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A Field Survey on Non-Conventional Fruits in North-Lakhimpur District of Assam, India

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ABSTRACT

Assam is located in the Northeastern part of India and is known for its large biodiversity. North-Lakhimpur district is located on the easternmost part of the state and is largely surrounded with tropical rain forest. A survey was conducted in a number of discrete locations in North-Lakhimpur district to identify various types of non-conventional wild edible fruits found in this region. A total of 33 wild non-conventional fruits are found, out of which 10 species (*Baccaurea ramiflora*, *Duchesnea indica*, *Garcinia xanthochymus*, *Glycosmis arborea*, *Prunus jenkinsii*, *Morus alba*, *Livistona jenkinsiana*, *Physalis minima*, *Garcinia lanceiofolia*, and *Citrus macroptera*) are least or not at all cultivated. However, most of them are known to have wide range of antimicrobial and various medicinal uses. In this study an attempt has been made to enlist the diversity, morphological features, taxonomical classification, fruiting season, local names, ethnobotanical and medicinal uses of the non-conventional fruits available in the in North-Lakhimpur district of Assam, India. Strategies needs to be undertaken for the popularization and cultivation of such wild fruits at commercial level before they extinct.

Key words: Non-conventional fruits, Wild fruits, Commercial values, Nutraceutical values

The use of non-conventional plants and its products is very common among the ethnic communities and tribes around the different parts of the globe. People rely on natural resources for many of their daily needs and tend to use non-conventional plants for food and medicinal purposes. Non-conventional plants are wild or semi-wild species that grow naturally in forest, forest margins, community land, degraded and discarded lands etc. Non-conventional fruits are rich sources of vitamins, sugar, fiber, minerals, protein and water. Nutritional value of non-conventional plants has been found to be higher than several known common vegetables and fruits [1-4].

In rural areas, village people are mainly dependent on natural resources for their basic food requirement and non-conventional plants are part of those. These non-conventional plants mostly include herbs, shrubs, and trees, which are used either as vegetables or fruits [5-8]. At food deficient times, these non-conventional plants could be used as an alternative to provide balanced diet with valuable nutritional supplement [9-10]. Villagers also use these non-conventional fruits as a source of income for their livelihood. Throughout the world, non-conventional plants species makes a great benefaction to the life of local communities. They play a significant part in the agricultural systems as non-conventional food and fuel wood. Also, they have an important socio-economic role through their usages in medicines, dyes, poisons, shelter, fibers and religious and cultural ceremonies [11]. Only 5% of the total higher plants species that exist on earth have been scientifically studied and are reported of having potential medicinal properties, while the rest (95%) of the plants are still to be analyzed [12]. Thus, non-conventional plants and plant-based products have immense economic and commercial potential.

India is a rich country in terms of wild plants are concerned. It is estimated that of over 15,000 species of higher plants occur in different phyto-geographical/agro-ecological zones of the country that also includes wild relatives of crop plants [13]. Due to climatic conditions, the North-Eastern region of India is one of the greatest treasure troves in terms of diversity of edibles plants [14]. This is evident by the fact that about 40% of the total flora of the country is represented by the

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plants from the Northeastern part of India [15]. A large variety of economic plants such as medicinal, aromatic, tree fodders, fruits, oil seed producers' trees, legumes, spices, orchids and flowering plants grows here that are wild in nature. Even though, a number of literatures reported about the use of wild edible plants having traditional, ethno-botanical, nutritional and phytochemical values from the North-Eastern part of the country; but only a handful of reports are available on wild edible fruits available in Assam so far [16-20].

Here, an effort has been undertaken to identify & evaluate the ethnobotanical significance of the non-conventional fruits found in selected areas of North Lakhimpur district, which is located in the eastern part of Assam mostly covered with tropical rain forest. The finding of this study enlisted the diversity, morphological features, taxonomical classification, fruiting season, local names, ethnobotanical and medicinal uses of the non-conventional fruits available in the selected areas.

MATERIALS AND METHODS

Description of the study area

The selected study area is North-Lakhimpur district of Assam located in the eastern part of the country (27.2253° N and 94.1053° E). Overall, 34.21% of the total land area is covered with tropical rain forest. The maximum temperature goes up to 35° C during summer and minimum temperature falls to 8° C in winter. The average annual rainfall in the region is roughly 3268 mm which makes the weather very humid throughout the year and favors the growth of evergreen vegetation with large variety of non-conventional fruiting plants [21]. All locations of all the sample collection sites are shown in (Fig 1).

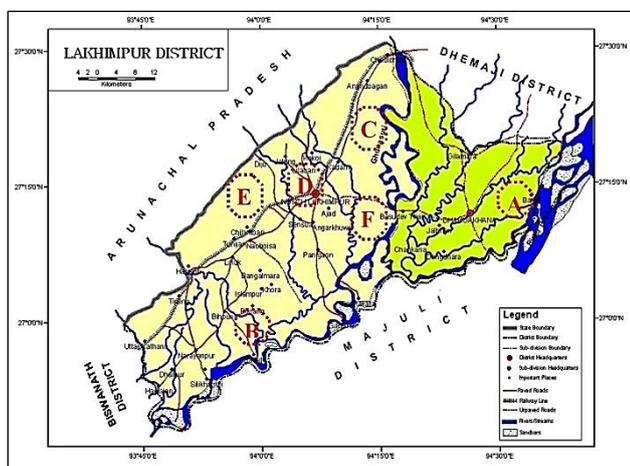


Fig 1 Map showing the locations of sample collection sites in Lakhimpur district; where, A= Kathalguri, B= Majuli gaon, C= Rohagoan, D= Heraipowa, E= Amuluguri, and F= Gandhia (<http://lakhimpur.nic.in/Lakhimpur/map.htm>). NB: Map not to scale

Details of the field equipments used

The following tools viz., blade, knife, cutter, compass, notebook, pencil, plant presser, scale, blotting paper, tags, paper sheets, polythene bags, measuring rope, portable weighing machine, walking stick, gloves, digital camera, standard questionnaire forms were used during the sample collection.

Specimen collection

The following plant parts viz., stem, leaf, flower, and fruits were collected during the field survey. At least 2-3 samples of each specimen were collected in polythene bags to

avoid mixing up of the specimens and were tagged properly. These were then wrapped in paper sheets to avoid damage and wilting during transportation.

Pressing of the specimen

After collection of the specimen, they were laid carefully between sheets of paper and tightly pressed with plant presser. Paper sheets were changed every day for first 2 to 4 days for several times. These were changed more frequently at longer intervals for proper drying of plants and then the dried specimens were exposed to sun or air and stored in paper sheets until mounting.

Poisoning

Dry specimens were dipped in saturated solution of mercuric chloride in ethyl alcohol before mounting. Treatment with saturated solution of mercuric chloride in ethyl alcohol prevents possible infection of bacteria, fungi, and insects etc.

Mounting

The treated specimens were mounted on herbarium sheets in standard dimension as per the international size recommendation with glue and gummed tap. They were stitched whenever required. These were then labeled with the information viz., name of the flora, family, botanical name, local name, habit, and use etc.

Data collection through questionnaire

Frequent interactions and discussions were made with the local villagers including farmers, housewives, herdsman etc. Questionnaires were done for the information such as local name, time of fruiting and flowering season, taste, traditional uses, and other uses etc. Also, data were recorded in the field notebook that consists of flower and fruit colour information, length and weight of the fruits, date of the collection and information obtained during the collection process with the help of measuring rope and weight machine. The collected fruits were preserved in the formaldehyde solution.

Identification of the specimen

The plant specimens were identified in consultation with taxonomists of Department of Botany, Assam down town University, Guwahati.

RESULTS AND DISCUSSION

A total of 33 non-conventional wild fruit varieties were explored from 7 discrete locations of North Lakhimpur district of Assam. The vernacular names were identified in consultation with the local communities with a set of standard questionnaires. These were then identified in consultation with the taxonomists of Department of Botany, Assam down town University. The scientific names along with their vernacular names, family, GPS coordinates of the sample collection site, average length and dimension of the fruits, their colour and taste are shown in (Table 1). From the table it can be seen that maximum species of the selected non-conventional fruits are available in Kothalguri area ($n=14$) followed by Majuli gaon ($n= 11$), Roha gaon ($n=4$), Amuluguri ($n=1$), Heraipowa ($n=1$), Gandhia ($n=1$), and Kothalguri gaon ($n=1$). In addition to the above, the fruiting season of all the surveyed fruit plants were provided in consultation with the locals and botanists. (Fig 2) depicts all the collected fruit varieties during the survey conducted.

Northeastern part of India is well known for its large biodiversity and regarded as one of the biodiversity hotspots in

the world. This region is rich in plant varieties but is mostly underexplored, particularly in terms of wild fruit varieties. Even though, such wild fruits are rich in food values such as minerals, vitamins, proteins, essential amino acids, fats etc., but are least cultivated by the locals [22-23]. However, eighteen of them viz., *Annona reticulata*, *Averrhoa bilimbi*, *Aegle marmelos*, *Citrus aurantifolia*, *Citrus reticulata*, *Elaeocarpus serratus*, *Garcinia pedunculata*, *Garcinia Morella*, *Citrus maxima*, *Prunus persica*, *Averrhoa carambola*, *Carallia brachiata*, *Dillenia indica*, *Garcinia assamica*, *Spondias pinnata*, *Terminalia chebula*, *Zizyphus mauritiana* and *Tamarindus indica* are

cultivated by a handful of farmers and are locally sold in the market. Most of these wild fruits e.g., *Aegle marmelos*, *Citrus aurantifolia*, *Garcinia pedunculata*, *Garcinia morella*, *Averrhoa carambola*, *Carallia brachiata*, *Garcinia assamica*, *Spondias pinnata*, *Terminalia chebula*, *Zizyphus mauritiana* and *Tamarindus indica* etc. are known to have wide range of medicinal properties which includes anti-diabetic, anti-cholesterol, and anthelmintic properties etc. Additionally, some of them are also known to have potential antimicrobial properties against both gram positive and negative bacterial and also certain fungi [24-36].

Table 1 Details of the non-conventional fruits collected during the field survey

Scientific name	Local name	Family	Place of collection	GPS coordinate	Fruit colour	Average dimension (length & diameter) cm	Average weight (gm)	Fruiting season	Taste
<i>Annona reticulata</i>	Atlas	Annonaceae	Kathalguri	27°17'49" N 94°31'54" E	Light green to pale yellow brownish when ripe	18.4(L) and 10.5 (D)	180	Nov-April	Sandy sweet
<i>Averrhoa bilimbi</i>	Kordoi	Oxalidaceae			Green to yellow	15.1(L) and 6.3 (D)	64	Oct-March	Sour
<i>Aegle marmelos</i>	Bael	Rutaceae			Green to yellow	9.3(L) and 7.1 (D)	50	Feb-Jan	Sweet
<i>Baccaurea miflora</i>	Leteku	Phyllanthaceae			Golden yellow	2.4(L) and 2.5 (D)	13.5	May-july	Sour
<i>Citrus aurantifolia</i>	Gul nemu	Rutaceae			Green to yellow	7 (L) and 3.4 (D)	48	May-Nov	Sour
<i>Citrus reticulata</i>	Humthira tenga	Rutaceae	Kathalguri nagoan	27°9'29" N 94°33'50" E	Green to orange	7.3(L) and 5.3 (D)	90	Dec-Feb	Sweetish sour
<i>Duchesnea indica</i>	Garukhis	Rosaceae	Majuli goan	27°18'51" N 94°31'52" E	Red	1.6(L) and 1.2 (D)	1.2	Feb-Aug	Tasteless
<i>Elaeocarpus serratus</i>	Jolphai	Elaeocarpaceae			Green	3.2(L) and 1.8 (D)	25	Oct-Jan	Sour
<i>Garcinia xanthochymus</i>	Tepor tenga	Clusiaceae			Yellow	7.7(L) and 4.8 (D)	78	May-July	Sour
<i>Garcinia pedunculata</i>	Bor thekera	Clusiaceae			Green to yellow	11 (L) and 7.6 (D)	390	May-July	Sour
<i>Garcinia morella</i>	Kuji thekera	Clusiaceae			Green	8 (L) and 4.2 (D)	120	April -july	Sour
<i>Glycosmis arborea</i>	Hengena Poka	Rutaceae			Pink	1.4 (L) and 1.1 (D)	1.5	March-Nov	Sour
<i>Phyllanthus emblica</i>	Amlokhi	Phyllanthaceae			Green to yellow and turns brownish when mature	3.2 (L) and 2.6 (D)	24	May-Nov	Sour
<i>Prunus jenkinsii</i>	Thereju	Rosaceae			Green to black	2.9 (L) and 1.7 (D)	23	Dec-March	Sour
<i>Citrus maxima</i>	Robab tenga	Rutaceae			Green to yellow	20.2 (L) and 11.5 (D)	1200	Winter	Sour
<i>Prunus persica</i>	Ahom bogori	Rosaceae			Yellow	4.2 (L) and 3.9 (D)	56	March-June	Sweet
<i>Averrhoa carambola</i>	Rohdoi	Oxalidaceae			Green to yellow	10.3 (L) and 5.2 (D)	52	Nov-Jan	Sweet
<i>Caralliabrachiata</i>	Thekera mahi	Rhizophoraceae			Green in immature, pink to red when mature	1.9 (L) and 1.1 (D)	5	Dec-July	Sour
<i>Dillenia indica</i>	Ou tenga	Dilleniaceae			Yellow green	11 (L) and 9.4 (D)	400	July-March	Sour
<i>Garcinia assamica</i>	Kuji thekera	Clusiaceae			Green	12 (L) and 5.4 (D)	140	May -Aug	Sour
<i>Morus alba</i>	Nuni	Moraceae			Green to red	1.2 (L) and 1 (D)	12.3	Jan- Feb	Sour and sweet
<i>Livistonajenkinsian a</i>	Tokou tamul	Arecaceae			Copper blue to black	2.9 (L) and 1.9 (D)	16	April-May	Peppery taste
<i>Physalis minima</i>	Pokmou	Solanaceae			Yellow	1.4 (L) and 1 (D)	3.5	March- sept	Sweet
<i>Spondias pinnata</i>	Amora	Anacardiaceae			Yellow	5.1 (L) and 3.8 (D)	84	Sept-Dec	Sour and slightly bitter
<i>Terminalia chebula</i>	Silikha	Combretaceae			Green	2.6 (L) and 1.3 (D)	13	Oct-Dec	Bitter
<i>Zizyphus mauritiana</i>	Bogori	Rhamnaceae			Green to yellow, when ripe red colour	2.2 (L) and 1.6 (D)	11.8	Dec-Jan	Sour
<i>Tamarindus indica</i>	Tateli	Fabaceae	Rohagoan	27°10'40" N 94°23'52" E	Brown	9 (L) and 2.4 (D)	30	Nov-Feb	Sour
<i>Cassia fistula</i>	Hunaru	Fabaceae			Dark green	35 (L) and 2.1 (D)	68	Feb-Aug	Sweet
<i>Ficus auriculata</i>	Dimoru	Moraceae			Green	3.1 (L) and 2.5 (D)	23	Feb-Nov	Sweet
<i>Garcinia lanceifolia</i>	Rupohi thekera	Clusiaceae			Red	4 (L) and 3.2 (D)	31	Jan-July	Sour
<i>Citrus macroptera</i>	Jul tenga	Rutaceae	Heraipowa	28°19'39" N 94°33'24" E	Dark green	13 (L) and 5.9 (D)	400	Oct-Feb	Sour
<i>Mimusops selengi</i>	Bokul	Sapotaceae	Amuluguri	27.3114° N 94.4568° E	Yellow-orange	3.2 (L) and 1.8 (D)	7.6	Feb-Sept	Sandy sweet
<i>Phyllanthus acidus</i>	Pora amlokhi	Phyllanthaceae	Gandhia	27.3191° N 94.5101° E	Yellow	1.6 (L) and 1.2 (D)	14	Feb-July	Sour

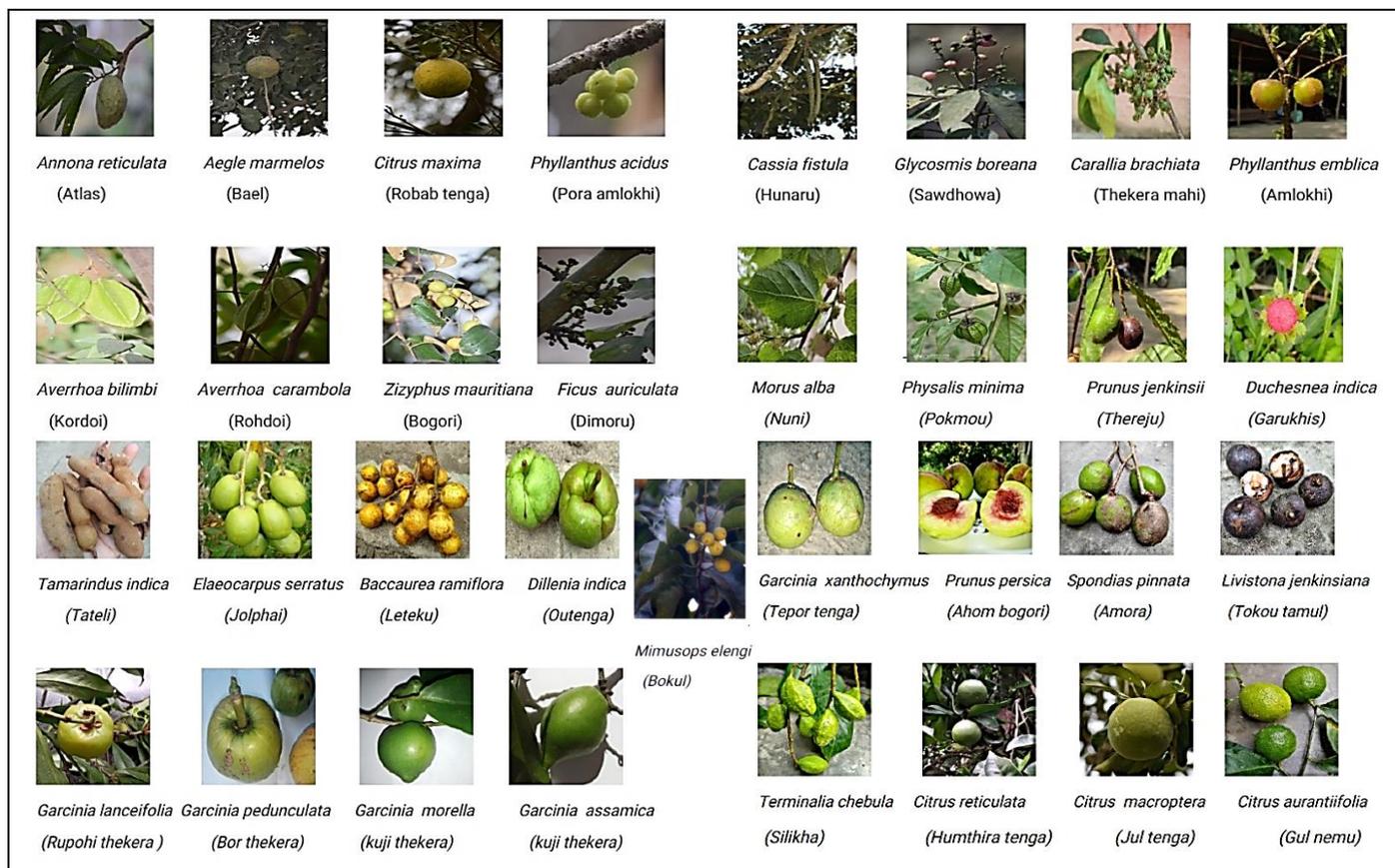


Fig 2 Figure shows all the collected non-conventional fruits along with their botanical names and local (in brackets)

Some of the surveyed wild fruits in this study such as *Aegle marmelos*, *Garcinia pedunculata*, *Garcinia Morella*, *Spondias pinnata*, *Terminalia chebula*, and *Tamarindus indica* are known to be practiced as natural healers for various diseases as per the Ayurveda [37-38]. Many of them are well known for their medicinal applications as ethnic medicine among the indigenous communities. Some of the wild fruits such as *Spondias pinnata*, *Terminalia chebula*, *Tamarindus indica*, *Aegle marmelos*, *Citrus aurantifolia*, *Phyllanthus emblica*, *Citrus maxima*, *Averrhoa carambola*, and *Dillenia indica* etc. are known to be cultivated commercially not only in this region but also in various parts of the country for their nutraceutical values [39-42]. However, rest of the wild varieties is very rarely cultivated. For instance, *Baccaurea ramiflora*, *Duchesnea indica*, *Garcinia xanthochymus*, *Glycosmis arborea*, *Prunus jenkinsii*, *Morus alba*, *Livistona jenkinsiana*, *Physalis minima*, *Garcinia lanceifolia*, and *Citrus macroptera* etc. are least

available in this region and the chances of getting extinct in future cannot be nullified.

CONCLUSION

A total of 33 underutilized fruit species were surveyed in the North-Lakhimpur district of Assam out of which 10 were very rarely found in this region and are least or not at all cultivated by the locals. Even though, such wild fruits have a great nutraceutical value but only a handful of them are cultivated on commercial scale. Hence special emphasis should be given by the competent authorities in popularizing such fruit varieties so that they can be cultivated and exploited commercially by the local population.

Conflict of interest

Authors declare that there is no conflict of interest.

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