

Original Research Article
**An ethnobotanical survey of plants used by
communities around Jaunsar- Bawar region of
Uttarakhand, India**

ABSTRACT

The Jaunsar Bawar region of Uttarakhand, India, is well-known for its rich biodiversity and cultural history, which is inseparably connected through traditional ecological knowledge (TEK) and ethnobotanical traditions. This work explores the ethnobotanical knowledge and practices amongst the indigenous communities residing in the JaunsarBawar region, of 11 villages in three tehsils: Kalsi, Tyuni, and Chakrata of Uttarakhand state of India. With extensive field studies, literature reviews, surveys using standard questionnaires, and semi-structured interviews with local inhabitants including Vaidyas, Hakeem, and forest government officials, the study tends to document the rich biodiversity of the region and comprehend the relationship between humans and plants. It documents and explores the traditional usage of 64 plant species of different growth habits and forms for medicine, timber, food, fodder, culinary, rituals, and other purposes. Insights of the study aid in the documentation of local plant species and indigenous wisdom of plant use across generations in the tribal region.

Keywords: Ethnobotany, traditional ecological knowledge, floral diversity, Himalaya, JaunsarBawar.

1. INTRODUCTION

The forest has long been a major source of many resources and services required for human well-being in India and around the world (Bargali et al., 2022). According to the Census (2011), 67.99 % of the population of the Uttarakhand state reside in rural regions and depend entirely or in part on neighboring forests for their daily needs of major forest produce and Non timber forest product (NTFP) species. John Harshberger described ethnobotany as the study of plants used by prehistoric and indigenous people in 1896. It is the study of the interaction between humans and plants, which includes the customs and knowledge of various societies regarding the use of plants for food, medicine, and other services (Panigrahi et al., 2021). Tribal societies have used indigenous knowledge acquired from their forefathers for ages in several aspects of their everyday lives (Sahu, 2020). These indigenous and local populations' skills and experiences benefit the world at large and can serve as a helpful illustration for biodiversity policies (Gerique, 2006). India is a land of diverse ethnic groups and abundant biological resources, making it a hotspot for ethnobotany (Singh et al., 2022). The Bhotia, Tharu, Jaunsari, and Buxa are just a few of the indigenous communities that call Uttarakhand state home and are distinguished by their unique flora varieties (Tewari et al., 2020). The Jaunsari tribe, who inhabit the state's northernmost portion JaunsarBawar region, is

extremely knowledgeable about the indigenous flora and its traditional usage (Tomar and Dhyani, 2020). Because of this, the area has a high biodiversity and a long history of using plants and other natural resources (Pratap and Pratap, 2021). The majority of their livelihood comes from wild natural resources, which they are familiar with. The majority of the population works in agriculture and cattle raising. These individuals also make money by selling the wild produce to nearby markets when the weather is favorable. Wild edible plants make up the majority of the resources that the people who live in the district's communities use to generate income (Thakur and Dutt, 2020). Several workers have conducted ethnobotanical investigations of a central region of the western Himalayas (Bhatt et al., 2024; Gupta et al., 2023; Bargali et al., 2022; Londhe et al., 2020; Sahu, 2020). However, not much is known about the utilization of plants other than their ethnomedicinal significance in the JaunsarBawar region. Hence, the sole objective of this exploration work was to summarise the anthropogenic approach to forest products by investigating the plants used for several purposes by the hill communities in their daily life; recording the plant species of medicinal value, wild edibles, fiber yields, fodder, fuelwood; identified the taxa used in religious ceremonies and psychological practices of the local people; and documented the species used as vegetables, fruits, seeds, grains, condiments, oils, and beverages as wild edibles of the of Uttarakhand's JaunsarBawar region.

2. METHODOLOGY

2.1 Study area: The study has been conducted in the hilly area of north Indian state of Uttarakhand's Gharwal division. JaunsarBawar tribe is mainly present in the districts of Uttarkashi and Dehradun in several villages (Chauhan, 2020), out of which 11 villages were chosen from tehsil Kalsi (4 villages) with elevation 780 m above mean sea level, tehsil Chakrata (5 villages) with elevation of 2,118m amsl and tehsil Tyuni (2 villages) with elevation of 947m amsl ,as mentioned in Table: 1 below.

Table 1. Study area

| SR | VILLAGE | GRAM PANCHAYAT | NO. OF HOUSEHOLD SURVEYED | COORDINATES |
|----------------------|-------------|----------------|---------------------------|------------------------|
| Teh. KALSI | | | | |
| 1 | Vyas Nahri | Vyas Nahri | 10 | 30.5225°N, 77.8403° E |
| 2 | Tilwari | Tilwari | 10 | 30.4010°N, 77.8982° E |
| 3 | Hari pur | Haripur | 10 | 30.5170°N, 77.8363° E |
| 4 | Kalsi | Kalsi | 10 | 30.5179°N, 77.8439° E |
| Teh. CHAKRATA | | | | |
| 5 | Sahiya | Sahiya | 10 | 30.6115° N, 77.8753° E |
| 6 | Lakhamandal | Lakhamandal | 10 | 30.7016° N, 77.8696° E |
| 7 | Rikhar | Rikhaad | 10 | 30.6461° N, 77.8810° E |
| 8 | Birmau | Rikhaad | 10 | 30.6587° N, 77.8953° E |
| 9 | Thana | Thana | 10 | 30.6666° N, 77.8739° E |
| Teh. TYUNI | | | | |
| 10 | Bhagawat | Meghatu | 10 | 30.9483°N, 77.8467° E |
| 11 | Raygi | Raygi | 10 | 30.6332°N, 77.6753° E |

The map layout for geographical representation of selected sites of the study area has been developed using ArcMap.

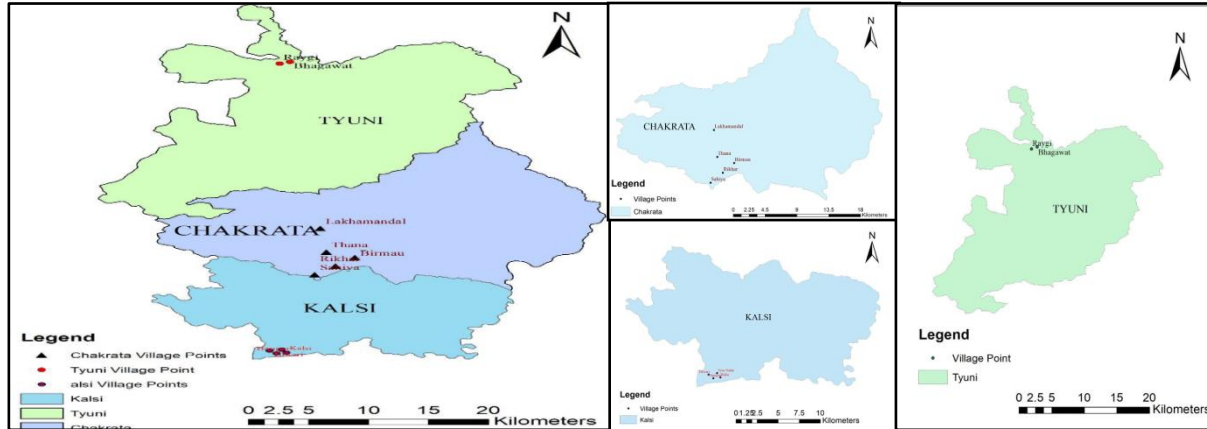


Fig.1. Study sites map

2.2 Selection of study sites: During first two months (Jan-Feb, 2023), field trips were done for a reconnaissance survey. Availability of local inhabitants was the basis of site selection (Assefa et al. 2021).

2.3 Data collection: The initial stages of data collection were secondary in nature. Information regarding access to local people was collected from the panchayat offices and block development offices. Semi-structured interviews with the Kalsi Forest Department officials provided the information for the basis of field visits according to the composition of floral wealth in accordance with the working plan. Primary data was collected based on ethnographic approach and accessibility to the remote villages (Sahu, 2020).

The ethnobotanical surveys were conducted using a standard questionnaire to obtain a huge number of qualitative data on plants used by the tribes by speaking with a significant number of their members of different ages; Vaidyas, known as Jariyaras in Jaunsar-Bawar area (Sahu, 2020), Hakeems, and local healers, according to the contact information that was obtained from the locals, were mostly consulted (Kumar and Khan, 2023). The questionnaire was prepared to collect information based on local names, ethnobotanical usage, part used, etc. (Panda & Uniyal, 2023). The identification was confirmed based on local names of plant species as mentioned in the Forest Flora of Chakrata, Dehra Dun & Saharanpur (Kanjilal, 2004). The primary data have been categorized and organized according to their botanical names and families. The updated botanical names of all the plants were cross-checked from the World Flora Online Plant list (WFO, 2023). During the study, attempts were made to collect optimum data from January 2023 to May 2023 from the maximum parts of the study area. This study aimed to document the native plant species and explore the existing traditional wisdom for the ethnobotanical and cultural usage of those plants by the tribe.

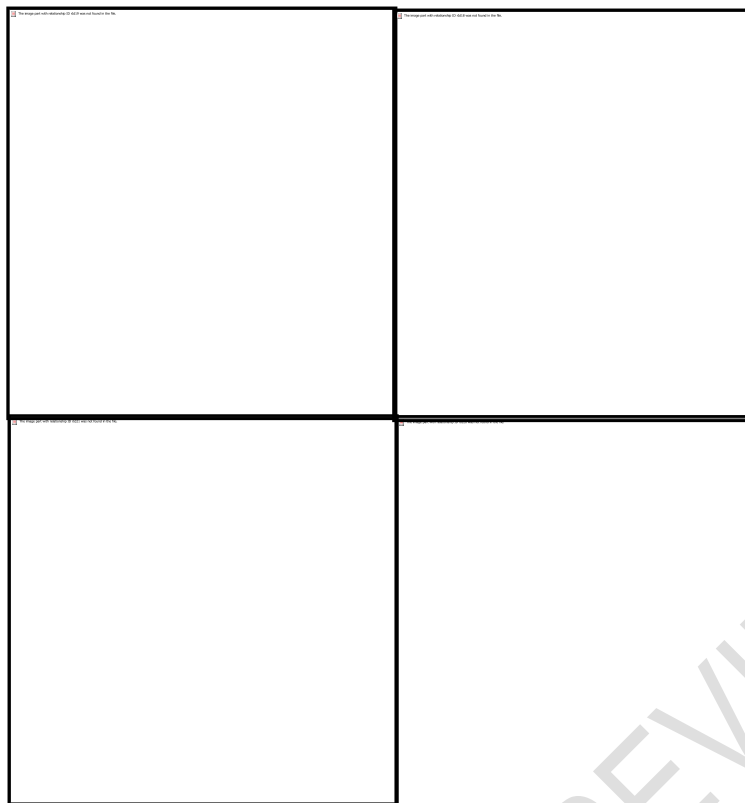


Fig.2. Interaction with the local inhabitants of JaunsarBawar region

3. RESULTS AND DISCUSSION

The results of the study are based on responses from 110 respondents with 57.27% male and 42.72% females (Figure: 3) from 11 villages on their traditional usage of various plant species present in the area.

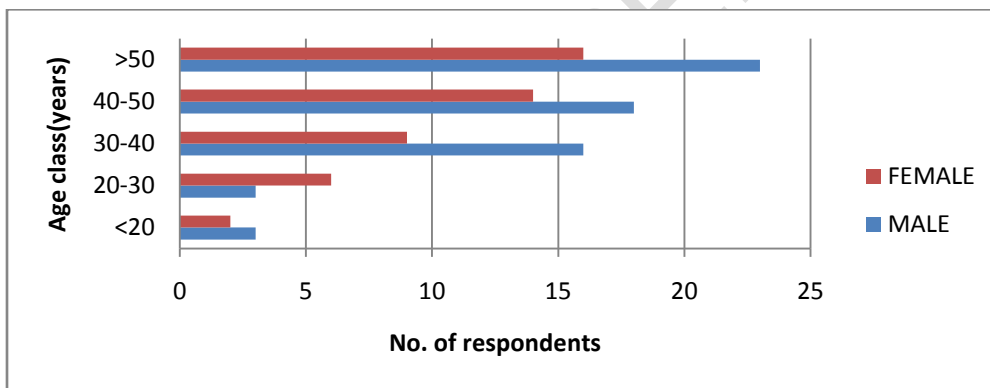


Fig.3. Number of respondents based on gender

3.1 Ethnobotanical knowledge- The present study compiles 64 ethnobotanical plant species belonging to 44 families and 59 genera varied in their usage and consumption by the local inhabitants are listed in Table: 2. Out of the recorded 44 families, three dominant families are Rosaceae (13.6%), Fabaceae and Lamiaceae (6.8% each). Most common plant species available in three study sites are *Rhododendron arboretum* (Burans), *Pinus roxburghii* (Chir), *Quercus leucotrichophora* (Banj), *Cedrus deodara* (Devdar), *Aesculus indica* (Ban akhrot), *Ficus religiosa* (Peepal), *Pyrus pashia* (Kainth), *Berberis aristata* (Daruhaldi), *Bombax ceiba* (Simal), *Bauhinia variegata* (Kachnar), *Bauhinia vahlii* (Siyali), *Cupressus torulosa* (Surai), *Phyllanthus emblica* (Amla), *Ricinus communis* (Arandi), *Grewia optiva* (Bhimal), *Mentha arvensis* (Pudina), *Betula utilis* (Bhojpatra), *Toona ciliata* (Toon), *Rubus ellipticus* (Hisalu),

Celtis australis (Khirak), *Urtica dioica* (Kandali) etc. The plant species fall under various growth habit and form within which trees (40.6%) covers the maximum number and climbers cover the minimum number of species (Figure: 4).

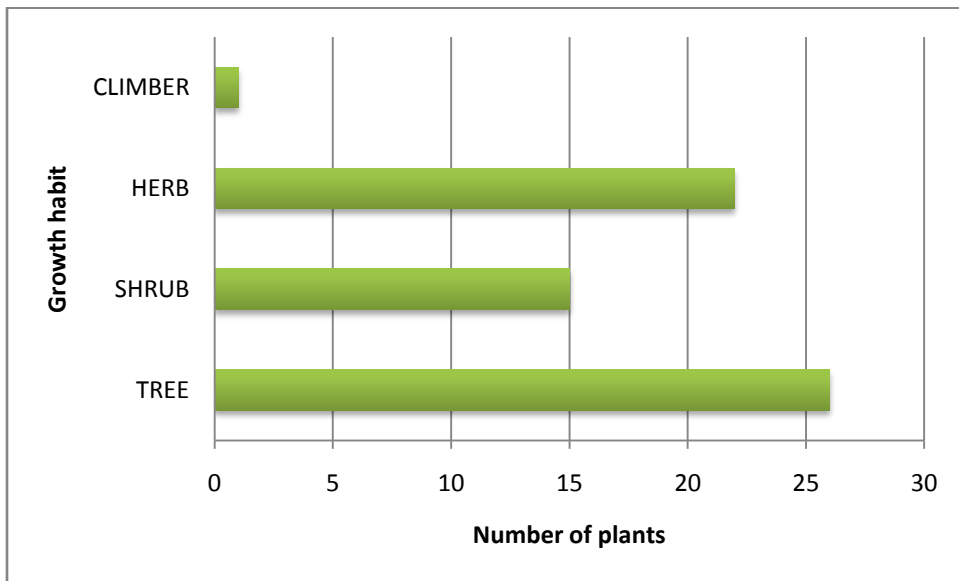


Fig.4. Growth habit of species

Each plant species tabulated in Table:2 have multiple uses but most preferred plant species used under different categories are discussed below.

3.1.1 Medicine-84.3% of the total plant data was documented to have medicinal properties such as anti-inflammatory, antiviral, antitumor, anti-malarial, analgesic, etc. Some important medicinal plant species present in the three study sites are given below:

Cedrus deodara (Vernacular name: Devdar) belongs to the family Pinaceae. It is a large evergreen coniferous tree that can grow up to 40–50 metres (131–164 feet) tall, or 60 metres (197 feet), with a trunk diameter of up to 3 metres (10 feet). It features a conic crown with both level and drooping branches. At low concentrations (KD50 0.4452% in acetone), cedarwood oil exhibits insecticidal properties against adult Indian mosquitoes, *Anopheles slephensis*. The plant's essential oils have a longer duration of fungicidal activity (Gupta et al., 2011). Itching and skin infections of domestic animals like cows are treated with its wood oil. Wood is also being used for furniture crafting.

Picrorhiza kurroa (Vernacular name: Kutki) belongs to the family Scrophulariaceae. Kutkin, the active ingredient of *P. kurroa*, is a combination of picoside and kutkoside. Kutkin has demonstrated pharmacological hepatoprotective qualities (Almeleebia et al., 2022). The Jaunsari tribe of Tiyuni and Chakrata uses it as a traditional fever medicine. It also treats liver and upper respiratory tract diseases, lowers fevers, and treats indigestion, scorpion stings, and persistent diarrhoea (Panda & Uniyal, 2023). To treat diabetes, 5 g of crushed root is steeped overnight in 250 ml of water in a copper kettle, cleaned, and then consumed.

Rhododendron arboretum (Vernacular name: Burans) belongs to the family Ericaceae. Significant reductions in magnesium sulphate-induced diarrhoea were observed with the ethyl acetate fraction of *R. arboreum* flowers; this effect may be attributed to enhanced water and electrolyte absorption (Srivastava, 2012). The majority of the population uses flower juice as a coolant and treatment for dysentery. Vaidyas suggests grinding the leaves of the plant and inhaling the fine powder to relieve coughing. The paste of young

leaves is applied to the forehead to relieve headaches and is also claimed to be therapeutic and deadly (high doses can cause intoxication) (Watt, 1892). 40% of the flowers are to be retained on the tree during collection.

Siegesbeckia orientalis (Vernacular name: Dudhla) belongs to the family Asteraceae. *Siegesbeckia orientalis* is an annual herb or subshrub that grows to be approximately 0.4–1.5 m (1 feet 4 inches–4 ft 11 in) tall. It is typically multi-branched and has hollow, reddish stems. Traditional medicine has utilised the sections of *Siegesbeckia* to treat rheumatoid arthritis, hypertension, malaria, neurasthenia, and snakebite (Wang and Hu, 2006). The roots are crushed and applied directly to the snakebite.

Terminalia bellirica (vernacular name Baheda) belongs to the family Combretaceae. The enzymatic and non-enzymatic antioxidants found in the fruits of the large deciduous tree, *Terminalia belerica*, have antioxidant qualities and can be highly efficient against microorganisms that cause a variety of ailments (Deb et al., 2016). The fruit is roasted and ground, and the powder so formed is consumed with honey to treat coughs.

Urtica dioica (Vernacular name: Bicchughas) belongs to the family Urticaceae. Stinging nettles have been used to treat arthritis and stomach-aches. The leaves are high in calcium, iron, magnesium, potassium, sodium, phosphorus, vitamins B, C, and other minerals and have also been used to treat diarrhoea, vaginal discharge, internal bleeding, and external bleeding. The high nutritional content of the leaves makes them useful for human use as a tonic to strengthen the body and for making soups, etc. (Joshi et al., 2014). Flowers and leaves of plants are cooked as vegetables for pregnant women. Dry and brownish seed heads of the plant are collected, and seeds are extracted by rubbing. Seeds are then cleaned and dried, away from sunlight, and stored.

Withania somnifera (vernacular name Ashwagandha) belongs to the family Solanaceae. Ashwagandha helps with insomnia but does not act as a sedative. Its rejuvenating and nervine effects boost energy levels, promoting restful sleep (Umadevi et al., 2012). The light brown roots, which are free from mould or decay, are cleaned and washed thoroughly using a brush. Then they are dried and roasted for 15 minutes. Once cooled, roots are ground into a fine powder using a mortar and pestle. Powder is served in hot drinks.

The traditional medicinal knowledge of Uttarakhand has been partially highlighted by several works of literature. However, there are various undocumented regions and plant species that are utilised for purposes other than medicine.

3.1.2 Timber- 10.9% of the total data accounts for plant species used for furniture and construction. Some species in the timber category are discussed below:

Celtis australis (Vernacular name: Kharik) belongs to the family Cannabaceae. The timber quality of this multipurpose tree species is excellent. It is used to create tools, whip handles, mugs, spoons, churners, sports equipment, canoes, sticks, and agricultural implements. It can be carved, used to manufacture carriages, and used as a general building material. Its wood is also used for fuel purposes (Yadav and Bisht, 2015). The handles of agricultural implements used by the local farmers of the region are made from the wood of the tree. Thin, flexible shoots are used as walking sticks for elders.

Himalayacalamus falconeri (Vernacular name: Himalayan bans) belongs to the family Poaceae. Researchers have explored many approaches to using bamboo as a wood substitute. Bamboo is a renewable resource with numerous applications, including chipboard, medium-density fiberboard, and flake board for engineering and construction. Bamboo plywood is used for floor tiles and wall panels. Bamboo is used to make fuel briquettes, handicrafts, pulp and paper, furniture, and composite thermoplastic reinforcement for roofing. Bamboo is also used to make drinks and beverages, pharmaceuticals, pesticides, and household items like toothpaste and detergent

(Kumar et al., 2023). The olive green hollow and dense clumps are smooth and are harvested for making furniture. The outer parts of culms are weaved into baskets and mats by the tribal people. The young edible shoots, about 8 cm, are harvested in March–May for making pickles.

Juglans regia (Vernacular name: Akhrot) belongs to the family Juglandaceae. Walnut wood is recognised as the most valuable of temperate zone woods and is appropriate for a wide range of products and uses, including veneers, furniture and interior woodwork constructions, music instruments, carving, sporting goods, gun stocks and fore-ends, etc. (Vassiliou and Voulgaridis, 2004). In spite of the edible fruit obtained from the tree, walnut wood is dark, very hard, moderately dense, and tight-grained, but in short lengths, thus being used by locals mainly for furniture.

Populus ciliata (Vernacular name: Neeru) belongs to the family Salicaceae. *P. ciliata* is a versatile wood that can be used to make packing cases, crates, doors, matches, and artificial limbs. It also produces high-quality veneers that peel easily (Naithani and Nautiyal, 2012). Local people readily use Neeru wood logs for furniture. The logs are stacked and air-dried to 20%, then recut and used accordingly.

3.1.3 Food Some of the plant species preferred for food purposes, such as jams, pickles, spices, etc., are:

Mentha arvensis (vernacular name Pudeena) belongs to the Lamiaceae family. Unani scholars refer to this aromatic plant as Misni (Saleem and Idris, 2016). Its antioxidant, cytotoxic, antibacterial, and antidiabetic properties make it a valuable ingredient in the food sector (Asghar et al., 2022). Most tribal women grow pudeena in their kitchen gardens and use the fresh leaves in dal and drinks. The leaves are collected, sun-dried for 2 hours, and then shade-dried. The powder obtained after grinding is used in various food recipes.

Murraya koenigii (Vernacular name: Gandheli) belongs to the family Rutaceae. *Murrayakoenigii* is noted for its therapeutic properties, including phenolics, flavonoids, and carboxylic alkaloids. Plant has previously claimed to have anti-diabetic, anticarcinogenic, antidysenteric, antioxidant, hypoglycemic, and antibacterial properties (Bhatt et al., 2020). The green leaves are rich in iron; thus, women readily use the leaves in curries. Also, the leaves are boiled with coconut oil and applied to dry hair.

Myrica esculenta (vernacular name Kaphal) belongs to the family Myricaceae. These wild fruits grown in isolated regions provide an important source of food and revenue for local communities. *Myrica esculenta* fruit contains ascorbic acids, phenols, flavonoids, saponins, and alkaloid compounds. The fruit contains several chemicals, including hydroxybenzoic acid, gallic acid, p-coumaric acid, caffeic acid, catechin, ellagic acid, trans-cinnamic acid, chlorogenic acid, and myricetin. This is also a pleasant source of protein, carbs, and vitamin C (Bhatt et al., 2023). Fruit ripening from April to May is being collected and sold by the local people. Pickles are made after drying fruit for 3–4 days, and jams are made immediately by adding jaggery and salt.

Rubus ellipticus (Vernacular name: Ishav) belongs to the family Rosaceae. The shrub grows to a height of 1–3 metres and has glandular hair and a needle-like hook on the stem. The plant is well-known for its golden-yellow subglobose fruit, which is high in nutrients. As the fruit matures, its colour changes from green to golden or yellow, enhancing its aesthetic and therapeutic benefits (Lamichhane et al., 2023). Fruits are directly consumed by children and locals. Jams are also being prepared by women.

3.1.4 Recreation, cultural, and sacred 18.7% of the data accounts fall under this category. Some of them are:

Cannabis sativa (vernacular name Bhang) belongs to the family Cannabaceae. Cannabis has long been produced and used in India for medical, nutritional, spiritual-religious, and socio-cultural purposes, as recounted in ancient Indian literature. Furthermore, other ancient therapeutic methods unique to India, such as Ayurveda, Siddha, and Unani, demonstrate the widespread usage of cannabis in treating a variety of illnesses. Cannabis cultivation and application of various components of the plant such as the flowers, leaves (and the resinous materials obtained from them), fruit, young twigs, and stalk or stem, have a long and continuous history in India, dating back centuries (Govindasamy et al., 2022). The five-finger leaves are worshipped and offered to Lord Shiva in various temples every day in the region, along with fruit.

Emblica officinalis (vernacular name Amla) belongs to the family Euphorbiaceae. Native to tropical Southeast Asia, *Emblica* is a small to medium-sized deciduous tree. Its leaves are small, closely spaced, feather-like, and simple along the branchlets. The smooth and hard round greenish-yellow fruits have a smooth look, while the flowers are yellow-green in colour. Indian cuisine often includes hand-harvested fruits, which ripen in autumn (Khosla and Sharma, 2012). It is an antioxidant-rich, fleshy edible fruit used in Ayurvedic medicine and hair color. Endocarps with distinctive marks on their surfaces are prevalent in Hindu temple buildings (Ram, 2016). Lord Vishnu is worshipped in the form of the Amla tree. On Thursdays, eating amla fruits is restricted, as has been worshipped.

Ocimum sanctum (Vernacular name: Tulsi) belongs to the Lamiaceae family. Planting tulsi in the home serves both religious and spiritual reasons, connecting the devotee with nature's creativity. Connecting with nature has several physiological, emotional, social, and cognitive benefits (Cohen, 2014). Almost every household in the region has planted Tulsi and offers water every day except Sundays for spiritual reasons.

Pyrus pashia (Vernacular name: Kainth) belongs to the family Rosaceae. The bark and roots of *P. pashia* fruits have been used in Ayurvedic medicine to cure sore throats, fevers, and ulcers. The fruits are edible and hold religious and cultural significance. The locals believe that maintaining *P. pashia* twigs in their agricultural fields may ward off evil spirits (Prakash et al., 2021). Local people believe in keeping the twigs of the plant in their varandas to protect their families from evil eyes.

Tribulu terrestris (Vernacular name Gorkhu) belongs to the family Zygophyllaceae. It is a widespread weed that grows in numerous countries across the world. It is well-known for its ability to treat sexual problems, impotence, and hormonal imbalances in humans and animals alike. It is also used as a sexual stimulant. However, in the last 30 years, there has been a surge of interest in this plant following the identification of active compounds that can be used to treat sexual and other diseases (Semerdjieva and Zheljzkov, 2019). This annual herb is collected by Vaidayas and Hakeems, converted into small balls of thick paste, and then dried. This medicine is given to people suffering from uterine and sexual problems.

3.1.5 Fuelwood-Most preferred plant species used for making charcoal, heating chullahs, water heating and cooking are-

Pinus roxburghii (Vernacular name Chir) belongs to family Pinaceae. *Pinus roxburghii*, known as Himalayan Long Leaf Pine, is a significant gregarious forest type found in the Himalayan range's middle altitudes of 1000m to 2000m. It is commonly found on dry, sun-facing hillsides where other tree species cannot thrive. Because of its high resin content, the tree wood is a good fuelwood resource. However, the same property makes its needle litter extremely inflammable (Kumar et al., 2020). The resinous wood is called chhilla in the region and is collected by locals for fuelwood since ages.

Quercus leucotrichophora (Vernacular name: Banj oak) belongs to the family Fagaceae. Oak is an economically important firewood tree species found in warm broadleaf forests, evergreen oak forests, and cool mixed broadleaf forests at various altitudes. Oak firewood

is extensively used for heating and cooking in both urban and rural homes due to its high calorific content and accessibility (Moktan, 2014). Oak logs split easily and are easier to light. These trees are readily available in the region and are lopped in the winter season by the local people because they are dormant in that season.

3.1.6 Fodder—Most preferred plant species used to feed domestic animals are:

Grewia optiva (vernacular name: Bhimal) belongs to the family Malvaceae. *G. optiva* is a small to medium-sized tree of 9–12 m in height, with a clear bole of 3–4 m and a spreading crown. A mature tree has a spreading crown, reaching a height of up to 12 m, a clear bole of 3–4 m, and a girth of approximately 80 cm. The Bhimal tree is a valued asset to the local community due to its numerous benefits. The tree's leaves provide excellent fodder for cattle (Singh and Singh, 2019).

Quercus leucotrichophora (vernacular name: Banj oak) belongs to the family Fagaceae. *Q. leucotrichophora* is usually found between 1400 and 2200 m.a.s.l. in the Himalayas. The tree is moderate in size to big evergreen with a slightly rounded crown that attains a height of 20 m and a diameter of 60 cm, seldom reaching 30 m in height and 100 cm in diameter. The tree has been extensively lopped for fodder and is considered to be of good quality (Rawat et al., 2022). It is the most common species whose leaves are collected for fodder at all three study sites. Branches are lopped throughout the annual seasons except March–April between 3:00 and 8:00 p.m. Tips and branches above 15 cm are to be retained.

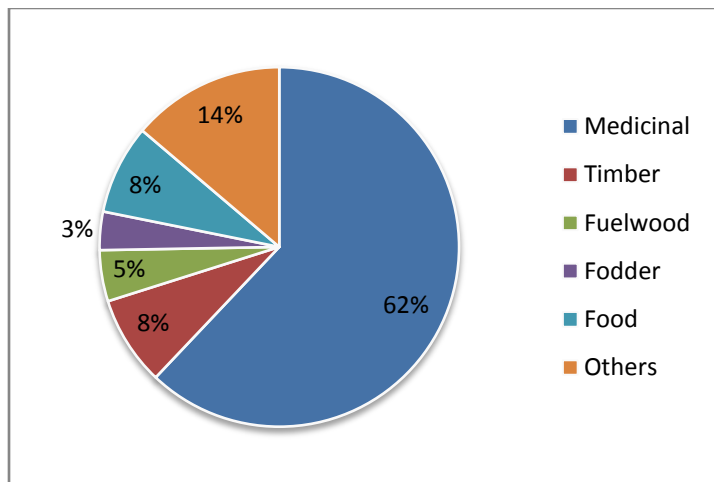


Fig.5. Category of usage

Within the documented data, different plant parts used for the various categories mentioned above are leaves (28.1%), wood (20.3%), seeds (15.6%), bark (14.06%), flowers (7.8%), stems (4.6%), and rhizomes (3.1%). 9.3% of the total species is used as a whole plant (Figure: 6).

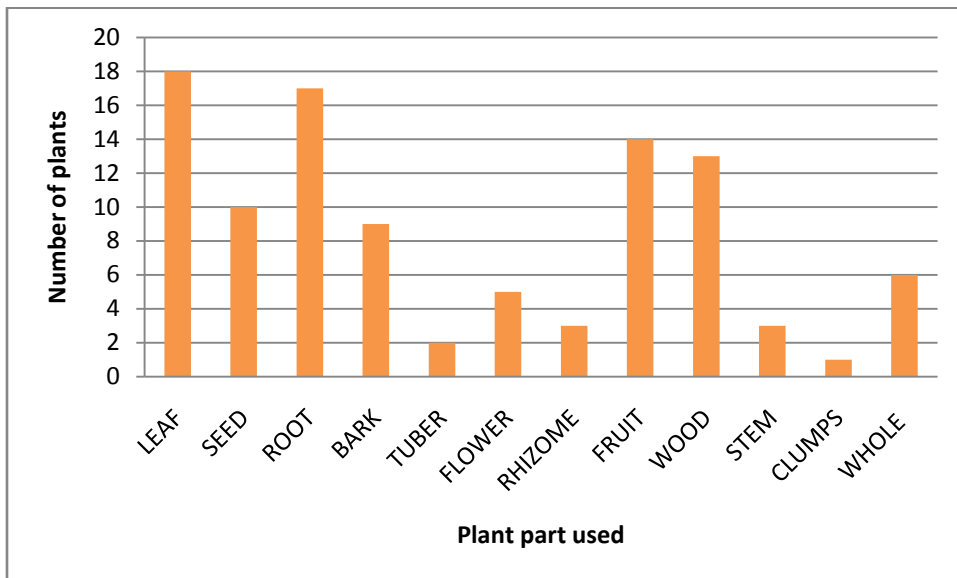


Fig.6. Number of plants used for its various parts

Table2. List of plant species and their utility in Jaunsar Bawar

| Sr | Botanical Name | Family | Habit | Vernacular Name | Uses | Plant Part (S) |
|----|----------------------------|---------------|---------|-----------------|--|------------------|
| 1 | <i>Abrus precatorious</i> | Fabaceae | Climber | Gunja | Headache, intestinal ulcer | Leaf, Seed, Root |
| 3 | <i>Acorus calamus</i> | Araceae | Herb | Bach | Stomach worms | Root |
| 4 | <i>Ageratum conyzoides</i> | Asteraceae | Herb | Ghaghra | Healing in cuts | Leaf |
| 5 | <i>Aloe vera</i> | Liliaceae | Herb | Gwarpatha | Treat burns, wounds, and skin diseases | Leaf |
| 6 | <i>Amomum subulatum</i> | Zingiberaceae | Herb | Siru | Digestive problems, spice | Seed |
| 7 | <i>Asparagus curillus</i> | Asperagaceae | Shrub | Sharanoi | Acne | Tuber |
| 8 | <i>Bauhinia variegata</i> | Fabaceae | Tree | Kachnar | Acne, lowers blood sugar level | Leaf |
| 10 | <i>Berberis spp.</i> | Berberidaceae | Shrub | Kashmoi | Eye tonic | Root |

| | | | | | | |
|----|------------------------------|---------------|-------------|--------------|--|-------------------------------|
| 11 | <i>Bergenia ciliata</i> | Saxifragaceae | Herb | Pattharchoor | Urinary troubles | Tuber |
| 9 | <i>Bistorta nplexicaulis</i> | Polygonaceae | Herb | Ninai | Ear ache, acne | Root |
| 12 | <i>Bombax ceiba</i> | Malvaceae | Tree | Semal | Combat fever and acne problems | Bark |
| 13 | <i>Cannabis sativa</i> | Cannabaceae | Herb | Bhang | Medicinal, recreational | Whole plant |
| 14 | <i>Cassia tora</i> | Fabaceae | Shrub | Panwar | Vermicide, malaria | Seed, Root, Leaf, Whole plant |
| 15 | <i>Cedrus deodara</i> | Pinaceae | Tree | Deodar | Itching in animals, furniture | Wood |
| 16 | <i>Celtis australis</i> | Cannabaceae | Tree | Kharik | Fever, cough, and diarrhea, furniture, agricultural tools religious ceremonies | Bark, Leaf, Fruit, Wood |
| 17 | <i>Cinnamomum tamala</i> | Lauraceae | Tree | Tejpatta | Cold | Leaf |
| 18 | <i>Clerodendrum serratum</i> | Lamiaceae | Shrub | Bharangi | Cold, allergy, sinusitis | Flower |
| 19 | <i>Curcuma zeboaria</i> | Zingiberaceae | Herb | Kachoor | Infant stomach ache | Rhizome |
| 20 | <i>Cynodon dactylon</i> | Poaceae | Herb | Doob | Dysentery, sacred purpose | Whole plant |
| 21 | <i>Diploknema butyrcea</i> | Sapotaceae | Tree | Cheura | Diarrhea, dysentery, and skin disease, furniture and oil preparation | Seed, Wood |
| 22 | <i>Embllica officinalis</i> | Euphorbiaceae | Tree | Amla | Hair tonic, cultural use | Fruit |
| 23 | <i>Ephedra gerardiana</i> | Ephedraceae | Small shrub | Somlata | Eye trouble | Leaf, Fruit, Root, Stem |

| | | | | | | |
|----|----------------------------------|---------------|-------|------------------------|--|--------------------------|
| 26 | <i>Ficus palmata</i> | Moraceae | Tree | Bairu | Fuelwood and fodder for domestic animals | Leaf, Wood |
| 24 | <i>Ficus racemosa</i> | Moraceae | Tree | Fig | Digestion, edible fruits, sacred purposes | Flower, Wood |
| 25 | <i>Ficus religiosa</i> | Moraceae | Tree | Peepal | Burn | Bark |
| 27 | <i>Grewia optiva</i> | Malvaceae | Tree | Bhimal | Rope making, fodder, edible fruits, firewood, religious purpose | Leaf, Bark, Wood, Fruit |
| 28 | <i>Hellenia speciose</i> | Costaceae | Herb | Keol, Belori | Gonorrhea | Rhizome |
| 29 | <i>Heracleum candicans</i> | Apiaceae | Herb | Padra | Eczema, skin diseases | Root, Fruit, Seed |
| 30 | <i>Himalayacalamus falconeri</i> | Poaceae | Herb | Bans, Himalayan bamboo | Baskets, mats, furniture & other construction, young shoots edible. | Culms |
| 31 | <i>Jasminum humile</i> | Oleaceae | Shrub | Sungli, Shanjol | Ring worms, STDs, Skin diseases | Bark, Root, Flower, Leaf |
| 32 | <i>Juglans regia</i> | Juglandaceae | Tree | Akhrot | Fruit, furniture, oil for skincare | Fruit, Wood |
| 33 | <i>Mallotus philippensis</i> | Euphorbeaceae | Tree | Kamil, Kamlu | Itching, Stomach ache | Seed, Leaf |
| 34 | <i>Mentha arvensis</i> | Lamiaceae | Herb | Pudeena | Dysentery, Culinary purposes | Leaf |
| 35 | <i>Murraya koenigii</i> | Rutaceae | Tree | Gandheli | Stomach worms in infants, Culinary purposes | Leaf |
| 36 | <i>Musa spp.</i> | Musaceae | Herb | Banana | Used in festivals and ceremonies, fruit is consumed directly, mats, baskets etc. | Leaf, Flower, Fruit |

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|----|---------------------------------|------------------|-------|-------------|--|----------------------------|
| 37 | <i>Myrica esculenta</i> | Myricaceae | Tree | Kaphal | Fruit for pickle, jam and chutneys, timber, fuelwood | Fruit, Wood |
| 38 | <i>Ocimum sanctum</i> | Lamiaceae | Shrub | Tulsi | Fever, Cough, Cold | Whole plant |
| 40 | <i>Picrorhiza kurroa</i> | Scrophulariaceae | Herb | Kutki | Fever, digestion, cultural, flavoring agent | Root, Rhizome, Whole plant |
| 41 | <i>Pinus roxburghii</i> | Pinaceae | Tree | Chir | Bark used as cast for cattle fracture, fuel | Bark |
| 42 | <i>Podophyllum hexandrum</i> | Podophyllaceae | Herb | Bankakri | Hoof diseases | Root |
| 43 | <i>Populus ciliata</i> | Salicaceae | Tree | Neeru | Timber, fuelwood, bark and leaves for fever and pain | Bark, Leaf, Wood |
| 39 | <i>Prinsepia utilis</i> | Rosaceae | Shrub | Bhekkoi | Boils | Root |
| 45 | <i>Prunus armeniaca</i> | Rosaceae | Tree | Chula | Headache | Seed |
| 46 | <i>Prunus persica</i> | Rosaceae | Tree | Aadu | Seed coat for acne | Seed |
| 44 | <i>Punica granatum</i> | Lythraceae | Shrub | Damoi, Anar | Gastric | Fruit |
| 47 | <i>Pyrus pashia</i> | Rosaceae | Tree | Kainth | Cough, fever, fuelwood, timber, jams and pickles | Fruit, Wood |
| 48 | <i>Quercus leucotrichophora</i> | Fagaceae | Tree | Banj oak | Scorpion bite, fodder | Leaf |
| 49 | <i>Rauvolfia serpentine</i> | Apocynaceae | Shrub | Sarpgandha | Powder of roots used for hypertension | Root |
| 50 | <i>Rhododendron arboretum</i> | Ericaceae | Tree | Burans | Dysentery, blood coolant | Flower |

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|----|----------------------------------|----------------|-------|--------------------|---|--------------------------|
| 51 | <i>Rubus ellipticus</i> | Rosaceae | Shrub | Aakhe, Ishav | Edible fruit | Fruit |
| 52 | <i>Rubus niveus</i> | Rosaceae | Shrub | Kali achoi, Heesar | Wounds | Root |
| 53 | <i>Sapindus mukorossi</i> | Sapindaceae | Tree | Reethachilka | Hair tonic | Seed |
| 2 | <i>Senegalia catechu</i> | Fabaceae | Tree | Khair | Diarrhea, cough, fever | Leaf, Bark |
| 54 | <i>Siegesbeckia orientalis</i> | Asteraceae | Herb | Dudhla | Snake bite | Root |
| 55 | <i>Terminalia bellirica</i> | Combretaceae | Tree | Baheda | Piles, urinary disorders, liver problems | Bark, Fruit, Seed |
| 56 | <i>Terminalia chebula</i> | Combretaceae | Tree | Harad | Constipation, diarrhea, and indigestion | Fruit |
| 57 | <i>Tinospora cordifolia</i> | Menispermaceae | Shrub | Giloy, guduchi | Jaundice, diabetes | Stem |
| 58 | <i>Toona ciliata</i> | Meliaceae | Tree | Tun, Toon, Tooni | Hair oil to cure baldness, fodder | Bark |
| 59 | <i>Trianthema portulacastrum</i> | Aizoaceae | Herb | Panchphuli | Fever, skin diseases, leafy vegetable | Leaf |
| 60 | <i>Tribulus terrestris</i> | Zygophyllaceae | Herb | Gokhru | Uterine tonic, vegetable | Fruit, Root, Whole plant |
| 61 | <i>Urtica ardens</i> | Urticaceae | Herb | Kushka | Skin diseases | Root |
| 62 | <i>Viola pilosa</i> | Violaceae | Herb | Vanafsa | Fever, Cold | Flower |
| 63 | <i>Withania somnifera</i> | Solanaceae | Shrub | Ashwagandha | Stress, anxiety, inflammation, flavoring agent and cultural use | Root, whole plant |

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|----|----------------------------|----------|-------|---------------|------------------------------------|------------|
| 64 | <i>Zanthoxylum armatum</i> | Rutaceae | Shrub | Timru, Timbur | Stem used as toothbrush, toothache | Stem, seed |
|----|----------------------------|----------|-------|---------------|------------------------------------|------------|

Some of the traditional plant use methods being observed and explored through interaction with the older women of upper age class in the region are listed in Table: 3 below:

Table3. Most common plants used by local women in JaunsarBawar

| Plant common name | Method of usage |
|-------------------|---|
| Aadu | The shell or seed coat of the seeds is grinded as fine paste to be used as scrub and face mask as pimple and acne cure. |
| Brahmi | The boiled leaves are applied on forehead to cure headache. |
| Chulu | The oil extracted from the seeds is believed to be hot in nature thus massaged on pregnant women body. |
| Gandheli | The extract of the leaves are given to young children to kill stomach worms. |
| Golda | The roots are crushed and applied on the snake bite. |
| Kashmoi | The roots are dried and consumed empty stomach to control blood sugar level. Extracted juice also cures red eyes and other eye infections. |
| Shilpada | Kidney and gall bladder stones are cured by the juice of boiled roots. |
| Timru | Leaves are dried and kept for years and used to cure toothache. |

Future research avenues provide researchers with several opportunities to study local plant and animal species. Socioeconomic factors can be calculated for services. Ecotourism can boost the economic incentives for conservation operations while also benefiting local communities in the area. Policies that encourage local empowerment in natural resource management while simultaneously protecting traditional knowledge systems must be created. Additionally, because the study area is isolated and its narrow, curving roadways are prone to calamities like landslides, researchers can develop tactics to deal with issues like language barriers, as two-fourths of the respondents speak only Jaunsari natively. To prevent any detrimental effects on the local population, cultural awareness must be ensured.

4. CONCLUSION

Changes in plant usage may not influence knowledge immediately but can lead to long-term changes. Due to a lack of modern facilities, the JaunsarBawar region retains access to traditional knowledge, which is mostly used for everyday activities. Notable findings from this study show that residents in the more isolated hamlet know and consume more plants than people in more accessible settlements. Knowledge of incorporating cultural norms and customs into conservation strategies is required to achieve more inclusive and successful conservation outcomes. Threats can be detected and conservation strategies can be developed with the help of continuous research and monitoring of the region's plant diversity.

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