Traditional knowledge and quantitative assessment of ethnomedicinal uses of plants in Lahaul valley of Himachal Pradesh

Renu Sharma, Aradhna Bharti, Ashish Kumar, Sanjay Kr. Uniyal

Correspondence

Renu Sharma[1], Aradhna Bharti[1], Ashish Kumar[1], Sanjay Kr. Uniyal[1*]

[1]Environmental Technology Division, CSIR-Institute of Himalayan Bioresource Technology, Post Box No. 6, Palampur-176061 (H.P.) India.

*Corresponding Author: suniyal@ihbt.res.in

Ethnobotany Research and Applications 31:45 (2025) - http://dx.doi.org/10.32859/era.31.45.1-15
Manuscript received: 13/05/2025 – Revised manuscript received: 23/07/2025 - Published: 25/07/2025

Research

Abstract

Background: Traditional knowledge (TK) on plants and their use forms the basis of local healthcare, especially in the high altitude regions of the Himalaya. Rapid transformation of these areas is threatening the rich TK with serious implications. The present study, therefore, focused on documenting the medicinal plant use amongst the tribal population of Lahaul, Himachal Pradesh.

Methods: Field survey was conducted during summer (2022-2023) to document medicinal plant use among the *Lahulas* community. Five villages, namely Gondhla, Kardang, Khangsar, Tholang, and Yangla were surveyed based on their geographical location, accessibility, and cultural relevance. Information on uses of plant species was collected using semi-structured questionnaires (n=43) and participant observations, followed by quantitative analyses i.e., Fidelity Level (FL), Informant Consensus Factor (ICF), and Use Value (UV).

Results: Forty-one plant species placed in 25 families were noted for treating 10 different categories of human ailments, with higher number of species being used to treat digestive problems (n=19). Leaves were most commonly used plant part (39%) followed by roots (21%). Quantitatively, the highest use value was recorded for *Angelica glauca* (UV=0.88), while *Arnebia benthamii*, *Fragaria vesca*, and *Viola canescens* showed 100% fidelity. The highest ICF was noted for respiratory problems (0.29).

Conclusions: The study highlights the dependence of local communities on plants for medicinal purposes wherein a total of 41 plant species were used. The use of these species is guided by the rich TK. Therefore, documentation of TK is imperative for identifying future leads and also for knowledge preservation.

Keywords: Ethnomedicine, Fidelity level, Informant consensus factor, Use value, Traditional knowledge

Background

Plants form the basis of human survival and well-being, especially the tribal communities who even today regularly collect and use resources from the wild. The collection and use of resources by them is guided by their traditional knowledge that they have acquired through personal experiences over generations. Their dependence on plants for medicine is particularly high, and so is their knowledgebase on medicinal plants. How these communities practice healing and health care processes, in order to cure disease and illness through traditional medicines, falls under the ambit of ethnomedicine (Mahapatra *et al.* 2019). The importance of this can be gauged from the fact that recently World Health Organization (WHO) has established a Global Centre for Traditional Medicine in India (WHO 2023). It recognizes that more than 85% of all countries have a prevalence of traditional medicine, and close to 40% of pharmaceutical formulations are based on natural products, with many having their origin based on the leads obtained through documentation of folk knowledge (Wangchuk 2018, Ekor 2014). In developing countries, the percentage of the population using traditional medicine is as high as 80% (Farnsworth 1988, Daniel & Fransworth 2001, WHO 2002). Forty-three percent of the flowering plant species occurring in India are reported to have medicinal properties (Uniyal *et al.* 2006); their use is higher in the high-altitude regions of the Himalaya, where more than ~50% of the plant species are traditionally used as medicines (Verma & Tewari 2016). The traditional knowledge associated with the use of plants is an intrinsic part of the local tradition, heritage, beliefs, and folklore of the Himalayan regions. The natives of the region identify, collect, formulate, and use these medicinal plants to treat common ailments through their knowledge and experience. Here, the indigenous healthcare system is regarded as the primary support system. The widespread use of plants as ethnomedicine at higher altitudes can be attributed to the lack of modern medical facilities, as well as being more economical than the expensive pharmaceuticals. It, therefore, is no surprise that plant resources collected from the wild are used to treat nearly 60% of health issues (Kumar *et al.* 2020).

Additionally, the therapeutic use of several medicinal plants is supported by phytochemical studies, such as *Dactylorhiza hatagirea*, and *Picrorhiza kurrooa* which have revealed the presence of bioactive compounds like alkaloids, flavonoids, glycosides, and essential oils, supporting their therapeutic importance (Sharma *et al.* 2024, Sultan *et al.* 2016). This scientific validation strengthens the credibility of traditional knowledge and highlights the potential of these plants in modern drug development. Moreover, the high-altitude region, due to its distinct ecological conditions and location, harbors many endemic and endangered plant species such as *Angelica glauca*, *Aconitum heterophyllum*, and *Picrorhiza kurrooa* (Wani *et al.* 2020, Singh *et al.* 2022). Their overharvesting for medicinal purposes necessitates the promotion of sustainable cultivation practices to ensure their long-term survival and continued availability for both local communities and pharmaceutical use (Anand *et al.* 2023).

However, recently, trends of declining ethnomedicinal knowledge have been reported to an extent that concerns have been raised over their becoming permanently lost (Singh *et al.* 2017, Thakur *et al.* 2016). Information on these traditionally used medicinal plants is critical for preserving declining traditional knowledge (Anand *et al.* 2023). Therefore, protection and recognition of medicinal plants knowledge are being prioritized in various forums. Also, recognizing that most of the ethnomedicinal studies in the Himalaya have been qualitative, quantitative assessment of knowledge and generation of indices is being promoted (Leonti 2022).

Considering these aspects, the present study was undertaken as a part of Council of Scientific and Industrial Research (CSIR) project HCP-0035, which focused on identifying and evaluating plant-based immunomodulators to support traditional healthcare systems. The research was conducted in the Lahaul Valley of Himachal Pradesh, Western Himalaya, with the following objectives: 1) to collect the traditional knowledge of the resident population on the use of medicinal plants for treating various diseases (including medicine preparation, dosage and administration); 2) to quantitatively assess the knowledge indices associated with plants and their uses.

Materials and Methods

Study area

The Lahaul valley of Himachal Pradesh, India (Fig. 1) lies between 31° 41′ 57′′- 32° 59′ 57′′ N to 76° 46′ 29′′- 78° 41′ 34′′ E with an elevation ranging from ~2400m to 6500 m asl. The area forms a part of the trans Himalayan biogeographic zone and comprises distinct ecological and sociological characteristics (Kumar *et al.* 2017). It receives low rainfall during summers (~300 mm annually) and heavy snowfall during winters (3 to 15 feet) with temperatures ranging from -19°C to 32°C (Singh *et al.* 2022). Till late, owing to snow accumulation, the area remained inaccessible during winters, however, the construction of the Atal tunnel between Manali (Kullu) and Lahaul (Lahaul & Spiti) has resulted in year around connectivity. Due to the peculiar climatic conditions, the area supports unique plant diversity that includes many endemic and endangered species

(Vidyarthi *et al.* 2013). Lahaul & Spiti is the largest district of Himachal Pradesh in terms of geographical area, covering ~13,835 square kilometers. Of the total area, approximately 8% is under forest cover, while only 1% is classified as agricultural land (DSR 2024). The Lahaul & Spiti, known to harbor nearly 980 plant taxa, reflects its rich floristic diversity (Aswal & Mehrotra 1994). Despite its vast expanse, it has the lowest population in the state, ~31,000 inhabitants, and a population density of just 2 persons per square kilometer (Census of India 2011). Farming is the main occupation of local people, and they are largely dependent on available biodiversity for their sustenance. An inclination towards cash crop cultivation (peas, cauliflower, etc.), including floriculture, is now noted in the area, which is bringing changes in the socio-economy of the people as well as the ecology of the region.

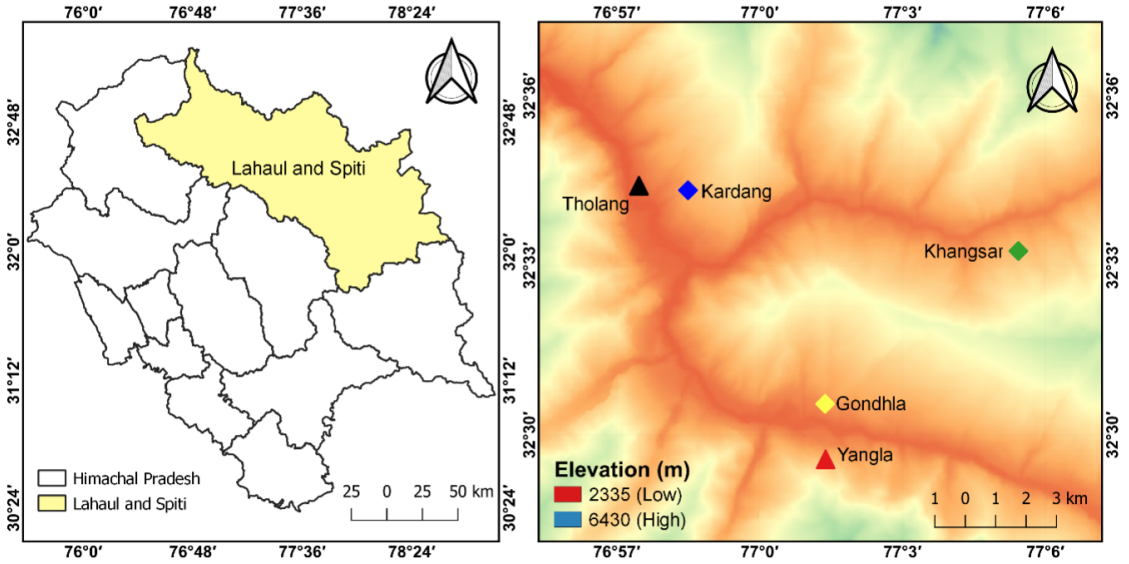

Figure 1. Map of the Study area

Ethnobotanical survey and data collection

Field surveys were carried out in the Lahaul valley during the summer season (2022-2023) to record information pertaining to traditional usage of medicinal plants amongst the local communities (i.e *Lahulas*). Five villages namely Gondhla, Kardang, Khangsar, Tholang and Yangla were selected based on their geographical distribution, accessibility and representation for their rich ethnomedicinal heritage. As per the Census of India (2011), the population of these villages is close to 1100 individuals. A total of 43 knowledge holders (27 males and 16 females), aged between 30 and 75 years including 8 **vaids** (local healers or practitioners who inherit the family legacy of medicament and treatment) were identified and interviewed (Figure 2). The ethno-medicinal data were collected using semi-structured questionnaires (Supplementary Material S1) and open conversations, allowing for flexibility in response and deeper engagement with participants. In addition to basic personal information of the respondents (name, age, village, etc.), information on plant species used as medicine, its vernacular name, plant part(s) used, mode of use, and type of disease treated were also recorded. The different ailments have been categorized and adapted as per "International Classification of Primary Care" (ICPC-2) according to the "World Organization of Family Doctors" (WONCA). Oral prior informed consent was obtained from all the study participants. Field visits were also organized with the local people to identify plant species based on traditional knowledge and local names, while the botanical identification of collected specimens was carried out and confirmed by taxonomist at CSIR-Institute of Himalayan Bioresource Technology, Palampur (HP), using standard floras and herbarium comparisons. The specimens are deposited in the herbarium of CSIR-IHBT, Palampur.

Data Analysis

The data collected through structured interviews was evaluated for taxonomic richness, part used and life-form. Further, the data were quantitatively evaluated for "fidelity level" (FL %) index, "informant consensus factor" (ICF), and "use value" (UV).

Species consensus or Fidelity level (FL)

For curing a particular ailment, one or more plant species may be individually used. To work out which species is mostly preferred for the treatment of the ailment, FL (%) is used. The fidelity level is the proportion of respondents claiming to have used a specific plant species for treating a particular ailment. It was calculated using formula by Teklehymanot *et al.* (2007).

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

Where Np is the number of respondents who independently asserted to have utilized a plant species for the treatment of same specific ailment and N is the number of respondents claiming the use of plant species for any ailment. The plant species which is frequently used by people records a higher FL while the ones that are rarely used have a low fidelity value (Canales *et al.* 2005).

Figure 2. Interaction with the local inhabitant of Lahaul valley

Informant consensus factor (ICF)

The ICF is used to determine whether people in an area agree on the use of a species in the ailment category in order to assess the uniformity of the knowledge of respondent. It was calculated using the formula by Heinrich *et al.* (1998).

$$\text{ICF} = \frac{Nur - Nt}{Nur - 1}$$

Where Nur denotes the count of use reports for a disease classification and Nt denotes the number of taxa used by all respondents for that disease category. ICF ranges from 0-1. An ICF value of 0 suggests that the respondents disagree on the use of a plant species in the treatment of a specific disease category, whereas a value close to 1 indicates that a large number of people agree on the use of the plant for a specific disease category. ICF aids in the shortlisting of plants for pharmaceutical or pharmacological applications (Gazzaneo *et al.* 2005).

Use value (UV)

It reveals the significance of a plant species by considering the number of uses mentioned by informants for the said specific plant species. The use value was determined using the formula proposed by Phillips *et al.* (1994)

$$\text{UV} = \sum \frac{Ui}{N}$$

Where Ui denotes the total number of uses reported by each respondent for a given species and N denotes the total number of respondents taking part in the study.

Results and Discussions

The study noted use of 41 plant species from 25 families to treat 10 different disease categories ranging from gastric problems to earache, showcasing the depth of region-specific ethnomedicinal knowledge (Fig. 3). The information on the Latin name, local name, plant part(s) used, and mode of use of the species is listed in Table 1. Out of all the species used, 37

represent herbs, 2 shrubs, and 2 trees. The majority of the species used belong to the family Asteraceae (6 species) and is followed by Lamiaceae (5 species). Three species each from Polygonaceae, Scrophulariaceae, and Solanaceae were used while Apiaceae, Rosaceae, and Ranunculaceae accounted for 2 species each. The remaining 17 families had one species each. With regard to the plant parts used, in most of the cases leaves (39%) were used followed by roots (21%), whole plant (13%), and aerial parts (7%) (Fig. 4).

Figure 3. a. *Thymus serpyllum* b. *Podophyllum hexandrum* c. *Taraxacum officinale* d. *Inula racemosa* e. *Bergenia stracheyi* f. *Arnebia benthamii* g. *Plantago major* **h**. *Pedicularis bicornuta* i. *Aconitum heterophyllum* j. *Dactylorhiza hatagirea* k. *Picrorhiza kurrooa*

Table 1 - Medicinal plants used in Lahaul valley of Himachal Pradesh, India

Scientific name	Local name	Habit	Part used	Disease treated	Ethnobotanical uses	Use value	Fidelity level (%)
Aconitum heterophyllum Walls. ex Royle (Ranunculaceae)	Patish, Atis	Herb	Root	Antidote against snake and scorpion bite, Cough, Gastric problems	Dried root powder is taken with lukewarm water against snake and scorpion bite. A small piece of root is boiled, and the water is taken to cure cough and gastric disorders.	0.37	53%
Ajuga intergrifolia Buch-Ham. ex D. Don (Lamiaceae)	Karku	Herb	Leaf	Asthma, Blood purification	Leaf juice is taken twice a day to cure asthma. Leaf juice is used to purify blood.	0.11	75%
Allium carolinianum Redoute (Alliaceae)	Jangli pyaz	Herb	Bulb	Joint pain, Gastric problems	Powder of bulb is boiled in water or consumed as such (1/2 tea spoon) to cure gastric problems. Also used to relieve joint pain.	0.81	60%
Angelica glauca Edgew. (Apiaceae)	Chaura	Shrub	Root	Thyroid, Gastric problems	A small part of root is boiled, then honey is added. It is taken empty stomach early in the morning to cure thyroid and to avoid gastric problems.	0.88	51%
Arnebia benthamii (Wall. ex. G. Don) I.M. Johnst. (Boraginaceae)	Ratanjot	Herb	Root	Blood purification	Powder of the roots is taken empty stomach every morning to purify blood.	0.34	100%
Artemisia maritima L. (Asteraceae)	Nayurcha, nyurchi, Seski	Herb	Whole plant	Asthma, Wounds, Cough, and Fever	The paste of whole plant is applied to heal cuts and wounds. Decoction of leaves is used to treat cough and fever. The dry root powder is given with water to asthma patients.	0.37	30%
Artemisia nilagirica (C.B. Clarke) Pamp. (Asteraceae)	Chirmara	Herb	Leaf	Fungal infections	The paste of the leaves is applied on the affected area to cure fungal infections.	0.13	100%
Aster flaccidus Bunge (Asteraceae)	Seertik	Herb	Aerial part	Cold	Powder of aerial parts is given to cure cold.	0.04	100%
Astragalus rhizanthus Benth. (Fabaceae)	Zomoshing	Herb	Leaf, Root	Fungal infections, Gastric disorders, Abdominal pain, Leucorrhoea	The leaf paste is applied to treat fungal infections. Root powder is taken with warm water to cure gastric troubles and abdominal pain. Also, one tea spoon of this powder is taken empty stomach to cure leucorrhoea.	0.23	50%
Bergenia stracheyi (Hook F. & Thomas.) Engl.	Shamlot	Herb	Rhizome , Leaf	Blood purification, Jaundice	Leaves are chewed as a blood purifier. Rhizome paste is given with water to cure jaundice.	0.27	70%

(Saxifragaceae)							
Chaerophyllum villosum Wall. ex DC. (Apiaceae)	Tila	Herb	Root, Tuber	Gastric problems, Fungal infections	Root paste is applied on skin to cure fungal infections. Tubers are consumed to cure gastric problems.	0.16	60%
Chenopodium album L. (Amaranthaceae)	Chilm	Herb	Leaf	Irregular periods, Gastric problems	Decoction of leaves is given to cure irregular periods. Also, the leaf decoction is taken empty stomach in the morning to alleviate gastric problems.	0.18	50%
Convolvulus arvensis L. (Convolvulaceae)	Dechig-mendo	Herb	Leaf, Flower	Kidney pain	Sun-dried leaves and flowers are boiled in water and taken to cure kidney pain.	0.04	100%
Dactylorhiza hatagirea (D. Don) Soo (Orchidaceae)	Salampanja	Herb	Rhizom e	Wounds, Cough and Cold	The rhizome paste is applied on wounds. Also, it is mixed with honey and given to children to cure cough and cold.	0.79	37%
Dolomiaea costus (Falc.) Kasana & A.K. Pandey (Asteraceae)	Kuth	Herb	Root	Cold and Cough	Root paste is applied on chest to get relief from cold and cough.	0.74	67%
Fragaria vesca L. (Rosaceae)	Palla	Herb	Leaf	Earache	The juice of leaves is put in ears to cure earache.	0.02	100%
Fraxinus xanthoxyloides (G. Don) Wall. ex A. DC. (Oleaceae)	Chumb	Tree	Leaf	Diabetes	Two to three leaves are chewed empty stomach every morning to control blood sugar levels.	0.37	100%
Geranium nepalense Sweet (Geraniaceae)	Laljadi	Herb	Root	Stomach ulcers, Stomach ache, and Wounds	Root paste is applied on wounds. Root is boiled in water and taken to cure stomach ache and stomach ulcers.	0.06	33%
Hippophae rhamnoides L. (Elaeagnaceae)	Sarla	Tree	Leaf, Fruit	Immunity booster and Gastric problems	Leaves and fruit are boiled in water and taken empty stomach to cure gastric problems. The juice of the fruit is taken as immunity booster.	0.46	52%
Hyoscyamus niger L. (Solanaceae)	Bazerbangh	Herb	Leaf	Toothache, Mouth ulcers	Leaves are kept as such on tooth to reduce toothache. Leaves are boiled in water and gargled to treat mouth ulcers.	0.25	62%
Hyssopus officinalis L. (Lamiaceae)	Tiyanku	Herb	Flower, Leaf	Fungal infections	Paste of flowers and leaves is applied to fungal infections.	0.04	100%
Inula racemosa Hook.f. (Asteraceae)	Mano	Herb	Root	Asthma, Blisters	Root powder is taken to treat asthma while root paste is applied on blisters.	0.16	60%

Juniperus communis L. (Cupressaceae)	Devidyal	Shrub	Leaf, Heart wood	Fungal infection	Leaves and a piece of heartwood are boiled until a small amount of extract remains. This is then applied to the fungal-infected area.	0.41	100%
Koenigia polystachya (Wall. ex Meisn.) T.M. Schust. & Reveal (Polygonaceae)	Khabin	Herb	Aerial part	Kidney stone, Mouth ulcers, Acidity and Indigestion	Aerial parts of the plant are consumed empty stomach during morning to treat indigestion & acidity. It also cures mouth ulcers. Decoction of the leaves is taken to treat kidney stone.	0.18	50%
Malva verticillata L. (Malvaceae)	Sotsal, Mikandi	Herb	Leaf, Root	Sores (oral), Diarrhoea, Pain during child birth	Leaves are boiled in water; this water is used for gargling to treat sores. Also, decoction of the leaves is given to treat diarrhea while root decoction is given to relieve pain during child birth.	0.11	50%
Origanum vulgare L. (Lamiaceae)	Lamay masha, Massow	Herb	Whole plant	Asthma, Diarrhoea	Decoction of the plant is given regularly in the morning to treat asthma. Also, the leaf decoction is given to treat diarrhoea.	0.32	83%
Pedicularis bicornuta Klotzsch (Scrophulariaceae)	Lugru serpo	Herb	Leaf, Root	Liver ailments, Kidney pain	Powder of the leaves is taken empty stomach every morning to treat liver infection while the root powder is taken in a same way to cure kidney pain.	0.23	50%
Piccorhiza kurrooa Royle ex Benth. (Scrophulariaceae)	Karu	Herb	Whole plant	Intestinal worms, Asthma	Decoction of the plant is used to expel intestinal worms. Smoke of roots is used to cure asthma.	0.51	55%
Plantago major L. (Plantaginaceae)	Kareecha	Herb	Whole plant	Gastric problems, Fever	Decoction of the plant is taken to get relief from gastric problems and to cure fever.	0.04	50%
Podophyllum hexandrum Royle (Berberidaceae)	Ban kakdi	Herb	Fruit, Rhizome	Asthma, Constipation	Fruits are used to treat constipation. Decoction of rhizome is used to treat asthma.	0.67	77%
Potentilla atrosanguinea G. Lodd. (Rosaceae)	Marpu	Herb	Leaf	Wounds	Paste of leaves is applied on wounds.	0.04	100%
Primula denticulata Sm. (Primulaceae)	Marpo	Herb	Leaf	Warts, Psoriasis	Paste of the leaves is applied to remove warts. Leaf juice is mixed with mustard oil and applied to treat psoriasis.	0.13	66%
Ranunculus diffusus DC. (Ranunculaceae)	Chesa	Herb	Leaf	Burns, Cough	Paste of the leaves is applied on burns. Powder of dried leaves is taken with honey to cure cough.	0.04	50%

Rheum emodi Wallich. (Polygonaceae)	Archo, Chukri	Herb	Aerial part	Indigestion, Fungal infection	The decoction of aerial part is taken to relieve indigestion. Paste of the leaves is applied on fungal infections.	0.20	71%
Rumex nepalensis Spreng. (Polygonaceae)	Chumcha	Herb	Root, Leaf	Gastric problems, Boils, and Tonic	Decoction of roots is used to cure gastric problems. Paste of the leaves is applied on boils. Leaves are added in either vegetable or curries as a tonic.	0.18	50%
Salvia campanulata Wall. ex Benth. (Lamiaceae)		Herb	Leaf	Fever, Cough and Cold	Leaves are dried and powdered and taken with water. Leaves are chewed to cure cough and cold.	0.06	33%
Taraxacum officinale L. (Asteraceae)	Khur-Khang, Paranbala	Herb	Stem	Stomach ache, Boils	Dried powder of stem is taken with lukewarm water once a day to treat stomach ache. Also the paste of the stem is applied to cure boils.	0.09	50%
Thymus serpyllum L. (Lamiaceae)	Banajwain	Herb	Leaf, Seed	Pain during childbirth	Decoction of leaves and seeds is regularly given to avoid pain during childbirth.	0.60	100%
Urtica dioica L. (Urticaceae)	Aan	Herb	Leaf, Root	Arthritis, Periods pain	The leaves are boiled along with other vegetables like a soup and taken to cure period pains. Also, the root decoction is applied externally for 2-3 weeks to treat arthritis.	0.34	92%
Verbascum thapsus L. (Scrophulareaceae)	Kolomasta	Herb	Leaf, Flower	Cough, Boils and Asthma	Smoke of the leaves is inhaled to cure cough and asthma. Flower is cooked in mustard oil and applied on boils.	0.30	63%
Viola canescens Wall. (Violaceae)	Vanaska	Herb	Root	Fever	Powder of dried root is given to cure fever.	0.02	100%

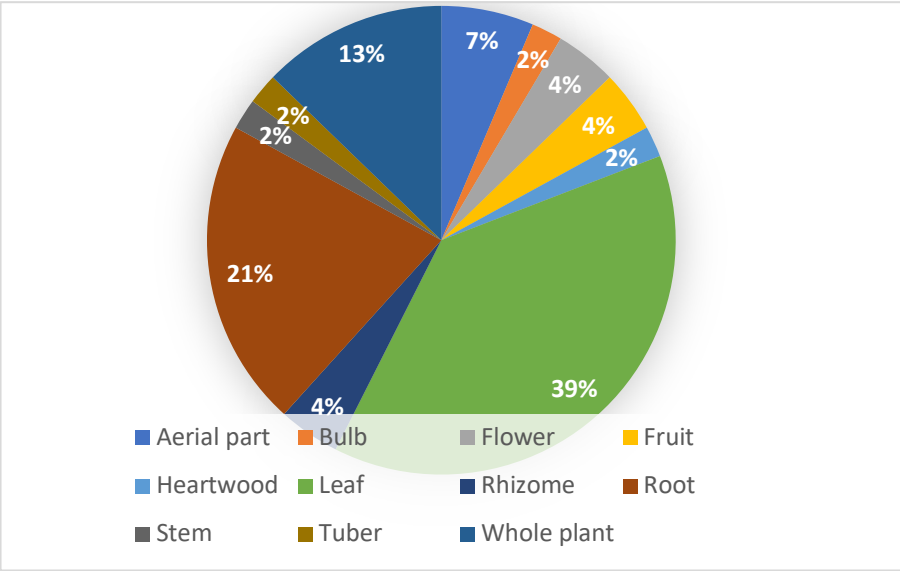

Figure 4. Plant parts used in Lahaul valley

As per the International Classification of Primary Care, the ailments were categorized into ten disease categories (Table 2). The maximum number of species was used for the digestive category of diseases (n=19), while the least number of species (n=1 each) was used against diseases under the eye and ear problems category.

Quantitative parameters help in the determination of the importance of a particular species, its research value, and its developmental potential in the future.

Species consensus or Fidelity level (FI%)

The FL varied from 30% to 100%. It was highest for *Arnebia benthamii, Artemisia nilagirica*, *Aster flaccidus, Convolvulus arvensis, Fragaria vesca, Hyssopus officinalis, Juniperus communis, Potentilla atrosanguinea, Thymus serpyllum, Viola canescens,* and *Fraxinus xanthoxyloides* (100% each) while *Artemisia maritima* reported the lowest FL (30%).

Informant consensus factor (ICF)

The ICF was evaluated to assess the degree of homogeneity among the informants for the plant species that were employed in each ailment category. Here, the ICF values ranged between 0 to 0.29 and were highest for respiratory disorders (0.29) meaning that most informants agreed on the usage of plants in this category (Table 2).

Use Value (UV)

The UV of each of the species was determined to assess its spectrum of medicinal use in the valley. *Angelica glauca* (UV=0.88) was one of the most frequently reported plant species, followed by *Allium carolinianum* (UV=0.81), *Dactylorhiza hatagirea* and (UV=0.79), *Dolomiaea costus* (UV=0.74). The lowest use value was noted for *Fragaria vesca* (0.02).

The history of human evolution and progression has revolved around the natural assets and their use in a wide range of applications. Still today, plants form the basis of livelihood in tribal dominated landscapes, and the present study revealed the importance of plants for curing various ailments by the natives of the Lahaul valley. This probably can be related to the area's remote location, where modern health facilities are relatively limited. A few of the plant species highlighted in the current study are also used by resident communities of other Himalayan regions, but for different purposes, highlighting regional variations in ethnobotanical knowledge. *Thymus serpyllum* is used in Kinnaur (HP) for treating constipation, stomach ache, and other digestive problems (Bhoria *et al.* 2022) while in Lahaul, we found it to be used for relieving pain during childbirth. Similarly, *Taraxacum officinale* is reported to cure stomach disorders in the Paddar valley of Jammu and Kashmir (Gupta *et al.* 2013), whereas in Lahaul it has applications in curing stomach and skin disorders. Leaves of *Bergenia stracheyi* are used as a blood purifier, and the rhizome paste is administered to cure jaundice in the Pangi Valley as well as in Lahaul Valley (Dutt *et al.* 2014). The diverse uses of species emphasise their importance and variations in folk knowledge. The Asteraceae family accounted for majority of the species that were used. This could be because Asteraceae is amongst the species rich families of Himalaya (Uniyal & Singh 2014).

Table:2- Classification of disease and Informant consensus factor (ICF)

Categories	Ailments	Species Used	No. of use reported	No of taxa used	ICF
Digestive	Constipation, gastric problems, intestinal worms, indigestion, liver ailments, stomach ache, stomach ulcers, abdominal pain, diarrhoea, and acidity, jaundice	*Aconitum heterophyllum, Allium carolinianum, Angelica glauca, Astragalus rhizanthus, Bergenia stracheyi, Chaerophyllum villosum, Chenopodium album, Geranium nepalense, Hippophae rhamnoides, Koenigia polystachya, Malva verticillata, Origanum vulgare, Pedicularis bicornuta, Piccorhiza kurrooa Plantago major, Podophyllum hexandrum, Rheum emodi, Rumex nepalensis, Taraxacum officinale*	22	19	0.14
Urological problems	Kidney stone and kidney pain	*Convolvulus arvensis, Koenigia polystachya, Pedicularis bicornuta*	3	3	0
Endocrine, metabolic and nutritional system	Diabetes, thyroid	*Fraxinus xanthoxyloides, Angelica glauca*	2	2	0
Musculo skeletal	Arthritis and joint pain	*Allium carolinianum, Urtica dioica*	2	2	0
Respiratory	Asthma, cough and cold	*Aconitum heterophyllum, Ajuga integrifolia, Artemisia maritima, Aster flaccidus, Dactylorhiza hatagirea, Dolomiaea costus, Inula racemosa, Origanum vulgare, Picrorhiza kurrooa, Podophyllum hexandrum, Ranunculus diffusus, Salvia campanulata, Verbascum thapsus*	18	13	0.29
Skin problems	Boils, burns, warts, wounds, fungal infections, psoriasis, snake bite, and scorpion bite (animal bite)	*Aconitum heterophyllum, Artemisia maritima, Artemisia nilagirica, Astragalus rhizanthus, Chaerophyllum villosum, Dactylorhiza hatagirea, Geranium nepalense, Hyssopus officinalis, Juniperus communis, Potentilla atrosanguinea, Primula denticulata, Ranunculus diffusus, Rheum emodi, Rumex nepalensis, Taraxacum officinale, Verbascum Thapsus*	17	16	0.06
Oral health problems	Toothache, mouth ulcers, blisters, and sores	*Hyoscyamus niger, Inula racemosa, Koenigia polystachya, Malva verticillata*	5	4	0.25
General and unspecified	Fever, tonic, immunity booster, blood purification	*Ajuga integrifolia, Arnebia benthamii, Artemisia maritima, Bergenia stracheyi, Hippophae rhamnoides, Plantago major, Rumex nepalensis, Salvia campanulata, Viola canescens*	9	9	0
Eye and ear problems	Earache	*Fragaria vesca*	1	1	0
Female Genital system	Pain during childbirth, irregular periods, leucorrhoea, and periods pain	*Astragalus rhizanthus, Chenopodium album, Malva verticillata, Thymus serpyllum, Urtica dioica*	5	5	0

Many of the species used by the respondents form important ingredients of various ayurvedic formulations. *Aconitum heterophyllum* which is used in the area against snakebites is an ingredient of *Chandraprabha vati* that relieves musculoskeletal disorders (Kumar *et al.* 2019). Similarly, *Picrorhiza kurrooa* is the main ingredient of *Arogyavardhini vati* and in the valley, it is used for curing chronic stomach disorders and also skin eruptions. It is a constituent of ayurvedic drugs that target liver health (Shakya *et al.* 2020). To meet the high demand of the industry, rampant extraction of these species occurs which has threatened their survival in the wild. They are now listed as threatened by the International Union for Conservation of Nature. The same holds true for *Dactylorhiza hatagirea* which is used to treat cold in Lahaul valley (Wani *et al.* 2020).

The high FL value (100% for species such as *Arnebia benthamii, Artemisia nilagirica*, & *Aster flaccidus*) indicates the importance of the species in the area, and their relative medicinal potential to cure the disorder. This, at times, may also reveal the presence of important phytochemicals with pharmacological applications. Further, for respiratory disorders, a high ICF value (0.29) indicates agreement amongst informants with regard to the use of the mentioned species for the purpose. High-altitude regions are characterized by low atmospheric pressure and rarified gases, which can exacerbate respiratory conditions (Guo *et al.* 2023) and thus high ICF value for the respiratory disease category is noteworthy, thereby highlighting the importance of knowledge documentation. The high UV of species such as *Angelica glauca* (UV=0.88) and *Allium carolinianum* (UV=0.81) indicate their high importance to the local communities as they are used to treat a wide array of ailments. This ethnomedicinal significance aligns closely with existing pharmacological evidence. *Angelica glauca* is well-documented for its anti-inflammatory, antioxidant, antifungal, antibacterial, and anticancer properties, largely attributed to its essential oils, coumarins, and phthalide compounds such as (Z)-ligustilide, (Z)-butylidene phthalide, and (E)-butylidene phthalide (Parkash *et al.* 2025, Kumar *et al.* 2022). Similarly, *Allium* sp. contain bioactive compounds like allicin and flavonoids, which exhibit anti-inflammatory, antioxidant, and anticancer properties by modulating key cellular pathways (Singh *et al.* 2025).

Additionally, *Dactylorhiza hatagirea* is known to contain dactylorhins (A–E) and dactylose (A and B), linked to diverse biological activities including anti-inflammatory, and antimicrobial (Sharma *et al.* 2024). *Bergenia stracheyi* demonstrates significant antioxidant and free-radical scavenging activity, which is attributed to its high polyphenol content (Kumar & Tyagi 2013). *Picrorhiza kurrooa,* a primary source of iridoid glycosides—picrosides I, II, and kutkosides widely recognized for its potent hepatoprotective and immunomodulatory properties (Sultan *et al.* 2016). It is also worth noting that chumb (*Fraxinus xanthoxyloides)*, was reported by people to treat diabetes, which appears to be a novel use in the area. These findings demonstrate a clear convergence between indigenous knowledge and scientific validation, reinforcing the importance of documenting, conserving, and further evaluating these valuable ethnomedicinal species. All of the respondents were aware of the importance of these plants and feel that their populations are declining.

Noting that many of the species used by the communities are threatened, how traditional knowledge of the communities can be utilized for the conservation of these species must be looked into. Stakeholder involvement, awareness creation, and development of good collection practices for medicinal plants from the wild will not only lead to sustaining plant populations as well as rich traditional knowledge. Also, uses of plants for other purposes such as veterinary may be targeted in future studies along with knowledge comparison between the genders.

Conclusion

This study highlights the rich ethnomedicinal heritage of the Lahaul Valley, where 41 plant species are used to treat a diverse range of ailments. The high Use Values (UV), Fidelity Levels (FL), and Informant Consensus Factors (ICF) recorded for key species such as *Angelica glauca*, *Allium carolinianum*, *Dactylorhiza hatagirea*, and *Picrorhiza kurrooa* reflect their therapeutic relevance and consistent use in traditional healing systems. Many of these species exhibit potent biological activities, having applications in both traditional and modern systems, with some being ingredients in established Ayurvedic formulations. The findings not only highlight region-specific uses but also affirm the alignment of folk practices with scientifically established pharmacological properties. This reinforces the pharmacological promise of these plants and underscores their potential in the development of novel therapeutics.

The documentation of traditional knowledge offers a critical foundation for bioprospecting and future pharmacological research. However, the increasing commercial demand for medicinal plants has led to unsustainable harvesting practices, threatening the survival of several high-value species. Therefore, the conservation of ethnomedicinal knowledge must go hand in hand with the promotion of sustainable cultivation practices. Active involvement of local communities, capacity building, and formulation of region-specific management plans are essential to ensure the long-term availability of these bioresources.

Declarations

List of abbreviations: TK – Traditional Knowledge; FL- Fidelity Levels**;** ICF - Informant Consensus Factors; UV - Use Values; asl – Above Sea Level; CSIR – Council of Scientific and Industrial Research; IHBT – Institute of Himalayan Bioresource Technology; HP – Himachal Pradesh; ICPC – International Classification of Primary Care; WONCA – World Organization for Family Doctors; WHO – World Health Organization

Ethics approval and consent to participate: Recognizing that the study aimed at documenting traditional uses of plants only, the study was granted an exemption from requiring ethics approval CSIR-IHBT Institutional Ethics Committee (IEC/OR/Him SKU/0523). Prior informed consent of the respondents was obtained.

Consent for publication: Oral consent taken. All persons shown in images provided their consent to have the image published.

Availability of data and materials: data generated or analysed during this study are included in this article.

Competing interests: The authors declare having no competing interests

Funding: Financial Assistance for the study was provided by the Council of Scientific and Industrial Research, India, through the project on Immunomodulation (HCP-0035).

Author contributions: RS: Survey, data collection, literature review, drafting. AB: Data recording, analysis, literature review, manuscript drafting. AK: Survey, data collection. Sanjay Kr. Uniyal**:** Overall guidance, Manuscript review, and Fund acquisition.

Acknowledgements

The authors are thankful to the Director CSIR-IHBT for the support and facilities and to the local inhabitants of the area for sharing their knowledge. We thank Dr. Vikas Kumar and Mr. Om Parkash for taxonomical assistance while Mr. Narinder is thanked for helping us in the field. The Editor-in-Chief and the two anonymous reviewers are thanked for their comments and suggestions that helped improve the manuscript.

Literature cited

Anand AV, Sreedevi MJ, Swapna TS. 2023. Plant Conservation Associated with Traditional Knowledge: Past and Future. In Conservation and Sustainable Utilization of Bioresources. Singapore: Springer Nature Singapore 261-290. doi: 10.1007/978-981-19-5841-0_11

Aswal BS, Mehrotra BN. 1994. Flora of Lahaul-Spiti (A cold desert in north west Himalaya). Bishen Singh Mahendra Pal Singh, Dehradun, India.

Bhoria R, Pathania R, Kumar N, Rawat S, Thakur N. 2022. Traditional medicinal aspects of some plants of Kinnaur and Lahaul Spiti tribal habitat of north west Himalayan region of HP: a review. International Journal of Phytology Research 2:19-23.

Canales M, Hernandez T, Caballero J, De Vivar AR, Avila G, Duran A, Lira R. 2005. Informant consensus factor and antibacterial activity of the medicinal plants used by the people of San Rafael Coxcatlan, Puebla, Mexico. Journal of Ethnopharmacology 97:429-439. doi: 10.1016/j.jep.2004.11.013

Census of India. 2011. https://censusindia.gov.in (Accessed 03/07/2025).

Daniel SF, Fransworth NR. 2001. The value of plants used in traditional medicine for drug discovery, Reviews in Environmental Health 1:69-75.doi: 10.1289/ehp.01109s169

District Survey Report. https://dest.hp.gov.in/sites/default/files/DSR%20LahaulSpiti.pdf#:~:text=According%20to%20the%20Department%20of%20Land%20Records%2C,is%2066%20percent%20less%20than%20the%20estimated. (Accessed 03/07/2025).

Dutt B, Nath D, Chauhan NS, Sharma KR, Sharma SS. 2014. Ethno-medicinal plant resources of tribal Pangi Valley in district Chamba, Himachal Pradesh, India. International Journal of Bio-resource and stress management 5(3):416-21. doi: 10.5958/0976-4038.2014.00591.0

Ekor M. 2014. The growing use of herbal medicines: issues relating to adverse reactions and challenges in monitoring safety. Frontiers in Pharmacology 4:177. doi: 10.3389/fphar.2013.00177

Farnsworth NR. 1988. Screening plants for new medicines. In: Wilson EO. (Ed). Biodiversity. National Academy Press, Washington, D.C., USA, Pp. 81-99.

Gazzaneo LR, De Lucena RF, de Albuquerque UP. 2005. Knowledge and use of medicinal plants by local specialists in a region of Atlantic Forest in the state of Pernambuco (Northeastern Brazil). Journal of Ethnobiology and Ethnomedicine 1:1-8. doi: 10.1186/1746-4269-1-9

Guo L, Sun J, He Z, Shi Q, Ma. 2023. Understanding acute respiratory distress syndrome in high-altitude environments: a comprehensive review of diagnosis and treatment. Medical Science Monitor: International Medical Journal of Experimental and Clinical Research 29: e939935-1–e939935-10.doi: 10.12659/MSM.939935

Gupta SK, Sharma OP, Raina NS, Sehgal S. 2013. Ethno-Botanical Study of Medicinal Plants of Paddar Valley of Jammu and Kashmir, India. African Journal of Traditional, Complementary, and Alternative Medicines 10:59-65. doi: 10.4314/ajtcam.v10i4.10

Heinrich M, Ankli A, Frei B, Weimann C Sticher O. 1998. Medicinal plants in Mexico: Healers consensus and cultural importance. Social Science & Medicine 47:1859-1871. doi: 10.1016/S0277-9536(98)00181-6

Kumar A, Adhikari BS, Rawat GS. 2017. Biogeographic delineation of the Indian Trans-Himalaya: need for revision. Current Science 113(6):1032-3.

Kumar A, Aswal S, Chauhan A, Semwal RB, Kumar A, Semwal DK. 2019. Ethnomedicinal investigation of medicinal plants of Chakrata region (Uttarakhand) used in the traditional medicine for diabetes by Jaunsari tribe. Natural Products and Bioprospecting 9:175-200. doi: 10.1007/s13659-019-0202-5

Kumar A, Choudhary A, Kaur H. 2020. Diversity of wild medicinal flora in Lahaul valley of Himachal Pradesh. International Journal of Current microbiology and Applied Sciences 9:48-62. doi: 10.20546/ijcmas.2020.907.006

Kumar P, Rana V, Singh AN. 2022. Angelica glauca Edgew. –a comprehensive review. Journal of Applied Research on Medicinal and Aromatic Plants 1; 31:100397. doi: 10.1016/j.jarmap.2022.100397

Kumar V, Tyagi D. 2013. Phytochemical screening and free-radical scavenging activity of Bergenia stracheyi. Journal of Pharmacognosy and Phytochemistry 1;2(2).

Leonti M. 2022. The relevance of quantitative ethnobotanical indices for ethnopharmacology and ethnobotany. Journal of Ethnopharmacology 288:115008. doi: 10.1016/j.jep.2022.115008

Mahapatra AD, Bhowmik P, Banerjee A, Das A, Ojha D, Chattopadhyay D. 2019. Ethnomedicinal wisdom: an approach for antiviral drug development. In: Khan MS, Ahmad I, Chattopadhyay D. (eds). New look to phytomedicine: Advancements in Herbal Products as Novel Drug Leads, Academic Press, Cambridge, MA, USA, Pp. 35-61. doi: 10.1016/B978-0-12-814619-4.00003-3

Parkash V, Kumar V, Gaur A, Chirag H, Thakur A, Purohit VK. 2025. Chemical composition and antifungal activity of rhizomatous essential oil of cultivated Angelica glauca Edgew.: an endangered and medicinally valuable plant species of Northwest Himalayas. Natural Product Research 30:1-7. doi: 10.1080.14786419.2025.2513040

Phillips O, Gentry AH, Reynel C, Wilkin P, Galvez-Durand B. 1994. Quantitative ethnobotany and Amazonian conservation. Conservation Biology 8:225-248. doi: 10.1046/j.1523-1739.1994.08010225.x

Shakya N, Verma GK, Chaturvedi A, Verma R, Singh JP. 2020. Role of virechanottara sanshamana chikitsa in the management of Ekakushtha (Psoriasis vulgaris): a case study. Journal of Ayurveda and Pharma Research 11(4):2020.

Sharma S, Kumar V, Seth CA, Sourirajan A, El-Shazly M, Dev K. 2024. A comprehensive review on the phytochemistry, pharmacological properties, and in vitro propagation of an endemic medicinal orchid, *Dactylorhiza hatagirea*. Naunyn-Schmiedeberg's Archives of Pharmacology 397(5):2621-35. doi: 10.1007/s00210-023-02827-5

Singh A, Nautiyal MC, Kunwar RM, Bussmann RW. 2017. Ethnomedicinal plants used by local inhabitants of Jakholi block, Rudraprayag district, western Himalaya, India. Journal of Ethnobiology and Ethnomedicine 13:1-29. doi: 10.1186/s13002-017-0178-3

Singh A, Samant SS, Manohar L, Sharma. 2022. Conservation Prioritization Criteria to Identify Rarity of the Plant Species, Habitats and Communities in the Lahaul Valley, Trans North-Western Himalaya, India. Arid Ecosystems 12(3):251-271. doi: 10.1134/S2079096122030131

Singh N, Gusain A, Nigam M, Mishra AP. 2025. The pharmacological and therapeutic versatility of Allium species: a comprehensive exploration of bioactive constituents and biological activities. Discover Applied Sciences 14;7(4):349. doi: 10.1007/s42452-025-06800-0

Sultan P, Jan A, Pervaiz Q. 2016. Phytochemical studies for quantitative estimation of iridoid glycosides in *Picrorhiza kurroa* Royle. Botanical Studies 57(1):7. doi: 10.1186/s40529-016-0121-2

Teklehaymanot T, Mirutse G. 2007. Ethnobotanical study of medicinal plants used by people in Zegie Peninsula, Northwestern Ethiopia. Journal of ethnobiology and Ethnomedicine 3:1-11.

Thakur M, Asrani RK, Thakur S, Sharma PK, Patil RD, Lal B, Parkash O. 2016. Observations on traditional usage of ethnomedicinal plants in humans and animals of Kangra and Chamba districts of Himachal Pradesh in North-Western Himalaya, India. Journal Ef ethnopharmacology 191:280-300. doi: 10.1016/j.jep.2016.06.033.

Thakur M, Sharma PK, Asrani RK, Patil RD, Gautam H. 2020. Traditional therapeutic uses of some important medicinal and aromatic plants of the tribal area of Lahaul valley of Himachal Pradesh, India. Indian Journal of Traditional Knowledge 19(4):761-775.

Uniyal SK, Singh KN, Jamwal P, Lal B. 2006. Traditional use of medicinal plants among the tribal communities of Chhota Bhangal, Western Himalaya. Journal of Ethnobiology and Ethnomedicine 2:1-8. doi: 10.1186/1746-4269-2-14

Uniyal SK, Singh RD. 2014. Biodiversity Information: The Need and Importance of FloralSurveys. Proceedings of the National Academy of Sciences, India Section B: Biological Sciences 84(3):439–446. doi: 10.1007/s40011-013-0277-4

Verma RK, Tewari VP. 2016. Some Important Medicinal Plants of Cold Desert Regions of District Kinnaur of Himachal Pradesh State in India Their uses and Chemical Ingredients. Journal of Plant Chemistry and Ecophysiology 1:1-9.

Vidyarthi S, Samant SS, Sharma P. 2013. Traditional and indigenous uses of medicinal plants by local residents in Himachal Pradesh, North Western Himalaya, India. International Journal of Biodiversity Science, Ecosystem Services & Management 9:185-200. doi: 10.1080/21513732.2013.823113

Wangchuk P. 2018. Therapeutic applications of natural products in herbal medicines, biodiscovery programs, and biomedicine. Journal of Biologically Active Products from Nature 8(1):1-20. doi: 10.1080/22311866.2018.1426495

Wani IA, Kumar V, Verma S, Jan AT, Rather IA. 2020. *Dactylorhiza hatagirea* (D. Don) Soo: A Critically Endangered Perennial Orchid from the North-West Himalayas. Plants 9:1-7. doi: 10.3390/plants9121644

World health organization, https://www.who.int/initiatives/who-global-centre-for-traditional-medicine (Accessed 15/12/2023).

World health organization, the world health report. 2002: Reducing risks, promoting healthy life. 2002.

World Organization of Family Doctors, https://www.globalfamilydoctor.com/groups/ workingparties/wicc.aspx (Accessed 4/07/2025).