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Wild edible plants used by Konyak tribe in Mon district of Nagaland: Survey and inventorisation

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This paper deals with 41 species of wild edible plants (WEPs) used by Konyak tribe in Mon district of Nagaland, recorded in two survey-cum-exploration trips undertaken during 2013 and 2014. The scientific and vernacular names of the plants, trends in domestication, period of availability, part(s) used and related notes are provided. Investigation for ethnobotanical studies and nutritive analysis has been emphasised. Fifteen WEPs were prioritised for germplasm collection and conservation.

Keywords: Conservation, Konyak tribe, Nagaland, Wild edible plants.
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Introduction

Wild edible plants (WEPs) comprise of indigenous or native species occurring in primary or secondary forests as well as human-disturbed habitats as weeds; their edible part(s) are harvested or gathered from underground (roots, tubers) or above ground plant parts (leaves, tender shoots, flower-buds, flowers, fruits, seed/ kernel, etc.). Their potential to substitute or supplement the well-known crops (belonging to cereals, grain legumes, oilseeds, fruits and nuts, vegetables and spices and condiments) through adding variety to diet thereby ensuring balanced nutrition among the rural people, is well recognized. Some of these species are also therapeutically important. More importantly, they form an additional income, especially for small landholders and landless people living near forest fringes through sale in local market. Konyaks, one of the major tribes of Nagaland predominantly inhabit the Mon district of Nagaland and adjoining regions of Arunachal Pradesh, Assam and Myanmar. They belong to the Mongoloid race and linguistically fall under the Naga-Kuki group of the Tibeto-Burman family. They are generally divided into two groups – the *Thendu* (the tattooed group, found in central parts of district) and the *Thenko* (the non tattooed group)[1]. Mon is reported as one of the backward districts of the state[1] owing to remoteness coupled with inhospitable terrain and insufficient basic amenities. Despite the main occupation being *jhum* cultivation, Konyaks effectually utilise wild plants for food, shelter, clothes, medicine, handicrafts, etc[2].

Due to their significant role in the livelihood, Konyak people while clearing for *jhum* cultivation have begun to protect WEPs like *Clerodendrum glandulosum*, *Rhus chinensis*, *Zanthoxylum rhetsum*. They also introduced some important species in their homegardens (called *pesha*) because of their usefulness to the households. This has resulted in increasing diversity of cultivated plants in the *jhum* area as well as their homegardens[3]. Information on crop genetic resources as well as ethnomedicinal plants used by Konyak tribes of Mon district has been documented[2,4,5]. However similar work on WEPs used by this tribe was lacking and hence preliminary survey was undertaken to document edible species, prioritise species for systematic germplasm collection for conservation, popularisation and use in the near future.

Materials and Methods

The study area is located in Northeast Nagaland, bordered on the northwest by Sibsagar district of Assam, on the South by Tuensang district of Nagaland, on the East by Myanmar, on the West by Longleng district of Nagaland and in the Northeast by the Longding district of Arunachal Pradesh. District altitude varies from 290 to 1800 m above mean sea level and the topography is of undulating nature with

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gentle to steep slope. Average rainfall ranges from 2000 to 3000 mm (mostly between May and October), while average relative humidity and temperature are 76 % and 24.4 °C, respectively. Three major rivers – *Dikhu*, *Tizit* and *Young* flow through the district and their tributaries form major watersheds. Soil is predominantly laterite in hilly areas and red in the plains bordering Assam. Vegetation covers about 89 % of total geographical area; predominant forest types are Northern Tropical Wet Evergreen Forest and Northern Sub-Tropical Broad Leaf Wet Hill Forest[1]. This district can be divided into three agro-climatic zones: upper region – Longchin, Chen, Mopong, Longwa, Tobu areas with sub-temperate climate; middle region – Aboi, Mon with warmer climate; lower region – Tizit, Tiru Valley, Naginimora areas with sub-tropical climate. Villages are situated on the hilltops and each family has its own forest patches within community forests to fulfil their household needs[1].

Two survey-cum-exploration trips were undertaken during November 2013 and August 2014 in Mon district of Nagaland, covering all the six blocks, *viz.* Chen, Mon, Phomching, Tizit, Tobu and Wakching for collection/survey of plant genetic resources and wild edibles (with the exception of bamboo, ferns and mushrooms). In addition to the field trips, visits were also made to local markets of Tizit, Tang, Mon, Aboi and Tobu. Information was gathered on wild edible plants from different sources, *viz.* harvested from the wild, protected in *jhum* lands and/ or cultivated in homegardens. Local names, edible part, stage/level of domestication, period of availability, habitat and frequency of occurrence, diversity, use pattern, etc. were recorded through direct observation (to the extent possible), which was supplemented/validated through group interview with vendors, farmers, villager elders, *Gaon Bora*, etc. across the region. Each plant was allotted a use category according to its main use[6]. Plant specimens were identified with the help of floristic literature and online herbaria *viz.* Beijing herbarium, Edinburgh herbarium, Kew herbarium and Paris herbarium. Herbarium specimens of selected wild edibles {*Amaranthus cruentus* (21730), *Balakata baccata* (21727), *Ficus virens* (21729), *Herpetospermum operculatum* (21361), *Litsea cubeba* (21366, 21754), *Sauropus androgynus* (21757) and *Solanum torvum* (21374)} were deposited in National Herbarium of Cultivated Plants, ICAR-National Bureau of Plant Genetic Resources, New Delhi.

Results and Discussion

During the study, a total of 41 wild edibles belonging to 36 genera and 27 families being used by the Konyak tribes in Mon district of Nagaland were documented (Table 1,2). Of which, 9 were exclusively harvested from the wild, while 26 were protected in the wild and/or brought under homestead cultivation, and six were exclusively under homestead cultivation (of which, three were exotic, but completely naturalised) (Table 1,2; Plate 1,2). They belong to different groups namely fruits (18), leafy vegetables (15), seeds and nuts (4), roots and tubers (2) and buds and flowers (2). Habit-wise distribution depicts that tree species were high in number (16) and it was followed by herbs (13), shrubs (7) and climbers (5), respectively. Interestingly, use value of eight edibles *viz. Calamus tenuis*, *Canarium strictum*, *Crotalaria tetragona*, *Elaeagnus conferta*, *Gynura cusimbua*, *Herpetospermum operculatum*, *Livistona jenkinsiana* and *Zanthoxylum acanthopodium* consumed by this tribe has not been reported in literatures[2,3,6,7] covering this district/tribe. Mostly women and children were engaged in collecting wild edibles. The uses of different plant parts are discussed in details.

Leafy vegetables

Wild leafy vegetables in North-eastern Hill (NEH) region, in general are harvested within a month of flushing i.e., at tender stage[9]. Most of these wild vegetables were available for 3-4 months, with peak

Table 1: Summary of wild edible plants used by Konyak tribes

Sl. No.	Level/stage of domestication	Edible categories					Total
		Fruits*	Leafy vegetables	Seeds and nuts	Roots and tubers	Buds and flowers	
1.	Harvested from wild only	4 (1)	2	2	-	1	9
2.	Protected in the wild/ homestead cultivation	13 (4)	8	2	2	1	26
3.	Homestead cultivation only	1 (1)	5	-	-	-	6
Total		18 (6)	15	4	2	2	41

*plants with 'unripe fruit use' provided in parenthesis

Table 2 — Wild edible plants used by Konyaks in Mon district of Nagaland

Sl no.	Species	Family	Vernacular name (Area)	Source*	Period of availability	Use category	Remarks
1	*Alocasia macrorrhizos* (L.) G.Don	Araceae	-	HW, P/HC	Throughout year	Tuber	Occasionally observed; baked or roasted
2	*Amaranthus cruentus* L.	Amaranthaceae	*Chekoi, Phatakshii*	HC; in disturbed areas	Throughout year	Leafy vegetable	Commonly in homegarden but rare in market; cooked
3	*Artocarpus chama* Buch.-Ham.	Moraceae	*Vivoi*	HW	May-June	Fruit	Ripe fruits eaten raw; young fruits and seeds taken as vegetable
4	*Balakata baccata* (Roxb.) Esser (syn. *Sapium baccatum* Roxb.)	Euphorbiaceae	*Oohu (Tobu)*	P/HC	Sept.-Nov.	Fruit	Most preferred in Tobu block; also planted along roadsides; ripe fruits sweetish
5	*Bauhinia variegata* L.	Fabaceae	*Phum*	HW	Feb.-May	Flower-bud	Also young pod as vegetable
6	*Calamus tenuis* Roxb.	Arecaceae	*Veiyong*	HW, P/HC	Nov.-Dec.	Fruit	Ripe fruits eaten raw; slightly sour in taste
7	*Canarium resiniferum* Bruce ex King	Burseraceae	-	HW	Oct.-Dec.	Fruit	Ripe fruits eaten raw
8	*Canarium strictum* Roxb.	Burseraceae	*Kong*	HW	Oct.-Dec.	Fruit	Common in Tizit block; taste like *aonla*
9	*Centella asiatica* (L.) Urb.	Apiaceae	*Hing (Mon)*	HW, P/HC	Throughout year	Leafy vegetable	Eaten after cooking; also used in chutney-making
10	*Chenopodium album* L.	Chenopodiaceae	*Yaolu, Yaoha, Aphom, Shizü, Nene, Shinge*	HC; in disturbed areas	Throughout year	Leafy vegetable	At young stage, leaves cooked with pulse; not coming to market; also a pseudocereal
11	*Clerodendrum glandulosum* Lindl.	Verbenaceae	*Wangpet (Mon)*	HW, P/HC	June-Sept.	Leafy-vegetable	Common in homegardens; tender shoots consumed as vegetable stew
12	*Colocasia esculenta* (L.) Schott	Araceae	*Kuchu*	HW, P/HC; in disturbed areas	Throughout year	Tuber	Common in cleared marshy areas in forests; staple cooked vegetable; also used as leafy-vegetable
13	*Cordia dichotoma* G.Forst.	Boraginaceae	-	P/HC	June-Aug.	Fruit	Recorded only in Longwa area
14	*Crotalaria tetragona* Roxb. ex Andrews	Fabaceae	-	P/HC	Aug.-Nov.	Flower-bud	Rare in occurrence
15	*Elaeagnus conferta* Roxb.	Elaeagnaceae	-	P/HC	Feb-Mar.	Fruit	Leaves brownish in colour; ripe fruits eaten raw
16	*Elaeocarpus floribundus* Blume	Elaeocarpaceae	-	P/HC	Sept.-Nov.	Fruit (unripe)	Used for pickle-making
17	*Elsholtzia blanda* (Benth.) Benth.	Lamiaceae	*Lajing (Monyakshu)*	HC	June-Nov.	Leafy vegetable	Common in homestead garden and in market; spice/ condiment
18	*Entada phaseoloides* (L.) Merr.	Fabaceae	*Vewü*	HW	Oct.-Dec.	Seed/nut	Rare; kernel eaten after necessary processing
19	*Eryngium foetidum* L.	Apiaceae	*Dunia*	HC; in disturbed areas	Throughout year	Leafy vegetable	Most preferred in all places; eaten raw or cooked, as flavouring agent in curry and chutney
20	*Euryale ferox* Salisb.	Nymphaeaceae	-	P/HC	Aug.-Nov.	Seed/nut	Rare in occurrence
21	*Ficus auriculata* Lour.	Moraceae	*Phok*	P/HC	June-Aug.	Fruit	Rare in occurrence
22	*Ficus virens* Aiton	Moraceae	*Hishi (Monyakshu)*	P/HC	June-Sept.	Leafy vegetable	Most preferred in Tobu and Monyakshu blocks; young leaves eaten as vegetable
23	*Garcinia cowa* Roxb. ex DC.	Clusiaceae	-	HW, P/HC	June-Nov.	Leafy vegetable	Common in local markets; tender twigs reddish in colour

Contd.

Table 2 — Wild edible plants used by Konyaks in Mon district of Nagaland—(Contd.)

Sl no.	Species	Family	Vernacular name (Area)	Source*	Period of availability	Use category	Remarks
24	*Gynura cusimbua* (D.Don) S.Moore	Asteraceae	*Sille (Mon) Eneshi (Monyakshu)*	HC	June-Nov.	Leafy vegetable	Very common in use for soup preparation; also cooked vegetable
25	*Herpetospermum operculatum* K.Pradheep, A.Pandey, K.C.Bhatt & E.R.Nayar	Cucurbitaceae	*Thruinam (Mon)*	HW	June-Nov.	Leafy vegetable	Locally preferred for soup preparation
26	*Hodgsonia heteroclita* (Roxb.) Hook.f. & Thomson	Cucurbitaceae	*Pai*	P/HC; in field boundaries	Oct.-Dec.	Seed/nut	Kernel forms a delicacy
27	*Houttuynia cordata* Thunb.	Saurauriaceae	*Kaiyukhing*	P/HC	Throughout year	Leafy vegetable	Occasional in occurrence; boiled vegetable; also roots cooked as vegetable; added in pickle
28	*Lecanthus peduncularis* (Royle) Wedd.	Urticaceae	*Yoangshi (Monyakshu)*	HW	Throughout year	Leafy vegetable	Also used as animal feed
29	*Litsea cubeba* (Lour.) Pers.	Lauraceae	*Voting*	HW, P/HC	May-Aug.	Fruit	Common in sub-temperate forests; fruits eaten raw or mixed with pickle after roasting; dried as powder; used as spice
30	*Livistona jenkinsiana* Griff.	Arecaceae	*Toko, Yuoh*	HW, P/HC; cultivated in large areas	Oct.-Dec.	Fruit	Common multipurpose economic plant; mesocarp eaten after soaking ripe fruit in salt for 4-5 days
31	*Myrica esculenta* Buch.-Ham.	Myricaceae	*Akolick*	HW, P/HC	April-June	Fruit	Rare; also used as medicinal
32	*Nelumbo nucifera* Gaertn.	Nymphaeaceae	-	HW	Nov.-Dec.	Seed/nut	Rare in occurrence
33	*Parkia timoriana* (DC.) Merr.	Fabaceae	*Yongchak*	HC	June-Nov.	Fruit (unripe)	Young pods form delicious vegetable
34	*Phyllanthus emblica* L.	Euphorbiaceae	*Phang*	HW, P/HC	Nov.-Jan.	Fruit (unripe)	Important minor harvest produce; eaten raw or pickled
35	*Rhus chinensis* Mill.	Anacardiaceae	*Aomah, Opahpe*	P/HC	Nov.-Jan.	Fruit	Decoction/curry of powdered fruit therapeutically valued
36	*Sauropus androgynus* (L.) Merr.	Euphorbiaceae	*Poshi (Tobu)*	P/HC	June-Sept.	Leafy vegetable	Found in local markets of Tobu and Tizit blocks
37	*Solanum torvum* Sw.	Solanaceae	*Kheang khah Khoith ha*	P/HC	Aug.-Oct.	Fruit (unripe)	Naturalized; eaten as vegetable
38	*Solanum violaceum* Ortega	Solanaceae	*Khasa Kang (Monyakshu)*	P/HC	Aug.-Jan.	Fruit (unripe)	Common in homestead garden; eaten as vegetable
39	*Stixis suaveolens* (Roxb.) Pierre	Capparaceae	*Mokha (Monyakshu)*	HW	Oct.-Dec.	Fruit (unripe)	Rare in occurrence
40	*Zanthoxylum acanthopodium* DC.	Rutaceae	*Matkat Mekhat*	HW, P/HC	May-Nov.	Leafy vegetable	Occasional in *jhum* areas; spice/condiment; medicinal
41	*Zanthoxylum rhetsum* (Roxb.) DC.	Rutaceae	*Michangakoti Petak, Cheang (Tobu)*	P/HC	May-Jan.	Leafy vegetable	Young leaves and shoot as condiment; fruit-husk used in chutney

*HW-harvested from wild; P/HC-Protected in the wild/cultivated in homegarden; HC-Cultivated in homegarden

availability during rainy and late rainy season. Some commonly observed species with high frequency/abundance in local markets during the survey include *Clerodendrum glandulosum*, *Elsholtzia blanda*, *Eryngium foetidum*, *G. cusimbua* and *Zanthoxylum rhetsum*. However, few vegetables were observed only in a few localities, for instance, *F. virens* was observed only in Tobu and Monyakshu

areas. Unlike in the Himalaya and other places, *Amaranthus cruentus* is grown here for leafy vegetable use than as pseudocereal. In general, wild vegetables were observed to be consumed in the form of soup or as cooked vegetables almost on daily basis. In some species, more than one part is being used as vegetable, for instance *Colocasia esculenta* (tuber, petiole and leaves) and *Houttuynia cordata* (shoot and root). In Monyakshu (sub-temperate area), it was observed that the dried leaves and petiole of *F. virens*

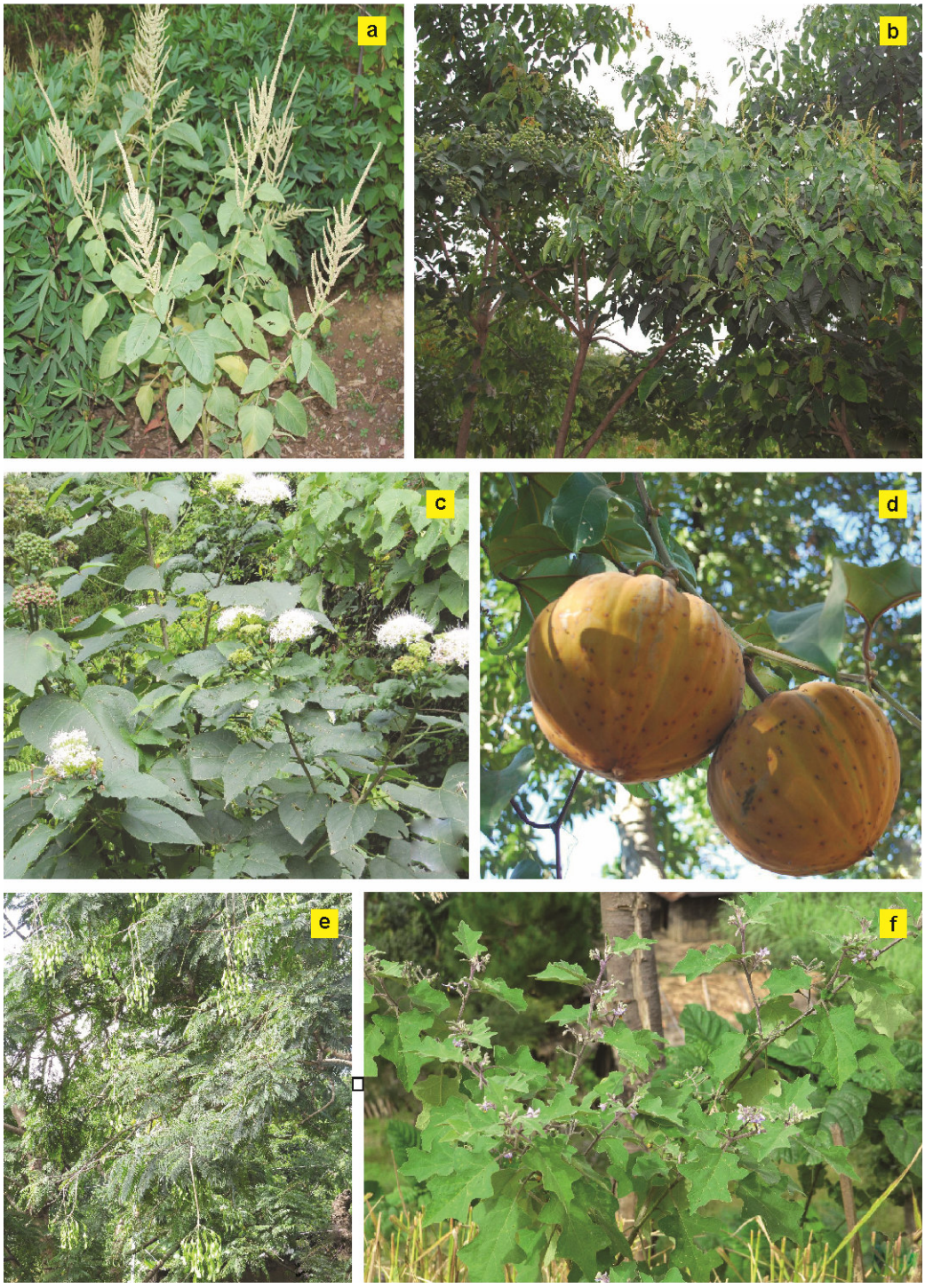

Plate 1–Wild edibles observed at homegarden. a) *Amaranthus cruentus*, b) *Balakata baccata*, c) *Clerodendrum glandulosum*, d) *Hodgsonia heteroclita*, e) *Parkia timoriana* and f) *Solanum violaceum*

Plate 2–Wild edibles observed at local market. a) A view of market at Mon town, b) *Calamus tenuis* (fruits), c) *Canarium strictum* (fruits), d) *Elsholtzia blanda* (leafy shoots), e) *Gynura cusimbua* (leafy shoots), f) *Herpetospermum operculatum* (leafy shoots), g) *Houttuynia cordata* (leafy shoots) and h) *Litsea cubeba* (fruits)

and *C. esculenta* were being sold for consumption and use during offseason i.e., winter. In Eastern and Southern parts of the district bordering Myanmar, young leaves of *Chenopodium album* are plucked till flowering for vegetable use and later left undisturbed for pseudocereal use[5]. *Thruinam* is a wild vegetable gathered by Konyaks since ages from forest fringes and its tender shoots are being sold in Mon market;

surprisingly this turned out to be a newly described species, *Herpetospermum operculatum*[9]. All these indicate that the efforts on crop diversification, both horizontally (through search of new edibles) and vertically (through utilising more than one edible part within the plant) by tribal people have helped to increase their farm income, resulting in food, nutrition and ecological security of the region.

It was a common observation that people were becoming interested in quick growing crops mainly to get instant return. In this regard, cultivation of a popular leafy vegetable *Gynura cusimbua* is emphasised, as this along with other major vegetables can form a mainstay in midday meal preparation in Nagaland[10] throughout the year. Also, *E. foetidum*, *E. blanda* and *C. glandulosum* deserve mentioning owing to their fast growing nature, even under marginal lands with low input.

Fruits

All the fruit-yielding plants documented in the study are perennial in nature and majority of them are protected in the wild and/or brought under homestead cultivation. Ripe fruits are eaten raw in two-thirds of these species whereas unripe fruits are cooked as vegetable and mixed with curry. During the survey, some commonly observed wild fruits in local markets include *Litsea cubeba*, *Phyllanthus emblica* and *Solanum violaceum*. However, *Ficus auriculata* and *Stixis suaveolens* were observed only in Monyakshu area. Since tree fruits are seasonal, their availability is rather restricted to 2-3 months only. Nevertheless, phenological information about these trees revealed the potential of year-round availability of at least any one fruit at any single point of time.

Others

Hodgsonia heteroclita, a native of NEH region and known for its delicious kernels[11], is often planted as crop near hut or boundary areas. People extract the nuts from ripe fruits, clean and put them under fire to take out the white kernels from hard shells. Then, the pounded kernel is wrapped in chow-chow (*Sechium edule*) leaves and kept one week inside bamboo culms for fermentation. The resultant product is stored for 2-3 months and used in curries. In *Entada phaseoloides*, mature seeds are roasted and the extracted kernels are boiled in water for two hours followed by placing them in running water overnight to remove anti-nutritional components. *Crotalaria tetragona* was observed under homestead cultivation only in Aboi area for its flower-buds used as cooked vegetable; similar edible use has been reported from the state of Mizoram[12].

Domestication trends

Besides collecting potential material from the wild by Konyaks, 11 edible species were also observed to be protected in *jhum* areas or brought under cultivation in their backyards, homegardens and boundaries. This evidently showed the trend towards domestication, possibly some genetic variability and useful traits development under human management. However, except *P. emblica* (for fruit size), authors could not observe any obvious selection in case of locally important fruits. It was also observed that the protected trees of Balakata baccata in *jhum* lands of Tobu and Changlangshu areas are coppiced at a height of about 3 m to promote profuse branching. Similar observation was made for this plant from Ngangching village of Mon district[13]. Konyaks, in general, prioritise species for homegarden cultivation based on demand from both household and local market. Their homegardens are reported to have more than 120 plant species[3]. According to Godbole[14], of total 68 plant products recorded in a market survey of Mon town, 40 were harvested from their homegardens. The most common plants growing in homegardens were *C. glandulosum*, *C. esculenta*, *E. blanda*, *G. cusimbua*, *S. violaceum* and *Z. Rhetsum*.

On the basis of domestication trends, market demand, preference and significance in local diet, 15 wild edibles were prioritised for germplasm collection and conservation namely *A. cruentus*, *B. baccata*, *C. album*, *C. glandulosum*, *C. esculenta*, *E. blanda*, *E. foetidum*, *G. cusimbua*, *H. operculatum*, *H. heteroclita*, *Livistona jenkinsiana*, *P. emblica*, *R. chinensis*, *S. violaceum* and *Z. rhetsum*.

Conclusion

The study resulted in listing out the edible wealth present in the Mon district of Nagaland. Good scope for unearthing of wild edibles exists in interior pockets of this diversity-rich district, which demands an intensive survey and exploration across the district in different seasons along with detailed ethnobotanical notes. This will help us in better monitoring and management of these natural resources and socio-economic development of this tribal community. Wild edibles such as *C. glandulosum*, *E. blanda*, *E. foetidum*, *G. cusimbua*,

P. emblica, *S. violaceum* and *Z. rhetsum* have good prospects in the local markets. As about two-third of the 41 wild edible species mentioned here are not known for their nutritive values and hence, in future biochemical analysis of their edible part may be undertaken. Apart from inclusion of 15 prioritised wild edibles in different agro-forestry systems/ homegardens, their germplasm collection from diverse habitats (field/homestead/wild) across altitudinal and distributional ranges is required for conservation and sustainable utilisation. In addition focus on fundamental studies on ecology and reproductive biology including seed storage behaviour need immediate attention.

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