Asian Journal of Conservation Biology, December 2024. Vol. 13 No. 2, pp. 171–182 AJCB: FP0251/77335
ISSN 2278-7666 ©TCRP Foundation 2024 https://doi.org/10.53562/ajcb.77335

Research Article

Use of wild edible plants by the indigenous group of Namsai district, Arunachal Pradesh, Northeast India

Bhitalee Dutta[1], Bijay Thakur[2], Shilpa Baidya[2] and Biswa Deori[3*]

[1]*Department of Botany, Arunachal University of Studies, Knowledge City, Namsai, Arunachal Pradesh 792103, India*
[2] *Department of Environmental Science, Tezpur University, Tezpur, Assam 784028, India*
[3]*Department of Environmental Science, Arunachal University of Studies, Knowledge City, Namsai, Arunachal Pradesh 792103, India*

(Received: July 31 2023; Revised: June 19, 2024; Accepted: July 19, 2024)

ABSTRACT

The necessity for depending on wild edible plants (WEPs) by tribal communities is due to their high medicinal and economic value. Namsai district of Arunachal Pradesh is a home of different indigenous group of people. The communities of the region depend on the WEPs for the sustenance of their livelihood. The present study conducted in the markets of Namsai district recorded a total of 35 WEPs used by the local people for consumption purposes. In the study, majority of the plants are recorded as herbs (14), followed by the tree (8), shrub (5), fungi (3) and aquatic plants (3). Tangsa and Adi tribes have the highest consumption of wild plants, with *Phoebe cooperiana* being a widely consumed edible plant among the communities. The Leguminosae family exhibited the highest utilization efficiency with a score of 10. The edibility index indicated that two species (*Centella asiatica* and *Mastersia assamica*) achieved a score of 100% while the remaining 31 species scored between 10% and 20%. Based on the analysis of relative frequency of citation, 17 out of the 35 species exhibit relative frequency values greater than 0.5. The study emphasizes on significance of preserving the utilization of Wild Edible Plants (WEPs) by the local community and to secure their availability for future generations.

Keywords: wild edible plants, community, medicinal, utilization efficiency, edibility index, economical

INTRODUCTION

Wild Edible Plants (WEPs) refer to species that can be readily available in their natural habitats without cultivation or domestication (Ramaidani and Navia, 2022). Local communities surrounding forests frequently utilize them as one of the non-timber forest products (Suwardi *et al.,* 2022a). These plants hold significance in times of food scarcity, ensuring food sovereignty, security, and wellbeing in vulnerable households. For rural communities, WEPs are recognized for their significant contributions in providing various resources such as traditional brews, diet, oil, remedies, fodder, firewood, construction materials and for facilitating traditional rituals (Asha and Singh, 2020; Elfrida *et al.,* 2021; Sutrisno *et al.,* 2020; Navia *et al.,* 2021; Sutrinso *et al.,* 2021; Suwardi *et al.,* 2021; Ramaidani and Navia, 2022; Syamsuardi *et al.,* 2022a). The local people mostly consume these wild edible plants as vegetables and foods and use them as ethnomedicine. Some claim that earlier societies used wild plants more frequently than modern ones to fend off hunger (Agea *et al.*, 2011; Leonti *et al.,* 2006). As a result of having inherited indigenous knowledge from their ancestors (Hussain *et al.,* 2022), diverse tribes use a wider variety of wild plant species closely related to their traditional and cultural systems. These are a vital component of the global food basket and one of the alternative sources of wholesome and nutritious food used worldwide (Chakravarty *et al.,* 2016). Overall, wild edibles have contributed significantly to the diet and provided financial stability of the local people, and as such, emphasis on these species should be privileged.

The FAO estimates that one billion people worldwide consume wild foods daily (Aberoumand, 2009). India consumes more than 1000 species of wild plants as food and vegetables (Ray *et al.,* 2020; Priyadarshini *et al.,* 2024). The traditional ecological knowledge concerning utilizing WEPs, including their numbers and frequencies, varies according to tradition, culture and geographical area and is only restricted to specific communities. Local communities are renowned for their profound knowledge of utilizing local plants for various purposes, including food, and supporting health conditions (Adnan *et al.,* 2022; Haruna *et al.,* 2022). The food consumption habits of local communities are primarily influenced by the availability of edible plant resources and ecological variables. Additionally, at the community level, food consumption habits have also been regulated by traditional ecological knowledge and ethnobotanical knowledge. The application of the WEPs has been preserved through this unique traditional ecological knowledge passed down verbally from generation to generation based on age-old experiences. It is inferred that wild plants serve as a rich source of vitamins, fats, proteins, and other biological micro-nutrients required to develop the body (Sundriyal and Sundriyal, 2004; Elfrida *et al.,* 2020; Navia *et al.,* 2021). On the other hand, WEPs are preferred more because they are cost-effective and readily available in the surrounding areas.

[*]*Corresponding Author's E-mail: biswa.deori@gmail.com*

In Northeastern India Arunachal Pradesh is the largest state known as a region of rich culture heritage and traditional wisdom. The state is home to 110 sub-tribes and 26 major tribes, and each uses forest bioresources in its unique traditional way for subsistence (Tag and Das, 2004). Furthermore, this region is well recognized as the centre of wild food and medicinal herbs, and each tribe has a wealth of indigenous knowledge regarding using these plants (Nag, 1988; Pal, 1992, Pal, 1984). In Arunachal Pradesh, the tribal community consumes WEPs without access to modern medicine (Kohli, 1995, 1983). However, the escalating population pressure with the conversion of forest regions for urban expansion and construction endeavors, has significantly jeopardized the survival of wild food plants in different parts of the world. There are studies that have reported that modernization and change in cultural and traditional values have triggered the declination of using WEPs (Łuczaj *et al.,* 2013). Limited studies are available on documentation of the wild edible plants used by the different communities. Therefore, to protect these valuable natural resources, it is imperative for the scientific community to prioritize their endeavors in documenting and acknowledging the significance of WEPs. The present study aimed to document the various WEPs, parts of plants used for consumption, and quantitative analyses to determine their edibility index and utilization efficiency among different tribes in the Namsai district of Arunachal Pradesh.

MATERIALS AND METHODS

Study area

The present investigation was carried out in the Namsai district of Arunachal Pradesh (Figure 1). The district lies between the 27°30' to 27°55'N latitude and 95° 45' to 96°20' East longitude with 152 m average elevation above mean sea level. The region of the surveyed site comes under a sub-tropical climate with a mean annual temperature of 22.8 °C. The rainfall pattern of the district is also quite variable, with 2728 mm of annual mean precipitation. The Namsai district is inhabited by many indigenous communities (Adi, Tangsa, Chakma, Aka, Nishi, Deori, Assamese and Bihari) having Khamti and Singphos as the major tribe. All the tribes of the district are culturally and linguistically more or less akin to one another.

Survey and data collection

For the study, a field survey was carried out during the year 2021 in the local markets of Namsai district of Arunachal Pradesh. There was a total of 6 weekly markets (viz. Old mohong, Lathao, Nongkhon, Kumari, Mahadevpur and Namsai). However, considering the diversity of wild vegetables sold in the market, the two markets, Mahadevpur and Namsai were considered for the present study. Thirty-two informants in total were taken into consideration for interviewing and data collection. A semi-structured questionnaire focused on the vernacular (local) name of the plant, habitat, plant parts used, mode of consumption, parts sold and cost of the vegetables. The plants were identified by interacting with the local vendors and following relevant literature. Specimens of unidentified plants collected from the study site were taxonomically identified using the standardized Flora of Assam (Kanjilal *et al.,* 1934-1940) and Flora of Arunachal Pradesh (Hajra *et al.,* 1996) and based on personal taxonomic knowledge. According to the plants of the world online, the final list was prepared with the accepted scientific names of plant species (https://powo.science.kew.org/).

Quantitative analysis

The following quantitative analyses were conducted to understand and identify the species of wild edible plants that are commonly preferred and valuable, as well as to know their local significance.

***Edibility Index* (*EI*)**: Utilizing a method based on component-wise scale values, all wild edible plant species' EI was determined (Chand *et al.,* 2017; Doni and Gajurel, 2020). Each plant component was assigned a value

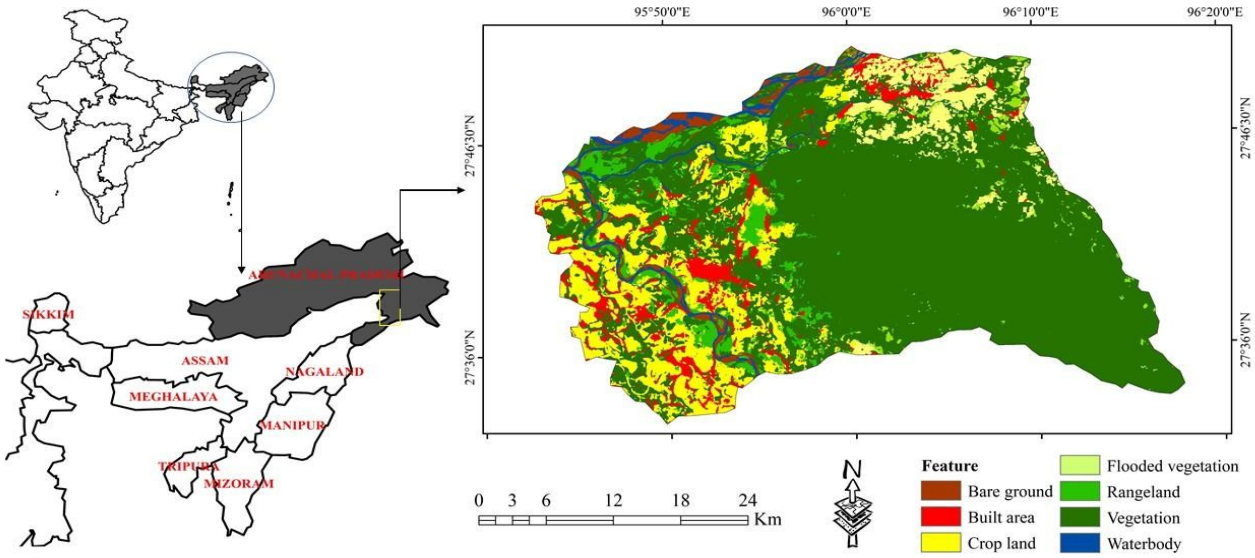

Figure 1. Location map of the study area

value of 10% on a scale of one to ten. It was then determined by dividing the total number of times each edible plant's parts were used with the whole plant.

$$EI(\%) = \frac{PUi}{WPUi} \times 100$$

Where EI refers to the Edibility index, whereas PUi denotes the components utilised from the *i*th species, additionally, WPUi represents the whole plant usage of the *i*th species.

***Relative Frequency of Citation (RFC)*:** For each species, the RFC value was determined based on the informants who mentioned using a particular species for consumption. The formula was used to determine the RFC value, which ranges from 0 to 1. 0 means none of the informants said they used the plant and one where all of the informants said they used the plant (Tardío and Pardo-de-Santayana, 2008; Doni and Gajurel, 2020).

$$RFC = RFC/N$$

where RFC is the number of informants who said they used a species and N is the total number of informants who took part in the study.

***Utilization efficiency*:** Utilization efficiency is calculated by adding the number of edible plant parts used from all species within each family by the total number of plant species in each family (Chand *et al.,* 2017).

$$UE = \sum_{i}^{n} \frac{TNPPsU}{TNPS}$$

UE stands for utilization efficiency, TNPPsU stands for the total number of plant parts used by all species, and TNPS stands for the total number of plant species within the family.

RESULTS AND DISCUSSION

Diversity of wild edible plants

The study recorded a total of 35 WEPs used by the region's indigenous groups (Table 1) in Namsai district for consumption purposes. The number of species recorded in this study (35) is comparable to the findings of Gogoi *et al.* (2023), who identified 43 wild edible plant species from longding district, Arunachal Pradesh. However, this is less when compared 52 wild edible plant species in Thanh Hoa Province, Northern Vietnam (Nguyen *et al.*, 2021) and 67 WEPs reported in the Bukit Rimbang-Bukit Baling wildlife Reserve, Kampar, Riau, Indonesia (Syamsuardi *et al*., 2022b). The variation in the number of wild edible plants in different regions is due to the availability of the resources in natural habitat, consumption and taste preferences of the plants based on their food habits. During the study it was noted that vegetables sold in the markets are collected from natural habitats (Figure 2). The villagers valued the WEPs as a unique food supplement for their livelihoods because of their nutrient and medicinal value. A similar study conducted by Angami *et al.* (2006), Yanka *et al.* (2019) in different districts of Arunachal Pradesh has revealed that many communities in the state locally consume WEPs as staple foods and has medicinal properties. Ngomle *et al.* (2020) documented 57 species of wild edible plants consumed by Digaru Mishmi in Arunachal Pradesh. Likewise, Lungphi *et al.* (2018) found 51 species of wild edible plants consumed by the Tangsa tribal community. It has been noted that WEPs were cultivated to supplement cultivated crops and serve as a survival strategy during times of food shortage (Doley *et al.,* 2010) and it is believed that harvest and consumption of WEPs helped to lessen the food crisis to some extent (Ngomle *et al.,* 2020). Similar experiences have been recorded in the East Kameng and West Kameng districts of Arunachal Pradesh about 25 plants that may serve as additional food material during the lean period and scarcity (Kar, 2004).

Plants parts used by different communities

The investigation revealed that among the recorded edible plants, herbaceous species constituted the largest portion, with 14 herb species, followed by eight tree species, five shrub species, three climber species, three aquatic plant species, and two fungi species. Leaves (35.9%) were the most frequently utilized plant components, followed by fruits, tuber (10.26% each), whole plant, young sprout, and stem, with 7.69% in each category (Figure 3). Most ethnobotanical studies confirmed that leaves are the major portion of the plant used for consumption (Sivasankari *et al.,* 2014; Araya *et al.,* 2015; Doni and Gajurel, 2020; Hazarika and Tayeng, 2020; Suwardi *et al.,* 2022b). In addition, leaves are the only parts of the plant that are available throughout the growing season and, consequently, have a higher consumption (Doni and Gajurel, 2020).

The consumption of wild plants is a crucial component of the livelihood strategies used by the locals. It was found that most species are cooked or boiled as a vegetable; some are eaten fried and consumed as chutneys. The high amount of nutrients in these wild vegetables can reduce the risk of diseases. Among the recorded tribes in the study, Tangsa utilized the maximum number of plants (11 spp.), followed by Adi (10 spp.), followed by Khamti and Chakma (6 spp.), Aka (3 spp.), Nyishi (3 spp.), Singpho (2 spp.) and Monpa (1 spp.) in Namsai district (Table 2). Sell of wild edible plants in the markets have facilitated the local people to generate income and provided the opportunity for developing microbusinesses and entrepreneurship. The other reason for selling these vegetables could be their importance as medicinal and phytochemical properties. Also, exploiting WEPs would significantly boost the economy (Kumar *et al.,* 2013). The study by Tsering *et al.* (2017) reported that the production of WEPs supports the local economy and livelihood since villagers and women earn their family income by selling wild plants in nearby markets. In the present study, *Diplazium esculantum, Eryngium foetidum, Garcinia pedunculata, Manihot esculenta, Portulaca oleraceae, Sagittaria*

Figure 2. Wild edible plants recorded in the studied market of Namsai district, Arunachal Pradesh

Table 1. Wild Edible species sold in the local market of Namsai district, Arunachal Pradesh

Sl. no.	Scientific name	Family	Vernacular name	Habit	Parts used	Mode of consumption	Market
1	*Alpinia nigra*	Zingiberaceae	Thura (T)	Herb	Pseudo stem	Cooked	Both
2	*Amaranthus viridis*	Amaranthaceae	Khahram (T)	Herb	Leafy shoot	Boiled and consumed as vegetables	Both
3	*Auricularia auricula*	Auriculariaceae	Uol (C)	Fungi	-	Cooked	Namsai
4	*Auricularia delica*	Auriculariaceae	Uol (C)	Fungi	-	Cooked	Namsai
5	*Bambusa spinosa*	Poaceae	Schee (Aka)	Tree	Young and tender sprout	Pickle and cooked	Both
6	*Calamus rotang*	Arecaceae	Raiding (A)	Tree	Stem	Tender shoots burn on fire and prepared as curry	Both
7	*Cinnamomum tamala*	Lauraceae	Tezpat (C)	Tree	Leaves	Bark used as condiment	Both
8	*Centella asiatica*	Apiaceae	Ningkhoi (T), Panang (K)	Herb	Whole plant	Salad	Both
9	*Clerodendrum colebrookianum*	Verbenaceae	Ongin (A), Nephaphu (S)	Shrub	Leaves, twigs	Young leaves are boiled and used as vegetables	Both
10	*Chenopodium album*	Amaranthaceae	Polom (K)	Herb	Leaves, tender shoot	Tender shoots eaten raw or cooked	Both
11	*Colocasia esculenta*	Araceae	Teu (T), Annyi (A)	Herb	Leaves, stem	Whole plant cooked	Mahadevpur
12	*Diplazium esculantum*	Athyriaceae	Horon (T), Lochanch (Aka)	Herb	Tender leaves	Young frond used as vegetables	Both
13	*Eryngium foetidum*	Apiaceae	Panchi (T)	Herb	Leaves	Leaves are specially used in preparation of a curry made from pork and salad	Both
14	*Garcinia pedunculata*	Clusiaceae	Tabing-asing (A)	Tree	Fruits	Cooked	Mahadevpur
15	*Houttuynia cordata*	Saururaceae	Pukhoi (K)	Herb	Leaves and roots	Cooked	Mahadevpur
16	*Ipomoea batatas*	Convolvulaceae	Yengjok tang (S)	Shrub	Tuber	Boiled, roasted and cooked	Namsai
17	*Ipomoea aquatica*	Convolvulaceae	Harma sak (C)	Aquatic	Tuber	Cooked	Both
18	*Lasia spinosa*	Araceae	Sibenjento (K)	Herb	Leaves	Young shoots eaten fried and mature tubers eaten boiled	Mahadevpur

19	*Manihot esculenta*	Euphorbiaceae	Sin Eegin (N)	Shrub	Root tuber	Boiled, roasted, cooked, fermented and use as a bevarage sources (Dogom/Opo)	Namsai
20	*Mastersia assamica*	Leguminosae	Pichi khah (K)	Climber	Whole plant	Cooked	Namsai
21	*Musa balbisiana*	Musaceae	Kopak (A)	Herb	Inflorescence	Cooked	Both
22	*Musa sanguinea*	Musaceae	Kopak (A)	Herb	Inflorescence	Cooked	Both
23	*Oxalis corniculata*	Oxalidaceae	Pulungsukhu (Aka)	Herb	Leaves	Cooked	Both
24	*Paederia foetida*	Rubiaceae	Raonam (T)	Climber	Leaves	Cooked	Namsai
25	*Passiflora edules*	Passifloraceae	Oszati (T)	Tree	Fruits	Eaten raw or cooked	Namsai
26	*Prasiola crispa*	Prasiolaceae	Hokolok (M)	Aquatic	Whole plant	Used in preparation of soup and sometimes cooked with vegetables	Namsai
27	*Phoebe cooperiana*	Lauraceae	Tapir (A), Jishir (N), Huk (T)	Tree	Fruits	Ripe fruits eaten raw	Both
28	*Portulaca oleraceae*	Portulacaceae	Totek dilsa (C), Gubar oying (A)	Herb	Leaves	Cooked	Both
29	*Pouzolzia hirta*	Urticaceae	Oyik (A)	Herb	Leaves	Cooked	Namsai
30	*Sagittaria sagittifolia*	Alismataceae	Ning (K)	Aquatic	Tuber	Cooked	Namsai
31	*Sarcochlamys pulcherrima*	Urticaceae	Mesaki (A)	Shrub	Young leaf	Cooked	Mahadevpur
32	*Solanum torvum*	Solanaceae	Tita begol (C)	Shrub	Fruits	Cooked	Both
33	*Smilax perfoliata*	Smilacaceae	Phantok (T)	Climber	Young sprout	Cooked	Both
34	*Xanthozylum armatum*	Rutaceae	Changkao (T)	Tree	Leaves	Cooked	Both
35	*Xanthoxylum oxyphyllum*	Rutaceae	Honyor (N)	Tree	Young shoot, leaves	Cooked	Both

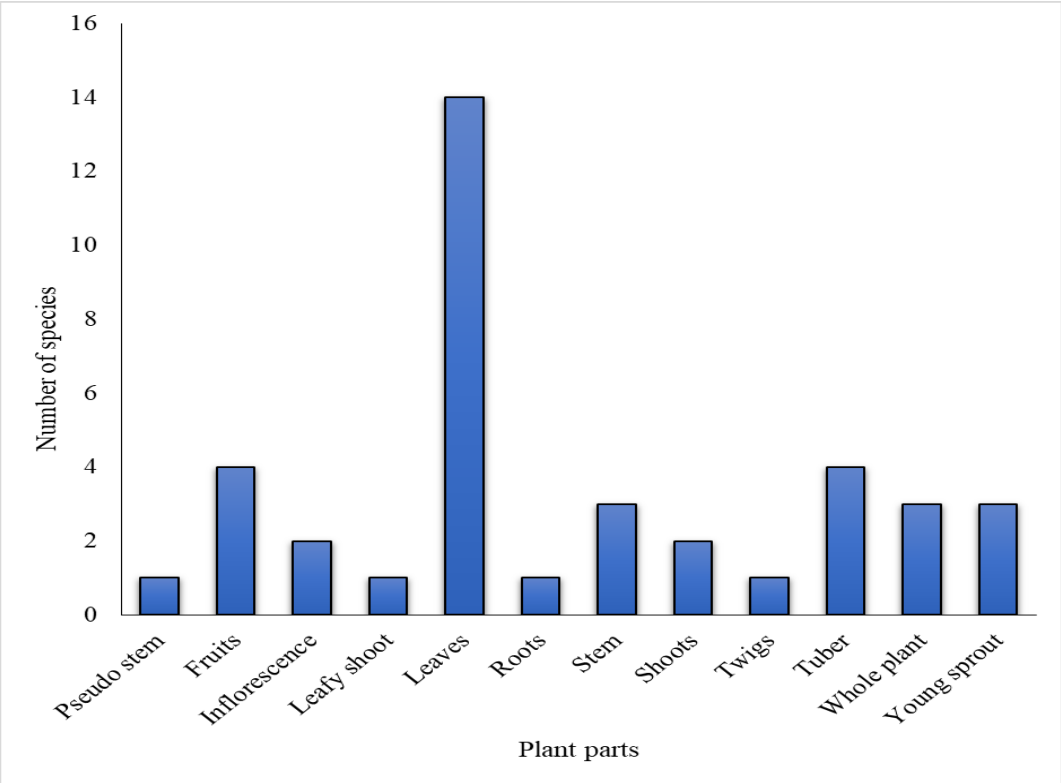

Figure 3. Mode of consumption of different plant parts

Quantitative analyses

The edibility index (EI) is one of the significant indicators that can provide accurate information regarding the edibility of each species. It indicates the utility of specific plant components and the extent to which a community is currently consuming a certain plant species. Two species (*Centella asiatica, Mastersia assamica*) out of a total of 35 species had 100%, while two species, *Colocasia esculenta* and *Musa balbisiana*, showed an edibility index of 30% each. Meanwhile, six species had 20%, and the remaining 25 had 10% (Figure 4). The current study's findings were very similar to those from Arunachal Pradesh, eastern Himalayan state of India, where four species had an edibility index of 100% and 42 species had an edibility index of more than 30%. In contrast, the current study data contradicts the findings of Chand et al. (Chand *et al.,* 2017), with a 100% edibility index for two species and more than 80% for eleven species. The variance in a species' edibility index could be related to a certain tribe's limited expertise in selecting wild edible plant species (Kahlon and Singh, 2019).

Table 2. List of the recorded plants used by different tribes in Namsai district, Arunachal Pradesh

Sl no.	Tribe	Scientific name
1	Adi	*Calamus rotang*
		Clerodendrum colebrookianum
		Colocasia esculenta
		Garcinia pedunculata
		Musa balbisiana
		Musa sanguinea
		Phoebe cooperiana
		Portulaca oleraceae
		Pouzolzia hirta
		Sarcochlamys pulcherrima

2	Tangsa	*Alpinia nigra*
		Amaranthus viridis
		Centella asiatica
		Colocasia esculenta
		Diplazium esculantum
		Eryngium foetidum
		Paederia foetida
		Phoebe cooperiana
		Passiflora edules
		Smilax perfoliata
		Xanthozylum armatum
3	Khamti	*Centella asiatica*
		Chenopodium album
		Houttuynia cordata
		Lasia spinosa
		Mastersia assamica
		Sagittaria sagittifolia
4	Chakma	*Auricularia auricula*
		Auricularia delica
		Cinnamomum tamala
		Ipomoea aquatica
		Portulaca oleraceae
		Solanum indicum
5	Aka	*Bambusa spinosa*
		Diplazium esculantum
		Oxalis corniculata
6	Nyishi	*Manihot esculenta*
		Phoebe cooperiana
		Xanthoxylum oxyphyllum
7	Singpho	*Clerodendrum colebrookianum*
		Ipomoea batatas
8	Monpa	*Prasiola crispa*

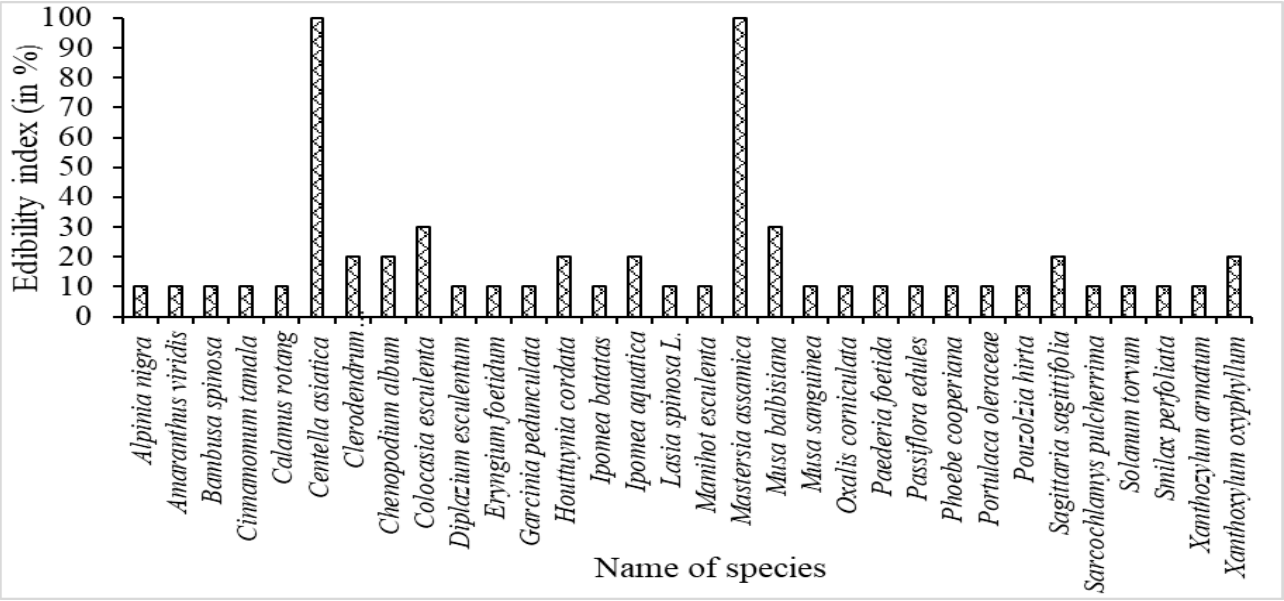

Figure 4. Edibility index of WEPs recorded from Namsai district, Arunachal Pradesh

Another index, known as utilization efficiency, per species per component is calculated in the current study. Leguminosae family has the maximum efficiency (10 scores) with 100% utilization of all components for edible purposes, whereas the Apiaceae family has a 5.5 score. However, five families (Alismataceae, Araceae, Musaceae, Saururaceae, and Verbenaceae) showed two scores, Rutaceae demonstrated a 1.5 score, and the remaining 17 demonstrated only one score (Figure 5). Tardío and Pardo-de-Santayana (2008) highlighted the different indigenous communities where Leguminosae crops are used on a large scale for cultivated economic food crops. In addition, Legumes also contribute to long-term soil improvement due to their ability to fix atmospheric molecular nitrogen through symbiotic relationships with rhizobia (Ron *et al.,* 2013).

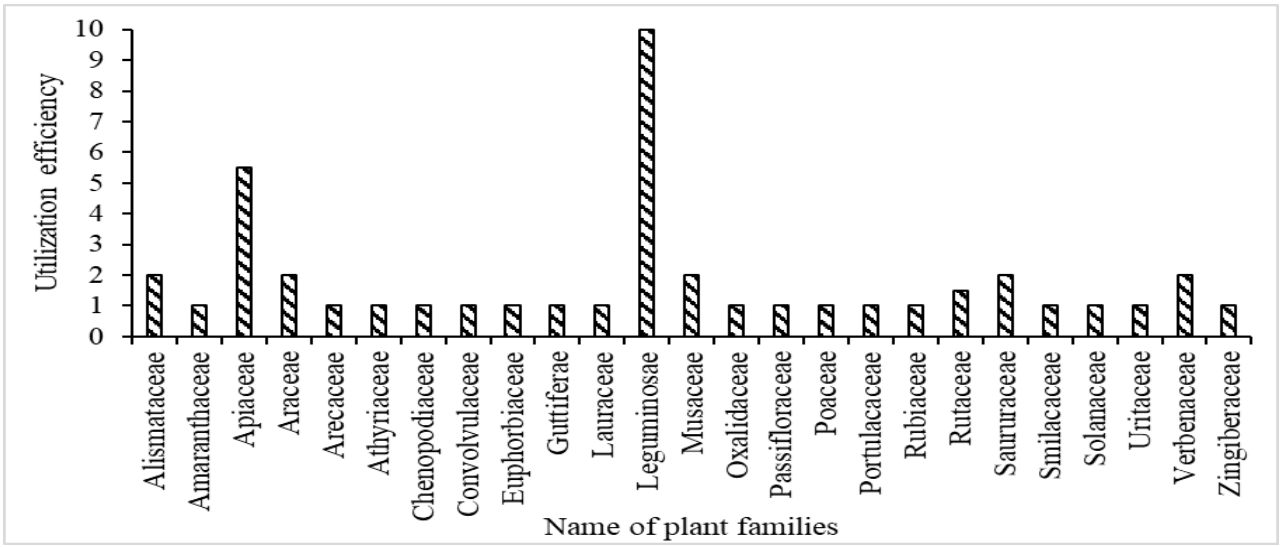

Figure 5. Utilization efficiency of WEPs recorded from Namsai district, Arunachal Pradesh

The significance of wild edible species was demonstrated by the relative frequency of citation in relation to local informants who cited the plant. In the present study, the value of the relative citation frequency ranges from 0.06 to 1.0. The current investigation results show that higher RFC values result from more than 50% of informants favouring a particular species.*Colocasia esculenta, Diplazium esculentum* and *Garcinia pedunculata* has highest value of RFC with a value of 1 each, followed by *Centella asiatica* (0.94), *Cinnamomum tamala* (0.91) and *Pouzolzia hirta* (0.91). At the same time, the lowest value was recorded in *Smilax perfoliate* (0.06). The leaves, stems, and tubers of *Colocasia esculenta* and *Diplazium esculentum* are well recognized for their use and *Garcinia pedunculata* is-used for medicinal importance. They are used as edible

and are regarded as a staple food. A further factor contributing to the greater RFC is the local communities' widespread consumption of such plants and their ease of availability (Zaman *et al.,* 2020). The other factors contributing to increased RFC include wild food plants use for medicinal and commercial value (Doni and Gajurel, 2020). However, as we found that the use of WEPs is very high in this region and without proper management strategies, these plants may get extinct. A study carried out by Schunko *et al.* (2022) stated many wild plants are subjected to deforestation by the local community due to agricultural land expansions, wildfire, fuel wood collection, overgrazing and overharvesting. Due to increasing hunger in the world, it is unlikely to eliminate the stable foods consumed by the people (Demir and Ayaz, 2022). With the increasing population, the demand for wild edible plants is likely to increase significantly. Hence to enhance the production and cultivation of wild edible plants (WEPs) it is necessary to sustainably conserve and manage the utilization of these resources.

CONCLUSION

The present study showed that indigenous communities depend on WEPs for their dietary needs. Moreover, the extensive knowledge about using WEPs highlights the importance and uniqueness of these plants in their local food habits. The quantitative analysis revealed that the WEPs of the region has a high utilization efficiency and can act be a potential source of food, nutrition, and economic value. Overall, the findings of the study suggest that the high dependency of the local people on these wild plants could lead to a decline in their numbers. Therefore, adopting effective management and conservation strategies is essential to ensure the sustainable utilization of these plants, thereby securing their availability for the future.

Author Contributions

Conceptualization: BD. Investigation and Data Collection: BD & BD. Methodology: BD & BD. Statistical and Formal Analysis: BT & SB. Resources: BD. Supervision: BD & BT. Writing – review & editing: BD, BT & SB.

ACKNOWLEDGEMENT

The author would like to acknowledge all the respondents during the questionnaire survey for their active participation and willingness to share their valuable knowledge on the use of WEPs.

REFERENCES

Aberoumand, A. 2009. Nutritional evaluation of edible Portulaca oleracia as plant food. *Food Analytical Methods*. 2: 204–207. doi: 10.1007/s12161-008-9049-9

Adnan, A., Navia, Z.I., Silvia, M., Antika, M., Suwardi, A.B., Baihaqi, B. and Yakob M. 2022. Diversity of herbs and spices plants and their importance in traditional medicine in the South Aceh District, Indonesia. *Biodiversitas*. 23 (7): 3836-3843. doi: 10.13057/biodiv/d230761

Agea, J. G., Okia, C. A., Abohassan, R. A. A., Kimondo, J. M., Obua, J., Hall, J., and Teklehaimanot, Z. 2011. Wild and Semi-Wild Food Plants of Bunyoro-Kitara Kingdom of Uganda: growth forms, collection niches, parts consumed, consumption patterns, main gatherers and consumers. *Environmental Research Journal*, 5(2): 74-86. doi: 10.3923/erj.2011.74.86

Angami, A., Gajurel, P. R., Rethy, P., Singh, B., and Kalita, S. K. 2006. Status and potential of wild edible plants of Arunachal Pradesh. *Indian Journal of Traditional Knowledge*. 5 (4): 541-550.

Araya, S., Abera, B. and Giday, M. 2015. Study of plants traditionally used in public and animal health management in Seharti Samre District, Southern Tigray, Ethiopia. *Journal of ethnobiology and ethnomedicine*. 11: 1–25. doi: 10.1186/s13002-015-0015-5

Asha, H., and Singh, A. V. 2020. Diversity of medicinal wild fruits in the Lower Subansiri district of Arunachal Pradesh in Northeast India. *Asian Journal of Conservation Biology*. 9 (1): 113-22.

Chakravarty, S., Bhutia, K. D., Suresh, C. P., Shukla, G., and Pala, N. A. 2016. A review on diversity, conservation and nutrition of wild edible fruits. *Journal of Applied and Natural Science*, 8 (4), 2346-2353 doi: https://doi.org/10.31018/jans.v8i4.1135

Chand, R., Singh, A.N. and Nirmala, C. 2017. Ethnoecological Survey of Underutilized Plant Diversity of Hamirpur District , Himachal Pradesh , India : An Edibility Assessment. *Environment and Ecology Research*. 5(1): 13-29. doi: 10.13189/eer.2017.050103

Demir, Ġ. and Ayaz, N. 2022. Wild edible plants contributing to the traditional foods of Mardin (Turkey) Province. *Indian Journal of Traditional Knowledge*. 21: 569–582. doi: https://doi.org/10.56042/ijtk.v21i3.43299

Doley, B., Gajurel, P. R., Rethy, P., Singh, B., Buragohain, R., and Potsangbam, S. 2010. Lesser known ethno medicinal plants used by the Nyshi community of Papumpare District, Arunachal Pradesh. *Journal of Biological Science Research*, 1: 34-36.

Doni, T. and Gajurel, P.R. 2020. Diversity of wild edible plants traditionally used by the Galo tribe of Indian Eastern Himalayan state of Arunachal Pradesh. *Plant Science Today*. 7: 523–533. doi: https://doi.org/10.14719/PST.2020.7.4.855

Elfrida, E., Mubarak, A. and Suwardi, A.B. 2020. The fruit plant species diversity in the home gardens and their contribution to the livelihood of communities in rural area. *Biodiversitas* 21 (8): 3670-3675. doi: 10.13057/biodiv/d210833.

Elfrida, E., Tarigan, N. S. and Suwardi, A. B. 2021. Ethnobotanical study of medicinal plants used by community in Jambur Labu Village, East Aceh, Indonesia. *Biodiversitas Journal of Biological Diversity*, 22(7): 2893-2900. doi: 10.13057/biodiv/d220741.

Gogoi, J., Sharma, M., Sharma, C. L. and Pangging, G. 2023. Market Survey of Wild Edible Plants Consumed by the Wancho Tribe in Longding District of Arunachal Pradesh. *Advances in Zoology and Botany*. 11(4): 270-281. doi: 10.13189/azb.2023.110404

Hajra, P.K., Verma, D.M. and Giri, G.S. 1996. Materials for the flora of Arunachal Pradesh. *Botanical Survey of India*.

Haruna, M.F., Kenta, A.M. and Herawati. H. 2022. Medicinal plants used by the community of Lipulalongo Village, Banggai Laut District, Central Sulawesi, Indonesia. *Asian Journal of Ethnobiology*. 5 (2): 62-68. doi: 10.13057/asianjethnobiol/y050107.

Hazarika, T. and Tayeng, B. 2020. Wild Edible Fruits of Arunachal Pradesh, India: Ethno-Medicinal Uses, Socio Economic Importance and Role in Rural Economy and Livelihood Security. *Research Square*. 1–30. doi: https://doi.org/10.21203/rs.3.rs-51721/v1

Hussain, A., Spaldon, S. and Tundup, P. 2022. Traditional food systems of Changthang, Ladakh. *Indian Journal of Traditional Knowledge*. 21: 625–636. doi: https://doi.org/10.56042/ijtk.v21i3.42319

Kahlon, L.K. and Singh, R. 2019. Traditional knowledge & Dynamics of edible plants of primitive tribal group 'Paudi Bhuyan' with changing demography migration patterns in Northern Odisha. *Indian Journal of Traditional Knowledge*.18: 7–15.

Kanjilal, U.N., Kanjilal, P.C., Das. A. and Purkaystha, C. 1934. Flora of Assam, Vol. 1, Assam Govt. Press, Shillong.

Kanjilal, U.N., Kanjilal, P.C. and Das, A. 1938. Flora of Assam, Vol. 2, Assam Govt. Press, Shillong.

Kanjilal, U.N., Kanjilal, P.C., Das. A. and Dey, R.N. 1939. Flora of Assam, Vol. 3, Assam Govt. Govt. Press, Shillong.

Kanjilal, U.N., Kanjilal, P.C., Das, A. and Dey, R.N. 1940. Flora of Assam, Vol. 4, Assam Govt. Govt. Press, Shillong

Kar, A. 2004. Common wild vegetables of Aka tribe of Arunachal Pradesh. *Indian Journal of Traditional Knowledge*. 3: 305–313.

Kohli, Y.P. 1995. Herbal medicines in Arunachal Pradesh. *The Himalaya*. 12: 17–20.

Kohli, Y.P. 1983. Our Scientific Heritage: Folk Medicine. *Arunachal News.* 12: 9–15.

Kumar, R., Tapwal, A., Pandey, S., Borah, R. K., Borah, D. and Borgohain, J. 2013. Macro-fungal diversity and nutrient content of some edible mushrooms of Nagaland, India. *Nusantara Bioscience*, *5*(1):1-7. doi: 10.13057/nusbiosci/n050101

Leonti, M., Nebel, S., Rivera, D. and Heinrich, M. 2006. Wild gathered food plants in the European Mediterranean: a comparative analysis. *Economic botany*, 60(2), 130-142.

Łuczaj, Ł., Zovko Končić, M., Miličević, T., Dolina, K. and Pandža, M. 2013. Wild vegetable mixes sold in the markets of Dalmatia (southern Croatia). *Journal of ethnobiology and ethnomedicine*, 9(1): 1-12.

Lungphi, P., Wangpan, T. and Tangjang, S. 2018. Wild edible plants and their additional uses by the Tangsa community living in the Changlang district of Arunachal Pradesh, India. *Pleione*. 12: 141. doi: https://doi.org/10.26679/pleione.12.2.2018.151-164

Nag, D.S. 1988. Ethnobotanical observation on some medicinal folklores of Tirap district of Arunachal Pradesh, Himalaya. *Man and Nature*. 11(8-9): 321–325.

Navia, Z.I., Suwardi, A.B. and Nuraini. 2021. The importance of tropical edible fruit plants for tribal communities in East Aceh Region, Indonesia. *Earth and Environmental Science*. 637: 012003. DOI:10.1088/1755-1315/637/1/012003.

Ngomle, S., Eko, R., Kanwat, M., Kalita, H. and Moyon, N. N. 2020. Eating from the wild: an insight into the indigenous wild edible plants consumed by the Digaru Mishmi tribe of Arunachal Pradesh. *Indian Journal of Traditional Knowledge.* 19(2): 360-369.

Nguyen, C.H., Averyanov, L., Egorov, A., Nguyen, C.V. and Tran, T.T. 2021. Edible wild plants in the flora of Pu Luong Nature Reserve, Thanh Hoa Province, northern Vietnam. *Earth and Environmental Science*. 876: 012054. doi: 10.1088/1755-1315/876/1/012054.

Pal, G.D. 1992. Observations on less known interesting tribal uses of plants in Lower Subansiri district, Arunachal Pradesh. *Journal of Economic and Taxonomic Botany*. 10: 198–203.

Pal, G.D. 1984. Observations on ethnobotany of tribals of Subansiri, Arunachal Pradesh. *Nelumbo*. 26: 26 –37.

POWO. Plants of the World Online. 2017. Facilitated by the Royal Botanic Gardens, Kew. Retrieved on 13 June 2021 from http://www.plantsoftheworldonline.

Priyadarshini, S., Tudu, S., Dash, S. S., Biswal, A. K., and Sahu, S. C. 2024. Wild edible plants: diversity, use pattern and livelihood linkage in Eastern India. *Genetic Resources and Crop Evolution*. 71: 3111-3133. https://doi.org/10.1007/s10722-023-01833-z

Ramaidani, R. and Navia, Z. I. 2022. Documentation of the traditional Gayo food in Lokop village, East Aceh, Indonesia. *Biodiversitas Journal of Biological Diversity*, 23(4): 2017-2024. doi: 10.13057/biodiv/d230437

Ray, A., Ray, R., and Sreevidya, E. A. 2020. How many wild edible plants do we eat—their diversity, use, and implications for sustainable food system: an exploratory analysis in India. *Frontiers in Sustainable Food Systems*. 4 (56):1-21. doi: 10.3389/fsufs.2020.00056

Ron, De. A. M., Cubero, J. I., Singh, S. P. and Aguilar, O. M. 2013. Cultivated legume species. *International journal of agronomy*. 2013:1-2. doi: http://dx.doi.org/10.1155/2013/324619

Schunko, C., Li, X., Klappoth, B., Lesi, F., Porcher, V., Porcuna-Ferrer, A. and Reyes-García, V. 2022. Local communities' perceptions of wild edible plant and mushroom change: A systematic review. *Global Food Security*, 32: 100601. doi: https://doi.org/10.1016/j.gfs.2021.100601

Sivasankari, B., Anandharaj, M. and Gunasekaran, P. 2014. An ethnobotanical study of indigenous knowledge on medicinal plants used by the village peoples of Thoppampatti, Dindigul district, Tamilnadu, India. *Journal of Ethnopharmacology*. 153: 408–423. doi: http://dx.doi.org/10.1016/j.jep.2014.02.040

Sundriyal, M. and Sundriyal, R.C. 2004. Wild edible plants of the Sikkim Himalaya: Marketing, value addition and implications for management. *Economic Botany*. 58 (2): 300–315. doi: https://doi.org/10.1663/0013-0001(2004)058[0300:WEPOTS]2.0.CO;2

Sutrisno, I. H., Akob, B., Navia, Z. I., Nuraini, N. and Suwardi, A. B. 2020. Documentation of ritual plants used among the Aceh tribe in Peureulak, East Aceh District, Indonesia. *Biodiversitas Journal of Biological Diversity*, 21(11): 4990-4998. doi: 10.13057/biodiv/d211102.

Sutrisno, I.H., Suwardi, A.B., Navia, Z.I., Baihaqi, B. and Fadhilah, M.A. 2021. Documentation of the traditional Alas food in Southeast Aceh District, Indonesia. *Biodiversitas* 22 (8): 3243-3249. doi: 10.13057/biodiv/d220818.

Suwardi, A.B., Mardudi, M., Navia Z.I., Baihaqi, B. and Muntaha, M. 2021. Documentation of medicinal plants used by Aneuk Jamee tribe in Kota Bahagia sub-district, South Aceh, Indonesia. *Biodiversitas*. 22 (1): 6-15. doi: 10.13057/biodiv/d220102.

Suwardi, A. B., Navia, Z. I., Harmawan, T., Syamsuardi, S. and Mukhtar, E. 2022a. Importance and local conservation of wild edible fruit plants in the East Aceh region, Indonesia. *International Journal of Conservation Science*, 13(1): 221-232.

Suwardi, A.B., Navia, Z.I., Harmawan, T., Syamsuardi, S. and Mukhtar E. 2022b. Diversity of wild edible fruit plant species and their threatened status in the Aceh Province, Indonesia. *Biodiversitas.* 23 (3): 1310-1318. doi: 10.13057/biodiv/d230315

Syamsuardi, S., Nurainas, N., Taufiq, A., Harmawan, T. and Suwardi, A.B. 2022a. Aneuk Jamee traditional foods in the South Aceh District, Indonesia. *Biodiversitas*. 23 (1): 443-454. doi: 10.13057/biodiv/d230146.

Syamsuardi, S., Mukhtar, E., Nurainas, N. and Suwardi, A. B. 2022b. Diversity and use of wild edible fruits in the Bukit Rimbang-Bukit Baling Wildlife Reserve, Kampar, Riau, Indonesia. *Biodiversitas Journal of Biological Diversity*, 23(10): 5035-5042. doi:10.13057/biodiv/d231009

Tag, H. and Das, A.K. 2004. Ethnobotanical notes on the Hill Miri tribe of Arunachal Pradesh. *Indian Journal of Traditional knowledg*e. 3 (1): 80-85.

Tardío, J. and Pardo-de-Santayana, M. 2008. Cultural importance indices: a comparative analysis based on the useful wild plants of Southern Cantabria (Northern Spain) 1. *Economic Botany*. 62 (1): 24–39.

Tsering, J., Gogoi, B. J., Hui, P. K., Tam, N. and Tag, H. 2017. Ethnobotanical appraisal on wild edible plants used by the Monpa community of Arunachal Pradesh. *Indian Journal of Traditional Knowledge*. 16 (4): 626-637

Yanka, H., Rinyo, R., Das, S.K., Das, T.J., Paul, D., Gupta, D.D., Hui, P.K., Bansod, S., Godugu, C., Ananthan, R. and Jambhulkar, S. 2019. A brief cross-cultural ethnobotanical note on the Abotani tribes of Arunachal Pradesh, India. *Pleione*. 13(2): 269 - 283. doi: 10.26679/Pleione.13.2.2019.269-283

Zaman, W., Ahmad, M., Zafar, M., Amina, H., Ullah, F., Bahadur, S., Ayaz, A., Saqib, S., Begum, N. and Jahan, S., 2020. The quest for some novel antifertility herbals used as male contraceptives in district Shangla, Pakistan. *Acta Ecologica Sinica*, 40(1): 102-112. doi: https://doi.org/10.1016/j.chnaes.2019.05.017