

RESEARCH ARTICLE

Traditional uses of edible flowers among the native tribal communities of Kohima district, Nagaland, India

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Abstract

Edible flowers have been reported to play a significant role in human sustenance throughout history, serving multiple purposes such as culinary use, ornamental value, medicinal applications, decorative arrangements, essential oil production, nutraceutical support and being utilized in various religious rituals. This study aims to create a comprehensive record of the traditional use of edible flowers by the indigenous tribal communities residing in Kohima district of Nagaland, India. Traditional knowledge of plants holds immense importance in local culture and belief systems of various ethnic groups worldwide and preserving this knowledge system in written form is crucial given the rapid erosion of plant based traditional knowledge in recent decades. The present research documents flower bearing edible plants of Kohima district of Nagaland, and providing valuable insights into their medicinal significance. A total of 51 edible flower bearing species from 22 different plant families were documented through random interview and focused group discussions with traditional practitioners, field guides and local village elders. Plants samples collected were identified using online literatures, regional floras, monographs and other botanical references. Notably, the plant families with highest number of edible flowers bearing species were documented from Amaryllidaceae, Zingiberaceae, Brassicaceae and Apiaceae. Present findings have provided valuable insights into edible flowers and phytochemical studies could unveil some important compounds of medicinal and nutraceutical significance.

Keywords: Edible Flowers; Indigenous Tribes; Traditional Knowledge; Kohima; Nagaland

1. Introduction

The plant that yields fruit includes flowers and can be generally categorized into four main classes depending upon the purpose for which they are grown: commercial, ornamental, medicinal, vegetable, or edible flowers. They come in a variety of colors, and shapes, sizes, aroma and flavors (Prathapa et al., 2015). For many years, edible flower bearing plants (EFBP) have been used in the food industry as flavoring agents, garnishes, preservatives, etc. and also employed as culinary herbs, an essential component of the human diet. EFBP has recently gained recognition for its medicinal properties and numerous health benefits, in addition to its beauty and aesthetic benefits (Takahashi et al., 2020; Thakur, 2023; Mohapatra et al., 2023). Some studies have determined the sensory profile of flowers, and have revealed not only the degree of general appreciation of some species of flowers but also their specific organoleptic characteristics like sweetness, spiciness, aroma, bitterness and consistency along with their similarity to other well-known vegetables and spices (Benvenuti et al., 2021). The rising popularity of EFBP is a result of an array of factors, including the desire for unique flavors and new opportunities for gourmet creativity, in addition to ornamental and nutritional benefits. Previous studies on the conventional application of EFBP have been documented from Asia, Europe, the Middle East, Ancient Greece, and Rome, as well as Medieval France and Victorian England (Sandhya et al., 2014). In Asian nations, EFBP are reported to be used as a primary ingredient in herbal medicines against a variety of diseases in addition to being consumed as vegetables (Lu et al., 2016). People in Peninsular India use the flowers of *Madhuca indica* J.F.Gmel. as a source of staple food, particularly during the monsoon season. An antioxidant liquid sweetener from *M. indica* has also been patented from this region. The fleshy floral parts of the *Sesbania grandiflora* (L.) Pers. and *Oroxylum indicum* (L.) Kurz have been reported to be used by the Bodo community of Assam as food (Khodram et al., 2019). Deb et al. (2016) reported few edible flowers used by the tribal communities of Nagaland, India.

The present study aims to document the edible flower bearing plants (EFBP) used by the indigenous tribal communities of

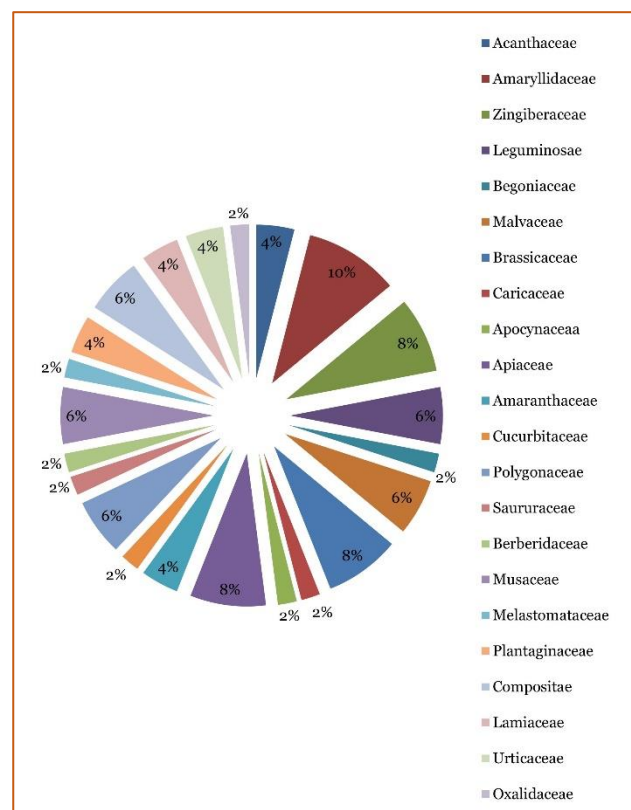


Figure 1. Family wise distribution of edible flowers used by native communities of Kohima district, Nagaland, India.

Kohima district, Nagaland, India. The North Eastern states of India are known for their rich biodiversity, including a diverse range of medicinal, aromatic and wild edible plants including flower bearing species. The region of Nagaland specifically is blessed with scenic landscapes, mountains and unique pattern of flora. It is a part of the Indo - Burma Biodiversity Hotspots and is recognized as one of the richest regions in terms of biological richness and endemism within the Indian subcontinent (Myers et al., 2000). While previous research from Northeast India has focused on documentation of edible flower bearing plants, however, there is no specific report on the edible flower bearing plants from Nagaland. Therefore, this study seeks to fill up the gap by recording the use of EFBPs by the local communities in Kohima district. The consumption of EFBPs has a deep connection with local cultures of many societies, often associated with socio-cultural festivals and traditional folk medicine. Researchers from different parts of Northeast India have already documented the local knowledge and ethnobotanical usage of edible flower bearing plants in the North East India. Deka et al (2014) reported some edible flowers in Western Assam while Thokchom et al (2016) also reported wild and medicinal flowers from Manipur Khomdram et al (2019) documented some edible flower bearing plants used by the indigenous people in two districts of Mizoram. Additionally, apart from their consumption the importance of ethnomedicinal plants including EFBPs have been reported by various researchers from different parts of Northeast India (Sumi et al. 2018; Panmei et al. 2019; Eko et al. 2020; Wangcha et al. 2021; Moyon et al. 2021; Bushi et al. 2021; Borah et al. 2021). Given the significance and richness of EFBP species and their ethnobotanical potential in the region, this study aims to contribute to the existing knowledge gap by documenting the specific EFBP used by the tribal communities in Kohima.

2. Materials and methods

2.1. Study area

The state of Nagaland is located in North Eastern India which shares an international border with Myanmar in the East, Indian state of Assam in the West and Manipur in the South. The region is known for its diverse physiographic and climatic conditions which favour luxuriant growth of plant species of economic and cultural significance to the local communities (Wangcha and Konyak, 2021). Nagaland occupies an area of approximately 16,579 square kilometers is situated between the latitudes 25°06'N and 29°04'N and longitudes 92°20'E and 95°15'E. The state experiences an annual rainfall ranging from 1800 to 2500 mm. Summer in Nagaland is characterized by hot and humid temperature ranging between 21 °C to 36 °C, while during winter the temperatures often drop from 21 °C to 4 °C. Frost is common at higher elevation (2800 – 3500 m from msl) during winter. Forest covers are significant in Nagaland, which accounts for approximately 52% of the total geographical area (Changkiya et al., 2017). The state has various forest types including sub-tropical broad-leaved forests, montane wet temperate forests and sub-tropical pine forests. This diversity of forest types contributes to the overall growth of biodiversity of the region making it a favourable habitat for a wide range of plants and animal species. The combination of favourable climatic conditions, diverse topography and rich forest coverage in Nagaland creates an ideal environment for the growth and preservation of numerous plant species including wild edible, medicinal and aromatic plants of ecological, economic and cultural significance (Sumi and Shohe, 2018).

2.2. Field survey

Field survey was conducted from the year 2021 to 2022 in and around Kohima district of Nagaland. During the field survey ethnobotanical methods suggested by Martin (1995) were employed to gather information from the knowledgeable local informants related to the various use of EFBP species used by the local communities. The following activities were carried out as a part of the study:

2.2.1. Field interview schedule

Random field interviews with local people, field guides and village elders were conducted in selected localities of Jotsoma, Jakahama, Khonoma, Teichiima, Meriema, Dziidza, and T-Khel Model villages of Kohima district. A total of 40 informants aged between 30-85 years were interviewed including traditional medicine practitioners, village elders and the local inhabitants. Among the informants, 24 were male and 16 were female. These interactions were aimed at collecting information about the collection and

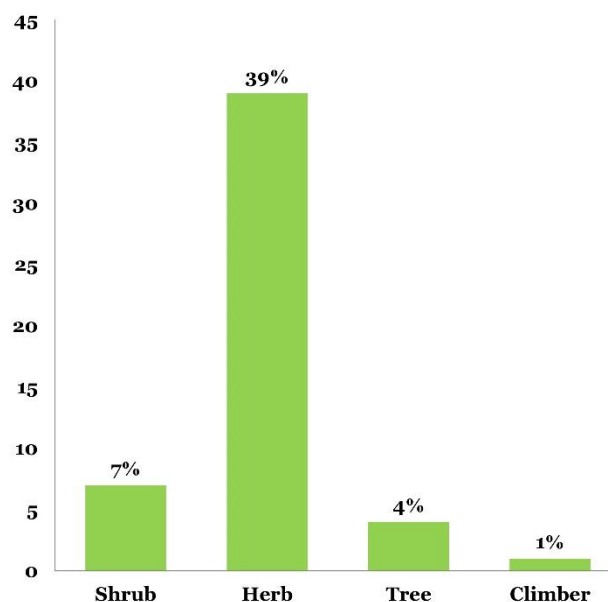


Figure 2. Percentage of different life forms of edible flowers.

utilization of edible flowers from different plant species and documentation of associated traditional knowledge.

2.2.2. Collection of EFBP

Samples of EFBP were collected during field survey along with digital photographs using digital camera (Canon EOS 200D II) to aid in the identification process. Additionally, plant samples were also obtained from street vegetable vendors and recorded their associated traditional utilization knowledge.

2.2.3. Identification of EFB plant species

The plant species collected as voucher specimens for herbarium preservation and digital photographs were identified using various online literature sources by consulting regional floras (Kanjiyal et al., 1939; Haridasan et al., 1987; Deorani et al., 2007; Changkiya et al., 2017), monographs and other botanical references. The accepted scientific names of all the plant species were verified using online database of TWF (<http://www.worldfloraonline.org/>).

2.2.4. Preparation of voucher specimen

The voucher specimen bearing field collection numbers were prepared for herbarium preservation using standard field and herbarium methods suggested by Jain and Rao (1976) and deposited in the herbarium of Department of Botany, Nagaland University for future reference.

3. Results and discussion

3.1. Taxonomic diversity of EFB plant species

In the present study a total of 51 species of EFB plants belonging to 22 families and 36 genera have been identified (Table 1; Figure 3 and 4). Detailed information on each species, including scientific and local names, family, habit, flowering time, and brief notes on their uses were recorded. The present study shows the highest number of species (10%) was found distributed in the family Amaryllidaceae which is followed by the families Zingiberaceae, Brassicaceae and Apiaceae each accounting for (8%) with 4 species each. Leguminosae, Polygonaceae, Musaceae, Malvaceae and Compositae accounts for 6% of the total collection with 3 species each, while Acanthaceae, Amaranthaceae, Plantaginaceae, Lamiaceae and Urticaceae accounts for 4% with 2 species each and the remaining plant families were found to be represented by 1 species each (Figure 1). Herbaceous species have been recorded with highest number of species (38%) followed by shrubs (7%), trees (4%) and climbers with 1% (Figure 2).

3.2. Conservation status

It was also observed that 26 species were found to be domesticated in home gardens and agricultural field and community open forest area for local consumption.

Table 1. Checklist of edible flower bearing plant species used by the native inhabitants of Kohima district, Nagaland, India.
(Legends: S= Shrub, H= Herb, T= Tree, C= Climber, TY= Throughout the year)

SN	Botanical name/ Family	Local name (Angami)	Habit	Flowering Time	Uses
1	<i>Allium cepa</i> L. [Amaryllidaceae] NU-BOT-RK-412/28.06.2022/T-Khel Model village	Piaz	H	June - July	Flowers taken raw or boiled with other vegetables
2	<i>Allium ascalonicum</i> L. [Amaryllidaceae] NU-BOT-RK-400/28.06.2022/T-Khel Model village	Themera	H	July-Sept.	The flowers are used for garnishing salads
3	<i>Allium chinense</i> G.Don [Amaryllidaceae] NU-BOT-RK-302/28.06.2022/T-Khel Model village	Khuvie	H	Aug.-Sept.	The whole plant including the flowers are grounded along with king chili and tomatoes and other spices for making chutney
4	<i>Allium hookeri</i> Thwaites [Amaryllidaceae] NU-BOT-RK-413/28.06.2022/T-Khel Model village	Siila	H	July-Oct.	The flowers are eaten raw, it is also used for garnishing salads
5	<i>Allium sativum</i> L. [Amaryllidaceae] NU-BOT-RK-414/28.06.2022/T-Khel Model village	Chiimerie	H	July- Sept.	The whole plant is cooked and eaten as vegetable
6	<i>Alpinia nigra</i> (Gaertn.) Burt [Zingiberaceae] NU-BOT-RK-501/01.04.2021/Teichiima		H	July-Aug.	Eaten raw or cooked s vegetable
7	<i>Amomum maximum</i> Roxb. [Zingiberaceae] NU-BOT-RK-503/01.04.2021/Teichiima	Sokriinuo	H	April-Sept.	Young flower buds eaten raw
8	<i>Bauhinia purpurea</i> L. [Leguminosae] NU-BOT-RK-238/03.11.2022/Dziidza	Teguo	T	Sept.- Nov.	Fresh or dried flowers taken as vegetable
9	<i>Bauhinia variegata</i> L. [Leguminosae] NU-BOT-RK-153/03.05.2021/Jotsoma	Teguo	T	Sept. – Nov.	The flowers are usually cooked with potatoes and fermented soybean paste and served with rice
10	<i>Begonia palmata</i> D.Don [Begoniaceae] NU-BOT-RK-410/13.05.2022/Jotsoma	Rhichii	H	June-Sept.	Flowers eaten raw
11	<i>Bombax ceiba</i> L. [Malvaceae] NU-BOT-RK-154/31.01.2021/T-Khel Model village	Chievu	T	Feb.- May	Flowers used as vegetable
12	<i>Brassica juncea</i> (L.) Czern. [Brassicaceae] NU-BOT-RK-415/28.02.2022/T-Khel Model village	Gakrie	H	TY	Flowers and leaves eaten raw, boiled or fried with other condiments
13	<i>Brassica oleracea</i> var. <i>botrytis</i> L. [Brassicaceae] NU-BOT-RK-416/28.02.2022/T-Khel Model village	-	H	TY	Aerial parts taken as vegetable
14	<i>Brassica oleracea</i> var. <i>italica</i> Plenck [Brassicaceae] NU-BOT-RK-417/28.02.2022/T-Khel Model village	-	H	TY	Soft aerial parts blanched or boiled in water taken as vegetable
15	<i>Cardamine hirsuta</i> L. [Brassicaceae] NU-BOT-RK-296/19.12.2021/Khonoma	Seguoga	H	April-June	The flowers are cooked with fermented soy bean paste with a pinch of salt
16	<i>Carica papaya</i> L. [Caricaceae] NU-BOT-RK-409/05.04.2022/T-Khel Model village	Kopita	T	Aug.-Nov.	Fried flowers served with rice
17	<i>Catharanthus roseus</i> (L.) G.Don [Apocynaceae] NU-BOT-RK-401/03.04.2022/Meriema	-	H	July-Sept.	Flower exact taken as juice, used for treating diabetes
18	<i>Centella asiatica</i> (L.) Urb. [Apiaceae] NU-BOT-RK-199/21.04.2022/Khonoma	Gara	H	April-May	The whole plant is taken raw
19	<i>Chenopodium album</i> L. [Amaranthaceae] NU-BOT-RK-402/15.01.2021/T-Khel Model village	Terhuotiepfii	H	Feb.-March	The flowers are fried with spices and taken with rice
20	<i>Chenopodium giganteum</i> D.Don [Amaranthaceae] NU-BOT-RK-403/15.01.2021/T-Khel Model village	Terhuotiepfii	H	July-Sept.	Flowers taken as vegetable
21	<i>Coriandrum sativum</i> L. [Apiaceae] NU-BOT-RK-420/18.03.2021/T-Khel Model village	Dunia	H	Sept.-Oct.	Eaten raw
22	<i>Cucurbita maxima</i> Duchesne [Cucurbitaceae] NU-BOT-RK-399/16.06.2021/Jakhama	Riimo	C	Aug.-Oct.	Flowers are coated in a mixture of egg and chickpea batter and made into fritters
23	<i>Curcuma angustifolia</i> Roxb. [Zingiberaceae] NU-BOT-RK-159/15.05.2021/T-Khel Model village	Hutu	H	July-Aug.	Flowers are boiled then dried and the dried flowers are cooked with eggs, sometimes fried with other spices
24	<i>Elsholtzia blanda</i> (Benth.) Benth. [Lamiaceae] NU-BOT-RK-210/19.06.2021/Jotsoma	Niefii	H	June-Oct.	Used as a condiment for flavoring curries and soups, also used for treating cough and cold
25	<i>Eryngium foetidum</i> L. [Apiaceae] NU-BOT-RK-212/08.07.2021/T-Khel Model village	Dunya	H	May	Flowers used as a condiment for flavoring dishes/ garnishing
26	<i>Fagopyrum esculentum</i> Moench [Polygonaceae] NU-BOT-RK-197/09.07.2021/Teichiima	Garei	H	July-Sept.	Young flower buds are used for making porridge
27	<i>Hibiscus rosa-sinensis</i> L. [Malvaceae] NU-BOT-RK-230/14.05.2021/Jotsoma	-	S	Feb. - March	Extract of fresh and dried flowers taken as juice
28	<i>Hibiscus sabdariffa</i> L. [Malvaceae] NU-BOT-RK-216/12.11.2021/T-Khel Model village	Gakhro	S	Oct.	The flowers are sundried and cooked with various spices, also cooked with rice and dry meat. The dried flowers are also used for brewing tea
29	<i>Hibiscus syriacus</i> L. [Malvaceae] NU-BOT-RK-408/30.09.2021/ T-Khel Model village	Chakha nha	S	Aug	Young shoots boil with spices taken as vegetable
30	<i>Houttuynia cordata</i> Thunb. [Saururaceae] NU-BOT-RK-425/23.09.2021/Khonoma	Gatha	H	April-June	Eaten raw with a mixture of roasted chilies and tomatoes
31	<i>Justicia adhatoda</i> L. [Acanthaceae] NU-BOT-RK-508/24.04.2021/Meriema	Tsiesenyii	S	Feb- April	Young inflorescence fried and taken as vegetable
32	<i>Koenigia mollis</i> (D.Don) T.M.Schust. & Reveal [Polygonaceae] NU-BOT-RK-391/29.03.2022/Meriema	Gazie	H	July	Taken as vegetable
33	<i>Mahonia napaulensis</i> DC. [Berberidaceae] NU-BOT-RK-295/07.03.2021/Jotsoma	Athuo	S	March-April	Flowers eaten raw
34	<i>Musa × paradisiaca</i> L. [Musaceae] NU-BOT-RK-515/07.07.2022/Meriema	Thayie	H	Whole year	Inflorescence cooked with spices and dried fish

Table 1. Checklist of edible flower bearing plant species.....

35	<i>Musa sikkimensis</i> Kurz [Musaceae] NU-BOT-RK-511/07.07.2022/Meriema	Tepfhe	H	Oct.-April	Inflorescence boiled and taken as vegetable
36	<i>Musa flaviflora</i> N.W.Simmonds [Musaceae] NU-BOT-RK-512/06.07.2021/Meriema	Ruochiinuo	H	July	Inflorescence cooked with chilies and other spices taken as chutney
37	<i>Ocimum tenuiflorum</i> L. [Lamiaceae] NU-BOT-RK-221/19.06.2021/T-Khel Model village	Nietso	H	March- Sept.	Both fresh and dried flowers used as a condiment. The plant is also used against hypertension
38	<i>Oenanthe javanica</i> (Blume) DC. [Apiaceae] NU-BOT-RK-224/06.05.2021/ T-Khel Model village	Gakra	H	April-Aug.	The whole plant including flowers are boiled in plain water served with rice
39	<i>Osbeckia stellata</i> Buch.-Ham. ex Ker Gawl. [Melastomataceae] NU-BOT-RK-308/28.06.2021/Khonoma	-	S	July-Nov.	Flowers eaten raw
40	<i>Oxalis corniculata</i> L. [Oxalidaceae] NU-BOT-RK-211/21.06.2022/T-Khel Model village	-	H	March-Oct.	Flowers eaten raw
41	<i>Persicaria chinensis</i> (L.) H. Gross [Polygonaceae] NU-BOT-RK-225/09.07.2021/Jakhama	Gazie	H	Aug.-Oct.	Young shoots and flowers cooked with rice
42	<i>Phlogacanthus pubinervius</i> T. Anderson [Acanthaceae] NU-BOT-RK-499/19.01.2022/T-Khel Model village	-	S	Jan.- May	Flowers fried and taken as vegetable
43	<i>Pisum sativum</i> L. [Leguminosae] NU-BOT-RK-454/28.02.2022/T-Khel Model village	Motor	H	Feb.-March	Flowers blanched in warm water for making tea.
44	<i>Plantago erosa</i> Waththaceael. [Plantaginaceae] NU-BOT-RK-194/28.04.2021/T-Khel Model village	Gapa	H	April- June	Whole plat taken raw or cooked
45	<i>Plantago asiatica</i> L. [Plantaginaceae] NU-BOT-RK-326/28.04.2021/T-Khel Model village	Gapa	H	April-Sept.	Flowers are eaten as cooked vegetable
46	<i>Pseudognaphalium affine</i> (D.Don) Anderb. [Compositae] NU-BOT-RK-217/25.02.2022/Khonoma	Cienega	H	Feb.- Oct.	Flowers boiled with potatoes, fermented soybean and bamboo shoots
47	<i>Spilanthes acmella</i> (L.) L. [Compositae] NU-BOT-RK-392/04.08.2021/T-Khel Model village	Kevenha	H	June-Sept.	Eaten raw also boiled with salt and taken with rice
48	<i>Tagetes erecta</i> L. [Compositae] NU-BOT-RK-393/14.10.2021/Jotsoma	Puja Nyiepu	H	May- Sept.	Flowers fried in chickpea batter with spices
49	<i>Urtica ardens</i> Link [Urticaceae] NU-BOT-RK-215/07.06.2021/Dziidza	Zozie	H	March-Aug.	Inflorescence and leaves boiled and taken as vegetable, I is also used for treating stomach pain and dysentery
50	<i>Urtica fissa</i> E. Pritz. [Urticaceae] NU-BOT-RK-325/07.06.2021/Dziidza	Zozie	H	April- Sept.	Aerial parts take as vegetable
51	<i>Zingiber officinale</i> Roscoe [Zingiberaceae] NU-BOT-RK-220/15.12.2022/t-Khel Model village	Kevii	H	Oct.-Nov.	The young flower bud is usually added for flavoring meat, tea, chutneys, boil vegetables, etc.

They have been identified to be the potential species to ensure rural livelihood security. Additionally, 29 species were found to be harvested from wild sources, while 9 species were found to be semi-domesticated.

This study provides valuable insights into the diversity and usage of edible flower bearing plants of Kohima region, and highlighted the significance of various plant families, habits and their roles in the daily lives of the local community.

3.2. Part harvest, mode of consumption and economic importance

The forest and its resources have always played a significant role in the socio-economic life of the indigenous Naga people of Nagaland. Previous studies by various workers (Deb et al., 2016; Wangcha and Konyak, 2021; Moyon et al., 2021) also reported about deep dependence of Naga communities on plant resources, including various parts such as leaves, branches, fruits, rhizomes and flowers which are utilized as a source of food and medicine. In the present study, the whole plant including the inflorescence, young tender shoots, flower buds etc. were considered as a part of edible flowers. It was observed that edible flowers are consumed in various ways, either raw or cooked. They are typically boiled along with other foods, spices and condiments, occasionally fried and some are also taken as supplementary dishes. Some of the edible flowers were found to be utilized as ornamental plants (Figure 3 and 4), including *Mahonia napaulensis*, *Tagetes erecta*, *Hibiscus syriacus* and *Catharanthus roseus*. *Ocimum tenuiflorum* and *Elsholtzia blanda* have been observed as typical examples of plants used in Naga cuisine as distinctive condiment to flavour food. Many of the edible flower species were also reported to possess ethno-pharmacological properties that are highly valued by the local inhabitants. *Allium chinense*, *Bombax ceiba*, *Hibiscus rosasinensis* and *Melastoma malabatricum* have been reported to be used to treat stomach related problems such as dysentery, urinary tract infection (UTIs), menstrual pains and piles. Flower paste of *Persicaria capitatum*, *Plantago asiatica* and *P. erosa* were applied on burns, insect bites, skin allergies and other skin related problems. Certain species like *Centella asiatica*, *O. tenuiflorum* and *Fagopyrum esculentum* were found to be employed in the

treatment of hypertension. Additionally, *Spilanthes acmella* was found to be regarded as a miraculous plant with the ability to relieve toothache by the native people for many years. The diverse range of edible flower bearing species reported in the present study not only contributes to the local cuisine and cultural practices of the local people but also holds potential for their ethno-pharmacological properties. Traditional healers used plant parts of the same plant or combination of two or more than two plant species. It was also observed that traditional knowledge of the elderly people was found to be transmitted orally from one generation to another while the elder people were found more knowledgeable as they have given more importance in traditional knowledge and possesses long-term experience about conservation, harvesting and utilization of EFBP. Similar information was reported by various ethnobotanical literatures of the Northeast India (Deka et al., 2014; Prathapa et al., 2015; Khondram et al., 2019). Present studies have revealed the significance of EFB plants among the Naga tribal community which suggests that traditional knowledge of the local inhabitants are significantly diverse and useful, and therefore the bioassay and toxicity studies could be carried out on such valuable edible flower bearing species to assure nutritional quality status and safety profile for safe human consumption.

4. Conclusion

In recent times, there has been a renewed interest in the use of edible flowers for flavoring foods. The present study has reported 51 species of edible flower bearing plants that are traditionally consumed by the native people of Kohima district, Nagaland, India. These edible flowers not only contribute to the local food security and livelihood but also hold medicinal values capable of curing various ailments of the indigenous communities. The ethnobotanical information on EFBP species gathered from present study is expected to contribute towards effective conservation at local and regional level, sustainable management and utilization of edible flower bearing plant species which has the potential to ensure food, medicinal and livelihood security to the local communities.

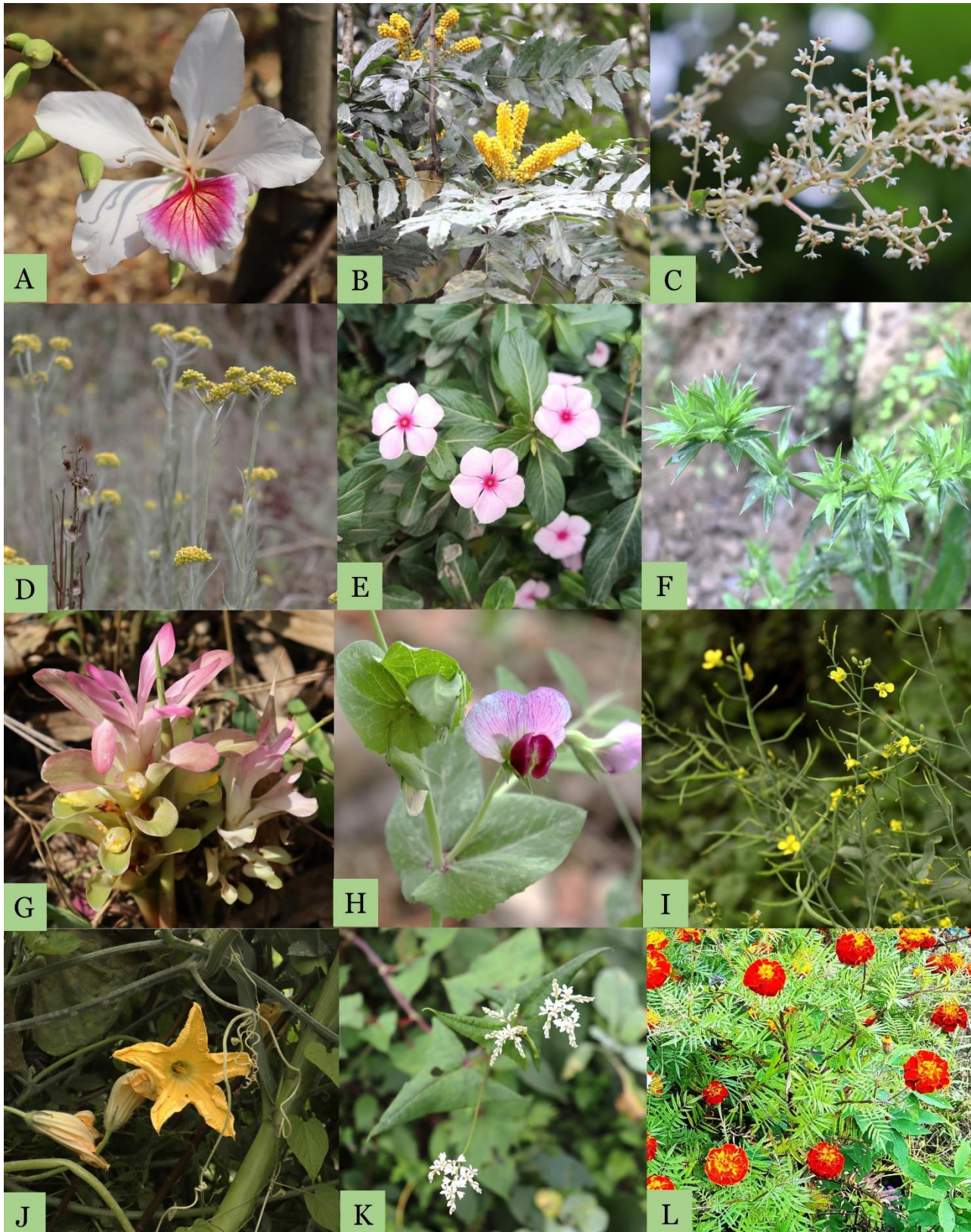


Figure 3. A. *Bauhinia variegata* L., B. *Mahonia napaulensis* DC., C. *Koenigia mollis* (D. Don) T.M. Schust. & Reveal, D. *Pseudognaphalium affine* (D. Don) Anderb., E. *Catharanthus roseus* (L.) G. Don, F. *Eryngium foetidum* L., G. *Curcuma angustifolia* Roxb., H. *Pisum sativum* L., I. *Brassica juncea* (L.) Czern., J. *Cucurbita maxima* Duchesne, K. *Fagopyrum esculentum* Moench, L. *Tagetes erecta* L.

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Authors contribution

RK conducted the field survey, documentation, identification and preparation of manuscript. PS contributed in research design and revision of manuscript. PK contributed in identification and herbarium preparation and L contributed in research design, supervision and proof reading.

Conflict of interest

The authors have no conflict of interests.



Figure 4. A. *Bombax ceiba* L., B. *Ocimum tenuiflorum* L., C. *Oxalis corniculata* L., D. *Phlogacanthus pubinervius* T. Anderson, E-*Elsholtzia blanda* (Benth.) Benth., F. *Justicia adhatoda* L., G. *Amomum maximum* Roxb., H. *Persicaria chinensis* (L.) H. Gross, I-*Houttuynia cordata* Thunb., J. *Allium hookeri* Thwaites, K. *Hibiscus sabdariffa* L., L. *Musa flaviflora* N.W. Simmond

References

- Benvenuti S and Mazzoncini M. 2021. The biodiversity of edible flowers: Discovering new tastes and new health benefits. *Frontiers in Plant Science* 11: 569499. Doi: 10.3389/fpls.2020.569499.
- Borah D, Mipun P, Sarma J, Mili C and Narah D. 2021. Quantitative documentation of traditionally used medicinal plants and their significance to healthcare among the Mishing community of Northeast India. *Ecological Questions* 32 (4): 61 – 94.
- Bushi D, Bam K, Mahato R., Nimasow G, Nimasow OD and Tag H. 2021. Ethnomedicinal plants used by the indigenous tribal communities of Arunachal Pradesh, India: a review. *Ethnobotany Research and Applications* 22 (34): 1 – 40.
- Changkija S and Gurung PB. 2017. *Flora of Nagaland*. Vol I. Forest Department, Environment and Climate Change, Govt. of Nagaland. P. 272.
- Deb CR., Khruomo N and Jamir NS. 2016. A study on documentation and market acceptability of underutilized wild edible crops of Kohima district, Nagaland, India. *Asian Journal of Biological and Life Sciences* 5 (2): 201 – 206.
- Deka K and Nath N. 2014. Documentation of edible flowers of Western Assam. *American Journal of Phytomedicine and Clinical Therapeutics* 10: 2321 – 2748.
- Deorani SC and Sharma GD. 2007. *Medicinal plants of Nagaland*. Bishen Singh and Mahendra Pal Singh, Dehradun, India.
- Eko R, Ngomle S, Kanwat M, Kalita H and Moyon NN. 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.
- Haridasan K and Rao RR. 1987. *Forest Flora of Meghalaya* Vol II. Botanical Survey of India. Dehradun. Pp. 619 – 620.
- Jain SK, Rao RR. 1977. *A handbook of field and herbarium methods*. Today and tomorrow printers and publishers, New Delhi. P.157.
- Kanjilal UN, Das A, Kanjilal PC, Purkaystha C, De RN and Bor NL. 1934 – 1940. *Flora of Assam* (Vols. I – V). Government of Assam, Shillong [Printed by: Prabasi Press, Calcutta].
- Khomdram SD, Fanai L and Yumkham SD. 2019. Local knowledge of edible flowers used in Mizoram. *Indian Journal of Traditional Knowledge* 18 (4): 714 – 723.
- Lu B, Li M and Yin R. 2016. Phytochemical content, health benefits, and toxicology of common edible flowers, a review. *Critical Reviews in Food Science and Nutrition* 56:130 – 148.
- Mohapatra R, Induar S and Parida S. 2023. Blossoming wellness: Exploring the therapeutic potential of edible flowers. *European Chemical Bulletin* 12 (5): 5411 – 5419.
- Moyon WA, Chara E, Moyon NK and Moyon RK. 2021. Ethnobotanical resources: Edible plants consumed by the Moyon Naga tribe of Manipur (India) and Myanmar. *International Journal of Botany Studies* 6 (6): 1 – 9.
- Myers N., Mittermeier RA., Mittermeier., da Fonseca., GAB and Jennifer K. 2000. Biodiversity hot spots for conservation priorities. *Nature* 403: 853 – 858.
- Panmei R, Gajurel PR and Singh B. 2019. Ethnobotany of medicinal plants used by the Zelinagrong ethnic group of Manipur, Northeast India. *Journal of Ethnopharmacology* 235: 164 – 182.
- Prathapa RM, Kavya B, Rama RV, Shantha TR, Kishore KR, Venkateshwarlu G and Rahmathulla. 2015. Therapeutic uses of flowers- Leads from traditional system of medicine. *International Journal of Herbal Medicine* 3(3): 12 – 20.
- Sandhya Deepika S, Sowjanya Lakshmi G, Laxmi Sowmya K and Sulakshana M. 2014. Edible flowers - A Review article. *International Journal of Advanced Research in Science and Technology* 3: 51 – 57.
- Sumi A and Shohe K. 2018. Ethnomedicinal plants of Sumi Nagas in Zunheboto District, Nagaland, Northeast India. *Acta Scientific Pharmaceutical Sciences* 2(8): 15 – 21.
- Takahashi JA, Rezende FAGG, Maura MAF, Dominguet LCB and Sande D. 2020. Edible flowers: Bioactive profile and its potential to be used in food development. *Food Research International* 129: 108868. Doi: 10.1016/j.foodres.2019.108868.
- Thakur S. 2023. A comprehensive review on edible flowers: Phytochemical profile and its food application. *The Pharma Innovation Journal* 12(5): 2721 – 2725.
- Thokchom RO., Hanglem AM., Zimisai S., Thongam CA., Devi YR, Thokchom J and Singh SS. 2016. Documentation and assessment of wild medicinal and edible flowers of valley districts of Manipur. *International Journal of Research and Social Sciences* 4(11): 13 – 20.
- Wangcha A and Konyak Z. 2021. Survey of ethnomedicinal plants and its uses by the Konyak tribe in Mon district, Nagaland, India. *International Journal of Ecology and Environmental Sciences* 3(1): 280 – 285.
- WFO. 2023. World Flora Online. <http://www.worldfloraonline.org>, accessed on 6-01-2023.

