

Ethnobotanical analysis of wild edible plants used by tribal and rural communities of Bhandara district (MS), India

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Bhandara district situated in eastern part of Vidarbha in Maharashtra state of India, is provided with vast diversity includes forest cover, agricultural lands and even wetlands. This supports the livelihood of tribal and rural people in and around the forest areas and are involved in agriculture for their basic needs. Many of these people are well-aware about the traditional knowledge of utilizing wild edible plants. This study was undertaken to compile the hidden indigenous knowledge of wild edible plants and its diversity in the district. The tribal and rural people of the district involved in utilization of wild edible plants are Gond, Rajgond, Halba, Halbi, Pardhi and Holi. In addition to these, many rural communities are also using wild edible plants during food scarcity since long time. Participatory rural appraisal (PRA), semi-structured interviews, and group discussions with tribal elders, traditional healers, and local foragers was carried out to know the maximum number of wild edible plants used in the district. In this study, a total of 77 species, representing 72 genera and 38 families of angiosperms from dicot and monocot were recorded as wild edible plants. The various parts of the plant like, roots, tubers, rhizomes, corms, tender shoots, stems, gums, leaves, aril, receptacle, flowers, fruits, seeds and whole plants were reported as important dietary resources. The outcome of this study underscores the cultural significance, diversity of wild edible plants, its nutritional value and conservation potential. This will also help to conserve floristic biodiversity and sustainable utilization of resources to promote dietary diversity among tribal and rural communities.

Keywords: Bhandara district, Ethnobotany, Food scarcity, Indigenous knowledge, Wild edible plants

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Bhandara district is situated in eastern part of Vidharbha in Maharashtra state of India, showing excellent association between floristic biodiversity and traditional knowledge. Its topography, forest covers and natural resources support livelihood of many tribes like *Gond*, *Rajgond*, *Halba*, *Halbi*, *Pardhi*, and *Holi*. This study uncovers the remarkable adaptations, with managing, harvesting, consuming and even conserving dozens of wild plant species across the seasons.

In India, the research in ethnobotany has disclosed how tribal and rural communities lean on a spectacular range of wild edible plants (WEPs) for dietary resources, local medicines and cultural continuity¹. These wild edible plant species are nutritionally rich and supplement cultivated diets, especially for the communities inhabiting in and around ecologically sensitive and resource-scarce regions. The studies in India have disclosed the nutritional preeminence of WEPs, which often surpass staple crop in contents of basic nutrients like

carbohydrates, proteins, vitamins, minerals and antioxidants. Every part of WEPs are full of nutrients such as roots, stem, leaves, flowers, fruits, seeds which form part of daily diets and authenticate dietary diversity during the periods of food scarcity². This study uncovers the remarkable adaptations, with managing, harvesting, consuming and even conserving dozens of wild plant species across the seasons³.

The comparative studies across the country from different regions like Odisha, Western Ghats, Uttarakhand and Manipur, reinforce the significance of traditional knowledge in molding food system for sustainable development. The diversity of WEPs is indication of cultural beliefs surrounding resource management in the methods of collection, processing and consumption^{1,2}. The dominant families varies for use of wild edible plants by regions, as for example in Odisha, *Fabaceae* and *Amaranthaceae*; in Manipur, *Fabaceae*, *Rutaceae* and *Euphorbiaceae*; in Western Ghats, *Myrtaceae*, *Euphorbiaceae* and *Anacardiaceae*;

and in Uttarakhand, *Rosaceae*, *Lamiaceae* and *Fabaceae* were found dominant⁴.

The indigenous knowledge is day by day eroding because of industrialization, urbanization, modernization and climatic changes. This is threat to the traditional knowledge which shows urgent need of documentation that will help in conservation of cultural heritage helpful in both nutritional security and ecological adoptability¹.

The use of WEPs should be aligned with preservation of natural habitat, conservation of plant species and genetic diversity, uncovered by ethnobotanical research. This will help in sustainable use of ecosystem and also provide policy models for management of biodiversity. In addition, the local market survey shows that, commercialization of some WEPs in small scale can also boost tribal income and motive conservation in rural areas⁴.

The high biological diversity and strong cultural dependence was disclosed from ethnobotanical studies of wild edible plants from various parts of India such as Trans-Himalayan regions, Eastern Himalaya and Deccan plateau which documented from 60 to 300 species of wild edibles⁵⁻⁷. A review from encyclopedia of wild edible plants and agroecosystem sustainability highlights WEPs significantly provide nutritional strength, dietary diversity and sustainable food security at both local to global scale⁸.

Phytochemical analysis of many WEPs validated antioxidant activity, abundance of micronutrients and functional food properties, boosting their role in fighting malnutrition and lifestyle disorders⁹. Some regional studies in ethnobotany of wild edible plants from north-east and eastern part of India and Karnataka, also confirm that WEP species comprise an essential safeguard in extreme climatic events producing food scarcity¹⁰. Processing methods including boiling, cooking, roasting, fermenting, further enhance their bioavailability and palatability².

Novelty and regional gap

Although several ethnobotanical surveys have previously been conducted in Maharashtra, very few studies have focused exclusively on WEPs while applying standardized quantitative indices for species prioritization. By documenting 77 wild edible plant species from Bhandara District and by applying ethnobotanical indices, the present study provides a novel, region-specific quantitative assessment that strengthens the current national database of wild food resources and supports conservation, nutritional, and livelihood-oriented research.

Material and Methods

Study area

Bhandara District of the east Vidarbha region in the state of Maharashtra, India, situated between latitudes 20°39'N to 21°38'N and longitudes 79°27'E to 80°42'E. The district comprises 7 tehsils (Fig. 1)¹¹. The climate is typically tropical monsoon, with very hot summers (temperatures often exceeding 45°C), an average annual rainfall of 900 to 1200 mm, and cool winters (8 to 12°C). The vegetation represents tropical dry deciduous forests interspersed with scrubland, agricultural fields, and wetlands, forming habitats rich in wild edible plant diversity^{12,13}.

Data collection

Field surveys were conducted from 2020 to 2024 across different seasons (summer, monsoon, winter) to capture seasonal variation in edible plant availability. Standard ethnobotanical survey methods were followed^{14,15}.

Sampling design and informant selection

Seventy villages and forest-edge settlements were purposively selected across the seven tehsils to capture ecological and cultural variation. Purposive sampling targeted villages with known dependence on local wild foods and representation of tribal and local communities.

Informant selection combined purposive and snowball approaches to identify experienced knowledge holders. Data were collected through semi-structured interviews, household surveys, and group discussions¹⁶. A total of 66 informants (48 men, 18 women; age range 40-80 years) were interviewed. Informant demographics and occupational categories are presented in (Table 1). Informants included elderly people, traditional healers, foragers, women,

Table 1 — Socio-demographic profile of the informants

Factors	Category	No. of Informants	Percentage (%)
Age	40-50	13	19.70
	51-60	17	25.76
	61-70	24	36.36
	71-80	12	18.18
Gender	Male	48	72.73
	Female	18	27.27
Profession	Healers	13	19.70
	Farmers	34	51.52
	Housewives	19	28.79
Marital Status	Married	42	63.64
	Unmarried	3	4.55
	Divorced	7	10.61
	Widow	14	21.21

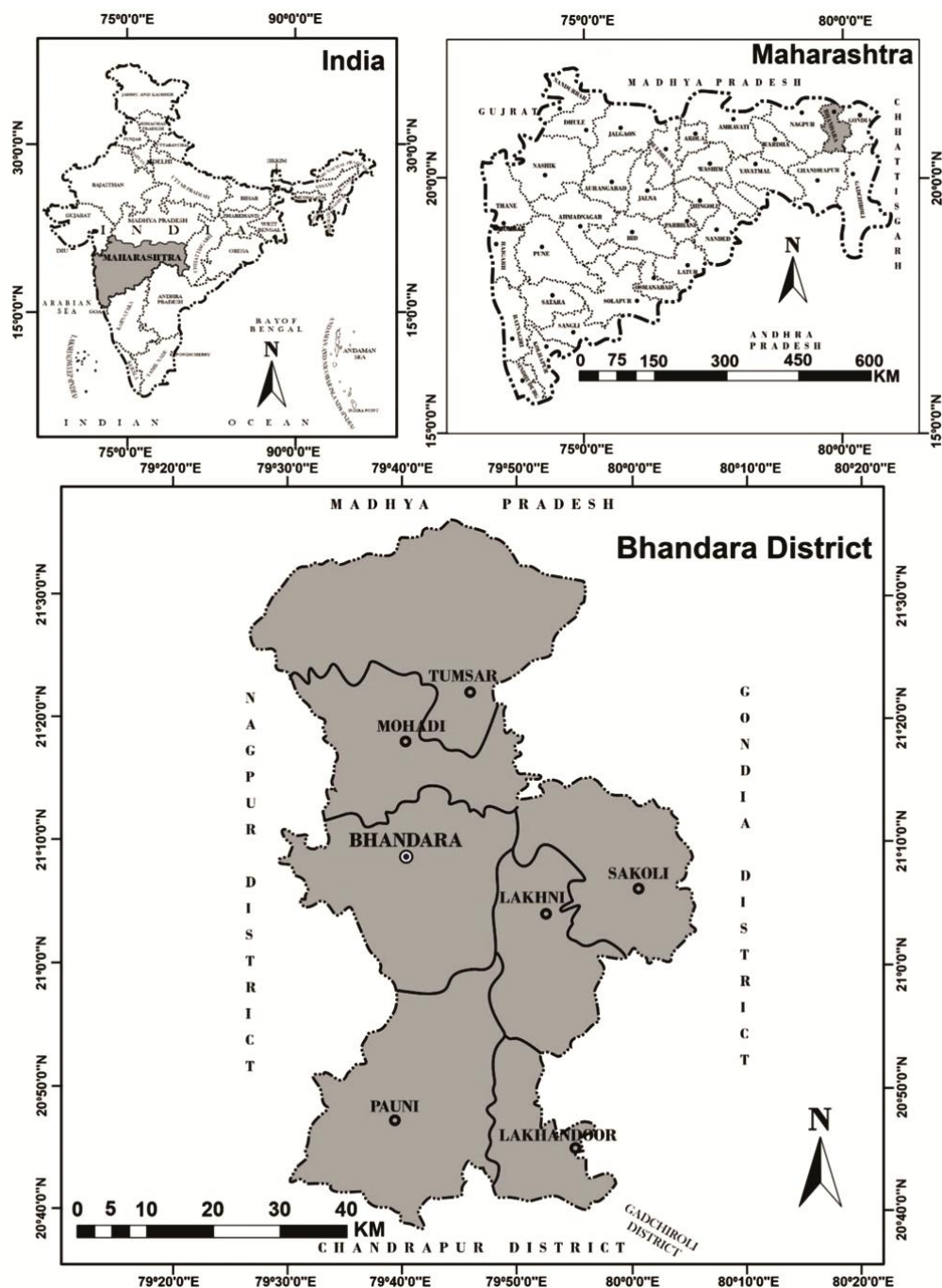


Fig. 1 — Location map of Bhandara district (MS), India¹¹
 (Source: <http://dx.doi.org/10.32859/era.32.41.1-23>)

and farmers, as they are the primary knowledge-holders of edible wild resources¹⁷.

Prior informed oral consent was obtained from each participant before interviews. The study followed the recommendations of the International Society of Ethnobiology Code of Ethics and local customary protocols for knowledge documentation.

Plant collection and identification

Voucher specimens were collected, preserved, and deposited in the Herbarium of the Department of Botany, Dharampeth M. P. Deo Memorial Science College, Nagpur. Species identification was done with the help of regional floras and monographs¹⁸⁻²⁰. Plant names were validated using the World Flora Online

(WFO)²¹ and International Plant Names Index (IPNI)²² for updated nomenclature. Accepted names have been used consistently throughout the manuscript and in (Table 2); herbarium voucher numbers accompany each entry.

Data documentation

For each wild edible species, the following data were recorded: Scientific name, vernacular

name, family, part used. Edible parts include aril, corm, flowers, fruits, gum, leaves, receptacle, rhizome, roots, seeds, tender shoots, tubers, and whole plant.

Mode of consumption (raw, cooked, boiled, roasted, curry, flour, spice, fermented, beverage, etc.), processing techniques, cultural preferences, seasonal availability, and harvesting practices were also recorded¹.

Table 2 — List of Wild Edible Plants (WEPs)

Sr. No.	Specimen No.	Botanical Name	Ver. Name	Family	Part used	Mode of consumption	FC %	RFC	RI
1	PTH0021	<i>Abrus precatorius</i> L.	Gunja	Fabaceae	Leaves	Fresh leaves are eaten as digestive as well as dried and used with betel leaves.	68.57	0.69	1.06
2	PTH0189	<i>Achyranthes aspera</i> L.	Aghada	Amarathaceae	Leaves	Tender leaves are cooked as vegetable.	80.00	0.80	1.23
3	PTH0616	<i>Aegle marmelos</i> (L.) Corr.	Bel	Rutaceae	Fruits	The ripe fruits are eaten and also used in pickles.	94.29	0.94	1.45
4	PTH0311	<i>Alangium salvifolium</i> (L. f.) Wangerin	Akwal	Cornaceae	Fruits	The ripe fruits are eaten.	88.57	0.89	1.36
5	PTH0451	<i>Albizia procera</i> (Roxb.) Benth.	Kinh	Fabaceae	Gum	Gum is eaten as well as used as food additive.	91.43	0.91	1.41
6	PTH0951	<i>Alocasia macrorrhizos</i> (L.) G. Don.	Brahma-rakshas	Araceae	Leaves	Leaves are used in preparation of Wadi made with gram flour, which is eaten either with chapati or rice.	100.00	1.00	1.54
7	PTH0035	<i>Alternanthera sessilis</i> (L.) R. Br. ex DC.	Patur	Amarathaceae	Leaves	Leaves and tender shoots are cooked and eaten as vegetable.	84.29	0.84	1.30
8	PTH0252	<i>Amaranthus spinosus</i> L.	Katemath	Amarathaceae	Leaves	Leaves and tender shoots are cooked and eaten as vegetable.	100.00	1.00	1.54
9	PTH0664	<i>Amaranthus viridis</i> L.	Math	Amarathaceae	Leaves	Leaves and tender shoots are cooked and eaten as vegetable.	97.14	0.97	1.50
10	PTH0948	<i>Amorphophallus paeoniifolius</i> (Dennst.) Nicols.	Suran	Araceae	Corm	Corms are boiled with tamarind fruits or leaves and then cooked as vegetable.	100.00	1.00	1.54
11	PTH0464	<i>Antidesma ghaesembilla</i> Gaertn.	Jondhurli	Phyllanthaceae	Fruits	The ripe fruits are eaten, rich in vitamin-C.	74.29	0.74	1.14
12	PTH0187	<i>Basella alba</i> L.	Dalbhaji	Basellaceae	Leaves	Leaves and tender shoots are cooked and eaten as vegetable.	80.00	0.80	1.23
13	PTH0784	<i>Boerhavia repens</i> L.	Khaparkhuti	Nyctaginaceae	Leaves	Leaves and tender shoots are cooked and eaten as vegetable.	68.57	0.69	1.06
14	PTH0504	<i>Bridelia retusa</i> (L.) A. Juss.	Kateyan	Phyllanthaceae	Fruits	The ripe fruits are eaten, rich in vitamin-C.	60.00	0.60	0.92
15	PTH0327	<i>Buchanania cochinchinensis</i> (Lour.) Almeida	Char	Anacardiaceae	Fruits	The ripe fruits are eaten, rich in vitamin-C.	100.00	1.00	1.54
16	PTH1766	<i>Cajanus scarabaeoides</i> (L.) Thouars	Ran tur	Fabaceae	Seeds	The seeds of ripe pod are eaten as protein source.	54.29	0.54	0.84

... Contd.

Table 2 — List of Wild Edible Plants (WEPs) (Contd.)

Sr. No.	Specimen No.	Botanical Name	Ver. Name	Family	Part used	Mode of consumption	FC %	RFC	RI
17	PTH1039	<i>Canavalia gladiata</i> (Jacq.) DC.	Khadsheng	Fabaceae	Fruits	The pods are cooked and eaten as vegetable.	62.86	0.63	0.97
18	PTH0397	<i>Cassia fistula</i> L.	Bahava	Fabaceae	Flowers	The flowers are cooked as vegetable.	68.57	0.69	1.06
19	PTH0138	<i>Celosia argentea</i> L.	Kukada	Amarathaceae	Leaves	Leaves and tender shoots are cooked and eaten as vegetable.	80.00	0.80	1.23
20	PTH0432	<i>Chenopodium album</i> L.	Tandulbhaji	Amarathaceae	Leaves	Leaves and tender shoots are cooked and eaten as vegetable.	88.57	0.89	1.36
21	PTH0854	<i>Cochlospermum religiosum</i> (L.) Alst.	Gogal	Cochlospermaceae	Gum	The gum is used as a food additive by some tribes.	60.00	0.60	0.92
22	PTH0215	<i>Coixlacryma-jobi</i> L.	Irkali	Poaceae	Seeds	The seeds are eaten especially during food scarcity.	67.14	0.67	1.03
23	PTH0485	<i>Colocasia esculenta</i> (L.) Schott	Kochai	Araceae	Leaves / Rhizomes	Leaves are used in preparation of Wadi made with gram flour, which is eaten either with chapati or rice. Also, rhizomes are boiled with tamarind and cooked as vegetable.	100.00	1.00	1.54
24	PTH0468	<i>Cordia dichotoma</i> G. Forst.	Bhokar	Cordiaceae	Fruits	The ripe fruits are eaten and the unripe fruits are used in preparation of pickles.	100.00	1.00	1.54
25	PTH0637	<i>Curculigo orchioides</i> Gaertn.	Kajuri	Hypoxidaceae	Rhizome	The rhizomes are boiled as used as food additive.	65.71	0.66	1.01
26	PTH1334	<i>Cyanotis axillaris</i> (L.) D. Don ex Sweet	Kena	Commelinaceae	Leaves	The leaves and tender shoots are used in preparation of Wadi made with gram flour, which is eaten either with chapati or rice.	82.86	0.83	1.28
27	PTH0621	<i>Dendrocalamus strictus</i> (Roxb.) Nees.	Bamboo	Poaceae	Tender shoots	The tender shoots are cooked as vegetables as well as used in different traditional recipes.	60.00	0.60	0.92
28	PTH0906	<i>Dendrophthoe falcata</i> (L. f.) Etting	Wanda	Loranthaceae	Fruits	The ripe fruits are eaten.	67.14	0.67	1.03
29	PTH01043	<i>Dillenia pentagyna</i> Roxb.	Rankela	Dilleniaceae	Fruits	The ripe fruits are eaten.	54.29	0.54	0.84
30	PTH0911	<i>Dioscorea bulbifera</i> L.	Matnar	Dioscoreaceae	Tubers	The stem tubers are boiled or roasted and eaten. Some people also cooked as vegetable.	97.14	0.97	1.50
31	PTH0828	<i>Diospyros melanoxylon</i> Roxb.	Tembhrun	Ebenaceae	Fruits	The ripe fruits are eaten.	100.00	1.00	1.54
32	PTH0384	<i>Ficus racemosa</i> L.	Umbar	Moraceae	Fruits	The ripe fruits are eaten.	82.86	0.83	1.28
33	PTH0328	<i>Gardenia resinifera</i> Roth	Dikemali	Rubiaceae	Gum	The gum is used as a food additive by some tribes.	45.71	0.46	0.70
34	PTH0259	<i>Glossocardia bosvallea</i> (L. f.) DC.	Pipada	Asteraceae	Whole plant	Leaves and tender shoots are cooked and eaten as vegetable.	62.86	0.63	0.97
35	PTH0378	<i>Gmelina asiatica</i> L.	Nagphul	Lamiaceae	Fruits	The ripe fruits are eaten.	45.71	0.46	0.70
36	PTH0626	<i>Grewia tiliifolia</i> Vahl	Tadsal	Malvaceae	Fruits	The ripe fruits are eaten.	52.86	0.53	0.81

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Table 2 — List of Wild Edible Plants (WEPs) (Contd.)

Sr. No.	Specimen No.	Botanical Name	Ver. Name	Family	Part used	Mode of consumption	FC %	RFC	RI
37	PTH0646	<i>Hellenia speciosa</i> (J.Koenig) S.R. Dutta	Kevkanda	Costaceae	Rhizome	The rhizomes are cooked as vegetable.	91.43	0.91	1.41
38	PTH0476	<i>Hemidesmus indicus</i> (L.) R. Br. Ex Schult.	Khobarvel	Apocynaceae	Roots	The roots are used as food additive, specifically used in preparation of tea.	88.57	0.89	1.36
39	PTH0322	<i>Holarrhena pubescens</i> Wall. ex G. Don	Kuda	Apocynaceae	Flowers	The flowers are cooked as vegetable.	97.14	0.97	1.50
40	PTH0090	<i>Indigofera glandulosa</i> Wendl.	Ranji	Fabaceae	Seeds	The seeds are roasted and eaten as protein source.	75.71	0.76	1.17
41	PTH0240	<i>Ipomoea aquatic</i> Forssk.	Nelachi bhaji	Convolvulaceae	Leaves	Leaves and tender shoots are cooked and eaten as vegetable.	68.57	0.69	1.06
42	PTH0330	<i>Lannea coromandelica</i> (Houtt.) Merr.	Moya	Anacardiaceae	Gum	The gum is used as a food additive by some tribes.	58.57	0.59	0.90
43	PTH0372	<i>Launaea procumbens</i> (Roxb.) Ramayya & Rajagopal	Pathari	Asteraceae	Leaves	Leaves and tender shoots are cooked and eaten as vegetable.	67.14	0.67	1.03
44	PTH0608	<i>Limonia acidissima</i> L.	Kawath	Rutaceae	Fruits	The ripe fruits are eaten and also used in preparation of pickle.	100.00	1.00	1.54
45	PTH0160	<i>Luffa melo</i> L.	Galgala	Cucurbitaceae	Fruits	The fruits are cooked as vegetable.	90.00	0.90	1.39
46	PTH0307	<i>Madhuca longifolia</i> var. <i>latifolia</i> (Roxb.) A.Chev.	Mahua	Sapotaceae	Flowers / Fruits	The ripe fruits and flowers are eaten. The fresh flowers are also cooked with Arhar dal and eaten, and dried flowers are fermented to obtain alcoholic drink.	100.00	1.00	1.54
47	PTH0299	<i>Mangifera indica</i> L.	Amba	Anacardiaceae	Gum / Fruits	The gum is used as food additive and the ripe fruits are eaten while unripe fruits are used in preparation of pickle.	100.00	1.00	1.54
48	PTH0238	<i>Merremia emarginata</i> (Burm.f.) Hallier f.	Undirkani	Convolvulaceae	Leaves	Leaves and tender shoots are cooked and eaten as vegetable.	87.14	0.87	1.34
49	PTH0124	<i>Mesosphaerum suaveolens</i> (L.) Kuntze	Bhatukali	Lamiaceae	Seeds	The seeds are roasted and eaten by some tribes, especially in food scarcity.	64.29	0.64	0.99
50	PTH0450	<i>Momordica dioica</i> Roxb. ex. Willd.	Kartoli	Cucurbitaceae	Fruits	The fruits are cooked and eaten as vegetable.	100.00	1.00	1.54
51	PTH0818	<i>Morus alba</i> L.	Tuti	Moraceae	Fruits	The ripe fruits are eaten.	100.00	1.00	1.54
52	PTH1224	<i>Mucuna pruriens</i> (L.) DC.	Kavaskurli	Fabaceae	Fruits / Seeds	The tender pods are cooked and eaten as vegetable. The seeds are roasted and eaten as protein source.	75.71	0.76	1.17
53	PTH0256	<i>Nelumbo nucifera</i> Gaertn.	Kamal	Nelumbonaceae	Seeds / Tubers / Rhizome	The fresh seeds are eaten raw while tubers and rhizomes are boiled or cooked as vegetable.	82.86	0.83	1.28
54	PTH0249	<i>Nymphaea nouchali</i> Burm. f.	Upliya Kamal	Nymphaeaceae	Rhizome	The rhizomes are boiled and eaten.	82.86	0.83	1.28
55	PTH0140	<i>Ocimum tenuiflorum</i> L.	Tulas	Lamiaceae	Seeds	The seeds are eaten as medicinal purposes.	90.00	0.90	1.39

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Table 2 — List of Wild Edible Plants (WEPs) (Contd.)

Sr. No.	Specimen No.	Botanical Name	Ver. Name	Family	Part used	Mode of consumption	FC %	RFC	RI
56	PTH0011	<i>Oxalys psittacorum</i> (Lam.) Vahl	Harat-phari	Oxalaceae	Tender shoots	Leaves and tender shoots are cooked and eaten as vegetable.	95.71	0.96	1.48
57	PTH0304	<i>Oxalis corniculata</i> L.	Ambuti	Oxalidaceae	Leaves	Leaves and tender shoots are cooked and eaten as vegetable.	84.29	0.84	1.30
58	PTH0622	<i>Phanera vahlii</i> (Wight & Arn.) Benth.	Mahur	Fabaceae	Seeds	The seeds are roasted and eaten as protein source.	82.86	0.83	1.28
59	PTH0615	<i>Phoenix sylvestris</i> (L.) Roxb.	Shindi	Aracaceae	Fruits	The ripe fruits are eaten.	88.57	0.89	1.36
60	PTH0305	<i>Phyllanthus emblica</i> L.	Aawla	Phyllanthaceae	Fruits	The unripe or ripe fruits are eaten, richest source of vitamin-C. Also, they are used to prepare pickles.	100.00	1.00	1.54
61	PTH0040	<i>Physalis minima</i> L.	Phopandra	Solanaceae	Fruits	The ripe fruits are eaten.	94.29	0.94	1.45
62	PTH0303	<i>Pithecellobium dulce</i> (Roxb.) Benth.	Chijbil	Fabaceae	Aril	The ripe fruits are eaten.	100.00	1.00	1.54
63	PTH0284	<i>Portulaca oleracea</i> L.	Gholbhaji	Portulacaceae	Leaves	Leaves and tender shoots are cooked and eaten as vegetable.	100.00	1.00	1.54
64	PTH0518	<i>Semecarpus anacardium</i> L. f.	Bibba	Anacardiaceae	Receptacle	The ripe receptacles are eaten.	95.71	0.96	1.48
65	PTH0029	<i>Senna tora</i> (L.) Roxb.	Tarota	Fabaceae	Leaves	Leaves and tender shoots are cooked and eaten as vegetable.	98.57	0.99	1.52
66	PTH0870	<i>Sesbania grandiflora</i> (L.) Poir.	Heti	Fabaceae	Flowers / fruits	The flowers are cooked as vegetable, also used in preparation of bhajiya with gram flour. The tender pods are also cooked and eaten as vegetable.	95.71	0.96	1.48
67	PTH0354	<i>Solanum nigrum</i> L.	Kangani	Solanaceae	Leaves / Fruits	Leaves and tender shoots are cooked and eaten as vegetable. The ripe fruits are also eaten.	68.57	0.69	1.06
68	PTH0382	<i>Sterculia urens</i> Roxb.	Kadai	Malvaceae	Gum	The gum is used as a food additive by some tribes.	78.57	0.79	1.21
69	PTH0314	<i>Syzygium cumini</i> (L.) Skeels	Jambhul	Myrtaceae	Fruits	The ripe fruits are eaten.	100.00	1.00	1.54
70	PTH0406	<i>Tamarindus indica</i> L.	Chinch	Fabaceae	Flowers / Fruits	The flowers are eaten raw and the ripen fruits are also eaten and use as additive in different food preparation.	100.00	1.00	1.54
71	PTH0443	<i>Terminalia anogeissiana</i> Gere & Boatwr	Dhawda	Combretaceae	Gum	The gum is used as a food additive by some tribes.	100.00	1.00	1.54
72	PTH0331	<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Behda	Combretaceae	Seeds / Gum	The gum is used as a food additive by some tribes. and the seeds are eaten as protein source.	100.00	1.00	1.54
73	PTH0337	<i>Terminalia chebula</i> Retz.	Hirda	Combretaceae	Fruits	The dried fruits are eaten as digestive and throat infections.	100.00	1.00	1.54
74	PTH0404	<i>Terminalia elliptica</i> Willd.	Yin	Combretaceae	Gum	The gum is used as a food additive by some tribes.	100.00	1.00	1.54
75	PTH0439	<i>Vachellia nilotica</i> (L.) P.J.H.Hurter & Mabb.	Babhul	Fabaceae	Gum	The gum is used as a food additive by some tribes.	100.00	1.00	1.54

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Table 2 — List of Wild Edible Plants (WEPs) (Contd.)

Sr. No.	Specimen No.	Botanical Name	Ver. Name	Family	Part used	Mode of consumption	FC %	RFC	RI
76	PTH0266	<i>Ziziphus mauritiana</i> Lam.	Bor	Rhamnaceae	Fruits	The ripe fruits are eaten.	100.00	1.00	1.54
77	PTH1239	<i>Ziziphus oenopolia</i> (L.) Mill.	Yeruni	Rhamnaceae	Fruits	The ripe fruits are eaten.	100.00	1.00	1.54

Data analysis

Data were compiled in Microsoft Excel, analysed statistically and quantitative ethnobotanical indices were calculated. A chord diagram was used to analyse the distribution of plant parts used as wild edible source within the study area. The diagram was generated using OriginPro software. Frequency of citation percentage (FC%), Relative Frequency of Citation (RFC) and Relative importance index (RI)²³ were calculated with the help of following formulae:

1. Frequency of citation percent (FC %) = $\frac{FC}{N} \times 100$
2. Relative Frequency of citation (RFC) = $\frac{FC}{N}$
3. Relative Importance Index (RI) = $\frac{RFC}{\sum RFC} \times 100$

Where: FC = Frequency of citation; N = Total number of informants; Σ = Summation. Equations and rationale^{23,24}.

Results and Discussion

The present study documented a total of 77 species of WEPs, representing 72 genera and 38 families of angiosperms. Of these, 67 species belonged to dicotyledons, while 10 species were monocotyledons, indicating a strong dominance of dicot taxa in the regional wild edible flora (Table 2). Such dominance of dicotyledonous plants in ethnobotanical studies is consistent with reports from other parts of India and Southeast Asia, where dicots contribute the majority of wild edible resources²⁵.

Analysis of family distribution revealed that *Fabaceae* was the most species-rich family with 13 species, followed by *Amaranthaceae* (6 species), *Anacardiaceae* (4 species), *Combretaceae* (4 species), and *Araceae*, *Lamiaceae*, and *Phyllanthaceae* (3 species each). Families such as *Apocynaceae*, *Asteraceae*, *Convolvulaceae*, *Cucurbitaceae*, *Malvaceae*, *Moraceae*, *Rhamnaceae*, *Rutaceae*, and *Solanaceae* were represented by two species each, whereas the remaining 22 families contributed a single species each (Fig. 2). Due to nutritional richness in proteins, minerals, and multiple edible parts, the family *Fabaceae* contribute significantly to both wild and

cultivated food resources, this was also demonstrated from observations from central and eastern India²⁶. Likewise, family *Amaranthaceae* members also are widely consumed as leafy vegetables, because of their high iron, calcium, and vitamin A content, thus playing a major role in quality nutrition²⁷.

These 77 wild edible plants documented, demonstrated significant variation in growth habit. Among these, tree species were predominant, comprising 34 (44.2%). The herbaceous species represented 29 (37.7%), a trend that indicates their central role in medicinal and cultural practices. The species from twiners category accounted 8 (10.4%), while the species from shrubs and climbers habit were represented by 4 (5.2%) and 2 (2.6%), respectively (Fig. 3). The cumulative percentages of plant parts exceed 100% because several species provide more than one edible part; therefore percentage represent the proportion of species for which each part was recorded and are not mutually exclusive categories. The availability and versatility of trees and herbs in the dataset is consistently dominant, this also validated with ethnobotanical studies from various parts of India²⁸. The climbers and shrubs have lower occurrence that might reflect ecological prevalence or traditional preferences, as also reported in related studies²⁹.

Among WEPs, the plant parts used, fruits were most often consumed (25 species, 32.5%), succeeded by leaves (19 species, 24.6%), gums (9 species, 11.6%), seeds (8 species, 10.3%), flowers (5 species, 6.5%), rhizomes (3 species, 3.9%), and tender shoots (2 species, 2.6%). Moreover, corms, roots, tubers, arils, receptacles, and whole plants were used less frequently (Fig. 4). This pattern underline a clear dependence on fruits and leafy vegetables for daily diets, a study consistent with reports from tribal areas of Madhya Pradesh, Chhattisgarh, Odisha, and Jharkhand from India^{30,31}.

Amaranthus spinosus L., *Boerhavia repens* L., *Portulaca oleracea* L., and *Chenopodium album* L. as leafy green, are cooked as vegetables and consumed for their micronutrient value, which is vital in alleviating

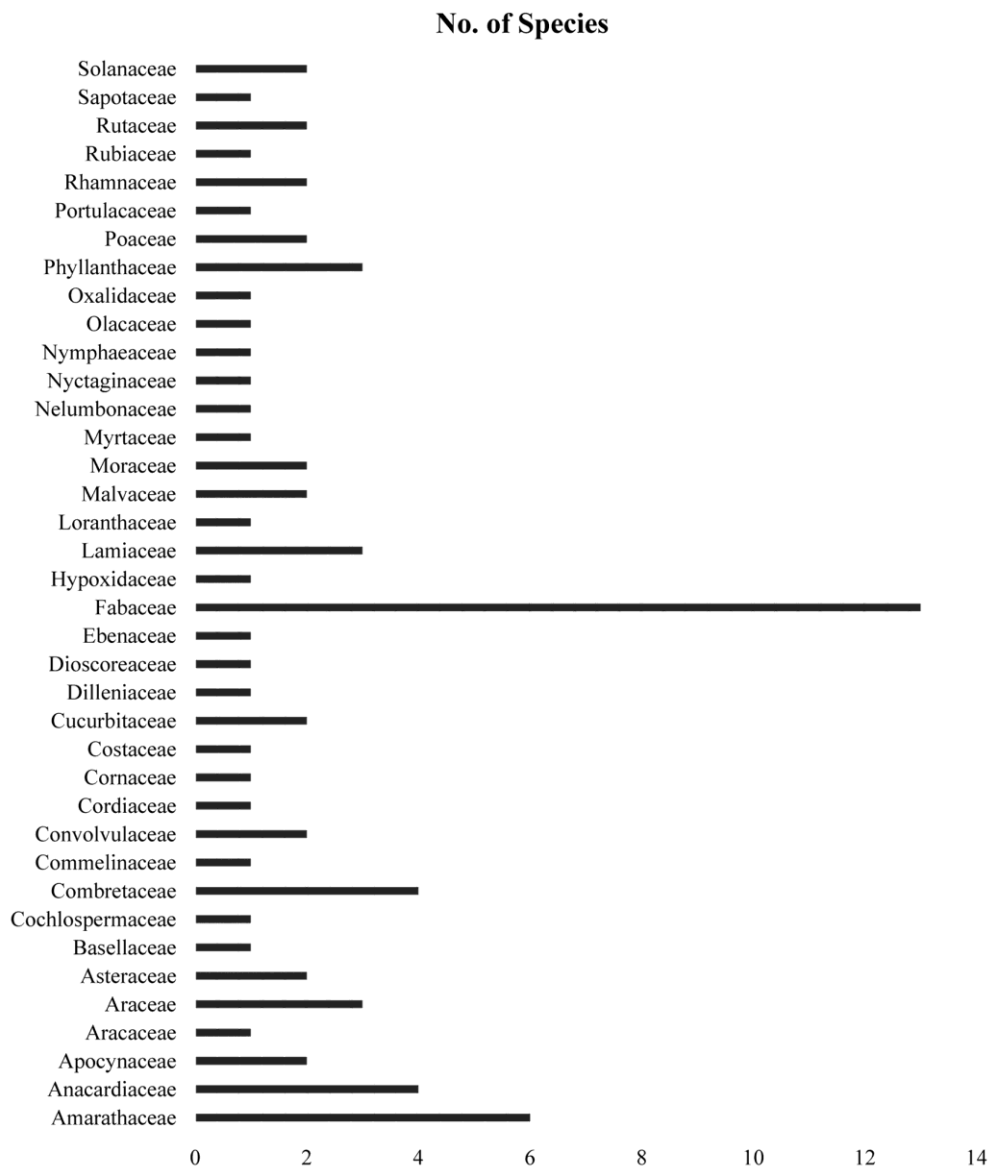


Fig. 2 — Families with number of species

under nutrition. The fruits of Anacardiaceae (e.g., *Buchanania cochinchinensis* (Lour.) Almeida, wild relatives of *Mangifera indica* L.) and Moraceae (*Ficus* spp.) are consumed raw or preserved, while fruits of *Ziziphus mauritiana* Lam. (Rhamnaceae) are even seasonally sold in local markets, contributing to household income of tribal and local people. Some of the plant species yield gums, like members of Fabaceae and Sterculiaceae cater as natural sweeteners or thickeners. In some WEPs, underground parts such as tubers (*Dioscorea* spp.), rhizomes (*Nelumbo nucifera* Gaertn.), and corms [*Colocasia esculenta* (L.) Schott.] are consumed as 'forage foods' during periods of insecurity^{25,32}.

The documented WEPs not only upgrade dietary diversity but also play a pivotal role in ensuring nutritional security and seasonal food resilience. The protein-rich seeds and nuts from *Fabaceae* and *Anacardiaceae*, making them crucial food supplement during lean agricultural seasons. Additionally, several WEPs such as *Buchanania cochinchinensis* (Lour.) Almeida fruits, *Tamarindus indica* L. pulp, and *Ziziphus* spp. fruits are commercially important, being sold in weekly tribal markets, thereby providing additional income to tribal and rural households³³.

The studies from neighbouring states: Chhattisgarh (80 species), Madhya Pradesh (74 species), and Odisha (65 species), comparable to ethnobotanical

study from Bhandara district (77 species) indicates richness and diversity which highlight the prominence of Fabaceae, Amaranthaceae, and Cucurbitaceae as dominant food plant families³⁴. The dependence on

Dioscorea tubers and *Amaranthus* greens during times of food scarcity shows strong cultural continuity across central India as well as neighbouring areas.

The inventory and prioritization of wild edible plants in Bhandara district disclose species that play both dietary and economic roles. Several top-ranked species [e.g., *Buchanania cochinchinensis* (Lour.) Almeida, *Dioscorea bulbifera* L., *Phyllanthus emblica* L.] provide micronutrients and energy during seasonal shortages and are either sold or bartered in local markets, contributing to household income to poor people of the society. These observations align with regional reports from central India, where wild edible plants use contributes to dietary diversity and resilience during lean seasons, this was earlier revealed from the studies from Chhattisgarh, Madhya Pradesh and Odisha. Integrating prioritised wild edible plants into local food security strategies, for example through community conservation plots, value-addition, or

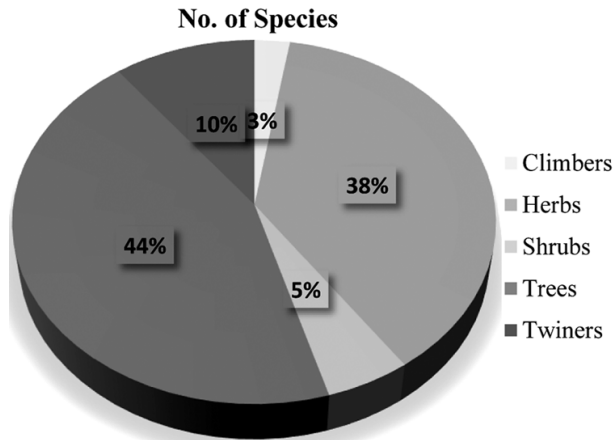


Fig. 3 — Habit of the plants used

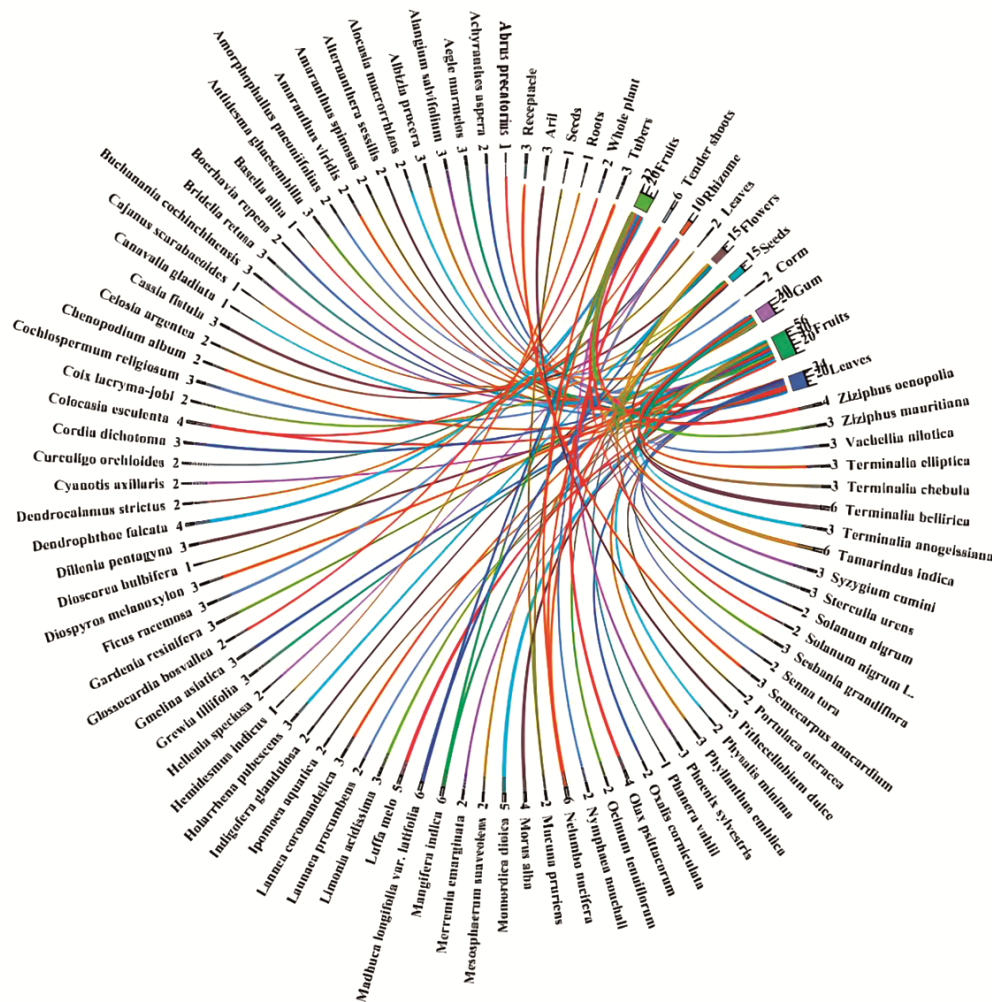


Fig. 4 — Plant part used as wild edible

market linkage initiatives, could support both nutritional outcomes and sustainable livelihoods.

The urbanization with industrial development leads to habitat destruction and deforestation that face the loss of traditional knowledge, though, many WEPs play recognized and crucial role in food security³³. This accentuates the necessity for *in situ* and *ex situ* conservation strategies, along with mass awareness of tribal and rural people to promote sustainable use of wild edible plant species.

Ethnobotanical analysis highlights herbaceous and arboreal species as wild edible plants exhibiting exceptionally high levels of cultural prominence and consensus among informants, represented by Frequency of Citation Percent (FC %), Relative Frequency of Citation (RFC), and the Relative Importance (RI) index (Table 1).

Top-ranked species

The quantitative ethnobotanical studies indicates, 22 species emerged as the most culturally significant wild edible plants in the study area, each exhibiting FC = 100%, RFC = 1.00, and the highest RI value (RI = 1.54), showing universal recognition and use among all informants. *Alocasia macrorrhizos* (L.) G. Don., *Amaranthus spinosus* L., *Amorphophallus paeoniifolius* (Dennst.) Nicols., *Buchanania cochinchinensis* (Lour.) Almeida, *Colocasia esculenta* (L.) Schott, *Cordia dichotoma* G. Forst., *Limonia acidissima* L., *Madhuca longifolia* var. *latifolia* (Roxb.) A. Chev., *Mangifera indica* L., *Momordica dioica* Roxb. ex Willd., *Morus alba* L., *Phyllanthus emblica* L., *Pithecellobium dulce* (Roxb.) Benth., *Portulaca oleracea* L., *Syzygium cumini* (L.) Skeels, *Tamarindus indica* L., *Terminalia anogeissiana* Gere & Boatwr, *Terminalia bellirica* (Gaertn.) Roxb., *Terminalia chebula* Retz., *Terminalia elliptica* Willd., *Vachellia nilotica* (L.) P.J.H. Hurter & Mabb., *Ziziphus mauritiana* Lam., and *Ziziphus oenopolia* (L.) Mill are found most prominent species. These species are universally recognized and utilised across all informants, which suggest their central cultural and utilitarian significance as WEPs.

Near-universal usage

Species exhibiting near-universal usage include *Amaranthus viridis* L., *Dioscorea bulbifera* L., *Holarrhena pubescens* Wall. ex G. Don, and *Senna tora* (L.) Roxb. each with RFC values ranging from 0.97 to 0.99 and RI values between 1.50 and 1.52, reflecting their widespread dietary and cultural importance.

High to moderate importance across the community

Several species showed high to moderate cultural importance, with RFC values between 0.80 to 0.94, such as *Aegle marmelos* (L.) Corr., *Olax pinnatifidus* (Lam.) Vahl, *Semecarpus anacardium* L. f., and *Sesbania grandiflora* (L.) Poir., indicating strong but slightly less universal community dependence.

Less-recognized species

In contrast, a few species including *Gardenia resinifera* Roth, *Gmelina asiatica* L., *Grewia tiliifolia* Vahl, and *Dillenia pentagyna* Roxb. recorded lower RFC (0.46 to 0.54) and RI (0.70 to 0.84) values, suggesting more localized or specialized usage patterns.

Overall, the distribution of FC, RFC, and RI values clearly demonstrates that a relatively small group of wild edible species forms the backbone of traditional food systems in the study area, while a larger pool of moderately and sparsely used species contributes to dietary diversification and cultural resilience.

Medicinal and nutritional value

The ethnobotanical studies of WEPs across the globe suggest that, these are not only consumed for nutritional potential but also their ability to fight against health hazards. Some of the most prominent top-ranked species includes *Amaranthus spinosus*, *Madhuca longifolia*, *Alocasia macrorrhizos*, *Buchanania cochinchinensis*, *Phyllanthus emblica*, *Mangifera indica*, and *Syzygium cumini*, all exhibiting FC = 100% and high RI values (RI = 1.54), were cited for their dual role as staple food resources and curative agents. Some other wild edible plant species such as *Amaranthus viridis*, *Dioscorea bulbifera*, and *Holarrhena pubescens* were traditionally documented for treating gastrointestinal ailments, boosting immunity, and managing chronic conditions, reflecting deep-rooted indigenous knowledge. Less commonly but prominently *Aegle marmelos* and *Sesbania grandiflora*, were considered in treatment of digestive and respiratory disorders. In contrast, rarely cited species such as *Gardenia resinifera* and *Gmelina asiatica* were recommended for specialized usage, signifying that some nutritional or medicinal knowledge may be confined to specific healers or family traditions. In conclusion, the high RFC and RI values intensely highlight the pivotal role in both nutritional well-being as well as traditional healthcare system within the tribal and rural communities of the district.

Conclusion

This extensive ethnobotanical survey of wild edible plants in Bhandara district uncovers a consolidated repository of traditional knowledge held by tribal and rural communities. A total of 77 wild edible plant species were documented, emphasizing representation of taxonomic diversity and dietary treasure in local ecosystems in and around wetlands, forest and agricultural fields. The ethnobotanical quantitative indices such as frequency of citation, relative frequency of citation and relative importance index unquestionably highlight a subset of plant species that play pivotal role in diets and culture of tribal and rural communities.

The findings of this study enlighten the significant cultural, nutritional, and conservation value of WEPs in sustainable livelihood of tribal and rural communities, during food scarcity, showing deep understanding from regional studies in the state of Maharashtra. The compilation of such indigenous knowledge not only helps conservation of biodiversity and sustainable use but also promote dietary diversity among tribal and rural communities.

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Author Contributions

The data included in this manuscript were collected by the author itself during the floristic exploration of the district. Plant identification, data analysis and editing of the manuscript were done by the author.

Conflict of Interest

There is no conflict of interest.

Prior Information Consent

All the informants provided prior informed consent.

Data Availability

The author confirms that the data generated and/or analysed in this study are included in this published manuscript.

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