

## A study on documentation and market acceptability of underutilized wild edible crops of Kohima district, Nagaland, India

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### Abstract

Underutilized Edible Crops (UEC) has the potential for contributing to food security (nutritional/medicinal), income generation yet they are under exploited. Underutilized crops play important role in the daily lives of the rural people of Kohima, Nagaland. The present study aimed at survey and collections of UEC in Kohima district, Nagaland. A total of 56 species of UEC belonging to 32 families are collected and identified. Based on the survey it was found that of the collected and identified species, 26 of them were wild edible fruits, 2 cereals and 30 vegetables (young leaves, shoots, stem, leafy), 1 rhizome. The use of these crops and market acceptability are studied by surveying the different markets in Kohima district, Nagaland.

Key words : Food, Kohima district, market acceptability, medicine, rural income, underutilized wild edible crops.

### INTRODUCTION

The world population is increasing at an alarming rate and it is estimated that 1.2 billion of the world population do not have enough food to meet their daily requirement with deficiency in one or more micro-nutrient<sup>[1]</sup>. Almost 95% of the world population depends on 30 plant species as their staple food, termed as 'Major Crops' and increased reliance on major food crops has been accompanied by a shrinking of the food basket which humankind has been relying upon for generations<sup>[2]</sup>. The dependency on these crops to feed hundreds and thousands of mouth, many parts of the developing countries are suffering from starvation, and as such the need to fight against poverty has raised a great concern for the developing countries. Human being needs an urgent action to promote crop diversification to encounter these problems. Underutilized Edible Crops (UEC) can play an important role to tackle these problems. Underutilized edible crops are defined as the species which are under exploited of its potential for contributing to food security (nutritional/medicinal), income generation and environmental services<sup>[3]</sup>. These are also referred as 'Neglected and Underutilized species'/'Orphan crops'/'Minor crops'<sup>[4]</sup>. Underutilized species are locally abundant instead of globally, lack scientific knowledge concerning their physiological, agronomic and ecological properties and have a limited current use relative to their economic potential<sup>[5]</sup>. These species of plant are so called underutilized because their product output markets may be missing due to exogenous and/or endogenous constraints e.g., African garden egg (*Solanum aethiopicum* L.) is underutilized in Ghana due to its short shelf life<sup>[6]</sup>, market equilibrium may be suboptimal as a result of market imperfections, market failure may generate greater public than private value<sup>[5]</sup>, receive little attention from research, extension services, farmers, policy and decision makers, donors, technology providers and consumers. Underutilized edible crops maybe abundant in a particular area/region but could be little or less available in another region due to different environmental conditions between these regions. These crops have great potential for contributing to improved incomes, food security and nutrition, combating the 'hidden hunger' caused by micronutrients

deficiencies. They have a strong cultural identify and are associated with traditional customs and beliefs<sup>[7]</sup>. Underutilized plants are also used as medicine traditionally, e.g., *Vitex agnus-castus* (chaste tree) is widely used as a pharmaceutical drug, phytotherapy in the treatment of many female conditions<sup>[8-10]</sup>. The main causes of underutilization are the general lack of transport, processing and market infrastructure, the lack of demand, due to product information, the lack of market information and co-operation between the different market chain actors and the low productivity of the traditional slash and burn plots<sup>[11]</sup>. Micropropagation is an important step for producing millions of underutilized plants under a controlled and aseptic condition, independent of seasonal constraints and also gives greater output and allows further augmentation of elite disease free propagules<sup>[12]</sup>. The prevailing agro-ecological condition of North-eastern region of India is very suitable to producing underutilized crops/plants such as *Fagopyrum esculentum* and *F. tataricum*<sup>[13]</sup>. Rai *et al.*<sup>[14]</sup> stated that problems relating to conservation and enhancement of underutilized crops in north eastern region are land tenure issues, gender and equity issues, interdepartmental coordination, shifting cultivation, inter-state border dispute, insurgency etc. Nagaland is a remote state of North East India and exhibits a great deal of plant diversity. The people of Nagaland are mostly dependent on the natural resources for their food, raw material and traditional medicines etc. Very little work has been done on underutilized edible crops in Nagaland<sup>[11]</sup>. The present study was under taken to document the underutilized wild edible crops of different districts of Nagaland, India, survey the market acceptability of these crops, nutritional analysis and workout the steps for popularization of these crops. The present communication reports a part of the works done in the Kohima district of Nagaland.

### MATERIALS AND METHODS

#### Survey area

Kohima is the capital city of the North-Eastern state of Nagaland, India. The district is located between the geographical coordinates of 25.40°N and 94.08° E. Kohima is surrounded by

the state of Assam to the west, Zunheboto to the east, Wokha to the north and Manipur state to the south. Kohima district has a total geographical area of 1595 Sq. KM and an average elevation of 1261 meters (4137 feet). Kohima lies north of the Japfü Barail intersection. Due to its elevation, Kohima features a more moderate version of a humid subtropical climate. Kohima has hot and rainy summer and very cool winter. The coldest months are from December to February, frost occurs and in the higher altitudes snowfall occurs occasionally. During the height of summer, from June to August, temperature ranges between 27-32°C. The district experiences heavy rainfall during summer (2000 mm).

With the help of forest experts and field guides, intensive field survey and collection with regard to UECs was carried out in the district of Kohima, Nagaland during different seasons of the year for two successive years (2013-2015). Information based on the traditional knowledge on the different uses of the collected specimens was also acquired by interacting with the local people. The plant specimens were collected in the zipper poly bags and were brought to the laboratory for identification. Both conventional and digital herbariums were maintained. The specimens were categorized according to the types of plants and their parts used i.e. cereals, fruits, nuts and leafy vegetables. The leafy specimens were mounted and preserved in 40% formaldehyde solution (v/v) and kept as herbarium. Specimens like fruits and nuts are dried at 70°C and packed and kept as herbarium specimens with their accession number (Table 1).

## RESULTS

During the survey and collection, a total of 56 species of UEC belonging to the families of Moraceae, Juglandaceae, Anacardiaceae, Rosaceae, Capparaceae, Caesalpinaceae, Elaeagnaceae, Ebenaceae, Malvaceae, Cucurbitaceae,

Combretaceae, Berberidaceae, Myricaceae, Solanaceae, Fagaceae, Clusiaceae, Apiaceae, Saururaceae, Plantaginaceae, Begoniaceae, Brassicaceae, Asteraceae, Zingiberaceae, Phyllanthaceae, Verbenaceae, Polygonaceae, Urticaceae, Poaceae, Musaceae, Costaceae, Araceae, Rutaceae were collected and identified. Based on the survey it was found that of the collected and identified species, 26 of them were wild edible fruits, 2 cereals and 30 vegetables (young leaves, shoots, stem, leafy), 1 rhizome. The plant parts in use and purpose is documented in (Table 1). Different plants parts such as fruits, young leaves, shoots, stem, rhizome, inflorescence, flower, whole plant parts and cereals are taken as food in different manners by the local people of Kohima. Some of the crops marketed are shown in figure 1. Most of the plants are also used due to its high nutritional and medicinal values. To understand the acceptability of these crops/plant products and commercial viability, different markets under Kohima district was surveyed in different seasons of the year. It was found that some of the plant parts/products are commonly accepted and faces good market value and has good demand. The market survey also shows that some of these plants are sold at the local markets ranging from INR 20-70 per packet/cup/plate/bunch (local system of marketing) during different seasons (Table 2). During the survey it was found that there is no species standard system of measuring unit(s) exists for the crops being marketed. The different local markets have different local system/units like bunch, packets, plates, cup etc. which is shown in table 2. Even the rates are not static and vary from market to market, season to season and also depend on the supply from the rural mass to the market.

## DISCUSSION

In rural areas of many countries of the world underutilized edible crops/lesser known crops are the backbone of the rural

**Table 1:** Underutilized Edible Crops found in Kohima District, Nagaland

Scientific name	Common name	Vernacular name*	Fruit Family	Uses	Accession No
<i>Ficus racemosa</i>	Fig	Zuvithi (Lotha)	Moraceae	Mature fruit eaten raw	NU-BOT-UC-NK-1011
<i>Ficus semicordata</i>	Drooping fig	Chiede (Ang), Aki (Ao)	Moraceae	Mature fruit eaten raw	NU-BOT-UC-NK-1012
<i>Juglans regia</i>	Local walnut	Pfhü (Ang), Akojong (Ao)	Juglandaceae	Mature fruit eaten raw	NU-BOT-UC-NK-1013
<i>Rhus semialata</i>	Nutgall Tree	Zombou (Ang), Thumpak (Lotha)	Anacardiaceae	Mature fruit eaten raw	NU-BOT-UC-NK-1014
<i>Terminalia chebida</i>	Myrobalan	Seipfü sei (Ang)	Combretaceae	Mature fruit eaten raw	NU-BOT-UC-NK-1015
<i>Choerospondias axillaris</i>	Nepali Hog plum	Khola (Ang)	Anacardiaceae	Ripped fruit eaten raw	NU-BOT-UC-NK-1018
<i>Stixis suaveolens</i>	Stixis	-----	Capparaceae	Mature fruits eaten raw	NU-BOT-UC-NK-1019
<i>Spondias pinnata</i>	Wild mango	Mezi (Ang), Emungthi (Lotha)	Anacardiaceae	Ripped fruit eaten raw	NU-BOT-UC-NK-1020
<i>Bauhinia variegata</i>	Variagate bauhinia	Teguo (Ang), Piangnok (Ao)	Caesalpinaceae	Immature fruit eaten fresh	NU-BOT-UC-NK-1023
<i>Eleaagnus latifolia</i>	Wild olive	Pesü (Ang)	Elacagnaceae	Ripped fruit eaten raw	NU-BOT-UC-NK-1024
<i>Diospyros kaki</i>	Asian persimmon	Ziedi (Ang)	Ebenaceae	Mature fruit eaten raw	NU-BOT-UC-NK-1027
<i>Hibiscus abelmoschus</i>	Musk mallow	Wild Bindi (Hin.)	Malvaceae	Taken as vegetable	NU-BOT-UC-NK-1029
<i>Cucumis hystrix</i>	Wild Cucumber	Tsütuo (Ang)	Cucurbitaceae	Young fruits eaten raw	NU-BOT-UC-NK-1030
<i>Docynia indica</i>	Wild apple	Ciepho (Ang)	Rosaceae	Mature fruit eaten raw	NU-BOT-UC-NK-1032
<i>Mahonia nepaulensis</i>	Blue berry	Athuo (Ang)	Berberidaceae	Ripped fruit eaten raw	NU-BOT-UC-NK-1035
<i>Myrica esculenta</i>	Box-myrtle	Thugei (Ang), Lamrothi (Lotha)	Myricaceae	Ripped fruit eaten raw	NU-BOT-UC-NK-1036
<i>Physalis peruviana</i>	Cape goose berry	Chahamiaca sei (Ang)	Solanaceae	Ripped fruit eaten raw	NU-BOT-UC-NK-1037
<i>Rubus niveus</i>	Hill raspberry	Temeirom (Ang)	Rosaceae	Ripped fruit eaten raw	NU-BOT-UC-NK-1039
<i>Rubus ellipticus</i>	Golden Raspberry	Rom (Ang), Taiheap (Khiam)	Rosaceae	Ripped fruit eaten raw	NU-BOT-UC-NK-1040
<i>Castanopsis indica</i>	Chestnut	Thezüsei (Ang), Khew (Khiam)	Fagaceae	Mature nuts is eaten raw	NU-BOT-UC-NK-1041



<i>Rubus ellipticus</i>	Golden Raspberry Rom (Ang), Taiheap (Kham)	Rosaceae	Ripped fruit eaten raw	NU-BOT-UC-NK-1040
<i>Castanopsis indica</i>	Chestnut Thezusei (Ang), Khew (Kham)	Fagaceae	Mature nuts is eaten raw	NU-BOT-UC-NK-1041
<i>Syzygium cumini</i>	Black Plum Keloguo (Ang)	Myrtaceae	Ripped fruit eaten raw	NU-BOT-UC-NK-1042
<i>Prunus nepalensis</i>	----- Rünyü sei (Ang)	Rosaceae	Ripped fruit eaten raw	NU-BOT-UC-NK-1043
<i>Garcinia xanthochymus</i>	Sour mangosteen Chierie (Ang)	Clusiaceae	Ripped fruit eaten raw	NU-BOT-UC-NK-1044
<i>Prunus carmesina</i>	Wild cherry Kezie (Ang)	Rosaceae	Ripped fruit eaten raw	NU-BOT-UC-NK-1053
<i>Duchesnia indica</i>	Mock strawberry -----	Rosaceae	Ripped fruit eaten raw	NU-BOT-UC-NK-1055
<i>Rubus indotibetanus</i>	Rom (Ang)	Rosaceae	Ripped fruit eaten raw	NU-BOT-UC-NK-1056
<b>Whole plant</b>				
<i>Centella asiatica</i>	Indian Pennywort Gara(Ang), Longsokorok (Ao)	Apiaceae	Taken as salad or vegetables	NU-BOT-UC-NK-1003
<i>Houttuynia cordata</i>	Stink grass Gatha (Ang), Hinse (Reng)	Saururaceae	Taken as salad or vegetables	NU-BOT-UC-NK-1005
<i>Plantago erosa</i>	Common plantain Gapa (Ang), Akaba (Ao)	Plantaginaceae	Taken as salad or vegetables	NU-BOT-UC-NK-1007
<i>Begonia picta</i>	Begonia Cophru (Chak), Onsürup (Ao)	Begoniaceae	Taken as salad or vegetables	NU-BOT-UC-NK-1028
<i>Cardamine hirsuta</i>	Watercress Seguoga (Ang)	Brassicaceae	Vegetables	NU-BOT-UC-NK-1034
<i>Pseudognaphalium affine</i>	Jersey cudweed Chien ga (Ang)	Asteraceae	Vegetable	NU-BOT-UC-NK-1038
<b>Inflorescence and flower</b>				
<i>Amomum dealbatum</i>	Javda Cardamon Sokrünuo (Ang)	Zingiberaceae	Eaten fresh as well as vegetable	NU-BOT-UC-NK-1001
<i>Alpinia nigra</i>	Tora -----	Zingiberaceae	Eaten fresh as well as vegetable	NU-BOT-UC-NK-1022
<i>Bauhinia variegata</i>	Variagate bauhinia Teguo (Ang)	Caesalpinaceae	Cooked and eaten as vegetable	NU-BOT-UC-NK-1023
<i>Curcuma angustifolia</i>	Wild Turmeric Hupfü (Ang)	Zingiberaceae	Cooked and eaten as vegetable	NU-BOT-UC-NK-1031
<i>Musa thomsonii</i>	Wild banana Ruochünuo (Ang)	Musaceae	Cooked and eaten as vegetable	NU-BOT-UC-NK-1048
<b>Young shoot, stem and leafy Vegetable</b>				
<i>Antidesma bunius</i>	Salamander tree Gaja sei (Ang)	Phyllanthaceae	Cooked and eaten as vegetable	NU-BOT-UC-NK-1002
<i>Clerodendrum colebrookianum</i>	Glory Hill Bower Gathera (Ang)	Verbenaceae	Cooked and eaten as vegetable	NU-BOT-UC-NK-1004
<i>Gynura bicolor</i>	Velvet plant Liezienuo (Ang)	Asteraceae	Taken as vegetable	NU-BOT-UC-NK-1006
<i>Polygonum chinense</i>	Knotgrass Gare (Ang)	Polygonaceae	Fresh/cooked & eaten as vegetable	NU-BOT-UC-NK-1008
<i>Polygonum molle</i>	Soft Knot weed Gazic (Ang)	Polygonaceae	Fresh/cooked and eaten as vegetable	NU-BOT-UC-NK-1009
<i>Lasia spinosa</i>	Queen flower Churam (Zelg)	Araceae	Cooked and eaten as vegetable	NU-BOT-UC-NK-1010
<i>Ficus racemosa</i>	Fig Zuvithi (Lotha)	Moraceae	Cooked and eaten as vegetable	NU-BOT-UC-NK-1011
<i>Elatostema lineolatum</i>	----- Jotho (Ang)	Urticaceae	Cooked and eaten as vegetable	NU-BOT-UC-NK-1021
<i>Alpinia nigra</i>	Tora -----	Zingiberaceae	Cooked and eaten as vegetable	NU-BOT-UC-NK-1022
<i>Spilanthes acmella</i>	Pellitory Keve (Ang)	Asteraceae	Cooked and eaten as vegetable	NU-BOT-UC-NK-1025
<i>Fagopyrum esculentum</i>	Buckwheat Gare (Ang)	Polygonaceae	Cooked and eaten as vegetable	NU-BOT-UC-NK-1026
<i>Zanthoxylum rhetsa</i>	Badrang (Hin) Ganya (Ang)	Rutaceae	Cooked and eaten as vegetable	NU-BOT-UC-NK-1033
<i>Amorphophallus nepalensis</i>	Voodoo Lily Teinhyiemidu (Ang)	Araceae	Cooked and eaten as vegetable	NU-BOT-UC-NK-1045
<i>Chimonobambusa callosa</i>	Bamboo Oung (Kham)	Poaceae	Young shoot eaten as vegetable	NU-BOT-UC-NK-1046
<i>Musa sikkimensis</i>	Darjeeling Banana Tephe (Ang)	Musaceae	Cooked and eaten as vegetable	NU-BOT-UC-NK-1047
<i>Cheilocostus speciosus</i>	Spiral ginger Thevorieto (Ang)	Costaceae	Cooked and eaten as vegetable	NU-BOT-UC-NK-1049
<i>Herpetospermum pedunculatum</i>	Beej karela (Hin) Mesha (Kham)	Cucurbitaceae	Cooked and eaten as vegetable	NU-BOT-UC-NK-1050
<i>Colocasia lithengiae</i>	Wild yam Thekrüenuo (Ang)	Araceae	Cooked and eaten as vegetable	NU-BOT-UC-NK-1051
<i>Elatostema platyphylla</i>	----- Johunyü (Ang)	Urticaceae	Cooked and eaten as vegetable	NU-BOT-UC-NK-1052
<i>Zanthoxylum armatum</i>	Toothache tree Ganya (Ang)	Rutaceae	Cooked and eaten as vegetable	NU-BOT-UC-NK-1054
<b>Cereal</b>				
<i>Coix lacryma-jobi</i>	Job's tear Kesi (Ang), Menjang (Ao)	Poaceae	Cooked with rice and eaten	NU-BOT-UC-NK-1016
<i>Pennisetum glaucum</i>	Pearl Millet Chütienuo (Ang)	Poaceae	Cooked with rice and eaten	NU-BOT-UC-NK-1017
<b>Others (Rhizome, Tuber)</b>				
<i>Cheilocostus speciosus</i>	Spiral ginger Thevorieto (Ang)	Costaceae	Rhizome decoction used for diabetic	NU-BOT-UC-NK-1050

\* Ang: Angami; Hin: Hindi; Kham: Khamnyungan; Reng: Rengma.

**Table 2:** Some underutilized edible crops sold in the local markets of Kohima

Name of the plant species	Parts sold	Rate per unit* (in INR)
<i>Pennisetum gluacum</i>	Seeds	50-70/cup or packet
<i>Alpinia nigra</i>	Young branch and Inflorescence (Fresh)	20/bunch
<i>Amomum dealbatum</i>	Inflorescence (Fresh)	20-40/plate
<i>Cardamine hirsuta</i>	Whole plant (Fresh)	20/bunch
<i>Centella asiatica</i>	Whole plant (Fresh)	20/bunch
<i>Coix lacryma-jobi</i>	Seeds	50-7000/cup or packet
<i>Elaeagnus latifolia</i>	Fruits (Fresh)	20-50/plate
<i>Gynura bicolor</i>	Young leaves and branch (Fresh)	20-30/bunch
<i>Houttuynia cordata</i>	Whole plant (Fresh)	20-30/bunch
<i>Juglans regia</i>	Nuts	50/cup or packet
<i>Lasia spinosa</i>	Young leaves and branch (Fresh)	20-30/bunch
<i>Zanthoxylum acanthopodium</i>	Young branch and leaves (Fresh)	20/bunch
<i>Castanopsis indica</i>	Nuts	20/packet
<i>Docynia indica</i>	Fruits (Fresh/Dried)	20/50/plate
<i>Curcuma angustifolia</i>	Inflorescence (Fresh/Dried)	20/bunch & 50/packet
<i>Clerodendrum colebrookianum</i>	Young leaves and shoot (Fresh)	20/bunch
<i>Rhus semialata</i>	Fruits (Fresh/Dried)	20/50/cup or packet
<i>Terminalia chebula</i>	Fruits (Dried)	20/plate, 30/packet**
<i>Prunus nepalensis</i>	Fruits (Fresh)	20-40/bunch or plate

Note: Market rate varies from area to area, season to season and also depends on the supply in the market by the rural people. There is no standard measurement system exists. Units for sale in the market are approximate only; \* 1cup or packet: Approx. 500 grams; 1bunch: Approx. 250grams; 1plate: Approx. 500 grams. \*\* 1packet: Approx. 200 grams.

masses for their livelihood<sup>[1]</sup>. In the present study it was found that these underutilized crops immensely play important role in the daily lives of the local people of Kohima. The present study shows that UEC represents a daily diet of the local people. Though the world has progressed technology, the rural people of the world still depends on their basic necessities like medicines and other health care on the forest products and depend on ethnic knowledge. Apart from their use as food, some are important for their medicinal, nutritional and nutraceutical values through traditional practices. With the rising crisis such as rapid population growth leading to scarcity of food supply, unplanned urbanization and unemployment, collection and utilization of UECs are considered very essential as they represent a cheaper option against those few major crops and offers opportunities for income generation to the farmers. Market survey also shows that some UEC are well accepted in the local market which can uplift the socio-economic status of the rural people. During the study it was understood that almost all of these plants parts/products are collected from the wild/forest and are marketed in the local market and the knowledge about these crops are being transferred from generation to generation. Some of these crops are

documented in figure 1. Though these minor forest products are being used by the rural people, neither there is no scientific base nor exact idea about the nutritional value of these crops. Further, though these crops are collected from the wild in different seasons, there is no attempt to either popularize the acceptability, commercial scale production nor proper strategy for these plant species. Therefore, it is the need of the hour to make concerted effort to evaluate the nutritional value of these crops, create awareness for better market acceptability, proper commercial scale cultivation and workout the proper conservation strategies in order to prevent depletion and extinction of the natural environment mainly cause by anthropogenic activities. The present study is engage in documentation and dissemination of information on UEC in order to explore the potentiality for commercial purposes as well as providing food security. Besides documentation, we also have undertaken the steps towards the nutritional analyses of some selected UECs and works are in progress.

## CONCLUSION

Present study reveals the potential underutilized wild crops of





**Figure 1: Some of the common underutilized crops sold in local markets of Kohima district, Nagaland** (Source: Photos taken from different markets in Kohima district). 1. *Pennisitum glaucum* 2. *Alpinia nigra* 3. *Amomum dealbatum* 4. *Cardamine hirsuta* 5. *Centella asiatica* 6. *Coix lacryma-jobi* 7. *Eleaegnus latifolia* 8. *Gynura bicolor* 9. *Houttuynia cordata* 10. *Juglans regia* 11. *Lasia spinosa* 12. *Zanthoxylum acanthopodium*.

Kohima district, Nagaland, India. This is the first ever endeavor in this field. The finding of this study can be used by the policy maker of the state for popularization and commercial scale production, which will add to the food sustainability of the region.

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