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Traditional knowledge on preparation of starter culture cakes and rice-beers by Chaodang community of upper Assam, India

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Abstract

Preparation of *Saj* or *Laopani* (rice beer) by using varieties of cooked rice with traditionally prepared Su-pitha/Modor-pitha (starter culture cake) is a very old tradition among Chaodang community, Upper Assam, India. The fermented *Saj* is considered as the best alcoholic beverage, healthy, and energy booster liquor and it is a vital part of Chaodang culture. Chaodang people prepared rice-beer during festivals (Bihu), ritual functions, birth and marriage ceremonies etc. Data regarding the preparation of starter culture cakes and rice beers were collected from 80 traditional knowledge holders (key informants) covering 10 villages selected randomly from Jorhat district, Upper Assam dominated with Chaodang people. Chaodang community used 81 medicinal plant species belonging to 47 families, which was found as the highest number of medicinal plants for preparation of starter culture cake than other tribal communities of India ever documented. They used three varieties of rice in the process of rice beer preparation i.e. Bora rice (sticky rice), Chakuwa rice and normal rice. This paper documents and describes some important medicinal plants, which are traditionally used in the preparation of starter culture cake by the Chaodang community and their process of preparation of starter culture cake and rice beers.

Keywords alcoholic beverage, ethnobotany, laopani, medicinal plants

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Introduction

The Chaodang community of Assam is dominated in Jorhat sub-division of undivided Sibsagar district (Now Jorhat, Golaghat, Sivasagar districts) with 42 villages. As per the report on the socio-economic survey of the Chaudang Community in the Jorhat Subdivision, Department of Economics and Statistics, Govt. of Assam, [1] and Dutta and Puzari [2] out of the 42 villages, 21 villages are located very near to each other. Besides, Jorhat the Chaodang people are scattered in Golaghat, Sivasagar, Lakhimpur, and Dibrugarh districts of Upper Assam [2]. During Ahom period (1228–1826), the 5th Ahom king, Swargadeo Sukhrangpha (1332–1364) created a department with the devoted, trusted, courageous, healthy and strong people of Ahom community to protect the king and his ministers and to guard in the royal places [2].

The Chaodang people were also used by the Ahom kings to punish the people who committed crimes and revolted against the king. According to Gogoi [3] 'Chao' means 'Owner' and 'Dang' means 'punishment', so 'Chaodang' means the 'owner of punishment'. The duties of the Chaodang during Ahom period can be compared with the police department of a state. In the middle of the 17 century, Pandit Chihabuddin

Table 1. Medicinal plant species used for preparation of Su-pitha

Figures	Vernacular Name	Botanical Name	Family	Part (s) used
2I	Tita phul	*Phlogacanthus thyrsiflorus* Nees	Acanthaceae	Leaves and Flowers
2II	Kauri thutia lota	*Thunbergia grandiflora* (Roxb. ex Rottl.) Roxb.	Acanthaceae	Leaves
2III	Ubhata bon	*Cyathula prostrata*(L.) Blume	Amaranthaceae	Whole Plants
2IV	Bor Manimuni	*Centella asiatica* (L.) Urb.	Apiaceae	Whole Plants
2V	Nahar lota	*Cryptolepis sinensis* (Lour.) Merr.	Apocynaceae	Leaves
2VI	Chatiyana)	*Alstonia scholaris* (L.) R. Br.	Apocynaceae	Leaves
2VII	Sangmora	*Lasia spinosa* (L.) Thwaites	Araceae	Rhizomes
2VIII	Gumuni lota	*Epipremnum aureum* (Linden & André) G.S.Bunting	Araceae	Leaves
2IX	Haru Manimuni	*Hydrocotyle sibthorpioides* Lam.	Araliaceae	Whole Plants
2X	Prithibi dhoka	*Elephantopus scaber* L	Asteraceae	Whole Plants
2XI	Lukaluki bon	*Calyptocarpus vialis* Less.	Asteraceae	Whole Plants
2XII	Baghdhekia	*Blechnum orientale* L.	Blechnaceae	Fronds
2XIII	Dhekia loti	*Stenochlaena palustris* (Burm. f.) Bedd.	Blechnaceae	Fronds
2XIV	Matikothal	*Ananas comosus* (L.) Merr.	Bromeliaceae	Soft parts of leaves
2XV	Bhang	*Cannabis sativa* L.	Cannabaceae	Leaves
2XVI	kolia lota	*Merremia umbellata* (L.) Hallier f. i	Convolvulaceae	Leaves
2XVII	TuKoria Alu	*Argyreia argentea* (Roxb.) Sweet	Convolvulaceae	Leaves
2XVIII	Jamlakhuti	*Cheilocostus speciosus* (J.Koenig) C.D.Specht	Costaceae	Leaves
2XIX	Belipoka	*Solena amplexicaulis* (Lam.) Gandhi	Cucurbitaceae	Leaves
2XX	Lota mahuti	*Croton caudatus* Geiseler	Euphorbiaceae	Leaves
2XXI	Konibih	*Croton tiglium* L.	Euphorbiaceae	Leaves
2XXII	Bioni habota	*Desmodium laxiflorum* DC.	Fabaceae	Leaves
2XXIII	Dhuplota	*Spatholobus* sp.	Fabaceae	Leaves
2XXIV	Mahlota	*Rhynchosia aurea* (Willd.) DC.	Fabaceae	Leaves
2XXV	Makhioti	*Flemingia strobilifera* (L.)W.T.Aiton	Fabaceae	Leaves
2XXVI	Sib kathi dhekia	*Dicranopteris linearis* (Burm. f.) Underw.	Gleicheniaceae	Fronds
2XXVII	Tongloti	*Callicarpa macrophylla* Vahl	Lamiaceae	Leaves
2XXVIII	Doron Bon	*Leucas aspera* (Willd.) Link	Lamiaceae	Whole Plants
2XXIX	Dhopat Tita	*Clerodendrum infortunatum* L.	Lamiaceae	Leaves
2XXX	Gorokhiya korai	*Callicarpa arborea* Roxb.	Lamiaceae	Leaves
2XXXI	Mejangkori	*Litsea cubeba* (Lour.) Pers.	Lauraceae	Leaves
2XXXII	Patihonda	*Cinnamomum bejolghota* (Buch.-Ham.) Sweet	Lauraceae	Leaves
2XXXIII	Tezpat	*Cinnamomum tamala* (Buch.-Ham.) T.Nees & Eberm.	Lauraceae	Leaves
2XXXIV	Dighloti	*Litsea salicifolia* (Roxb. ex Nees) Hook. f.	Lauraceae	Leaves
2XXXV	Dugdhika Bon	*Legazpia polygonoides* (Benth.) T. Yamaz.	Linderniaceae	Whole Plants
2XXXVI	Kachidoria bon	*Lindernia ruellioides* (Colsm.) Pennell	Linderniaceae	Whole Plants
2XXXVII	Humhomia dhekia	*Lycopodium clavatum* L.	Lycopodiaceae	Whole Plants
2XXXVIII	Pani Jetuka	*Cuphea carthagenensis* (Jacq.) J.F.Macbr.	Lythraceae	Whole Plants
2XXXIX	Borhomthuri	*Magnolia pterocarpa* Roxb.	Magnoliaceae	Young shoots
2XL	Kotholua sopa	*Magnolia mannii (King)* Figlar	Magnoliaceae	Leaves
2XLI	Sun borial	*Sida cordifolia* L.	Malvaceae	Leaves
2XLII	Phutukala	*Melastoma malabathricum* L	Melastomataceae	Leaves
2XLIII	Boga phutukala	*Osbeckia nepalensis* Hook. f.	Melastomataceae	Leaves
2XLIV	Saru tubuki lota	*Cissampelos sympodialis* Eichler	Menispermaceae	Whole Plants
2XLV	Soura	*Streblus asper* Lour.	Moraceae	Leaves & barks
2XLVI	Kothal	*Artocarpus heterophyllus* Lam.	Moraceae	Leaves
2XLVII	Khakacha dimaru	*Ficus hispida* L.f.	Moraceae	Leaves
2XLVIII	Madhuri	*Psidium guajava* L.	Myrtaceae	Leaves
2XLIX	Murmuri	*Eurya nitida* Korth.	Pentaphylacaceae	Leaves
2L	Bon amlokhi	*Phyllanthus niruri* L.	Phyllanthaceae	Whole Plants
2LI	Jaluk	*Piper nigrum* L.	Piperaceae	Leaves & seeds
2LII	Pan	*Piper betle* L.	Piperaceae	Leaves
2LIII	Pipli	*Piper longum* L.	Piperaceae	Leaves
2LIV	Mitha bon	*Scoparia dulcis* L.	Plantaginaceae	Whole Plants
2LV	Dhan	*Oryza sativa* L.	Poaceae	Seeds
2LVI	Kuhiya	*Saccharum officinarum* L.	Poaceae	Young shoots
2LVII	Patharuwa Bihlongoni	*Persicaria hydropiper* (L.) Delarbre	Polygonaceae	Whole Plants
2LVIII	Mow sorali	*Polygonum hastatosagittatum* Makino	Polygonaceae	Whole Plants
2LIX	Garu sorali	*Polygonum muricatum* Meisn.	Polygonaceae	Whole Plants
2LX	Gahori gash	*Ardisia arborea* Koord. & Valeton	Primulaceae	Leaves
2LXI	Pakhila dhekia	*Pteris semipinnata* L.	Pteridaceae	Fronds & Rhizome
2LXII	Soipan	*Naravelia zeylanica* (L.) DC.	Ranunculaceae	Leaves
2LXIII	Jetulipoka	*Rubus paniculatus* Sm.	Rosaceae	Leaves
2LXIV	Soba atha	*Mussaenda frondosa* L.	Rubiaceae	Leaves & barks
2LXV	Bon jaluk	*Oldenlandia diffusa* (Willd.) Roxb.	Rubiaceae	Whole Plants
2LXVI	Duamali	*Coffea bengalensis* Roxb.	Rubiaceae	Leaves
2LXVII	Temena	*Mussaenda roxburghii* Hook.f.	Rubiaceae	Leaves
2LXVIII	Dophola-pat	*Ixora polyantha* Wight	Rubiaceae	Leaves
2LXIX	Hedbhedeli	*Hedyotis scandens* Roxb.	Rubiaceae	Leaves
2LXX	Bhedai lota	*Paederia foetida* L.	Rubiaceae	Whole Plants
2LXXI	Tejmuri	*Zanthoxylum nitidum* (Roxb.) DC.	Rutaceae	Leaves
2LXXII	Kopow lota	*Lygodium microphyllum* (Cav.) R.Br.	Schizaeaceae	Fronds
2LXXIII	Kopow dhekia	*Lygodium flexuosum* (L) Sw.	Schizaeaceae	Fronds
2LXXIV	Tikoni boruah	*Smilax ovalifolia* Roxb. ex D.Don	Smilacaceae	Leaves
2LXXV	Bhekuri	*Solanum torvum* Sw.	Solanaceae	Leaves
2LXXVI	Bhomloti	*Symplocos grandiflora* Wall	Symplocaceae	Leaves
2LXXVII	Bihlongoni	*Amblovenatum opulentum* J.P. Roux	Thelypteridaceae	Fronds
2LXXVIII	Atha-bon/Borali bokua	*Pouzolzia zeylanica* (L.) Benn.	Urticaceae	Whole Plants
2LXXIX	Kukurathengia	*Leea indica* (Burm. f.) Merr.	Vitaceae	Leaves
2LXXX	Haldhi	*Curcuma longa* L.	Zingiberaceae	Leaves
2LXXXI	Ada	*Zingiber officinale* Roscoe	Zingiberaceae	Leaves

who came with Mir Jumla (Auranzeb's general) to attack Assam had recorded about 7000 Chaodang people in Assam. Gait [4] in his "A History of Assam" wrote that "Six or seven thousand Assamese always stand guard round the abode and bed room of the Raja and those were called Chaodang. They were devoted and trusted servants of the Raja and were his executioners". According to Gait [5] and Barua [6] Sudangphaa (1397-1407) popularly known as Bamuni Knowar (Brahman prince) who was grown up in a Brahman's house and his reign marked the first stage in the growth of Hinduism in the Ahom dynasty. The best Ahom king, Swargadeo Rudra Singha (1696-1714), accepted Hindu religion and recognized it as a royal religion.

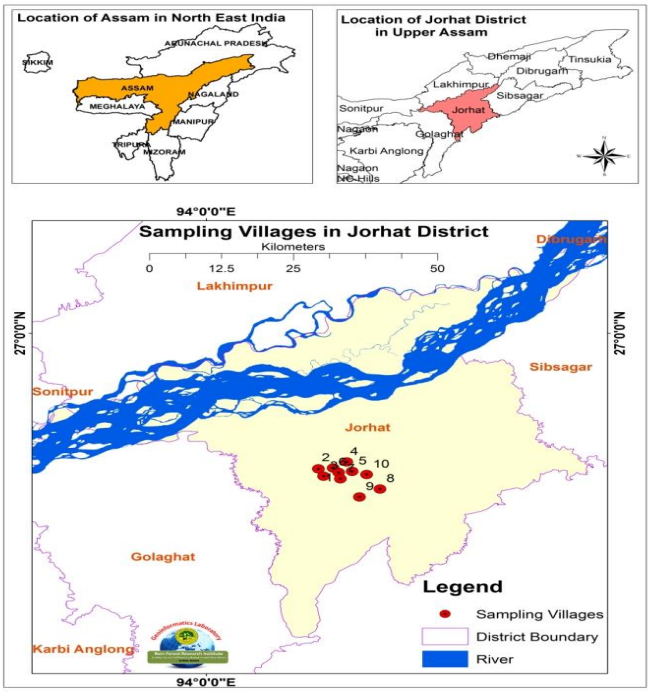

Figure 1. Location maps of the sampling villages

All the Ahom people accepted the Hindu religion but the Chaodang people were taught by their priest called Deodhai' and 'Bailong' not to accept this religion. Accordingly, the Chaodang people didn't accept the Hindu religion at that time and they were guided by their traditional priests 'Deodhai' and 'Bailong' [2]. So, most of the traditional knowledge on silk, Ari, and Muga farming; uses of medicinal plants, preparation of starter culture and rice-beer etc. had been passed from one generation to next generation of the Chaodang people. Later on, these Chaodang people became a community. As per the census of Assam [7] and Census of India [8] during British colonial period (1872), the total population of the Chaodang community was 2256 but this figure was not accepted by the All Assam Chaodang Sanillan as described by Bora in [9]. After this census, no new district or state population figure of the community was found in the census report of 1881 and onwards. Chaodang people used to drink the traditionally prepared strong liquor, eat pork and chickens, and bury their dead bodies [7-8, 10]. In order to socio-economic upliftment of the backward Chaodang community the Government of Assam has created the Chaodang Development Council in the year 2011. There is a non-government organization of the Chaodang community named as "Chaodang Jatiya Parishad" that is working for socio-economic, educational, cultural and ethnic advancement of the people of the community. As per the discussion with the chairman of Chaodang Development Council, the present population of the Chaodang community is about 10 lakhs, scattered in Assam. Myers et al., [11] described that East India is a part of Indo Burma biodiversity hotspot of the world. According to Arnold [12] simply beer is one of the oldest and most widely alcoholic drinks

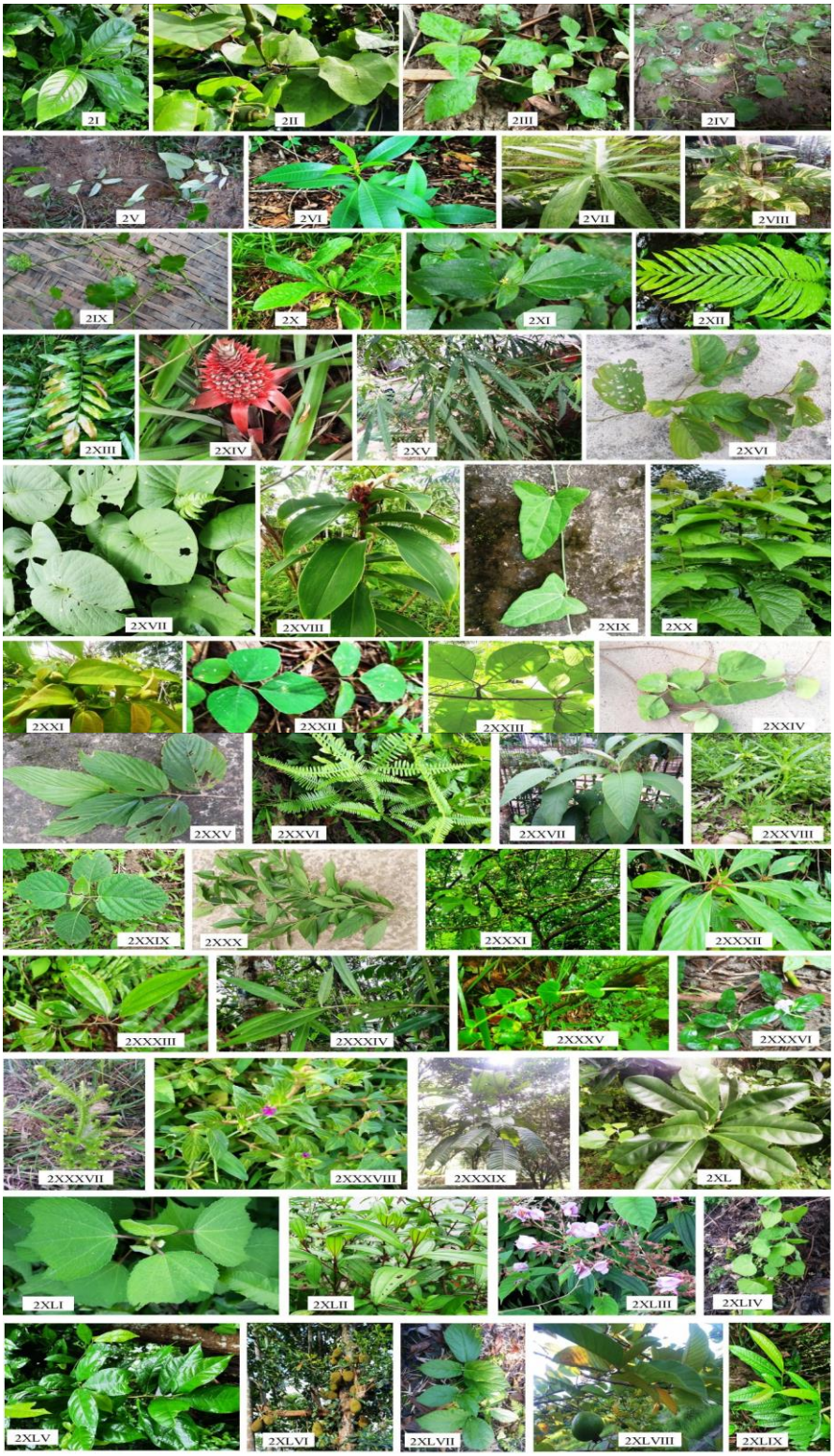

Figure 2a. (2I) ***Phlogacanthus thyrsiflorus*****, (2II)*****Thunbergia grandiflora*****, (2III)** ***Cyathula prostrata*****, (2IV)** ***Centella asiatica*****, (2V)** ***Cryptolepis sinensis*****, (2VI)** ***Alstonia scholaris*** **, (2VII)** ***Lasia spinosa*****, (2VIII)** ***Epipremnum aureum*****, (2IX)** ***Hydrocotyle sibthorpioides*****, (2X*****) Elephantopus scaber*****, (2XI)** ***Calyptocarpus vialis*****, (2XII)** ***Blechnum orientale*****, (2XIII)** ***Stenochlaena***

palustris*, (2XIV) *Ananas comosus*, (2XV) *Cannabis sativa*, (2XVI) *Merremia umbellata*, (2XVII) *Argyreia argentea*, (2XVIII) *Cheilocostus speciosus*, (2XIX) *Solena amplexicaulis*, (2XX) *Croton caudatus*, (2XXI) *Croton tiglium*, (2XXII) *Desmodium laxiflorum*, (2XXIII) *Spatholobus sp.* (2XXIV) *Rhynchosia aurea* (2XXV) *Flemingia strobilifera*, (2XXVI) *Dicranopteris linearis*, (2XXVII) *Callicarpa macrophylla*, (2XXVIII) *Leucas aspera*, (2XXIX) *Clerodendrum infortunatum*, (2XXX) *Callicarpa arborea*, (2XXXI) *Litsea cubeba*, (2XXXII) *Cinnamomum bejolghota*, (2XXXIII) *Cinnamomum tamala*, (2XXXIV) *Litsea salicifolia*, (2XXXV) *Legazpia polygonoides*, (2XXXVI) *Lindernia ruellioides*, (2XXXVII) *Lycopodium clavatum*, (2XXXVIII) *Cuphea carthagenensis*, (2XXXIX) *Magnolia pterocarpa*, (2XL) *Magnolia mannii*, (2XLI) *Sida cordifolia*, (2XLII) *Melastoma malabathricum*, (2XLIII) *Osbeckia nepalensis*, (2XLIV) *Cissampelos sympodialis*, (2XLV) *Streblus asper*, (2XLVI) *Artocarpus heterophyllus*, (2XLVII) *Ficus hispida*, (2XLVIII) *Psidium guajav*, (2XLIX) *Eurya nitida

in the globe, which is the third most popular drink next to water and tea. Beer is prepared from cereal grains-like barely, wheat, maize and rice by the process of fermentation of the starch, Max [13]. In North-East India, consumption of rice-based alcoholic beverage is a very popular traditional practice among the ethnic communities, Ghosh and Das [14] and Das et al., [15]. A total of 220 (approx.) different ethnic tribes of North East India consume rice beer on a regular basis in various forms prepared by their own traditional methods by using different starter cultures made of locally available rice and medicinal plants, Mishra et al., [16]. The rice beers are prepared totally with traditional protocols which are transferred from generation to generation, since time immemorial, Tanti et al., [17]. Rice-beer prepared by almost all aboriginal communities of Northeast India is known by different names such as Apong in Adi, Bunkchung in Monpa, Chi in Lepcha, Laopani in Aka, Ijadijang in Naga, etc., Saklani and Jain [18]. In Assam Rice-beer is called as Jou bishi by Bodos, Sujen by Deoris, Morpo by Mikirs, Horlang by Karbi, Chu/ Bitchi by Garos, Jou by Meches, Zu by Tiwas, Apong by Mishings, Laopani and *Sajpani* by Ahom, Bordoloi [19], Jonga mod by Rabha, Deka and Sarma [20]. Starter culture cake is also known as different names in Northeast (NE) India such as Dabai by Adivasi, Hamao by Dimasa, *Sajar Pitha* by Ahom, Apong kusure/Apop by Mishing, Angku by Bodo, Thap by Karbi, Hamei by Meithei, Epo by Apatani, Marcha by Nepali, Yei by Angami, Tanti et al., [17], Bakhor/Surachi/Phap by Rabha, Deka and Sarma [20]. The primary yeast species found in the Starter culture cake which is responsible for fermentation is *Saccharomyces cerevisiae*, Cavalieri et al., [21] and Donalies et al., [22]. Fermentation is a chemical reaction in which carbohydrates are converted into alcohol and carbon dioxide or organic acids using yeast or bacteria, under anaerobic conditions, William and Dennis [23].

Traditional rice-beer preparation is an important household as well as social drinking activity associated to religious occasions, marriage, birth ceremonies and all the festivals among different ethnic tribal groups of NE India. The methods for rice-beer production among the tribes differ as because all of them use their own traditional protocols using different starter cultures, although most of them apply similar substrates for fermentation, Ghosh [24]. This rice beer or liquor is believed to possess many medicinal and therapeutic properties possibly contributed by different indigenous herbs used in starter culture cake preparation. All the tribes used to prepare their indigenous rice beer at home using round to flattened solid ball-like mixed dosh inocula or starter, Tamang et al., [25], Jeyaram et al., [26] and these contain amylolytic and alcohol producing yeasts, starch degrading moulds and lactic acid bacteria, Dung et al., [27]. These traditional rice-beers have some limitations like bad odour, turbidity, toxic metabolites, texture and inconsistency which lower down the quality as well as yield, Tanti et al., [17]. Different varieties of rice are used by the various ethnic groups of Assam; the main rice variety used by the Ahom is Bora rice belonging to Sali variety, Saikia et al., [28], glutinous type of rice by Deori tribes, Deori et al., [29], Sali and Ahu variety of rice by Rabha tribes, Deka and Sarma [20], glutinous rice/brown sticky rice/also mixed sometimes by Boro tribe, Basumatary and Gogoi [30] and so on.

The preparation methods of rice beer by different major ethnic groups of Assam have already been documented by various authors, Deori et al., [29]; Saikia et al., [28]; Chakrabarty et al., [31]; Deka and Sarma [20]; Tanti et al., [17]; Kardong et al., [32]; Bhuyan and Baishya [33]; Gogoi et al., [34]; Basumatary and Gogoi [30]; Teron [35]; Handique and Deka [36] except Chaodang Community. The herbs or tree species used by the Chaodang community in the preparation of rice-beer are having medicinal properties. They believe rice-beer to have curative property against some ailments of human beings

Figure 2L. (2L) *Phyllanthus niruri*, (2LI) *Piper nigrum*, (2LII) *Piper betle*, (2LIII) *Piper longum*, (2LIV) *Scoparia dulcis*, (2LV) *Oryza sativa*, (2LVI) *Saccharum officinarum*, (2LVII) *Persicaria hydropiper*, (2LVIII) *Polygonum hastatosagittatum*, (2LIX) *Polygonum muricatum*, (2LX) *Ardisia arborea*, (2LXI) *Pteris semipinnata*, (2LXII) *Naravelia zeylanica*, (2LXIII) *Rubus paniculatus*, (2LXIV) *Mussaenda frondosa*, (2LXV) *Oldenlandia diffusa*, (2LXVI).*Coffea bengalensis*, (2LXVII) *Mussaenda roxburghii*, (2LXVIII) *Ixora polyantha*, (2LXIX) *Hedyotis scandens*, (2LXX) *Paederia foetida*, (2LXXI) *Zanthoxylum nitidum*, (2LXXII) *Lygodium microphyllum*, (2LXXIII) *Lygodium flexuosum*, (2LXXIV) *Smilax ovalifolia*, (2LXXV) *Solanum torvum*, (2LXXVI) *Symplocos grandiflora*, (2LXXVII) *Amblovenatum opulentum*, (2LXXVIII) *Pouzolzia zeylanica*, (2LXXIX) *Leea indica*, (2LXXX) *Curcuma longa*, (2LXXXI) *Zingiber officinale*

and cattle. About 90% Chaodang people prepared rice-beer during festivals (Bihu), ritual functions, birth and marriage ceremonies etc. They also offer rice-beer to their forefathers' spirits during every festival. Earlier, Chaodang people had used 101 species of plants having medicinal importance but now the number is decreasing due to non-availability of all the species and identification problem among the new generation. In this study, an attempt has been made to document the medicinal plants used by the Chaodang community in starter culture cake for the preparation of rice-beer.

In Assam, the traditional farmers have identified three distinct rice growing season in its different agroclimatic zones in the state namely, Sali (winter rice) sown in June-July which is harvested in November-December, Ahu (autumn rice) sown in March-April which is harvested in June-July, and Boro (summer rice), which is generally sown in November-December and harvested in May-June. Out of these three rice growing season, the local farmers of Assam for a long time have adapted to only two principal seasons-Ahu and Sali for the cultivation of different rice varieties, Ghosh [24].

The protocols followed by Chaodang community for the preparation of starter culture cake are very unique because they used maximum number of medicinal plant species. The community has good ethno–botanical knowledge about the importance of medicinal plants. There is a need to evaluate the quality and quantity of each medicinal plant used by the community for the preparation of starter culture cakes. There is a very good commercial potential of rice beers in the region after proper qualitative and quantitative evaluation and value addition of the rice beers.

Methodology

Ten villages from Baghchung Development Block under Jorhat sub-division of Jorhat district, Upper Assam were selected randomly for data collection where Chaodang community is dominated (Figure1). Survey and data collection were done during the period January to June 2020. Prior Informed Consents (PIC) were taken in the prescribed format from the traditional knowledge holders, village heads (Gaon Buha)/Gaon Panchayat President (GP presidents). Eight key persons (mainly aged experienced men and women) were interviewed in each village to collect the data regarding the preparation of *Su-pitha* and *Saj*. The local names of all the plant species used by them for the preparation of *Su-pitha* were noted down and photographed the same in the natural habitats. The plant samples were collected from the villages which were identified and documented with help of Hooker [37], Kanjilal [38], Bor [39]. The whole process of preparation of *Su-pitha* and *Saj* were also recorded and photographed at different stages with due permission from key informants. The colours, odours, turbidity and tastes of different rice-beers prepared by using different varieties of rice were recorded. GPS co-ordinate of each village was recorded and a map of the study area showing sampling villages was prepared in ArcGIS (Figure1). The plants species used by the Chaodang community and methods of preparation of *Su-pitha* and *Saj* were compared with the other ethnic groups of NE India.

Results and Discussion

The ten villages selected randomly for survey in Jorhat district were (I) Habungia Gaon, (II) Jamuguri Gaon, (III) Kumar Chaodang Gaon, (IV) Borbheta Gaon, (V) Kebang Gaon, (VI) Baghmoria gaon, (VII) Timtimia Gaon, (VIII) Lojonia Gaon, (IX) Ujani Nonoi Gaon and (X) Khoriachuk Gaon. The location of the sampling villages are shown in the Figure1.

A total of 81 species (Table1) (Figures 2I-2LXXXI) of medicinal plants belonging to 47 families were used by the Chaodang community for the preparation of Su-pitha. Out of 47 families, Rubiaceae was found more frequently used family with seven species, followed by Fabaceae (four species), Lamiaceae (four species), Lauraceae (four species), Moraceae (three species), Polygonaceae (three species), Piperaceae (three species) Acanthaceae, Apocynaceae, Araceae, Asteraceae, Blechnaceae, Convolvulaceae, Euphorbiaceae, Linderniaceae, Magnoliaceae, Melastomataceae, Poaceae, Schizaeaceae, Zingiberaceae (two species each) and so on. Out of 81 species, 50 species were found common used by all the ten sampling villages for preparation of Su-pitha. The remaining 31 species were found not common for all the villages, i.e. one village used some species which were not used by the other villages. It was also found that one village used maximum 61 species for the preparation of Su-pitha. The 81 species is the total species extrapolated from the ten sampling villages in Jorhat district used by the Chaodang community for preparation of *Su-pitha*.

All the plant species were enumerated with their local names in Chaodang and Assamese, botanical names and plant parts used for the preparation of Su-pitha. Leaves of 46 species, the whole plants of 19 species, fronds of six species, leaves and barks of two species, young shoots of two species, fronds and rhizome, leaves and flowers, leaves and seeds, rhizomes, seeds, soft parts of leaves, of one species each were used for preparation of Su-pitha. The Chaodang people used the highest numbers of medicinal plants than any other ethnic groups of India for preparation of starter culture cakes. The other ethnic groups in Assam, like Deori 32 species [29], Mishing 16 species [36], Ahom community 13 species [33], Rabha tribe 10 species [20], Sonowal kachari tribe seven species [20], Boro tribe four species [20], Adivasi two species, Dimasa tribe two species, Meithei two species, Apatani two species [17] etc. were used for the preparation of starter culture cakes. The tribes in Tripura like Kalai, Jamatia, Debbarnma, Molsom etc. used not more than six species [40]. Tamang and Thapa [41] and Tamang et al., [42] reported that Gorkha and Nepalese in Sikkim used not more than four species of plants for the preparation of starter culture cakes. Hence, the medicinal value of the Su-pitha prepared by Chaodang community will be definitely more than the other starter culture cakes prepared by other ethnic groups of NE India. All the traditional knowledge holders told that their forefathers had used 101 species of plants for the preparation of Su-pitha but now, due to the lack of documentation and availability of the species only 81 species are used.

Figure 3. (3I) Dheki (wooden mortar), (3II) Air dried ingredients, (3III) Semi-grinded ingredients, (3IV) Grinded ingredients, (3V) Sieving the grinded ingredients, (3VI) Making Paste with the powdered ingredients, (3VII) Mixing the newly prepared cakes with old *Su-pitha* powder, (3VIII) *Su-pitha* just prepared, (3IX) and (3X) *Su-pitha* (yeast grown completely), (3XI) and (3XII) Smoked *Su-pitha*, (3XIII) Fermented cooked rice ready to keep in the earthen pot, (3XIV) Drying and Smoking of earthen pot, (3XV) Earthen pot full with fermented rice

In the preparation of *Su-pitha* and rice beer, the major ingredient is the rice.

Preparation of Su-pitha

First of all, the medicinal plants required for Su-pitha are collected by them from homestead gardens, tea gardens, private forests, road sides, riversides, agriculture fields and natural forests. All the species are not required in equal proportion, the species like *Amblovenatum opulentum*, *Lygodium microphyllum*, *Lygodium flexuosum*, *Mussaenda frondosa*, *Centella asiatica*, *Hydrocotyle sibthorpioides*, are required in larger quantity in comparison to the other species. The other species are used only two to three leaves/other plant parts / whole plants depending on the amount of rice. The 81 species (Table 1) of plants used in preparation of Su-pitha by the Chaodang community, each species has a unique role in the starter culture, few plants are used as additive ingredients, some are used for sweet taste of the rice beer, some are used for stimulation etc.

The *Amblovenatum opulentum* which is required in maximum amount is first sundried (Figure 3II) for one to two days (summer) and three to four days (winter). The other plant species are not required to dry because if these species are dried, it will be difficult for them to grind with Dheki (wooden mortar) (Figure 3I). After collecting all the plant species, they used to soak any normal rice grains (Sali variety) in water for three to four hours. Now, the soft rice is taken out from the water and kept for one hour to drain out the excess water and then mixed with all the plant species after properly washing with clean water. After that the mixture is grinded with the help of Dheki (Figure 3III), the mixture is sieved with bamboo sieve (Figures 3IV and 3V) and again sieved with metallic sieve having smaller pores than the bamboo sieve. The process is repeated many times till the mixture become powder. Now, the powder is mixed with required clean water to make a paste (Figure 3VI) and then many round ball like cakes (Figure 3VII)

(about 2.5 cm diameter) are prepared from the paste. This paste is the media for culturing of different species of yeasts required for the fermentation process during the preparation of rice beer. Each cake is overlaid (Figure 3VII) with the powder of old starter culture cakes (selected the best one) as a source of yeasts which can be compared as inoculation of yeast. Theses cakes are kept for four days (summer) and six days (winter) covering with paddy straw on both upper and lower sides (Figure 3VIII). The cakes become white because, the yeasts are grown completely around it (Figures 3IX and 3X). The paddy straw is removed and the cakes are taken out and kept for two to three hours for air drying. Now, these are kept on Dhua chang (a square/rectangular frame made of bamboos) or bamboo sieve, over fire heat in the kitchen (Figure 3XI) or other places where fire is made daily in a height of one to two meters. The heated smokes coming out from the fire completely dried the cakes within two to three days. Finally, these starter culture cakes are ready to use or can be stored for a long time (Figure 3XII) usually for two to three months.

Figure 4. (4I–4III) Rice beer of *Bora rice*, (4IV–4VI) Rice beer of mixed rice, (4VII–4IX) Rice beer of *Chakuwa rice*, (4X–4XII)Rice beer of *normal rice*

Out of 13 species, used by Ahom community [33] in preparation of Xaj Pitha (starter culture cake), 12 species were found common with the Chaodang community. Deori tribe [29] used 32 species, out of which 20 species were found common with the Chaodang community. In case of Mishing tribe [32], they used 16 species, out of which 12 species were found common with Chaodang community, Rabha tribe [20] used 10 species, out of which five species are common with Chaodang, Sonowal kachari tribes [33] used seven species, out of which five species are common with Chaodang. The other tribes of NE India used very less number of plant species in the preparation of starter culture cakes, out of which hardly few species were found common with the Chaodang community.

Preparation of rice beer (Saj/Laopani)

The rice variety used by the Chaodang community for the preparation of rice beer is Bora rice (sticky rice), Chakuwa rice, normal rice belonging to Sali variety and sometimes combination of three. In case of all

the varieties the rice is washed and cooked properly. But the Bora rice is cooked in boil water stream. The cooked rice is spread on banana leaves and allows cooling for 1 hour. Now, the Su–pitha (source of yeasts) is crashed and then properly mixed with cooked rice at the ratio of three to five Su–pithas per kg of rice and kept covered with banana leaves (Figure 3XIII). After one to two days (summer) and three to four days (winter) the mixture is kept in a properly smoked (Figure 3XIV) and dried earthen pot (Figure 3XV) for five to seven days. During this period, the yeasts with the help of Diastase enzyme, converted the polysaccharide starch molecules of rice into disaccharide maltose and then into simple sugar glucose in the presence of maltase enzyme through the process of hydrolysis. Hence, in the initial stage the rice beer is very sweet in taste due to the presence of glucose. Finally, the glucose molecules are broken down into ethyl alcohol and carbon dioxide in the presence of zymase enzyme through the process of fermentation. In this stage, highly concentrated rice beer is deposited at the bottom of the earthen pot. About one and half litres of clean water is poured in the ratio of per kg rice, into the earthen pot and after 12 hours the rice beer is ready to drink. The rice beer is poured in a wide utensil by bending the earthen pot and sometimes it is separated from the mixture with the help of sieve. The first time extracting liquor/rice beer from the fermented mass is known as 'Rohi mod'. All the above mentioned rice beers are Rohi mod. After extracting the Rohi mod, about one litre water is again added to the remaining fermented mass (one kg) and mixed properly and then sieved out the liquor second time. This second time extracted liquor is known as 'Choka mod'. This Choka mod is always white in colour with high turbidity and low alcohol content. After second time extraction of liquor the remaining mass is feed to the pigs. In the whole process, preparation of rice beer is kept away from any *Citrus* plant species which contains acids and spoils the rice beer by turning sour.

The taste, colour, odour and alcohol concentration of the rice beer depends upon the variety of rice used and the quality of Su–pitha used for fermentation. Generally, the rice beer prepared from the Bora rice is the best one, with very delicious taste, sweet, yellow in colour with very good odour (Figures 4I–4III). Quality wise next to Bora rice, the rice beer prepared from the mixture of three varieties of rice viz. Bora, Chakuwa and normal rice occupies the second position. The mixed rice beer (Figures 4IV–4VI) is sometimes sweet in taste, light green in colour with high alcohol concentration. The rice beer prepared from *Chakuwa rice* (Figures 4VII–4IX) also has high alcohol concentration with pale yellow in colour. The rice beer which is prepared from normal rice (Figures 4X–4XII) is pale yellow or white in colour with slight bitter taste and low alcohol concentration. Hence, the Saj is generally aromatic, alcoholic, sweet and with hallucination property, which is taken as energy booster during physical labour, and other important occasional ceremonies of the families and the societies of the Chaodang community. Sometime due to bad quality of *Su-pitha* and contamination occurs during the process of preparation, the desired quality of rice beer is not found and it becomes sour in taste, colourless, odourless with low concentration of alcohol. Therefore, proper hygiene must be maintained during the whole process to avoid mixing of unwanted materials.

The preparation method of *Saj* is almost similar with *Sajpani* of Ahom [28], Sujen of Deori tribe [29], Apong of Mishing tribe [36] and some other tribes of NE India. But, it is different from Hor of Karbi tribe [35], Jonga Mod of Rabha tribe [20] and some other tribes of NE India, which is prepared by distillation of the fermented mixture after addition of required quantity of water. Different tribes used various indigenous and traditional rice varieties for the preparation of rice beer, so the tastes, odours, colours and hallucination properties are different.

Conclusion

The consumption of limited amount of alcohol in the form of alcoholic beverage gives some relaxation to the hard working population of this community which has no side effect on their health. The choice of the variety of rice used for fermentation also differs from communities to communities and it is seen that glutinous rice is preferred more than non-glutinous rice, due to the taste, colour, odor and alcohol content of the product. It is observed that the plants used as an ingredient in preparation of starter culture cakes are mostly found in wild and their population are decreasing due to deforestation in the study area day by day.

Now a days, use of *Saj* by the Chaodang community in their religious and social festivals is some of the Chaodang people in upper Assam are the follower of Sri Sankardev Sangha (the biggest religious organization of NE India) where the use of alcoholic beverage is completed restricted. The second reason is that the new generation is not aware of medicinal plants and their importance.

The protocols followed by Chaodang people for the preparation of starter culture cakes and rice beer is completely based on their traditional knowledge. They don't have any scientific knowledge about the yeasts and the fermentation process. Some rural poor people sold the starter culture cakes at the rate rupee one per piece and one kg rice beer (about 1.5 litres) at the rate Rs. 80./-. There is a need to evaluate the quality and quantity of each medicinal plant used by the community for the preparation of starter culture cakes. There is a very good commercial potential of rice beers in the region after proper qualitative and quantitative evaluation and value addition of the rice beers. This will help to uplift the socio-economic status of the very backward rural communities who earn their livelihood by selling starter cultures and rice beers.

The Government of Assam proposed to conduct proper research on different tribal brews which are healthy and of high medicinal values, so as to ensure the standardization, hygiene and proper bottling in attractive package. These products will be promoted as licensed items that can be sold in permitted shops and establishments. Now, the Government of Assam is taking interest in the protection and popularization of traditional brews in Assam. Hence, on 06 May 2017, the Government of Assam published a gazetted order notifying new rules amending the Assam Excise Rules, 2016, and these new rules, on legalizing the production and sale of traditional brews as Heritage Brews.

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