Wild edible plants used by the ethnic communities of Shi Yomi District of Arunachal Pradesh, India

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[Received 08.07. 2019; Revised 17.12.2019; Accepted 18.12.2019; Published 31.12.2019]

Abstract

An ethnobotanical study of wild edible plants was conducted at different altitudinal gradient in Shi Yomi District of Arunachal Pradesh, India. The objective of the study was to document the diversity of wild edible plants used by ethnic communities in the study area and to highlight the utilization pattern of the edible plant resources. During the study a total of 83 species of edibles plants have been recorded belonging to 58 genera and 39 families. Out of total species recorded, 27 species are consumed as vegetables, 34 species as fruits and 22 species has multiple uses as fruits, vegetables or spices. Rosaceae is contributing the highest number of 10 wild edible species followed by Solanaceae (7 spp.) and Urticaceae (7 spp.). Herbs represent the highest number of 27 species, followed by trees (25 spp.), shrubs (24 spp.) and climbers (9 spp.). From the present study, it was found that there is huge potential for commercialization of some of the edible plants through proper management, sustainable harvesting and value addition of the plant products.

Key words: Wild edible plant, Ethnobotany, Arunachal Pradesh, Eastern Himalaya, Sustainable Management

INTRODUCTION

Wild edible plants have been playing significant role in the life and culture of indigenous local communities in various part of the world (Saqib *et al.*, 2011). Maundu *et al.* (1999) reported that majority of the rural community in the developing countries depends on wild edible plants to meet their nutritional requirements during the period of food shortage. About 30 species are contributing 90 % of the global food production and moreover 85 – 90 % of the total caloric intake obtained from the 12 domesticated species, which can create an intense biotic and abiotic pressure on modern agriculture in future (Misra *et al.*, 2008). However, the majority of the edible plants are neglected, which are grown naturally in the wild and do not have to be tended before producing edible parts (FAO 1988). Over-dependence on limited number of crops can be reduced significantly by increasing sustainability approach with wild edible plants. Some research has also demonstrated that most of the wild edible plants are rich with nutrients or therapeutic values due to the presence of bio-active compounds, and therefore, can be considered as nutraceutical agents (Sánchez-Mata *et al.* 2012; Pereira *et al.* 2011). The wild edible plants are essential food and livelihood sources of indigenous community (Gemedo *et al.* 2005; Teklehaymanot & Giday 2010; Schippmann *et al.* 2002). Majority of the wild edible plants used by the tribal communities are rich in essential nutrients, minerals and vitamins compare to cultivated plants (Nordeide *et al.* 1996; Sundriyal & Sundriyal 2001).

The state of Arunachal Pradesh is rich in ethnic and floristic diversity. However, the receding forest coverage in the tribal localities due to increasing anthropogenic activities have been significantly contributing towards depletion of several wild edible plants from the natural habitat in current decade. Perusal of literature have revealed documentation of wild edible plants of Arunachal Pradesh since late 1990 by the several workers such as Haridasan *et al.* (1990); Rawat *et al.* (1998); Angami *et al.* (2006); Singh & Asha (2017). However, there is an urgent need for further exploration and documentation of wild edible plants focused on local tribal communities of Arunachal Pradesh for conservation and sustainable management. Present study aims to document wild edible plants resources used by the tribal community of Shi Yomi District of Arunachal Pradesh and to evaluate and prioritize the marketable species for conservation and sustainable utilization.

MATERIALS AND METHODS

Study Site

The study was conducted in six villages of Shi Yomi district of Arunachal Pradesh during 2017–2018 (Figure 1; Table 1) covering Mechuka and Tato Circle inhabited by Adi, Memba, Ramo, Bori Bokar, Pailibo and Tagin tribes.

Table 1. Checklist of the villages surveyed for documentation of wild edible plants

Sl. No.	Village Name	No. of Household	No. of Household surveyed	Elevation	Latitude	Longitude
1	Mechuka	20	10	2083 m	28°35'52.09"N	94° 7'53.67"E
2	Segong	14	10	2175 m	28°36'34.35"N	94° 5'43.99"E
3	Rapum	18	5	1500 m	28°31'59.76"N	94°15'18.71"E
4	Dorjeeling	44	5	1934m	28°34'45.96"N	94° 9'27.27"E
5	Rego	26	5	1912m	28°33'26.93"N	94°13'27.15"E
6	Tato	50	10	1200 m	28°31'53.70"N	94°22'28.73"E

Field survey and data collection

Extensive field surveys were undertaken in 6 villages covering 45 household of Shi Yomi district of Arunachal Pradesh with the help of knowledgeable local informants for collection of wild edible fruit species and documentation of associated traditional knowledge using structured questionnaire format. Apart from visiting the community forest area, ethnobotanical market survey was also conducted in Mechuka and Tato town for collection and documentation of commercially viable wild edible plants sold in the market. The voucher specimen for each species was collected and made in mounted herbarium-sheets following the method suggested by Jain & Rao (1977). The plants were identified with the help of floras of Assam and Arunachal Pradesh (Kanjilal *et al.*, 1934- 1940; Hajra *et al.* 1996; Giri *et al.* 2008; Chowdhury *et al.* 2009) and consulted herbarium of State Forest Research Institute, Itanagar, Botanical Survey of India (BSI), Arunachal Pradesh Regional Centre (BSI-APRC) Itanagar (ARUN), and Botanical Survey of India (BSI), North Eastern Regional Centre, Shillong (ASSAM). Herbarium specimens were deposited at Herbarium of G.B. Pant National Institute of Himalayan Environment & Sustainable Development, North East Center, Itanagar, Arunachal Pradesh. The accepted names were verified through the website www.theplantlist.org hosted by Royal Botanic Garden, Kew UK and Missouri Botanical Garden, St Louis, USA.

Figure 1. Map showing study sites in Shi Yomi district bordering West Siang district of Arunachal Pradesh [Source: <https://www.mapsofindia.com/maps/arunachalpradesh>]

RESULT AND DISCUSSION

Taxonomic diversity of wild edible plants

A total of 83 species belonging to 58 genera and 39 families were recorded during the study, out of which 27 species are consumed as vegetables, 34 species as fruits and 22 species has multiple uses as fruits, vegetables or spice (Table 2; Plate - I). Rosaceae presents highest number of 10 species of wild edibles plants, followed by Solanaceae (7 spp.) and Urticaceae (7 spp.) (Figure 2). The genera like *Solanum*, *Rubus* and *Piper* are contributing more than three species each and *Zanthoxylum* with three species. Herbs represent highest numbers of 27 species, followed by trees (25 spp.), shrubs (24 spp.) and climbers (9 spp.) (Figure 3). Highest number of species was observed from Urticaceae followed by Rubiaceae. However, in the wild species category which are eaten as fruits, spice and others it was found that Solanaceae has the highest number of species followed by Rutaceae and Polygonaceae. As per as plant-part used is concerned, fruits represent highest number of 39 species, followed by leaves (31 spp.) and multiple uses (7 spp.) (Figure 4).

Distribution and frequency of uses

From the total species reported, majority of 59 species are from subtropical origin (1200 – 1800 m), while 12 species are observed in the higher elevation temperate zone (1900 – 2100

m). And, 14 species were found occurring in both subtropical and temperate zones. Present investigation also recorded 42 species of fruit plants, 11 of these were found to be frequently used by the local community (Figure 5). Species like *Pyrus pyrifolia* and *Castanopsis indica* were reported to have very high preference. The fruit plants frequently used by the local communities in the order of preference are *Juglans sp.*, *Castanopsis indica*, *Averrhoa carambola* and *Pyrus pyrifolia*. The fruit plants with less frequently used by the local communities with moderate preference are *Fragaria nubicola*, *Rubus rosifolius*, and *Rubus ellipticus* of the total species reported, 27 species are marketable i.e. are capable of supporting local livelihood systems while 16 species have the marketing potential.

Figure 2. Distribution of wild edibles plants under different families

Figure 3. Graphical representation of wild edibles collected from different habit

It has been observed that some fruits from *Solanum violaceum*, *Solanum spirale*, *Solanum torvum*, *Musa acuminata* unripe fruit are consumed as vegetables. The commercially viable three species of *Zanthoxylum* namely, *Z. hamiltonianum*, *Z. oxyphyllum*, and *Z. rhetsa* are frequently sold and consumed among the local residents as spices and same has been reported by Thongam *et al.* (2016), Chauhan *et al.* (2013), Angami *et al.* (2006), Mahapatra & Panda (2012). The commercially viable species such as *Solanum spirale*, *Solanum indicum*, *Zanthoxylum rhetsa*, and *Piper pedicellatum*, popularly sold in the local markets, need to be promoted among the local communities for conservation and sustainable utilization. This will not only help conservation of these wild edible plants in

PLATE - I. Some important wild-edible plant-parts of **Shii Yomi** district, Arunachal Pradesh: **A.** Fruit-branch of *Pyrus pyrifolia*; **B.** Spiny fruits of *Castanopsis indica*; **C.** Inner nuts of *Juglans regia*; **D.** Leafy twigs of *Piper pedicellatum*; **E.** Spadix of *Musa aurantiaca*; **F.** Ripe fruits of *Musa x paradisiaca*; **G.** Fruits of *Saurauia roxburghii*; **H.** Ripe fruits of *Rubus treutleri*; **I.** Fruits of *Glochidium zeylanicum*

Figure 4. Categorization of wild edible plants base on their part used

Table 2. Inventory of wild edible plants used by the various ethnic communities of Shi Yomi district, Arunachal Pradesh [*Abbreviations used:* Ethnic communities: A=Adi; M=Memba; G=Galo; B= Bokar. Marketability: MKT = Marketed; MKTP = Market Potential]

Edibles	Family	Habit	Local Name	Uses	Part use	Marketability
<i>Amomum subulatum</i> Roxb.	Zingiberaceae	Herb	-	Inflorescence are eaten as vegetables. Fruits are eaten raw	Inflorescence, Fruit	MKT
<i>Angiopteris evecta</i> (G.Forst.) Hoffm.	Marattiaceae	Shrub	Fadey (M) Taba (A)	Leaves are edible as vegetable.	Leaf	MKT
<i>Ardisia crispa</i> (Thunb.) A. DC.	Primulaceae	Shrub	-	Leaves are edible as chutney.	Leaf	-
<i>Ardisia solanacea</i> Roxb.	Primulaceae	Shrub	Tamak (G)	Ripe fruits (sweet) are edible.	Fruit	-
<i>Averrhoa carambola</i> L	Oxalidaceae	Tree	Kordoi (M)	Fruits edible.	Fruit	MKT
<i>Balakata baccata</i> (Roxb.) Esser	Euphorbiaceae	Tree	Shigum (A)	Fruits (sweet) are edible.	Fruit	
<i>Baliospermum calycinum</i> Müll.-Arg.	Euphorbiaceae	Shrub	Gilgal (A)	Leaves (cooked) are edible as vegetable.	Leaf	-
<i>Begonia griffithiana</i> (A.DC.) Warb.	Begoniaceae	Herb	Sudum Meku (A)	Leaves (cooked) are edible as vegetable and sour in taste.	Leaf	-
<i>Begonia roxburghii</i> (Miq.) DC.	Begoniaceae	Herb	-	Edible as pickle. Petiole is eaten raw.	Petiole	-
<i>Castanopsis indica</i> (Roxb. ex Lindl.) A.DC.	Fagaceae	Tree	Sirang (A)	Ripe fruits are edible.	Fruit	MKTP
<i>Castanopsis inermis</i> (Lindl.) Benth. & Hook.f.	Fagaceae	Tree	Anke (A)	Ripe fruits are edible.	Fruit	-
<i>Cinnamomum verum</i> J.Presl	Lauraceae	Tree	Siripori (A); Solosing (M)	Leaves used as spice.	Leaf	MKT
<i>Citrus medica</i> L.	Rutaceae	Shrub	Jipin (A)	Ripe fruits (sweet) are edible.	Fruit	MKT
<i>Clerodendrum glandulosum</i> Lindl.	Lamiaceae	Shrub	Tapen (A)	Leaved (cooked) are edible as vegetable.	Leaf	MKT
<i>Clerodendrum kaempferi</i> (Jacq.) Siebold.	Lamiaceae	Shrub	Tapen (A)	Tender leaves are edible as vegetable.	Leaf	MKT
<i>Crassocephalum crepidioides</i> (Benth.) S.Moore	Asteraceae	Herb	-	Leaves (cooked) are edible as vegetable.	Leaf	MKT
<i>Cyathea andina</i> (H. Karst.) Domin	Cyatheaceae	Tree	Taste (A)	Core is dried removing the stem bark and ground; powder thus obtained is used as substitute of wheat flour	Stem	-
<i>Debregeasia longifolia</i> (Burm.f.) Wedd.	Urticaceae	Shrub	Jirepole (A)	Tender leaves (cooked) are edible as vegetable, Fruits edible	Leaf, Fruit	MKTP
<i>Dendrocalamus</i> sp.	Poaceae	Shrub	-	Young shoots are eaten	Shoot	MKT
<i>Diplazium esculentum</i> (Retz.) Sw.	Athyriaceae	Herb	-	Young fronds (cooked) are edible as vegetable.	Shoot	MKT
<i>Elatostema sessile</i> J.R.Forst. & G.Forst.	Urticaceae	Herb	Sakobadha (A)	Whole plant is consumed as vegetable.	Whole plant	MKT
<i>Fagopyrum esculantum</i> Moench.	Polygonaceae	Herb	Amintatek (A)	Leaves (cooked) are edible as vegetable; ripe fruits are edible.	Leaf, Fruit	MKT

Edibles	Family	Habit	Local Name	Uses	Part use	Marketability
<i>Ficus auriculata</i> Lour.	Moraceae	Tree	Hote (A), Bangoh (B)	Ripe fruits are edible.	Fruit	-
<i>Ficus semicordata</i> Buch.-Ham. ex Sm.	Moraceae	Tree	Bangoh (B)	Ripe fruits are edible.	Fruit	-
<i>Fragaria nubicola</i> (Lindl. ex Hook.f.) Lacaita	Rosaceae	Herb	Pasi (B)	Ripe fruits are edible	Fruit	MKTP
<i>Fragaria sp.</i>	Rosaceae	Herb	-	Ripe fruits are edible.	Fruit	MKTP
<i>Glochidion lanceolarium</i> (Roxb.) Voigt	Phyllanthaceae	Tree	-	Ripe fruits are edible	Fruit	-
<i>Gonostegia hirta</i> (Blume ex Hassk.) Miq.	Urticaceae	Herb	Oyik (G)	Leaves (cooked) are edible as vegetable.	Leaf	MKT
<i>Hedyotis scandens</i> Roxb.	Rubiaceae	Herb	-	Leaves are edible as vegetable.	Leaf	-
<i>Hydrangea robusta</i> Hook.f. & Thoms.	Hydrangeaceae	Shrub	Takmi (A)	Leaves (cooked) are edible as vegetable.	Leaf	-
<i>Hydrocotyle sibthorpioides</i> Lam.	Araliaceae	Herb	Nyinyo-Tamo (G)	Leaves edible as vegetable.	Leaf	MKT
<i>Juglans regia</i> L.	Juglandaceae	Tree	Tirkhuh (B)	Fruits edible.	Fruit	MKT
<i>Limacia blumei</i> Miers	Menispermaceae	Tree	Titmilie (A)	Ripe fruits (sweet) are edible.	Fruit	-
<i>Litsea suberosa</i> Yen C. Yang & P.H. Huang	Araceae	Tree	Teir (G)	Ripe fruits are eaten as salad.	Fruit	MKTP
<i>Livistona jenkinsiana</i> Griff.	Arecaceae	Tree	Tc- ek (G)	Rife fruits are edible/leaves are used for house roofing	Fruit	MKTP
<i>Melastoma malabathricum</i> L.	Melastomataceae	Shrub	Pudiraju (A)	Fruits are edible.	Fruit	-
<i>Melothria heterophylla</i> (Lour.) Cogn.	Cucurbitaceae	Climber	Kubumiku (A)	Fruits are edible.	Fruit	-
<i>Murraya paniculata</i> (L.) Jack.	Rutaceae	Shrub	Nyibumtarum (A)	Ripe fruits are edible.	Fruit	-
<i>Musa aurantiaca</i> G.Mann ex Baker	Musaceae	Herb	Kodok (A)	Inflorescence is edible; cooked unripe fruits eaten as vegetable	Fruit	MKT
<i>Musa x paradisiaca</i> L.	Musaceae	Herb	Kodok (A)	Fuits edible also as vegetable.	Fruit	MKT
<i>Mussaenda roxburghii</i> Hook. f.	Rubiaceae	Shrub	Tangmeng (A)	Leaves (cooked) are edible as vegetable.	Leaf	MKT
<i>Mycetia longifolia</i> (Wall.) Kuntze	Rubiaceae	Shrub	Tangmge (A)	Leaves (cooked) are edible as vegetable.	Leaf	-
<i>Osbeckia nepalensis</i> Hook.f.	Melastomataceae	Shrub	Pudirasa (A)	Ripe fruits are edible.	Fruit	-
<i>Osbeckia nutans</i> Wall. ex C.B.Clarke	Melastomataceae	Shrub	Jikenemi (A)	Ripe fruits are edible.	Fruit	-
<i>Paris polyphylla</i> Sm.	Melanthiaceae	Herb		Leaves (cooked) are edible as vegetable, tuber medicinal.	Leaf	-
<i>Perilla frutescens</i> (L.) Britton	Lamiaceae	Herb	Namdung (A)	Seed paste is used to enhance the taste of curry-soup; also used as a substitute of mustard oil or spices. Leaves (cooked) are edible as vegetables.	Leaf, Seed	-
<i>Physalis minima</i> L.	Solanaceae	Herb	Bodopati (A)	Fruits are edible.	Fruit	-
<i>Pilea bracteosa</i> Wedd.	Urticaceae	Herb	Guge (A)	Leaves are edible as vegetable.	Leaf	-

Edibles	Family	Habit	Local Name	Uses	Part use	Marketability
<i>Piper mullesua</i> Buch.-Ham. ex D. Don	Piperaceae	Climbing shrub	Lo-ree (M)	Young tender leaves are used as flavour, Fruits edible.	Leaf, Fruit	MKT
<i>Piper pedicellatum</i> C. DC.	Piperaceae	Shrub	-	Leaves are edible as vegetable.	Leaf	MKT
<i>Piper sylvaticum</i> Roxb.	Piperaceae	Climber	Rari (A)	Leaves are edible as vegetable.	Leaf	MKT
<i>Persicaria chinensis</i> (L.) H. Gross	Polygonaceae	Herb	Amintaktabe	Ripe fruits (sweet) are edible.	Fruit	MKT
<i>Persicaria hydropiper</i> (L.) Delarbre	Polygonaceae	Herb	Kotsamang (M)	Leaves are used as spice with meat, also eaten as chutney.	Leaf	
<i>Persicaria nepalensis</i> (Meisn.) Miyabe	Polygonaceae	Herb	Ruri (A)	The entire plant is crushed and eaten as chutney.	Whole plant	MKT
<i>Pouzolzia hirta</i> Blume ex Hassk.	Urticaceae	Herb		Leaves (cooked) are edible as vegetables.	Leaf	MKT
<i>Prunus</i> sp.	Rosaceae	Tree	-	Ripe fruits are edible.	Fruit	
<i>Pyrus pyrifolia</i> (Burm.f.) Nakai	Rosaceae	Tree	-	Ripe fruits are edible.	Fruit	MKT
<i>Pyrus</i> sp.	Rosaceae	Tree	-	Ripe fruits are edible.	Fruit	MKTP
<i>Rhynchosyris calycinum</i> C. B. Clarke	Gesneriaceae	Shrub	-	Leaves (cooked) are edible as vegetable.	Leaf	MKT
<i>Rhynchosyris ellipticum</i> (Wall. ex D. Dietr.) A. DC.	Gesneriaceae	Shrub	-	Leaves are edible as vegetable.	Leaf	MKTP
<i>Rubus ellipticus</i> Sm.	Rosaceae	Shrub	Pakomtinne (M)	Fruits edible.	Fruit	MKTP
<i>Rubus insignis</i> Hook. f.	Rosaceae	Climber	Taptare (A)	Leaves are edible as substitute of betel (Piper betel) leaves; Ripe fruits (sweet) are edible.	Fruit	MKTP
<i>Rubus paniculatus</i> Sm.	Rosaceae	Climber	Taptara (A)	Leaves are edible by children as substitute for betel leaves. Ripe fruits (sweet) are edible.	Fruit	MKTP
<i>Rubus rosifolius</i> Sm.	Rosaceae	Shrub	Kibolepum (A)	Fruits (sour) are edible.	Fruit	MKTP
<i>Rubus treutleri</i> Hook. f.	Rosaceae	Climber		Ripe fruits (sweet) are edible.	Fruit	MKTP
<i>Sauropus androgynus</i> (L.) Merr.	Phyllanthaceae	Shrub	-	Tender leaves and shoots (cooked) are edible as vegetable.	Leaf	-
<i>Silene herminii</i> (Welw. ex Rouy) Welw. ex Rouy.	Caryophyllaceae	Herb	Kubumeku (A)	Fruits (sweet) are edible.	Fruit	-
<i>Solanum americanum</i> Mill.	Solanaceae	Herb	-	Fruits (cooked) are edible as vegetable.	Leaf, Fruit	MKT
<i>Solanum anguivi</i> Lam.	Solanaceae	Shrub	Bangko (A)	Half ripe fruits are edible as vegetable, paste or pickles. Leaves are edible as vegetable. Fruits are digestive but more quantity is considered toxic.	Leaf, Fruit	MKT
<i>Solanum violaceum</i> Ortega	Solanaceae	Shrub	Kopi (A)	Fruits (cooked) are edible as vegetable.	Fruit	MKT
<i>Solanum spirale</i> Roxb.	Solanaceae	Shrub	-	Fruits (cooked) are edible as vegetable.	Fruit	-

Edibles	Family	Habit	Local Name	Uses	Part use	Marketability
<i>Solanum torvum</i> Sw.	Solanaceae	Shrub	Singkotey (A)	Fruits edible as salad with bamboo shoot.	Fruit	MKT
<i>Spilanthes acmella</i> (L.) L.	Compositae	Herb	Marsang (A) & (M)	Tender leaves and flowers (cooked) are edible as vegetable. The fresh flowers are used as fishes poison. Flowers are used for toothache	Leaf	MKT
<i>Spiradiclis bifida</i> Wall. ex Kurz	Rubiaceae	Herb	Sokho (A)	Leaves (cooked) are edible as vegetable.	Leaf	MKT
<i>Spondias</i> sp.	Anacardiaceae	Tree	-	Ripe fruits edible	Fruit	-
<i>Stixis suaveolens</i> (Roxb.) Pierre	Capparaceae	Climber/Liana	Titegille (A)	Fruits (sweet) are edible.	Fruit	MKTP
<i>Pteridium aquilinum</i> (L.)	Pteridaceae	Herb	Khang duwai (M), Okang (A)	Leaves (cooked) are edible as vegetable.	Leaf	MKT
<i>Xanthophyllum burkillii</i> J.R.Drumm. & Dunn	Polygalaceae	Tree	-	Fruits edible.	Fruit	
<i>Youngia japonica</i> (L.) DC.	Compositae	Herb	Rum Dum (A)	Entire plant (cooked) edible as vegetable.	Leaf	MKT
<i>Zanthoxylum nitidum</i> (Roxb.) DC.	Rutaceae	Tree	-	Leaves used as spice with meat.	Leaf	MKTP
<i>Zanthoxylum armatum</i> DC.	Rutaceae	Shrub	Brasing (M)	Leaves used as spice with meat.	Leaf	MKT
<i>Zanthoxylum rhetsa</i> DC.	Rutaceae	Tree	-	Leaves used as spice with meat, also eaten as chutney.	Leaf	MKT
<i>Zingiber</i> sp.	Zingiberaceae	Herb	-	The flower buds (cooked) and edible.	Inflorescence	-

traditional biocultural landscape but would also enhance the livelihood opportunities of the poor and marginalized rural farmers.

Figure 5. Graphical presentation of preference upon selected wild edible fruits by the local community

CONCLUSION

Present investigation has revealed that the local tribal communities of Shi Yomi district of Arunachal Pradesh namely Bokar, Ramo, Memba and Khamba are rich in traditional knowledge related to harvesting, collection and sustainable utilization of the wild edible plant resources from their traditional biocultural landscape. Some of the frequently harvested and commercially viable species should be promoted for cultivation in their community forest land for ensuring sustainable harvesting and selling in the local and regional market. Value addition activities such as drying, packaging and storage of these marketable wild edible species could be promoted by imparting technical training to the prospective marginalized local farmers which would help ensuring livelihood security through supplementary income generation. Present report has conferred scope for the nutritional and phytochemical analysis of those biochemically unexplored wild edible species to unveil the nutritional and nutraceutical potential for food and medicinal applications.

Acknowledgments

The authors are highly thankful to the local communities of the Shi Yomi district, Arunachal Pradesh for sharing their valuable traditional knowledge related to the wild edible plants of their local biocultural landscape. Authors are also thankful for financial support extended from Department of Science & Technology (DST), Government of India through National Mission for Sustaining Himalayan Ecosystem (NMSHE) Task Force-3 “Forest Resources and Plant Biodiversity” project. Authors are highly thankful to the Director of G.B. Pant National Institute of Himalayan Environment & Sustainable Development for support and encouragement.

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