Indian Journal of Traditional Knowledge
Vol 19(1), January 2020, pp 73-82

Edible bamboo resources of Manipur: consumption pattern of young shoots, processing techniques and their commercial status in the local market

Thounaojam Premlata[1], Vivek Sharma[1], Madho Singh Bisht[2] & Chongtham Nirmala*[,1,+]

[1]Department of Botany, Panjab University, Chandigarh 160 014, India
[2]Department of Environmental Studies, NEHU, Shillong 793 002, India
E-mail: [+]cnirmala10@gmail.com

Received 26 March 2019, revised 07 November 2019

Manipur constitutes one of the major hubs of bamboo resource in the country. Apart from its household and industrial uses, bamboo is also revered in the state for its dietary usefulness through consumption of its tender shoots. To quantify the magnitude of usage patterns of bamboo shoots for food in the state, a detailed survey was undertaken covering all the 16 districts and 21 main markets of Manipur. Of the 53 reported species, 15 species belonging to genera *Bambusa*, *Cephalostachyum*, *Chimonobambusa*, *Dendrocalamus* and *Melocanna* were recorded as major edible bamboo species consumed as food in different areas of Manipur. *Dendrocalamus latiflorus* emerged as the most popular edible bamboo species in the state, being consumed in all the 16 districts. Along with fresh shoots, boiled, fermented, pickled and dried forms are also consumed. Different traditional processing and preservation methods of bamboo shoots are also practised in the state of which fermentation is the most popular one. In market places, fresh shoots are sold during the monsoon season whereas fermented shoots are available throughout the year while the sales of other bamboo shoot products in local markets are in a very nascent state.

Keywords: Bamboo shoots, Edible bamboos, Fermentation, Food, Manipur, Processing
IPC Code: Int. Cl.[20]: A61K 36/899, A23F 3/08, A23L 5/40, A61K 36/00, A21D 8/06

Manipur, which is fondly known as 'Jewel of India', is one of the eight states of North-Eastern region of India falling under the Indo-Myanmar biodiversity hotspot region[1]. It has been blessed with a wealth of biodiversity and natural resources. By being primarily an agrarian economy, quality of life of its households heavily depends upon the successful and sustainable utilisation of these natural resources especially for food. With the help of acquired traditional knowledge that is being passed on from generation to generation, people of Manipur have mastered the art of diversifying and expanding their food baskets. They have admirably lessened their dependence on staple crops by regularly incorporating several seasonal and novel food resources into their eating habits. One such traditional food resource of Manipur is bamboo, a tall, versatile and arborescent member of the family Poaceae. Manipur is endowed with a great diversity of bamboo. Out of 136 species reported from India[2,3], 53 species under 9 genera are reported from Manipur[4]. Bamboo occupies a total growing area of 10,687 sq. km which is 61.36% of the total forest area of the state[3] and a total growing stock of 15,469 tonnes is obtained from the state which is the second highest among the eight states of North East India[3].

In Manipur, bamboo is locally called as *Wa* and is one of the most important forest resources of the state. It plays a very important role in socio-economics of the local people as they depend on it for earning their livelihood. They use bamboo for house construction, making tools, musical instruments, agricultural implements and other household items; use as fuel and fodder; and they also use bamboo in handicraft industry as well as in many religious ceremonies. The need for bamboo exists from birth to death and it is a culture to grow bamboo in their homestead. Almost all the households maintain bamboo colonies known as *Wapal* in their private land.

Bamboo shoots, locally called as *Usoi*, are young, tender culms of the bamboo plants arising from the underground rhizome. They have been used as an important food ingredient in this region since ancient times and constitute a range of traditional delicacies. During the rainy season, all the bamboo species produce young shoots which are harvested from forests and home gardens and are used for domestic consumption. Not only in fresh form, but bamboo shoots are also consumed in various processed forms.

*Corresponding author

Fermented bamboo shoots, owing to their unique aroma and texture, are very popular and consumed profoundly in the state. Annual consumption of 2188 tonnes of fresh bamboo shoots and 114.3 tonnes of fermented shoots have been reported from the state[5,6]. Despite the tremendous popularity of bamboo shoots as a traditional food resource in the state for a long time, only a few and scattered reports are available on the extent of its edible bamboo species[5,7,8]. Hence, the present study was undertaken to document the information about the bamboo species used as food in different areas of Manipur, their mode of consumption, processing and preservation techniques used in local regions along with documenting their commercial status in the local markets.

Methodology

Study area

Manipur, a small hilly state of North-East India, is situated between 92º 59′ to 94º 46′ E longitudes and 23º 50′ to 25º 42′ N latitudes covering an area of 22,327 sq. km. It mainly comprises of hilly terrain which occupies about 90% area of the state and surrounds a saucer-shaped central valley of 10% area. Fig. 1 represents the

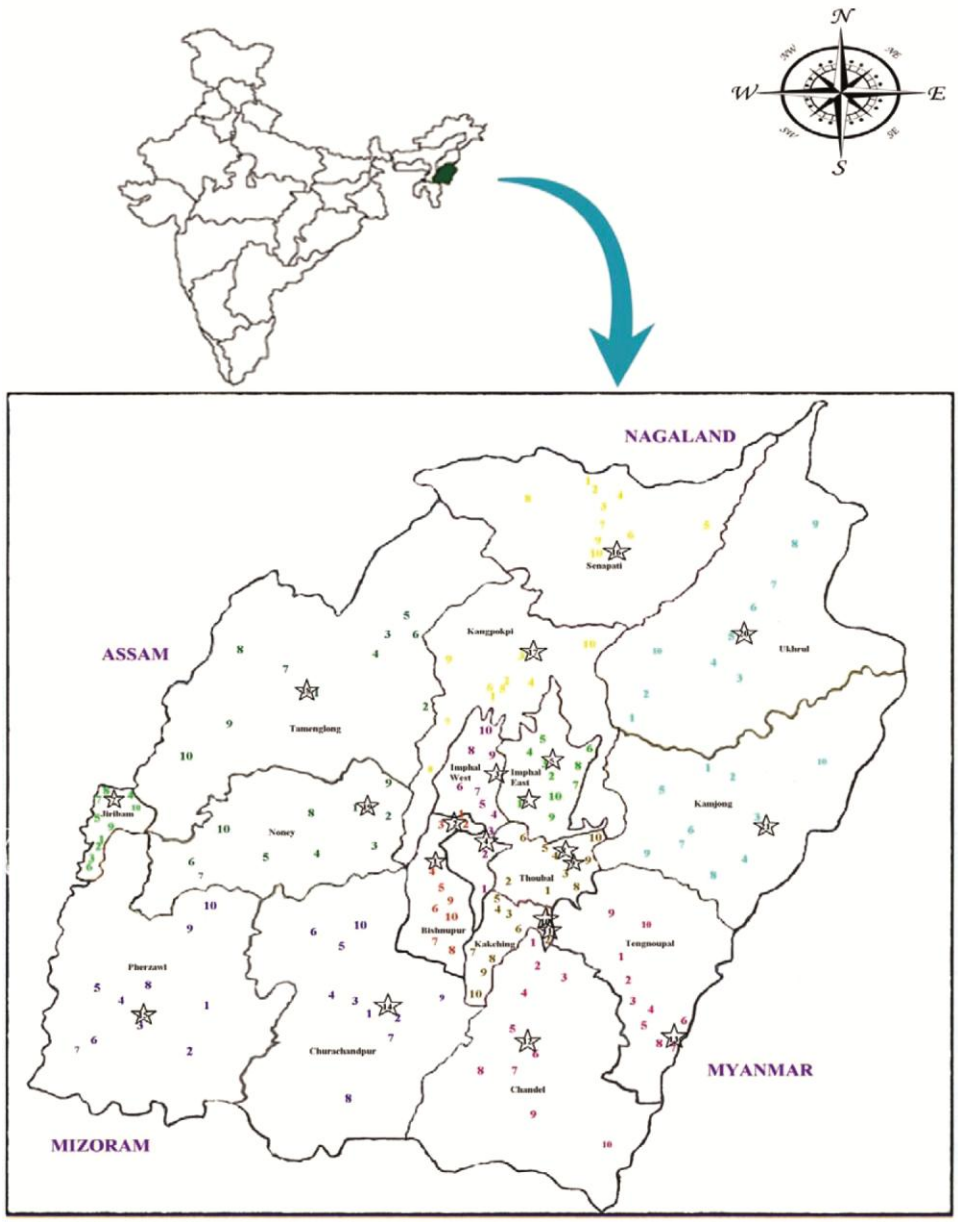

Fig. 1 — Map showing location of Manipur and its districts (1-10: local areas surveyed of each district; *: market places)

map showing location of Manipur and its districts. The state has an altitude ranging from 41 to 2994 m above the sea level. It receives an annual average rainfall of 1400 mm where maximum rainfall occurs in the month of May to September and temperature ranges from 0ºC during winters to 36ºC during summers. It has tropical to sub-tropical to temperate montane forests within its territory. The major ethnic group of the state is *Meitei* who inhabit the valley region while the hill areas are predominantly inhabited by 33 ethnic tribes dominated by *Nagas* and *Kukis*.

Methods

Survey was conducted at different localities and areas of all the 16 districts of Manipur, viz., Imphal East, Imphal West, Bishnupur, Thoubal, Kakching, Jiribam, Chandel, Tengnoupal, Churachandpur, Pherzawl, Senapati, Kangpokpi, Tamenglong, Noney, Ukhrul and Kamjong during bamboo shoot growing season *i,e*, May-October during the period of 2014 to 2017 (Fig. 1). 10 localities of each district were surveyed and from each selected locality, 10 local villagers (both men and women) of age ranging from 30-80 years were interviewed through pre-prepared questionnaires to collect information about the bamboo species used for edible purposes with regards to their local names, shooting period, mode of consumption and processing and preservation techniques used for bamboo shoots. A total of 1600 informants were interviewed across the study site. Regular monthly surveys were also conducted at 21 main market places of the state during shoot growing season to ascertain the commercial availability of shoots in the market. Prevalent market prices of the available shoots were also recorded. Identification of the surveyed bamboo species was done by using keys and descriptions given in monographs, manuals, research publications and later with the help of experts.

Results and discussion

Bamboo species used for food

Around 1482 species of bamboo in 119 genera are known to exist throughout the world[9]. Out of which about hundred species are commonly grown and utilized for their edible shoots and the species employed for the production of shoots belong to a few genera like *Bambusa*, *Dendrocalamus* and *Phyllostachys*[10,11]. Bamboo shoots have been used as delicacies in many Asian countries and are attracting significant attention worldwide due to their high nutritive value and health benefiting properties[6,12-19]. In Manipur, bamboo shoots have always been a popular component of its traditional cuisines since ages. Most of the bamboo species growing in Manipur yield shoots of edible quality but some are more popular because of their better productivity and taste. During the survey, 15 bamboo species were recorded as the major edible bamboo species whose shoots are consumed as food in different areas of Manipur. List of major edible bamboo species consumed as food in Manipur along with their habitat, availability, major consuming areas and their shoot growing period are given in Table 1. Out of the 15 species recorded, 6 species belong to genus *Bambusa*, 6 to *Dendrocalamus* and 1 species each to *Cephalostachyum*, *Chimonobambusa* and *Melocanna*. Young juvenile shoots of 15 edible bamboo species are shown in Fig. 2.

Habitat and availability

The surveyed bamboo species are distributed either only in plain areas and hill areas or both in plain and hill areas. *Bambusa balcooa*, *B. cacharensis*, *B. nutans* and *B. vulgaris* are mainly adapted to plain areas while *B. manipureana*, *Cephalostachyum capitatum*, *Chimonobambusa callosa*, *Dendrocalamus hamiltonii*, *D. sikkimensis* and *Melocanna baccifera* are restricted to hill areas only and *B. tulda*, *D. hookeri*, *D. latiflorus*, *D. longispathus* and *D. manipureanus* show equal adaptability to both plain and hill areas of Manipur. In terms of availability, most of the selected bamboo species are growing in wild as well as cultivated in home gardens whereas *B. manipureana*, *C. capitatum*, *C. callosa*, *D. sikkimensis* and *M. baccifera* are restricted to forest areas only (Table 1).

Popularity index

During the survey, it was also observed that the use of a bamboo species as food in an area depends on distribution and availability of that species in that particular area. However, some species are made available in non-growing areas through market sales. Shoots of *C. callosa* and *D. sikkimensis* are available in huge amount in valley markets though their distributions are restricted to hill areas only. Major consuming areas of the surveyed bamboo species are listed in Table 1. Among the surveyed bamboo species, *D. latiflorus* was found to be the most commonly used species for food in all the districts which was followed by *C. callosa* and *D. hamiltonii* (in 10 districts) and *D. hookeri* and *M. baccifera* (in 9 districts). *D. hamiltonii* and *M. baccifera* were found to be used mainly in hilly regions but in valley

Table 1 — List of major edible bamboo species recorded from different areas of Manipur

Species	Vernacular names	Habitat and Availability	Major consuming areas (in districts)	Shoot growing period
Bambusa balcooa Roxb.	Leewa (Manipuri), Baru wa (Bengali)	Plain areas; Wild and Cultivated	Jiribam	July-August
B. cacharensis Majumdar	Moirang-wa (Manipuri), Betu wa/ Jama betu (Bengali)	Plain areas; Wild and Cultivated	Jiribam	July-August
B. manipureana Naithani & Bisht	Umu (Manipuri), Govam, Gosing (Kuki), Uying, Luwom (Chothe)	Hill areas; Wild	Tengnoupal	July-August
B. nutans Wall. ex Munro	Saneibi (Manipuri)	Plain and Foot hills; Wild and Cultivated	Bishnupur, Imphal West, Imphal East, Jiribam, Thoubal, Kakching, Churachandpur	June-July
B. tulda Roxb.	Utang (Manipuri), Liangpai (Kabui), Bakal (Bengali)	Plain and Hills; Wild and Cultivated	Chandel, Tengnoupal, Churachandpur, Pherzawl	July-August
B. vulgaris Schrad. ex endl.	Jaibaru wa (Bengali)	Plain areas; Wild and Cultivated	Jiribam	July-August
Cephalostachyum capitatum Munro	Naat (Manipuri), Nagatheo (Tangkhul), Nhu (Kabui, Rongmei)	Hill areas; Wild	Bishnupur, Tamenglong, Noney	August-December
Chimonobambusa callosa (Munro) Nakai	Laiwa (Manipuri), Ngatha (Tangkhul), Pangki (Kabui, Rongmei)	Higher hills; Wild	Bishnupur, Imphal West, Imphal East, Thoubal, Kakching, Kangpokpi, Senapati, Ukhrul, Noney, Tamenglong	July-October
Dendrocalamus hamiltonii Nees & Arn. ex Munro	Unap/Wanap (Manipuri), Kongha, Ramkaha (Tangkhul), Gova, Gonam (Kuki), Peidiau (Kabui, Rongmei), Petcha (Jiribam)	Hill areas; Wild and Cultivated	Imphal East, Jiribam, Chandel, Tengnoupal, Churachandpur, Pherzawl, Ukhrul, Kamjong, Tamenglong, Noney	July-August
D. hookeri Munro	Watangkhoi (Manipuri), Govon (Kuki), Rapi (Chothe)	Plain and Hills; Wild and Cultivated	Bishnupur, Imphal West, Imphal East, Thoubal, Kakching, Tengnoupal, Churachandpur, Senapati, Kangpokpi	July-August
D. latiflorus Munro	Maribob (Manipuri), Hava, Kaha (Tangkhul), Gomi (Kuki, Paite)	Plain and Hills; Wild and Cultivated	Bishnupur, Imphal West, Imphal East, Jiribam, Thoubal, Kakching, Chandel, Tengnoupal, Churachandpur, Pherzawl, Senapati, Kangpokpi, Tamenglong, Noney, Ukhrul, Kamjong	June-September
D. longispathus Kurz	Unan (Manipuri), Dujangpai (Kabui), Gothi (Paite)	Plain and Hills; Wild and Cultivated	Bishnupur, Imphal West, Imphal East, Thoubal, Kakching, Tamenglong, Noney, Churachandpur	July-August
D. manipureanus Naithani & Bisht	Ui (Manipuri), Ooe, Ruv (Maring), Nango, Gopi (Kuki)	Plain and Low hills; Wild and Cultivated	Bishnupur, Thoubal, Kakching, Ukhrul	July-August
D. sikkimensis Gamble	Maribob amuba (Manipuri), Paalm (Kabui, Rongmei)	Hill areas; Wild	Bishnupur, Imphal West, Imphal East, Jiribam, Tamenglong, Noney, Tengnoupal	May- July
Melocanna baccifera (Roxb.) Kurz	Moubi-wa (Manipuri), Muli (Assamese)	Hill areas; Wild	Chandel, Tengnoupal, Churachandpur, Pherzawl, Senapati, Kangpokpi, Tamenglong, Noney, Jiribam	July-August

regions, *B. nutans* was recorded as the most preferred species for edible purpose. The popularity of a bamboo species as food is determined in terms of percentage of districts out of total 16 districts where the bamboo species is being used and it is depicted in Fig. 3. On popularity basis, *D. latiflorus*, *C. callosa*, *D. hamiltonii*, *D. hookeri*, *M. baccifera*, *D. longispathus*, *B. nutans* and *D. sikkimensis* are the 8 top most popular bamboo species used for food in the state (Fig. 3).

Shoot growing period

Emergence of young bamboo shoots in Manipur starts at the onset of rainy season, *i.e.*, from May and continues till October. Shoot growing period for 15 recorded bamboo species is given in Table 1. *D. sikkimensis* was found to be the earliest shoot producing species of the state where shoot emergence starts from May and continues till July. It was followed by *B. nutans* (June to July) and *D. latiflorus* (June to September). *C. callosa* starts producing its young shoots in July

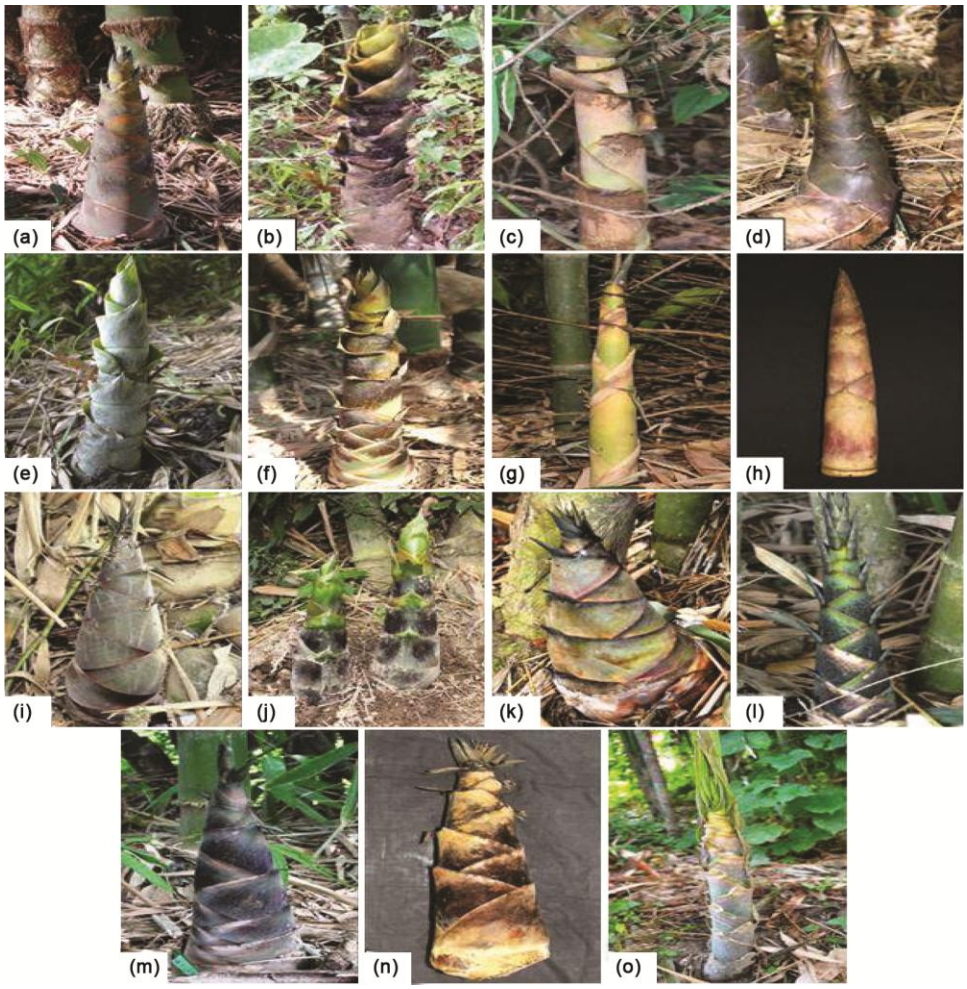

Fig. 2 — young shoots of 15 edible bamboo species of Manipur: A) *B. balcooa*, B) *B. cacharensis*, C) *B. manipureana*, D) *B. nutans*, E) *B. tulda*, F) *B. vulgaris*, G) *C. capitatum*, H) *C. callosa*, I) *D. hamiltonii*, J) *D. hookeri*, K) *D. latiflorus*, L) *D. longispathus*, M) *D. manipureanus*, N) *D. sikkimensis* and O) *M. baccifera*

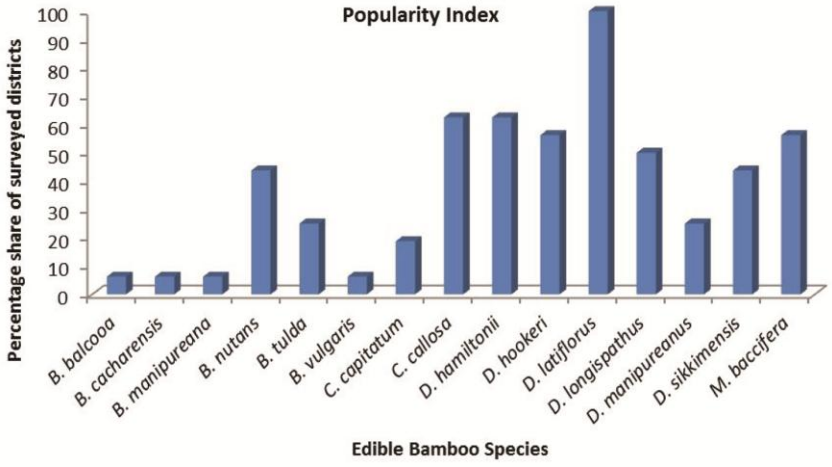

Fig. 3 — Popularity index of edible bamboo species (given by % share of surveyed districts)

and extends till October. In case of *Cephalo stachyum capitatum*, whose shoots are especially used for the preparation of fermented product known as S*oidon*, shoots availability extends till December after its initiation from August. Rest of the species produce their young shoots during the month of July and August (Table 1).

Processing and preservation of bamboo shoots

In Manipur, bamboo shoots are not directly eaten as raw but after proper cooking. Prior to cooking, shoots are subjected to different pre-cooking processing techniques such as soaking overnight in water and boiling to remove the bitterness present in fresh shoots. However, species such as *C. capitatum*, *C. callosa* and *M. baccifera* do not require such methods because of negligible bitterness in their shoots. Different preservation methods such as fermentation, drying and storage of shoots in water or salt solution are also employed for long term usage of shoots. Among these, fermentation is the most popular one and the traditional fermentation of bamboo shoot on large scale is done in areas such as Khongkhang, Kwatha, Tengnoupal, Andro, Bishnupur, Noney and Churachandpur and from these areas fermented shoots are supplied throughout the state. Two distinct forms of fermented shoots are eaten in Manipur: sliced fermented shoots '*Soibum*' and whole tip fermented shoots '*Soidon*'.

Soibum are fermented shoot slices prepared by fermenting thin slices of fresh juvenile shoots. The main species used for the preparation of *Soibum* are *D. hamiltonii* and *B. manipureana.* Further, *Soibum* is mainly prepared in 02 different ways: Khongkhang/ Kwatha type and Andro type and their respective mode of preparation are described in Table 2, Fig. 4 & Fig. 5.

Soidon are fermented shoot whole tips prepared from the succulent tender shoot tips of a small sized

Fig. 4 — (A-D) khongkhang/kwatha type *Soibum* preparation

Fig. 5 — (A-D) andro type *soibum* preparation

Table 2 — Methodology for different processing techniques

Processing techniques	Methodology
Soaking	Fresh young shoots are cut into thin slices and soaked overnight in water prior to cooking.
Boiling	Fresh young shoots are cut into thin slices or pieces and boiled in water for 20-30 min.
Drying	Fresh young shoots are cut into slices or pieces and dried under the sun or on top of the fire.
Water storage	Boiled shoots are stored in simple plain water or by addition of some salt in air tight container.
Fermentation: *Soibum*: Khongkhang/Kwatha type	Thin slices of fresh young shoots are packed tightly into a large bamboo basket lined with banana leaves and plastic sheets. The basket is then sealed with plastic sheets and weights are put on top for proper pressing. The bottom of the basket is perforated to drain the exudates released during the fermentation process and the shoots are allowed to ferment for 6-12 months.
Fermentation: *Soibum*: Andro type	Big earthen pots without bottom perforations are used for fermentation and are compactly filled up with thin slices of bamboo shoots. The pots are covered tightly and are allowed to ferment for 6-12 months.
Fermentation: *Soidon*	Tender shoot tips of *C. capitatum* are cut transversely and longitudinally for 4-5cm and submerged in a plastic tub containing water. Traditional starter, the sour liquid obtained from the previous batch, is added with *Garcinia pedunculata* leaves and the shoots are kept for 5-7 days with regular stirring.

bamboo *C. capitatum*, locally known as *Naat*. They are prepared exclusively in Bishnupur areas. *Soidon* is also prepared from the soft apical shoot portions of other bamboo species but *Naat* based *Soidon* is more popular and accepted (Fig. 6). Mode of preparation of different processing methods and different fermented shoots are given in Table 2.

Consumption pattern and different delicacies prepared from bamboo shoots

Fresh shoots of all the edible bamboo species are used as vegetables by all the communities of the state for the preparation of different delicacies. Some of the popular traditional dishes prepared from fresh shoots are *Usoi ooti* and *Usoi kangsu*. *Usoi ooti*, prepared from fresh bamboo shoots and dry peas, is a special delicacy offered to God during the *Ratha-yatra* festival of the state. *Usoi kangsu* is a nutritious bamboo shoot salad garnished with local medicinal herbs like *Houttuynia cordata*, *Ocimum canum*, *etc.* Along with fresh shoots, fermented shoots are also one of the most popular vegetable items of Manipur. They are consumed as vegetables or additives to enhance the delicacy of other dishes. Bamboo shoot chutney called *Eronba* is one of the famous dishes of the state which is prepared mainly from the fermented ones. Fermented shoots can also be cooked with other vegetables or fish or meat. *Eronba* can also be prepared from fresh shoots of *C. callosa* (*Laiwa*) which has a unique taste owing to its tremendous deliciousness. Shoots of *M. baccifera* are commonly consumed in hilly regions in boiled form. Bamboo shoot pickles and dried shoots are also consumed in different areas of the state. Different traditional dishes prepared from fresh and fermented shoots of Manipur and their recipes are given in Table 3.

Bamboo shoot sales

Young shoots of 10 bamboo species, viz., *B. nutans*, *B. tulda*, *C. capitatum*, *C. callosa*, *D. hamiltonii*, *D. hookeri*, *D. latiflorus*, *D. longispathus*, *D. sikkimensis* and *M. baccifera* are sold in different market

Fig. 6 — (A-D) *soidon* preparation

Table 3 — Traditional dishes prepared from fresh and fermented shoots of Manipur

English name	Local name	Preparation procedure/recipe
Bamboo shoot curry	*Usoi Ooti*	Fresh bamboo shoots are cut into thin slices and soaked in water overnight. The sliced shoots are cooked with rehydrated dry peas and a teaspoon of baking soda ($NaHCO_3$).
Bamboo shoot salad	*Usoi Kangsu*	Pre-soaked thinly sliced fresh bamboo shoots are boiled for half an hour and then squeezed to remove the water. Rehydrated dry peas are roasted and pounded in a mortar. The squeezed shoots are mixed with roasted fermented fish, chilli, salt and pounded peas. The mixture is then garnished with local herbs like spring onion, coriander, *Houttuynia cordata*, *Ocimum canum*, *etc*.
Bamboo shoot chutney	*Soibum*/*Soidon Eronba*	Sliced fermented shoots or small pieces of fermented shoot tips are washed with salt and water. It is then boiled with potato and chilli and mashed together with salt and roasted fermented fish. The chutney is garnished with onion, coriander, *etc*.
	Laiwa Eronba	Fresh shoots of *C. callosa* are partially roasted as whole, culm sheaths are then removed and soft shoots are cut into small pieces. It is boiled with potato and chilli and mashed together with salt and roasted fermented fish.
Fermented shoot curry	*Soibum Thongba*	Sliced fermented shoots are washed with salt and water and are cooked with other vegetables or potato or with fish or meat.
Fried bamboo shoot	*Laiwa Kanghou*	Fresh shoots of *C. callosa* are boiled and cut into small pieces. It is then fried in oil with spices or cooked with fish.
Boiled bamboo shoot	*Usoi Chamfut*	Fresh shoots of *M. baccifera* are simply boiled in plain water or with meat.
Bamboo shoot pickles	*Usoi achaar*	Fresh shoots are cut into thin slices or small pieces. The shoots are then boiled and dried partially under the sun. These shoots are then mixed with oil, spices and salt and stored in air tight container.

places throughout the state. Sales of young shoots start from second week of May and continue till October end. *D. sikkimensis* shoots are the first to reach the market places and *C. callosa* shoots are the last. Though the young shoots of *B. balcooa*, *B. cacharensis*, *B. manipureana*, *B. vulgaris* and *D. manipureanus* are used as food in local areas, their sales are not recorded from the market during the survey. Table 4 represents the bamboo species whose shoots are available in the market along with their market price. Among all the surveyed bamboo species, shoots of *B. nutans* and *C. callosa* fetch the highest market price. Besides fresh shoots, fermented shoots *Soibum* and *Soidon* are also sold in the market and are available throughout the year. *Soibum* is available in all the surveyed markets and its market price varies from place to place which ranges from 80-120 Rs/kg. *Soidon*, the speciality of Bishnupur market, fetches a market price ranging from 100-200 Rs/kg (Table 4). Sales of young shoots of eight bamboo species and fermented shoots (*Soibum* and *Soidon*) are also reported in earlier studies[5,6]. Bamboo shoot pickle is also found sold in some valley areas but in a very miniscule scale. Fig. 7

Table 4 — Young shoots and shoot products available in the market and their respective market value

Shoot form	Species	Price (Rs/kg)
Fresh shoots	*B. nutans*	50-60
	B. tulda	30-40
	C. capitatum	40-50
	C. callosa	50-60
	D. hamiltonii	30-40
	D. hookeri	40-50
	D. latiflorus	40-50
	D. longispathus	30-40
	D. sikkimensis	35-45
	M. baccifera	30-50
Fermented (*Soibum*)	-	80-120
Fermented (*Soidon*)	-	100-200

Fig. 7 — sales of young shoots and fermented shoots in market: A) *B. nutans*, B) *B. tulda*, C) *C. capitatum*, D) *C. callosa*, E) *D. hamiltonii*, F) *D. hookeri*, G) *D. latiflorus*, H) *D. longispathus*, I) *D. sikkimensis*, J) *M. baccifera*, K) *Soibum* and L) *Soidon*

shows the sales of young bamboo shoots and fermented shoots in local markets.

Conclusion

Resource use efficiency of bamboo in Manipur is expanded to such a degree that it is almost fundamental to the very existence and smooth functioning of its close-knit social structure and from birth to death, bamboo remains an essential commodity for Manipuri folks. Amidst all of its well-documented applications, there is one more dimension to the usefulness of bamboo which is still not particularly well known in most parts of India and that is the use of its tender shoots as a food resource. To strengthen the knowledge base regarding edible bamboo species from the state and to dwell out various usage patterns of shoots, a detailed survey was undertaken which revealed that out of known bamboo species of Manipur, 15 are mainly used for edible purposes. Among these *D. latiflorus*, *C. callosa*, *D. hamiltonii*, *D. hookeri*, *M. baccifera*, *D. longispathus*, *B. nutans* and *D. sikkimensis* are more commonly used and *D. latiflorus* is the one which is used in all the districts of the state. Production of young shoots starts from May and continues till October. People of Manipur still conserve their traditional methods of processing bamboo shoots for removing bitterness and preservation for long term use. Consumption patterns vary slightly across the state with different regions having their own speciality dishes prepared out of bamboo shoots. Fermented shoots are the most popular and are available throughout the year. However, most of the shoot production and consumption is still restricted for domestic use only even though a huge potential does exist for the export of shoots and shoot based food products to the urban markets at national as well as at international level. Thus, it is imperative to expand and popularise the traditional knowledge of its usage patterns so that this huge natural resource can contribute to the economic prosperity of the state as well as of the country in a much better way.

Acknowledgement

The authors are grateful to local villagers and village heads of Manipur for their co-operation and sharing of knowledge about bamboos and their uses. We are also thankful to the villagers of Andro, Khongkhang and Bishnupur for providing information about the fermentation of bamboo shoot. We also thank Mr Thoungamba Amom of Manipur University, Imphal and Ms Banita Thoudam of Jiribam for their help during the survey. The financial support from UGC, CSIR and DST PURSE (Government of India) for the conduction of research work is also highly acknowledged.

References

1 Myers N, Mittermeier RA, Mittermeier CG, da Fonseca GA & Kent J, Biodiversity hotspots for conservation priorities, *Nature*, 403 (2000) 853-858.

2 Sharma YML, Bamboos in the Asia Pacific Region, In: Bamboo research in Asia: proceedings of a workshop held in Singapore, 1980.

3 FSI (Forest Survey of India), India State of Forest Report, New Delhi: Ministry of Environment and Forests, Government of India, 2017, 1-286.

4 Devi ST & Sharma GS, Chromosome numbers in some bamboo species of Manipur, *BIC India Bulletin*, 3(1) (1993) 16-21.

5 Bhatt BP, Singha LB, Sachan MS & Singh K, Commercial edible bamboo species of the North-Eastern Himalayan Region, India. Part I: young shoot sales, *J Bamboo and Rattan*, 3(4) (2004) 337-364.

6 Bhatt BP, Singha LB, Sachan MS & Singh K, Commercial edible bamboo species of the North-Eastern Himalayan region, India. Part II: fermented, roasted, and boiled bamboo shoots sales, *J Bamboo and Rattan*, 4(1) (2005) 13-31.

7 Singh HB, Kumar B & Singh RS, Bamboo resources of Manipur: an overview for management and conservation, *J Bamboo and Rattan*, 2 (1) (2003) 43-55.

8 Rajkumari M & Gupta A, A note on the bamboo diversity and utilization from Manipur in N.E. India, *Pleione*, 7(2) (2013) 449-455.

9 Clark LG, Londoño X & Ruiz-Sanchez E, Bamboo taxonomy and habitat, In: *Bamboo*, Springer, Cham, 2015, 1-30.

10 Midmore D, Culinary bamboo shoots, In: *The new rural industries*, *Canberra*, Rural Industries Research and Development, edited by KW Hyde, 1998, 188-196.

11 Collins RJ & Keilar SM, The Australian bamboo shoot industry: a supply chain approach, Rural Industries Research and Development Corporation, *RIRDC*, Publication No. 05/022, Project No. UQ/87A, 2005.

12 Shi QT & Yang KS, Study on relationship between nutrients in bamboo shoots and human health, In: *Bamboo and its Uses*, Proceedings of the International Symposium on Industrial Use of Bamboo, International Tropical Timber Organization and Chinese Academy, Beijing, China, 1992, 338-346.

13 Tripathi YC, Food and nutrition potential of bamboo, *MFP News*, 8 (1) (1998) 10-11.

14 Sharma ML, Nirmala C, Richa P & David E, Variations in nutrient and nutritional components of juvenile bamboo shoots, *Panjab University Research J (Science)*, 54 (2004) 101-104.

15 Kumbhare V & Bhargava A, Effect of processing on nutritional value of central Indian bamboo shoots. Part-1, *J Food Sci Technol*, 44 (2007) 29-31.

16 Park E & Jhon D, Effects of bamboo shoot consumption on lipid profiles and bowel function in healthy young women, *Nutrition*, 25 (7) (2009) 723-728.

17 Nirmala C, Bisht MS & Haorongbam S, Nutritional properties of bamboo shoots: potential and prospects for utilization as a health food, *Compr Rev Food Sci Food Saf*, 10 (3) (2011) 153-168.

18 Nirmala C, Bisht MS & Laishram M, Bioactive compounds in bamboo shoots: health benefits and prospects for developing functional foods, *Int J Food Sci Technol*, 49 (2014) 1425-1431.

19 Nirmala C & Bisht MS, In: 10th WBC Reports: Bamboo: A prospective ingredient for functional food and nutraceuticals, *Bamboo J*, 30 (2017) 82-99.