

Methodology of rice beer preparation and various plant materials used in starter culture preparation by some tribal communities of North-East India: A survey

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Abstract: North-East India is inhabited by many indigenous tribes and as a part of their socio-cultural life most of these tribes prepare their own local brew, mostly using rice grains as the substrate. In addition each of the tribes also prepares their own unique starter cultures to carry out fermentation, and each type is a mixture of different parts of various plant species. These starter cultures in the form of cakes can be stored up to several months. The fermentation is usually carried out in earthen pots at room temperature and takes about 5-7 days for completion of the whole process of preparation. The authors visited some of the rural areas where rice beer is predominantly prepared and the process of preparation was observed and documented. The methodologies followed by the Bodo, Karbi, Ahom, Mising, Deori, Dimasa Kachari and Angami tribes of North-East India have been reported in this article. The plant species used for starter cake preparation were collected from the places visited and their taxonomical identification was carried out. This article also reflects some of the expertise of the ethnic people in maintenance of suitable conditions for microbial activities required for rice beer preparation.

Keywords: Rice beer, tribes, plant materials

Introduction

The consumption of rice beer prepared from rice is a common practice among many tribal communities residing in the North-Eastern states of India and many of them have been preparing it since time immemorial (Ghosh and Das, 2004; Jeyaram *et al.*, 2008). It also plays an important role in the socio-cultural life of the tribal people as it is found to be associated with many occasions like merry making, ritual ceremonies, festivals, marriages and even death ceremonies (Saikia *et al.*, 2007). The preparation and consumption of this type of liquor emerged mainly due to the climatic conditions and discovering the use of surrounding natural resources (Roy *et al.*, 2004). There are also reports of rice beer being used as a drug (Singh and Singh, 2006). It works effective against insomnia, headache, body ache, inflammation of body parts, diarrhoea and urinary problems, expelling worms and as a treatment of cholera (Samati and Begum, 2007; Deka and Sarma, 2010). All of the tribes prepare their indigenous alcoholic beverages at home using round to flattened solid ball-like mixed dough inocula or starter (Tamang *et al.*, 2007; Jeyaram *et al.*, 2008) and these contain amylolytic and alcohol-producing yeasts, starch degrading moulds and lactic acid bacteria (Dung *et al.*, 2006). The amylolytic microbes *M. Circinelloides*, *R. chinensis*, *S. fibuligera*, *S. capsularis* and *P. burtonii* have been isolated from the starter culture *marcha* used in Sikkim. Whereas,

ethanol production was shown by the isolated strains *S. bayanus*, *C. glabrata* and *P. anomala* (Tamang and Sarkar, 1995; Tsuyoshi *et al.*, 2005). The lactic acid bacteria *Lactobacillus plantarum*, *Lactobacillus brevis* and *Pediococcus pentosaceus* have been isolated from samples of starter cultures used in the states of Sikkim and Manipur (Tamang *et al.*, 2007). The methodology of fermentation carried out by different tribes is almost the same, except that the difference comes from the different types of plant species used in starter culture preparation (Tanti *et al.*, 2010). Various plants have been reported to be used in the preparation of rice beer starter cultures in North-East India by various authors. Some are *Albizia myriophylla* by the Maiteis in the state of Manipur (Singh and Singh, 2006), *Amomum aromaticum* by the Jaintia tribe of Meghalaya (Samati and Begum, 2007), *Plumbago zeylanica*, *Buddleja asiatica*, *Vernonia cinerea* and *Gingiber officinale* in the state of Sikkim (Tsuyoshi *et al.*, 2005), *Glycyrrhiza glabra* by the Dimasas in Assam (Chakrabarty *et al.*, 2009), *Ananas comosus*, *Artocarpus heterophyllus*, *Calotropis gigantea*, *Capsicum frutescens* etc. by the Rabha tribe of Assam (Deka and Sharma, 2010) and sprouted rice grains by the Angamis in Nagaland (Teramoto *et al.*, 2002). The focus of this survey work was to identify the key ingredients used in the preparation of rice beer starter cultures by different communities residing in North-East India and also to document the fermentation technologies followed by

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the indigenous people.

Materials and Methods

A field survey was carried out in the villages and rural areas of the states of Assam, Nagaland and Arunachal Pradesh for four months (September to December, 2010). The areas were selected based on the information available upon the prevalence of traditional methods of rice beer preparation. Information was collected from the producers predominantly involved in the process of making rice beer. The women in all the communities visited were mostly involved and they were inquired about their practices for preparation such as making of starter cakes along with plants and their parts added, fermentation procedure, duration and uses of the beverage. Some of the nearby fields and forests were visited along with local help and the available plant samples were collected and stored in plastic bags and sealed. Later on, these samples were dried and made into herbarium as per the guidelines given by Anderson, 1999. Further identification of the collected plant species, the plant samples and herbariums were done by Department of Agronomy, Assam Agricultural University, Jorhat, Assam and Department of Botany, Darrang College, Tezpur, Assam.

Observations

The following information was collected by dint of the survey work. Some of the vernacular names of the plants and various other materials used in rice beer preparation have also been mentioned. Table 1 shows the various plants and their parts used in the preparation of the starter culture. All the species were collected from nearby fields and forests as wild plants which are used by these tribes.

Jou bishi – Bodos of Assam

The *Bodos* are one of the largest linguistic groups in North-East India and among the earliest settlers of Assam. They inhabit most of the regions in Assam but resides mostly in the Bodoland regions. This study was done among the *Bodos* residing in Kokrajhar district of Assam, India.

The local rice beer prepared by the *Bodos* is known as *jou bishi* (Figure 1) and the starter cakes are known as *angkur* (Figure 2). For preparing *angkur*, different plant materials are said to be used based on their availability in different regions. However, the most common species are leaves of *agarsita* (*Xanthium strumarium*) and *dongphang rakhep* (*Scoparia dulcis*) and either roots or leaves

of *lokhunath* (*Clerodendrum viscosum*). These plants are first washed properly and allowed to dry in the air.

Table 1. Various plants used in preparation of starter culture for rice beer preparation in North East India

Tribe/ state	Plants used in Starter Cake			
	Local name	Scientific name	Family	Parts used
<i>Bodo</i> , Assam, India	Agarsita	<i>Xanthium strumarium</i>	Asteraceae	Whole plant
	Dongphang rakhep	<i>Scoparia dulcis</i>	Scrophulariaceae	Leaves
	Lokhunath	<i>Clerodendrum viscosum</i>	Verbenaceae	Leaves/ roots
<i>Karbi</i> , Assam, India	Marthu	<i>Croton joufra</i>	Euphorbiaceae	Leaves
	Janphong	<i>Artocarpus heterophyllus</i>	Moraceae	Leaves
	Jockan	<i>Phlogocanthus thysiflorus</i>	Acanthaceae	Leaves
	Hisou-kehrou	<i>Solanum viarum</i>	Solanaceae	Leaves
	Themra	<i>Acacia pennata</i>	Fabaceae	Barks
<i>Ahom</i> , Assam, India	Banjuluk	<i>Oldenlandia corymbosa</i>	Rubiaceae	Leaves
	Kopou lota	<i>Lygodium</i> sp	Lycopodiaceae	Leaves
	Horuminimuni	<i>Hydrocotyle sibthorpioides</i>	Apiaceae	Whole plant
	Bormanmunii	<i>Centella asiatica</i>	Mackinlayaceae	Whole plant
	Tubuki lota	<i>Cissampelos pareira</i>	Menispermaceae	Leaves
<i>Mising</i> , Assam, India	Jaluk	<i>Piper nigrum</i>	Piperaceae	Seeds
	Bormanimuni	<i>Centella asiatica</i>	Mackinlayaceae	Whole plant
	Horumanimuni	<i>Hydrocotyle sibthorpioides</i>	Apiaceae	Whole plant
	Banjuluk	<i>Oldenlandia corymbosa</i>	Rubiaceae	Leaves
	Kuhiar	<i>Saccharum officinarum</i>	Poaceae	Leaves
	Dhapat tita	<i>Clerodendrum viscosum</i>	Verbenaceae	Leaves
	Bhilongoni	<i>Cyclosorus exlensa</i>	Thelypteridaceae	Leaves
	Bam kolmou	<i>Ipoemea</i> sp.	Convolvulaceae	Leaves
	Senikuthi	<i>Scoparia dulcis</i>	Scrophulariaceae	Leaves
	Lai jabori	<i>Drymeria cordata</i>	Caryophyllaceae	Leaves
<i>Deori</i> , Assam, India	Jalokia	<i>Capsicum annuum</i>	Solanaceae	Leaves
	Anaras	<i>Ananas comosus</i>	Bromeliaceae	Young leaves
	Kopou dhekia	<i>Lygodium flexuosum</i>	Lycopodiaceae	Leaves
	Bhatar	<i>Jasminum sambac</i>	Olaceae	Leaves
	duamali	<i>Cinnamomum byzoghata</i>	Lauraceae	Leaves
	Thok thok	<i>Zanthoxylum hamiltonianum</i>	Rutaceae	Leaves
	Tesmuri	<i>Lygodium flexuosum</i>	Lycopodiaceae	Leaves
	Zing zing	<i>Acanthus leucostichys</i>	Acanthaceae	Leaves
	Zuuro	<i>Cyclosorus exlensa</i>	Thelypteridaceae	Leaves
	Bhilongoni	<i>Alstonia scholaris</i>	Apocynaceae	Leaves
<i>Adi-Galo</i> , Arunachal Pradesh, India	Sotiona	<i>Alpinia malaccensis</i>	Zingiberaceae	Roots
	Dubusiring	<i>Costus speciosus</i>	Costaceae	Stem, rhizome
	Jomlakhoti	<i>Costus speciosus</i>	Costaceae	Stem, rhizome
	Dhapat	<i>Clerodendron viscosum</i>	Verbenaceae	Leaves/ barks
<i>Dimasa</i> , Nagaland, India	Lohpohi	<i>Veronia</i> sp.	Asteraceae	Leaves
	Thempra	<i>Acacia pennata</i>	Fabaceae	Barks
<i>Angami</i> , Nagaland, India	Dhan	<i>Oryza sativa</i>	Poaceae	Sprouted- grains

Rice grains are soaked for about 5 hours in normal temperature water and allowed to soften. This is then mixed with the plants and grinded together in a wooden mortar with a pestle and this set of apparatus is called *wayal*. Dough is made by adding a little water to the mixture. They are then made into round cakes of about 5.5 cm diameter and 0.5 to 1 cm thickness and covered with powder of the mixture to which

water is not added. This is followed by covering with *gigab* (paddy straw) and allowed to dry for a period of 3–4 days. These can be stored in moisture free places for more than a year.

For preparing the beer, either glutinous or non-glutinous rice can be used. When glutinous rice is used the product is known as *maibra jou bishi* and when non-glutinous rice is used it is known as *matha jou bishi*. The rice is first boiled with care not to allow it to overcook. It is then cooled and allowed to dry. To this powdered *angkur* is added (about one *angkur* for 1 kg of rice) and mixed well. This mixture is put inside a plastic bag and kept closed for one night. After this a little water is added to it and left in a *baiphu* (earthen pot) covered with banana leaves for a period of at least 3 days. The fermented mass is further mixed with water and strained in order to get the liquid *jou bishi*.



Figure 1. A *baiphu* filled with *jou bishi*



Figure 2. Starter cakes (*angkur*)

Hor-alank – Karbis of Assam

The *Karbis* are one of the major tribes of Assam and are settled mostly in the districts of Karbi Anglong and North Cachar Hills. They prepare a traditional alcoholic beverage called *hor-alank*. This beverage is used as a refreshing drink and also bears significance in many social ceremonies and events. This study was conducted in Diphu sub-division of Karbi Anglong district in Assam, India.

For preparation of *hor-alank* the yeast starter culture called *thap* first needs to be prepared. For preparing *thap*, rice is soaked in water for 1 day. The soaked rice is then mixed with leaves of *marthu* (*Croton joufra*), *janphong* (*Artocarpus heterophyllus*), *jockan* (*Phlogocanthus thysiflorus*), *hisou-kehous* (*Solanum viarum*) (Figure 3) and barks of *themra* (*Acacia pennata*) (Figure 4) plant. The mixture is grinded together in a wooden mortar called “*long*” with a pestle called “*lingpum*” in order to make a paste. This paste is then made into small flat shaped cakes of about 6 cm in diameter and 0.5 cm in thickness. These are overlaid with powder of previous *thaps* and kept in a bamboo sieve called “*ingkrung*” and dried for about three days under the sun or above the fire place. These can be stored for about 1 year for further use.

For preparing beer, rice is first boiled, then spread and allowed to cool. It is followed by with powdered *thaps* (5 Kg rice + 7 *thaps*). The whole mixture is kept in a large container and covered, first with plastic bags and then with sack. It is left to ferment for a period of 2 days at room temperature. After that it is mixed with water and further fermented for 2 (summer) to 4 (winter) days.



Figure 3. *Hisou-kehous*



Figure 4. Plant Bark of *themra*

Xaj pani – Ahoms of Assam

The *Ahoms* or *Tai-Ahoms* are an ethnic group settled in Assam and are of Tai origin. They are a part of the Assamese society and are found all over Assam. This study was carried out in Sivasagar district of Assam. The *Ahoms* prepare rice beer in their own traditional way and name it as *xaj pani* or *koloh pani*. The starter cake is known as *vekur pitha* and consists of various parts of several plant species. The mainly used are leaves of *banjaluk* (*Oldenlandia corymbosa*), *kopou lota* (*Lygodium* sp.) (Figure 5), *horuminimuni* (*Hydrocotyle sibthorpioides*), *bormanmunii* (*Centella asiatica*), *tubuki lota* (*Cissampelos pareira*) and seeds of *jaluk* (*Piper nigrum*). All these are washed and dried well and then grinded in an ural (wooden mortar) with a pestle and mixed with grinded rice and a little water in a vessel and made into a paste. From this, oval shaped balls of about 4.5 cm x 3 cm are made and placed on *kol pat* [banana (*Musa* sp.) leaves] and dried either in the sun or over the fire place by taking care not to bring them not to close to the fire. After a period of about 5 days they become hard and are ready to be used. This *vekur pitha* can be stored for up to a year and used when needed.

For preparing *xaj pani*, rice (either glutinous or non-glutinous) are half cooked and spread on banana leaves to cool it down. It is then mixed with powdered *vekur pitha* (1 per Kg of rice) and again spread for some time. The mixture is kept on a *koloh* (earthen pot) and the mouth is sealed. This is kept in a closed room for a period of 3 to 5 days. After this some amount of water is added to the fermented mass and left for about 10 minutes. Filtration is done by straining the mass by using a cloth (Figure 6).

Apong - Misings of Assam

Although inhabiting in many districts of Assam,

the *Misings* are concentrated mostly in the districts of Dhemaji, Lakhimpur and Jorhat. They are said to have migrated to Assam from the state of Arunachal Pradesh.



Figure 5. *Kopou-lota*



Figure 6. An Ahom woman filtering *xaj pani*

This study was undertaken among the *Mising* communities residing in the district of Lakhimpur in Assam.

The rice beer prepared by the *Misings* is known as *apong* and the starter cake is called as *aopo pitha*. The different leaves needed for preparing *apop pitha* are of the plants *bormanimumi* (*Centella asiatica*), *horumanimumi* (*Hydrocotyle sibthorpioides*), *banjaluk* (*Oldenlandia corymbosa*), *kuhiar* (*Saccharum officinarum*), *dhapat tita* (*Clerodendrum viscosum*), *bhlongoni* (*Cyclosorus exlensa*), *bam kol mou* (*Ipoemea* sp.), *senikuthi* (*Scoparia dulcis*), *lai jabori* (*Drymeria cordata*), *jalokia* (*Capsicum annum*), *anaras* (*Ananas comosus*) and *kopou dhekia* (*Lygodium flexuosum*). All these leaves are cleaned and dried by placing on a bamboo mat called *opoh*. They can be either used freshly or dried in the sun before addition. Soaked rice and the leaves are grinded separately in a *kipar* (wooden grinder) and they are mixed together in a vessel with little water. From the dough, oval shaped balls of about 6 cm x 3 cm are made and dried in the sun.

Before starting the fermentation process, the *kiling* (earthen pot) used for fermentation is first fumigated by placing it on a *torap* (a bamboo frame constructed over the fire place) until the pot turns blackish (Figure 7). After that boiled rice is spread on a *kol pat* (banana leaf) and allowed to cool. To this powdered *apop pitha* is added (1 *apop pitha* for 1 kg of rice) and the whole mixture is kept inside the *kiling* and the mouth of the pot is covered with banana leaves or leaves of *bhlongoni*. This is left for fermentation to take place for a period of about 5 days. A little water is added to the fermented product and is filtered to get the *apong* (Figure 8).

The *Misings* also prepare another kind of rice beer and it is known by the name *sai mod*. In this method, hay and husk are half burned till they become black in colour. This ash is mixed in equal amount with boiled rice and to it the *apop pitha* is added. In this case, the amount of *apop pitha* added in double quantity with respect to *apong* preparation.

The mixture is compactly packed in a *kiling* and fermented for about 15 days. It is filtered in the same way as *apong*.



Figure 7. A *kiling* being fumigated



Figure 8. A *Mishing* woman filtering *apong*

Sujen – Deoris of Assam

Being one of the oldest settlers of Assam, the *Deoris* are mostly inhabitant of Lakhimpur, Sivasagar, Dibrugarh, and Tinsukia districts of Assam, India. Information was collected from the *Deori* communities residing in Lakhimpur district, Assam, India. The indigenous rice beer of the *Deoris* is known as *sujeu*. The starter material is known as *perok kushi*. The plant materials used for preparing *perok kushi* are leaves of *bhatar duamali* (*Jasminum sambac*), *thok thok* (*Cinnamomum byolghata*), *tesmuri* (*Zanthoxylum hamiltonianum*), *zing zing* (*Lygodium flexuosum*), *zuuro* (*Acanthus leucostychys*), *bhlongoni* (*Cyclosorus exlensa*), *sotiona* (*Alstonia scholaris*) and roots of *dubusiring* (*Alpinia malaccensis*) and the stem and rhizome of the plant *jomlakhoti* (*Costus speciosus*). All these are washed and cut into small pieces. They are then grinded in a specialized wooden grinder called as *dheki*. The mixture is then soaked in water in a vessel until the water becomes coloured. The whole mixture is added to grinded rice in a vessel in order to make dough. Round balls of about 4 cm diameter is made out of this and dried either in the sunlight or over the fire hearth by placing in a bamboo mat called as *aaphey*. After getting dried they are placed in a bamboo container called as *kula* (Figure 9) the inside of which is laid with *kher* (paddy straw). Its mouth is again covered with *kher* and is kept over the hearth for storage. They can be kept in this manner for many months and can be used as and when required.

For fermentation of *sujeu*, an earthen pot (*disoh*) is first sterilized by washing it with ash and placing it over the hearth for drying and fumigation. Rice is first boiled and then allowed to cool by spreading on banana leaves placed above an *aaphey*. This is followed by addition of powdered *perok kushi* to the cooled rice (1 starter per 3 Kg of rice). The mixture is kept in a *disoh*, the mouth of which is sealed with *kol pat* (banana leaves) and left for fermentation to take place for about 4 to 5 days. It can then be diluted and

filtered (Figure 10). It is said that the fermented mass in the *disoh* can be stored for up to 1 to 2 months at room temperature.



Figure 9. A *kula* used for storing *perok*



Figure 10. A *Deori* woman filtering *sujen kushi*

Judima - Dimasa Kacharis of Nagaland

The *Dimasa Kacharis* are one of the earliest indigenous ethnic groups of North-Eastern India. They are mostly found in the North Cachar Hills of Assam and Dimapur in Nagaland. This study was done among the *Dimasas* residing in Dimapur, Nagaland, India. The starter cake for preparing *judima* is called as *umhu* or *humao* and is a mixture of rice and bark of *thempra* (*Acacia pennata*) plant (Figure 11). The barks are cut into small pieces and dried in the sun. Rice is soaked in water until it is softened. It is then grinded in a wooden or metallic mortar pestle called *rimin* along with the barks of *thempra* plant. A little water is added in order to make a paste. They are then made into cakes of appropriate sizes and allowed to dry for a period of one week. They can be stored for many months.

For preparing *judima*, rice is boiled and allowed to cool. It is mixed with powdered *humao* (one large sized *humao* is sufficient for 5 Kg of rice) and kept in a large container which is covered with jute gunny bags. After about a week, slightly yellowish juices come out of the mass which indicates the completion of fermentation. This can further be diluted with water and filtered for consumption (Figure 12).



Figure 11. A twig of *thempra* plant



Figure 12. A *Dimasa* woman serving *judima*

Zutho / Litchumsu - Angamis / Aos of Nagaland

Nagaland is chiefly a mountainous state and is inhabited by many different Naga tribes. Each of these tribes has some common culture and traditions and they are all regarded as to having warrior background. This study was done in Dimapur and

Kohima districts of Nagaland, India. The local brew prepared by the *Angami* tribe is known as *zutho*. It is also called as *litchumsu* by the *Ao* tribe. This starter material used in the preparation of *zutho* is known as *piazu*, which is basically sprouted rice. For preparing *piazu*, un-hulled rice is first soaked in water for a period of about 3-4 days. After this, some of the water is drained out and the grains are allowed to germinate. This may sometimes take about a week depending on the prevailing temperature. After being dried in the air, the sprouted grains are pounded on a wooden mortar with a pestle. The powder obtained is known as *piazu*.

For preparing *zutho*, rice is first boiled and then allowed to cool by spreading on a bamboo mat. To this rice, *piazu* (about 10 g for 1 kg of rice) is added and mixed well. The amount of *piazu* added is needed more (almost double) during the months of winter. The mixture is then left to ferment in a closed earthen or wooden vessel for about 4 days in summer and about a week in winter. After completion of fermentation, some amount of water is added to the rice and is filtered by using a bamboo or plastic mesh and usually served in bamboo cups (Figures 13 and 14).



Figure 13. *Zutho* taken out to be added

Figure 14. *Zutho* being served in with water bamboo cups

Opo - Adi-Galos of Arunachal Pradesh

Located in the far North-East India, Arunachal Pradesh is inhabited by many different tribes and each of these bears their own cultural resemblance. This study was done in Pasighat sub-division of East Siang district and the contribution came from the *Adi-Galo* tribe residing in that area. The local rice beer prepared by this tribe is called as *opo* and the starter cake is known as *siyeh* (Figure 15) or *opop*. For preparing *opop*, leaves and barks of the plants *dhapat* (*Clerodendron viscosum*) and *Lohpohi* (*Veronia* sp.) are washed, sun dried and then made into powder. This is then mixed with powdered rice and a little bit of previously prepared *opo* in order to make a paste. From this flat cakes of about 10 – 11 cm diameter are made and placed upon bamboo mats. The mats are then kept in the hearth for about 3 – 4 days, when the cakes become hardened. These can be stored for many months.

For preparing *opo*, rice husk called *ampe* is half

burnt till they become black in colour. After that, rice is boiled and then spread on a bamboo mat called as *peche*. After the rice gets cooled, it is mixed with the burnt husk in 1:1 ratio. To this powdered *opop* is added (about 100 g of the starter for 10 kg of the mixture) and mixed well. This mixture is then put in a plastic container, the walls of which are covered with leaves of a locally available plant called as *oko* (*Zingiberaceae* family). The mouth is also sealed with *oko* leaves and is left undisturbed for about 5 days. After this the contents are mixed well and are again left in the same manner for a longer duration. The product becomes ready after about 20 days of fermentation. It is also kept for longer durations for production of more alcohol. For filtration, a special type of funnel called as *perpur* is used where *oko* leaves are used as the filter. The fermented mass is first placed on the *perpur* (Figure 16) and then hot water is poured over it slowly in order to obtain the *opo* as the filtrate. The quantity of water poured depends on the desired concentration of the final product.



Figure 15. A *siyeh*



Figure 16. An Adi woman filtering *opo*

Discussion

It was observed that the process of rice beer preparation followed by different ethnic tribes residing in different states of North-East India is more or less similar. The only difference is the ingredient in the form of different parts of various plants species. The tribes in different regions use different plant species based on their availability. This has been reported earlier by Tanti *et al.* 2010. Some of the plant species documented in this article have also been mentioned earlier by different authors like Saikia *et al.* (2007) about the *Ahoms* of Assam, Deori *et al.* (2007) about the *Deoris* of Assam, Teron (2006) about the *Karbis* of Assam, Tiwari and Mahanda (2007) about the *Arunachalis* of Arunachal Pradesh and Tanti *et al.* (2010) about the *Misings* of Assam. The knowledge of the indigenous people in the use of the starter cultures as a source of yeast is very interesting. The local brews such as rice beer bears very significant resemblance of the culture and traditions of the tribal people residing in this part of the country. Each of the beverages prepared is rooted with the socio-cultural practices of the individual tribes and also on various

environmental factors. It has been found that the preparation of rice beer is considered as sacred by all the tribes and it occupies special recognitions in many of the occasions like rituals, festivals, marriages and communal gathering. The consumption of mild amount of alcohol in the form of rice beer gives some relaxation to the hard working population of these states and practically has no side effect on their health. Apart from imparting colour, flavour and sweetness to the beer, the various plants used in the starter culture are also said to have many medicinal properties. Also some of the plant extracts may also provide certain nutrients for the survival of the microflora present in the starter cakes. The quality of the starter culture is said to be dependent on the variety of plant parts used and also on the maintenance of proper sanitary conditions. The preference of the variety of rice used for fermentation also differs from communities to communities. However, it is seen that glutinous rice is preferred more than non-glutinous rice, owing to the taste and alcohol content of the product. Further studies on the plants used and the final product may reveal some other important properties and beneficial effects of this traditional beverage. Furthermore the preparation and local marketing of this product serve as a source of income and livelihood to many of the families living in the rural regions.

Acknowledgements

The authors are very much thankful to the tribal people, especially the women folks of Assam, Nagaland and Arunachal Pradesh who helped the authors by sharing their valuable information and guided in the process of sample collection. We sincerely acknowledge Prof. Iswar Chandra Baruah of Assam Agricultural University, Jorhat, Assam and Dr. Akhil Baruah of Darrang College, Tezpur, Assam for their help in identification of the plant species. The authors are also grateful to the Ministry of Food Processing Industries (MoFPI), GoI, for funding a project in fermented foods to the Department of Food Processing Technology, Tezpur University, Assam, India.

References

- Anderson, L. C. 1999. Collecting and preparing plant specimens and producing an herbarium. Pages 295-300, in Tested studies for laboratory teaching, Volume 20 (S. J. Karcher, Editor).
- Chakrabarty, J., Sharma, G.D. and Tamang, J.P. 2009. Substrate utilisation in traditional fermentation technology practiced by tribes of North Cachar Hills district of Assam. Assam University Journal of Science

- & Technology: Biological Sciences 4 (1): 66-72.
- Deka, D. and Sarma, G.C. 2010. Traditionally used herbs in the preparation of rice-beer by the Rabha tribe of Goalpara district, Assam. *Indian Journal of Traditional Knowledge* 9(3): 459-462.
- Deori, C., Bengum, S.S. and Mao, A.A. 2007. Ethnobotany of sujen, a local rice beer of Deori tribe of Assam. *Indian Journal of Traditional Knowledge* 6 (1):121-125.
- Dung, N.T.P., Rombouts, F.M. and Nout, M.J.R. 2006. Functionality of selected strains of moulds and yeasts from Vietnamese rice wine starters. *Food Microbiology* 23: 331–340.
- Ghosh, C. and Das, A.P. 2004. Preparation of rice beer by the tribal inhabitants of tea gardens in Terai of West Bengal. *Indian Journal of Traditional Knowledge* 3(4): 374-382.
- Jeyaram, K., Singh, W.M., Capece, A. and Romano, P. 2008. Molecular identification of yeast species associated with 'Hamei' - A traditional starter used for rice wine production in Manipur, India. *International Journal of Food Microbiology* 124:115–125.
- Roy, B., Kala, C. P., Farooquee, N. A. and Majila, B.S. 2004. Indigenous Fermented Food and Beverages: A Potential for Economic Development of the High Altitude Societies in Uttaranchal. *Journal of Human Ecology* 15(1): 45-49.
- Saikia, B., Tag, H. and Das, A.K. 2007. Ethnobotany of foods and beverages among the rural farmers of Tai Ahom of North Lakhimpur district, Asom. *Indian Journal of Traditional Knowledge* 6 (1): 126-132.
- Samati, H. and Begum, S.S. 2007. Kiad, a popular local liquor of Pnar tribe of Jaintia hills district, Meghalaya. *Indian Journal of Traditional Knowledge* 6 (1): 133-135.
- Singh, P.K. and Singh, K.I. 2006. Traditional alcoholic beverage, Yu of Meitei communities of Manipur. *Indian Journal of Traditional Knowledge* 5(2): 184-190.
- Tamang, J. P., Dewan, S., Tamang, B., Rai, A., Schillinger, U. and Holzapfel, W. H. 2007. Lactic acid bacteria in Hamei and Marcha of North East India. *Indian Journal of Microbiology* 47: 119–125.
- Tamang, J.P. and Sarkar, P.K. 1995. Microflora of marcha: an amylolytic fermentation starter. *Microbios* 81 (327): 115-122.
- Tanti, B., Gurung, L., Sarma, H.K. and Buragohain, A.K. 2010. Ethnobotany of starter culture used in alcohol fermentation by a few ethnic tribes of Northeast India. *Indian Journal of Traditional Knowledge* 9 (3): 463-466.
- Teramoto, Y., Yoshida, S. and Ueda, S. 2002. Characteristics of a rice beer (zutho) and a yeast isolated from the fermented product in Nagaland, India. *World Journal of Microbiology and Biotechnology* 18: 813–816.
- Teron, R. 2006. Hor, the traditional alcoholic beverage of Karbi tribe in Assam, *Natural product Radiance* 5(5): 377-381.
- Tiwari, S.C. and Mahanda, D. 2007. Ethnological observations fermented food products of certain tribes of Arunachal Pradesh. *Indian Journal of Traditional Knowledge* 6(1): 106-110.
- Tsuyoshi, N., Fudou, R., Yamanaka, S., Kozaki, M., Tamang, N., Thapa, S. and Tamang, J.P. 2005. Identification of yeast stains isolated from marcha in Sikkim, a microbial starter for amylolytic fermentation. *International Journal of Food Microbiology* 99 (2): 135-146.