Documentation of traditional chuhi: a nearly lost legacy of the Meitei in Manipur, Northeast India

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Notes on Ethnobotany

Abstract

Background: **Chuhi**, a traditional product derived from *Saccharum officinarum* L., a C4 plant, exemplifies profound cultural associations with the Meitei community of Manipur (ꯃꯅꯤꯄꯨꯔ). Despite ancient cultivation practices, **chuhi** processing persists only in a few sites, signaling its near-lost legacy amid modernization pressures. This study documents **chuhi** production from two varieties of *S. officinarum,* **Musori** and **Ngahing-nambi**.

Methods: The study utilized purposive sampling across four valley districts of Manipur (ꯃꯅꯤꯄꯨꯔ). Data on sugarcane varieties, cultivation practices, harvest techniques, and **chuhi** processing methods were collected via interviews with skilled producers.

Results: Cultivation-harvest cycles include April planting, yielding four ratoon harvests through January, peaking at second/third cuts. **Chuhi** processing employs traditional apparatuses, including **leirang**, **garai**, **kharai**, **khabei**, and repurposed mustard oil tins for storage, with froth removal critical for quality. Sugarcane processing into **chuhi** involves washing and extraction via **Kolu** (traditionally bullock-powered, now mechanized), bagasse-fueled boiling in **garai** for 7-8 hours with **khabei** stirring and **kharai** froth removal through **Hangoi-Chongba** to **Khoidou Inba** stages, yielding **akaangba** or **kaangdaba** types stored traditionally in cool, stable conditions without preservatives. **Chuhi** serves as a versatile sweetener in traditional snacks like **kabok**, **heingan**, **laaloo**, and **hei-thongba** with *Garcinia pedunculata* Roxb. Ex Buch.-Ham. It is also used as a non-culinary agent, such as an insecticidal spray, binder during the construction of **Kangla** Fort by mixing with *Vigna mungo* (L.) Hepper.

Conclusion: By bridging ethnobotanical gaps amid modernization threats, this study safeguards **chuhi** as a symbol of Meitei resilience, providing a blueprint for conserving vanishing agro-cultural practices while promising nutritional resurgence, sustainable livelihoods, and intergenerational continuity.

Keywords: **Chuhi**, Cultivation, Legacy, Meitei, Processing, *Saccharum,* Traditional

Background

Saccharum officinarum L., a C4 plant belonging to the tribe Andropogonaceae within the family Poaceae, is primarily recognized as the principal source of sugar and, additionally, as a significant bioenergy resource (Altpeter & Oraby 2010, Jackson *et al*. 2014). The sugarcane plant yields refined sugar, a commercialized product widely used. However, several

byproducts generated during the sugar extraction process serve as alternative sweetening agents. One such byproduct is desugared molasses, a liquid obtained during the desugaring phase of sugar production, characterized by a reduced sugar concentration but a higher mineral ion content (Fang *et al*. 2011).

The molasses market has expanded significantly in recent years, driven by applications in food, animal feed, biofuel, and pharmaceutical industries. Molasses is primarily extracted from sugarcane and sugar beet, with the extraction method and the plant's maturity significantly influencing its nutritional composition and overall quality. The stage of plant maturity at harvest affects the sugar concentration in the juice and thus the molasses quality, with fully mature plants generally producing higher sugar yields. Additionally, the extraction and processing parameters, including heating temperature and duration, impact the final molasses composition, particularly its sugar content, mineral ion concentration, and flavor profile. These factors collectively determine the suitability of molasses for various industrial and food applications, with higher-grade molasses commonly used in food products and lower-grade molasses utilized for animal feed, biofuel, and other industrial purposes.

Molasses, locally known as **Chini-Angangba**, occupies a significant place in the cultural and customary practices of the Meitei community in Manipur (ꯃꯅꯤꯄꯨꯔ). Beyond its ritualistic importance, molasses production in the state has traditionally relied on indigenous knowledge and age-old techniques, reflecting methods rooted in traditional concepts and practices (Devi 2018).

Chuhi, commonly referred to as treacle, is a semi-consistent syrup derived from sugarcane. This semi-solid syrup, locally termed **chuhi** in Manipur (ꯃꯅꯤꯄꯨꯔ), is known regionally as **Sariyahor gur** or **Torol gur** in other north-eastern states like Assam. It has been identified as a nutritious food product and serves as a rich source of essential minerals, including iron, calcium, potassium, sodium, phosphorus, magnesium, and chlorine. In addition, sugarcane treacle contains bioactive compounds, including flavonoid-based antioxidants and various vitamins (Bele *et al*. 2019). Studies further indicate that treacle has a relatively lower glycemic index than refined sugar (Litha *et al*. 2024). Foods with a lower glycemic index are digested and absorbed more gradually by the body, suggesting that **chuhi** may be a healthier alternative to refined sugar for individuals seeking dietary options that support better metabolic health.

Despite its unique cultural significance and nutritional value, **chuhi**, a traditional sugarcane product of the Meitei community in Manipur (ꯃꯅꯤꯄꯨꯔ), is experiencing a decline in reliance among younger generations. This has confined its knowledge-intensive processing methods to isolated pockets within the state, placing the associated indigenous practices on the brink of extinction amid modernization, urbanization, and the growing preference for refined sugars. The erosion of this legacy not only threatens crop cultivation expertise but also highlights a critical gap in ethnobotanical documentation of Manipur's biodiversity. The present study addresses this imperative by systematically documenting the **chuhi** legacy, preserving vital indigenous knowledge for future generations.

Materials and Methods

Study area

A pilot survey was conducted across the four valley districts of Manipur (ꯃꯅꯤꯄꯨꯔ) to identify key **chuhi**-producing units, forming the foundational phase of this study. Major production sites identified at Irengband (ꯏꯔꯦꯡꯕꯟꯗ), Kakching Paji Leikai (ꯀꯛꯆꯤꯡ ꯄꯥꯖꯤ ꯂꯩꯀꯥꯏ), and Wabagai (ꯋꯥꯕꯒꯥꯏ) of Kakching (ꯀꯛꯆꯤꯡ) district; Kha-Langthabal (ꯈꯥ-ꯂꯪꯊꯕꯜ) of Imphal West (ꯏꯝꯐꯥꯜ ꯅꯣꯡꯆꯨꯞ) district; Khongjom (ꯈꯣꯡꯖꯣꯝ), Tentha (ꯇꯦꯟꯊꯥ), and Wangbal (ꯋꯥꯡꯕꯜ) of Thoubal (ꯊꯧꯕꯜ) district; and Nambol (ꯅꯝꯕꯣꯜ) of Bishnupur (ꯕꯤꯁꯅꯨꯄꯨꯔ) district were purposively selected for in-depth investigation based on their historical prominence and active artisanal production (Figure 1).

Data Collection

Primary data on sugarcane varieties, cultivation practices, harvest techniques, and **chuhi** processing steps were gathered via semi-structured, face-to-face interviews with skilled producers. Interviews employed purposive and snowball sampling to capture tacit knowledge from elders and active practitioners, following ethnographic protocols with field notes, and photographic documentation of tools/processes. Processing details included juice extraction, froth removal, boiling stages, and storage, cross-verified through participant observation during production cycles.

Secondary data from peer-reviewed articles, ethnobotanical monographs, and regional floras validated sugarcane varieties, technical terminology, and processing metrics. This triangulation ensured taxonomic accuracy and contextualized indigenous methods against agro-botanical standards, addressing gaps in prior Manipur-specific literature.

Prospects for utilization and value-added products were assessed through key informant interviews and site visits to food processing units and traditional sweet vendors in selected locales. This component explored market viability, nutritional profiling, and non-culinary uses, informing conservation recommendations.

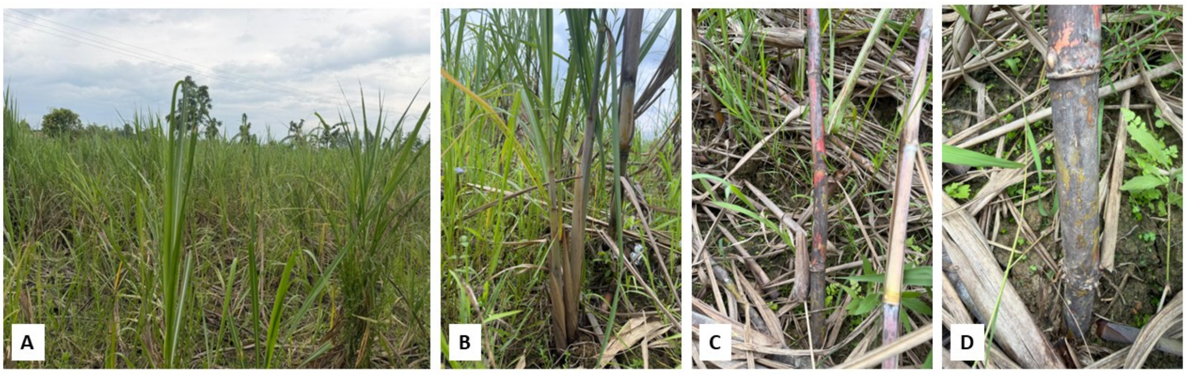

Figure 1. *S. officinarum* 'Musori', commonly used for **chuhi** preparation. (A) Cultivation site at Wabagai (ꯋꯥꯕꯥꯒꯥꯏ), Kakching (ꯀꯛꯆꯤꯡ) district (B) Young plant, (C & D) Mature stalks

Results

Cultivation and types

S. officinarum, vernacularly known as "**Chu**," among the Meitei community of Manipur (ꯃꯅꯤꯄꯨꯔ), is a crop historically vital to agriculture, especially in regions with sugarcane processing. Today, small-scale processing units cluster in a few locations. Among derivatives, **chuhi** stands out for its deep cultural role in rituals and nutritional value.

In Manipur (ꯃꯅꯤꯄꯨꯔ), two primary varieties of *S. officinarum* are commonly cultivated for **chuhi** production, locally referred to as **Musori Chu** and **Ngahing-nambi Chu**. Of these, the **Musori** variety is more widely cultivated and predominantly utilized in **chuhi** processing units. Morphologically, **Musori** is characterized by a slightly bent stem with elongated internodes, and its internal edible portion exhibits a softer texture. In contrast, the **Ngahing-nambi** variety is typically straight-stemmed, hard in texture, and often displays striping along the culm. Organoleptically, **Musori** is sweeter than **Ngahing-nambi** and provides a higher juice yield, likely attributable to its softer internal tissues. A notable feature of **Ngahing-nambi** is the presence of a subtle odor reminiscent of raw fish, which contributes to its limited use in both raw consumption and **chuhi** production.

S. officinarum cultivation in Manipur (ꯃꯅꯤꯄꯨꯔ) starts with soil preparation in January, involving 3-4 rounds of tillage every 15 days to remove weeds and apply fertilizers. Irrigation is generally carried out using the skip furrow method, which is widely practiced among sugarcane farmers in the region. The actual plantation process usually commences in April and is undertaken by experienced farmers following standardized planting methods and the use of appropriate sapling types. Commonly adopted planting techniques include the flat method, the trench method, and the paired row method. In the flat method, sugarcane setts or saplings are placed horizontally in shallow pits and subsequently covered with soil or soil-hay mixtures. In the trench method, saplings are laid in elongated, narrow furrows before being covered with soil or soil-hay mixtures. The paired row method involves planting in a systematic arrangement designed to optimize space utilization. Two types of planting material are employed: setts, which are shoot tips of sugarcane containing 2-3 nodes, and seed cane, which typically comprises stem sections with buds located at the nodes. The plant reaches maturity around 8 months after planting, determined by yield potential or basal leaf withering, while apical leaves stay intact. Harvesting in Manipur (ꯃꯅꯤꯄꯨꯔ) occurs from January to April, with January crops offering superior quality, yield, and sapling propagation potential; yields notably decline after flowering, especially in March. Ratooning enables 3-4 successive harvests from a single planting, with peak yields in the second and third cycles.

The growth cycles of sugarcane exhibit variations across countries, influenced by varietal differences, local cultivation conditions, and geographical parameters (Sukyai *et al*. 2016, Shukla *et al*. 2017, Prasara & Gheewala 2016, Rudorff *et al*. 2010, Som-ard *et al*. 2021). However, the fundamental process of cultivation, tillage, establishment, growth, and maturation remains consistent, aligning with patterns observed in the present study conducted in Manipur (ꯃꯅꯤꯄꯨꯔ), India. In India, plantations typically commence in January, with harvests occurring from December to March (Singh *et al*. 2007, Rajula *et al*. 2014, Som-ard *et al*. 2021). A widespread practice in Indian sugarcane cultivation, and documented in the present study, is ratooning, which yields substantial agronomic benefits by enabling multiple harvests from a single planting over successive

years. This practice boosts production of commercial sugarcane products, including **chuhi**, while reducing costs and energy inputs for land preparation and establishment compared to new plantings.

Ratoon productivity and longevity, however, are modulated by environmental conditions, cultivation practices, harvesting techniques, and genotypic variations. Ratoon crops display accelerated leaf expansion, vigorous early growth, and faster maturity relative to plant cane (Xu *et al*. 2021). Globally, ratooning cycles span 1 to 8 crops, but in India, they extend up to six cycles, with peak yields in the first and second ratoons (Singh *et al*. 2007, Rajula *et al*. 2014, Singh *et al*. 2015, Li 2010, Hu 2015, Som-ard *et al*. 2021). Similarly, this study documented peak yields in the second and third ratoons across four cycles sustained by local farmers.

From the pathological perspective, ratoon stunting disease (RSD), caused by the xylem-limited bacterium *Leifsonia xyli subsp. xyli*, invades sugarcane vascular bundles and limits global production (Garcia *et al*. 2021, Chakraborty *et al*. 2024). The only external symptom of RSD is growth stunting, whereas internal indicators prove unreliable for disease confirmation (Chakraborty *et al*. 2024). Susceptibility, infestation levels, and disease spread differ across cultivars and locations, with stunting severity in infected plants strongly influenced by environmental factors and genotypic traits (Hoy *et al*. 1999, Grisham 1991). The prevalence of RSD was not observed until the fourth ratoon cycle in the *S. officinarum* varieties Musori and Ngahing-nambi, widely cultivated in Manipur (ꯃꯅꯤꯄꯨꯔ), despite the farmers' reports of higher yields in the second and third ratoons. Higher incidence occurs in plant cane from harvested stalks compared to ratoons, primarily due to spread during planting via contaminated tools and infected seed cane, as the pathogen persists only briefly in soil (Forbes *et al*. 1960, Hoy *et al*. 1999, Monteiro-Vitorella *et al*. 2004). Therefore, establishing a disease-free initial cane minimizes RSD risks, making ratoon cultivation highly beneficial for maximizing yields, provided farmers select healthy planting materials and maintain hygienic plantation practices.

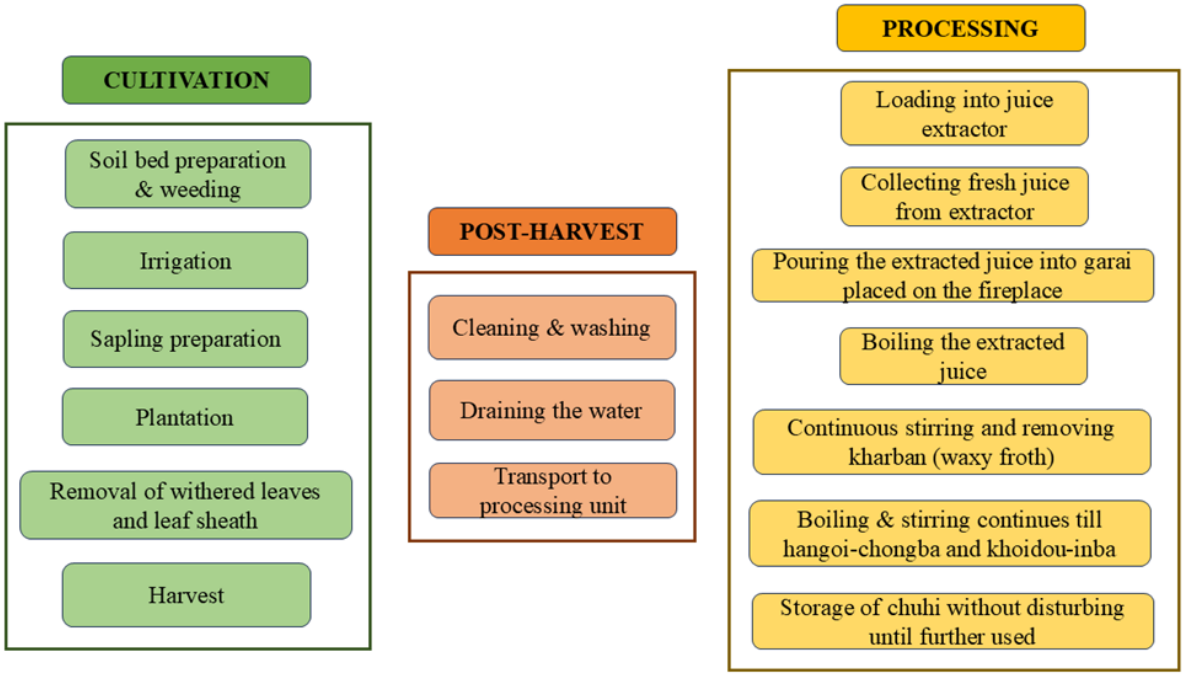

Figure 2. Flowchart illustrating the steps of cultivation, post-harvest handling, and processing in **chuhi** production

Equipment of the Chuhi processing unit

The processing of sugarcane into **chuhi** requires several locally designed apparatuses, including the **leirang**, **garai**, **kharai**, **khabei**, and storage tins. The **leirang** or fireplace, or hearth, is traditionally constructed using mud and bricks, with **chuhi** itself often incorporated into the mixture to enhance structural strength and durability (Figure 3C). The **garai** is a pan-like vessel used to boil freshly extracted sugarcane juice. Multiple garai sizes are available, with processors selecting the appropriate size based on the quantity of sugarcane to be processed. A commonly utilized **garai** has a capacity of approximately 200 liters, with dimensions of about 6 feet in diameter and 1 foot in depth, yielding nearly 110 liters of **chuhi** from a full load of juice. The **kharai**, typically crafted from metal or bamboo, is used to remove froth formed during boiling. This practice is critical, as timely removal of the froth, locally termed **kharban**, is essential for maintaining the quality of the final product. The **khabei**, a long-handled ladle, is employed to stir the juice continuously during boiling, ensuring a

uniform texture and consistency in the prepared **chuhi**. Storage constitutes a crucial final step in the processing chain, as improper storage can compromise the product's quality. Traditionally, empty mustard oil tins have been repurposed for storing **chuhi**.

Figure 3. (A) Local **chuhi** processing site; (B) Machine for sugarcane juice extraction; (C) Hearth for boiling sugarcane juice during **chuhi** processing

Processing of Chuhi

Step 1: Harvest and transport

Sugarcane is typically harvested at maturity directly from the field, where stalks are manually cut at their base. This task is performed by skilled, experienced farmers who carefully select only fully mature stalks. Following harvest, the sugarcane stalks are transported to **chuhi** processing units, where they are thoroughly cleaned to remove dust, mud, and dried leaf sheaths, ensuring that the raw material is clean and suitable for processing (Figure 4A).

Step 2: Juice extraction

The cleaned sugarcane canes are fed into an indigenous juice extraction machine known as a **Kolu**, a traditional rotary press used in **chuhi** production (Figures 3B & 4B). This machine may be operated by electricity or by a tractor, while in earlier times it was driven by bullocks. As the canes pass between the rollers, fresh juice is efficiently squeezed out and flows directly through an outlet pipe into collection vessels. The fibrous residue remaining after juice extraction, known as bagasse, is repurposed rather than discarded. It is used as fuel for the fireplace in the **chuhi** processing unit.

Step 3: Transfer to the boiling vessel

The freshly extracted sugarcane juice is poured into a traditional wide-mouthed vessel known as a **Garai** through a sieve to filter the smaller solid bagasse of sugarcane (Figure 4C). This vessel is carefully positioned over the fireplace to initiate the boiling stage under controlled conditions. The broad opening of **Garai** facilitates easy access for skimming froth and stirring, ensuring efficient processing of **chuhi**.

Step 4: Heating and boiling

The traditional fireplace is ignited with bagasse or any available fuel source, after which the juice is gradually heated. Throughout this process, the **chuhi** processor continuously monitors the boiling mixture, adjusting the flame intensity as needed to achieve uniform heating, prevent scorching or burning of the juice extract, and maintain the desired consistency of **chuhi**.

Step 5: Continuous stirring

During the boiling stage of **chuhi** preparation, the sugarcane juice is repeatedly stirred using a traditional wooden tool known as a **Khabei**. This continuous stirring ensures even concentration of the juice by promoting uniform heat distribution and evaporation, while preventing solid residues from settling at the bottom of the **Garai**, which could lead to scorching.

Step 6: Froth removal

As the sugarcane juice boils vigorously during **chuhi** preparation, a thick, waxy froth called **Kharban** forms on the surface. This froth is thoroughly and repeatedly skimmed off using a specialized ladle known as a **Kharai**, a tool often crafted from

wood or metal with a broad, shallow scoop for efficient removal. This crucial step prevents bitterness and discoloration in the final product, ensuring the clarity, purity, and high-quality flavor of the concentrated **chuhi** (Figure 4D).

Step 7: Boiling stage

The process of boiling, continuous stirring, and careful removal of froth persists until large, vigorous bubbles prominently appear across the surface of the sugarcane juice, indicating a critical transition in its concentration. This distinctive stage, known locally as **Hangoi-Chongba** among traditional **chuhi** processors in Manipur (ꯃꯅꯤꯄꯨꯔ). This **Hangoi-Chongba** stage acts as a crucial visual and textural indicator for local **chuhi** processors, confirming that the sugarcane juice has attained its optimal cooking consistency (Figures 4D & E).

Step 8: Final conversion into chuhi

The process then advances to the **Khoidou Inba** stage, the terminating phase where the raw sugarcane juice undergoes complete transformation into the rich, dark brown color **chuhi** concentrate through prolonged boiling and evaporation (Figure 4F). At this stage, the **chuhi** processors carefully remove the **garai** from the fireplace, allowing the mixture to cool.

Step 9: Duration of the process

The complete boiling and conversion process typically spans 7-8 hours and requires careful attention from the processor throughout. This extended process requires constant attention from the **chuhi** processor to monitor bubble formation, adjust flame intensity, skim froth thoroughly, and stir continuously to avoid scorching, overflow, or uneven concentration. Such careful attention ultimately yields high-quality **chuhi**, characterized by its ideal texture, flavor, and extended shelf stability.

Figure 4. Stages of **Chuhi** processing: (A & B) Juice extraction; (C) Filtering; (D, E, & F) Boiling phases

In general, two distinct types of **chuhi** are produced, locally referred to as **Chuhi akaangba** and **Chuhi kaangdaba**. **Chuhi akaangba** is obtained by prolonged heating of the juice, depending on the processors' preferences or demand. In contrast, **chuhi kaangdaba** results from precise boiling, yielding a product with a slightly sour taste.

Shelf-life maintenance is an important consideration in **chuhi** processing, as the product is not consumed in large quantities and its production is limited to skilled, experienced processors. In Manipur (ꯃꯅꯤꯄꯨꯔ), no technologically advanced processing units currently exist, and therefore, preservatives or modern packaging techniques are not employed. Consequently, the extension of **chuhi's** shelf life relies solely on traditional storage practices guided by the experiential knowledge of

processors. The shelf life of **Chuhi** can be prolonged by storing it under suitable conditions, such as keeping the container in a cool and dry environment, placing it off the ground, and avoiding frequent disturbance or shifting.

Ethno-utility of Chuhi

Chuhi is an indigenous traditional food of Manipur (ꯍꯨꯝꯍꯤ) that has been consumed since antiquity. It may be taken directly or in combination with other ingredients and serves as a key component in the preparation of several indigenous food snacks that are particularly popular within the state, especially among the Meitei community. Beyond its role as a dietary item, **chuhi** continues to hold cultural significance, as it remains an essential element in various traditional rituals of the Meitei community. Furthermore, its use extends to multiple other purposes, reflecting its nutritional, cultural, and functional value.

Chuhi has been utilized in the preparation of diverse traditional food items in Manipur (ꯍꯨꯝꯍꯤ) since ancient times. These food products are generally prepared by combining **chuhi** with various ingredients, depending on the type of food to be made. Commonly used ingredients include rice, wheat, and sesame seeds. While **chuhi** imparts a natural sweetness, it is also valued for its adhesive property, which helps to bind the individual components together, thereby forming distinct food products. A well-known example is **Kabok**, a popular snack prepared by mixing **chuhi** with popped or puffed rice. The mixture may be molded into compact spherical forms, locally termed **Kabok Khoidom**, or shaped into alternative forms such as cones or flat half-moon structures. Additionally, other ingredients such as popcorn, rice powder, sesame seeds, groundnuts, and sumac berry seeds are also incorporated to diversify **chuhi**-based products. Preparations with popcorn, rice powder, and sumac berry seeds are generally rolled into spherical shapes and are known locally as **Chujak-kabok**, **Laaloo**, **Heimang-heingan**, and **Leibakhawai-heingan,** respectively. By contrast, preparations using groundnut and sesame seeds are more commonly molded into flat structures.

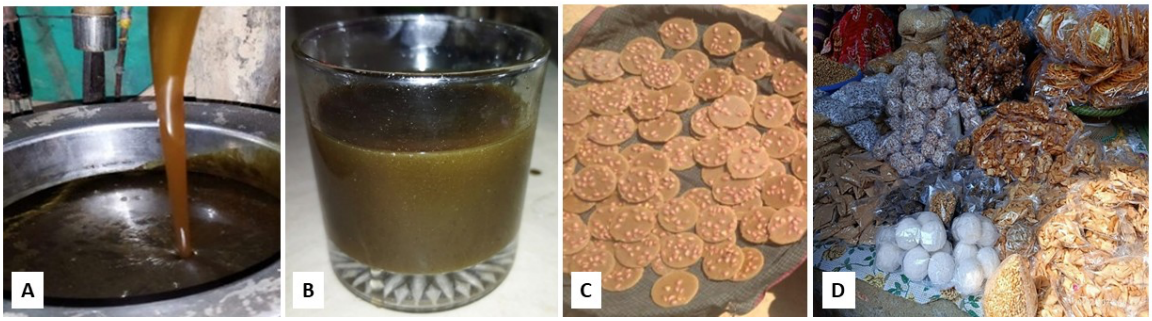

Figure 5. (A & B) Processed **chuhi;** (C & D) Various market-available food products derived from **chuhi**

The processing of **chuhi**-based food products also varies according to the type of **chuhi** used. Typically, **chuhi akaangba** is employed in the preparation of jaggery, a well-known alternative to refined sugar widely consumed for its nutritional and health benefits. Jaggery represents a solidified form of **chuhi** and is commonly used as a substitute in the preparation of various food snacks, particularly when liquid **chuhi** is unavailable. In such cases, jaggery is melted to obtain **chuhi kochi**, a locally used term that denotes the attainment of the desired sticky and consistent texture. Conversely, **chuhi kaangdaba** is generally preferred for the preparation of traditional snacks such as **kabok** and **laaloo** (Figure 5D).

In earlier times, **chuhi** constituted a part of the daily diet, particularly among the elderly, who commonly consumed it either mixed with rice or diluted as a beverage. Oral testimonies from elderly individuals indicate that the consumption of **chuhi** provided a sense of immediate rejuvenation and energy restoration following physical exertion.

In addition to its dietary value, **chuhi** holds considerable socio-cultural significance in the traditional rituals of the Meitei community of Manipur (ꯍꯨꯝꯍꯤ). Edible products such as **heingan** (Figure 5C) and **kabok** are regarded as obligatory offerings during ceremonies, including **Luhongba**, **Asti**, **Sorat**, **Firoi**, and **Ushop**. Similarly, **chuhi heingan** is an essential ritual item in observances dedicated to deities such as **Lainingthou Sanamahi Khoirumba** and **Imoinu Iratpa**. Beyond these, freshly prepared **chuhi** is a key component in the preparation of **Pholla**, an indigenous sweet dish traditionally offered during prayer ceremonies such as **Shani Khoirumba** and **Kangsubi**, an indigenous snack offered during Makar Sankranti. Moreover, in ceremonial feasts such as **chakkouba** and **ushop**, a customary fruit dish known as **hei-thongba**, prepared by mixing **chuhi** with seasonal fruits such as **heibung** (*Garcinia pedunculata* Roxb. ex Buch.-Ham.) and **chorphon** (*Elaeocarpus floribundus* Blume), is invariably served as the concluding item, a practice that has been maintained since time immemorial.

Beyond its role in the preparation of edible items, **chuhi** has also been traditionally employed for a variety of non-culinary purposes. When diluted with water, **chuhi** is sprayed on vegetables, particularly mustard, owing to its perceived insecticidal and antimicrobial properties. Additionally, its adhesive and heat-resistant properties have made it useful in construction, especially for crematoriums and fortifications, where it is believed to improve both structural strength and durability. Historical accounts suggest that **chuhi** was incorporated in the construction of the **Kangla** Fort of Manipur (ꯀꯡꯂꯥ), alongside mud and **sagol hawai** (*Vigna mungo* (L.) Hepper), reflecting its significance as a traditional binding material with multipurpose utility.

Conclusion

The systematic documentation of the nearly lost **chuhi** legacy among the Meitei community of Manipur (ꯃꯅꯤꯄꯨꯔꯤ), Northeast India, not only revives a vital thread of indigenous knowledge but also underscores the profound interplay between traditional sugarcane processing, nutritional heritage, and cultural identity. By bridging the ethnobotanical gap amid threats of modernization and urbanization, this study safeguards **chuhi's** role as a symbol of resilience and biodiversity, offering a blueprint for conserving similar vanishing agro-cultural practices. Ultimately, revitalizing **chuhi** promises not just nutritional resurgence but a pathway to sustainable livelihoods and intergenerational continuity for the Meitei people.

Declarations

List of abbreviations: Not applicable.
Ethics approval and consent to participate: All the informants provided prior consent.
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