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Original Research Article

Ethnobotanical Exploration of Plants Utilized by the Bhotiya Tribe in the Upper Johar Valley, Indo-Tibet Border

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Abstract: The Johar Valleyis divided into three zones- Malla Johar, Talla Johar, and Goriphat ranging from 2200m to 3500m altitude in Munsiyari Tehsil, Pithoragarh district, Kumaon Himalaya. The Bhotiya, the predominant tribe in the area, relies heavily on the region's vegetation and practices transhumance. Focusing on documenting plants used by the tribe for ethnobotanical purposes. This study was conducted in the Upper Johar Valley across all 13 villages in the study area. During the field survey, elderly individuals aged 40 to 75 were interviewed within the villages using a semi-structured questionnaire. The questionnaire was designed to collect both quantitative and qualitative data. A total of 55 individuals were interviewed across the villages, resulting in the identification of 45 medicinal plant species belonging to 25 different families. Among these, 33 species were herbs and 6 were shrubs, with the Apiaceae, Asteraceae, and Polygonaceae families each represented by four species. Use Value (UV) analysis for each species was also done, ranging from 0.02 to 1.0, with *Allium stracheyi* showing the highest UV (1.0), and *Arisaema propinquum* and *Humulus lupulus* the lowest at 0.02 each. Additionally, the study documented nine traditional practices employed by the tribe to treat various ailments, emphasizing the depth of ethnobotanical knowledge preserved by this community. The study concluded that the decline of indigenous knowledge surrounding medicinal plants among local communities in the upper Johar Valley. Preserving this information requires urgent action, including the documentation of these plants, the implementation of educational programs, and the promotion of intergenerational knowledge-sharing initiatives

Keywords: Bhotiya tribe, Ethnomedicinal plants, Goriphat, Malla Johar, Talla Johar

Introduction

Humans have relied on plants for their well-being and survival for thousands of years, utilizing them as essential resources for food, medicine, shelter, and various daily needs. This deep-rooted relationship has driven countless innovations and practices across cultures, from ancient herbal remedies and agricultural systems to modern pharmaceuticals and sustainable materials. Even today, plants remain indispensable in addressing pressing issues like food security, health care, and environmental sustainability, underscoring the ongoing importance of plant-based resources in human society. An estimate by the WHO reveals that 80% of the global population relies on plant-based drugs as a primary source of healthcare (Kala *et al.*, 2006; Singh, 2023). Over 21,000 plant species are used worldwide for health-related purposes, with approximately 2,500 species originating from India. Among these, 150 species are widely and profitably utilized for

medicinal production (Modak *et al.*, 2007). India has a rich heritage of traditional medicinal practices, including systems like Siddha, Unani, and Ayurveda, which collectively utilize over 2,000 plant species. The country is home to one of the oldest folk traditions globally in the use of medicinal plants, with this knowledge rooted in the customs and expertise of indigenous communities (Samant *et al.*, 1998). The Indian Himalayan Region (IHR) stands out for its diverse array of medicinal plants, housing a unique assortment of traditional folk plants. Notably, 31% of the species in the IHR are native, and 15.5% are endemic to the region, while only 14% of the flora is under threat (Kumari *et al.*, 2011). The IHR is also inhabited by various tribal groups, including the Bhotias, Buksa, Tharu, Jaunsari, Shaukas, Kharvar and Mahigir, who actively use medicinal plants for natural treatments. This integration of traditional plant knowledge remains a crucial part of healthcare among these communities (Singh *et al.*, 2003).

The hilly state Uttarakhand in India, is home to five major tribal groups: the Jaunsari, Tharu, Raji, Buksa, and Bhotiya (Sharma *et al.*, 2011). In particular, the Kumaun region stands out for its rich diversity of ethnomedicinal plants and holds a significant place in the traditional medicine practices of the western Himalayas (Kapkoti *et al.*, 2014). These communities rely on local plants as primary sources of medicine to treat various ailments. Their ethnobotanical knowledge, deeply rooted in the use of native plants for medicinal purposes, has become an integral part of their beliefs, cultural heritage, art, and folklore (Pushpangadan and Kumar, 2005). However, due to the ongoing reliance on these plants and unsustainable harvesting practices, many valuable medicinal species are now becoming rare (Swe and Win, 2005). The focus of this study was to document and analyze the traditional knowledge held by the community in the Upper Johar Valley of Uttarakhand. By capturing this information, the study aims to facilitate further scientific research into these ethnomedicinal practices and to support conservation efforts for the sustainable use of these valuable plant resources.

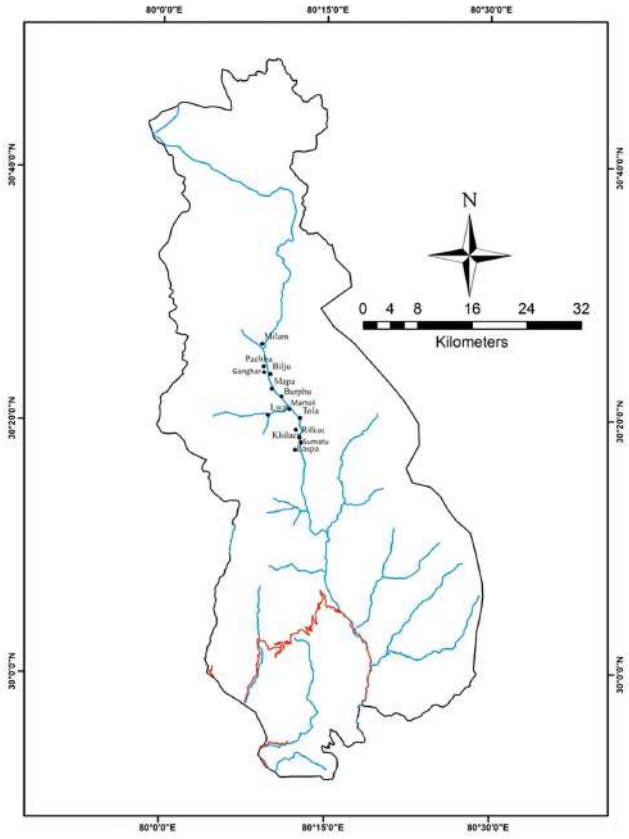


Fig. 1. Location map of the study area.

Materials and methods

Study area: The high Himalayan region of the Pithoragarh district in Uttarakhand is home to the five Bhotiya valleys, including the Johar Valley (Kak, 2001). The Johar Valley is divided into three main areas: Malla Johar, Salla Johar, and Goriphat, located between 80° east longitude and 30° north latitude. The valley comprises 13 villages, namely Laspa, Rilkote, Tola, Khilach, Sematu, Martoli, Lwa, Burfu, Mapa, Ganghar, Paachu, Bilju, and Milam (Fig. 1). Among these, Laspa has the highest number of households (approximately 25–30 families), followed by Milam with around 20–25 families. In contrast, Sematu has become a ghost village, and Khilach is on the verge of abandonment. The livelihoods of these villages are closely tied to the cultivation of medicinal plants, agriculture, tourism, and livestock. For centuries, the Bhotiya community has been an integral part of this mountainous region, developing extensive knowledge of medicinal herbs. This expertise has evolved over generations, partly due to their frequent travel and trade across the border with Tibet and within Indian markets, where medicinal herbs were among the primary trade

Fig. 2. Geographical proximity and spatial arrangement of village Ganghar and village Paachu in the Johar Valley.

Fig. 3. Gathering indigenous knowledge through questionnaire surveys.

items (Farooque *et al.*, 1999). The Bhotiya's unique relationship with these plants reflects a blend of cultural tradition and ecological understanding, deeply embedded in their way of life (Fig. 2).

Data mining: To collect ethnobotanical knowledge, a questionnaire survey was conducted from July to August 2024 across all 13 villages in the study area. The survey specifically targeted elderly individuals, aged 40 to 75, as they are often the primary holders of traditional knowledge within these communities. In total, 55 people were interviewed across the villages (Fig. 3). Interviews took place within the villages, using semi-structured questionnaires designed to capture both quantitative and qualitative data (Hargreaves and Seale, 1981). The survey gathered detailed information on various aspects of local plant usage, including the indigenous names of plants, medicinal and other utilitarian applications, specific plant parts used, and traditional methods of drug preparation. Additionally, the study aimed to document folk taxonomy, which encompasses the community's unique categorization of plants based on cultural and ecological knowledge. This traditional classification system often includes subtle distinctions not always recognized in scientific taxonomy, reflecting the deep-rooted relationship these communities have with their environment.

Validation of the field information: To validate and enrich the field survey data, secondary literature from credible sources such as research papers, articles, books, and online databases was consulted (Jain 1981; Farooquee and Nautiyal 1999; Ratha *et al.*, 2014, 2015). This process provided additional information and allowed cross-referencing of plant names, uses, and preparation methods, enhancing the accuracy and reliability of the findings. Integrating primary and secondary data created a solid foundation for scientific analysis, future research, and conservation efforts.

Data analysis: The data collected during the field survey was copulated and analyzed for quantitative index: use value (UV). The use value determines which plants are the most useful for medicine in a community. It helps to understand how many times people use a certain plant to treat different illnesses. UV has a range of 0 to 1. UV is high when numerous people report the same plant while UV drops to 0 when only few use-related reports of a part are found.

$$UV = \Sigma UN/N$$

Were, UN= Total number of times people reported using a plant to treat different illness; N= Total number of people reported (Phillips and Gentry, 1993).

Table 1. Ethnobotanical plants utilized by tribes in the study area.

S. No.	Ethnobotanical plants	Local name	Ethnic practices	Part used	Use value
1.	*Aconitum ferox* Wall. ex Ser. (Ranunculaceae)	Vis	The entire plant is toxic, but its root paste is applied as a snakebite remedy.	Root	0.4
2.	*A. heterophyllum* Wall. ex Royle (Ranunculaceae)	Atees	Root juice is ingested to treat fever and stomachache.	Root	0.85
3.	*Allium stracheyi* Baker (Amaryllidaceae)	Jumbo	A paste of fresh leaves and mustard oil is applied for joint pain relief, while dried leaves are used as a spice.	Leaf, Flower	1
4.	*A. wallichii* Kunth (Amaryllidaceae)	Jangali Jumbo	Consumed as food and also used to treat joint pain.	Leaf, Flower	0.18
5.	*Angelica glauca* Edgew. (Apiaceae)	Chipi	Dried roots are chewed to relieve cough and cold, boiled roots are used for stomach issues, and the roots are also consumed as food.	Root	0.91
6.	*Arisaema jacquemontii* Blume (Araceae)	Bhak	Boiled roots are eaten as a dish, seasoned with Jumbo and Kalajeera spices.	Root	0.22
7.	*A. propinquum* Schott (Araceae)	Bhak	Root paste used against snakebite.	Root	0.02
8.	*Arnebia benthamii* (Wall. ex G. Don) I. M. Johnst. (Boraginaceae)	Lal Jari	Dried roots mixed with any type of oil are used to treat hair problems.	Root	0.82
9.	*Berberis jaeschkeana* C. K. Schneid (Berberidaceae)	Kilmora	Root juice treats jaundice and diabetes, while seeds are eaten like wild berries.	Root, Stem	0.04
10.	*Bergenia ciliata* (Haw.) Sternb. (Saxifragaceae)	Patharchatta	Root juice is used for the treatment of kidney stones.	Root	0.13
11.	*Betula utilis* D. Don (Betulaceae)	Bhuj	Powdered bark mixed with oil is used to treat earaches, and wood serves as a primary fuel source for locals.	Wood	0.75
12.	*Bistorta vivipara* (L.) Delarbe (Polygonaceae)	Ban maduva	Seeds are ground into flour, and seed juice is used to treat diabetes.	Seeds	0.22
13.	*Carum carvi* L. (Apiaceae)	Kala Jeera	Seeds are consumed as food, and boiled seeds used as a remedy for stomachache.	Seeds	0.98
14.	*Chaerophyllum villosum* Wall. ex DC. (Apiaceae)	Ganjari	Roots are eaten raw to boost immunity or boiled to treat respiratory issues.	Roots	0.56
15.	*Colocasia esculenta* (L.) Schott (Araceae)	Papar	Leaves are mixed with flour, steamed, and fried with spices like Jumbo and Kalajeera to make the popular local dish "Pathure."	Leaf	0.07
16.	*Dactylorhiza hatagirea* (D. Don) Soo (Orchidaceae)	Hathi Jari	Boiled roots are used to treat leukorrhea and to boost immunity.	Root	0.85
17.	*Delphinium brunonianum* Royle (Ranunculaceae)	Kasturi Phool	A paste of leaves and flowers is applied to boils, cuts, and wounds, and also used as incense.	Flower, Leaf	0.11
18.	*Hippophae salicifolia* D. Don (Elaeagnaceae)	Bodywar Chuk	Seeds were consumed as wild berry and are a rich source of Vitamin C.	Seeds	0.09
19.	*H. tibetana* Schltdl. (Elaeagnaceae)	Chuk	Seeds were consumed as wild berry and is a rich source of Vitamin C.	Seeds	0.42
20.	*Humulus lupulus* L. (Cannabaceae)	Him-hops	Flowers were used to make alcoholic beverages.	Flower	0.02
21.	*Juniperus indica* Bertol. (Cupressaceae)	Bil	Plant is used as fuel and incense.	Leaf, Seeds, Wood	0.75
22.	*Mentha arvensis* L. (Lamiaceae)	Pudina	Leaves are used to make chutney and, when boiled, are brewed into tea for stomachache relief.	Leaf	0.15
23.	*Nardostachys jatamansi* (D. Don) DC. (Caprifoliaceae)	Maasi	Root paste with oil treats back pain; root smoke is used for epilepsy, respiratory issues, and as incense.	Root	0.71
24.	*Ophiocordyceps sinensis* Hywel-Jones & Spatafora (Ophiocordycipitaceae)	Kida Jari	Eaten raw, it helps boost immunity.	-	0.38
25.	*Origanum vulgare* L. (Lamiaceae)	Bantulsi	It is used as incense and locally consumed as green tea, while is also used to cure stomachache.	Leaf, Flower	0.42
26.	*Phytolacca acinosa* Roxb. (Phytolaccaceae)	Jarak	Fried leaves are eaten as fritters, while thoroughly washed and chopped leaves are consumed as food to help cure jaundice.	Leaf	0.27
27.	*Picrorhiza kurroa* Royle ex Benth. (Plantaginaceae)	Kutki	Roots soaked overnight and consumed early in the morning are used as a treatment for diabetes.	Root	0.73
28.	*Pleurospermum brunonis* (DC.) Benth (Apiaceae)	Gokul	Used as incense.	Flower, Leaf	0.49

29.	*Podophyllum hexandrum* Royle. (Berberidaceae)	Ban kakri	Paste made from the root is used to treat cut and wounds.	Root	0.65
30.	*Rheum australe* D. Don (Polygonaceae)	Dolu	A thick paste of boiled roots and resin is applied to broken bones, while root paste is used to relieve joint pain.	Root	0.87
31.	*R. moorcroftianum* Royle. (Polygonaceae)	Taturi	Root juice cures fever, leaf paste treats cuts and wounds, and boiled roots dye woolen products maroon-red.	Root, Leaf	0.45
32.	*Rhododendron campanulatum* D. Don (Ericaceae)	Buras	Root paste treats cuts and wounds, flowers hold religious significance, and wood is used as fuel.	Wood	0.24
33.	*Rosa sericea* Lindl. (Rosaceae)	Sipal	Seeds, eaten as wild berries, are used to treat Jaundice.	Seeds	0.04
34.	*Rumex nepalensis* Spreng. (Polygonaceae)	Shayam	Roots are used as dye to give a light red color.	Roots	0.07
35.	*Satyrium nepalense* D. Don (Orchidaceae)	Salam mishri	Root is consumed to boost immunity.	Roots	0.04
36.	*Saussurea costus* (Falc.) Lipsch (Asteraceae)	Kuth	Root juice is used to treat stomachache, root paste is applied to cut, and wounds and boiled root is used as a dye.	Roots	0.8
37.	*S. gossipiphora* D. Don (Asteraceae)	Kapasi	Used as incense. Flower paste is applied to treat skin related issues, such as pimples.	Roots, Flower	0.04
38.	*S. obvallata* (DC.) Sch. Bip. (Asteraceae)	Bharamkamal	Used as incense and has religious significance. Flower paste is applied to treat cut and wounds.	Flower	0.2
39.	*Skimmia laureola* (DC.) Decne. (Rutaceae)	Nair	Used as incense.	Root	0.04
40.	*Swertia chirayita* (Roxb.) H. Karst. (Gentianaceae)	Chirata	Leaves and flowers soaked overnight and consumed early in the morning are used to cure diabetes and fever.	Leaf, Flower	0.91
41.	*Taraxacum officinale* F. H. Wigg. (Asteraceae)	Gururbuti, Kanphool	Leaf paste is applied to treat cuts and wounds, while boiled roots are used to cure stomach parasitic infections.	Leaf	0.04
42.	*Taxus wallichiana* Zucc. (Taxaceae)	Thuner	Burned bark powder is used to make a butter tea called "Jha" and is believed to have cancer-curing properties.	Bark	0.76
43.	*Thymus linearis* Benth. (Lamiaceae)	Banajwain	Seeds are used as a spice, and boiled seeds are consumed to treat stomachaches.	Seeds	0.16
44.	*Urtica dioica* L. (Urticaceae)	Bichu	Leaf is consumed as food and is used to treat sprain ankles.	Leaf	0.07
45.	*Zanthoxylum armatum* DC. (Rutaceae)	Timur	Seeds are consumed as food and to relieve toothaches, while the stem helps regulate blood pressure.	Seeds, Stem	0.87

Results

Ethnobotanical plants of the study area

The study centred on documenting the ethnomedicinal uses of plants by the local inhabitants of the valley, with a special focus on the Bhotiya tribe, who are known for their traditional plant knowledge. A sum of 45 medicinal plant species, spanning 25 families, were identified and recorded in the region (Table 1). The plant types varied, with herbs being the most prevalent, accounting for 33 of the species. This was followed by 6 shrub species, 4 tree species, and one species each of climber and fungi, emphasizing the diversity of plant forms utilized by the community. Among the families represented, Apiaceae, Asteraceae, and Polygonaceae were the most dominant, each contributing 4 species to the total. This diversity underscores the Bhotiya tribe's extensive knowledge of local flora and their reliance on a range of plant forms for medicinal purposes.The all 45 plant species are used locally in the treatment of 14 types of diseases (Table 1; Fig. 4). Among these, 11 species are primarily used for treating skin conditions and gastrointestinal issues. Additionally, nine distinct plants are commonly applied to reduce fever.

For joint pain relief, five plants- *Allium stracheyi*, *Allium wallichii*, *Rheum australe*, *Rheum moorcroftianum*, and *Saussure acostus* are frequently used (Fig. 5). To enhance immunity, *Dactylorhiza hatagirea*, *Chaerophyllum villosum*, and *Ophiocordyceps sinensis* are highly valued. Similarly, *Bistorta vivipara*, *Picrorhiza kurroa* and *Swertia chirayita* are known for their benefits in managing diabetes.

In other health contexts, specific plants are employed for distinct purposes: *Aconitum ferox* and *Arisaema propinquum* serve as antidotes, while *Chaerophyllum villosum* and *Angelica glauca* are used to alleviate cough and cold. For epilepsy, *Nardostachys jatamansi* and *Aconitum ferox* are locally recognized remedies.

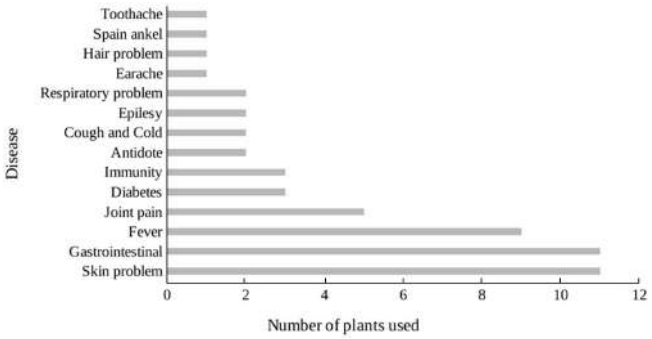


Fig. 4. Ethnobotanical plants and their traditional uses in treating various diseases.

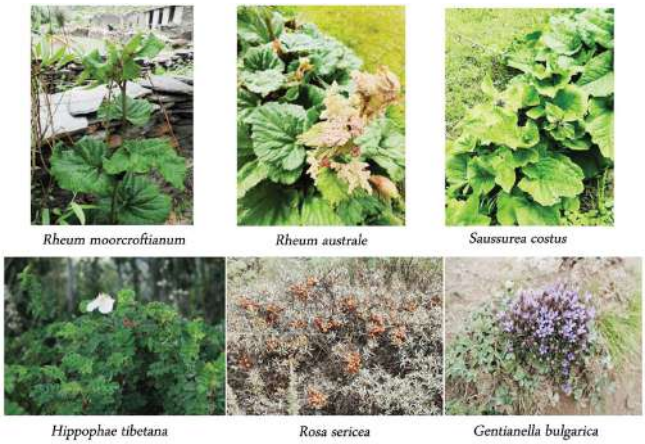


Fig. 5. Showing important ethnomedicinal plants of the study area.

Moreover, certain plants target unique ailments, with individual species used for specific conditions. *Betula utilis*is applied for earache, *Arnebia benthamii*for hair issues, *Urtica dioica* for sprained ankles, and *Zanthoxylum armatum* for toothache (Table 1; Fig. 4).

Use value status: The study calculated the Use Value (UV) to evaluate the cultural significance of each plant. This metric, as defined by Phillips and Gentry (1993), quantifies a plant's relative importance by considering local knowledge and its frequency of use. It revealed that roots were the most commonly utilized plant part for ethnobotanical purposes, accounting for 36.36% of usage, followed by leaves at 23.63% and flowers at 16.36% (Table 1). This preference suggests a deep-rooted traditional knowledge among locals regarding the specific plant parts most effective for medicinal applications. To further quantify plant usage, a Use Value (UV) analysis was conducted for each species, ranging from 0.02 to 1.0. Based on UV scores, the plants were classified into three categories: minimum use value ranged 0.01-0.30, medium use value from 0.31-0.60, and high use value between 0.61-1 represented by 16%, 36% and 49% respectively (Fig. 6). The highest UV was recorded for *Allium stracheyi* (1.0), indicating its significant ethnobotanical importance in the community, while *Arisaema propinquum* and *Humulus lupulus* had the lowest UV (0.02 each), reflecting their limited use. Fifteen plant species were recorded in the high-use category, showing their critical role in local medicinal practices. These include *Allium stracheyi*, *Aconitum heterophyllum*, *Carum carvi*, *Angelica glauca*, *Swertia chirayita*, *Rheum australe*, *Zanthoxylum armatum*, *Dactylorhiza hatagirea*, *Arnebia benthamii*, *Saussurea costus*, *Taxus wallichiana*, *Betula utilis*, *Juniperus indica*, *Picrorhiza kurroa*, and *Nardostachys jatamansi*. This high-use value group indicates the community's dependence on specific plant species for healthcare, and it underscores the importance of these plants not only for local wellness but also for biodiversity conservation initiatives.

Plant parts used in traditional remedies: Plants are highly valued in traditional medicine, with different parts offering specific health benefits. This study identified 14 plants whose roots are used for digestive health, inflammation relief, energy restoration, and immune support (Table 1). Leaves, utilized

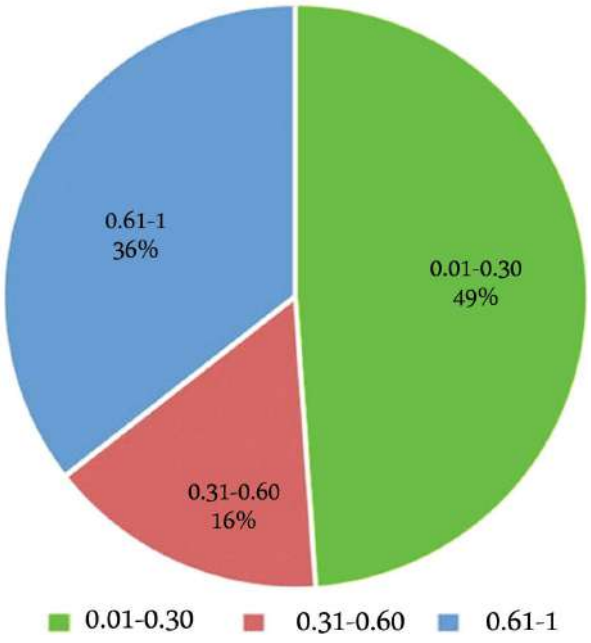
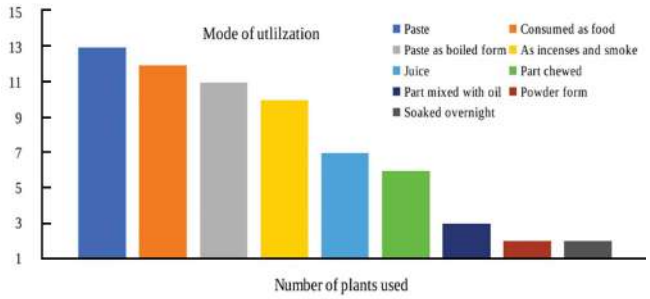


Fig. 6. Use value range.

for respiratory support, skin conditions, and detoxification, are recorded in 13 plants. Flowers from nine plants provide calming effects, aiding in anxiety relief, sleep support, and digestive soothing. Seeds from nine plants promote heart health, hormonal balance, and digestion. Stems (4 plants) and bark (2 plants) are also used; bark is especially known for pain relief, fever reduction, and circulation improvement.

Ethnic practices and traditional knowledge system: The study provides valuable information about the community's ethnobotanical practices, including plant selection based on both availability and efficacy for treating various ailments. The tribal community utilizes ethnobotanical plants in unique ways to treat a variety of ailments, employing nine different preparation forms using various plant parts. These forms include paste, powder, juice, incense, smoke, chewing, soaking overnight, boiling, and raw consumption (Table 1 and Fig. 7). The study found that leaf and root pastes from 13 plants are most commonly used as home remedies. Additionally, 12 plants are regularly consumed as food, followed by 11 plants whose boiled parts are applied in treatments. Incense and smoke derived from 10 plant species are used therapeutically, while the juices of seven plants are popular for medicinal use. Six plants are also eaten raw. Specific examples include *Angelica glauca* for coughs and colds, *Chaerophyllum villosum* and *Ophiocordyceps sinensis* to boost immunity, and *Hippophae salicifolia*, *Hippophae tibetana*, and *Rosa sericea* as edible wild berries (Fig. 5). Three plant extracts are combined with oil for topical applications: *Allium stracheyi*, *Nardostachys jatamansi*, and *Arnebia benthamii* are applied for joint pain and hair treatment. Additionally, *Picrorhiza kurroa* and *Swertia chirayita* are soaked overnight and consumed on an empty stomach to address diabetes and fever. For earaches and cancer, powdered bark from *Betula utilis* and *Taxus wallichiana* is used as a traditional treatment. This diverse range of applications underscores the community's extensive knowledge of ethnobotanical practices, allowing them to address both common and severe health issues with natural resources.



Folk taxonomical characteristics of ethnobotanical plants of the region

During the field survey, the folk taxonomic characteristics of ethnobotanical plants native to the region were also documented. This knowledge on folk taxonomy, which includes the naming and categorization of plants based on local understanding, is invaluable to communities, especially when it comes to commonly used plants. However, the unique, relevant, and easily memorable local names are disappearing, with minimal recorded information on folk taxonomy for many plants (Loko *et al.*, 2018). Globally, plants are frequently recognized by their local names, which often reflect distinct attributes such as appearance, habitat, size, taste, smell, or colour (Singh, 2008).

Engaging with local communities during the study underscored that people's understanding of folk taxonomy is closely linked to the practical uses of diverse plant species found in their environment. These plants serve a variety of essential roles, including providing food, fodder, fuel and medicinal resources. This deep-rooted knowledge is traditionally passed down from generation to generation, preserving information about plants and their uses.

Specific to medicinal plants, local people provided details on the ethnomedicinal applications of several species. Common ailments in the region, such as colds, stomach issues, skin problems, fevers, and diabetes, are typically treated using traditional remedies derived from these plants. The ethnobotanical survey of Upper Johar Valley revealed that tribals still rely onthese traditional practices as their primary healthcare resources, underscoring the importance of preserving and documenting this folk knowledge for future generations.

Ethnobotanical plant conservation and local efforts

This study also underscores urgent conservation concerns among 45 ethnobotanical plant species of Johar valley, with 21 identified as threatened. Among these, 13 are endangered, facing a high risk of extinction due to habitat loss and overharvesting, requiring immediate protective actions. Nine species are critically endangered, at an even higher risk, needing immediate habitat preservation and cultivation efforts. One species is categorized as vulnerable, indicating a high extinction risk without intervention. These findings emphasize the need for conservation strategies, including habitat restoration, sustainable harvesting, and community awareness, to protect these vital ethnobotanical resources.

Swertia chirayita demonstrates a high use value of 0.91, reflecting its significant importance and reliance within the local community for medicinal purposes. This high use value shows that *S. chirayita* holds a prominent place in local healthcare systems, likely due to its well-recognized therapeutic properties. However, the field investigation revealed an interesting practice: local residents are not only using but also marketing *Gentianella bulgarica* under the name "*Chirayita*" (Fig. 5). This substitution likely stems from the diminishing availability of *S. chirayita* in its natural habitat. Overharvesting and environmental pressures have led to a notable decline in its population in the wild, making it increasingly difficult to source *S. chirayita* sustainably. Consequently, *G. bulgarica* has become a substitute, filling the demand for medicinal plants marketed as Chirayita. Although *G. bulgarica* might share some therapeutic properties with *S. chirayita*, the replacement may not offer the same medicinal efficacy, posing potential implications for both healthcare practices and biodiversity conservation.

This situation displays the urgent need for conservation efforts to protect *S. chirayita*, along with public awareness initiatives to ensure the sustainable and accurate use of medicinal plants. By promoting sustainable harvesting practices and educating both locals and consumers about the correct identification and value of *S. chirayita*, efforts can be made to curb its depletion and maintain the integrity of traditional medicine in the region.

Discussion

Kumaun region stands out for its rich diversity of ethnomedicinal plants and holds a significant place in the traditional medicine practices of the western Himalayas where previous attempts have been made by many ethno-botanists (Jain 1981, Pangtey *et al.*, 1989, Samant 1998, Kala 2004; 2005; 2007; 2023, Nautiyal 2000, Negi 2007, Chandra, 2013, Kumar 2020). Indigenous knowledge that the people in a given community have developed over the time and continue to develop it (Balick and Cox, 1996). The present study identified a total of 45 medicinal plant species belonging to 25 different families, exhibiting the rich diversity of flora in the study area. Among these, herbs were the most dominant group, with 33 species, followed by shrubs, which accounted for 6 species. Notably, the families Apiaceae, Asteraceae, and Polygonaceae each contributed significantly to this diversity, with four species represented in each family. This extensive documentation underscores the ecological and medicinal value of the region's plant biodiversity. In contrast, a study by Uniyal *et al.* (2002) reported only 14 threatened medicinal and aromatic plant species within the same study area. This discrepancy may indicate differences in the scope, methodology, or temporal factors influencing plant populations. It also emphasizes the need for continued research and conservation efforts to preserve these valuable species, many of which may be at risk due to habitat loss, overharvesting, or other anthropogenic pressures.

Similar study was conducted by Jalal and Kumar, (2006) and recorded 28 species in the same study area. Some of the plants were found to be used for similar therapeutic purposes as documented in the survey. *Aconitum heterophyllum* tuber is reported to be used in fever; *Carum carvi*and roots of *Pleurospermum angelicoides* are used in gastric ailments; *Cordyceps sinensis* as traditional Chinese medicine; *Dactylorhiza hatagirea* tuber use in making tonic; *Picrorhiza kurroa* roots are applied to treat abdominal pains; *Rheum australe* roots of the treatment of internal injuries.

The villagers utilized 36 of the 45 ethnobotanical plants that were reported as medicine to cure a variety of ailments.

Chemical composition of these 36 plants has been thoroughly investigated worldwide, demonstrating the connection between traditional knowledge and modern medicine. Locals use *Carum carvi* (UV=0.98) extensively as food and its seeds to treat stomach issues. However, studies on its chemical constituents reveal that its seeds contain carvacrol, carvone, α-pinene, limonene, α-terpinene and other compounds that have been shown to have anti-inflammatory, anti-arthritic, antioxidant, and immunomodulatory properties (Sachan *et al.,* 2016). Chemicals founds in *Angelica glauca* (UV=0.91) includes trans-ligustilide, (Z)-3-butylide nephthalide, α-phellandrene, α-phellandrene, p-cymene, (-)-spathulenol, which exhibit a variety of biological activities such as immunomodulatory, analgesic, anti-inflammatory properties (Tewari *et al.,* 2018). Indigenous people have been employing these ethnomedicinal plants since ages, but now aids to various technologies, we have finally discovered the true cause of these plant's therapeutic qualities. However, daily discoveries, harvesting, and over exploitation put these plants in danger of being lost due to their tremendous biodiversity. To conserve and sustainably utilize ethnobotanical plants, some species are being domesticated by local tribes in remote and border areas of Kumaun. This domestication process helps ensure the survival of valuable medicinal plants while allowing communities to benefit from their use with integrated support in these areas, the cultivation and sale of ethnobotanical plants could become a sustainable source of income for the communities in Kumaun, while also conserving biodiversity and preserving valuable traditional knowledge for future generations.

Conclusion

The study concluded that the decline of indigenous and traditional knowledge surrounding medicinal plants among local communities in the upper Johar Valley. This region, historically rich in ethnobotanical practices, uses a total of 45 medicinal plants for treating various ailments. However, with the fading of folk knowledge, these valuable practices face a significant threat. The UV scores ranged from 0.02 to 1.0, indicating varying levels of importance. *Allium stracheyi* scored the maximum UV (1.0), reflecting its high relevance in local medicinal practices, followed closely by *Carum carvi* (0.98), and both *Angelica glauca* and *Swertia chirayita* (0.91 each). These plants are widely used and hold high cultural significance in traditional remedies. *Arisaema propinquum* and *Humulus lupulus* each had a UV of 0.02, suggesting limited use or knowledge regarding their medicinal properties among the community. The study also found that older people possess a deeper understanding of folk taxonomy, likely due to direct experience and long-standing traditions. This folk taxonomy, encompassing locally meaningful and memorable names for plants, plays a crucial role in how communities identify and understand plant usage. Unfortunately, the transmission of this knowledge is diminishing, as younger generations show less familiarity with identification and traditional, resulting in the gradual loss of folk names and the erosion of plant knowledge. This erosion of knowledge not only impacts local healthcare but also threatens the cultural heritage of the Johar Valley. Preserving this information requires urgent action, such as documentation efforts, educational programs and intergenerational knowledge-sharing initiatives. This study underscores the importance of conserving both the plants and the invaluable traditional knowledge associated with them.

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