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RICE LANDRACES IN NAMSAI DISTRICT OF ARUNACHAL PRADESH, NORTHEAST INDIA

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ABSTRACT

Rice (*Oryza sativa* L.), belongs to the family Poaceae and is regarded as an important food crops worldwide. Its importance is evident in Asian countries. Northeast India is a global centre of genetic diversity because of the various landraces prevalent in the region. The present study documented the traditional landraces in Namsai district with semi-structured interviews and participant observation. A total of 29 landraces were documented. The diversity analysis of rice landraces in the district demonstrated higher Shannon diversity index and a lower Simpson dominance index. The evenness values reflect moderately fair distribution of landraces and the higher Menhinick index in Namsai (1.07) showing its greater species richness per unit sampling effort. Thus, the rice landraces in Namsai district should be conserved on-farm.

KEYWORDS: *Namsai, Landraces, Rice, Arunachal Pradesh.*

INTRODUCTION

Rice (*Oryza sativa* L.), is recognized as one of the important food crop globally, serving as the primary source of nutrition for over one-third of the world's population and meeting the daily caloric requirements of billions. The global importance of this crop is particularly evident in Asia, where India and China together contribute to 49% of the global rice production, thereby establishing their agricultural systems as crucial components of global food security (Bandumula, 2018).

Archaeological evidence suggests that rice cultivation originated approximately 7,000 years ago in China's Yangtze River Valley and slowly spread across Asia before reaching Europe and the Americas (Maclean et al., 2003; Vaughan et al., 2008). The genus *Oryza* consists of different species, including two primary domesticated species, *O. sativa* (Asian rice) and *O. glaberrima* (African rice), which follow different evolutionary and domestication pathways (Sweeney and McCouch, 2007). Apart from these cultivated species, the genus includes 21 wild relatives organised into four distinct species complexes: *O. sativa, O. officinalis, O. ridleyi*, and *O. granulata* (Umadevi et al., 2012).

Northeast India is a globally important centre of genetic diversity in rice, consisting of numerous traditional varieties (landraces) that have evolved over millennia through farmer selection and natural adaptation. Traditional farming communities have preserved these varieties by employing the indigenous knowledge systems including traditional soil classification methods and selection practices that prioritise resilience to environmental stress (Anupam et al., 2017). This invaluable genetic heritage is increasingly in threat. Land fragmentation, declining economic returns from traditional varieties, and the advent of high-yielding modern cultivars have jeopardised the continued cultivation of landraces (Das & Das, 2020). Climate change supplements these challenges by increasing temperatures, altering precipitation patterns, and increasing the frequency of extreme weather events, such as floods and droughts (Dar et al., 2020; Das et al., 2024). Farmers empirical observations consistently indicated that traditional varieties often demonstrate superior tolerance to environmental stresses, including drought resistance and disease tolerance.

Considering the challenges posed by the necessity to feed an expanding global population and the imperative to adapt to climate change, it is essential to understand

and document the rice landraces and its diversity. Consequently, research on rice landraces were carried out in Namsai district.

METHODOLOGY

Household surveys

A household survey was conducted in ten stratified randomly selected villages in Namsai district. Ethnographic methods were used, including semi-structured interviews and participant observation to document the rice landraces. The villages selected were Momong, Chongkham, Wingko, Nongtaw Khampti, Man-Phakta, Sengshap, Mahadepur-I, Deobil, Lathao-IV, and Manfaiseng. A total of 100 farmers were interviewed, including the village headman (Gaon Buras) and the elders actively involved in farming. Rice samples were collected from ten selected villages in district. This sampling strategy was chosen to document a comprehensive assessment of rice diversity. The collected samples will serve as the basis for subsequent diversity analyses of the variety's population (Mohanavel et al., 2021).

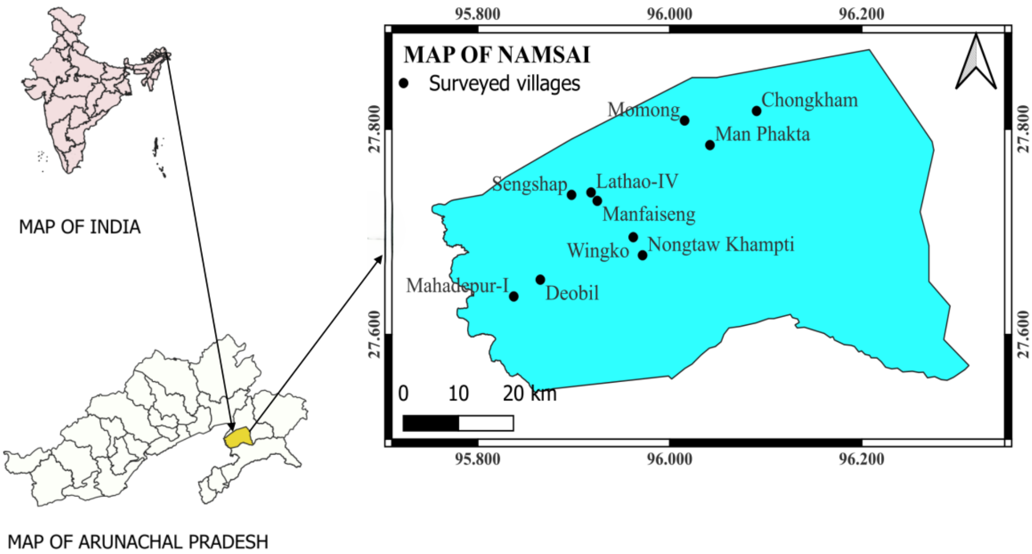

Figure-1: Surveyed villages of Namsai district.

Data Analysis

The diversity data were calculated using the following formula.

A. Simpson's Dominance (D)

Simpson's Dominance was calculated using the formula

$$D = \sum_i \left(\frac{n_i}{n}\right)^2$$

Where, n_i is the number of individuals in the taxon i,

and n is the total number of individuals.

B. Shannon-Wiener Index (H)

Shannon-Wiener Index was calculated using the formula.

$$H = -\sum_i \left(\frac{n_i}{n} \ln \frac{n_i}{n}\right)$$

Where, n_i is the number of individuals of the taxon *i*, and *n* is the total number of individuals.

C. Evenness ($E^{\frac{H}{S}}$)

Evenness was calculated using the formula.

$$E^{\frac{H}{S}} = \frac{H}{\ln S}$$

Where *S* is the number of species, and *H* is the Shannon Index.

D. Menhinick's Richness Index

Menhinick's Richness Index was calculated using the formula:

$$\text{Menhinick} = \frac{S}{\sqrt{n}}$$

Where *S* is the number of species and *n* is the total number of individuals.

All the diversity analysis calculations were done using PAST software (version 4.13).

RESULTS

The survey conducted through the semi-structured interviews and participant observation in the district documented a total of 29 rice landraces with local names (Table 1).

Table 1: Rice landraces documented in Namsai district with the local names.

Sl. No.	Local Name	Sl. No.	Local Name
1	Khaw-Dolkosi	16	Khaw-Joha
2	Khaw- Phakgnok-onn	17	Khaw-noo neng
3	Khaw-Nok-Kang	18	Khaw-No-yasai
4	Khaw-Law -Dubi	19	Khaw-Birya-Bhonga
5	Khaw-Long-Neng	20	Khaw-Long-Nak
6	Khaw-Joha onn	21	Badam-Lahi
7	Khaw-Chowwong	22	Khaw-Nam Tak
8	Khaw-Chakoi-Lahi	23	Khaw-Gundho-Lahi
9	Khaw-Tai	24	Khaw-Bora-Joha
10	Khaw-Ann	25	Lal Bihari
11	Khaw-Pa Khi	26	Khaw-Nak
12	Khaw-Aki	27	Khaw-noo Khaw
13	Khaw-Long	28	Khaw-Tai-Neng
14	Khaw-Phakgnok	29	Khaw-on-chowwong
15	Khaw-Kolom		

The diversity analysis of rice landraces in the district demonstrated higher Shannon diversity index (H = 2.90), indicating a more heterogeneous landrace composition and absence of a dominant varieties (Tables 4.3). The substantially lower Simpson dominance index in Namsai (D = 0.07) further corroborates the absence of dominant varieties and the presence of a more equitable distribution of landrace frequencies (Table 4.3). The evenness values Namsai (0.62), suggests moderately balanced distribution pattern of landraces, indicating overall fairly uniform distribution, and the higher Menhinick index in Namsai (1.07) showing its greater species richness per unit sampling effort (Table 4.3).

A higher number of landraces in the district directly contribute to higher Shannon diversity index, as this index incorporates both richness and proportional abundance. The lower Simpson dominance index in Namsai further represents a lack of overrepresentation of few landraces, indicating that cultivation is distributed across different range of varieties. The higher Menhinick index in Namsai is also consistent with its greater landrace's richness per unit sampling effort, while the evenness value in Namsai district indicate fairly even distribution.

These findings suggest that Namsai has a stronger repository of rice landraces diversity, highlighting its importance for on-farm conservation and genetic resource management.

Table 2: Diversity indices in Namsai district.

Diversity Indices	Namsai
Simpson Dominance_D	0.07
Shannon_H	2.90
Evenness_ $E \frac{H}{S}$	0.62
Menhinick Index of sp. richness	1.07

DISCUSSION AND CONCLUSION

The diversity analysis revealed that Namsai harbours a greater richness and fairly even distribution of rice landraces, as indicated by higher Shannon diversity (H = 2.90) and lower Simpson dominance (D = 0.07). These findings suggest that Namsai functions as a stronger repository of rice genetic resources, possibly because of more stable wet rice systems and lower genetic erosion pressure. Similar diversity levels reported in other parts of Asia (Dhakal et al., 2020; Mursyidin et al., 2022) citing the importance of these regions in safeguarding agrobiodiversity. The maintenance of diverse landraces across households also reflects a deliberate conservation strategy, consistent with studies highlighting the role of traditional farmers in sustaining genetic resources for future breeding programmes (Shrestha et al., 2024; Sharma et al., 2018). The district's greater rice landrace diversity is also supported by irrigation and stable wet rice systems. The integration of indigenous knowledge with appropriate innovations along with better water management, landrace value-addition, community seed banking, and agrotourism will provide a pathway for sustainable intensification while preserving cultural originality. Protecting and revitalizing these agroecosystems is essential for preserving biocultural heritage and maintaining genetic diversity essential for global food security. Policy frameworks must recognize traditional farming communities as essential partners in conservation and sustainable development, creating environments that enhance rather than undermine indigenous knowledge systems. These rice agroecosystems represent living laboratories of sustainability whose preservation constitutes a critical investment in both local resilience and global agricultural transformation pathways.

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