Compendium of plants used for preparation of traditional alcoholic beverages by four major ethnic communities of Assam, northeast India

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Abstract. Borah D, Gogoi T, Sarma J, Borah PJ, Gohain B, Mili C, Upadhyaya A, Basumatary J, Neog K, Wangpan T, Tangjang S. 2021. Compendium of plants used for preparation of traditional alcoholic beverages by different major ethnic communities of Assam, Northeast India. Biodiversitas 22: 2019-2031. This paper deals with the ethnobotanical research on the preparation of traditional alcoholic beverages by Ahom, Bodo, Karbi and Mishing ethnic communities of Assam, India. Along with the information on preparation, the plant species associated with the preparation of alcoholic beverages are also recorded. Field investigations were conducted to cover 32 villages of six districts of Assam, India. The data was generated from 202 respondents using participatory rural appraisal tools including semi-structured questionnaires and personal interviews. The plant species were collected, identified and submitted in the Herbarium of Rajiv Gandhi University, Arunachal Pradesh, India. The study recorded 129 plants falling under 107 genera and 54 families which are exclusively used for the preparation of alcoholic beverages by the studied communities. The study confirmed that the association of traditional alcoholic beverages with their rich indigenous knowledge. The finding also revealed varied forms of protocol followed by these tribes to prepare traditional liquors and the starter cakes for brewing alcohol were prepared locally. However, the Mishing tribe was known to prepare unique rice beer known as Po:ro apong, as the preparation technique and extraction process of this liquor was slightly different. Distillation of alcohol was also observed in all the communities except the Ahom. The rich traditional knowledge of brewing alcohol and the plant species used in the process were worth documenting considering the ongoing alteration of traditional society with the modernization.

Keywords: Alcoholic beverage, ethnobotany, Northeast India, traditional knowledge, tribal society

INTRODUCTION

Fermentation and fermented beverages have always been an integral part to human cultures and traditions since ancient times (Alan 1997). The beer is supposed to have originated in Sumeria before 7000 B.C. (Demain et al. 1998). Traditionally prepared fermented beverages have always been associated with the values and survival of the tribes throughout the world since the dawn of civilization (Alan 1997). It is assumed that the preparation of traditional wine, beer and their varieties in consumption may have probably emerged due to the varied climatic conditions and was heavily dependent on the availability and utilization of locally available natural resources (Roy et al. 2004). The fermented rice beverages of the tribal people are prepared using various plants which are known to possess numerous medicinal properties. It has been reported that the phytochemical components present in these plant species proved to have remarkable therapeutic potential when used alone or in combinations (Prakash et al. 2004; Bhuayan and Baishya 2013). These forms of traditional alcoholic beverages have a considerable impact on health care and provide health benefits of preventing and treating gastrointestinal diseases along with certain physiological disorders (Nath et al. 2019) such as insomnia, headache, diarrhea, body ache and inflammation of body parts, expelling worms along with the treatment of cholera and urinary problems (Samati et al. 2007; Deka and Sarma 2010; Nath et al. 2019). Several reports from different parts of Northeast India have also been claimed the presence of nutritional as well as antioxidant properties in rice beer samples which is due to the presence of compounds such as phenolic acids, polyphenols, and flavonoids (Nath et al. 2019).

Assam is home to diverse ethnic communities and tribal groups, mostly of Mongoloid origin, such as Ahom, Rabha, Deori, Tiwa, Bodo, Karbi, Mishing, Sonowal Kachari, etc. (Sharma 2017). These communities have been preparing and consuming traditional rice beer for about 2500 years and possess a good deal of knowledge about fermented food products (Tamang 2010). As such, a variety of cereal-based alcoholic beverages are prepared and consumed by these communities during many occasions such as ritual ceremonies, marriages and merry-making, festivals and
even death ceremonies (Saikia et al. 2007; Das et al. 2012). The fermentation methods are similar among the ethnic groups with some variations in the preparation of starter cakes which occasionally contain various herbs and rice flour (Das et al. 2012; Das et al. 2019). The current research deals with the ethnobotanical research of important plants used for the preparation of traditional alcoholic beverages by four major ethnic communities (Ahom, Bodo, Karbi, and Mishing) of Assam, India.

MATERIALS AND METHODS

The field study was conducted in six districts of Assam, namely Baksa, Biswanath, Golaghat, Lakhimpur, Sibasagar, and Sonitpur because several ethnic communities reside in these districts (Figure 1), which falls within the upper zone of the state. The boundary of the state extends from 89°42’ E to 96° E longitudes and 24°8’ N to 28° 2’ N latitudes and covers an area of 78,438 km². The elevation ranges from 45 to 1,960 meters above mean sea level and the temperature from 35-38 °C (95-100 °F) during summers and 6-8°C (43-46°F) during winters. It has a mean annual rainfall of 1,524.6 mm. The present population is 31 million and the literacy rate is 72.19% (Census 2011).

Field investigations were conducted from October 2019 to March 2020 to cover thirty two villages of six districts of Assam, India. Selection of respondents was done through purposive stratified sampling from those villagers who accepted the request for an interview voluntarily. A total of 202 respondents (i.e., mostly age-old folks and women), present in these villages were selected for data collection. Data was collected through interviews by various participatory rural appraisal tools such as semi-structured questionnaires and personal interviews. Collection of plant species was done in the presence of respondents and was later processed following the methods of Jain and Rao (1976). It was then identified using relevant literatures (Hooker 1897; Kanjilal et al. 1934-1940), and consulting voucher specimens present in regional herbaria (ARUN, ASSAM) and submitted in Herbarium of Rajiv Gandhi University, Arunachal Pradesh, India.

Figure 1. Map of Assam showing study area, i.e. 6 districts of Assam, India
RESULTS AND DISCUSSION

The study reported a total of 129 plants falling under 107 genera and 54 families used by four major ethnic communities of Assam for the preparation of traditional alcoholic beverages (Table S1). Among the 54 families, Lamiaceae and Lauraceae were the most dominant families with eight species each, followed by Asteraceae (7 spp.), Rubiaceae and Polygonaceae with 6 spp. each (Table 3). Leaf (88%) is the most commonly used plant part, followed by twig (4%) and root (3%) (Figure 2). A brief pictorial account of traditional alcoholic beverages prepared by major ethnic communities Ahom, Bodo, Karbi and Mishing of Assam is depicted in Figure 3.

Table 2. Traditional alcoholic beverages of major tribal communities residing in Assam

| Community | Alcoholic-beverage | Starter culture |
|-----------|--------------------|-----------------|
| Ahom      | Haaj, Laupani      | Haajpitha, Vekurpitha |
| Bodo      | Jou, Bishi         | Amao, Angkur    |
| Karbi     | Hor/Hor-alank      | Thap            |
| Mishing   | Poro apong, Sai mod | Apoppitha      |

Table 3. Table showing ten dominant families of plants used in preparation of traditional alcoholic beverages in Assam, India

| Family     | Number of species |
|------------|-------------------|
| Asteraceae | 7                 |
| Fabaceae   | 5                 |
| Lamiaceae  | 8                 |
| Lauraceae  | 8                 |
| Moraceae   | 4                 |
| Piperaceae | 5                 |
| Poaceae    | 4                 |
| Polygonaceae | 6               |
| Rubiaceae  | 6                 |
| Solanaceae | 5                 |

Figure 2. Bar diagram showing the percentage of plants parts used in preparation of traditional alcoholic beverages in Assam, India

Preparation of starter cakes

The preparation of starter cakes usually begins with the collection of various plants which add to the starter cakes and are believed to add certain flavor/medicinal value/nutrients to it (Figure 5). The collected plant parts were washed properly and used in either fresh form or dried. Drying was done under smoke or sun for a couple of days. At the same time, rice grains were soaked in water for about 2 to 6 hours and then rinsed to drain out the excess water and ground into powder. The dried plant parts are also grounded separately and mixed with the powdered rice. Subsequently, the dough was prepared, adding a small amount of finely powdered previously prepared starter cake (which serves as inoculants). Small-sized round balls were prepared from the dough, which is then dried and stored above the fireplace until further use. Dried leaves of Thelypteris parasitica (L.) Tardieu, Musa balbisiana Colla, and paddy hay were used to keep the starter balls free from harmful pests and moisture and increase the longevity of the product. The starter cakes and alcoholic beverages acquired different names in different tribal dialects (Table 2).

Preparation of rice beer

Traditional rice beer is usually prepared by fermenting boiled rice mixed with starter cakes (Figure 5). The process starts with the boiling of rice (preferably glutinous varieties). The cooked rice was then spread on banana leaves placed in a winnowing basket and allowed to cool to room temperature. The powdered starter cakes were mixed with the boiled rice and filled in an earthen pot or any vessel, and sealed with banana or Alpinia leaves, straw and a piece of clean cloth. The incubation period of fermentation varied from 5-9 days depending on the season and the climate of the region. After the incubation period, the mixture was taken out and filtered to separate the alcoholic liquid from the fermented rice. The filtered liquid or rice beer is now ready for consumption. Several tribal nomenclatures of rice beer and the materials used are mentioned in Table 2.

Preparation of Po:ro apong

It is worth mentioning that the process of rice beer preparation of all the studied tribes of Assam (Ahom, Mishing, Bodo, and Karbi) was more or less similar, differing only in the plants used (Table S1). But the Mishing tribe is known to prepare an additional unique rice beer known as Po:ro apong. The preparation technique, as well as extraction process of this alcoholic beverage, was slightly different from its counterparts (Figure 6). To prepare this beverage, paddy husk and dried paddy straw were partially burnt to collect the ash in a separate container. The collected ash along with the powdered starter cake was mixed along with the boiled rice. The mixture was then added to an earthen pot (severely fumigated pot, turning its color into blackish) and the mouth was sealed with the help of straw and leaves of Thelypteris parasitica (L.) Tardieu. The fermentation usually takes a week or two (depending on the season of preparation, warmer the climate faster the fermentation process or vice versa, and amount of starter used).
Figure 3. Traditional alcoholic beverages of Assam: A-B. Starter cakes, C. Vessel for rice beer preparation, D. Rice beer (Xaajpani of Ahom), E. Po-ro apong filtration unit, F. The mixture of Po-ro apong, G-H. Distilled alcohol distillation unit

For the extraction of liquid, the cone-shaped bamboo basket called Taksuk was hung from a post. The interior walls of the bamboo basket were covered with banana leaves. A pack of paddy straw (Amrong) was placed at the base of the bamboo basket which serves as a sieve for filtration. The prepared fermented mixture (boiled rice + ash) was then poured inside the Taksuk and warm water were poured from above which usually extracts the soluble components of the rice beer including alcohol. Coldwater is poured at first, to cool the fermented mixture, then hot water is slowly poured, sequentially, however, the filtrate remains cool for the first batches, until the filtrate turns hot, then the process is stopped. The filtrate (Apong) was then collected in a container placed just below the bamboo basket. But excess addition of water is not advised as it is believed to decrease the intoxicating effect as well as the sweetness of the beverage. Nevertheless, the production of Po:ro apong is considered to be a tedious process; thus, it is usually prepared in case of large and important community gatherings such as festivals, rituals and other cultural gatherings.

Preparation of distilled alcohol

The distillation of alcohol was observed among the three studied communities except for the Ahoms (Figure 7). For distillation, the fermented rice beer was diluted by adding water and stored for some time. At the same time, the distillation process can be carried out either at the early stage of rice beer preparation or after harvesting of rice beer. The complete process of distillation may take 4 hours. The quality of alcohol is strong if prepared before harvesting rice beer by adding more amounts of starter cakes, or by adding less water while diluting.

The traditional distillation apparatus has three different chambers which consist of: (i) The lower chamber consists of a metallic utensil containing diluted fermented rice beer. (ii) The middle chamber consists of an earthen pot with a perforated base. It also has a small bowl over the
perforation, inside the pot which acts as a receiver to contain the distilled alcohol. In certain cases, the earthen pot was also found to be fitted with a long bamboo cylindrical tube on the side of the pot, which permits the flow of the distilled alcohol outside of the apparatus. The distilled alcohol is collected in a utensil placed at the end of the cylindrical tube. (iii) The upper chamber entails a metallic utensil, filled with cold water which acts as a condenser.

To prevent the leakage of vapors from the apparatus, the gap between the utensils was sealed with a moist muslin cloth, mud or with the residue of rice beer.

On constant heating, the filtered rice beer in the lowermost utensil forms vapor, passes through the perforated base of the middle compartment before hitting the base of the condenser, after which it settles down and collected by the bowl placed above the perforation, or through the tube directly into a bottle. The water of the condenser was repeatedly replaced so that the condensation continues. The more the alcohol is distilled, the less is the concentration.

The study unveiled the association of traditional alcoholic beverages with the rich indigenous knowledge system of the region. The finding also revealed the varied forms of protocol followed by different tribes of Assam for the preparation of traditional liquors. The starter culture was usually used as a source of yeast strains in the fermentation process. Also, they included various plant species in preparation for starter culture. Such starter culture usually persists for several months at room temperature and in a dry place (Tamang and Sarkar 1998).

There are several pieces of literature mentioned in Table S1 (last column) that corroborate the current findings. Thus, total 39 plants from our record were already reported by previous workers. While, a total of 90 plant species were newly recorded among the Ahom, Mishing, Bodo and Karbi for the preparation of traditional alcoholic beverages. Also, the most commonly added plants were *Ananas comosus* (L.) Merr., *Capsicum annuum* L., *Centella asiatica* (L.) Urb., *Clerodendrum infortunatum* L., *Lygodium flexuosum* (L.) Sw., *Oryza sativa* L., *Piper nigrum* L., *Saccharum officinarum* L. and *Scoparia dulcis* L.. The neighboring Northeastern states of India also retain their unique way of brewing alcohol. For instance, the addition of leaf extracts of *Clerodendrum viscosum* Vent. (synonym of *Clerodendrum infortunatum* L.) and *Calotropis gigantea* (L.) W.T.Aiton to rice, millet and corn to prepare beers in Sikkim (Tsuyoshi et al. 2005). Production of fermented spirit from rice called *U Phandieng* and cocktail of millet and rice beer called *KaKiad* among the Khasis of Meghalaya (Ahmed and Borthakur 2005). Addition of extract of tree barks and fern leaves to rice beer by Meithei tribe of Manipur (Hodson 1999). Germinated rice grains are mixed with powdered rice to produce *Peyazu* by *Angamis* of Nagaland (Sharma et al. 2019). The addition of ash and extracts of *Eleusine coracana* (L.) Gaertn. and *Saurauia roxburghii* Wall. to the broth containing dried or boiled millet or rice and starter yeast powder (called *epo*) by the *Apatani* tribe of Arunachal Pradesh (Tanti et al. 2010).
Our findings assumed that the process of distillation of alcohol which was executed by the three studied tribes of Assam was almost similar. Likewise, in other parts of India, such distilled alcoholic liquor is very commonly consumed, such as Yu angouba of Manipur (Singh and Singh 2006), Chulli of Himachal Pradesh (Thakur and Savitri 2004), fenny of Goa (Nayak and Prabhu 2013), Mahua of Central India (Yadav et al. 2009), Mahuli from Orissa (Behera et al. 2016), Soor from Uttarakhand and Himachal Pradesh (Rana et al. 2004) and Chhang of Western Himalayan region (Ahuja et al. 2014), etc.

In conclusion, the rich traditional knowledge of brewing alcohol and the plant species used in the process were worth documenting considering the alteration of traditional society with the modernization. Also, considering the on-going rapid industrialization, the successful relocation of the traditional beverages from the household to the industrial-scale production with improved quality from a microbiological stance may stimulate the rural economy.

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Table S1. Plants used for the preparation of traditional alcoholic beverages by major ethnic communities of Assam: Parts used and previous records. Note: Ah, A= Ahom; M, Mi=Mishing, Bo, B=Bodo and Ka, Ga, G=Karbi

| Tribal community | Updated name | Family | Local name | Parts used | Collection number | Previous records |
|------------------|--------------|--------|------------|-------------|-------------------|------------------|
| Ah               | Achyranthes aspera L. | Amaranthaceae | Uvotahoth (A) | Leaf | TG 1078 | - |
| Ah               | Acmella oleracea (L.) R.K. Jansen | Asteraceae | Hu honi bon (A) | Leaf | TG 1079 | - |
| Ah               | Acmella paniculata (Wall. ex DC.) R.K. Jansen | Asteraceae | Hu honi bon (A) | Leaf | PB 1039 | - |
| Ah               | Actinodaphne sp. | Lauraceae | Baghnola pat (A) | Leaf | TG 1080 | - |
| Ah               | Alternanthera sessilis (L.) R.Br. ex DC. | Amaranthaceae | Matikaduri (A) | Leaf | PB 1059 | - |
| Ah               | Alternanthera sessilis | Amaranthaceae | Khutura (A) | Leaf | PB 1059 | - |
| Ah               | Amonesia solanacea Roxb. | Primulaceae | Tuluthapoka (A) | Leaf | TG 1083 | - |
| Ah               | Aporosa octandra (Buch.-Ham. ex D.Don) Vickery | Phyllanthaceae | Khokoracheloch (A) | Leaf | TG 1142 | - |
| Ah               | Ardisia solanacea Roxb. | Primulaceae | Tuluthapoka (A) | Leaf | TG 1083 | - |
| Ah               | Argyreia nervosa (Burm.f.) Bojer | Convolvulaceae | Bli dhotoroklota/Hunporuah lota/Tukoriyaal (A) | Leaf | TG 1143 | - |
| Ah               | Artocarpus chama Buch.-Ham. | Moraceae | Sam kathal (A) | Leaf | TG 1085 | - |
| Ah               | Artocarpus heterophyllus Lam. | Moraceae | Belang (M), Kothal (A), Khatol/Khanthal (B) | Leaf | CM 108; BG 002; PB 1030; JS 2346; JB 021; TG 1084 | Baruah et al. 2010; Deka and Sarma 2010; Bhuyan and Baishya 2013; Gogoi et al. 2013; Pawe and Gogoi 2013; Basumatary et al. 2014; Basumatary and Gogoi 2014; Senapati and Gurumayum 2016; Das 2016; Bhuyan and Rajak 2019 |
| Ah               | Averrhoa carambola L. | Oxalidaceae | Kordoi (A) | Leaf | PB 1056 | - |
| Ah               | Bambusa tulda Roxb. | Poaceae | Baah pat (A) | Leaf | PB 1071; TG 1086 | - |
| Ah               | Bonnaya ciliata (Colsm.) Spreng. | Linderniaceae | Kasidaria/Horukasi-doriya (A) | Leaf | PB 1057; TG 1145 | - |
| Ah               | Bonnaya ruellioiides (Colsm.) Spreng. | Linderniaceae | Bor kasi-doriya (A) | Leaf | TG 1146 | - |
| Ah               | Callicarpa arborea Roxb. | Lamiaceae | Tangloti (A) | Leaf | TG 1087 | - |
| Ah               | Callicarpa longifolia Lam. | Lamiaceae | Gorokhiyakorai (A) | Leaf | TG 1088 | - |
| Ah               | Cannabis sativa L. | Cannabaceae | Bhang gos (A) | Leaf | PB 1068 | - |
| Ah               | Capsicum annuum L. | Solanaceae | Jolokia (A) | Leaf | TG 1089 | Baruah et al. 2010; Deka and Sarma 2010; Pawe and Gogoi 2013; Gogoi et al. 2013; Bhuyan and Baishya 2013; Basumatary et al. 2014; Basumatary and Gogoi 2014; Senapati and Gurumayum 2016; Das 2016; Bhuyan and Rajak 2019 |
| Mi               | Capsicum frutescens L. | Solanaceae | Mirsi (M) | Leaf | CM 111 | - |
| Ah | Centella asiatica (L.) Urb. | Apiaceae | Bor mani-muni (A) | Whole plant | BG 004; TG 1090 | Deori et al. 2007; Baruah et al. 2010; Das et al. 2012; Kardong et al. 2012; Gogoi et al. 2013; Pawe and Gogoi 2013; Bhuyan and Baishya 2013; Senapati and Gurumayum 2016; Handique and Deka 2016; Bhuyan and Rajak 2019; Nath et al. 2019 |
| Ah | Chloranthus elatior Link | Chloranthaceae | Gathikaliya (A) | Leaf | TG 1147 | - |
| Ah | Cinnamomum bejolghota (Buch.-Ham.) Sweet | Lauraceae | Patihunda/Naga dalseni (A) | Leaf | TG 1148 | - |
| Ah | Cinnamomum tamala (Buch.-Ham.) T.Nees & C.H.Eberm | Lauraceae | Tuzpat (A) | Leaf | PB 1074 | Baruah et al. 2010; Gogoi et al. 2013; Senapati and Gurumayum 2016 |
| Ah | Cinnamonum verum J.Presl | Lauraceae | Dalseni pat (A) | Leaf | TG 1091 | - |
| Ah | Cissampelos pareira | Menispermaceae | Bor tubukilota (A) | Leaf | TG 1092; TG 1149 | Saikia et al. 2007; Das et al. 2012; Bhuyan and Baishya 2013; Handique and Deka 2016; Senapati and Gurumayum 2016; Nath et al. 2019 |
| Ah, Mi | Citrus × limon (L.) Osbeck | Rutaceae | Nenutenga (A) | Leaf | TG 1094 | - |
| Ah, Mi | Clematis aphifolia DC. | Ranunculaceae | Horusoi/ Horugorosoi (A), Ramam bon (M) | Leaf | CM 117; TG 1150 | - |
| Ah, Mi | Clematis zeylanica (L.) Poir. | Ranunculaceae | Gop-sori/Soi pan/ Gorobsoi (A) | Leaf | PB 1027; TG 1119 | Deori et al. 2007; Baruah et al. 2010; Kardong et al. 2012; Bhuyan and Baishya 2013; Gogoi et al. 2013; Handique and Deka 2016 Senapati and Gurumayum 2016; Bhuyan and Rajak 2019; Nath et al. 2019 |
| Ah, Bo | Clerodendrum colebrookeanum Walp. | Lamiaceae | Nefafu (A), Mswkhwna (B) | Leaf | JB 024; PB 1038; JS 2345 | Tanti et al. 2008; Baruah et al. 2010; Deka and Sarma 2010; Das et al. 2012; Bhuyan and Baishya 2013; Gogoi et al. 2013; Pawe and Gogoi 2013; Basumatary et al. 2014; Basumatary and Gogoi 2014; Brahma et al. 2014; Das 2016; Handique and Deka 2016; Senapati and Gurumayum 2016; Bhuyan and Rajak 2019; Nath et al. 2019 |
| Ah, Bo, Ga, Mi | Clerodendrum infortunatum L. | Lamiaceae | Dhopattita (A), Pakkom (M), Samaki (G) | Leaf | JS 001; JS 012; TG 1095 | - |
| Ah | Commelina benghalensis L. | Commelinaeae | Kona himolu (A) | Leaf | PB 1046 | - |
| Ah | Cordyline fruticosa (L.) A.Chev. | Asparagaceae | Panormahi (A) | Leaf | TG 1151 | - |
| Mi | Coriandrum sativum L. | Apiaceae | Dhania (M) | Twig | JS 002 | - |
| Ah | Crosocephalum crepidoidees (Benth.) S.Moore | Asteraceae | Bon kopahi (A) | Leaf | TG 1152 | - |
| Ah | Croton caudatus Geiseler | Euphorbiaceae | Lotamahudi/Mahudi (A) | Leaf | BG 005; PB 1042; TG 1096 | Senapati and Gurumayum 2016; Nath et al. 2019 |
| Ah, Ka | Croton jofra Roxb. | Euphorbiaceae | Gochmahudi (A), Marthu (K) | Leaf | DB1067; TG 1097 | Teron 2006; Baruah et al. 2010; Bhuyan and Baishya 2013; Senapati and Gurumayum 2016 |
| Ah | Curcuma longa L. | Zingiberaceae | Halodhi (A) | Leaf | TG 1098 | Das 2016; Bhuyan and Rajak 2019 |
| Mi | Cuscuta reflexa Roxb. | Convolvulaceae | Rabonlota (M) | Root | JS 004 | - |
| Ah | Cyanthillium cinereum (L.) H.Rob. | Asteraceae | Hohodevi bon (A) | Leaf | TG 1099 | - |
| Ah | Cydonia dactylon (L.) Pers. | Poaceae | Dubori bon (A) | Leaf | PB 1031 | - |
| Ah | Cyperus mindorensis (Steu.d.) Huygh | Cyperaceae | Keya bon (A) | Leaf | PB 1048 | - |
Ah, Mi | *Desmodium sp.* (L.) Willd. ex Schult. | Fabaceae | Bionihabota (A) | Leaf | PB 1033; TG 1101 | -

Ah | *Drymaria cordata* (L.) Willd. | Fabaceae | Caryophyllaceae | Lai jabori (A), Dobag/porog-tape (M) | Leaf, twig | PB 1051; CM 1102 | Baruah et al. 2010; Das et al. 2012; Gogoi et al. 2013; Senapati and Gurumayum 2016; Bhuyan and Rajak 2019

Ah | *Eclipta prostrata* (L.) | Fabaceae | Asteraceae | Kehrj (A) | Leaf | PB 1057 | -

Ah | *Eryngium foetidum* L. | Fabaceae | Asteraceae | Maandhania (A) | Leaf | PB 1075 | -

Ah, Mi | *Eurya acuminata* DC. | Fabaceae | Pentaphylacacea | Murmuri pat (A) | Leaf | TG 1103 | -

Ah, Mi | *Flemingia strobilifera* (L.) W.T.Aiton | Fabaceae | Makhioti (A, M) | Leaf | JS 005; PB 1035; TG 1105 | Deori et al. 2007; Das et al. 2012; Kardong et al. 2012; Gogoi et al. 2013; Pawe and Gogoi 2013; Senapati and Gurumayum 2016; Bhuyan and Rajak 2019; Nath et al. 2019;

Ah | *Glochidion zeylanicum* var. *Tomentosum* (Dalzell) Trimen | Phyllanthaceae | Pani madhuri (A) | Leaf | TG 1105 | -

Ah | *Grewia serralata* DC. | Malvaceae | Malvaceae | Kukurhuta (A) | Leaf | TG 1106 | -

Ah, Mi | *Hibiscus rosa-sinensis* L. | Malvaceae | Araliaceae | Leunaapum (M), Joba (A) | Leaf | JS 006; PB 1060; TG 1107 | Baruah et al. 2010; Das et al. 2012; Kardong et al. 2012; Bhuyan and Baishya 2013; Bhuyan and Rajak 2019; Senapati and Gurumayum 2016; Senapati and Gurumayum 2016; Bhuyan and Rajak 2019; Nath et al. 2019;

Ah | *Hydrocotyle sibthorpioides* Lam. | Araliaceae | Vitaceae | Horumani-muni (A) | Whole plant | BG 008; PB 1034; TG 1107 | -

Ah | *Ixora polyantha* Wight | Rubiaceae | Dhepaijamu/Matikataha (A) | Leaf | TG 1154 | -

Ah | *Jasminum sp.* | Oleaceae | Duamali (A) | Leaf | BG 009 | -

Ah | *Leea indica* (Burm.f.) Merr. | Vitaceae | Kukurathenga (A) | Leaf | PB 1072 | -

Ah, Bo | *Leucas aspera* (Willd.) Link | Lamiaceae | Lamiales | Durun bon (A), Khansisa (B) | Leaf | PB 1037; JB 025; TG 1108 | Saikia et al. 2007; Das et al. 2012; Pawe and Gogoi 2013; Gogoi et al. 2013; Das 2016; Handique and Deka 2016; Senapati and Gurumayum 2016; Bhuyan and Rajak 2019; Goswami 2020

Mi | *Lippia alba* (Mill.) N.E.Br. ex Britton &P.Wilson | Verbenaceae | Pohukata (M) | Leaf, flower | JS 007 | -

Ah | *Litsea glutinosa* (Lour.) C.B.Rob. | Lauraceae | Lauraceae | Gahnualu (A) | Leaf | TG 1109 | -

Mi | *Litsea monopetala* (Roxb.) Pers. | Lauraceae | Tusip (M) | Leaf | CM 116 | -

Ah | *Litsea nitida* (Roxb. ex Nees) Hook.f. | Lauraceae | Lauraceae | Kothlusa pat (A) | Leaf | TG 1110 | -

Ah | *Litsea salicifolia* (Roxb. ex Nees) Hook.f. | Lauraceae | Lauraceae | Dighloti pat (A) | Leaf | TG 1111 | -

Ah, Mi | *Lygodium flexuosum* (L.) Sw. | Lygodiaceae | Kaphau-dhekia (A), Tisurkosang (M) | Twig | BG 010; PB 1021; CM 113; TG 1112 | Deori et al. 2007; Saikia et al. 2007; Baruah et al. 2010; Das et al. 2012; Bhuyan and Baishya 2013; Gogoi et al. 2013; Pawe and Gogoi 2013; Handique and Deka 2016; Senapati and Gurumayum 2016; Bhuyan and Rajak 2019; Goswami 2020
| Code | Species | Family | Part(s) Used | Reference(s) |
|------|---------|--------|--------------|--------------|
| Ah   | Macaranga indica Wight | Euphorbiaceae | Leaf | Nath et al. 2019 |
| Ah   | Maesa chisia D.Don | Primulaceae | Leaf |  |
| Ah   | Maesa indica (Roxb.) Sweet | Primulaceae | Leaf |  |
| Ah   | Melastoma malabathricum L. | Melastomataceae | Leaf | Deori et al. 2007; Gogoi et al. 2013; Das et al. 2012; Arjun et al. 2014; Bhuyan and Rajak 2019 |
| Ah   | Mesua ferrea L. | Calophyllaceae | Leaf |  |
| Ah   | Mimus pudica L. | Fabaceae | Leaf | Nath et al. 2019 |
| Ah   | Morinda angustifolia Roxb. | Rubiaceae | Leaf, Root | Senapati and Gurumayum 2016; Bhuyan and Rajak 2019 |
| Ah   | Morus rubra L. | Moraceae | Leaf | Deori et al. 2007; Senapati and Gurumayum 2016; Bhuyan and Rajak 2019 |
| Ah   | Murraya koenigii (L.) Spreng. | Rutaceae | Leaf |  |
| Ah   | Musa balbisiana Colla | Musaceae | Leaf |  |
| Ah   | Musa ensata roxburghii Hook.f. | Rubiaceae | Leaf | Gogoi et al. 2013; Senapati and Gurumayum 2016; Bhuyan and Rajak 2019 |
| Ah   | Nelsonia canescens (Lam.) Spreng. | Acanthaceae | Leaf | Deori et al. 2007; Senapati and Gurumayum 2016; Bhuyan and Rajak 2019 |
| Ah   | Olax acuminata Wall. ex Benth. | Oxlidaceae | Leaf | Rau et al. 2010; Das et al. 2012; Gogoi et al. 2013; Handique and Deka 2016; Bhuyan and Rajak 2019 |
| Ah   | Oldenlandia corymbosa L. | Rubiaceae | Whole plant | Barua et al. 2010; Das et al. 2012; Gogoi et al. 2013; Senapati and Gurumayum 2016; Handique and Deka 2016; Bhuyan and Rajak 2019 |
| Ah   | Ophiobriza sp. | Rubiaceae | Leaf | Deori et al. 2007; Senapati and Gurumayum 2016; Bhuyan and Rajak 2019 |
| Ah   | Oryza sativa L. | Poaceae | Seed |  |
| Ah   | Oxalis debilis Kunth | Oxalidaceae | Leaf | Das and Hazarika 2015 |
| Ah   | Peperomia pellucida (L.) Kunth | Piperaceae | Leaf |  |
| Ah   | Persicaria chinensis (L.) H.Gross | Polygonaceae | Leaf |  |
| Bo   | Persicaria glabra (Willd.) M.Gomez | Polygonaceae | Leaf |  |
| Ah,Mi | Persicaria hydropiper (L.) Delarbre | Polygonaceae | Leaf |  |
| Mi   | Persicaria microcephala (D.Don) H.Gross | Polygonaceae | Leaf |  |
| Ah   | Persicaria perfoliata (L.) H.Gross | Polygonaceae | Leaf |  |
| Ah   | Phyllanthus fraternus G.L.Webster | Phyllanthaceae | Leaf | Basumatary and Gogoi 2014; Basumatary and Gogoi 2014; Senapati and Gurumayum 2016; Bhuyan and Rajak 2019 |
| Ah   | Physalis angulata L. | Solanaceae | Leaf |  |
| Ah,Mi | Piper betle L. | Piperaceae | Leaf |  |
| Ah   | Piper longum L. | Piperaceae | Leaf |  |

Note: The table above lists various plants used for preparing traditional alcoholic beverages, along with their family, part(s) used, and references. The codes (Ah, Mi, Bo) indicate the order of the plants listed.
| Ah  | *Piper nigrum* L.                         | Piperaceae      | Juluk (A)                       | Leaf | PB 1025; TG 1125 | Hazarika 2015; Senapati and Gurumayum 2016; Bhuyan and Rajak 2019 |
|-----|-----------------------------------------|-----------------|--------------------------------|------|-----------------|---------------------------------------------------------------|
| Ah  | *Piper* sp.                             | Piperaceae      | Auni pan (A)                   | Leaf | TG 1126         | -                                                             |
| Ah  | *Plantago asiatica* L.                  | Plantaginaceae  | Hinga pat (A)                  | Leaf | TG 1161         | -                                                             |
| Ga  | *Plumbago zeylanica* L.                 | Plumbaginaceae  | Achetra (M)                    | Leaf | JS 011          | Basumary and Gogoi 2014; Basumary et al. 2014; Senapati and Gurumayum 2016; Bhuyan and Rajak 2019 |
| Ah  | *Pogostemon benghalensis* (Burm.f.) Kuntze | Lamiaceae      | Hukloti (A)                    | Leaf | PB 1063         | -                                                             |
| Ah  | *Potentilla indica* (Andrews) Th.Wolf   | Rosaceae        | Gorukhis (A)                   | Leaf | PB 1058         | -                                                             |
| Ah  | *Pouzolzia zeylanica* (L.) Benn. (Vahl) B.Hansen | Urticaceae     | Boralibakua (A)                | Leaf | PB 1047         | -                                                             |
| Ah  | *Pseuderanthemum latifolium* (M)        | Acanthaceae     | Athutangana/Hohakoniya/Pastel flower (A) | Leaf | TG 1162         | -                                                             |
| Ah, Mi | *Psidium guajava* L.                | Myrtaceae       | Madhuri (A)                    | Leaf | CM 107; BG 013; PB 1041; TG 1128 | Deori et al. 2007; Baruah et al. 2010; Deka and Sarma 2010; Das et al. 2012; Pawe and Gogoi 2013; Bhuyan and Baishya 2013; Gogoi et al. 2013; Das and Hazarika 2015; Senapati and Gurumayum 2016; Das 2016; Bhuyan and Rajak 2019; Goswami 2020 |
| Ah  | *Psychotria* sp.                        | Rubiaceae       | Pani mudoi/Pani-moori (A)      | Leaf | BG 001; PB 1023; TG 1163 | -                                                             |
| Ah  | *Rotheca serrata* (L.) Steane & Mabb.   | Lamiaceae       | Nangalvonga (A)                | Leaf | TG 1164         | Das 2016                                                     |
| Ah  | *Rubus moluccanus* L.                   | Rosaceae        | Jetelipoka (A)                 | Leaf | PB 1036; TG 1130 | Bhuyan and Rajak 2019                                       |
| Ah  | *Rubus* sp.                             | Rosaceae        | Jetelipoka (A)                 | Leaf | TG 1131         | -                                                            |
| Ah, Bo | *Saccharum officinarum* L.              | Polygonaceae    | Lo baruah (A)                  | Leaf | JB 023; TG 1165 | Deori et al. 2007; Baruah et al. 2010; Deka and Sarma 2010; Das et al. 2012; Pawe and Gogoi 2013; Bhuyan and Baishya 2013; Gogoi et al. 2013; Das and Hazarika 2015; Senapati and Gurumayum 2016; Bhuyan and Rajak 2019 |
| Ah, Bo, Mi | *Scoparia dulcis* L.                | Plantaginaceae  | Senibon/Senigutigoch/Bon tulokhi/Modhumehari (A), Juluk bon (M), Dongfangrakheb (B) | Leaf, Young shoot | BG 014; PB 1022; JB 022; CM 112; JS 2348; TG 1132 | Deori et al. 2007; Saikia et al. 2007; Baruah et al. 2010; Deka and Sarma 2010; Kardong et al. 2012; Das et al. 2012; Pawe and Gogoi 2013; Gogoi et al. 2013; Bhuyan and Baishya 2013; Basumary et al. 2014; Basumary and Gogoi 2014; Brahma et al. 2014; Senapati and Gurumayum 2016; Das 2016; Handique and Deka 2016; Bhuyan and Rajak 2019 |
| Ah  | *Selaginella* sp.                       | Selaginellaceae | Khunkhunidheki (A)             | Leaf | TG 1133         | -                                                            |
| Ah  | *Sida rhombifolia* L.                   | Malvaceae       | Hoonbarial (A)                 | Leaf | PB 1053         | Bhuyan and Baishya 2013; Senapati and Gurumayum 2016; Nath et al. 2019 |
| Ah  | *Smilax ovalifolia* Roxb. ex D.Don       | Smilacaceae     | Tikonibaruah (A)               | Leaf | PB 1028; TG 1134 | -                                                            |
| Ah  | *Soemmerni laxiflora* (DC.) H.Ohashi & K.Ohashi | Fabaceae       | Beoni-haputa/Beonihabota/ULutak hot (A) | Leaf | BG 007; TG 1166 | Baruah et al. 2010                                           |
| Page | Solanum americanum Mill. | Solanaceae | Loskosi (A) | Leaf | PB 1055 | - |
|------|-------------------------|------------|-------------|------|---------|---|
| Ah   | Solanum nigrum L.       | Solanaceae | Bhekuri (A) | Leaf | PB 1065 | - |
| Ah   | Solena heterophylla Lour. | Cucurbitaceae | Belipoka, Ghukusmoi (A) | Leaf | TG 1167 | Kardong et al. 2012; Gogoi et al. 2013; Pawe and Gogoi 2013; Senapati and Gurumayum 2016 |
| Ah   | Spathenicola trilobata (L.) Pruski | Asteraceae | Bhringraj (A) | Leaf | TG 1135 | - |
| Ah   | Spondias pinnata (L.f.) Kurz | Anacardiaceae | Omora (A) | Leaf | PB 1067 | - |
| Ah   | Stellaria media (L.) Vill. | Caryophyllaceae | Morolia (A) | Leaf | PB 1049 | - |
| Ah   | Stenochlaena palustris (Burm.f.) Bedd. | Aspleniaceae | Dhekia loti (A) | Leaf | PB 1032; TG 1136 | - |
| Ah, Mi | Stephensia rotunda Lour. | Menispermacae | Hortubukilota/Tubukilota (A), Nginti (M) | Leaf | PB 1024; CM 114; TG 1093 | - |
| Ah   | Stixissuaveolens (Roxb.) Baill. | Resedaceae | Madhoimalati (A) | Leaf, Root | TG 1129 | - |
| Ah   | Strebus asper Lour. | Moraceae | Houra pat (A) | Leaf | TG 1137 | Das 2016; Goswami 2020 |
| Ah   | Tetraceras sarmentosa (L.) Vahl | Dilleniaceae | Otu lata (A) | Leaf | TG 1168 | - |
| Ah, Bo, Mi, Ga | Thelyptis parasitica (L.) Tardeu | Aspleniaceae | Bihlongoni (A), Sarath (G), Dinghka (B) | Frond | PB 1029; BG 006; JS 013; JB 028; TG 1081; CM 109 | Pawe and Gogoi 2013 |
| Ah   | Thunbergia grandiflora (Roxb. ex Rottler) Roxb. | Acanthaceae | Hetaloti/Kauri thutialota (A) | Leaf | TG 1139 | - |
| Ah, Mi | Tinospora cordifolia (Willd.) Hook.f. & Thomson | Menispermacae | Amrita (M), Hogunilota (A) | Leaf | JS 008; PB 1064 | - |
| Ah   | Vitex negundo L. | Lamiaceae | Posotia (A) | Leaf | PB 1066 | Senapati and Gurumayum 2016 |
| Ah   | Zanthoxylum nitidum (Roxb.) DC. | Rutaceae | Tezmui/Tezmoori (A) | Leaf, Root | BG 015; TG 1140 | Tanti et al. 2008; Baruaah et al. 2010; Kardong et al. 2012; Pawe and Gogoi 2013; Senapati and Gurumayum 2016; Handisque and Deka 2016; Bhuyan and Rajak 2019 |
| Ah   | Zingiber officinale Roscoe | Zingiberaceae | Ada (A) | Leaf | TG 1141 | Desri et al. 2007; Pawe and Gogoi 2013; Senapati and Gurumayum 2016; Bhuyan and Rajak 2019 |