landraces. They grow all of these landraces for their requirements but dominance is observed where major area under cultivation is allocated for Khushbuya, followed by Black Burma. Previous research reports show that Khushbuya and Black Burma can act as donors for quality traits and abiotic stress tolerance specially to salt stress and heavy metals like Aluminium (Mandal *et al.*, 2004; Elanchezhian and Mandal, 2001) [11; 12]. The Karen rice landraces are also rich in micronutrients with white Burma recording the highest Zn content (31 ppm) and Red Burma having the highest (15.9) Fe content (Gautam *et al.*, unpublished) [4]. The traditional socio-cultural belief and respect to preserve these rice landraces could be evident by the statements of Mr. Pee "that once originally pure Burmese "Karen race" has become impure due to inter-marrying with other population, but the rice cultures preserved and grown by them are pure".



Fig 1: The Karen rice culture: a symbol of socio-cultural diversity

Indigenous Uses

The traditional food recipes prepared by the Karen people using these rice landraces are represented below in Table 2. The recipe names and method of preparation are tabulated in the local language as told by the family members of the informants and some literatures.

The role/intervention of ICAR-CIARI scientists in preserving the Karen rice cultures

A team of scientists from the CIARI, located at Port Blair had taken interest in documenting the traditional knowledge of the Karen community with the Protection of Plant Varieties and Farmers’ Rights Authority (PPVFRA), Ministry of Agriculture & Farmers’ Welfare, Government of India. The Karen community of North & Middle Andaman was conferred with the Plant Genome Saviour Community Award of Rs.10 lakh, Citation and Memento upon Karen. The award was conferred by the Union Minister of Agriculture & Farmers’ Welfare, Govt. of India on December 21, 2016 to Mr. Saw Saytha who is the President of Karen Welfare Association, Mayabunder, North & Middle Andaman. The community was privileged and respected for its contribution to the on-farm conservation of these traditional and unique rice varieties in A&N Islands that constitutes one of the agrobiodiversity hotspots of India.

Table 2: Details of documentation of the Karen rice cultures with PPVFRA

S. No	Applicant name	PPVFRA Registration No.	Application No.	Denomination of traditional varieties	Date of Registration No.
1	Karen Welfare Association	221 of 2017	F542 OS573 14 892	Black Burma	11-07-2017
2	Karen Welfare Association	222 of 2017	F543 OS594 14 893	Khushbayya	11-07-2017
3	Karen Welfare Association	219 of 2017	F544 OS575 14 894	White Burma	11-07-2017
4	Karen Welfare Association	308 of 2017	F545 OS576 14 895	Mushley	27-11-2017
5	Karen Welfare Association	220 of 2017	F546 OS577 14 896	Nyaw-in	11-07-2017

Source: Gautam *et al.*, 2014 [4]

Maintenance breeding programs are conducted regularly at CIARI, to maintain the genetic purity of Khushbuyya and Black Burma as these landraces were chosen due to their

agronomic traits and consumption preferences among the people of Karens (Gautam *et al.*, 2014) [4].

Table 2: Traditional rice-based Karen recipes

S. No.	Name of recipe	Ingredients	Method of preparation
1	Mohinga	Rice (Khushbuyya)	Rice is soaked in sufficient water overnight. Next day water is drained and kept for 1-2 days. After 1-2 days water is added to rice and this rice water mixture is strained through thin muslin cloth. This mixture of rice is left overnight to ferment in a container. By next day this mixture will be hard enough to give it any shape. A big ball is made from this mixture with the help of hands. Take another container add water to it and bring the water to boil, to this boiling water, the rice ball is added at high flame. The rice ball is allowed to boil for around 5 minutes. A particular type of basket is used to remove the rice ball from the boiling water. When still hot, the ball is pounded and at the same time another person keeps on mixing the pounded rice and checks for knots. At this stage lukewarm water is added to the pounded rice just to soften it. Now the consistency of the rice mixture will be like that of cake batter. A flat round plate with tiny holes all over it, usually made up of copper or brass is used to make mohinga. A special cotton cloth is also attached to the plate for ease of holding. In a deep vessel water is boiled and rice batter is poured in the cotton cloth attached with plate. The batter is squeezed and dropped into the boiling water which comes out like noodles. When noodles moves up in the vessels and also starts rotating, it is removed from the water and placed in a native winnowing basket (supda) to drain water. Noodles are kept for draining for about 2 hrs. After 2 hrs it is ready to be consumed.
2	Kotee (Curry)/Mohinga Tee	Ingredients for curry Rice (Khshuboiya)-250 gms Fish- 1 Kg any Big or medium fish (Usually	Clean the fish and place it water and allow the water to boil. Add salt to water and let it boil for 5-10 minutes, till the fish becomes tender. Drain the fish from water, let it cool and remove the flesh from the bones. Keep the flesh aside. Add bones to the same water used for boiling fish and let is boil for 15- 20 minutes. In the mean time put oil in kadhai and sauté onions,

		<p>Kokari, dandus and gobra) Onion-1 big onion Garlic-4-5 cloves Ginger-1 inch piece Banana Stem-3-4 inches. Salt- To taste Turmeric-a pinch Oil-1 tb spoon</p> <p>Ingredients for garnishing Dry red chilly (freshly powdered)-50 gms Onion (chopped)-1 small Coriander Leaves (Burmes Dhania)-50 gms Lemon-2</p>	<p>garlic and ginger till light golden brown. Add fish flesh to the sautéed onions and fry for some more time. Roast rice in a pan till it becomes brown in colour and then the rice is coarsely grounded. Grounded rice is added to the fried fish. Bones are removed from the boiling water after it cools down a little and this water is added to the fish and rice masala and allowed to simmer on low flame. Banana stem is cut into small pieces and added to the curry. It is then simmered for around 5 minutes and removed from fire. Freshly grounded dry red chillies, chopped onions, coriander leaves and lemon juice are kept in separate bowls and after serving kotee the individual may select any of these garnishing as per their liking.</p>
3	Maythawtha (Ladoo)/ Paiethoo	<p>Ingredients Burmese Rice(black/white) - 1 kg Banana(China) -10-12 Water -1 cup Umbrella palm leaves -4-5 Desiccated cocconut -1 cup Sugar -2 tb spoons Salt -1 tspoon</p>	<p>Soak Burmese black or white rice for 3-4 hrs. Take the palm leaf and remove the stem, cut the leaf into 3-4 equal pieces. Make a conical pocket out of palm leaves and stuff it with soaked rice and place a little mashed banana in the centre of the rice. Wrap the palm leaves properly and tie it with a string of the palm stem. Now stem the delicacy for around 1 hr so that rice is cooked completely. After one hour take delicacy from water and unwrap it from the leaves. Cut Paiethoo into small pieces and serve it with desiccated cocconut either with sugar or salt.</p>
4	Mopetoe	<p>Ingredients Powdered Burmese Rice(black/white) -1 kg Desiccated cocconut -4 cups Jaggery -2 50 gms Salt -to taste Banana leaves Water -for making dough</p>	<p>Knead the powdered rice with water and a pinch of salt till a firm but soft dough is formed. Cover the dough and keep aside. Take a pan and add desiccated cocconut along with jaggery. Fry it for 5-10 minutes. Divide the dough into equal parts and roll each part into your palms to make balls. Dust the rolling board lightly with powdered rice flour. Roll each ball with the rolling pin to a small circle to a 4 to 5 inch diameter. Place about 1tb spoon of cocconut jaggery filling in the centre of the rolled circle and seal the edges properly to give it a round shape. Spread the banana leaf and place the filled in ball at the centre of the leaf. Fold the leaf four times and tie it with a string so that it does not loosen while steaming. In a double boiler place the Mopetoe for steaming and cover the boiler with banana leaves to completely seal it. After one hour remove it from the boiler and serve hot.</p>
5	Kokolo	<p>Powdered black Burmese Rice(black/white) -1 kg Desiccated cocconut -4 cups Sugar -250 gms Salt -to taste Oil-for frying Water -for making dough</p>	<p>Knead the powdered rice with water and a pinch of salt till a firm but soft dough is formed. Cover the dough and keep aside. Mix desiccated cocconut with sugar and keep aside. Divide the dough into equal parts and roll each part into your palms to make balls. Dust the rolling board lightly with powdered rice flour. Roll each ball with the rolling pin to a small circle to a 4 to 5 inch diameter. Place about 1tb spoon of cocconut sugar filling in the centre of the rolled circle and seal the edges properly to give it a round shape. Heat the oil in kadhai and slowly add the balls to the kadhai. Fry the balls till golden brown in colour.</p>
6	Kosehtho	<p>Burmese Brown Rice -1 kg Oil-for frying Salt-to taste</p>	<p>Pound the rice till fine. Knead the pounded rice with water and salt to make firm dough. Divide the dough into equal parts and roll each part into your palms to make balls. Dust the rolling board lightly with powdered rice flour. Roll each ball with the rolling pin to give it a shape of a diamond. Heat oil in kadhai and put gently slide the rolled diamond shaped pieces into the kadhai. Fry them till light brown in colour. Traditionally, fat of the pig was used to fry kosehtho. It is eaten as a snack with tea.</p>
7	Molonyibow	<p>Burmese Brown Rice Flour-1 kg Milk (cow's)/Coconut milk-1 lt Jaggery -250gms Oil-for frying Salt-to taste Water-to make dough</p>	<p>Knead rice flour with water and salt to make firm dough. Divide the dough into equal parts and roll each part into your palms to make small balls. Boil water in a pan and dip the balls into boiling water for 15-20 minutes. Take the balls out of water and keep aside. Heat a vessel on a low flame, add cow's milk, jaggery and let it simmer till jaggery gets completely dissolved in milk. Remove from flame and gently slide cooked balls into the milk. Instead of cow's milk cocconut milk can also be used with the addition of sugar and without heating cocconut milk. At the time of serving balls are served with little milk.</p>
8	Selenmekin	<p>Rice (Khshuboiya) flour-4 cups Onion-2 Garlic-3-4 cloves Oil-2 tb spoon Turmeric dry-1 inch Green chillies-1-2 Salt- to taste Water-8 cups</p> <p>Ingredients for garnishing Onion (chopped) – 1 small Coriander (Burmese dhania) – few leaves Green chilly-1 Garlic (chopped)-1-2 clove</p>	<p>Roast rice in the kadhai without adding oil for around 5-8 minutes. Keep it aside. Heat oil in a pan. Add chopped garlic and chopped onion to the kadhai, fry till golden brown. Add turmeric and salt and fry for some more time. Now add the roasted rice flour to the kadhai, stir well. Add water to the kadhai and cook it for 10-15 minutes. Remove from heat once water dries completely. Grease a flat plate and spread this mixture on the plate. Evenly spread the mixture by using a knife and let it cool. In a pan heat oil and put chopped onions, garlic, turmeric, coriander and salt and sauté it for 3-4 minutes. Garnish the selenmekin with the fried onion mix and cut into small pieces like cake.</p>

		Salt –to taste	
9	Kotoo	Rice (Khshuboiya) flour-2 cups Desiccated coconut-1 cup Sugar-200gms Salt-a pinch Water-to make dough	Knead rice flour with a pinch of salt and water to make dough. Divide the dough into small equal parts and roll each part into your palms to give elongated finger like shape. These are then placed in a double boiler and steamed for 15-20 minutes. In a bowl desiccated coconut and sugar are mixed and eaten with Kotoo.
10	Molosan	Rice (Khshuboiya) -1 Kg Lime-100 gms Jaggery-250 gms Water-2 litres	Soak rice in water overnight. Next day drain water and spread the rice on a sheet under sun. In the evening again rice is soaked in water and drained next day and spread under sun. This process is repeated for three days. By this time rice is well fermented. On day four water is added to rice and rice is properly mashed. It is then strained through a muslin cloth. Rice left on the cloth is discarded and strained water is taken in a vessel. This rice water will resemble milk. Mix 100 gms of lime with 2 litres of water in a vessel. Mix rice water with lime water and boil it for 1 hour till it thickens. Take water in a drum and cover it with a big steel sieve. Pour the hot mixture over the sieve and press it. Thin long strands like vermicile will drop in water. Allow it to stand for 5 minutes then remove it from water. In a pan take jaggery and add little lukewarm water so that jaggery dissolves completely in it. Molansan is served with jaggery solution. A glass is half filled with jaggery solution and remaining half with Molosan (50:50) and then served.
11	Chicken haynyotee (soup)	Bones of poultry -5 pieces Red Burma Rice-50 gms Water-4 cups Salt-to taste Ingredients for garnishing Onion (chopped)-1/2 Garlic (chopped)-2-3 cloves Black pepper (freshly ground) Coriander (Burmese dhania)- few leaves	Chicken is boiled and flesh is removed. In a deep container around 4 cups of water is added along with bones and salt. Rice is roasted and coarsely grounded. The grounded rice is also added to the water and it is boiled for around an hour till the bones become very tender. The soup is garnished with chopped onions, garlic, coriander and black pepper and served hot.
12	Tatopa	Chicken with bones -500 gms Rice-50 gms Garlic-3-4 cloves Cane Shoot -2 inches Black pepper (freshly ground)-1/2 tea spoon Water-1 litre Salt-To taste Coriander(Burmese dhaniya)- Few leaves	Roast raw chicken along with the bones in open fire. Keep it aside. Roast rice and pound it finely. In a deep vessel add water, roasted chicken with bones, garlic, rice and salt and boil it for 45-50 minutes. Before removing from fire add chopped cane shoot to it and let it simmer for 5 minutes. Garnish it with chopped coriander leaves. Instead of cane shoot chopped bitter guard leaves are also used. It is eaten as a side dish with rice.
13	Fish nappi	Fish (any big fish)-10 kgs Fermented rice-5 kgs Salt-To taste	Clean fish and cut it into thick pieces. Spread the cut fish on a sheet for drying under sun. In the evening fish is hand pounded, a large quantity of salt is added at that time and then covered and kept inside the house. The same process of sun drying the fish and pounding it is repeated for 07 days. Fermented rice is now mixed with Nappi and pounded together to get a fine paste. A big ball is then made out of it. The balls are then stored in clay jars.

Conclusion

The extensive efforts to preserve the Karen rice cultures *in-situ* as well as *ex-situ* have brought significant implications for conservation and utilization of these landraces for the community. Because of their important role in socio-cultural and economic importance, the Karen landraces has bestowed recognition for the entire Karen community of the Andamans. The production constraints can thus be overcome by proper market channels and consumer awareness of the uniqueness of traditional these rice cultures for health and nutrition. The genetic purification trials showed that they have unique alleles, which needs special attention for their conservation. These landraces could be used as donors in breeding new farmer-preferred varieties.

Future dimensions

To preserve the rice cultures, future efforts are to be focused in conserving them at gene bank for *ex situ* conservation, in case of any climatic adversity or on-farm conservation constraints in the near future. Also, bioprospecting studies and allele mining for important traits including low glycaemic

index and mechanisms conferring Nutrient Use Efficiency and Water Use Efficiency in these landraces have to be targeted. Market-based incentives could be adapted as means of encouraging the Karen farmers to grow landraces that are of social importance to them.

Acknowledgement

The authors acknowledge the technical and intellectual advices of Dr. P.K. Singh, Principal Scientist & Head, Field Crops Division, ICAR- CIARI, Port Blair in taking efforts to register the landraces with PPVFRA and conducting field experiments. Also, acknowledgment for Saw Andrew and Saw Robert Pee who were the Karen farmers and key informants based on which the manuscript has been planned and written.

Declarations

Author contributions

Both the authors have equally contributed in bringing up this manuscript where author SS was involved in conceptualization, data management, manuscript writing and

editing; GRK was involved in conceptualization, carrying out the study at locations, identification of key informants, field experiments, manuscript editing and finalization.

Conflict of interest

The authors have no conflict of interest as everyone have equally contributed in bringing out this manuscript. The authors declare that the research paper has not been published before or submitted to any other journal and if accepted for publish in your esteemed journal will not published elsewhere.

Ethics Approval: Not applicable

Data Transparency: All the data presented are original and any data file will be provided for further reference.

References

1. Maiti S. The Karen – A lesser-known community of the Andaman Islands (India), presented at the ISLANDS of the WORLD VIII International Conference, Changing Islands-Changing Worlds, 1-7 November Kinmen Island (Quemoy), Taiwan; c2004.
2. Singh KS. India's Communities: H-M. New Delhi: Oxford Press for Anthropological survey of India. 1994.
3. Smith M. Burma, Insurgency and the Politics of Ethnicity, quoting Tinker. 1991, p 62.
4. Gautam RK, Singh PK, Ahmed SKZ, Singh AK, Naresh Kumar, Saw Saytha Roy SD. Special features and characterization of rice land races grown by Karen community in Andaman and Nicobar Islands. J Indian Society of Coastal Agricultural Research. 2014;32(2):97-100.
5. <https://www.thehindu.com/society/a-little-myanmar-in-andamans/article24894384.ece2>
6. Chander MP, Kartick C, Vijayachari P. Ethnomedicinal knowledge among Karens of Andaman & Nicobar Islands, India. J Ethnopharmacol. 2015;162:127-33.
7. Singh RK, Singh KP, Nancy JT. A special note on Prior Informed consent (PIC). Indian J Traditional Knowledge. 2013;12(3):547-562.
8. Singh KS. (Eds.) People of India. Andaman and Nicobar Islands. Vol XII. Anthropological Survey of India. Madras: East-West Press PVT Ltd; c1994.
9. Adoukonou-Sagbadja H, Dansi A, Vodouhe R, Akpagana K. Indigenous knowledge and traditional conservation of fonio millet (*Digitaria exilis*, *Digitaria iburua*) in Togo. Biodiversity and Conservation. 2006;15:2379-2395.
10. Rana RB, Garforth C, Sthapit B, Jarvis D. Influence of socio-economic and cultural factors in rice varietal diversity management on-farm in Nepal. Agriculture and Human Values. 2007. DOI 10.1007/s10460-007-9082-0.
11. Mandal AB, Elanchezhian R, Majumdar ND. Genetic management for increased productivity of rice in Andaman and Nicobar Islands. CARI publication, 2004, 196.
12. Elanchezhian R, Mandal AB. Rice genetic resources indigenous to bay islands- a profile, Tropical Agricultural Research and Extension. 2001;4(2):61-67.