A comprehensive study of ethnomedicinal plants of Thein Conservation Reserve, Jammu & Kashmir, India, used by local communities

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Research

Abstract

Background: Plants have been integral to human healthcare since antiquity, functioning as the primary source of therapeutically active substances employed in both traditional and contemporary medicine. Nearly 85% of the global population relies on traditional plant-based remedies, valued for their safety and cost-effectiveness. This study constitutes the first ethnobotanical survey of Thein Conservation Reserve, District Kathua, Jammu and Kashmir (J&K), India. It aims to systematically document the ethnomedicinal repertoire of local communities, particularly the Gujjar, Bakarwal, and Dogra communities.

Methods: Data were elicited from 293 informants (171 men, 122 women, aged 22-94 years) through semi-structured interviews. Quantitative ethnobotanical metrics, such as Fidelity Level (FL), Use Value (UV), and Informant Consensus Factor (FIC), were employed to evaluate the medicinal importance of plants.

Results: A total of 91 plant species from 51 families and 85 genera were catalogued. Fabaceae was the most frequently cited family, followed by Asteraceae, Moraceae, and Euphorbiaceae. Leaves emerged as the predominantly utilized plant part (38%), with oral administration being the predominant mode. A total of 76 species (83.51%) were obtained from wild sources, whereas 15 species (16.48%) were collected from both wild and cultivated environments. *Justicia adhatoda* L. exhibited the highest UV (3.06), followed by *Azadirachta indica* A. Juss. (2.20). The highest FIC was observed for gastrointestinal ailments (FIC = 0.89). Some community-level variation in ethnomedicinal knowledge and plant-use practices was observed between the semi-nomadic and sedentary groups.

Conclusions: The study highlights extensive ethnomedicinal knowledge within local communities, suggesting possible knowledge transmission and therapeutic correlations. These findings accentuate the need for pharmacological validation and the conservation of indigenous medicinal practices.

Keywords: Ethnobotany, Thein Conservation Reserve, Dogra, Gujjar, Bakarwal, Medicinal plant.

Background

Traditional knowledge constitutes the cornerstone of all ethnobotanical research. The use of plants for medicinal purposes by humans can be traced back to early civilizations, reflecting a deep-rooted coevolutionary relationship. Despite advances in modern medicine, traditional plant-based remedies remain indispensable to global healthcare systems, with nearly 85% of people worldwide relying on them (Hart 2024). India represents one of the world's megadiverse biogeographical regions, harboring a remarkable wealth of medicinal plant resources (Bouyahya *et al.* 2017, Gowthami *et al*. 2021). Approximately 85% of traditional healthcare remedies are obtained from medicinal plant sources (Qadir & Raja 2021). A substantial proportion of recommended medications incorporate active components obtained directly from plants, and some of these are sold directly as natural products (Nasim *et al.* 2022).

Traditional medical systems are gaining renewed prominence due to their comparatively few adverse effects and greater affordability for large segments of low-income populations. In many developing nations, including Myanmar, Bangladesh, India, Sri Lanka, Nepal, and Indonesia, rural communities rely profoundly and persistently on these systems (Jeelani *et al.* 2018, Bodeker & Graz 2020). The global medicinal plants and phytotherapeutic products market is valued at approximately $85 billion annually (Singh & Kumar 2021), with India accounting for nearly $1 billion (Joshi *et al.* 2009). According to the WHO, the requirement for the supply of plant-derived raw materials is expanding at a rate of 15 to 25% annually and is predicted to exceed $5 trillion by 2050 (Parvin *et al.* 2023). This escalating global demand for herbal medicines underscores the concomitant necessity to have a consistent supply of high-quality medicinal herbs containing active ingredients at pharmacologically relevant concentrations (Saggar *et al.* 2022).

The synthesis of complicated naturally derived substances via synthetic chemistry remains economically prohibitive (Maier 2015). As a result, plants remain the primary sustainable reservoir of many medicinally essential secondary metabolites. Moreover, indigenous medicinal plant knowledge can aid ecologists, pharmacologists, taxonomists, and wildlife managers in strengthening regional bioeconomics (Ibrar *et al.* 2007). Ethnobotanical surveys have gained increasing scientific traction during the last century, and such documentation plays an essential role in the conservation-oriented management and sustainable exploitation of biological resources (Panigrahi *et al.* 2021, Nargawe *et al.* 2023).

India is widely acknowledged to possess a vast and irreplaceable repository of traditional knowledge accumulated through centuries of cultural and intellectual heritage. Its indigenous traditional healing systems, including Ayurvedic, Greco-Arabic, and Siddha (Gadgil 1996, Silambarasan *et al.* 2017), have made significant contributions in herbal medicine, especially within the past two decades (Gibji *et al.* 2012, Jan *et al.* 2021). J&K exhibits exceptional floristic diversity, with its inhabitants holding rich and nuanced ethnobotanical knowledge of indigenous flora (Jee 2020, Dar & Khuroo 2020). Thein Conservation Reserve is geographically situated within the highland district of Kathua in J&K, where plant species have historically profound ethnomedicinal significance. The majority of the inhabitants of this area live in villages, and it is inhabited by numerous ethnic groups like Gujjars, Bakarwal, and shepherds, each possessing distinct knowledge of conventional herbal medicine that they have inherited from their forefathers (Bhatia *et al.* 2014, Mir *et al.* 2021). Since generations have witnessed their efficacy in treating a wide range of ailments, these medications are well-accepted by the local population. In contrast to the nomadic populace, the sedentary inhabitants of this region have developed localized ethnomedical practices, employing readily accessible plant species and derivatives for the treatment of ailments. The traditional learning is passed from one lineage to the next, yet remains largely confined to village settings, making such regions valuable repositories for ethnobotanical exploration (Bhushan & Kumar 2013, Kumar *et al.* 2021). Because of rising adverse drug reaction rates, the financial burden of modern medicine, and the imminent erosion of traditional knowledge systems have drawn increasing attention from the researchers, policy stakeholders, and the general public (Ramirez 2007). Therefore, systematic documentation of this knowledge is crucial to validate traditional claims; the preservation of such data will support future pharmacological investigations and reinforce conservation strategies for medicinal plants (Bunalema *et al.* 2014).

The global herbal medicine market is expanding rapidly, with India’s market growing at an annual rate of 7.4% (Kaundal & Kumar 2025). However, this growing demand has led to intensified wild plant collection, often through destructive methods such as uprooting and bark stripping, thereby threatening the long-term availability of key medicinal taxa. Understanding how local practices intersect with broader market pressures is thus critical to balancing traditional health care with conservation priorities. This rising demand underscores the need for localized ethnobotanical studies. In the Thein Conservation Reserve, such variation remains undocumented, particularly regarding how Gujjar, Bakarwal (semi-nomadic), and Dogra (sedentary) communities differ in their ethnomedicinal knowledge and practices. Their traditional knowledge plays an important role in safeguarding and regenerating medicinal plant populations within natural habitats. Recent Himalayan ethnobotanical studies have extensively documented medicinal plant diversity and the socio-ecological factors

influencing rural reliance on traditional phytotherapy (Balkrishna *et al.* 2024, Manzoor 2024, Singh *et al.* 2025, Mansoor *et al.* 2025, Prakash & Samant 2026). However, current literature is largely dominated by broad regional inventories and single-community assessments.

A critical gap remains regarding protected ecosystems, specifically the ecologically significant Thein Conservation Reserve. Notably, the ethnomedicinal knowledge within this landscape remains undocumented. Therefore, investigating this area becomes crucial to catalogue its unique ethnomedicinal resources. Accordingly, this study aims to bridge existing research gaps by documenting the ethnomedicinal knowledge of local communities in the Thein Conservation Reserve, thereby fostering the sustainable use and conservation of medicinal plant diversity.

Materials and Methods

Study area

The present ethnobotanical investigation was carried out in the Thein Conservation Reserve, located in the Jammu region of J&K, India. It is situated along the Himalayan foothills and distinguished by undulating mountainous terrain and a predominantly temperate climatic regime.

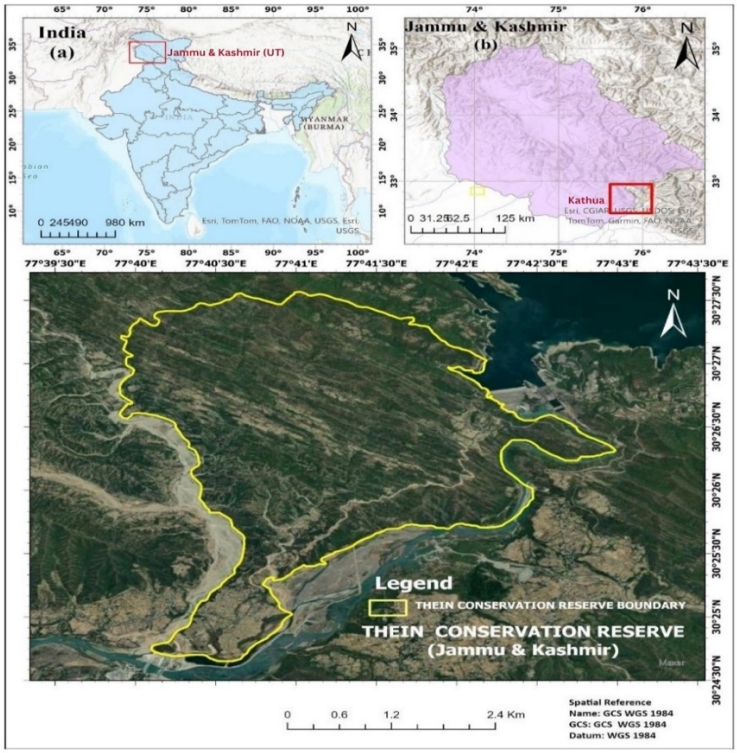


Figure 1. Map depicting the Study Area (generated using ArcGIS)

The area is geographically demarcated by distinct natural boundaries, bounded by the Ravi River to the southeast, Badiari Ki-Dhar to the northeast, Sukal Khad to the southwest, and Tikkar Nallah to the northwest, and covering a total area of 18.90 km^2. It is situated between latitudes 32°28'1"N to 32°24'6"N and longitudes 75°40'3"E to 75°44'7"E (Fig 1). From an administrative standpoint, the reserve incorporates six compartments (10, 11, 12, 13, 14, and 16/KTH) within the demarcated forest areas of Kathua forest division. The area experiences a mean annual temperature ranging from 25°C to 34.5°C.

Survey and Data Collection

An intensive survey was carried out in the reserve from February 2023 to February 2024 to collate a comprehensive inventory of ethnobotanical resources utilized by indigenous inhabitants of the research area. Informants were selected based on predefined inclusion criteria, including individuals aged 22 years and above, who had resided in the study area for at least five years and were willing to participate in the study. For key informants, more stringent criteria were applied, requiring a minimum of 10 years of practice and residence in the study area for more than 30 years. Key informants were stratified through snowball sampling, starting with expert practitioners who referred additional participants. Before gathering any data, participants were briefed with detailed information regarding the study objectives, the discretionary nature of their participation, and that they could withdraw at any point without any consequences. Informed consent was obtained from all participants before enrollment, with written consent from literate individuals and verbal corroboration or thumb

impressions from those with limited literacy, witnessed locally. Participant anonymity was strictly maintained, and data were used solely for academic and research purposes. Semi-structured interviews and group discussions were conducted to gather data on the traditional medicinal uses of plant species. For each documented species, the questionnaire recorded its habit, local name, utilized plant part(s), ethnomedicinal uses, preparation techniques, and modes of administration. To facilitate effective communication, interviews as well as discussions were conducted in Hindi or Dogri for their convenience. The authors possess proficiency in these local languages, which enabled precise documentation and reliable interpretation of the ethnomedicinal information collected. The medicinal plants knowledge was systematically gathered from the Gujjar and Bakarwal tribes, as well as the Dogra communities residing in the peripheral zones of the reserve.

Traditional healers and knowledgeable elders from these communities frequently acted as key informants and guides, facilitating the in-situ identification of therapeutic plants. Initial identification of plant species was conducted in the field. When accurate identification was not feasible on-site, specimens were collected and subsequently authenticated in the research laboratory using regional and standard floras as taxonomic references (Kapur & Sarin 1984, Chopra & Vishwakarma 2018). Scientific names were verified using the WFO Plant List (https://wfoplantlist.org/). Specimens of the recorded plant species were collected and deposited in the herbarium, Department of Botany, Central University of Jammu, J&K.

Data analysis

The data was analyzed in Microsoft Office 2013. All the graphical illustrations were done in R software (version 4.2.0) using different packages (plotly, ggplot2, and patchwork, etc.). Additionally, the map of the study area was plotted using ArcGIS.

Use value (UV)

The UV index was employed to quantify the relative significance of individual plant species as perceived and utilized by the participants within the surveyed area. Following the approach outlined by Gazzaneo *et al.* (2005), the UV for each species was determined using the formula presented below:

$$UV = \Sigma\frac{U}{n}$$

where UV represents the use value of a specific plant species, U indicates the total number of usage reports recorded for a given species across all informants, and n denotes the total number of informants consulted. The UV metric serves as a quantitative measure to identify plant species that are commonly employed for specific medicinal or other applications within the community. A high UV value reflects that the plant is frequently referenced and utilized by a large proportion of the respondents, suggesting a greater cultural and practical significance. Conversely, a low UV value suggests limited reported use of the species among the surveyed population.

Informant consensus factor (FIC)

To assess the degree of agreement among respondents concerning the utilization of a specific plant, the FIC was employed. Following the methodology outlined by Heinrich *et al.* (1998), the FIC was determined using the formula presented below:

$$FIC = (N_{ur} - N_t) / (N_{ur} - 1)$$

where N_{ur} represents the count of usage citation for a distinct ailment category, while N_t denotes the number of taxa employed for that category by all respondents. A noteworthy FIC value suggests that a particular taxon is utilized for the same ailment by relatively substantial cohorts of respondents. Conversely, a low FIC value suggests less agreement and potentially a more diverse or less defined use of plants for that category.

Fidelity level (FL)

The FL serves as a metric to select plant species cited most frequently by informants for the alleviation of specific health issues within the study site. Following the methodology stated by Friedman *et al.* (1986), the FL was determined using the formula:

$$FL\ (\%) = \frac{Np}{N} \times 100$$

Here, (N_P) represents the total reports mentioning the usage of a particular species for a distinct ailment category, while (N) denotes the overall count of use reports for that specific ailment category across all plant species mentioned by informants. A higher value of FL (100%) suggests that a particular plant species is predominantly used for a specific ailment, suggesting a specialized application recognized by the community, whereas a lower FL value suggests that the plant species is utilized for a wider spectrum of health issues.

Relative frequency of citation (RFC)

The RFC serves as a metric to assess the prominence of individual plant species in the ethnomedicinal practices of indigenous healers for the treatment of various diseases. Following the methodology outlined by Vitalini *et al*. (2013), the RFC was determined using the formula presented below:

$$RFC = \frac{FC}{N}$$

where FC represents the citation frequency, defined as the number of informants referencing the use of a particular plant species, and N represents the overall number of informants surveyed. The RFC value provides a numerical assessment of the significance of each plant species, with higher values indicating greater recognition and utilization among the community of healers.

Multi-health analysis ranking

To evaluate the relative importance of different health conditions within the community, a multi-health analysis ranking was performed. Unlike species-specific indices (UV and RFC), this approach prioritized treatable disorders by aggregating three key variables: N_{ur}, N_t, and FIC. A high ranking indicates that the ailment is widely prevalent within the community (Susanti *et al.* 2023), shows strong consensus among informants, and is treated using well-established and reliable ethnomedicinal practices.

Results

Profile of the informants

A sum of 293 individuals (171 men and 122 women), aged between 22 and 94 years (Table 1), were interviewed using a semi-structured questionnaire to gather ethnomedicinal data. The literacy rates among the informants varied by gender, with 7.02% of male participants and 18.03% of female participants lacking formal education. The relatively lower representation of female informants, which was 16.72% lower than that of male informants, may be attributed to entrenched socio-cultural constraints that may limit women's mobility and interaction with unfamiliar researchers outside their domestic sphere.

Table 1. Informants' profile of the respondents includes male and female percentages, age profile (22-94 years), and education level (illiterate to post-graduate).

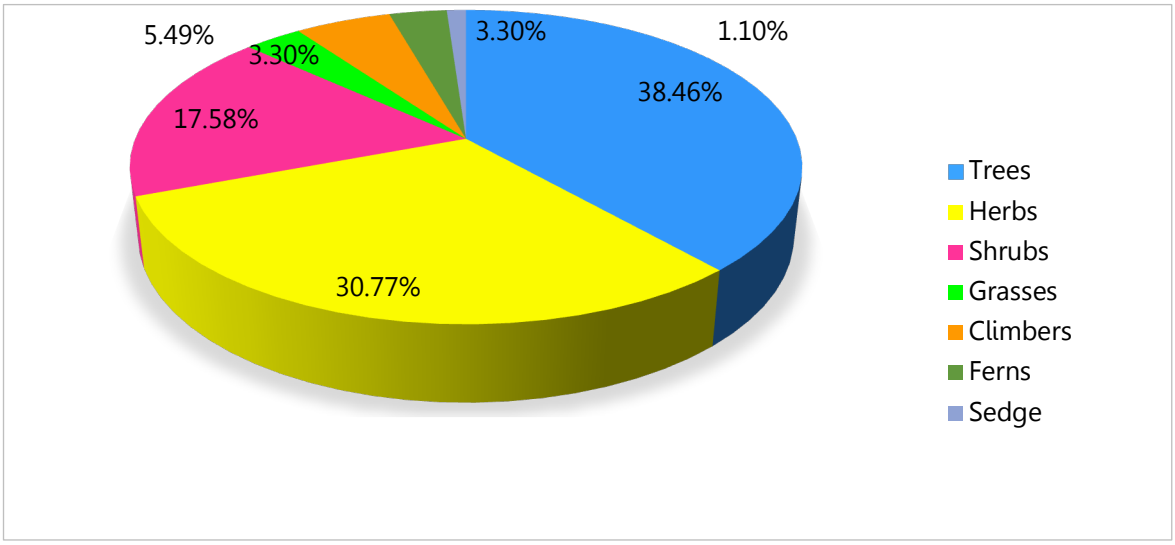
Informants	**Male**	**Female**
	171 (58.36%)	122 (41.64%)
Age class	**Male**	**Female**
22-30	12 (7.02%)	11 (9.02%)
31-40	61 (35.67%)	28 (22.95%)
41-50	46 (26.90%)	39 (31.97%)
51-60	12 (7.02%)	16 (13.11%)
61-70	17 (9.94%)	11 (9.02%)
71-80	07 (4.09%)	10 (8.20%)
81-90	11 (6.43 %)	6 (4.92%)
91-94	05 (2.92%)	-
Education level	**Male**	**Female**
Illiterate	12 (7.02%)	22 (18.03%)
1-5 classes	43 (25.15%)	50 (40.98%)
6-10 classes	59 (34.50%)	28 (22.95%)
11-12 classes	36 (21.05%)	17 (13.93%)
Graduate	14 (8.19%)	-
Post-graduate	07 (4.09%)	5 (4.09%)

The majority of informants belonged to the Gujjar, Bakarwal, and Dogra communities residing in the periphery of the reserve. Among the participants, the most experienced traditional healer was an 81-year-old male from the village Kasori, who shared nearly 50 years of his experience of treating ailments. In contrast, the youngest practitioner was a 42-year-old female with approximately 7 years of experience in traditional healing.

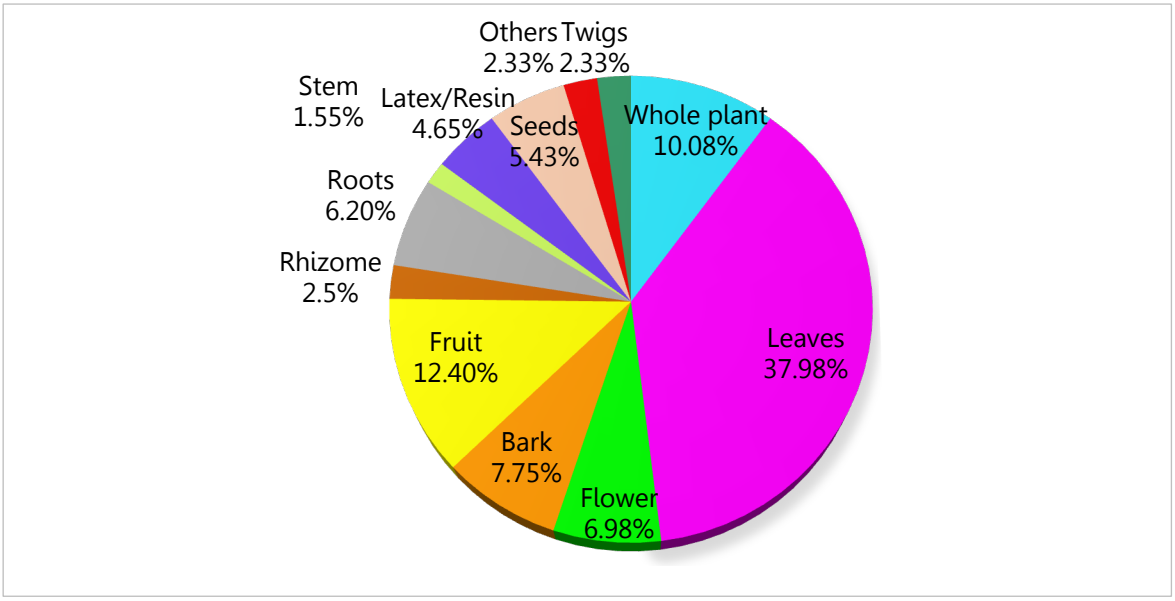
Floristic description

A sum of 91 plant species, classified under 85 genera and 51 families, were identified by the informants for ethnopharmacological applications (Table 2). Among the recorded families, the most abundant was Fabaceae (10 genera, 11

species), followed by Asteraceae (6 genera, 6 species), Moraceae (2 genera, 5 species), and Euphorbiaceae (3 genera, 4 species). The documented medicinal plants exhibited a variety of life forms, with trees constituting the largest proportion (38.46%), followed by herbs (30.7%) and shrubs (17.58%) (Fig. 2A). The primary plant parts utilized were leaves (37.98%), fruits (12.40%), whole plant (10.08%), and bark (7.75%) (Fig. 2B). Approximately 18% of plant material was collected through destructive and unscientific harvesting practices. Local inhabitants typically collected ethnomedicinal plants primarily from nearby wild habitats, especially within the Thein Conservation Reserve (approximately 83.51%).



(A)



(B)

Figure 2. (A) Distribution of plant life forms (%), (B) Percentage of plant parts used in medicinal formulations (%)

Table 2. Details of ethnomedicinal plants used by local communities of Thein Conservation Reserve.

Botanical name	Local name	Habit	Family	Plant parts used	Ailment Treated with Mode and method of administration	*N*	*UV*
Achyranthes aspera Linn.	Pudkanda	Herb	Acyranthaceae	Whole plant	• Cotton soaked in the extract of leaves is used to treat toothache. • Roots are used to treat fevers. If fever is high enough, the roots are tied to the foot's artery. • Coughs and throat irritations are treated with roasted seed powder combined with honey. • Spike paste is used externally over skin for scorpion sting to reduce pain and inflammation.	13	0.46
Adiantum capillus-veneris L.	Dhumtuli	Fern	Pteridaceae	Leaves, rhizomes	• Rhizome paste combined with curd is administered on herpes. • Leaves are used for dissolving stones in the bladder and kidneys. • An aqueous decoction of the leaves is utilized as an antipyretic agent to manage elevated body temperature.	23	0.13
Aegle marmelos (L.) Corrêa	Bill	Tree	Rutaceae	Fruit, leaves, Stem	• A drink prepared with leaf powder is used to treat night blindness. • *Aegle* leaves, as well as guava and jamun leaves, are beneficial in the treatment of diabetes. • Drinking fruit pulp can help regulate body temperature. • The stem is hollowed to hold water. This water is good for stomach issues.	29	0.06
Ageratum conyzoides L.	Pootana jadii	Herb	Asteraceae	Leaves	• To stop bleeding, leaf extract is applied to a cut or wound.	10	1.3
Ajuga integrifolia Buch.-Ham. ex D.Don	Neelkanthi	Herb	Lamiaceae	Leaves	• Leaf extract is used orally to alleviate spasms and dysentery. • To get rid of lice, a decoction of the plant as a whole is utilized to wash hair.	25	0.12
Albizia chinensis (Osbeck) Merr.	Narsini	Tree	Fabaceae	Bark	• Paste of bark is applied orally to reduce inflammation.	15	0.06
Albizia lebbeck (L.) Benth	Sirein	Tree	Fabaceae	Bark	• To treat impotency, dried powder of bark with water is taken.	15	0.13
Amaranthus spinosus L.	Chaleri	Herb	Amaranthaceae	Leaves	• For laxative qualities, the leaves are consumed as a vegetable.	5	0.2
Amaranthus viridis L.	Chaleri Saag	Herb	Amaranthaceae	Seeds	• It has cancer-curing properties. • Boiling *Amaranthus* seeds produces a drink that can treat diabetes.	23	0.08
Argemone mexicana L.	Pili kandiari	Herb	Papaveraceae	Leaves	• Ringworm is treated externally using leaf extract.	8	0.12
Azadirachta indica A. Juss.	Nim, Neem	Tree	Meliaceae	Leaves	• The leaves are utilized to alleviate stomach problems and also used as an insect repellant for woollen clothing. • Leaf juice is utilized to cure skin problems.	15	2.2
Bauhinia variegata L.	Karal	Tree	Caesalpinaceae	Leaves, flower	• Flower buds are used as a vegetable or used to make pickle from them. • The separations are taken on a regular basis to cure dysentery, diarrhea, and piles. • For rapid bone binding, leaves are wrapped over the shattered arm or leg.	10	1.6

Berberis lycium Royle	Kaimbloo	Shrub	Berberidaceae	Roots	• Oral administration of aqueous leaf extract is utilized to release kidney stones.	6	0.16
Bombax ceiba L.	Simbbal	Tree	Bombacaceae	Fruit, bark roots	• Diarrhoea is treated with root decoction. • The gelatinous bark is mixed with water and topically applied to cuts and wounds to reduce blood flow and aid healing. • Decoction is utilized to treat bladder and kidney ulcers.	15	0.4
Butea monosperma (Lam.) Kuntze	Plah	Tree	Fabaceae	Flower	• Flowers are used as medication to relieve gastrointestinal blockages such as constipation.	10	0.2
Calotropis procera (Aiton) Dryand.	Desi aak	Herb	Ascelpiadaceae	Roots, leaves	• The smoke produced by the burning of leaves is breathed to treat cough and asthma. • A charcoal paste made from its roots is combined with oil of mustard seed and administered topically to skin disorders.	8	0.37
Cannabis sativa L.	Bhang	Herb	Cannabaceae	Leaves	• Smoking the leaves of Bhang induces a calming effect.	18	1.16
Capsella bursa-pastoris Medik.	Kralmund	Herb	Brassicaceae	Whole plant	• Bloody urination and diarrhoea are treated with a decoction of the whole plant.	9	0.11
Carissa spinarum L.	Gharna	Shrub	Apocynaceae	Latex, leaves	• Species' leaves, together with those of *Dalbergia sissoo*, are used to treat pneumonia. • Orally, a combination crushed leaves and curd is used against herpes. • Plant latex is used to treat abscesses. • Leaves are boiled in water and the infusion is administered orally to treat coughs.	11	0.45
Cassia fistula L.	Kranjal	Tree	Fabaceae	Leaves, flower	• As an aperient, seed decoction is employed.	6	0.16
Centella asiatica (L.) Urb.	Brahmi	Herb	Apiaceae	Leaves	• Decoction prepared using leaves is taken orally, as a brain tonic to improve memory.	10	0.1
Cissampelos pareira L.	Lal dodu	Climber	Menispermaceae	Roots, Bark	• To reduce inflammation, decoctions made from roots or stem bark taken orally, or apply a poultice made from crushed leaves to the affected areas.	26	0.11

Colebrookea oppositifolia Sm.	Duss	Shrub	Lamiaceae	Leaves	• Leaves are tied on head to ease headache. • The leaves are utilized to heal wounds and bruises. • Fish poison is made from leaf extract.	20	1.35
Commelina benghalensis L.	Churra	Herb	Commelinaceae	Whole plant	• Extract of entire plant is employed as an aperient and a refrigerant.	4	0.25
Cordia myxa L.	Lasuda	Tree	Boraginaceae	Leaves, bark, fruit	• Decoction is used to treat coughs and colds. • Dyspepsia and fever can be treated with a bark decoction.	33	0.27
Cynodon dactylon (L.) Pers.	Dhrub	Grass	Poaceae	Roots	• The root infusion is employed for curing piles. • Plant juice is administered on cuts.	26	0.15
Cyperus rotundus L.	Dhila gha	Sedge	Cyperaceae	Rhizome	• The root infusion is an excellent antidote to all toxins.	18	0.05
Dalbergia sissoo Roxb. ex DC.	Talli	Tree	Fabaceae	Leaves	• Menstrual problems are treated using a decoction of the leaves.	21	0.04
Datura stramonium L.	Dhatura	Herb	Solanaceae	Seeds, leaves	• Paste of leaf is used orally as an antidote of venom and styptic against bug bites.	25	0.16
Debregeasia saeneb (Forssk.) Hepper & J.R.I.Wood	Sanssaru	Shrub	Urticaceae	Young shoots	• To treat otalgia, twig juice is used as an ear drop.	36	0.02
Dendrocalamus strictus (Roxb.) Nees	Baans	Grass	Poaceae	Twigs	• Delicate branches are used as a tonic and to treat calcium deficiencies.	20	0.15
Digera muricata (L.) Mart.	Kunera	Herb	Amaranthaceae	Flowers, seeds, leaves	• Acts as astringent when applied topically over skin. • Used to treat problems in urinary discharges.	7	0.71
Dioscorea deltoidea Wall. Ex Griseb.	Kins	Climber	Dioscoreaceae	Tubers	• Root tubers extract is administered to cure roundworm. • It's also used to treat constipation. To kill lice, tuber extract is utilized.	13	0.30
Dodonaea viscosa Jacq.	Mahendu	Shrub	Sapindaceae	Leaves, twigs	• The leaves are woven together and used to wounds, burns, and swellings.	18	0.05
Eleusine indica (L.) Gaertn.	Panja gha	Grass	Poaceae	Whole plant	• Used to reduce fever, treat convulsions and liver problems.	25	0.04
Eucalyptus globulus Labill.	Safeda	Tree	Myrtaceae	Leaves	• To cure nasal blockage, leaves undergo boiling and the resulting vapours are breathed while covered in a blanket.	30	1.06
Euphorbia hirta L.	Dudli	Herb	Euphorbiaceae	Latex, whole plant, inflorescence	• To treat piles, the plant's inflorescence is eaten uncooked combined with *Piper nigrum*. • The latex is employed to cure styes on the eyelids. • To treat piles, a paste of whole plant and *Piper nigrum* seeds is mixed with water.	16	1
Euphorbia royleana Boiss.	Thor	Shrub	Euphorbiaceae	Stem	• It is used to treat wounds.	9	0.22

Ficus benghalensis L.	Badh	Tree	Moraceae	Latex	• Its latex is utilized to evacuate thorns that have been broken down within the body.	43	1.34
Ficus palmata Forssk.	Phagura	Tree	Moraceae	Fruit	• The fruit has purgative properties and is used to treat constipation.	35	0.94
Ficus racemosa L.	Rumbal	Tree	Moraceae	Latex, fruit	• Fruit is consumed raw to treat renal issues, coughing, and loss of voice.	35	1.08
Ficus religiosa L.	Peepal	Tree	Moraceae	Leaves	• To cure piles, freshly sprouting leaves are mashed with *P. nigrum* seeds and administered with water.	30	0.6
Grewia optiva J.R. Drumm. ex Burret	Taman	Tree	Tiliaceae	Seeds, leaves	• The leaves are excellent source of galactagogue for cattles. • Animals are fed a paste made of seeds and leaves following delivery to help them to overcome asthenia.	23	0.21
Ipomoea carnea Jacq.	Billaeti aak	Climber	Convolvulaceae	Leaves	• To ease pain, leaves placed in heated mustard oil are applied to abscesses and joints.	42	2.07
Justicia adhatoda L.	Branker, basuti	Shrub	Acanthaceae	Roots, leaves	• Leaf extract shows insecticidal properties. • Roots and leaves are used to treat asthma, cough, and chronic bronchitis. • Topical placement of leaves on the forehead is employed for headache relief. • Young shoots are high in Fe and protein.	45	3.06
Lannea coromandelica (Houtt.) Merr.	Kaembal	Tree	Anacardiaceae	Bark	• Bark is used as an ointment for rashes and ulcers, and an extract of the bark is used to cure toothaches.	19	0.31
Lantana camara L.	Panjfulli jadii	Shrub	Verbenaceae	Latex	• Latex is used to encourage hair development at the location of alopecia.	27	0.11
Lysimachia arvensis (L.) U.Manns & Anderb.	Kokoon	Herb	Primulaceae	Whole plant	• Hair lice are controlled by applying leaf extract to the scalp. • Gout and dermatitis are treated with a plant extract combined with a few drops of mustard oil.	15	0.26
Mallotus philippensis (Lam.) Müll.Arg.	Kamela	Tree	Euphorbiaceae	Fruit	• Fruits are consumed to kill stomach worms.	6	0.16
Mangifera indica L.	Aamb, aam	Tree	Anacardiaceae	Fruit, leaves	• Finely crushed unripe fruits are given to animals to help them detoxify the effects of ingesting noxious weeds. • To treat dysentery, young leaves are crushed and administered orally.	45	1.04
Melia azedarach L.	Daraink	Tree	Meliaceae	Leaves, bark	• The bark decoction cleanses the skin to treat rashes, acne, dermatitis, and eczema. • Leaves are placed over the boils to reduce swellings. • Fruit extract is used against snakebites and to maintain blood sugar levels. • A small amount of bark powder is taken orally with water as an anti-pyretic and anti-helminthic.	30	0.86

Mentha longifolia (L.) L.	Jangli pootna	Herb	Lamiaceae	Leaves	• Used to treat early symptoms of asthma, relieve cramps of intestine and bladder.	10	0.3
Mimosa pudica L.	Chuii mui	Herb	Fabaceae	Leaves	• Decoction of leaves is employed to treat diabetes. • The leaf paste stops bleeding and speeds up the healing process.	10	0.1
Morus alba L.	Toot	Tree	Moraceae	Fruit	• Fruits are consumed as an appetizer. • Oral administration of fruit juice aids in the treatment of jaundice.	17	0.23
Musa x *paradisiaca* L.	Keela	Tree	Musaceae	Rhizome	• Tonsillitis is treated by rhizome paste applied to the throat.	6	0.16
Nerium oleander L.	Gandera	Shrub	Apocynaceae	Leaves	• Leaves are boiled, and the resulting decoction is used in the treatment of cardiac disorders.	20	0.05
Opuntia humifusa (Raf.) Raf.	Trappad shu	Shrub	Cactaceae	Whole plant	• Whole-plant juice is administered as an ear drop to alleviate otalgia.	12	0.16
Oxalis stricta L.	Tinpatiyan	Herb	Oxalidaceae	Leaves	• Leaves paste is applied orally to reduce the pain and swelling caused by ant sting.	10	1
Parthenium hysterophorus L.	Congress gha	Herb	Asteraceae	Whole plant	• Used to lowers body temperature or alleviate fever. • Acts as analgesic in neuralgia.	18	0.38
Phanera vahlii (Wight & Arn.) Benth.	Baloonger	Climber	Fabaceae	Leaves	• A paste prepared from the leaves is applied topically to wounds to aid in the healing process.	7	0.14
Phyllanthus emblica L.	Amla	Tree	Phyllanthaceae	Fruit	• Used as a medication for constipation and hair care. • Fruit is eaten to treat gastric problems.	31	0.96
Physalis lagascae Roem. & Schult.	Pataka	Herb	Solanaceae	Leaves	• Acts as purgative and used in treatment of gonorrhea and spleen disorder.	15	0.06
Pinus roxburghii Sarg.	Chir	Tree	Pinaceae	Resin	• Resin is used as an anti-phlogistic and styptic agent on boils, cuts, and wounds. • Resin is also used to speed up the healing of damaged heels.	8	0.25
Portulaca oleracea L.	Kulffa	Herb	Portulaceae	Leaves	• Used to cure respiratory ailments like coughs and sore throats. • Leaf paste is effective in alleviating skin conditions such as insect bites, wounds, and burns.	29	0.10
Prunus persica (L.) Batsch.	Aadu	Tree	Rosaceae	Leaves	• Crushed leaf paste is used topically on wounds, cuts, boils, and burns to alleviate inflammation and facilitate recovery.	25	0.04
Psidium guajava L.	Amrood	Tree	Myrtaceae	Fruit, leaves	• Oral ulcers can be treated by chewing on young leaves and bark. • A toothache is treated with cotton drenched in leaf decoction. • To treat headaches; finely powdered raw fruit is placed to the forehead.	48	0.43
Pteridium aquilinum (L.) Kuhn	Bann	Fern	Dennstaedtiaceae	Leaves	• It is used topically as a bandage or ointment to treat wounds, cuts, and bruises.	27	0.03
Pteris vittata L.	Pura patte	Fern	Pteridaceae	Leaves	• Used as tea or infusion to promote digestive health and soothe upset stomachs.	4	0.25
Punica granatum L.	Anar, darunni	Tree	Lythraceae	Leaves, bark seeds, fruit	• Fruit juice is given to anemic people as a tonic, and when eaten with warm water two times per day, it treats dysentery.	50	0.7

					• The ash produced by burning seeds is distinctive. Fruits are taken for heart health and in cases of jaundice. • As astringent, a tablespoon of dry powder of bark is administered.		
Ricinus communis L.	Arande	Shrub	Euphorbiaceae	Leaves, oil	• Castor oil is administered topically to relieve irritation. • To enhance milk production, leaf paste is applied topically to the breasts of the breastfeeding women. • To treat headaches, apply a paste of leaves to the forehead.	12	0.08
Senegalia catechu (L.f.) P.J.H.Hurter & Mabb	Khair	Tree	Fabaceae	Wood	• The extract of wood known as Katha used to treat mouth ulcers.	36	0.77
Senna tora (L.) Roxb.	Aedva	Herb	Fabaceae	Leaves	• For the treatment of skin problems. • Dyspepsia is treated using a leaf decoction.	8	0.12
Sida acuta Burm.f.	Baare aaudha	Shrub	Malvaceae	Whole plant	• Exhibits anti-plasmodial, anti-ulcer, and anti-diarrheal, anti-dysentery activities.	21	0.04
Sonchus wightianus DC.	Dhodly	Herb	Asteraceae	Whole plant	• Used to treat whooping cough. • Used to cure chronic fevers, jaundice and pertussis	25	0.04
Syzygium cumini (L.) Skeels	Taal	Tree	Myrtaceae	Leaves, seeds, fruit	• Diabetes and piles are treated with dried seed powder mixed with water. • Oral ulcers can be treated by chewing new leaves and bark decoction is used as a gargle to treat oral ulcers. • Anorexia is relieved by a drink produced from its fruits.	54	0.05
Tamarindus indica L.	Imli	Tree	Fabaceae	Fruit	• Animals are given with fruit extract to treat anorexia and to detoxify the effects of harmful plant consumption.	62	0.14
Taraxacum officinale F.H.Wigg.	Bathur	Herb	Asteraceae	Leaves	• After boiling leaves are consumed by women during and after pregnancy to relieve discomfort and function as a galactagogue. • A root decoction can help with chronic renal and liver disorders. • To treat anemia, women are given a decoction of leaves two times a day after delivery.	13	0.15
Terminalia arjuna (Roxb. ex DC.) Wight & Arn.	Arjan	Tree	Combretaceae	Bark	• Paste made from bark is applied topically to wounds to promote healing.	18	0.05
Terminalia bellirica (Gaertn.) Roxb.	Bahera	Tree	Combretaceae	Fruit	• Fruits utilised either alone or as a component of Trifala to treat constipation and hoarse throat.	28	0.03
Tinospora cordifolia (Willd.) Hook.f. & Thomson	Gadoh	Climber	Menispermaceae	Whole plant	• Entire plant is given to animals for increasing milk production and to overcome asthenia and anorexia. • To treat hyperpyrexia, the peel is peeled and the inside section ingested.	23	0.08
Toona ciliata M. Roem.	Toonu	Tree	Meliaceae	Leaves	• The leaves can help with chronic dysentery. • Flowers are used to treat menstruation problems.	20	0.1

Tribulus terrestris L.	Bhakerwada	Herb	Zygophyllaceae	Whole plant	• Used to reduce bleeding in case of injury. • Used to reduce the painful micturition.	7	0.14
Tridax procumbens L.	Kumra	Herb	Asteraceae	Leaves	• The extract of leaves is styptic when applied topically.	15	0.06
Triumfetta rhomboidea Jacq.	Dhumjojdo	Shrub	Tiliaceae	Fruit, flower, leaves, roots	• Extract is applied orally to relieve skin irritation.	8	0.12
Urena lobata L.	Ban kaphda	Shrub	Malvaceae	Whole plant	• A paste is used orally to relieve lower back discomfort.	8	0.12
Vachellia nilotica (L.) P.J.H.Hurter & Mabb.	Kikkar	Tree	Fabaceae	Bark	• Gum is used together with latex of *C. procera* to treat asthma, reduce bleeding, and control urine and vaginal discharges. • Decoction prepared from bark is used to cure skin disorders, treat piles, and to strengthen the teeth.	6	1.3
Verbascum thapsus L.	Tamakoo	Herb	Scrophulariaceae	Leaves, seeds, flowers	• Flowers are placed in water overnight before being taken orally to cure coughs, bronchitis, pneumonia and asthma. • To treat pharyngitis, a leaf plus flower extract is given orally. • The abscess is treated by placing leaves drenched in hot mustard oil over the skin.	12	0.08
Vitex negundo L.	Baana	Shrub	Verbenaceae	Flower, leaves	• An infusion of the leaves is employed to cure children's intestinal worms. • Leaves are eaten to alleviate coughs and colds. • The aqueous extract of flowers is used for the treatment of diarrhea.	26	0.88
Woodfordia fruticosa (L.) Kurz	Dhaii	Shrub	Lythraceae	Flower, leaves	• Flowers are used to treat burns, wounds, and skin ailments. • To treat headaches, apply the flower extract to the forehead. • Gall bladder disorders are treated with leaf extract.	10	0.2
Xanthium strumarium L.	Joojra	Herb	Asteraceae	Leaves	• The afflicted area of alopecia is scraped with species' fruit before applying leaf paste.	10	0.1
Ziziphus mauritiana Lam.	Bair	Tree	Rhamnaceae	Fruits, root, seeds	• Pharyngitis and mouth ulcers can be cured by gargling with root decoction. • Dehydrated powder of seeds taken with water to control diabetes. • Hairs are washed with a decoction of *P. emblica* dried fruits and leaves together with *M. azedarach* & *Z. mauritiana* leaves to reduce hair loss and flakes.	42	0.69

Note: N, number of informants; UV, use value

Quantitative indices

Use Value

The documented species exhibited the highest UV (Table 2), indicating their relative importance within the local ethnomedicinal practices were *J. adhatoda* (3.06), *A. indica* (2.2), *I. carnea* (2.07), *B. variegata* (1.6), *C. oppositifolia* (1.35), *F. benghalensis* (1.34), *V. nilotica* (1.3), and *A. conyzoides* (1.3).

Informant Consensus Factor

The maximum FIC (Table 3) was observed for gastrointestinal disorders (0.89), followed by diabetes (0.87), physical pains (0.85), respiratory problems (0.84), poisoning (0.82), and skin problems (0.82).

Table 3. Important ailment category and FIC values.

Ailment category	Important diseases	N_{ur}	N_t	FIC
Gynaecological problems	Labour pains, pregnancy food for women, menstrual disorder	19	6	0.72
Skin problems	Abscess, cut and wounds, alopecia, dandruff, ringworm, herpes, inflammation, acne	334	58	0.82
Diabetes	Anti- diabetic	103	14	0.87
Fevers	Fever, hay-fever, pneumonia, febrifuge, typhoid	58	21	0.64
Gastrointestinal problems	Acidity, constipation, diarrhea, dysentery, piles, flatulence, ulcers, vomiting	390	42	0.89
Liver problems	Liver size increase, jaundice	61	25	0.6
Parasites	Lice, ticks	57	15	0.75
Physical pains	Headache, toothache, joint pain	108	17	0.85
Poisoning	Insect bite, scorpion sting, dangerous bug sting	46	9	0.82
Respiratory problems	Asthma, cough, bronchitis, whooping cough	472	73	0.84
Urological problems	Urinary stones, painful urination, diuretic	28	20	0.30

Fidelity Level

The FL of plant species across different ailment categories was assessed in the present study. Results indicated that eight species exhibited 100% FL (%), suggesting their primary use for a specific ailment category and consistent reports of numerous informants. Fewer than 10 utilization reports were excluded from the analysis (Fig 3). Notable FL values for species used across diverse ailment categories comprised *A. conyzoides* (skin problems), *S. cumini* (diabetes), *P. emblica* (liver problems), *P. granatum* (liver problems), *C. oppositifolia* (physical pains), *I. carnea* (physical pains), *E. globulus* (respiratory) and *B. lyceum* (urological problems).

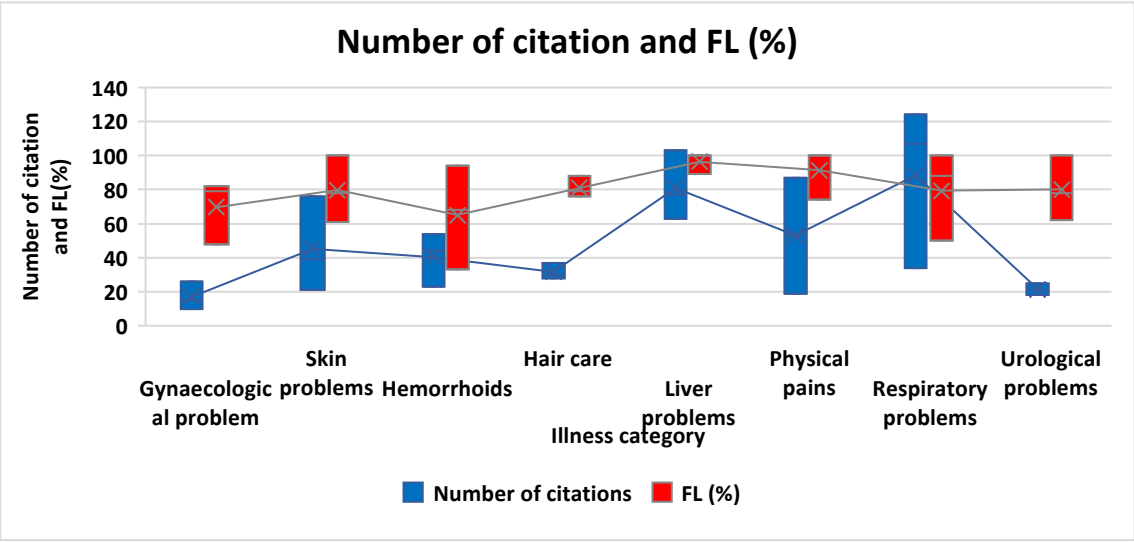


Figure 3. Number of use citations and FL% of documented medicinal plant species.

Relative Frequency of Citation

The RFC values ranged between 0.47 and 1.00. Three species, namely *P. emblica*, *I. carnea*, and *A. indica*, exhibited the maximum RFC value of 1.00. In contrast, *T. officinale* showed the minimum RFC value of 0.47 (Table 4). On the other hand, *T. officinale* showed the minimum RFC value of 0.47.

Table 4. RFC values of highly cited medicinal plant species based on informant responses

Species	FC	RFC
P. emblica	293	1.00
I. carnea	293	1.00
A. indica	293	1.00
S. cumini	285	0.97
C. oppositifolia	283	0.96
P. granatum	270	0.92
E. globulus	261	0.89
O. stricta	261	0.89
A. conyzoides	257	0.88
B. lyceum	255	0.87

Multi-health analysis ranking

The multi-health analysis revealed that respiratory disorders ranked highest in terms of community priority, accounting for the largest proportion of total use-reports (N_{ur} = 472) and involving 73 different plant species. While the FIC values indicated the highest agreement for gastrointestinal disorders (FIC = 0.89) (Table 3), the multi-health ranking highlights that respiratory ailments represent the most significant health burden managed through indigenous healthcare, as reflected by their highest citation frequency and species utilization (Table 5).

Table 5. Multi-health analysis ranking

Rank	Ailment category	Interpretation
1	Respiratory problems	Most prevalent and widely treated; high ethnomedicinal focus
2	Gastrointestinal problems	High agreement among informants; major health concern
3	Skin problems	Common ailments with diverse plant-based treatments
4	Physical pains	Frequently treated with relatively consistent remedies
5	Diabetes	High consensus; specialized treatment category
6	Liver problems	Moderate occurrence; diverse treatment approaches
7	Fevers	General condition with moderate agreement
8	Parasites	Moderate importance with fairly consistent remedies
9	Poisoning	High agreement despite fewer cases; critical treatments
10	Urological problems	Low consensus; varied treatment practices
11	Gynaecological problems	Least reported but culturally important category

Ailment remedies

Healthcare issues encompass a range of challenges, including gynecological issues, menstrual problems, and dysuria, which are more prevalent in the study area. Chronic diseases such as diabetes, diarrhea, and physical pains, including headache, toothache, and joint pain, were observed, potentially linked to changes in lifestyle patterns. Furthermore, inadequate sanitation infrastructure contributes to the incidence of gastrointestinal disorders. Due to constrained access to timely healthcare facilities in the region, there is a substantial dependence on traditional healing practices for addressing health concerns. Many plant species have been utilized for the treatment of various ailments (Fig 4) such as, *B. monosperma* (constipation), *D. sissoo* (menstrual problems), *T. officinale* (food, liver disorder), *C. oppositifolia* (headache), *I. carnea* (joint pain), *L. coromandelica* (toothache), *A. conyzoides* (cuts), *A. indica* (acne), *M. azedarach* (acne, rashes), *S. cumini* (diabetes), *E. hirta* (piles), *F. religiosa* (piles), *L. camara* (alopecia), *Z. mauritiana* (dandruff), *A. capillus-veneris* (fever), *M. alba* (jaundice), *P. emblica* (acidity), *P. granatum* (jaundice), *A. aspera* (scorpion sting), *O. stricta* (ant sting), *C. myxa* (cough), *E. globulus* (nasal blockage), *J. adhatoda* (bronchitis), *M. longifolia* (asthma) and *B. lyceum* (kidney stones).

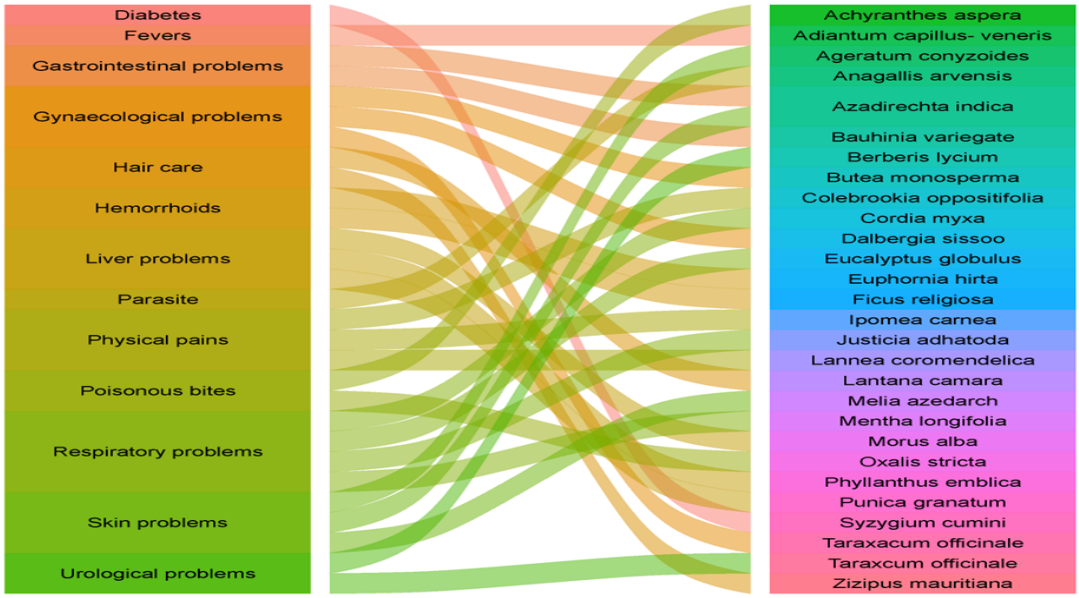


Figure 4. Major health issues reported within the study area.

Inter-Community use

Some inter-community variations in ethnobotanical practices were observed among Gujjar, Bakarwal, and Dogra communities. While some species, such as *A. aspera*, were commonly used across groups, differences were evident in plant parts utilized and modes of application. For instance, *V. nilotica* and *C. procera* were used by Gujjars primarily for respiratory and urinary-related ailments, whereas Bakarwals employed *V. nilotica* mainly for dermatological and dental purposes. Similarly, *A. aspera* was used by Gujjars for fever management, while Bakarwals applied it for scorpion stings, and Dogra communities used it for respiratory issues. In addition, certain species showed community-specific applications, such as the dietary and fracture-related use of *B. variegata* and the therapeutic use of *D. deltoidea* for gastrointestinal ailments. Overall, the observed differences are primarily related to preparation methods, plant parts used, and therapeutic applications rather than species selection.

Discussion

Thein Conservation Reserve is situated in a biodiverse region renowned for its diverse flora and fauna, nestled within the landscape of the Himalayan region of J&K, India. The area is acknowledged for its ecological significance and serves as an important habitat for numerous plant taxa, several of which are integral to the ethnobotanical practices of local communities. In the current study, 91 plant species across 51 families and 85 genera were documented for their medicinal and domestic applications. Fabaceae emerged as the most dominant family, representing 11 species (12.08%), followed by Asteraceae (6.59%) and Moraceae (5.49%). Among these species, 54 (59.34%) were categorized as woody, while 37 (40.65%) were described as non-woody plants. A majority of 76 species (83.51%) were sourced from wild, while 15 species (16.48%) were gathered both from wild and cultivated environments. In several cases, the whole plant and its parts were employed for treating various illnesses. The dominance of families such as Fabaceae and Asteraceae aligns with their use in treating common ailments, indicating partial synchrony between plant diversity and disease patterns. Their higher use may reflect rich phytochemistry, wide distribution, and strong traditional integration, while frequently occurring ailments like gastrointestinal disorders are treated with a broader range of species (Naik *et al.* 2021, Hani *et al.* 2023, Bhardwaj *et al.* 2025).

The predominance of leaves (38%) as the primary plant part used mirrors global ethnobotanical patterns. These results corroborate findings from studies conducted in Asia and Africa (Amri & Kisangau 2012, Datta *et al.* 2014, Aziz *et al.* 2018, Tamang *et al.* 2023), which similarly identified as the primary plant part utilized due to their easy accessibility and elevated concentrations of bioactive constituents (Tugume & Nyakoojo 2019). Furthermore, the use of other morphological parts, such as fruits (12.4%), whole plants (10.08%), bark (7.75%), flowers (6.98%), seeds (5.43%), roots (6.2%), latex/resin (4.65%), rhizomes (2.5%), and stems (1.55%), closely aligns with the usage patterns reported in earlier ethnobotanical surveys throughout the Himalayan region (Rashid *et al.* 2015, Kanta *et al.* 2018), which likewise emphasize therapeutic importance of these plant components across diverse traditional healing practices.

The preferred methods of preparation, such as formulation of pastes, decoctions, infusions, juices, and poultices, exhibit close conformity with the ethnomedicinal practices reported from neighboring regions. Similar preparation techniques documented collectively suggest a high degree of cultural continuity and shared therapeutic tradition across northern India (Kumar & Bhagat 2012, Bhushan & Kumar 2013). Likewise, the predominance of single-species formulations in this study aligns with findings by (Tamang *et al.* 2023), indicating that the simplicity and perceived efficacy of single-plant preparations support their widespread use.Approximately 18% of the documented medicinal flora were obtained through destructive harvesting. This proportion reflects the unsustainable extraction as a major conservation threat to the medicinal plants. The predominant reliance on wild populations (83.51%) aligns with findings reported that highlight a broader regional and global pattern in which community-based healthcare systems remain heavily dependent on wild flora (Bolson *et al.* 2015; Papageorgiou *et al.* 2020). These patterns highlight the urgent need for conservation strategies such as community education, controlled harvesting, propagation techniques, establishment of home gardens, and cultivation of high-demand medicinal species.

Plant species such as *J. adhatoda*, *A. indica*, *I. carnea*, *B. variegata*, *C. oppositifolia*, *F. benghalensis*, *V. nilotica*, and *A. conyzoides,* renowned for their significant UV, were the predominantly used species within the study area. This pattern corroborates findings from prior ethnobotanical surveys in the northern region (Kumar & Bhagat 2012, Bhushan & Kumar 2013, Kumar *et al.* 2020, Singh *et al.* 2020a, Kumar *et al.* 2021). *J. adhatoda* is used as an expectorant, insecticidal, anti-asthmatic, anti-rheumatic, and antiseptic (Manhas *et al.* 2022). *A. indica* is used as a laxative, gastrointestinal, diuretic, for indigestion, and insect repellent and therefore used to treat flatulence, gastric disorder, urinary problems, and to keep insects away (Nanda 2020). FIC values ranged from 0.89 to 0.42, with the highest consensus recorded for gastrointestinal ailments. The high FIC for gastrointestinal disorders (0.89) aligns with the findings reported from a study in Budgam, Jammu & Kashmir (Mir *et al.* 2021), where gastrointestinal problems also exhibited the highest informant consensus. Similarly, Chauhan *et al.* 2020 reported an FIC of 0.86 for gastrointestinal issues in rural Pabbar Valley, Himachal Pradesh. This regional convergence suggests shared health priorities, ethnobotanical knowledge, and dietary factors.

In this study, 3 species recorded 100% FL. A high FL (%) value of recorded plants reflects promising potential for treating respective ailments, indicating the need for deeper exploration into their bioactive compounds through additional phytochemical studies to uncover the source of their remarkable healing properties. This pattern mirrors findings in other regional studies, where species such as *P. emblica, A. indica, P. granatum,* and *S. cumini* have demonstrated similarly high FL values for liver disorders, diabetes, and respiratory ailments (Sujarwo *et al.* 2016, Kumar & Chander 2019, Singh *et al.* 2020a, Singh *et al.* 2020b, Khajuria *et al*. 2021). Lower FL values for species such as *T. officinale*, *M. longifolia,* and *M. azedarach* correspond to their broader therapeutic versatility, as also reported in previous studies. The multi-health analysis reveals how disease prevalence correlates with the consistency of traditional medicinal knowledge. Respiratory (Nur = 472, FIC = 0.84) and gastrointestinal disorders (FIC = 0.89) exhibited the highest prevalence and informant agreement on remedies. Skin issues, physical pains, and diabetes also demonstrated strong consensus (FIC > 0.80), indicating highly reliable traditional treatments. In contrast, treatments for liver issues and fevers showed moderate agreement, while urological problems (FIC = 0.42) had the lowest, reflecting highly diverse therapeutic approaches (Huang *et al.* 2025).

From an emic and socio-cultural perspective, plant selection and use are shaped by local disease priorities, traditional practices, and intergenerational knowledge. The preference for certain plant families reflects empirical knowledge, accessibility, and cultural familiarity rather than solely pharmacological value. The use of multipurpose species for common ailments highlights adaptive strategies shaped by the interplay of ecological availability, cultural beliefs, and healthcare needs (De Albuquerque 2006, Singh *et al.* 2024, Menaka *et al.* 2025). In the context of the expanding global herbal market, increasing international demand for medicinal raw materials has intensified harvesting pressure on wild plant populations, particularly in biodiversity-rich regions such as the Himalayas. Several species documented in Thein Conservation Reserve also possess significant relevance in global herbal and phytopharmaceutical markets, underscoring the broader importance of local ethnomedicinal practices. *J. adhatoda* is widely traded internationally for its alkaloid-rich leaves, which are utilized in commercial cough syrups and respiratory formulations targeting asthma and bronchitis (Gunjan *et al.* 2015). Similarly, *A. indica* is among the most commercially important medicinal plants, extensively employed in herbal pharmaceuticals, cosmetics, nutraceuticals, and biopesticides, reflecting a strong concordance between local use patterns and global supply chains (Gunjan *et al.* 2015). In contrast, species such as *C. oppositifolia* and *I. carnea*, despite their high local UV, remain underrepresented in international trade (Wadnerwar & Deogade 2021). This disparity highlights the critical role of ethnobotanical knowledge in identifying underexplored medicinal resources with potential for future pharmacological validation and sustainable market development.

This research underscores the pivotal role of local communities in conserving ethnomedicinal plant diversity within the Thein Conservation Reserve. It advocates for a synergistic approach, integrating Traditional Ecological Knowledge (TEK) with scientific methodologies to promote sustainable resource use and ecosystem resilience. Critical interventions include capacity-building programs to mitigate destructive harvesting and foster sustainable collection protocols. Furthermore, community-based initiatives, such as the establishment of ex-situ herbal gardens and awareness campaigns, are essential. These strategies are posited to reinforce biodiversity conservation objectives while concurrently safeguarding associated traditional knowledge systems.

Limitations

The study is limited by several limitations that should be acknowledged when interpreting the findings. The under-representation of female participants may have resulted in an incomplete documentation of gender-specific knowledge related to plant use. Furthermore, the data collection at discrete intervals may have failed to capture seasonal variations in plant availability and utilization patterns. Finally, logistical challenges, including restricted access to remote locations, may have constrained the scope and comprehensiveness of the data obtained.

Conclusion

The ethnobotanical survey conducted in the Thein Conservation Reserve region reveals a rich repository of medicinal plant resources utilized by local indigenous communities to address a spectrum of both common and complex health issues. The incorporation of multi-health analysis ranking further elucidates that respiratory disorders constitute the most prominent health concern, followed by gastrointestinal and skin-related ailments, reflecting both prevalence and reliance on ethnomedicinal practices. The continued reliance on these resources is likely facilitated by the positive rapport between knowledgeable traditional healers and patients, potentially enhancing healthcare delivery within these communities. Plant species exhibiting high FL values require further in-depth investigation to ascertain their specific therapeutic applications. Furthermore, the identification of plants with elevated UV and FIC values highlights their potential ethnomedicinal significance. These findings collectively strengthen the correlation between disease prevalence and plant utilization patterns within the study area. The outcomes of this study underscore the critical need to prioritize future research initiatives focused on the pharmacological evaluation and sustainable management of these significant plant resources.

Declarations

List of abbreviations: FL- fidelity; UV- use value; RFC- relative frequency of citation; FIC- informant consensus factor.

Ethics approval and consent to participate: This study was duly approved by Department of Botany, Central University of Jammu, India. All participants provided prior informed consent, with written consent obtained from literate informants and verbal or thumbprint consent from those with limited literacy.

Consent for publication: All authors read the final manuscript and approved it for publication.

Availability of data and materials: Not applicable.

Competing interests: The authors declare that they have no conflict of interest.

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Authors' contributions: HS conducted the experimental work, collected ethnobotanical data from informants, and prepared the first draft of the manuscript. DCA supervised the study and provided overall guidance. KB contributed to the writing and critical revision of the manuscript. VLT and PN performed data analysis and contributed to manuscript editing.

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