

## Ethnobotany of starter cultures used in alcohol fermentation by a few ethnic tribes of Northeast India

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The study of ethnobotany relating to any tribe is in itself a very intricate or convoluted process. The Northeastern part of India is well known for production of household liquors, which is associated with the regions rich indigenous knowledge system. The paper documents the traditional knowledge for the preparation of starter cultures used by the indigenous tribes through structured questionnaires in consultations with a few ethnic tribes residing in isolated pockets of Northeast India. The study revealed that the methods for production of household liquors among the different tribes vary, as all of them follow their own indigenous protocols, where they use different plants during the preparation of starter culture although the substrate employed as the source of carbon is common. The study thus highlights the potentials of the ethnobotanical research and the need for documentation of traditional knowledge pertaining to the production of alcohol.

**Keywords:** Starter culture, Indigenous knowledge, Alcohol fermentation, Northeast India

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Traditional knowledge of wine making in Northeast India has been both explicit and tacit that has been codified into words or transferred from one generation to another through ages; thereby suggesting a sense of common or communal ownership amongst different communities<sup>1</sup>. The Northeastern states of India harbours more than 130 major tribal communities of the total 427 tribal communities found in India. The various ethnic tribes represent a concoction of various original aborigines, which include the *Mongoloid*, the *Chinese* and the *Aryan* descent<sup>2</sup>. On the other hand, traditional alcoholic brewing is an important household cum societal drinking activity associated to many religious ceremonies among different ethnic tribal groups of this region<sup>3</sup>. The methods for wine and beverage production among the tribes differ as all of them follow their own indigenous protocols employing different starter cultures, although most of them use similar substrates for fermentation<sup>2</sup>. These locally produced alcohols and alcoholic beverages have several limitations like bad odour, turbidity, toxic metabolites, texture and inconsistency which not only lower down the quality and yield but also

contribute to obstacles on the commercialization of the fermented products<sup>4</sup>. During the investigations, the background information on indigenous and traditional brewing processes followed by a few ethnic tribes were studied comprehensively as no scientific database were available that could throw light and address the various problems associated with household wine making.

### Methodology

Starter culture used for fermentation and household production of alcoholic beverages by 11 ethnic tribal population representing six states of Northeast India, viz. Assam, Manipur, Nagaland, Meghalaya, Sikkim and Arunachal Pradesh were collected visiting remote villages of the mentioned states. The source of starter cultures collected from various ethnic tribes, substrate used for the production of household liquor and their local names has been provided (Table 1). While collecting information on various components used for the preparation of starter culture, information have been gathered from the village chiefs, and even local men and women using semi-structured questionnaires. During the study, Prior Informed Consents (PIC) have been taken from the knowledge providers. Analysis of

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Table 1— Sources of starter culture and their local name

Source of collection	State	Substrate used	Local name (Starter culture)	Local name (Liquor)
<i>Adivasi</i>	Assam	Rice	<i>Dabai</i>	<i>Haria</i>
<i>Dimasa</i>	Assam	Rice	<i>Hamao</i>	<i>Zu</i>
<i>Ahom</i>	Assam	Rice	<i>Xajar Pitha</i>	<i>Xajpani</i>
<i>Mishing</i>	Assam	Sticky Rice	<i>Apong kusure</i>	<i>Apong</i>
<i>Bodo</i>	Assam	Rice	<i>emao</i>	<i>Zu</i>
<i>Karbi</i>	Assam	Rice	<i>Thap</i>	<i>Arak</i>
<i>Meithei</i>	Manipur	Rice	<i>Hamei</i>	<i>Chameli</i>
<i>Apatani</i>	Arunachal Pradesh	Dried millet/boiled rice	<i>epo</i>	<i>Chu</i>
<i>Nepali</i>	Sikkim	Rice/corn	<i>Marcha</i>	<i>Jarr</i>
<i>Angami</i>	Nagaland	Sticky rice	<i>Yei</i>	<i>Peyazu</i>
<i>Khasi</i>	Nagaland	Rice	-	<i>U Phandieng</i>

data was made with the help of group discussions among different age classes of villagers that include both genders of the society. A total of 440 villagers (308 men and 132 women) participated in the study, but only 242 (~ 55% of the 440) provided information for all the methods of data collection. The permanent sample was almost evenly split between men (n=134, or 55.3%) and women (n=108, or 44.6%). Information were recorded with regards to their vernacular names, plant parts used, process of preparation of starter culture either individually or in combination with other plant parts, and mode of application and doses for the preparation of household liquor. Plant specimens were identified with the help of references and herbarium specimens of Botanical Survey of India, Shillong and the voucher specimens have been deposited in the herbarium of the Department of Botany, Gauhati University, Assam<sup>5,6</sup>. The collected information was analyzed, and correlation was made for different starter culture in order to understand the pattern of components uses and occurrences in the starter culture.

## Results and discussion

The Northeastern region of India is well known for production of household liquors, which is associated with the regions rich indigenous knowledge system and this knowledge is extricably linked to its social, cultural, environmental and institutional contexts<sup>1</sup>. Yeasts have been regarded as major sources of ethanol and other alcoholic beverage production since time immemorial<sup>7</sup>. Most of the tribes of Northeast India use rice as sources of starter cultures for perpetuation of yeast strains. On the other hand, production of wine and alcoholic beverages by traditional methods requires the addition of sugars either in the form of carbon sources or exogenously supplied together with

preconditioned yeast cells (starter culture), which have been perpetuated by an age long process through time immemorial. A variety of alcoholic beverages are prepared by these indigenous tribes, typical of their cultural heritage, the most desirable being rice and millet beer. In the study, 23 plant species that are used for the preparation of starter cultures by eleven communities, viz *Adivasi*, *Dimasa*, *Ahom*, *Mishing*, *Bodo*, *Karbi*, *Meithei*, *Apatani*, *Nepali*, *Angami* and *Khasi* have been documented (Table 2). The field investigations exposed various indigenous protocols of beer making. The method used by *Apatani* tribe of Arunachal Pradesh was found to be unique, compared to other tribes of the region. Dried millet or rice is boiled and starter yeast powder (called *epo*) is added to the starch. In addition, ash and extracts of certain plants like *Eleusine coracana* and *Saurua roxburghii* are added to the broth, packed in bamboo vessels with mouths closed and allowed to remain untouched for 5-7 days until fermentation is complete.

The *Ahom* community of Assam prepares rice beer to which they add seeds of *Datura metal*. This is popularly known as *Xajpani*. On the other hand, the *Bodo* tribe of Assam produces rice beer called *Zu* with starter cakes called *emao*, which are prepared from husked rice and leaves of *Atrocarpus integrifolia* to which concoction of wild herbs like *Clerodendrum viscosum* and *Polygonum hydropiper* are added. The *Karbi* tribal community of Assam has a distinct methodology of rice beer preparation to which they add leaves of *Dryopteris* sp during fermentation<sup>8</sup>. The *Adivasi* community of Assam also prepares rice beer, called *Haria*, where they add dry leave of *Nicotiana tabacum* and *Polygonum hydropiper*. The *Mishing* tribal population prepares rice beer from starter cakes made of rice flour mixed with dry powdered leaves of

Table 2—Plants used for the for the preparation of starter culture

Tribal community	Plant name/Family	Local name
Adivasi	<i>Polygonum hydropiper</i> L./Polygonaceae	Bishdhekia
	<i>Nicotiana tabacum</i> L./Solanaceae	Dhapat
Dimasa	<i>Hedyotis diffusa</i> Willd./Rubiaceae	Banjuluk
	<i>Solanum ferox</i> L./Solanaceae	Katahibengana
Karbi	<i>Dryopteris</i> sp /Polypodiaceae	Dhekia
Ahom	<i>Datura metal</i> L./Solanaceae	Dhutura
	<i>Zanthoxylum nitidum</i> (Roxb.) DC./Rutaceae	Tazmui
Mishing	<i>Clerodendrum viscosum</i> Vent./Verbenaceae	Dhapat Tita
	<i>Adenanthera lucidor</i> (Steud.) Nielson/Mimosaceae	Mishagach
	<i>Solanum viarum</i> Dunal./Solanaceae	Titabhakuri
	<i>Artocarpus integrifolia</i> L. Moraceae	Kathal
	<i>Ananas comosus</i> (L.) Merr./Bromeliaceae	Anaras
	<i>Saccharum officinarum</i> L./Poaceae	Kunhiar
	<i>Psidium guajava</i> L./Myrtaceae	Madhuriam
	<i>Musa balbisiana</i> Colla./Musaceae	Bhimkal
	<i>Capsicum annum</i> L./Solanaceae	Jalokia
	<i>Polygonum hydropiper</i> L./Polygonaceae	Bihlangani
Bodo	<i>Piper nigrum</i> L./Piperaceae	Jaluk
	<i>Clerodendrum viscosum</i> Vent./Verbenaceae	Dhapat Tita
	<i>Polygonum hydropiper</i> L./Polygonaceae	Bihlangani
Meithei	<i>Artocarpus integrifolia</i> L./Moraceae	Kathal
	<i>Clerodendrum colebrookianum</i> Walp./Verbenaceae	Nephaphu
Apatani	<i>Dryopteris</i> sp/Polypodiaceae	Dhekia
	<i>Eleusine coracana</i> /Poaceae	Babachakon
	<i>Saurua roxburghii</i> Wall./Saurauiaceae	Banpachala
Nepali	<i>Calotropis gigantea</i> (L.)/Asclepiadaceae	Akan
	<i>Clerodendrum viscosum</i> Vent./Verbenaceae	Dhapat Tita
Angami	<i>Oryza sativa</i> L./Poaceae	Dhan
Khasi	<i>Costus speciosus</i> (Koen.) Smith./Costaceae	Yamlakhuti

different plants (Table 2) and in addition to which they add seeds of *Piper longum*. They use half boiled sticky rice as substrate and directly mix with starter culture (*Kusure*) but sometimes they add rice husk with the above preparation. The former is known as *Nagin-apong* and later as *Poro-apong*.

The *Nepali* tribal community of Sikkim prepares beer from rice, millet and even corn to which they add extracts of leaves from *Clerodendrum viscosum* and *Calotropis gigantea*<sup>9</sup>. The *Khasis* of Meghalaya have traditionally been producing fermented spirit from rice called *U Phandieng* through ages<sup>10</sup>. They also prepare a cocktail of millet and rice beer called *Ka Kiad* to which they add extracts of a local arum, *Shoriu hadem* and roots of a plant, *Khawiang*<sup>10,11</sup>. The *Meithei* tribe of Manipur adds extract of tree barks and fern leaves during indigenous rice beer fermentation<sup>12</sup>. The *Angami* community of Nagaland prepare alcoholic beverage known as *Peyazu*. Rice grains are germinated, dried, ground and the powder is mixed with rice to prepare the starter culture. It is now well known that alcoholic fermentation successively involves different microorganisms,

although yeasts are the most prominent species observed<sup>13</sup>. In natural fermentation, there is a progressive pattern of yeast growth. Many ecological studies have shown that several species of yeasts with low fermentative activity such as *Hanseniaspora*, *Kloeckera*, *Pischia* and *Candida* are active during early stages of fermentation. The end product of fermentation (ethanol) is highly toxic to the survival of these yeasts and therefore they die off, leaving *Saccharomyces cerevisiae* strains to continue the fermentation process till the end<sup>14</sup>. The starter culture is used as a source of yeast strains in the process of fermentation.

### Conclusion

The findings have greater significance in a broader perspective as different plant species used for the production of household liquor were identified and documented. It was observed that different community of Northeast India follow almost identical protocols for fermentation, but they use different types of plant species in the starter culture preparation process, which are believed to add as an intoxicating

property of the liquor<sup>4</sup>. On the other hand, yeast strains associated with indigenous alcoholic fermentation practiced by various tribes has not been scientifically documented which is imperative taking into consideration the epidemiological effect of such isolates to human health, in particular the ignorant tribal communities accustomed to consumption of household alcohol prepared by traditional brewing practices without any scientific knowledge.

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### References

- 1 Das ST, *Tribal Life of Northeast India*, (Gyan Publishing House, New Delhi), 1986, 23-29.
- 2 Ghosh GK, *Tribals and their culture in northeast India: Assam, Meghalaya and Mizoram*, (Ashish Publishing House, New Delhi), 1992, 69-83.
- 3 Sharma TC & Mazumdar DN, *Eastern Himalayas: A Study on Anthropology and Tribalism*, (Cosmo Publications, New Delhi), 1980, 17-31.
- 4 Sarma HK, Isolation and characterization of yeast strains from indigenous starter culture for alcoholic fermentation, In: *Microbial Diversity: status and potential applications*, edited by Tiwari SC & Sharma GD, (Scientific Book Centre, Guwahati), 2002, 85-97.
- 5 Jain SK & Rao RR, *Hand Book of Field and Herbarium Methods*, (Today's & Tomorrows Publication, New Delhi), 1977, 42-67.
- 6 Hooker JD, *The Flora of British India*, (L Reeve & Co, London), 1872-1879.
- 7 Barnett JA, Payen RW & Yarrow D, *Yeasts: Characteristics and Identification*, (Cambridge University Press, Cambridge), 2000, 1101-1139.
- 8 Borthakur SK, Studies in ethnobotany of the *Karbis (Mikirs)* - Plant masticatories and dyestuffs, In: *Contributions to Ethnobotany of India*, edited by Jain SK, (Scientific Publisher, Jodhpur), 1990, 277-283.
- 9 Tsuyoshi N, Fudou R, Yamanaka S, Kozaki, M, Tamang N, Thapa S & Tamang JP, Identification of yeast strains isolated from marcha in Sikkim, a microbial starter for amyolytic fermentation, *J Appl Microbiol*, 97 (3) (2004) 647-655.
- 10 Ahmed AA & Borthakur SK, *Ethnobotanical wisdom of Khasis of Meghalaya*, (Bishen Singh Mahendra Pal Singh, Dabra Dun), 2005, 178-182.
- 11 Karotemprel S, *Changing Khasis: A historical account*, (Bookland Publications, Calcutta), 1984, 22-27.
- 12 Hodson TC, *The Meitheis*, (LPS Publications, New Delhi), 1999, 47-54.
- 13 Fleet GH, The microbiology of alcoholic beverages, In: *Microbiology of Fermented Foods*, edited by Wood BJB, (Blackie Academic & Professional, New York, USA), 1998, 217-262.
- 14 Mills DA, Johannsen EA & Cocolin L, Yeast diversity and persistence in Botrytis-affected wine fermentations, *Appl Environ Microbiol*, 68 (10) (2002) 4884-4893.