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Article

# A Green Pharmacy: Quantifying Medicinal Plant Use in the Sohagi Wildlife Sanctuary

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**Abstract:** Tribal healers and local practitioners possess knowledge about plant uses passed down through generations. However, habitat loss, unsustainable harvesting, and declining traditional knowledge threaten this valuable resource. India, a global biodiversity hotspot, is rich in medicinal plants. Documenting the traditional knowledge prevents it from being lost and ensures the preservation of this cultural heritage. Recording traditional practices helps bridge the gap between traditional and modern medicine. This study quantifies the ethnomedicinal uses of plants within the Sohag Wildlife Sanctuary. The findings contribute to preserving traditional knowledge and promoting the sustainable use of medicinal plants. The study documented 95 medicinal plant species from 39 families, highlighting the importance of ethnomedicinal studies for preserving traditional knowledge and ensuring the sustainable use of medicinal plants. In the future, scientific studies can be organized to understand their efficacy, leading to developing new, potentially safer, and more effective medications. Identifying and documenting medicinal plants is crucial in safeguarding cultural heritage, fostering scientific discovery, and promoting sustainable healthcare practices.

**Keywords:** ethnomedicine; medicinal plants; traditional knowledge; biodiversity conservation; sustainable healthcare; Sohagi; Tarai; India

## 1. Introduction

For millennia, medicinal plants have served as a cornerstone of traditional healthcare across the globe. From chamomile's soothing properties to turmeric's pain-relieving power, these natural wonders offer vast potential for human health. However, this valuable resource is threatened by habitat loss, unsustainable harvesting, and a decline in traditional knowledge.

Documentation is needed for two reasons. First, it ensures the preservation of indigenous communities' knowledge. Tribal healers and local practitioners possess information on plant uses passed down through generations. Recording this knowledge helps bridge the gap between traditional and modern medicine. Second, proper documentation allows for scientific exploration. By cataloguing plant species and their potential benefits, researchers can investigate their efficacy and develop new drugs.

India, a global biodiversity hotspot and home to 33.2% of tropical moist deciduous forests (TMDFs), possesses immense potential for ethnomedicinal discoveries. These rich ecosystems harbor many medicinal plants crucial for traditional healthcare practices. However, alarming rates of deforestation and resource overexploitation threaten this valuable resource.

The significance of TMDFs extends beyond biodiversity. According to the All India coordinated project sponsored by the Ministry of Environment and Forest (MoEF), New Delhi, ~40% of India's 16,000 recorded flowering plants have ethno-medical values. In the Indian subcontinent, 84% of the tribal population generates livelihood options from the forested areas.

Globally, 85% of primary healthcare relies on plant-derived medicines, highlighting the critical role of traditional knowledge held by tribal societies. This knowledge, passed down orally for generations (Maharjan et al 2021), faces threats from sociocultural change, migration, and limited transmission (Kunwar et al., 2016). Factors like geography, ethnicity, and education further influence the preservation of this knowledge (Joshi et al 2020).

Due to these reasons, ethnomedicinal research becomes crucial in this context. It fosters the sustainable cultivation of medicinal plants while safeguarding associated knowledge (Ford et al 2020, Kumar et al 2021). However, a significant portion of this information must be updated due to communication limitations. While the market for plant-based medicines flourishes (Subramanyam, 2007), detailed ethnomedicinal studies must be included, particularly in India's TMDFs like the Uttar Pradesh Terai region.

This research addresses this gap by quantifying the ethnomedicinal uses of plants within the Sohagi Wildlife Sanctuary. The findings will contribute to preserving traditional knowledge and promoting the sustainable use of this vital ecological resource.

## 2. Material and Methods

### 2.1. Study Sites

This ethnobotanical survey was conducted in the Sohagi Barwa Wildlife Sanctuary. The Sanctuary lies in the Maharajganj and Kushinagar districts of Uttar Pradesh, between 26° 58' to 27° 25' N and 83° 23' to 84°10' E. It is spread across the sub-mountain area of Terai in UP and is a vast alluvial plain. The underlying soil of the area consists of alluvial formations, showing a succession of clay beds, silt, and sand. The temperature ranges between 00°C to 40°C. The average annual rainfall is >1,500 mm. The earth's surface is almost plain, and the altitude varies from 95–103 m above mean sea level. However, the hill areas are easily visible towards the north of the Sanctuary, about 20 km towards the Indo-Nepal International boundary.

### 2.2. Data Collection and Identification of Medicinal Plants

Before beginning each interview, the research's purpose, methodology, and nature were explained to all participants, after which voluntary oral consent was obtained from all informants. Each informant had the chance to end the interview at any time. Acquire information on the therapeutic plants utilized by the indigenous people. Ethnobotanical data on the knowledge of plants and their use for medicinal purposes was collected using semi-structured and structured face-to-face interviews conducted in the Aravalli range with inhabitants of the research area on several trips to this region.

Eighty-six informants, including 57 males and 29 females, were interviewed. Most informants were traditional healers skilled in traditional medicine, using a purposive technique. After the interviews, all the data was deposited at the Department of Ecology of the JNU. Ethnobotanical and ethnomedicinal research was conducted by the International Society of Ethnobiology (ISE) Code of Ethics.

All principles of the Code of Ethics were respected, and there were no harmful consequences for the local community—furthermore, all the recommended standards for conducting ethnobotanical research (Weckerle et al 2018). The interview focused on the local population's traditional knowledge of using wild plants to treat various health problems. The correct taxonomy and nomenclature of the vascular plants were also checked by referring to World Flora Online (WFO) ([www.worldfloraonline.org](http://www.worldfloraonline.org)); Herbarium of plant twigs bearing voucher numbers were deposited in the Department of Botany, JNU New Delhi, India for future references.

### 2.3. Demography of Informants

The informants were selected according to the “snowball” method: the first informant in the village is randomly appointed, and the following ones are recruited based on the information and contacts provided by the first informant. The “snowball” technique provides an opportunity to study

the lifestyles and attitudes of hard-to-reach groups of society, which usually remain outside sociological studies.

The study area's population belongs to various ethnic groups and religions, and the region's official language is Hindi. Respondents of both sexes participated and resided permanently in the villages where we conducted the research. We interviewed 57 men and 29 women ( $n = 86$ ), aged 25–75. Most interviewees were between 36 and 60 (58.13%) (Table 1). We recorded the gender, age, level of education, and occupation of all the respondents. Traditional knowledge on the use of medicinal plants in the study area was collected from farmers, homemakers, medicinal plant pickers, and traditional healers.

#### 2.4. Data Analysis

The gathered data were revised and organized using MS Excel following use reports. The voucher number, scientific and local names, habit, part used, mode of preparation, and medicinal uses are included in each column as attributes of that reference. SPSS software was used for statistical analyses. We used a matrix plot employing Paste 4.03 to show species distribution among the families. A balloon plot represented the species used against different diseases. A cladogram showing the Pearson correlation between plant species and diseases was used.

#### 2.5. Use Value (UV)

Use value (UV) was used to determine the relative importance of the medicinal plants.  $UV = U_i/N$ , where  $U_i$  is the number of use reports, citations, or mentions by each informant for a particular species.  $N$  is the total number of informants who participated in the study. Low numbers signify fewer mentions or citations, whereas high values show a significant volume of use reports or citations from the informants. It counts as one use report or citation each time an informant identifies or describes a species of medicinal plant that is being used to treat a condition or for another reason.

#### 2.6. Relative Frequency Citation (RFC)

The relative frequency of citation (RFC) was computed to know the importance of the species. The relative frequency citation (RFC) is used to determine the relative frequency of reference or mention from the study participants who served as informants were calculated using the formula:  $RFC = FC/N$ , where  $FC$  is the number of informants cited or mentioned a plant, and  $N$  is the total number of informants. The values closest to 1 show that nearly all informants mentioned a medicinal plant used to treat a particular illness. Low scores show that the usage or purpose of a medicinal plant species is mentioned by few, or occasionally by one, informant.

#### 2.7. Informant Consensus Factor (ICF)

The informant consensus factor (ICF) was used to assess the homogeneity or degree of agreement of the informant's knowledge about medicinal plants, and calculated as follows:  $ICF = (Nur - Nt) / (Nur - 1)$ , where  $Nur$  represents the number of use reports or citations for each illness category and the species utilized in that specific category.

#### 2.8. Fidelity Level (FL)

The percentage of the most popular and valuable medicinal plant for a specific condition or use category was calculated using fidelity level (FL) using the formula:  $FL(\%) = N_p/N \times 100$ , where  $N_p$  is the proportion of informants who cited or discussed using a medicinal plant to treat a specific disease category.  $N$  is the number of informants who cited the plant for any other use or purpose.

A medicinal plant with a high value will likely have many citations and be the most popular species for treating a specific condition. This ethnobotanical documentation included 15 different use or disease categories updated and adapted from the ICD-11 (International Classification of Diseases) for Mortality and Morbidity Statistics.

### 2.9. The Jaccard Similarity Coefficient or Jaccard Index (JI)

The Jaccard similarity coefficient or Jaccard index (JI) is used when the level of similarity between two groups of elements should be identified. JI is calculated using the formula:

$$JI [\%] = NAB \times 100 / (NA + NB - NAB),$$

Where: NA is the number of elements in group A, NB is the number of elements in group B; NAB is the number of elements available in both groups. This formula could identify the similarity between the species identified in both analyzed regions: Central and East Rodopes. Thus, the following modified formula is applied:

$$JI [\%] = NAB \times 100 / (NA0 + NB0 + NAB)$$

where: NA0 = NA - NAB is the number of species identified only in region A; NB0 = NB - NAB is the number of species identified only in region B; NAB is the number of species identified in both regions.

### 3. Results

The total area of Sohagi Barwa is 42,820 ha, divided into seven zones for conservation and management. The Tharu and Mushar tribes live around the Sohagi Barwa forest area. More than 300 villages are situated inside and outside this Protected Area, and around 90% of the population here are rural, along with 12 Tangy villages.

The sanctuary is home to diverse flora and fauna, including tigers. The literacy rate is 67.66 percent, and the sex ratio is 955. Maharajganj has a sex ratio of 943 females for every 1000 males and a literacy rate of 62.76%. 5.02% of the population lives in urban areas. Out of 18, 12 villages in Maharajganj district are located in the dense forest of Sohagi Barwa Wildlife Sanctuary, while six villages – Vilaspur, Daulatpur, Barhawa, Bhari Vaisi, Surpar, and Khurrampur – lie on the edge of the forest. More than 4,500 Vantangiya families live across Maharajganj's 18 villages. Agriculture is the main occupation here. The community has received land on lease under the Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act. This act is better known as the Forest Rights Act. Around 100 years ago, the British brought practitioners of this farming system from then Burma to eastern Uttar Pradesh to set up sal and teak plantations in the Gorakhpur and Maharajganj regions. They came to be called the 'Vantangiya' – 'van' means 'forest.'

**Table 1.** Demographic features of the local informants in the study area (n = 86).

Demographic features (%)	Abundance	Relative Abundance (%)
<b>Gender</b>		
Male	57	66.27
Female	29	33.78
<b>Age group</b>		
25-35	25	29.06
36-60	50	58.13
61-75	11	12.79
<b>Education</b>		
Illiterate	07	8.13
Literate	23	26.74
Primary level	21	24.41
Secondary level	26	30.23
Graduation	09	10.46
<b>Healing experience</b>		
Key informants	27	31.39
General informants	59	68.60

### Demographic characteristics

Eighty-six informants were interviewed regarding the use of medicinal plants to treat different ailments (Table 1). Out of this number, 27 were traditional healers (Vaidyas and Daai) and the key informants for this study. Informants constituted three age groups between 25 and 75 years, with the majority (58,13%) being between 36–60 years old, and the second highest (29.06%) were between 25–35 years old. Men represented 66.27 % of informants, and women 33.74%. Informants were from different educational backgrounds; the majority (30.23%) were educated up to the secondary level, but some informants (8.13 %) were illiterate. Almost all illiterates were > 60 years old.

In the present study, 95 medicinal plant species belonging to 39 families have been reported for treating various ailments. The most prominent families were Fabaceae with 22 plant species, Poaceae with six plants, and Combretaceae with five plant species. Four species each among Moraceae Euphorbiaceae and Apocynaceae. Anacardiaceae Lamiaceae, Malvaceae, Rubiaceae, Rutaceae, and Tiliaceae Verbenaceae are with three species each, while Boraginaceae Lythraceae Menispermaceae are with two species each, and the other 23 families with one species each, as shown in Table 2. The high usage report of this large family, like Fabaceae, Poaceae, and Combretaceae, occupied 23.24%, 7.33%, and 7.14 % of the total used report, respectively, indicating that most people in the study area are inclined to use plants that are readily available and abundant around them (Table 2).

**Table 2.** Name of plant families with number of species and used report.

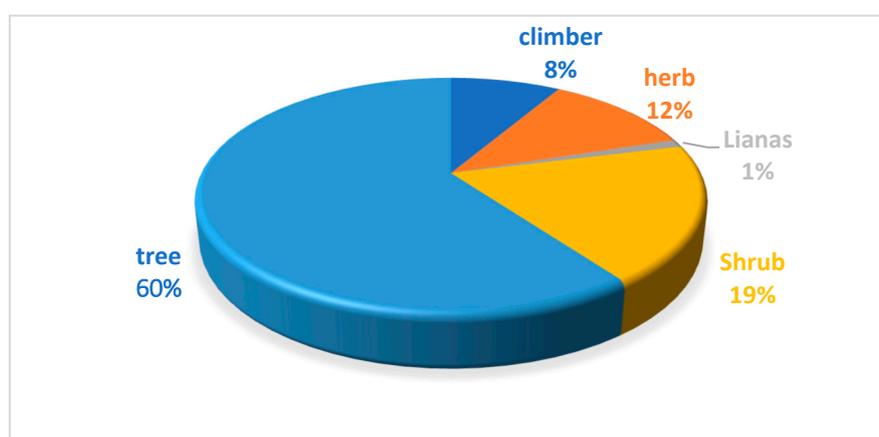
Sr. No.	Family Name	Number of medicinal plants	Number of used reports
1.	Alangiaceae	1	33
2.	Amaryllidaceae	1	36
3.	Anacardiaceae	3	142
4.	Apocynaceae	4	161
5.	Arecaceae	1	13
6.	Asclepiadaceae	1	86
7.	Bignoniaceae	1	24
8.	Bombacaceae	1	75
9.	Boraginaceae	2	53
10.	Burseraceae	1	26
11.	Cannabaceae	1	21
12.	Combretaceae	5	300
13.	Dilleniaceae	1	35
14.	Dipterocarpaceae	1	98
15.	Ebenaceae	1	45
16.	Euphorbiaceae	4	147
17.	Fabaceae	22	976
18.	Lamiaceae	3	127
19.	Lecythidaceae	1	65
20.	Liliaceae	1	21
21.	Lythraceae	2	108
22.	Malvaceae	3	57
23.	Meliaceae	1	24
24.	Menispermaceae	2	101
25.	Moraceae	4	194
26.	Myrtaceae	1	98
27.	Phyllanthaceae	1	31
28.	Poaceae	6	308
29.	Rhamnaceae	1	27
30.	Rubiaceae	3	85
31.	Rutaceae	3	175

32.	Sapindaceae	1	55
33.	Sapotaceae	1	76
34.	Smilacaceae	1	11
35.	Sterculiaceae	1	27
36.	Tiliaceae	3	142
37.	Typhaceae	1	68
38.	Ulmaceae	1	46
39.	Verbenaceae	3	81

#### Taxonomy identification

#### Growth form of medicinal plants

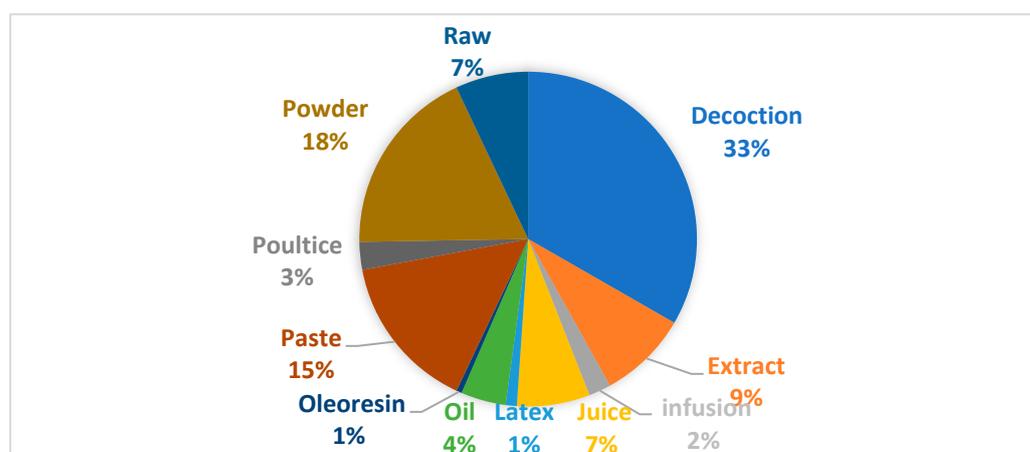
Herbs, shrubs, trees, climbers, and lianas were the preferred growth forms of the therapeutic plants in the study area. With 57 species (60.00%), the tree had the highest percentage of all growth forms, followed by 29 species (30.62%) of herbs and shrubs, eight species (8.42%) of climbers, and one species (1.05%) of lianas (Figure 1).



**Figure 1.** Growth forms of medicinal plant.

#### Mode of preparation and administration

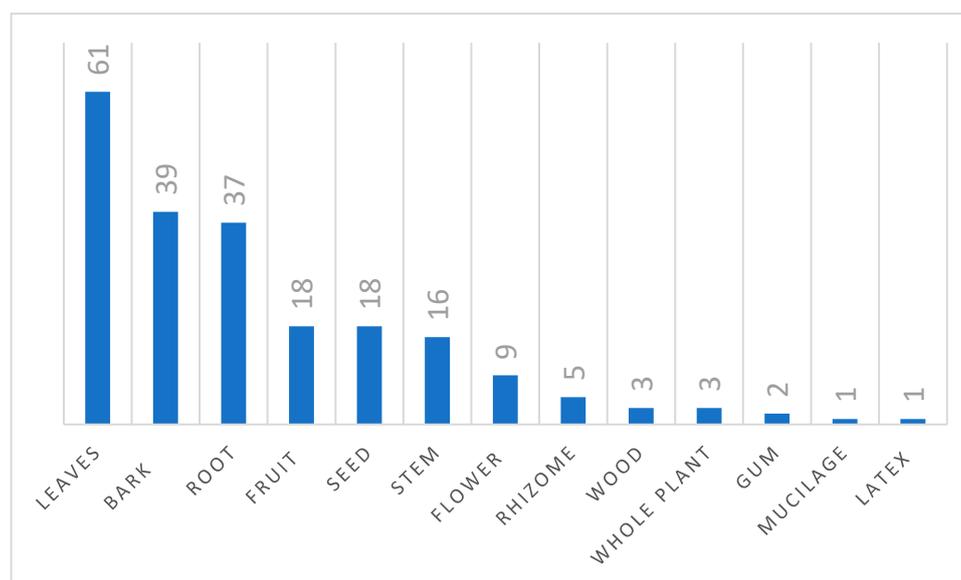
The mode of formulation preparation or administration was observed to be in the form of decoction (33%) followed by powder (18%), extract and juice (16%), paste (15%), raw (7%), oil (4%), poultice (3%) and others like latex and oleoresin (2%) (Figure 2).



**Figure 2.** Preparation methods of traditional medicine.

#### Frequency of usage of parts of plants

Different plant components such as bark, flowers, fruits, grains, leaves, rhizomes, roots, seeds, stems, tubers, and whole plants are utilized in traditional medicine in the study area by informants (Figure 4). Among the parts, leaves, fruits, and barks were mainly utilized for preparation of traditional medicine (Figure 2). A detailed analysis concluded that the majority of plant parts that were employed were the leaves from 61 species, bark from 29 species, roots from 37 species, fruit and seed from 18 each, stem from 16, flower from 9, rhizome from 5, wood from 3, whole plant from 3, gum from 2, mucilage from 1, and latex from 1.



**Figure 3.** The most frequently used plant parts in the ethnomedicine of the study area.

Use value (UV) and relative frequency citation (RFC)

The use value (UV) of documented medicinal plants was determined by employing the use report (UR). This helped in the evaluation of their relative importance in the research area and revealed the preferred medicinal plants used by the indigenous people (Table 4). The highest UV was recorded for *Acacia catechu* (1.28). The UV is 1.14 for *Acacia nilotica* and *Syzygium cumini*. Further, *Shorea robusta* (1.13), *Aegle marmelos* (1.08), *Acacia concinna* (1.07), and *Calotropis procera* (1.0) also revealed the plants with high UV while *Desmodium latifolium* (0.06) received the lowest recognition for their therapeutic potential. *Aegle marmelos* (0.98), *Acacia catechu* (0.95), and *Syzygium cumini* (0.94) had the highest RFC values among the documented medicinal plants.

Informant consensus factor (ICF)

The culturally significant medicinal plants utilized by various informants within the same use or ailment category were evaluated using ICF. The present study listed diseases treated by medicinal plants under 16 disease categories (Table 3). The digestive disease category had the highest ICF score (0.95), while the genitourinary, blood, and nervous system disorders had the lowest ICF score (0.90).

**Table 3.** The informant consensus factor (ICF) by disease category in the study.

Ailment category	Disease under each category	Number of plants used	Use report	ICF
Infectious diseases	measles, malaria, tuberculosis, dengue, typhoid, rabies, cholera, dysentery	22	281	0.93
Neoplasms	cancer, tumour	4	33	0.91
Blood diseases	anemia, blood purification, haemorrhage	10	91	0.90
Metabolic diseases	diabetes	13	171	0.93
Nervous system disorder	headache, epilepsy, paralysis, vertigo, migraine, mental illness	11	102	0.90

Cardiovascular diseases	heart disease and hypertension anxiety	7	73	0.92
Respiratory diseases	asthma, cough, lung problem, pneumonia, tonsillitis, catarrh, bronchitis, throat infection	26	442	0.94
Digestive diseases	abdominal pain, stomachache, constipation, diarrhea, nausea, hepatitis, indigestion, dyspepsia, liver disease, piles, stomach ulcer, hemorrhoids enlarge spleen, toothache, mouth ulcer gingivitis and jaundice	46	824	0.95
Skin diseases	rash skin eruptions, leucoderma scabies, boils, Scars leprosy, pimples, & other skin problems	35	511	0.93
Genitourinary diseases	kidney stone and urinary tract problem	12	112	0.90
Connective diseases	muscle swelling, sprain, rheumatoid, arthritis, gout	20	303	0.94
General symptoms	body pain, inflammation, nose bleeding, dandruff, Allergies, Heat stroke, and fever	30	411	0.93
Injury	burns, cuts, wounds, and fracture	33	502	0.94
Poisonous bites	snake, scorpio, rabbit, rat, dog, insect bites	11	108	0.91
Women problems	enhancing lactation, menstrual disorders, leucorrhoea gynecological disorders	8	84	0.92
ear and eye related diseases	ear pain burning of the eyes conjunctivitis	7	103	0.94

**Table 3.** Raw data of plants with physicochemical parameters.

Scientific name	Local name	Family	Habit	Parts used	Mode of use	Ailments uses	UV	RFC	IUCN status
Abrus precatorius	ratti	Fabaceae	Climber shrub	Seed, leaves	Powder, paste	Leucorrhoea Mouth ulcer, dog biting, malaria	0.17	0.13	
Acacia catechu	Khair	Fabaceae	tree	heartwood	Extract decoction	cold and cough diarrhea, piles, body pains fever, mouth ulcer, boils, skin eruptions and on gums as disinfectant	1.28	0.95	
Acacia concinna	Shikakai	Fabaceae	climbing shrub	leaves, bark and pods	Extract decoction paste	hair fall, dandruff, diabetes wound healing, prevents constipation, jaundice, scabies	1.07	0.86	
Acacia nilotica	Babul	Fabaceae	Tree	Bark, Gum, leaves	Decoction raw, paste	nausea, burns and wounds, stomach ache, diarrhea, immunity booster	1.14	0.92	
Adina cordifolia	Haldu	Rubiaceae	tree	Bark and leaves, latex	Juice, decoction, raw, paste	stomachache cholera, cold cough, fever, headache, scars urine complaints, pain and swelling, aching tooth, conjunctivitis, boils, rheumatism eczema	0.52	0.42	

Aegle marmelos	Bael,	Rutaceae	tree	fruits and leaves	Raw, extract, decoction	dysentery, dyspepsia, mal-absorption, vomiting, and rheumatism	1.08	0.98
Alangium salvifolium	sage leaved Alangium	Alangiaceae	tree	roots, leaves, stem and bark	Raw, extract	skin diseases, leprosy, scabies rheumatism haemorrhages, snake/scorpion, rabbit, rat, dog bites	0.38	0.24
Albizzia lebbek	Siris	fabaceae	tree	Bark, flower	Powder, decoction	skin eruptions, boils diarrhoea, dysentery and piles	0.83	0.54
Albizzia procera	Safed Siris Gurar,	fabaceae	tree	bark leaves	Seeds decoction powdered poultice	rheumatism, haemorrhage, haemorrhoids, skin diseases, stomach-ache amoebiasis ulcers	0.75	0.45
Anthocephalus cadamba	Kadam	Rubiaceae	tree	root, bark and leaves, flower, fruits	Decoction juice, paste, powder infusion	fever, uterine complaints, blood diseases, skin diseases, tumour, anaemia, eye inflammation and diarrheas, sour throat, cough,	0.87	0.71
Antidesma ghaesembilla	Binayuyo	Euphorbiaceae	tree	Leaves stem	decoction	headache menstrual flow	0.29	0.19
Arundo donax,	Kasa	Poaceae	herb	rhizome roots	decoction	dysuria, fever, enhancing lactation, menstrual, disorders, bone fracture, cancer	0.36	0.17
Barringtonia acutangula	Hijjal,	Lecythidaceae	tree	Seed, leaves, root	Powder, paste, decoction	Cold, diarrhea, scorpion bite, skin diseases	0.76	0.71
Bauhinia malabarica	Amlil	Fabaceae	tree	Flower Stem and root bark, leaves	decoction Infusion, raw	Jaundice, wound healing, diuretic, dysentery, fever	0.51	0.36
Bauhinia purpurea	Kaniar	Fabaceae	tree	Bark, leaves	Decoction juice	Diarrhea, dropsy, pain, rheumatism	0.47	0.37
Bauhinia recemosa	Bidi Leaf Tree	Fabaceae	tree	Bark, leaves, root	Decoction paste	headache, fever, skin diseases, blood diseases, dysentery, and diarrhea, ulcers diabetes, malaria, Epilepsy	0.94	0.91
Bauhinia vahlii	malu,	Fabaceae	climbing shrub	Seeds, leaves	Powder, decoction	Diabetes, tonic	0.11	0.07
Bombax ceiba	semal	Bombacaceae.	tree	Leaves, root bark	Extract, powder	Blood purification, Leucorrhoea skin blemish and pigmentation Wounds	0.87	0.71
Bridelia retusa	Kasi	Phyllanthaceae	tree	leaves fruits and seeds bark	Extract decoction	wound, urinary tract infection, dysentery, and diarrhoea. earache,	0.36	0.30

						indigestion snakebite		
Buchanania lanzan	Chironji	Anacardiaceae	tree	roots, leaves, seeds	Oil, powder	Diarrhea, coughs and asthma skin diseases	0.73	0.59
Butea monosperma	palas,	Fabaceae	tree.	flower	Infusion, juice	leprosy, gout, skin diseases inflammation, leucorrhoea eye diseases	0.92	0.86
Calamus tennis	cane palm plan	Arecaceae	shrub	young stems leaf	extracts	fevers, piles, bacterial infections, wounds diabetes inflammation	0.15	0.81
Callicarpa macrophylla	Priyangu	Verbenaceae	shrub,	Root, Bark, Leaves, Flowers, Fruits.	Extract , oil, decoction	tumour, diarrhoea, dysentery, diabetes, pneumonia , and rheumatic pain sores and gingivitis	0.20	0.13
Calotropis procera	Aak	Asclepiadaceae,	shrub	Whole plant, root	Latex, powder	fever, rheumatism, indigestion, cold, eczema and diarrhea. Boils, jaundice toothache	1.00	0.92
Carissa spinarum	Garna	Apocynaceae	shrub	roots and root bark, leaves, ripe or unripe, fruits, and stems and stem bark	Extract, decoction, raw	fever, jaundice, cardiac diseases, diabetes, malaria, pneumonia , chronic joint pain snake bites	0.28	0.15
Celtis tetrandra	Nilgiri elm,	Cannabaceae	Tree	seed	juice	indigestion	0.24	0.24
Clerodendrum viscosum	Bharangi	Verbenaceae	shrub	bark leaf	juice	cough and cold, itching, leprosy, scorpion sting	0.22	0.09
Colebrookea oppositifolia	Bhaman	Lamiaceae,	shrub	roots, leaves and stem	decoction and dry powder	headache, fever, dysentery, peptic ulcer, dermatitis, wounds, epilepsy	0.37	0.29
Cordia dichotoma	Leshora,	Boraginaceae	tree	Leaves and stem bark	Decoction paste	Common cold ,catarrh, cough, fever respiratory disease, leprosy	0.78	0.56
Curculigo orchioides	Kali Musli	Amaryllidaceae	herbs	rhizomes	Juice, powder	Arthritis immunomodulator jaundice, asthma ,cuts and wounds	0.41	0.29
Dalbergia sissoo	shisham	Fabaceae	tree	seed wood leaves	Oil powder	skin ailments and wounds	0.76	0.57
Demostachya bipinnata	Kusha	Poaceae	herb	Leaves and stem	Decoction	dysentery, diarrhoea, dysuria, skin diseases	0.63	0.50
Desmodium gangeticum	salparni.	Fabaceae	shrub,	Roots and whole plant	Extract, decoction	fever, respiratory problems, bronchitis, nervine tonic, vomiting,	0.48	0.30
Desmodium heterocarpon	Asian Tick Trefoil	Fabaceae	herb	whole plant	decoction	fever, strains	0.16	0.08
Desmodium latifolium	jagru	Fabaceae	Shrub	roots	raw	toothache	0.06	0.06

Desmodium pulchellum	Jatsalpan,	Fabaceae	Shrub	root	powder	abdominal and chest burning discomforts	0.16	0.13	
Dillenia pentagyna	Mota Karmal	Dilleniaceae	trees	Bark, leaf	Decoction, paste	body pain, diabetes, cut and wounds	0.41	0.24	
Diospyros tomentosa	Tendu	Ebenaceae	tree	Stem bark, seed	Paste, oil, decoction	Boils, diabetes, abscess	0.52	0.39	
Drypetes roxburghii	Jivputrak	Euphorbiaceae	tree	Fruit, leaves	Powder, decoction	Catarrh, fever, hemorrhoids, cold, fever, rheumatism, spermopoietic	0.56	0.48	
Ehretia laevis	Chamror	Boraginaceae	tree	leaves, stems barks, seeds	Paste, decoction	cuts and wounds, fractures, toothache, diabetes mellitus	0.34	0.24	
Ficus glomerata	gular	Moraceae	tree	Root bark, leaves, fruits	Powder, paste, decoction	antidiuretic, gynecological disorders, leprosy, leucorrhoea, burns, dry cough, bronchitis, piles	0.94	0.83	
Ficus ramphii	Kabaipipal	Moraceae	tree	Leaves, Bark	Juice	kill worms, asthma, snakebite,	0.38	0.32	
Ficus religiosa	pepal	Moraceae	tree	Bark, leaves	Juice, powder	antibacterial, skin diseases. antivenom activity, regulates the menstrual cycle, paralysis, bone fractures, cough, asthma, diarrhoea, ear pain, toothache	0.67	0.59	
Gmelina arborea	Gambhara,	Lamiaceae/ Verbenaceae	tree	Root, fruit, flower, leaves	Raw, powder, decoction	pulmonary and nervine tonic digestion, fever, thirst, heart diseases, nervous disorders, piles	0.31	0.24	
Garuga pinnata	Kharpat/ Ramasin	Burseraceae.	tree	Stem, leaves	juice	Opacity of conjunctiva, asthma	0.30	0.22	
Gloriosa superba	Kalihari	Liliaceae	herbaceous climber	Tuber root rhizome and seeds	Paste, powder	Arthritis, reduces pain, inflammation, ulcers, bleeding piles, skin diseases, leprosy, and snakebites	0.24	0.19	extinct ion
Glycosmis pentaphylla	Bannimbu	Rutaceae	shrub	leaves, stems, barks, fruits, and roots	Decoction, paste	cough, fever, bronchitis, inflammation, rheumatism, boils, eczema, fractures	0.33	0.20	
Grewia hirsute	Nagabala Kakarundah	Tiliaceae	Shrub	mucilage leaves, stems and roots	infusion or decoction poultice	diarrhoea and dysentery, wounds, cuts, ulcers, splenic enlargement, piles, rheumatism	0.38	0.31	
Grewia subinaequalis	Phalsa	Tiliaceae	shrub	unripe phalsa fruits leaves	raw	Inflammation, applied on skin eruptions	0.87	0.72	
Grewia tiliifolia	Dhaman	Tiliaceae/ malvaceae	tree	bark and roots	paste	fractures, diarrhoea wounds,	0.39	0.31	

						urinary infection and skin diseases.			
<i>Helicteres isora</i>	Marorphal	Sterculiaceae	tree	Root, Stem bark, fruit	Decoction	Diarrhea, dysentery, abdominal pain	0.31	0.26	
<i>Holarrhena antidysenterica</i>	Kutaj,	Apocynaceae	tree	Bark, Root, Seeds	Decoction	Gastric problems. Dysentery, diarrhea. anemia, epilepsy	0.36	0.27	
<i>Holoptelea integrifolia</i>	Chilbil,	Ulmaceae	tree,	leaves and stem bark	Decoction, paste	rheumatic swellings inflammation of lymph glands, leucoderma. wound healing	0.53	0.36	
<i>Hygroryza aristata</i>	Tini	Poaceae	herb	Leaves and seed	decoction	diuretic, diarrhea, fatigue, general weakness	0.90	0.88	
<i>Hymenodictyon spp.</i>	Bhurkur	Rubiaceae	tree	leaves	powder	Wound healing, anti-inflammatory	0.14	0.13	
<i>Indigofera cassioides</i>	Hakanu	Fabaceae	shrub	roots	decoction	coughs	0.11	0.06	
<i>Kydia clycina</i>	Pula	Malvaceae	tree	leaves	Paste, decoction, poultices	jaundice, skin diseases, wounds, cuts, and boils	0.28	0.15	
<i>Lagerstroemia parviflora</i>	Senia	Lythraceae	tree	leaves	decoction	coughs, fevers, asthma, and bronchitis	0.66	0.50	
<i>Lagerstroemia speciosa</i>	Jarul	Lythraceae	tree	Bark leaves	Decoction	fever, diabetes	0.59	0.48	
<i>Lannea cormendelica</i>	Mohin	Anacardiaceae	tree	Leaves, bark	Decoction, paste	swellings and body pains cuts, wounds, gout	0.54	0.36	
<i>Lantana camara</i>	Raimuniya	Verbenaceae	Shrub	leaves	Decoction	wound healing, fever, cough, malaria	0.52	0.39	
<i>Ichnocarpus frutescens</i>	Kali-dudhi	Apocynaceae	climbing shrub,	Roots, leaf	Decoction	blood purifier, jaundice, fever, gout, rheumatism, skin diseases	0.39	0.26	
<i>Madhuca indica</i>	Mahua	Sapotaceae	tree	Bark, leaves, flower, fruit, Seed	Raw, Decoction, paste, oil	fracture, swelling, itching, snake bite, wounds, leprosy, eczema, hemorrhoids, skin disease, headache, rheumatism	0.88	0.72	
<i>Mallotus philippensis</i>	kamala	euphorbiaceae	tree	fruits and glands	hairs powder	anthelmintic, ulcers and wounds scabies	0.41	0.28	endangered
<i>Milletia auriculata</i>	Garari	Fabaceae	Climbers	leaves, stem	Decoction	toothache	0.07	0.07	
<i>Moghania prostrate</i>	,	Fabaceae	Herb	roots	paste	rheumatism and associated inflammatory ailments	0.09	0.09	
<i>Murraya koenigii</i>	Katnims	Rutaceae	shrub	leaves	Decoction, raw, paste, oil	diabetes, skin inflammation strengthening the bones	0.62	0.49	

Ougeinia oojeinensis	Sandan	Fabaceae	tree	Stem bark	paste	cuts and wounds diarrhoea, dysentery, fever leucoderma	0.27	0.18
Pongamia pinnata	Karanj	Fabaceae	tree	Leaves, bark	Paste, decoction	piles, skin diseases, ulcers bronchitis, asthma	0.51	0.37
Pterocarpus marsupium	Bija	Fabaceae	tree	Bark leaves	Decoction, paste	Fractures, constipation, hemorrhages, cholera, neurological problems.	0.42	0.36
Rawolifia serpentine	Sarpagandha	Apocynaceae	shrub	Root, leaves	powder	Hypertension, anxiety, asthma headaches, snake bites	0.83	0.76
Sachrum munjha,	Sarkanda	Poaceae	herb	Root	Powder, decoction	dysuria, giddiness and vertigo, bleeding wounds	0.49	0.39
Sachrum spontaneum	Kasa	Poaceae	herb	Root	decoction	burning sensations, dyspepsia, urinary tract infection,	0.31	0.28
Schleichera oleosa	Kusum	Sapindaceae	tree	Leaves, bark	Juice, powder	Blood purification, skin disease	0.64	0.5
Semecarpus anacardium	Bhilwa	Anacardiaceae	tree	fruits, seeds	Oil, powder	Skin diseases, tumors, constipations, healing of wounds rheumatic disorders	0.37	0.24
Shorea robusta	Sal	Dipterocarpaceae	tree	leaves bark	Powder, extract, oleoresin	Inflammation, fever, wounds, ulcers, leprosy, cough, earache, burning of the eyes	1.13	0.91
Smilax macrophylla	catbriers,	SMILACACEAE	climber	Root, rhizome	Powder, extract	Syphilis, Gout, muscular sprain,	0.13	0.08
Stereospermum suaaveolens	Patala	Bignoniaceae	tree	Bark, root	Extract powder	fever, inflammation, and digestive problems	0.28	0.20
Streblus asper	khoi,	Moraceae	tree	Stem, leaves	Decoction, raw	leprosy, toothache, diarrhea, dysentery and cancer.	0.26	0.22
Syzygium cumini	Jamun	Myrtaceae	tree	Fruit,leave, seeds, stem bark	Raw, powder, decoction	cough, diabetes, dysentery, inflammation Bleeding gums wounds ulcers leucorrhea,	1.14	0.94
Tectona grandis teak		Lamiaceae	tree	Leaves, seeds, heartwood , bark	Decoction, paste, powder	piles, dysentery, leukoderma, anti- inflammatory, bronchitis, urinary and liver related troubles	0.79	0.60
Terminalia alatasaj		Combretaceae	tree	bark	Juice, powder	Diarrhea, cuts and wounds	0.62	0.48
Terminalia arjuna	Arjuna	Combretaceae	tree	Stem bark	Powder, decoction	cardiotonic in heart failure,	0.67	0.56

						ischemic, cardiomyopathy, fractures, ulcers, hepatic		
Terminalia bellirica	Behera	Combretaceae	tree	unripe fruit	powder	hepatitis, bronchitis, piles, diarrhea, coughs, eye diseases	0.84	0.74
Terminalia chebula	Harard	Combretaceae	tree	unripe fruit	Decoction, powder	vomiting, dysentery and diarrhea, gout and joints pain, wound	0.86	0.71
Terminalia tomentosa	Saja	Combretaceae	tree	bark	Decoction, paste	ulcers, fractures, bronchitis, and diarrhea	0.50	0.44
Tiliacora acuminata	Bagmushda.	Menispermaceae	lianas	Leaves, bark, and flowers	Decoction, extract, paste	wounds, snake bites, skin infections, jaundice, piles, ulcer, diabetes	0.31	0.19
Tinospora cordifolia	giloy	Menispermaceae	climbing shrubs	Stem, leaves	Decoction, juice	Dengue Fever, diabetes, upset stomach,	0.86	0.65
Toona ciliata	tuni	Meliaceae	tree	Bark, gum	powder	dysentery and wounds, boils	0.28	0.24
Trewia nudiflora	Gutel,	Euphorbiaceae	tree	root	Poultice, decoction	gout and rheumatism, swellings	0.45	0.24
Triumfetta pentandra	fivestamen burbark	Malvaceae	herb	root	poultice	Sores, small wounds	0.13	0.10
Triumfetta rhomboidea	Paroquet Bur	Malvaceae	shrub	Root, leaves	decoction	diarrhoea, dysentery, internal haemorrhages leprosy	0.25	0.16
Typha elephantina	Elephant grass,	Typhaceae	herb	Flower, rhizome leaves	Paste, decoction extract	boils, wounds, burns Leprosy, diuretic	0.79	0.67
Vetiveria zizanioides	khus	Poaceae	herb	root	Powder, decoction, oil	Blood purifier, digestive problem, cough, asthma, vertigo, skin problem	0.88	0.68
Ziziphus mauritina	Indian jujube	Rhamnaceae	shrub	Leaves, root ,seed	Paste, extract, decoction	fever, asthma, depression anxiety, wound healer	0.31	0.24

In this study, most informants were aged between 36 and 75 years (71%), with only (29%) of the remainder aged below 36 years. The informants' ability to mention more medicinal plant species also varied according to their age. Informants above the age of 35 could mention and identify more medicinal plants during this study than those 40 years and below.

#### DISCUSSION

Traditional healers typically prefer to impart their knowledge of native medicinal plants to other men, which may account for the high proportion of male informants in the research area. Similarly, other studies show that males constituted the majority while females were in the minority. Variations in the knowledge of medicinal plants among different age and gender classes have been widely reported in several studies (Laldingliani et al 2022). There is no significant difference among people of different educational levels in the use of herbal medicine.

As reported in previous work, key informants were predictably more knowledgeable than general informants (Giday et al 2009). Their extensive experience may explain this and extreme

discretion when employing therapeutic plants. The plant families with the most medicinal plants in the study were Fabaceae, Poaceae, Combretaceae, Moraceae, Euphorbiaceae, and Apocynaceae. Other studies have reported the broader use of medicinal plant species in the above families in herbal medicines.

The use of woody tree species as significant sources of herbal medicines has been widely reported in previous ethnobotanical studies. Similarly, our study found that shrubs were the bulk sources of herbal medicines in the area. The high uses of these plant species in herbal medicine could be attributed to their abundance in the area and probably the season in which the study was conducted.

Some ethnobotanical studies have recorded plant leaves as the dominant plant organs in herbal medicine preparations. In this study, leaves were the dominant plant organs used in the preparation. This has also been reported due to the high concentration of bioactive compounds and their fast regeneration abilities. The high use of leaves in the current study can be attributed to the fact that they are the primary photosynthetic organs of plants that can easily be harvested and processed into herbal medicine because they are readily available.

According to the informants, decoction is the most typical preparation mode for most herbal medicines, followed by powder and paste. Some recent studies have also indicated that decoction is the most typical mode of preparation for herbal medicines. The most common modes of administration for most herbal products are oral and topical. In this study, we found that the most common modes of administration of herbal medicines were oral and topical. Among the 16 clusters of diseases identified in this study, digestive system disorders recorded the highest Informant Consensus Factor (ICF) value of 0.95. This indicates that there was a strong agreement among the informants on the use of plant species for treating diseases belonging to the digestive system disorder. Similarly, the above findings in this study are closely related to previous studies in ethnobotany whereby the digestive system disorders recorded the highest ICF values among the informants.

Most of the human population here is reportedly below the poverty line with small land holdings. Due to floods and drought, the district always faces famine-like situations (Management Plan of Sohagi Barwa Wildlife Sanctuary 2010-11 to 2019-20). Hence, this forest's major management conservation concerns include illicit felling, grazing, and increasing pressure from cultivators living in and around the area. SBWS has seven forest ranges: Pakdi, Madhwaliya, Laxmipur, North Chouk, South Chouk, Sheopur, and Nichloul, with 21 grasslands. These seven ranges comprise 39,220.10 ha area and another 3,600 ha of agricultural land in the Sanctuary.

In this study, most informants were aged between 36 and 75 years (71%), with only (29%) of the remainder aged below 36 years. The informants' ability to mention more medicinal plant species also varied according to their age. Informants above 35 could mention and identify more medicinal plants during this study than those 40 years and below. This is because the older generation may know more about medicinal plants than the younger generation. Many medicinal plants grow wild and are susceptible to habitat destruction. Creating protected areas and promoting sustainable harvesting practices are crucial. Cultivating these plants can also ensure a steady supply and reduce pressure on wild populations.

Preserving medicinal plants has numerous benefits. They provide affordable healthcare options, particularly in regions with limited access to modern medicine. Furthermore, these plants can serve as a source of new drugs, potentially leading to breakthroughs in treating various ailments. In conclusion, medicinal plants represent a treasure trove of natural remedies. By documenting and preserving them, we safeguard this vital resource for future generations. This collaborative effort between indigenous communities, scientists, and conservationists can unlock nature's pharmacy and ensure a healthier future for all.

In the future, empowered by medicinal plant knowledge, we might see personalized plant-based medicine suitable for our unique genetic makeup. Traditional medicine has a vast amount of untapped knowledge. Advanced cultivation techniques combined with genetic analysis of medicinal plants could unlock their potential for tissue regeneration and disease reversal. By preserving this

"treasure trove" of natural remedies, a bright future for humanity is possible where healthcare is not just affordable and accessible but personalized and transformative.

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