

Seasonality chart of underutilized fruits found in the Eastern Himalayas

Nature in its generous abundance has bestowed the Eastern Himalayan region with a unique array of vegetation ranging from tropical and sub-tropical to temperate. The region has varied agro-climatic conditions supporting the growth of various plant species giving it a rich biological diversity. The article reports on the documentation of wild underutilized edible fruits species found in the entire region of North east India and its thorough observation on the time of flowering and fruit availability or fruit maturity which is paramount. A total of 44 underutilized fruit species represented by 21 families were listed and sampled from varied locations of the region in which Rosaceae family represented the highest with 6 species. Developing a seasonality chart or calendar will identify the timing of different seasons for locally available fruit species. The chart can also be used as a guide to explore different underutilized fruits throughout the year.

THE Eastern Himalayan region of India stretching between 21°50' and 29°34' N latitude and 85°34' and 97°50' E longitude spreading over an area of 2,620,230 sq km comprises Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Sikkim and Tripura. It is a region geographically nestled in one of the most biodiversity rich regions of the world. The region is divinely blessed with diverse agro-climatic conditions, soil physiography and is endowed with wealthy plant genetic resources including several underutilized fruit species. The region is considered an abode and reservoir of numerous wild genetic resources specifically underutilized fruit crops growing wild in the forest and in almost every homestead and backyard.

Underutilized or neglected fruit species are those fruit species which represent an enormous wealth of agrobiodiversity and have great potential for contributing to food security and nutrition, health (nutritional/medicinal), income generation, environmental services and combating the hidden hunger caused by micronutrient deficiencies. These fruit species are seen growing widely in forest and in almost every backyard without much care and attention that are neither grown commercially nor traded widely, lesser known to people, have less demand in the market and are less palatable. Further, whose distribution, cultivation and uses are poorly documented.

Underutilized fruits contribute significantly in improving human health by meeting their nutritional need, livelihood, household food security and ecological sustainability. Since yore, indigenous food resources constituted the bedrock of the diversity in traditional and indigenous food systems of communities in the north-eastern region of India and underutilized fruits constituted an integral part of traditional diets and contributed

significantly in the livelihood security of several ethnic tribal communities of the region. The ethnic tribal till the present time have excellent knowledge in the use of almost all the fruit tree species found in the forests as a source of food, medicine and timber and they have been using such species since several generations without having anything in written.

The information on the period (month) of flowering and fruit availability of underutilized fruit species has not been given much attention and documented since the beginning, as compared to the major fruit species leading to dearth of knowledge and awareness on its time of availability. Therefore, underlining a seasonality chart or calendar will confirm and identify the timing of different seasons for locally available fruit species. The chart can also be used as a guide to explore different underutilized fruits throughout the year. It is obvious to state that the time of flowering and fruit maturity will vary depending on the region and growing seasons as it is normally determined by environmental factors such as photoperiod, temperature, availability of water, nutrients and stress as well as various endogenous genetic components. Fruits are normally at their best in terms of quality when they are harvested in their natural seasons as it contains all the vitamins and nutrients that our body needs in that particular season. This article documents the diversification of wild underutilized edible fruit species found in the entire region of North east India and thorough investigation on the time of fruit availability or fruit maturity. A total of 44 numbers of underutilized fruit species represented by 21 families were listed and collected of which Rosaceae family represented the highest with 6 species. Time of flowering and period of fruit availability differed for different fruit species as shown

List of underutilized fruits found in the North-east region

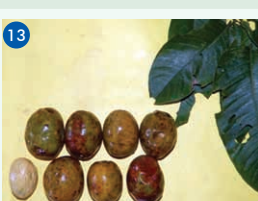
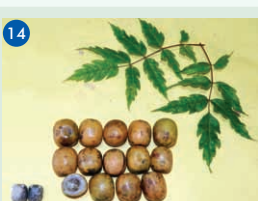
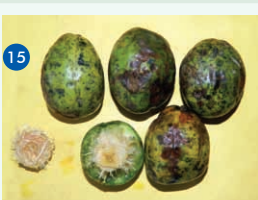
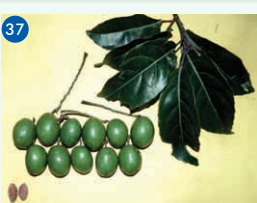
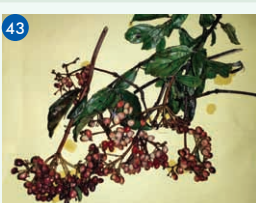
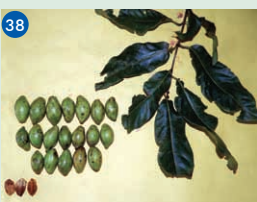
Image of fruit	Name of the fruit species	Image of fruit	Name of the fruit species
	<i>Docynia indica</i> Wall. Common name: Crab apple Family: Rosaceae Vernacular name: Phukhoithi (Sumi Naga); Sohphoh (Khasi) Time of flowering: March – April Period of fruit availability: November – January		<i>Garcinia pedunculata</i> Roxb. Family: Clusiaceae Vernacular name: Bor-thejera (Assamese); Thuhpi (Kuki) Time of flowering: October – December Period of fruit availability: May – August
	<i>Pyrus pashia</i> Hamilton ex D. Don Common name: Wild Himalayan pear Family: Rosaceae Vernacular name: Piita ayhi (Apatani) Time of flowering: Feb. – March Period of fruit availability: September – October		<i>Garcinia xanthochymus</i> Hook. f. Common name: False mangosteen Family: Clusiaceae Vernacular name: Tepor-tenga (Assamese) Time of flowering: March – May Period of fruit availability: October – February
	<i>Prunus nepalensis</i> Serr. Common name: Khasi cherry Family: Rosaceae Vernacular name: Sohiong (Khasi) Time of flowering: October – November Period of fruit availability: August – September		<i>Garcinia morella</i> (Gaertn.) Desr Common name: Indian gamboge Family: Clusiaceae Vernacular name: Kuji-thejera (Assamese) Time of flowering: February – March Period of fruit availability: July – August
	<i>Flacourtia jangomas</i> Lour. Common name: Governor's plum Family: Rosaceae Vernacular name: Poniol (Assamese) Time of flowering: February – March Period of fruit availability: July – August		<i>Garcinia paniculata</i> Roxb. Family: Clusiaceae Vernacular name: Kok (Kokborok) Time of flowering: December – February Period of fruit availability: May – July
	<i>Prunus cerasifera</i> Ehrh. Common name: Cherry plum Family: Rosaceae Vernacular name: Theikha (Kuki) Time of flowering: February Period of fruit availability: April – May		<i>Spondias pinnata</i> L. Common name: Indian hog plum Family: Anacardiaceae Vernacular name: Amora (Assamese); Medzisi (Angami Naga) Time of flowering: March – April Period of fruit availability: December – January
	<i>Rubus ellipticus</i> Smith. Common name: Yellow Himalayan raspberry Family: Rosaceae Vernacular name: Chilapoka nyigchi (Nyishi); Theimi (Kuki) Time of flowering: February – March Period of fruit availability: May		<i>Spondias axillaris</i> Roxb. Common name: Nepali hog plum Family: Anacardiaceae Vernacular name: Lapsi (Nepali); Khulasi (Angami Naga) Time of flowering: April – May Period of fruit availability: December – February
	<i>Rubus rosifolius</i> Smith. Common name: Roseleaf bramble Family: Rosaceae Vernacular name: Wachingwaring nyigchi (Nyishi) Time of flowering: March – April Period of fruit availability: June – July		<i>Spondias cytherea</i> Sonn. Common name: Ambarella/Golden apple Family: Anacardiaceae Vernacular name: Amra (Bangla) Time of flowering: Feb. – March Period of fruit availability: September – November
	<i>Garcinia lanceifolia</i> Roxb. Family: Clusiaceae Vernacular name: Taktir (Galo); Rupohi-thejera (Assamese) Time of flowering: October – December Period of fruit availability: April – May		<i>Rhus semialata</i> Murr. Common name: Nutgall Family: Anacardiaceae Vernacular name: Heimang(Meitei); Tsomhousi(Angami Naga) Time of flowering: Aug. – Sep. Period of fruit availability: December – January

Image of fruit	Name of the fruit species	Image of fruit	Name of the fruit species
17 	<i>Ficus racemosa</i> Linn. Common name: Cluster fig Family: Moraceae Time of flowering: February – March Period of fruit availability: May – June	25 	<i>Phoebe cooperiana</i> U.N Kanjilal ex A. Das Family: Lauraceae Vernacular name: Mekhai (Assamese); Tapir (Adi) Time of flowering: April Period of fruit availability: September – October
18 	<i>Ficus semicordata</i> Buch. -Ham. ex Sm. Common name: Drooping fig Family: Moraceae Vernacular name: Tapang (Adi) Time of flowering: February – March Period of fruit availability: June – August	26 	<i>Myrica esculenta</i> Buch.-Ham. ex D. Don. Common name: Bay berry Family: Myricaceae Vernacular name: Sohphie (Khasi); Naga tenga (Assamese) Time of flowering: Feb. – March Period of fruit availability: April – June
19 	<i>Artocarpus lakoocha</i> Roxb. Common name: Monkey jackfruit Family: Moraceae Vernacular name: Bohot (Assamese) Time of flowering: March – April Period of fruit availability: June – July	27 	<i>Myrica nagi</i> Thunb. Common name: Box myrtle Family: Myricaceae Vernacular name: Sohphie nam (Khasi) Time of flowering: Feb. – March Period of fruit availability: April – June
20 	<i>Streblus asper</i> Lour. Common name: Sand paper tree Family: Moraceae Vernacular name: Seora (Assamese) Time of flowering: March Period of fruit availability: May	28 	<i>Canarium strictum</i> Roxb. Common name: Black dammar Family: Burseraceae Vernacular name: Silum (Adi) Time of flowering: February – April Period of fruit availability: December – January
21 	<i>Citrus medica</i> L. Common name: Citron Family: Rutaceae Vernacular name: Tanyum (Galo); Jora tenga (Assamese) Time of flowering: Feb. – March Period of fruit availability: December – January	29 	<i>Bursera serrata</i> Wall. ex Colebr. Common name: Indian red pear Family: Burseraceae Vernacular name: Tekring (Garo); Thaisrem (Kokborok) Time of flowering: March – April Period of fruit availability: June – July
22 	<i>Citrus macroptera</i> Montr. Common name: Wild orange Family: Rutaceae Vernacular name: Hatkora (Assamese); Shatkora (Sylheti); Heiribob (Meitei) Time of flowering: Feb. – March Period of fruit availability: December – January	30 	<i>Elaeagnus latifolia</i> L. Common name: Silver berry Family: Elaeagnaceae Vernacular name: Sohshang (Khasi); Mirika tenga (Assamese) Time of flowering: September – November Period of fruit availability: April – May
23 	<i>Citrus indica</i> Tanaka. Common name: Indian wild orange Family: Rutaceae Vernacular name: Memang narang (Garo) Time of flowering: Sep. – January Period of fruit availability: October – February	31 	<i>Elaeagnus umbellata</i> Thunb. Common name: Autumn olive Family: Elaeagnaceae Vernacular name: Dang phereng (Monpa) Time of flowering: April – May Period of fruit availability: August – September
24 	<i>Machilus edulis</i> King. ex Hook.f. Common name: Wild avocado Family: Lauraceae Vernacular name: Pumsi (Bhutia); Maago (Monpa) Time of flowering: February – March Period of fruit availability: September – October	32 	<i>Phyllanthus acidus</i> (L.) Skeels Common name: Star gooseberry Family: Euphorbiaceae Vernacular name: Kawlsunhlu (Mizo) Time of flowering: February – March Period of fruit availability: May – June

Image of fruit	Name of the fruit species	Image of fruit	Name of the fruit species
	<i>Antidesma bunius</i> L. Spreng. Common name: Bignay Family: Euphorbiaceae Vernacular name: Heiyen (Meitei) Time of flowering: March – April Period of fruit availability: July – September		<i>Syzygium jambos</i> Alston. Common name: Myrtaceae Family: Rose apple Vernacular name: Bogi Jamu (Assamese) Time of flowering: Feb. – March Period of fruit availability: May – June
	<i>Baccaurea ramiflora</i> Lour. Common name: Burmese grape Family: Phyllanthaceae Vernacular name: Bureng (Adi); Leteku (Assamese) Time of flowering: March Period of fruit availability: June – July		<i>Nephelium lappaceum</i> Linn. Common name: Wild rambutan Family: Sapindaceae Vernacular name: Tader (Adi) Time of flowering: February Period of fruit availability: April – May
	<i>Dillenia indica</i> L. Common name: Elephant apple Family: Dilleniaceae Vernacular name: Outenga (Assamese) Time of flowering: May – August Period of fruit availability: September – February		<i>Calamus tenuis</i> Roxb. Common name: Cane fruit Family: Arecaceae Vernacular name: Jeying (Adi); Heiri (Meitei) Time of flowering: Dec. – January Period of fruit availability: April – May
	<i>Ziziphus mauritiana</i> Lam. Common name: Ber Family: Rhamnaceae Vernacular name: Bogori (Assamese) Time of flowering: October – November Period of fruit availability: December – January		<i>Haematocarpus validus</i> (Miers.) Bakh. ex F. Forman Common name: Blood fruit Family: Menispermaceae Vernacular name: Theichhungsen (Mizo) Time of flowering: Dec. – January Period of fruit availability: June – August
	<i>Elaeocarpus floribundus</i> Blume. Common name: Indian olive Family: Elaeocarpaceae Vernacular name: Jalphai (Assamese); Shekhuthi (Sumi Naga) Time of flowering: April - May Period of fruit availability: November – January		<i>Viburnum foetidum</i> Wall. Common name: Stinking viburnum Family: Caprifoliaceae Vernacular name: Yolyu (Apatani) Time of flowering: June – July Period of fruit availability: September – October
	<i>Terminalia chebula</i> Retz. Common name: Chebulic myrobalan Family: Combretaceae Vernacular name: Silikha (Assamese) Time of flowering: March – April Period of fruit availability: November – January		<i>Castanopsis hystrix</i> J. D. Hooker & Thomson ex A. de Candolle. Common name: Chest nut Family: Fagaceae Vernacular name: Amke (Adi) Time of flowering: October Period of fruit availability: August – September

in the seasonality chart figure. List of underutilized fruit species sampled from various locations of the region with vernacular names of various ethnic communities have been given to each species in the table along with photographs to elaborate the same.

Underutilized fruit species recreate an important role in mitigating hunger through diet diversification as they are reservoirs of minerals, vitamins, carbohydrates, proteins, antioxidants and also it can be considered as risk aversion and a resilient crop towards climate change owing to its wider phenological and soil adaptability in this difficult region. However, with rapid land transformation, growing connectivity, deforestation due to uncontrolled Jhum, wood felling, etc. regrettably, resulted in the decline and loss of these species, henceforth facing rarity. Several studies regarding these fruit species have been highlighted in different aspects nevertheless most of the

studies were in bits and pieces. Therefore, a small effort on developing a seasonality chart will create a catalogue of wild underutilized fruits which need to be consumed during a certain season. Further, promoting the use of underutilized fruit species needs to be achieved by highlighting their importance in their current production areas as well as exploiting further opportunities to extend their production and consumption as most of these fruit species are preferred in the region for their delightful taste, medicinal value and being a source of food and nutrition which betokens the natural essence of these wild underutilized fruit species.

For further interaction, please write to
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