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Nutritional attributes of indigenous vegetables and its consumption in the regions of North Eastern India

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Abstract

North East India comprising of eight states namely Assam, Arunachal Pradesh, Manipur, Meghalaya, Mizoram, Tripura, Nagaland, and the Himalayan state of Sikkim is surrounded by wide physiographical variations. This region is considered to be endowed with richest biodiversity conservation in terms of underutilised horticultural crops, spices, plantation crops as well as medicinal and aromatic plants including ornamental plants. Being the richest reservoir of genetic resources of various indigenous vegetable crops, it plays a crucial role with special reference to food and nutritional security of the tribal population of the entire states of North East India. In order to resolve the issues of nutritional securities, encouraging the rural and tribal populations for maximum utilisation of these indigenous vegetables is one of the first and foremost options since the underutilized vegetables are embedded with vitamins, minerals, fiber and phyto-chemicals. Besides these, it also contains phyto-chemicals that have free radical scavenging and anti-inflammatory properties which are endowed with many health benefits. Considering the importance of nutritional and economic values of such beneficial vegetables, emphasis should be confined to its proper cultivation practises as well as conservation of its germplasm for further utilisation by the population of North East India. Availability of several indigenous vegetables in the rural regions of North East India and its nutritional attributes with respect to human health benefits have been highlighted and reviewed in this paper.

Keywords: conservation, health benefits, indigenous vegetables, north east India, nutritional attribute

Introduction

North east India is enriched with biodiversity conservation surrounded by an altitude with its mesmerising climate thereby supporting a varied subtropical flora with diverse agrobiodiversity. The rural population of the entire north eastern states of India still practises traditional agricultural methods of cultivation such as shifting cultivation popularly practised in Nagaland, raised bed cultivation on hill slopes, and submergence rice cultivation on plain land. Due to its traditional ethnic beliefs, practise of cultivation of indigenous germplasm is confined in regions of North East India. Indigenous vegetables or wild edible plants refer to those vegetables which are confined to a particular region or locality which contributes to an essential part of the daily diet and can be consumed along with rice which has been considered as a staple food of the entire population. In this paper, analysis of evaluation of nutritional attributes of wild edible plant bio-resources along with its health benefits, prevalent in this hot spot region of North-East India has been highlighted and reviewed since majority of the people are not aware of its nutritional values and consider them as weeds (Shackleton, 2003; Steyn *et al.*, 2001) [54, 57]. But then gradually due to the recognition of potential benefit for human health as per the reports of Khattak (2011) [38], consumption of indigenous vegetables by the local people in a traditional manner has increased to a greater extent. Indigenous vegetables are enriched with vitamins, minerals, fibre and phyto-chemicals which further helps in resolving the issues of nutritional security. Vegetables containing phyto-chemicals are composed of free radical scavenging and anti-inflammatory properties thereby emphasising towards human health benefits. It has been scientifically proven that consumption of foods rich in vegetables helps in reducing the risk of cardiovascular disease as well slows down ageing effect. Intake of 350-400 g vegetables per capita per day is directly proportional to reduction of incidence of various forms of cancer. Some of the indigenous leafy vegetables and wild edible ferns collected from the locality can be utilised traditionally which are cheaper and easily available as well as enriched with nutritional values higher than several known common vegetables and fruits (Orech *et al.*, 2007) [46]. Wild or indigenous vegetables are considered to be the richest source

of antioxidants (Chu *et al.*, 2002) ^[14] which further encourages in scavenging free radicals produced in human body thereby leading to fight against several diseases for maintaining healthy body (Idowu *et al.*, 2006) ^[32]. Due to the regular consumption of edible wild plants and leafy vegetables in developing countries, it has become a source of adequate nutrition to the inhabitants (Aberoumand and Deokule, 2009) ^[3]. Apart from it, it also contains anti bacterial, hepatoprotective and anti-carcinogenic properties, and therefore endowed with medicinal value (Heywood, 1999) ^[30]. However, indigenous vegetables receive little attention in research activities, economic development, biodiversity conservation and sustainable management (Surjata *et al.*, 2016) ^[58]. Based on the nutritional values in relation to its health benefits, several researchers have studied and reported more than sixty indigenous vegetables comprising of ferns, herbs, shrubs, leafy vegetables, spices and condiments etc. which are consumed regularly by the local people of North East India. Some of them have been mentioned below which includes *Abelmoschus manihot*, *Amaranthus spinosus*, *Amaranthus tricolor*, *Alpina galangal*, *Asparagus recemosus*, *Alocasia indiacca*, *Allium tuberosum*, *Amorphophalus campanulatus*, *Antidesma acidum*, *Begonia barbata*, *Bacopa monnieri*, *Bambusa tulda*, *Bauhinia purpurea*, *Benincasa hispida*, *Boerhavia diffusa*, *Bombax malabarica*, *Canavalia gladiata*, *Centella asiatica*, *Ceratopteris thalictoides*, *Chenopodium album*, *Coccinia indica*, *Colocasia esculenta*, *Crotolaria juncea*, *Cucurbita moschata*, *Cycas circinalis*, *Drymaria cordata*, *Dioscorea alata*, *D. bulbifera*, *D. pentaphylla*, *D. esculanta*, *Dolichos lablab*, *Eleocharis dulcis*, *Enhydra fluctuans*, *Entada phaceolus*, *Eryngium foetidum*, *Euryale ferox*, *Hibiscus sabdariffa*, *Ipomea aquatica*, *Lannea coromandalica*, *Melothria heterophylla*, *Melochina corchorifolia*, *Mirabilis jalapa*, *Momordica cochinsinensis*, *Momordica charantia*, *Morinda tintoria*, *Neptunia prostrate*, *Nelumbo nucifera*, *Nymphaea pubescens*, *Oxalis corniculata*, *Parkia roxburghii*, *Perilla frutescens*, *Pueraria tuberosa*, *Premna esculanta*, *Polycarpon prostratum*, *Psophocarpus tetragonolobus*, *Rumex vesicarius*, *Sagittaria sagittifolia*, *Sterculia indica*, *Solanum torvum*, *Solanum ferox*, *Solanum nigrum*, *Smilax zyanica*, *Sesbania grandiflora*, *Thunbergia grandiflora*, *Trichosanthes dioica*, *Typhonium trilobatum*, *Vigna unguiculata* var. *sesquipedalis*, and *Xanthosoma sagittifolium*. This paper emphasises about several minor vegetable species available in entire region of North East India with special reference to its nutritional attribute.

Leafy vegetables

India, being endowed with diverse climatic conditions, has an extensive collection of edible green leafy vegetables some of which are locally grown-up and utilized from ancient periods as source of food as they contain several nutrients and minerals which can nourish the ever growing human population and assist to attain nutritional security. It is essential that the locally available edible green leafy vegetables which are cheap or free of cost and easy to cook could be used in the diets to eliminate micronutrient malnutrition and also to avoid degenerative diseases. The important commercial leafy vegetables include rai (*Brassica juncea*), lafa (*Malva verticillata*), palak (*Spinacea oleracea*). Additionally, a wide variety of indigenous leafy vegetables are also available. These are amaranth (*Amaranthus spp*), puroi sag (*Vasella rubra* and *B. alba*), sorrel (*Rumex*

rasicarius), etc. Other indigenous leafy vegetables which are used often include jilmil sag (*Chenopodium album*) and Kalmou sag (*Ipomea reptans*). *Amaranthus viridis*, *A. lividus*, *A. retroflexus* and *A. spinosus* are significant leafy vegetables grown naturally in North East India (Sarma, 2001) ^[53]. Apart from being a good source of protein, crude fibre and minerals, leafy vegetables are also known to be a good source of various essential free amino acids (Handique, 1993) ^[26], iron, phosphorous, calcium and vitamins particularly ascorbic acid as well as β and α -carotene (Ragu and Kapoor, 1997) ^[48]. Some non-conventional leafy vegetables are known to be loaded with dietary antioxidants like flavonoids, tannins etc. and *in vitro* assay confirms that they are very proficient in scavenging free radicals (Salam, 2011) ^[51].

Chenopodium album (Fat hen)

It is an annual herb, green, erect and branched coated with white mealy pubescence. The leaves and tender branches can be used as vegetables by the local people of the region as well as in many parts of the world. In some parts of India, it is also used for production of curd which is locally known as raita (Maheshwari, 1963) ^[40]. Young shoots of *Chenopodium album* is boiled and can be consumed with other vegetables (Fig.3).

Xanthosoma sagittifolium (Tania)

It is a herbaceous plant commonly known as Tania comprising of short stem with a few larger leaves born on the apex with long erect petioles. Individual parts of this plant consists of oxalate crystals which remains harmful if consumed raw but it could be eliminated or broken down by properly cooking or by drying under the sun. It is rich in carbohydrates, calcium, iron and phosphorous (Fig.1).

Amorphophallus campanulatus (Elephant Foot Yam)

It is an aroid which belongs to the family Araceae. It is a popular tuber crop grown wild in the regions of North East India and consisting of corms and cormels which can be consumed as vegetables after boiling and cooking. Value added products such as pickles can also be prepared from this plant. Although it contains less amount of proteins but it can be replaced by the presence of other wide varieties of minerals and trace elements such as iron, calcium, potassium and magnesium (Englberger *et al.*, 2003) ^[22].

Abelmoschus manihot (Sweet Hibiscus)

It is a large annual or perennial flowering plant belonging to the family Malvaceae and commonly known as hibiscus which have proven edible in nature. Its flowers are yellow in colour hence known as sunset muskmellow. Its tender leaves are sweet and impart a mucilaginous texture when cooked. Due to its high protein content, it is considered as one of the most nutritious leafy vegetables around the world as well as in the states of North East India. Its petals are also edible in nature which can be used for preparation of salads by the rural people of the locality (Fig.6).

Psophocarpus tetragonolobus (Winged Bean)

It is a leguminous plant and can be consumed as vegetables by the people of Manipur. The pods of the plant contain sufficient amount of proteins, carbohydrates, amino acids, minerals and higher amount of starch. Among the minerals, potassium is found to be highest. Since it is a leguminous crop, in terms of nutritional values such as protein and oil

content, seeds of winged bean has been found to be more nutritious. Based on the study of its nutritional qualities, it started growing gradually in more than 70 countries successfully depending upon its climate and edaphic conditions as well as its nutritional and anti-nutritional factors that varied among different cultivars of winged bean seeds (Mishra *et al.*, 1987) ^[41]. Almost all the parts of the plant such as seeds, pod without seeds and tuber contains significant amount of minerals during its developmental stages. Regarding the content of potassium in winged bean seeds, it ranged from 8.00 to 10.55 mg/g (Gajameragedera and Ravindran, 1989) ^[25]. Higher value of potassium content was found to be at the rate of 4.219 mg/g (Amoo *et al.*, 2006) ^[9].

***Talinum triangulare* (Water Leaf)**

It is a soft mucilaginous leafy vegetable which belongs to the family Portulacaceae and grown naturally in the regions of North East India. In some parts of India, it is also propagated by cuttings or divisions. Its tender leaves can be consumed as pot herb and soups when cooked and can also be used as a condiment in sauces or raw in salads since it is rich in minerals and amino acids from its nutritional point of view as well as having an anti-ascorbic properties for further preventing a disease called scurvy (Disu, 2010) ^[19]. Besides containing minerals and amino acids, it also consists of carotenoids such as Lutein and Zeaxanthin which acts as a stimulant thereby influencing immune cells of eyes (Shakuntala, 1985) ^[55]. Consumption of water leaf helps in reducing the occurrence of heart diseases, controls blood pressure and cholesterol level, prevents cancer, avoid a painful intestinal ailment called diverticulosis, and guard against cataract and muscular degeneration which are the two primary causes of vision loss (Fasuyi, 1985) ^[24].

***Nymphaea spp.* (Water Lily)**

Individual parts of the plant such as stems, young leaves, lower buds, flower stalks and rhizomes are edible in nature and can be cooked as vegetables. Rhizomes when cooked, have a combination of sweetness and bitterness in taste which are considered to be highly beneficial for treating diarrhoea, dysentery etc. Seeds of this wild edible plant are sweet in taste which helps in treating gastrointestinal disorders and jaundice as well (Jana, 2007) ^[35].

***Ipomea aquatica* (Water Spinach)**

It is a herbaceous perennial plant which belongs to the family Convolvulaceae and comes under the category of underutilised plant and hence its consumption is unaware by the locality of the region (Fig.5). It is grown wild as well as propagated by seeds or herbaceous cuttings. It is a herbaceous aquatic plant whose tender leaves are utilised as an indigenous vegetables and can also be added to sauces and soups (Westphal, 1994) ^[63]. Value added products prepared from the plant parts of water spinach contains significant amount of fibre, iron and calcium. In some parts of the country, this potherb is consumed frequently by the local people (Cornelius, 1985) ^[15]. An easy method for consuming this leafy vegetable is to stir fry the young shoots along with its stems and leaves (Westphal, 1993) ^[62]. Young shoots of water spinach can also be consumed either boiled, steamed, added to soups, stews, curries etc or with garlic, ginger, shrimp paste and cuttle fish (Herklots, 1972; Wikipedia, 2006) ^[29, 64].

***Nelumbo nucifera* (Lotus)**

It is an aquatic plant which is commonly known as water lily, lotus or sacred lotus and belongs to the family Nelumbonaceae. Its edible plant parts are seeds and roots which are popularly consumed by the people of South East Asia as well as North Eastern parts of India. Apart from seeds and roots, tender rhizomes, stems and leaves of lotus are also edible in nature which can also be consumed by cooking along with other vegetables as well as by soaking in syrup or pickled in vinegar. From its nutritional point of view, seeds of lotus are enriched with proteins (10.6-14.8) (Jaenicke and Zeledon, 2006) ^[33], essential minerals (Ibrahim and Eraqy, 1996) ^[31] (Fig.9).

***Dioscorea bulbifera* (Aerial Yam)**

Commonly known as air potato or air yam specifically belongs to the family Dioscoreaceae and propagated by bulbil which is edible in nature and comparatively tastes like potato. A number of dioscorea species *alata*, *bulbifera*, *brevipetiolata*, *esculenta*, *hamiltonii*, *hispida*, *kamaonensis*, *nummularia*, *pentaphylla*, *puber* and *quinata* were prevalent in the region. *D. hamiltonii* occurs in humid forests of North Eastern hills (Sarma, 2001) ^[53]. In Assam, local people commonly utilise as Kathalu, Mati alu, Goch-aloo, Bon-aloo, Gosh Alu. It is a good source of antioxidants since it contains appreciable amount of flavonoids and isoflavonoids (Fig.7).

***Moringa oleifera* (Sajina)**

It is a medium sized plant whose flowering starts within 12-15 weeks of planting, commonly known as drumstick and locally called as sajina which literally belongs to the family Moringaceae. It is well adapted in the regions of North East India due to its favourable geographical and climatic conditions. Individual parts of the drumstick tree including seeds, pods, flowers, leaves are enriched with nutrients and antioxidants. It is also a rich source of fibre, controls blood glucose levels, contains natural source of iron and is considered to be a powerhouse of antioxidants.

***Diplazium esculentum* (Vegetable Fern)**

It is a rhizomateous edible ferns of North Eastern India belonging to the family Athyriaceae. It is grown wild in open marshy areas, stream banks and canals from sea level upto 2300 m (Akter *et al.*, 2014; Evans, 2009) ^[6, 23]. Young shoots of vegetable fern can be consumed by the people as vegetables by cooking. It is a good source of iron, phosphorous, potassium and protein as compared to several conventional vegetables and wild edibles. Besides this, it also contains minerals higher than that of commercial fruits (Badola, 2010) ^[11]. In terms of crude protein, young shoots of edible ferns contains 33.27% which is considered to be the best among all the leafy vegetables as well as non conventional vegetables that are being cultivated (Handique, 2003b) ^[27]. Young shoots can also be consumed by boiling for laxative effect (Kagyung *et al.*, 2010) ^[36].

Perilla frutescens

It is an annual herb consisting of green or purple stem that grows upto a height of 150 cm. Leaves are ovate to round attached to a square stem with small tubular purplish to white flowers of 3-4mm in length. Flower stalks are about 1.5mm and its seeds are smaller in size weighing about approximately 4g/1000 seeds. Edible parts of *Perilla frutescens* are its leaves and seeds. Leaves could be utilised

in the form of spice which helps in imparting flavours and colour in many dishes. In Northeast Asia, it is mainly used by tribal groups of people for its edibility nature of seeds as it is a less expensive source of fat and protein. Seeds are roasted and grounded to convert it into a powdery form for further consumption in a salad called 'singju' by the people of Manipur. Leaves can also be preserved for later use as vegetable by drying. For soup preparation, flower buds and young shoots are used which are edible in nature (Longvah and Deosthale, 1998) [39]. The major phytochemical compounds reported in this species are phenols, flavonoids, phytosterols, tocopherols, Policosanols and fatty acid. Perilla seed oil is also a rich source of essential fatty acids.

***Canavalia ensiformis* (Jack Bean)**

It is a leguminous crop cultivated in the regions of North Eastern India and belongs to the family Fabaceae (CSIR, 1950) [16]. In western countries, it is utilised as a cover crop and its seeds are further roasted and grounded for the preparation of a drink like coffee (Bressani *et al.*, 1987) [12]. Based on the quality and quantity of seed proteins, effect of locality plays an important role rather than the plant cultivar (Dodd, 1980) [20]. Moderate intake of these seeds will greatly increase the total dietary protein intake of the consumers and hence these seed material of *Canavalia ensiformis* has a promising nutritional significance (Bressani *et al.*, 1987) [12]. Abitogun and Olasehinde (2012) [4] also observed high content of protein in the seeds of jack bean. Presence of high content of vitamin C and carbohydrate in the pods of *Canavalia ensiformis* have also been reported and studied by several researchers.

***Amaranthus spp.* (Amaranthus)**

It is a leafy vegetable which belongs to the family Amaranthaceae and is grown wild even in worst climatic conditions (Fig.2). From the nutritional point of view, uncooked amaranthus grains contain 12% water, 65% carbohydrates including 7% dietary fibre, 714% protein and 7% fat (USDA, 2018) [7]. As per the reports of USDA (2018) [8], cooked amaranthus leaves are a rich source of vitamin A, Vitamin C, Calcium and Manganese with smaller amounts of folate, iron, magnesium, and potassium. Due to its higher protein content as well as its recognition as an indigenous vegetable, it is well-suited to human nutritional needs and hence cultivation of various species of amaranthus for utilisation of its seeds (especially *A. cruentus* and *A. hypochondriacus*) gradually rejuvenated in the 1970s.

***Solanum torvum* (Pea Egg Plant)**

It is a shrub which is erect and short measuring approximately 2-4 m tall with numerous branches commonly known as turkey berry and belongs to the family Solanaceae. It is consumed by the local populations of North Eastern India and its fruits are born in clusters of tiny green spheres about 1 cm diameter which gradually turns yellow when it is fully ripen. Because of its nutritive values, its fruits are frequently consumed by the rural populations of the locality. Tender leaves and fruits of pea egg plant is enriched with calcium and iron and hence it is consumed in the form of edible indigenous vegetables by stir frying or by boiling (Akoto *et al.*, 2015) [5]. In addition, *Solanum torvum* exhibited an antioxidant activity and DNA-repair capability in oxidative DNA damage caused by free radicals (Abas *et al.*, 2006) [1]. Based on its phyto-chemical studies, it has been discovered

that fruits of pea egg plant are a good source of diverse alkaloids, flavonoids, saponins, tannins, and glycosides adequate enough to bestow pharmacological effects. Aqueous extracts extracted from several plant parts of this species exhibit a significant analgesics and anti-inflammatory properties (Ndebia *et al.*, 2007) [43].

***Bambusa tulda* (Bamboo)**

It is a forest tree grass which comes under the category of family Poaceae. Bamboos occupy a very noteworthy position in everyday life of indigenous people of North East India due to their massive utility as traditional food. The people of Northeast India are gifted and blessed with rich bamboo culture as the plants are inseparable part of several diverse traditions and religious beliefs of many ethnic people residing at both rural and urban areas. The presence of high content of protein, amino acids, minerals, fibre, carbohydrates, and low fat makes the shoot of bamboo as one of the widely acclaimed nutrient rich food items (Fig.8). Consumption of bamboo shoots as food in India is mainly confined to the people of Northeast states where they are taken either fresh at the time of harvesting season or dried, fermented or pickled forms during offseason (Nirmala *et al.*, 2008) [44]. Bamboo shoots are a good source of protein with protein content ranging from 1.49 g/100 g to 4.04 g/100 g fresh weight in fresh bamboo shoots (Chongtham *et al.*, 2011) [13]. Bamboo shoots have enormous prospective of being used as important health food as they contain high proteins, amino acids, carbohydrates, many important minerals, and vitamins (Shi and Yang, 1992) [56]. Bamboo shoots have rich amount of amino acids. Out of 17 amino acids reported in bamboo shoots, 8 amino acids were vital for human body (Qiu, 1992) [47]. Devi and Singh (1986) [18] found an enhancement of protein content in fermented shoots from 3.1% to 7.1% and 8.1% on the 3rd and 5th day of fermentation process, correspondingly.

***Cyphomandra betaceae* (Tree Tomato)**

It is a semi woody shrub of upto 2-3 m high commonly known as tamarillo and its flowers are usually pentamerous thereby representing pinkish colouration. Fruit colour is either reddish brown or orange depending upon the stage of maturity having a diameter of about 9-12 cm. It is grown naturally and is found in abundance in backyard of every individual residing in the regions of North Eastern India specifically in Meghalaya (Thakur *et al.*, 1988) [60], Nagaland and Sikkim. Due to the presence of higher content of antioxidant, it is believed to be a good substitute for tomato and cherry tomato (Noor *et al.*, 2014) [45]. It is a good source of protein (1.60 g/100g), vitamin A (4.80 mg/100g DW), vitamin C (55.90 mg/100 DW) and minerals like calcium (11.20 mg/100g), sodium (17.80mg/100g) and phosphorus (410.60mg/100g) (Mutalib *et al.*, 2017) [42]. Ascorbic acid content in tamarillo range between 25 to 30 mg/100g FW and displays a significantly greater reactive oxygen scavenging capacity, because of the presence of anthocyanins (Roberts *et al.*, 2003) [49]. Ascorbic acid is a water-soluble vitamin, hence it is known as an oxygen scavenger, acting as reducing agent (Vasco *et al.*, 2009) [61]. A number of phytochemical in *Cyphomandra betaceae* fruit like 2-Methyl (1, 3, 4) oxadiazole, 2, 3- Dihydro-3, 5-dihydroxy-6-methyl-4H-pyran-4-one and Thiazole have been evaluated in tree tomato. These have a role in anti inflammatory effects while hexadecanoic acid may have a role in antioxidant activities. 1, 3, 4-Oxadiazole products are well-known for their anti-inflammatory (Tan *et*

al., 2006) [59] antibacterial, antifungal (El-Emam *et al.*, 2004) [21] and HIV replication inhibition (Sahlin *et al.*, 2004) [50]. Therefore, the fruits of *Cyphomandra betacea* is considered to be as one of the richest sources of antioxidant and has an anti-cholinesterase properties that can enhance human health (Hassan *et al.*, 2013) [28].

***Solanum incacum* L. (Bitter Brinjal)**

It is commonly known as bitter brinjal for its bitterness in taste of its fruits and due to the presence of thorns in the entire plant, it represents the name 'thorn apple' belonging to the family Solanaceae. It can be grown annually since it has the potential to adapt in a wide variation of climatic and soil conditions. Fruits are oval in shape and imparts green colour during immaturity but gradually turns to deep yellow and red when it becomes fully matured. Although it is a popular vegetable among the people of those particular regions, it is

still lagging behind in terms of consumption specifically in some parts of North East India such as Assam due to its bitter taste. *Solanum incacum* L. is considered to be a wild species of bitter brinjal and has been originated in North Eastern regions of India (Kanjilal, 1939; Jain and Borthakur, 1986) [37, 34]. Bitter brinjal has its own recognition due to its contribution of nutritional values for human health. Based on the earliest reports regarding high carbohydrate content (Auta and Ali, 2011) [10], it has been verified that it is a good source of carbohydrates and energy in utilisation for human nutrition (Sambo, 2016) [52]. Fruits are an essential source of nutritional values consisting of considerable amount of macronutrients viz. carbohydrate, crude fiber and fat along with vitamin C, thiamine and folic acid with high moisture content. The leaves of *S. incanum* L. are rich in potassium (Auta and Ali, 2011) [10] and calcium (Abdalla, 2015) [2] (Fig.4).

Table 1: Proportion of essential nutrients of indigenous leafy vegetables of North Eastern regions of India

Vegetables	Protein (g)	Minerals (g)	Crude fibre (g)	Calcium (mg)	Phosphorous (mg)	Iron (mg)
<i>Amaranthus caudatus</i>	3.0	3.3	1.0	200	40	-
<i>Amaranthus gangeticus</i>	4.0	2.7	1.0	397	83	3.49
<i>Amaranthus paniculatus</i>	5.9	3.8	2.1	530	60	18.4
<i>Amaranthus spinosus</i>	3.0	3.6	1.1	800	50	22.9
<i>Chenopodium album</i> (jilmil)	3.7	2.6	1.8	150	80	4.2
Bottle gourd leaves	2.3	1.7	1.3	80	59	-
Colocasia leaves (black)	6.8	2.5	1.8	460	125	0.98
Colocasi leaves (green)	3.9	2.2	2.9	227	82	10.0
Curry leaves	6.1	4.0	6.4	830	57	0.93
Drumstick leaves	6.7	2.3	0.9	440	70	0.85
Fenugreek leaves	4.4	1.5	1.1	395	51	1.93
Garden sorrel (Chuka sak)	0.6	0.9	1.3	130	20	1.7
Ipomoea leaves (kolmow)	2.9	2.1	1.2	110	46	3.9
Mustard leaves	4.0	1.6	0.8	155	26	16.3
Radish leaves	3.8	1.6	1.0	265	59	0.09
Dhekia (ferns)	-	13.15	7.8	-	-	-

Source: Deka *et al* (2012) [17]

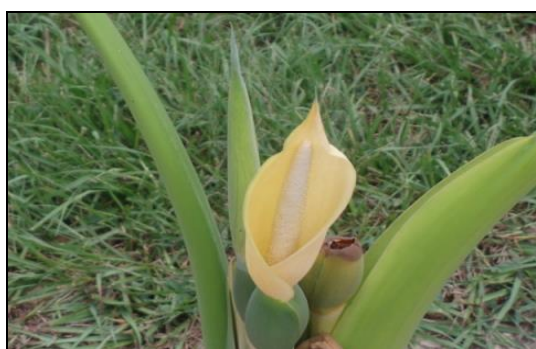


Fig 1: *Xanthosoma sagittifolium*



Fig 3: *Chenopodium album*



Fig 2: *Amaranthus tricolor*



Fig.4 Mature fruits of *Solanum incanum*



Fig 5: Stems and flowering branch of *Ipomea aquatica*



Fig 6: Unripe-fruits-of-Sunset-hibiscus



Fig 7: *Dioscorea bulbifera*



Fig 8: *Bambusa tulda*



Fig 9: *Nelumbo nucifera*

Conclusion

Based on the thorough study on a vast range of plant resources existing in natural conditions in the North-Eastern regions of India and even after knowing the importance of minor vegetables in the life of local people of the region, their production and consumption is still hindered by general lack of awareness among the locality of the region. Though, these minor vegetables help the rural people in mitigating the issues of malnutrition by contributing food and nutritional security through supplementation of vitamins, minerals and other nutrients, still they remain mainly underutilized since the people are still unaware of its nutritional factors and unintentionally consuming a good amount of nutrients from these non-cultivated or wild edible vegetables. Although several researches have been done in the recent years on the nutritional aspects and specific compounds, yet many functions and interactions are still required to be investigated. In order to eliminate this huge gap of ethno-botany, there is a need to develop an integrated approach for utilization of these rich genetic resources of indigenous minor vegetables for ensuring food and nutritional security of the people, health, and generation of income as well as to maintain ecological balance. Hence, there is an obvious need for collaboration among the scientists, researchers, institutions, government departments, local organizations and communities etc. to come forward and pay more attention towards research and ways of conserving these genetic resources. This will embrace a new dimension towards its management and conservation of natural plant wealth of the entire regions of North Eastern India.

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