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MEDICINAL PLANTS USED IN RICE BEER STARTER CULTURE BY DIFFERENT TRIBES IN ASSAM: AN ETHNOBOTANICAL SURVEY

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ABSTRACT: The study represents the ethnobotanical information of the medicinal plants used by the six major communities of Assam, namely *Mishing*, *Deori*, *Ahom*, *Tiwa*, *Bodo* and *Rabha*, for better understanding of their local beliefs, customs, and tradition in the preparation of traditional rice beer starter culture. A semi-structured questionnaire was used focusing on the local names of the plants used in a starter culture, parts used, the reason for their use in the preparation, and other medicinal properties. A total of thirty-six plants were found to be used in the preparation by the *Mishing* community, twenty-seven plants by the *Ahom* community, thirteen plants by the *Deori* community, twenty plants by the *Tiwa* community, and seven plants by *Bodo* and *Rabha* communities for their respective starter cultures. A total of fifty-one plants were documented from the study, many of which were commonly used by all the communities to prepare rice beer starter culture and in their traditional health care system for curing many diseases. There is a dearth of information on the efficacy of the plants used in the starter culture preparation by different communities. Therefore, this ethnobotanical survey can help scientists and researchers identify plants with medicinal properties that may be useful in developing new drugs.

INTRODUCTION: Traditional alcoholic beverages constitute an integral part of the dietary culture among the tribal communities residing within the North-Eastern states of India since ancient times. This beverage plays an important role in the socio-cultural life of the community as it is associated with many occasions like religious rituals, functions and festivals, marriages, and even death ceremonies [1]. The process of preparing the rice beer is considered sacred to women folks.

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Among all the communities, women folk actively prepare the traditional drink as they possess vast knowledge of the plants used in preparing the starter culture [2]. All have their specific ingredients for preparing the starter culture, which is slightly different even though the process remains almost the same. The starter culture plays an important role in the fermentation of rice beer.

Each community uses different herbs and plant parts and believes each of these plants contains a unique medicinal property, making rice beer an important drink for social gatherings [3]. Reports suggest that the rice beer starter culture has some antioxidant and fibrinolytic properties, making it freely consumable. It helps maintain the community's good health by preventing and curing many diseases. Researchers reported that rice beer

prepared by different communities contains good amounts of protein, carbohydrate, and free amino acids with phytochemicals, high antioxidant activity, and a negligible cytotoxic effect [4].

It is believed to be effective against insomnia, headache, body ache, inflammation, diarrhea, urinary problems, and expelling worms as a treatment of cholera. It is also believed to be effective against amoebiasis, acidity, vomiting; and it helps reduce cholesterol and endocrine function. Furthermore, it alters and maintains the gut microflora [5, 6]. So, proper use of the traditionally prepared rice beer may act as a source of medication as the indigenous people have used it, and it can be served to the people of other parts of the country too. The various plants used in the starter culture are also said to have many medicinal properties apart from imparting colour, flavour and sweetness to the beer [7]. The variety of plants provides nutrients to the microflora, thus improving the quality of rice beer. Nutrients in the finished product give energy besides its soothing effect and other medical properties to the consumer. The antioxidant activities of the plants used in starter culture cakes indicate that these plants are a good source of antioxidants which could be due to the presence of high polyphenol, alkaloids, and flavonoids [8, 9, 10].

MATERIALS AND METHODS:

Study Area: The ethnobotanical survey was conducted in selected rural villages of Sibsagar, Nagaon, and Bongaigaon districts of Assam for listing and a better understanding of local beliefs and habits regarding the use of medicinal plants in the rice beer starter culture preparation.

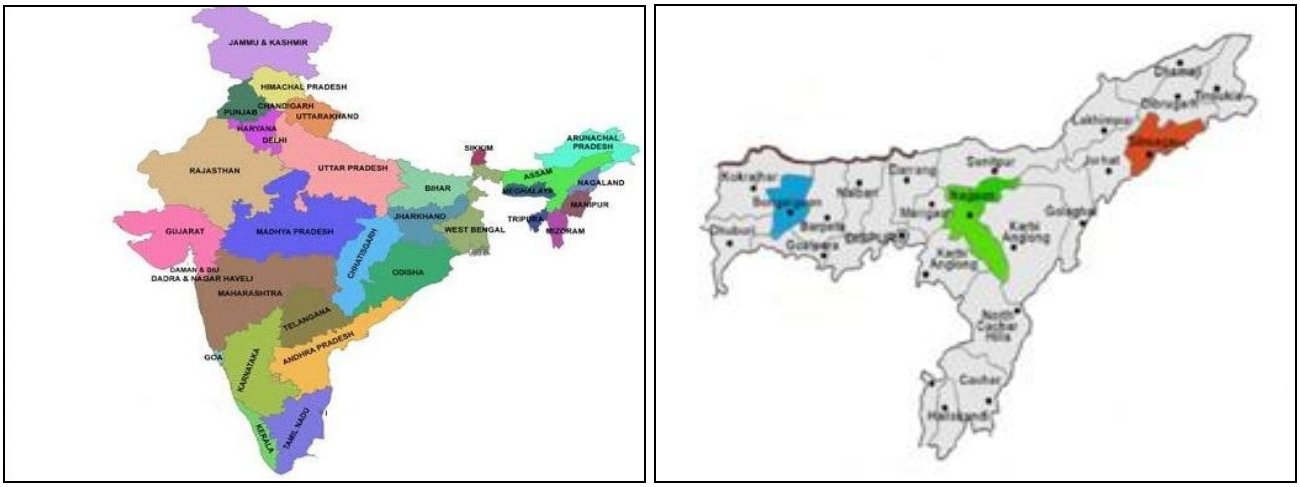

FIG. 1: MAP OF INDIA AND ASSAM SHOWING THE STUDY AREA

Three districts were purposively selected for the field survey based on communities predominantly residing in those areas. In a village, the households which prepare the starter culture are very limited. Therefore, prior information was taken to decide the households which could give information about the starter culture. The data have been collected from Sibsagar district for *Mishing*, *Deori,* and *Ahom* communities, Nagaon district for *Tiwa* community and Bongaigaon district for *Bodo* and *Rabha* community.

Ethnobotanical Data Collection: For collecting the information, rapports were made with the village heads, elderly men, and women, and prior informed consent was taken from the participants of the study who are predominantly involved in the process of preparing the starter culture. The field survey was conducted through a semi-structured questionnaire and group discussion with aged and experienced local women to get knowledge about the preparation of rice beer starter culture and the medicinal plants used in the preparation by the selected communities. The data collection technique also included village walks and walk along forest transects with a local person to identify and collect the plant samples.

Plant Collection and Taxonomic Identification: The plant parts were collected from nearby fields and forests with the help of local people and kept in sealed plastic packets. These samples were then dried, pressed, and preserved to make a herbarium following the guidelines given by Anderson (1999).

The taxonomist, Department of Agronomy, Assam Agricultural University, Jorhat, further identified and authenticated these plant samples.

RESULT AND DISCUSSION: The present study was primarily aimed at investigating the plants used by the villagers for the preparation of traditional rice beer starter culture. A total of six major communities of Assam were selected for documentation of plant materials used by them in starter culture preparation. The information was gathered through a household survey by interacting with the villagers of the selected districts using a semi-structured questionnaire. The survey was conducted in the predetermined villages of Sibsagar, Nagaon, and Bongaigaon districts to better understand local beliefs, customs, traditions, etc., in the choice of plants for starter culture preparation.

The preparation methods for both the starter culture and rice beer were almost similar for most of the communities in all the districts as detailed in **Fig. 2.**

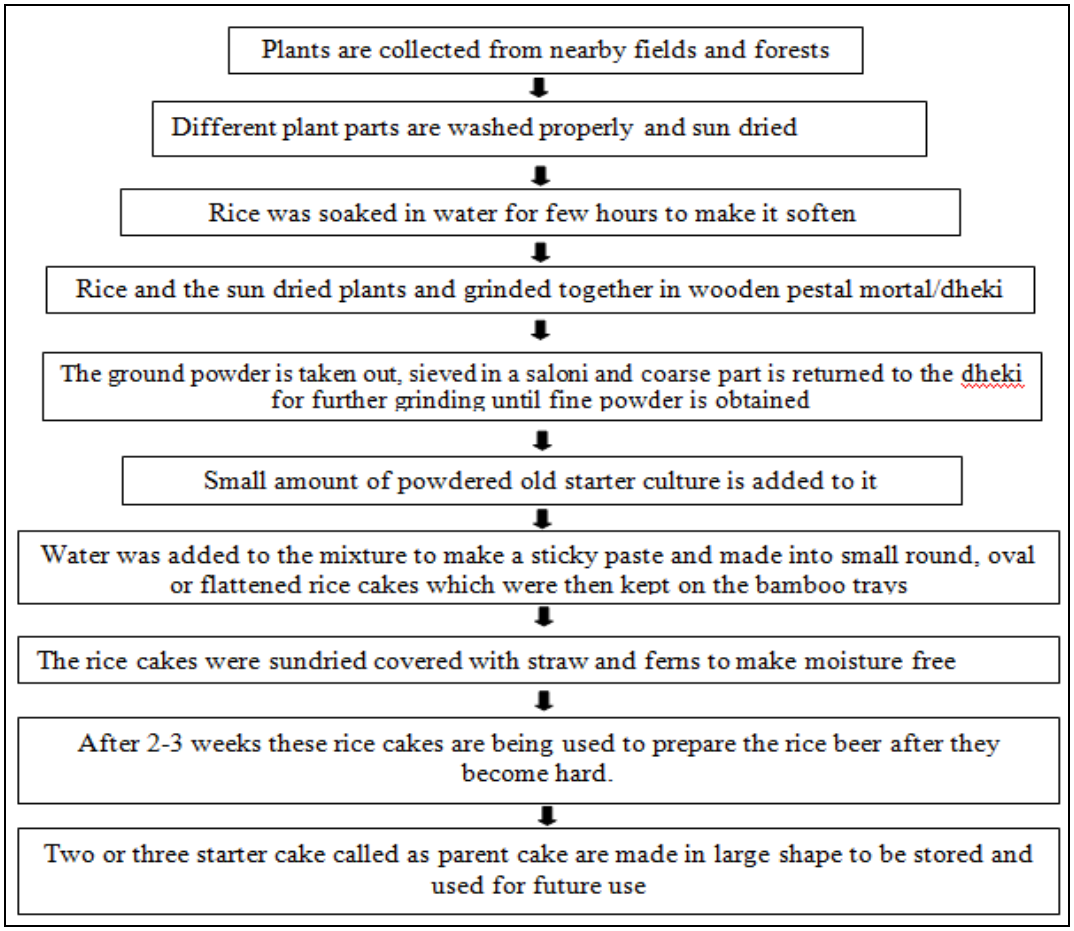

FIG. 2: THE METHOD OF PREPARATION OF STARTER CULTURE

Collection of Ethnomedicinal Information: Traditional medicinal knowledge of using local herbs and medicinal plants has been a part of therapeutic practices worldwide since time immemorial [11]. Documentation of indigenous knowledge of medicinal plants is important for preserving the traditional knowledge before it diminishes with knowledgeable people so that plants can be conserved and sustainably managed and utilized by the local communities [12]. Various indigenous ethnic tribes of Assam have rich indigenous knowledge regarding agriculture, food, medicine, and natural resources. This has led to a diverse cuisine comprising their methods of preparing fermented and non-fermented ethnic foods and alcoholic beverages [13, 14]. In the present study, it was observed that even though the method of preparation for the rice beer starter culture is the same for most of the tribes in Assam, the most important difference contributed by the plants which are being used in the preparation of the starter culture. These plants varied concerning

communities and areas to which they belonged. However, due to rapid afforestation and human habitation, these valuable plants are now unavailable in abundance, thus compelling the users to prepare the culture with fewer plants. Detail array of plants, along with their local and scientific names, family, and plant parts used, the purpose for using it in the starter culture preparation, and other medicinal properties, are recorded and presented in **Tables 1** to **6.**

TABLE 1: PLANTS USED IN THE PREPARATION OF STARTER CULTURE *OPO PITHA* BY *MISHING* COMMUNITY

S. no.	Local name	Botanical Name	Family	Parts used	Reason for using in the starter culture	Other medicinal claims
1	Ahom phool	*Justicia gendarussa*	Acanthaceae	Leaf	Provide bitterness	Asthma, the juice is used to treat ear pain
2	Baagh bon	*Chromolaena odorata*	Asteraceae	Leaf	For medicinal properties	Wound healing property, snake bite
3	Bonoriya dhekia/kopou dhekia	*Lygodium japonicum*/ L. Flexuosum	Lygodiaceae	Frond	Provides stickiness to the rice beer	Helps to treat Jaundice
4	Bonoriya tezpaat	Cinnamomum bejolghata	Lauraceae	Leaf	Adds flavor to the rice beer	Used as a spice, aids in digestion
5	Bor Bonjaluk /chenibon /jaluk bon	Scoparia dulcis	Scrophulariacea	Aerial parts	Imparts sweetness and increases concentration of; othe rice beer	Wound healing property, kidney stone, digestive problems, fever
6	Bor manmuni	*Centella asiatica*	Apiaceae	Whole lant	For medicinal properties	The juice or paste of the plant is taken to cure stomach pain, diarrhea and fever
7	China lota	*Mikania micrantha*	Asteraceae	Leaf	For medicinal properties	It exhibits wound healing property, useful in treating skin rashes
8	Dalchini	*Cinnamomum zeylanicum*	Lauraceae	Leaf	Adds flavor to the rice beer	treat cold, helps relieve vomiting
9	Durun bon	*Leucas indicus*	Lamiaceae	Aerial part	Increase concentration	Used in lack of appetite, sinusitis, stomach complaints, and headache, Roots are used to treat pneumonia, swellings
10	Horu manimuni	*Hydrocotyle sibthorpioides*	Araliaceae	Whole lant	It increases the concentration of the beer	Used to treat throat pain, bone healing, digestive, diuretic and vermifuge, and menstrual problems.
11	Jolokia	*Capsicum annum*	Solanaceae	Fruit	To ward off the evil forces, thus increasing the quality of the end product.	Better digestion
12	Jomlakhuti	*Costus speciosus*	Costaceae	Leaf	Gives bitterness but cooling effect to rice beer	Treats body ache
13	Makhioti	*Flemingia srobilifera*	Fabaceae	Root	For medicinal properties	Body-ache
14	Kenya bon /bon jaluk	*Polygonum plebium*	Polygonaceae	Whole plant	For medicinal properties	Helps to stop bleeding
15	Kopou lota	*Ipmoea pentaphylla*	Convolvulaceae	Leaf	Not known	-
16	Kuhiar	*Saccharum officinarum*	Poaceae	Leaf	Imparts sweetness	Helps to recover dehydration
17	Laijabori	*Drymaria cordata*	Caryophyllaceae	Leaf and tender stem	For medicinal benefits	Helps to cure sinusitis, to treat aching, inflamed, or painful parts
18	Letaguti / Yene dobin	*Caesapinia bondac*	Casealpinia boduc (L) Roxb	Leaf	Provides stickiness	Helps to cure fever, Body pain
19	Maarchang	*Spilanthes calva*	Spilanthes	Leaf	For intoxication	Given in toothache, has strong

			acmella (L.)			local anesthesia effect
20	Kothal	*Artocarpus heterophyllus*	Moraceae	Leaf	Imparts sweetness, Better taste, flavor, and gives yellow colour.	-
21	Modhuri	*Psidium guajava*	Myrtaceae	Tender Leaves	Provide flavor	Used to cure diarrhea, dysentery, helps to lose weight and prevents hair fall
22	Naming goying	*Ageratum loustonianum*	Asteraceae	Leaf	Not known	-
23	Noga maangmit	*Nelsonia sp*	Acanthaceae	Leaf	Not known	-
22	Naming goying	*Ageratum loustonianum*	Asteraceae	Leaf	Not known	-
23	Noga maangmit	*Nelsonia sp*	Acanthaceae	Leaf	Not known	-
24	Okolbeer/ Okolbih	*Clerodendrum indicum*	Lamiaceae	Leaf	One of the most potent sources of intoxication	Leaf juice is used to treat skin complaints
25	Oksi koksi	*Phylla nodiflora*	Verbenaceae	Leaf	Not known	-
26	Paarvate	*Mazus rugosus*	Mazaceae	Leaf	-	Helps in the treatment of typhoid, sinusitis
27	Pipli paan	*Piper longum*	Piperaceae	Leaf	Gives a better taste to the rice beer.	Acts as antibiotic, stomachache, heartburn, and indigestion
28	Posotiya	*Vitex negundo*	Lamiaceae	Leaf	Concentration	Body- ache, joint pain, ear pain
29	Pothar bihlongoni	*Polygonum hydropiper*	Polygonaceae	Tender twigs, Leaf and stem	The most potent among all the plants used in the starter culture, and increases intoxication.	Used to treat Jaundice, toothache, rheumatism, and gout
30	Raam naam	*Naravelia zeylanica*	Ranunculaceae	Twig	Gives bitter taste	Helps to treat fever
31	Rukji	*Sphaerostepher as unitus*	Thelypteridaceae	Frond	It increases the concentration or strength of the beer. also, act as an antibacterial for the starter culture	Used in the treatment of fever, body ache
32	Tezmui/ Rikom	*Zanthoxylum nitidum*	Rutaceae	Leaf	Gives good flavor to the rice beer	Helps to treat broken bone, toothache, body-ache, stomachache, pneumonia, tonsillitis, gall bladder, tumour, and snake bites
33	Titaphool	*Phlogacanthus curviflorus*	Acanthaceae	Leaf	Leaves a bitter taste in the rice beer	Used to treat cold and cough
34	Halodi	*Curcuma domestica*	Zingiberaceae	Leaf	Provide aroma and flavour to the rice beer	-
35	Bon tuloxi	*Elsholtzia blanda*	Lamiaceae	Leaf	Important flavor ingredient	Protect against cough and cold
36	Ta:sinpusin /jetulipoka	*Rubus hexagynous*	Rosaceae	Leaf	Provides medicinal benefits	ulceration of mouth and tongue

Mishing Community: Rice beer produced by Mishing community residing in Sibsagar district called Apong is prepared at home by fermenting rice with the help of the starter culture, *Opo Pitha/Apob*. They drink this traditional rice beer on a regular basis and believe that it causes no harmful effect in their body when consumed at a limit rather it helps them to cool down after a daylong hard work. *Apong* is also served as a welcome drink to the guests on various social occasions and is considered a matter of pride to the host family. Two types of *Apong* namely *Nogin Apong* prepared from the same type of starter culture following the traditional method, and *Poro apong* is prepared from cooked rice and ashes made of rice husk and rice straw that gives it a characteristic brown colour. *Poro apong* is also known as *Chai mod.* From **Table 1,** it can be observed that a total of thirty-six plants are found to have been used in the preparation of the starter cake by *Mishing*

community residing in Sibsagar district of Assam. According to this community, the plants included in the starter culture have various therapeutic properties. Thus, they make the rice beer suitable for various social functions and religious festivals.

***Ahom* Community:** Fermented rice beer prepared by *Ahom* community, commonly known as *Haaj or Laopani* is a very aromatic, sweet, and highly popular beverage of Assam. Their starter culture is called *Haaj Pitha* or *Vekur pitha*. The previous or parent starter culture from which the new starter culture is made is known as *Ghai pitha*. The starter culture is prepared during the two important festivals- *Rongali Bihu* and *Bhogali Bihu*. People usually drink this ricebeer in a community religious function called *Haaj'r hokam* and preparing this drink is considered a sacred activity.

Haajhas a property of hallucination, and various plants are added to it that contribute to the drink's overall flavor. It was observed from **Table 2** that the *Ahom* community residing in the Sibsagar district used a total of twenty-seven plants in the preparation of the main starter culture, the *Haaj Pitha* or *Vekur pitha*.

TABLE 2: PLANTS USED IN THE PREPARATION OF STARTER CULTURE *HAAJ PITHA* BY *AHOM* COMMUNITY

S. no.	Local name	Scientific name	Family	Parts used	Reason for using in the starter culture	Other medicinal claims
1	Aathiya kol	*Musa balbisiana*	Musaceae	Leaf	To cover the fermented rice	-
2	Beoni-haputa	*Desmodium laxiflorum*	Fabaceae	Leaf	Stickiness and increased Concentration	-
3	Bihlongoni	*Sphaerostepheras unitus*	Thelypteridaceae	Leaf and stem	Makes the drink harsh	Relieves pain
4	Bon tuloxi	*Elsholtzia blanda*	Lamiaceae	Leaf	Believes to be responsible for the smell of end product	Protect against cough and cold
5	Bonoriya dhekia/kopou dhekia	*Lygodium japonicum/ L. flexuosum*	Lygodiaceae	Frond	Provides stickiness to the rice beer	Helps to treat Jaundice
6	Bor manmuni	*Centella asiatica*	Apiaceae	Whole plant	Provides medicinal benefits	Stomach pain, diarrhea, and fever
7	Chenibon	*Scoparia dulcis*	Scrophulariacea	Leaf and twig	Imparts sweetness to the rice beer	Believes to treat kidney stone, skin disorders, hypertension,
8	Duroon bon	*Leucas aspera*	Lamiaceae	Aerial part	Increase concentration	The juice is useful in sinusitis, stops bleeding of the nose
9	Horu manimuni	*Hydrocotyle sibthorpioides*	Araliaceae	Whole plant	It increases the concentration of the beer	Used to treat throat pain, bone healing, acts as a digestive, diuretic and vermifuge and menstrual problem
10	Hunborua	*Pachystachys lutea*	Acanthaceae	Root	Provides medicinal benefits	To treat pneumonia
11	Jaluk	*Piper nigrum*	Piperaceae	Leaf and seeds	Increase concentration	Treat cough and cold
12	Jetulipoka	*Rubus hexagonus*	Rosaceae	Leaf	Provides medicinal benefits	Ulceration of mouth and tongue
13	*Jukloti/ makhioti*	*Flemingia srobilifera*	Fabaceae	Root	To add bitterness	Body-ache
14	Kenya bon	*Polygonum plebium*	Polygonaceae	Whole plant	Provides good aroma	Not known
15	Kopou dhekia	*Lygodium japonicum/ L. flexuosum*	Lygodiaceae	Frond	Provides stickiness to the rice beer	Treatment of Jaundice
16	Kothal	*Artocarpus heterophyllus*	Moraceae	Leaf	Imparts sweetness, Better taste, flavor, and	-

					gives yellow colour.	
17	Kuhiar	*Saccharum officinarum*	Poaceae	Leaf	Imparts sweetness	-
18	Laijabori	*Drymaria cordata*	Caryophyllaceae	Leaf and tender stem	For medicinal benefits	Helps to cure sinusitis, the juice is applied to treat snake bite
19	Modhuri	*Psidium guajava*	Myrteacea	Leaf	Flavour	Diarrhea and dysentery
20	Paatihuta	*Cinnamomum bejolghota*	Lauraceae	Leaf	Adds a sweet flavor to the rice beer	Aids in digestion
21	Pani-madhuri	*Acanthus leucostachys*	Acanthaceae	Leaf	Flavour	-
22	Posotia	*Vitex negundo*	Lamiaceae	Leaf	Provides medicinal benefits	Fever, body- ache, joint pain, ear pain, treatment of Jaundice, wounds, asthma, eye pain, and migraine.
23	Pothar bihlongoni	*Polygonum hydropiper*	Polygonaceae	Tender twigs, Leaf, and stem	The most potent among all the plants used in the starter culture, and increases intoxication.	Acts as antibacterial
24	Suhoni	*Spilanthes calva*	*Spilanthes acmella* (L.)	Leaf	Intoxication	Given in toothache, has strong local anesthesia effect
25	Sura	*Grewia optiva*	Malvaceae	Leaf	Flavour	-
26	Tezmui	*Zanthoxylum nitidum*	Rutaceae	Leaf	Adds flavor to the rice beer	Wound healing property
27	Titabahek	*Justicia gendarussa*	Acanthaceae	Leaf	Bitterness	Asthma and ear pain

***Deori* Community:** The rice beer prepared by the *Deori* community is known as *Sujen* and the starter culture is known as *Mod Pitha*. Just like *Mishing* community, this drink is also regarded as a matter of pride to the host family to serve as a welcome drink to the guests on various social occasions. *Sujen* plays a vital role in the socio-cultural life of the *Deori* tribe. No festivals such as *Bhogali Bihu, Rongali Bihu,* and religious ceremonies, including birth and marriage functions, are celebrated without *Sujen* in a *Deori* household. As usual, the *Deori* community prepares starter culture in two seasons (September-October and February-March) in a year. The weather is considered ideal for preparing starter culture during this period. **Table 3** depicts that a total of thirteen plant species were observed to have been used by the *Deori* community to prepare rice beer starter culture in the study area.

TABLE 3: PLANTS USED IN THE PREPARATION OF THE STARTER CULTURE *SUJEN PITHA, CHUZAE-PITHA,* OR *MOD PITHA* BY *DEORI* COMMUNITY

S. no.	Local name	Botanical name	Family	Parts used	Reason for using in the starter culture	Other medicinal claims
1	Bihlongoni	*Sphaerostephe ras unitus*	Thelypteridaceae	Leaf	Increases concentration	-
2	Bor manmuni	*Centella asiatica*	Apiaceae	Whole plant	For its medicinal values	Stomach pain, diarrhea, and fever
3	Chatiana	*Alstonia scholaris*	Apocynaceae	Leaf	For medicinal purpose	Helps to treat malaria fever
4	Chenibon	*Scoparia dulcis*	Scrophulariaceae	Aerial part	Imparts sweetness to the rice beer,	Used to treat hemorrhoids, diarrhea, dysentery,
5	Chon-chia	*Saccharum officinarum*	Poacea	Leaf	Imparts sweetness	Jaundice
6	Jom lakhuti	*Coitus speciosus*	Costaceae	Leaves	Gives bitterness but cooling effect to rice beer	Used to treat hepatitis kidney stone
7	Kolpaat	*Musa balbisiana*	Musacea	Leaf	To cover the fermented rice	-

8	Kothal	*Artocarpus heterophyllus*	Moraceae	Leaf	Imparts sweetness, flavor, and gives yellow colour.	-
9	Kotow chira	*Cinnamomum bejolghata*	Lauracea	Leaf	For adding flavor	Helps in digestion
10	Lai-jabori	*Drymaria cordata*	Caryophyllaceae	Arial part	Acts as a cooling agent.	The juice is used to treat sinus
11	Modhuri paat	*Psidium guajava*	Myrtaceae	Tender eaves	Provide flavor	Used to cure diarrhea and dysentery
12	Tesmuri	*Zanthoxylum nitidium*	Rutaceae	Leaf	Gives good flavor to the rice beer.	helps to treat broken bones, toothache, and body-ache
13	Ziziring-lota	*Selaginella sp.*	Selaginellaceae	Leaf	To make the drink light	-

***Tiwa* Community:** Rice beer and the starter culture prepared by the *Tiwa* community are known as *Zu/Chu* and *Bakhor*, respectively. The present study observed twenty plants that are used in the preparation of starter culture "*bakhor*" by the selected *Tiwa* community. *Tiwa* community prefers rice beer as a medicinal drink to cure and prevent disease conditions like fever, body ache, headache, urinary infection, *etc*. According to them, each plant added to the starter cake claim different medicinal properties which strengthen rice beer as a tonic. This rice beer starter culture not only possesses the property to cure human diseases but also acts as a curative for cattle. The medicinal concoction called *Juguli*, which is given as a tonic to the bulls, promotes body strength and is also effective for the leg swelling of cattle [14]. In a recent study, Goswami, (2020) identified eight plants from different plant families along with their medicinal use in the preparation of the starter culture. *Justicia Betonica, Polipodiumsp Saccharum, Solanum indicum, Tabernaemonta nacoronaria, Phlogocanthust hysiflorus, Leucus aspera,* and *Streblus asper* are some of the plants found to be identical to the plants documented in the present study [15].

***Bodo* Community:** Rice beer prepared by the *Boro* communities of Assam is known as *Jou bishi*/*Jumai*. The starter culture used to prepare *Jou* is locally known as *Angkur, Amao* or *Emao*. The *Bodo* special rice beer *Jumai* is considered one of the strongest rice beers in Assam as claimed by the community. This was also stated in a previous study by Basumatary and Gogoi, (2014) [16, 17]. The community prepares rice beer starter culture by using merely seven plant species in the surveyed village. However, the present study is similar to the study carried out by Basumatary and Gogoi, (2014), who listed eight plant species, such as *Ananas comosus* (L). *Musa balbiciana Colla*, *Artocarpus heterophyllus, Scoparia dulcis, Clerodendrum viscosum, Plumbago zeylanica, Polygonum glabrum, Cyclosorus dentatus* are considered essential for the preparation of rice beer starter culture [18].

***Rabha* Community:** The *Rabhas* prepare rice beer in their traditional way, commonly known as *Jonga mod* or *Kecha mod*. The starter cake, known as *surachi* or *phap* is made of several plant species. The study found them to use seven plant species to prepare *phap*, the starter culture. The survey conducted by Bhuyan and Baishya in 2013 in Goalpara district observed ten plant species for preparing starter culture, including *Artocarpus heterophyllus*, Calotropis gigantean, *Capsicum annuum, Clerodendrum viscosum, Piper nigrum, Saccharum officinarum, Scoparia dulcis,* and *Sida rhombifolia* [19]. Deka and Sharma, (2010) have documented ten plant species used in the preparation of *Phap*, including *Ananas comosus, Artocarpus heterophyllus, Calotropis gigantean, Capcicum fructescens, Cleodendrum viscosum, Dennstaedtia scabra, Ochthochloa coracana, Plumbago indica,* and *Saccharun officinarum* [20]. Most of the plants were similar, as reported in the present study. It was observed that the *Mishing* community used the highest number of plant species, followed by the *Ahom, Deori, Tiwa, Bodo,* and *Rabha* communities in the selected villages to prepare rice beer starter culture. The present study reveals that the plant parts used to prepare rice beer starter culture have several medicinal properties reported to be used in traditional healing and remedies against various diseases by the respective

communities. In earlier days more than a hundred plants were being used by different communities. Still, due to deforestation and climatic changes, the plants used in the starter culture have been reduced drastically. It has also been believed to affect rice beer's flavor and medicinal properties. All the selected communities in the present study were found to depend on traditional medicine for their primary healthcare and treatment of various ailments. They have gathered excellent knowledge through the experience of being constantly associated with forest-based resources over many generations. They prefer natural methods of disease treatment through various herbs and plant parts. In the present study it was recorded that all the plant species enumerated in **Tables 1** to **6** are used in the treatment of different ailments like Gastrointestinal ailments (constipation, diarrhoea, dysentery, digestive complaints, gastric problems, indigestion and stomach troubles, stomach ulcer, piles), Respiratory system disorders (asthma, bronchitis, and chest pain, cough, throat pain, sinusitis, respiratory and breathing problems, sore mouth, tonsillitis, and throat trouble), Inflammatory problems (relieve pains and swellings, back pain, muscular pain, swollen joints), Urinary ailments (urinary problems, infection and renal stone), Cardiovascular diseases (hypertension, heart problem), Dermatological problems (boils, pimples, ringworm, scabies, skin diseases, smallpox of children), First aids (antiseptic, bruises, wounds, burns, cuts and injuries), Endocrinology problems (controlling diabetes), Bone fracture, Tonic (liver tonic, Jaundice, heart disease, kidney tonic), *etc*. These plants are either consumed or applied externally in the form of powder or leaf extracts.

TABLE 4: PLANTS USED IN THE PREPARATION OF STARTER CULTURE *BAKHOR* BY *TIWA* COMMUNITY

S. no.	Local name	Scientific name	Family	Parts used	Reason for using in the starter culture	Other medicinal claims
1	Ayekson/ Titaphool	*Phlogacanthus curviflorus*	Acanthaceae	Leaf	Leaves a bitter taste in the rice beer	Used to treat cold and cough
2	Bahka tita	*Phlogocanthus thysiflorus (Roxb.)*	Acanthacea	Flower	Leaves a bitter taste in the rice beer	Used in throat infection
3	Bih dhekia	*Sphaerostepheras unitus*	Thelypteridaceae	Frond	Prevents spoilage and increases the concentration of the beer.	Used in the treatment of fever, also act as an antibacterial for the starter culture.
4	Bihu gos	*Clerodendrum infortunatum*	Lamiaceae	Leaf	For medicinal property	Wound healing property.
5	Chenehi bon	*Scoparia dulcis*	Scrophulariaceae	Aerial part	Provides sweetness and concentration	Treat insect bites, anemia, diabetes
6	Durun bon	*Leucas aspera*	Lamiaceae	Aerial part	For medicinal property	The juice is useful in sinusitis, stops bleeding of the nose
7	Gopchoi	*Naravelia zeylanica*	Ranunculaceae	Twig	Gives a bitter taste	Helps to treat fever,
8	Mati-Kothal	*Artocarpus heterophyllus*	Moraceae	Leaf	Imparts sweetness, Better taste, flavor and gives a yellow colour	Not known
9	Kotona phool	*Catharanthus roseus*	Apocynaceae	Leaf	For medicinal property	Reproductive problem
10	Kuhiar	*Saccharum officinarum*	Poaceae	Leaf	Imparts sweetness	Not known
11	Bhim kol	*Musa balbisiana*	Musaceae	Leaf	Imparts sweetness	Not known
12	Mohuwa	*Croton joufra*	Euphorbiaceae	Leaf	Imparts sweetness	Not known
13	Nangal bhanga	*Clerodendrum serratum*	Verbenaceae	Leaf	For medicinal property	Helps in wound healing and Stomach problem
14	Neem	*Azadirachta indica*	Meliaceae	Leaf	For medicinal property	Helps in fighting body-ache
15	Okolbeeh	*Clerodendrum indicum*	Lamiaceae	Leaf	The potent and very important ingredient to prepare Bakhor	Not known
16	Saura	*Grewia optiva*	Malvaceae	Leaf	For medicinal	Not known

					property	
17	Sojina	*Moringa oleifera*	Moringaceae	Leaf	For medicinal property	Dental care
18	Halodi	*Curcuma domestica*	Zingiberaceae	Leaf	Provide aroma and flavour to the rice beer	Used as a vegetable
19	Bon tuloxi	*Elsholtzia blanda*	Lamiaceae	Leaf	Provide aroma and flavour to the rice beer	Protect against cough and cold
20	Jetulipoka	*Rubus hexagonus*	Rosaceae	Leaf	For medicinal property	The ripe fruit is eaten. Used to treat ulceration of mouth and tongue

TABLE 5 PLANTS USED IN THE PREPARATION OF STARTER CULTURE*AMAO/ANGKUR/EMAO* BY *BODO* COMMUNITY

S. no.	Local name	Scientific name	Family	Parts used	Reasons for using in the starter culture	Other medicinal claims
1	Kothal	*Artocarpus heterophyllus*	Moraceae	Leaf	Imparts sweetness, Better taste, flavor, and gives yellow colour.	-
2	Algasita	*Xanthium strumarium*	Asteraceae / Plumbagenaceae	Whole plant	Medicinal property	Acts as a tonic and helps in digestive
3	Sal daokumwi	*Sphaerostepheras unitus*	Thelypteridaceae	Frond	Used to cover the starter cakes while drying.	Pain reliever
4	Bisongali	*Polygonum hydropiper*	Polygonaceae	Young leaves	Increases intoxication.	Helps to relieve body ache
5	Gidir manimuni	*Centella asiatica*	Apiaceae	Whole plant	For medicinal properties	Stomach pain, diarrhea, liver tonic, and fever.
6	Bongfang rakeb	*Scoparia dulcis*	Scrophulariacea	Aerial part	Imparts sweetness to the rice beer.	Believed to treat Kidney stone.
7	Talir kitir	*Musa balbisiana*	Musaceae	Leaf	Used to cover the fermented rice.	-

Researchers investigated the rich ethnomedicinal knowledge of the *Ahom* community of upper Assam and a total of 68 and 136 plant species were recorded, respectively. The recorded species were found to be commonly available and used for the treatment of various problems like cough, fever, headache, body pain, animal bite, heart problem, etc. Different parts of the plants, like seed, leaf, bark, root, etc were found to be used in the form of medicine. Most medicines were prepared as a mixture of other plant products [22]. **Table 7** reveals that all the selected communities use a total of fifty-one plant species in the starter cake preparation. It was reported that out of these fifty-one plants, plants are essential in all types of starter culture, whereas some of the other plants are merely used by only one community. In the present study, while comparing the plants used by *Mishing*, *Ahom*, *Tiwa*, *Bodo*, and *Rabha* communities in Assam, it was found that the plants *Sphaerostepheras unitus, Artocarpus heterophyllus* play a very important role in the preparation of the starter culture in all the communities. *Sphaerostepheras unitus* is used as an antimicrobial agent to stop the starter culture cake from spoilage.

TABLE 6: PLANTS USED IN THE PREPARATION OF STARTER CULTURE *PHAP* BY *RABHA* COMMUNITY

S. no.	Local name	Scientific name	Family	Parts used	Reasons for using in the starter culture	Other medicinal claims
1	Talir kitir /athia kol	*Musa balbisiana*	Musaceae	Leaf	To cover the fermented rice	-

2	Anaros	*Artocarpus heterophyllus*	Moraceae	Leaf	Produces foam	Ash is used to treat diarrhea and stomach ache
3	Algasita	*Xanthium strumarium*	Asteraceae / Plumbagenaceae	Whole plant	For Medicinal properties	The paste is used to cure sinusitis, headache, and ulcer
4	Bor manmuni/Gidir manimuni	*Centella asiatica*	Apiaceae	Whole plant	It increases the concentration of the beer	Stomach pain, diarrhea, liver tonic, and fever.
5	Soru manimuni	*Hydrocotyle sibthorpioides*	Araliaceae	Whole plant	It increases the concentration of the beer	Used to treat throat pain, bone healing, as digestive, diuretic, and menstrual problem
6	Sal daokumwi/ Bih dhekia	*Sphaerostephe ras unitus*	Thelypteridaceae	Frond	Used to cover the starter cakes while drying.	Believed to have antibacterial property
7	Holitita	*Clerodendrum indicum*	Lamiaceae	Leaf	One of the most potent sources of intoxication,	Leaf juice is used to treat skin complaints

TABLE 7: PLANTS USED FOR THE PREPARATION OF STARTER CULTURE BY SELECTED COMMUNITIES OF ASSAM

S. no.	Botanical name	Common name	Mishing	Ahom	Deori	Tiwa	Bodo	Rabha
1	*Acanthus leucostachys*	Pani-madhuri	NU	U	NU	NU	NU	NU
2	*Ageratum loustonianum*	Naming goying	U	NU	NU	NU	NU	NU
3	*Alstonia scholaris*	Chatiana	NU	NU	U	NU	NU	NU
4	*Artocarpus heterophyllus*	Mati Kothal	U	U	U	U	U	U
5	*Azadirachta indica*	Neem	NU	NU	NU	U	NU	NU
6	*Caesapinia bondac*	Letaguti / Yene dobin	U	NU	NU	NU	NU	NU
7	*Capsicum annum*	Jolokia	U	NU	NU	NU	NU	NU
8	*Catharanthus roseus*	Kotona phool	NU	NU	NU	U	NU	NU
9	*Centella asiatica*	Bor manmuni	U	U	U	NU	U	U
10	*chromolaena odorata*	Baagh bon	U	NU	NU	NU	NU	NU
11	*Cinnamomum bejolghata*	Bonoriya tezpaat	U	U	U	NU	NU	NU
12	*Cinnamomum zeylanicum*	Dalchini	U	NU	NU	NU	NU	NU
13	*Clerodendrum indicum*	Okolbeer/ hoilotitata	U	NU	NU	U	NU	U
14	*Clerodendrum infortunatum*	Bihu gos	NU	NU	NU	U	NU	NU
15	*Clerodendrum serratum*	Nangal bhanga	NU	NU	NU	U	NU	NU
16	*Coitus speciosus*	Jom lakhuti	U	NU	U	NU	NU	NU
17	*Croton joufra*	Mohuwa	NU	NU	NU	U	NU	NU
18	*Curcuma longa*	Halodi	U	U	NU	U	NU	NU
19	*Desmodium laxiflorum*	Beoni-haputa	NU	U	NU	NU	NU	NU
20	*Drymaria cordata*	Laijabori	U	U	U	NU	NU	NU
21	*Elsholtzia blanda*	Bon tuloxi	U	U	NU	U	NU	NU
22	*Flemingia srobilifera*	Jukloti/ makhioti	U	U	NU	NU	NU	NU
23	*Grewia optiva*	Saura	NU	U	NU	U	NU	NU
24	*Hydrocotyle sibthorpioides*	Horu manimuni	U	U	NU	NU	NU	U
25	*Ipmoea pentaphylla*	Kopou lota	U	NU	NU	NU	NU	NU
26	*Justicia gendarussa*	Ahom phool / tita bahek	U	U	NU	NU	NU	NU
27	*Leucas aspera*	Durun bon	U	U	NU	U	NU	NU
28	*Lygodium japonicum/ L. flexuosum*	Bonoriya dhekia/kopou dhekia	U	U	NU	NU	NU	NU
29	*Mazus rugosus*	Paarvate	U	NU	NU	NU	NU	NU
30	*Mikania micrantha*	China lota	U	NU	NU	NU	NU	NU
31	*Moringa oleifera*	Sojina	NU	NU	NU	U	NU	NU
32	*Musa balbisiana*	Talir kitir	NU	U	U	NU	U	U
33	*Naravelia zeylanica*	Raam naam	U	NU	NU	U	NU	NU
34	*Nelsonia sp.*	Noga maangmit	U	NU	NU	NU	NU	NU
35	*Pachystachys lutea*	Hunborua	NU	U	NU	NU	NU	NU
36	*Phlogacanthus curviflorus*	Titaphool	U	NU	NU	U	NU	NU

37	*Phlogocanthus thysiflorus (Roxb.)*	Bahka tita	NU	NU	NU	U	NU	NU
38	*Phylla nodiflora*	Oksi koksi	U	NU	NU	NU	NU	NU
39	*Piper longum*	Pipli paan	U	U	NU	NU	NU	NU
40	*Polygonum hydropiper*	Pothar bihlongoni	U	U	NU	NU	U	NU
41	*Polygonum plebium*	Kenya bon /bon jaluk	U	U	NU	NU	NU	NU
42	*Psidium guajava*	Modhuri	U	U	U	NU	NU	NU
43	*Rubus hexahydous*	Jetulipoka	U	U	NU	U	NU	NU
44	*Saccharum officinarum*	Kuhiar	U	U	U	U	NU	NU
45	*Scoparia dulcis*	Bor Bonjaluk /chenibon /jaluk bon	U	U	U	U	U	NU
46	*Selaginella sp.*	Ziziring-lota	NU	NU	U	NU	NU	NU
47	*Sphaerostepheras unitus*	Bihlongoni	U	U	U	U	U	U
48	*Spilanthes calva*	Maarchang /suhoni	U	U	NU	NU	NU	NU
49	*Vitex negundo*	Posotiya	U	U	NU	NU	NU	NU
50	*Xanthium strumarium*	Algasita	NU	NU	NU	NU	U	U
51	*Zanthoxylum nitidium*	Tezmui/ Rikom	U	U	U	NU	NU	NU

Mishing and *Tiwa* communities used this plant to cover the rice cakes while storing them above the fireplace, while *Ahom, Bodo, Rabha,* and *Deori* community people also mix the leaves of *Sphaerostepheras unitus* with rice powder along with other herbs. *Centella asiatica* is an important plant used by all five communities except the *Tiwa* community. Similarly, *Scoparia dulcis* is used by all the communities except the *Rabha* community. More than two communities use *Saccharum officinarum, Clerodendrum indicum, Musa balbisiana*, and *Zanthoxylum nitidum*.

According to a similar study, some of the common plants that are used in the preparation of starter culture among *Mishing*, *Ahom* and *Deori* communities are *Canthus leucostachys, Artocarpus integrifolia, Cinnamomum bejolghota, Cyclosorus extensa, Jasminum sambac, Psidium guajava, Saccharum officinarum, Scoparia dulcis* and *Selaginella sp* [23]. Singh and Singh, (2006) documented twelve different plant species having medicinal properties which are used to prepare the rice cake *Hamei* for preparation of *Yu*, a traditional alcoholic beverage by *Meitei* communities of Manipur. They concluded that the medicinal knowledge of *Yu* along with the twelve plant species, will be a useful lead for phytochemists and pharmacologists for further study [24].

The preliminary results obtained from this survey reveal that the plants used in preparing rice beer starter culture need to be investigated for pharmacology and phytochemical activity based on their uses in the traditional health care system. Studies suggest that the plants used in preparing starter culture contribute medicinal properties to rice beer and affect its quality because of their neutraceutical values [25]. The phytochemical components of these plant species, either alone or in combination, have remarkable therapeutic potential in curing various diseases and abnormalities [26]. Studies suggest that the plants used in preparing starter culture contribute medicinal properties to rice beer and affect its quality because of their neutraceutical values [27]. The phytochemical components of these plant species, either alone or in combination, have remarkable therapeutic potential in curing various diseases and abnormalities [29].

CONCLUSION: Assam is a rich source of biodiversity, and traditional herbal medicine has always played a key role in the health systems of different ethnic groups living in remote areas. There is a dearth of information on the efficacy of the plants used in the starter culture preparation by different communities. Therefore, there is a need for more scientific validation of these claims. Rapid urbanization has resulted in a loss of forest areas, hence, the plant species used to prepare rice beer by the ethnic communities is declining. It is also observed that the lack of interest of the young generation towards preserving indigenous knowledge makes it the need of the hour to properly document the knowledge that has been passed from previous generations among the communities regarding the plants used in the preparation of rice beer starter culture.

PLATE 1: PREPARATION OF RICE BEER STARTER CULTURE

PLATE 2: COLLECTION OF ETHNOMEDICINAL INFORMATION DURING HOUSEHOLD SURVEY

CURCUMA LONGA
(HALADHI PAAT)

SPHAEROSTEPHERAS UNITUS
(BIHLONGONI)

POLYGONUM HYDROPIPER
(POTHAR BIHLONGNONI)

DRYMARIA CORDATA
(LAIJABORI)

PLATE 3: SOME COMMON PLANTS USEDBY DIFFERENT TRIBES IN THE PREAPARATION OF STARTER CULTURE

PSIDIUM GUAJAVA
(MODHURI PAAT)

CINNAMOMUM BEJOLGHOTA
(BONORIYA TEZPAAT)

ZANTHOXYLUM NITIDIUM (TEZMUI/TEZMORI/RIKOM) ***ELSHOLTZIA BLANDA (BON TULOXI)***

PLATE 4: SOME COMMON PLANTS USED BY DIFFERENT TRIBES IN THE PREPARATION OF STARTER CULTURE

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REFERENCES:

1. Saikia A and Bori P: A study on the use of traditional alcoholic drinks in tribal communities of Assam. Pal Arch's J of Archae of Egypt /Egypt 2020; 17(9): 1490-94.
2. Nath N, Ghosh S, Rahaman L, Kaipeng DL and Sharma BK: An overview of traditional rice beer of North-east India: ethnic preparation, challenges and prospects. Indian Journal of Traditional Knowledge 2019; 18(4): 744-757.
3. Kalita P, Devi C, Konwar D, Kiranmai C, Tamuli AK, Allam US and Reddy PVB: Traditional Rice Beer of Assam, North East India: Traditionalism, Ethnobiology and its Pharmacomedicinal Trends. Annals of the Romanian Society for Cell Biology 2021; 25(6): 14276-93.
4. Tanti B, Gurung L, Sarma HK and Buragohain AK: Ethnobotany of starter culture used in alcohol fermentation by a few ethnic tribes of Northeast India. Indian Journal of Traditional Knowledge 2010; 9: 463-466.
5. Mishra BK, Hati S, Das S and Brahma J: Fermented Rice Beverage of Northeast India: A systematic review. International J of Fermented Foods 2019; 8(1): 41-56.
6. Borah VV, Choudhury MG and Phanjom P: Preparation and Health Benefits of Rice Beverages From Ethnomedicinal Plants: Case Study in North-East of India. In Plant-Based Functional Foods and Phytochemicals. Apple Academic Press 2021.
7. Sahoo TK: Ethnobotany of Bakhar Used To Prepare Rice Beer (Haria) in Paschim Medinipur, West Bengal, India. Indian Journal of Biological Sciences 2017; 23: 63-70.
8. Mishra S, Aravind SM, Charpe P, Ajlouni S, Ranadheera CS and Chakkaravarthi S: Traditional rice-based fermented products: Insight into their probiotic diversity and probable health benefits. Food Bioscience 2022; 102082.
9. Tamang JP: "Ethno-microbiology" of ethnic Indian fermented foods and alcoholic beverages. Journal of Applied Microbiology 2022; 133(1): 145-161.
10. Tamang JP, Jeyaram K, Rai AK and Mukherjee PK: Diversity of beneficial microorganisms and their functionalities in community-specific ethnic fermented foods of the Eastern Himalayas. Food Research International 2021; 148: 110633.
11. Adnan A, Navia ZI, Silvia, M, Antika M, Suwardi AB, Baihaqi B and Yakob M: Diversity of herbs and spices plants and their importance in traditional medicine in the South Aceh District, Indonesia. Biodiversitas Journal of Biological Diversity 2022; 23(7).
12. Mazumder TZ: Phytochemical study of some traditional medicinal plants of north-east India. Agriculture and Environment 2021; 2(11): 59-66.
13. De LC: Traditional knowledge practices of North East India for sustainable agriculture. Journal of Pharma-cogenosy Phytochemistry 2021; 10: 549-556.
14. Kalita G and Das K: Plants used for different household purposes by Tiwa Tribe and their conservation strategy of Morigaon District of Assam. Environment Conservation, Challenges Threats in Conservation of Biodiver 2021; 136.
15. Goswami N: Traditional Rice Beer of the Tiwa Community: An analytical exposition. International Journal of Scientific and Technology Research 2020; 9(03): 6265-6267.
16. Narzary B: Traditional Healer of the Bodos: Their Role And Significance In The Society (Doctoral Dissertation) 2021.
17. Narzary D, Boro N, Borah A, Okubo T and Takami H: Community structure and metabolic potentials of the traditional rice beer starter 'emao'. Scientific Reports 2021; 11(1): 1-15.
18. Basumatary M and Gogoi MA: traditional alcoholic beverage Jou: Prepared by Bodo community of Assam, India. International Journal of Multidisciplinary Research and Development 2014; 1(7): 307-313.
19. Bhuyan B and Baishya K: Ethno medicinal value of various plants used in the preparation of traditional rice beer by different tribes of Assam, India. Drug Invention Today 2013; 5(4): 335-341.
20. Deka D and Sarma GC: Traditionally used herbs in the preparation of rice-beer by the Rabha tribe of Goalpara

district, Assam. Indian Journal of Traditional Knowledge 2010; 9(3): 459-462.
21. Gogoi P, Gogoi MA and Dutta MH: Traditional Medicine among the Ahoms of Lakhimpur District, Assam. Journal of Positive School Psychology 2022; 6(3): 6341-6346.
22. Gogoi G: Traditional knowledge on preparation of starter culture cakes and rice-beers by Chaodang community of upper Assam, India. Emergent Life Sciences Research 2021; 7: 63-75.
23. Baruah A, Gohain K and Sonowal J: Plants used in the preparation of Starter culture of Rice-beer by the Ahom, Deori and Mishing tribes of Dhemaji District, Assam, India. Pleione 2010; 4(2): 288 - 293.
24. Singh PK and Singh KI: Traditional alcoholic beverage, Yu of Meitei communities of Manipur. Indian Journal of Traditional Knowledge 2006; 5(2): 184- 190.
25. Devi C, Kalita P, Deka H, Dutta H, Tamuli AK, Konwar D and Reddy PVB: Functional Characterization of traditional rice based alcoholic beverages of Assam, North East India. Annals of the Romanian Society for Cell Biology 2021; 25(6): 14228-14240.
26. Khan MI, Maqsood M, Saeed RA, Alam A, Sahar A, Kieliszek M and Aadil RM: Phytochemistry, Food Application, and Therapeutic Potential of the Medicinal Plant (*Withania coagulans*): A Review. Molecules 2021; 26(22): 6881.
27. Gam S, Deka D, Das B, Sarma D, Kumar S, Kushari S and Sarma H: Ethnobotanical Review of Medicinal Plants Used Against Diarrhea and Dysentery in Northeast India (Assam). Current Traditional Medicine 2021; 7(6): 29-41.
28. Poulios E, Vasios GK, Psara E and Giaginis C: Medicinal plants consumption against urinary tract infections: a narrative review of the current evidence. Expert Review of Anti-infective Therapy 2021; 19(4): 519-528.

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