

## Ethnobotanical Study of Flora Around Sunni Dam Catchment Area in Himachal Himalayas, India

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### Abstract

The present study was carried out during 2021-2022. The study aimed to document and highlight the important species of the study area around the Hydropower project. A total of 77 economically important species were documented from the area, out of which 76 species were recognized as Angiosperms and one as a Gymnosperm. Also, 74 species out of the total species recorded were used as medicine, 37 fuelwoods, 29 fodder, 29 wild edible, 19 timber, 8 agricultural implements, 6 religious, 07 fibres, and 6 dye. Apart from the survey, various quantitative methods were applied to determine the value of medicinally important species in the community in terms of their Use Value, Relative Frequency of Citation as well as Fidelity Level. The Use Value of the species recorded in the study area ranged from 0.25 (*Murraya koenigii*, *Mentha sylvestris*) to 1 (*Synedrella nodiflora*). The Relative Frequency of Citation ranged from 0.012% (*Phyllanthus emblica*) to 0.116% (*Rumex hastatus*). The Fidelity Level of the species ranged from 25-100% and the species with 100% FL were *Bauhinia variegata*, *Murraya koenigii*, *Mentha sylvestris*, *Grewia optiva*, and *Citrus limon* which were used against healing wounds, treating dysentery diarrhoea, headache, indigestion and dental problems. Therefore, it is evident to conclude that the species with high ethnobotanical importance have a greater risk of getting affected by the developmental project. Thus, various conservation strategies need to be planned and adopted to ensure that the species do not extinct and are available for future generations.



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### Keywords

Ethnobotanical significance; Fidelity level; Relative frequency of citation; Use value.

### Introduction

Ethnobotanical knowledge is the result of vast experience with plants since time immemorial and

has given us our recognized foods and medicines.<sup>1</sup>

It has been estimated that there are around 80,000 out of 374,000 plant species are being

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used globally, for medicinal purposes.<sup>2</sup> About 65,000 plant species are used only at home as medicine for the treatment of diseases and according to the World Health Organization (WHO), about 80% of the people globally follow the same.<sup>3,4</sup> Also, medicinal plants contribute to the world's economy.

An investigation into the ethnoflora utilized by indigenous populations in the Alaknanda River watershed of Uttarakhand state in the Western Himalayas of India was carried out and revealed the species utilization pattern. The entire plant (20%), roots/rhizomes/tubers (20%), leaves (18%), fruit (10%), seed (9%), bark (9%), stem (6%), flowers (6%), and resin (2%), are among the parts of medicinal plants that the rural residents of the area utilize to prepare herbal medicine. They concluded that the development of hydropower projects will have an impact on the distribution and diversity of ethnoflora in the area.<sup>5</sup>

The plant parts comprised whole plants, which were utilized by 63% of the respondents, leaves (22%), seeds (9%), fruits, and roots, which were used by only 3% of the people surveyed.<sup>6</sup> An Ethnobotanical study in the district of Dir upper Khyber Pakhtunkhwa, Pakistan was conducted. A total of 64 wild plants were recorded as locally used for numerous purposes. Since the inhabitants of the remote areas mostly depend on plants and are at risk, therefore it needs instantaneous attempts for the conservation of reported plant species.<sup>7</sup> The phytodiversity of Subhartipuram, Meerut, UP, India was revealed. Among all 34 families, the sum of 11 families was found to be the most diversified in terms of species richness and abundance.<sup>8</sup> A total of 79 plants from 45 families including trees, shrubs, and herbs were examined for their morphological traits and applications, particularly medicinal ones.<sup>9</sup> The locals of Malinao Albay have documented the usage of natural remedies in their traditional cures. Based on the study, 350 local residents used quantitative ethnobotanical indices to identify 74 medicinal plants from 38 families and 72 genera for therapeutic purposes.<sup>10</sup> The Dulong neighborhood in Gongshan County, Yunnan Province, China, served as the site of the fieldwork. Information on plants used in traditional beekeeping was supplied by 42 Dulong respondents.<sup>11</sup> According to the study, traditional Dulong beekeeping uses 38 species (in 19 families),

including 30 tree species, 5 bamboo species, 2 herbaceous species, and 1 liana species.

It was discovered that the climber was primarily utilized for medicinal plants (IAR = 0.97). The villagers reported using the most plant parts as fruit (39.47%), leaves (52.63%), and roots (57.89%). Consequently, the preservation of Ban Hua Kua village's traditional knowledge of medicinal plants is recommended for long-term, sustainable use.<sup>12</sup> Research was done on the medicinal floristic diversity of the Western Ghats' Pilavakkal dam Foothills. The Western Ghats' Pilavakkal dam foot slopes are home to 127 significant medicinal plant species. *Psydrax dicoccos* was listed as vulnerable, 27 plant species were classified as Least Concern, *Mangifera indica* was classified as Data Deficient, and 98 plant species that were reviewed were not classified by IUCN.<sup>13</sup> A study was carried out in District Bhimber in Azad Jammu and Kashmir, Pakistan, to investigate and record the traditional ethnobotanical knowledge of Indigenous rural communities in the Shivalik mountain range regarding the local tree flora. *Melia azedarach* had the highest relative frequency of citation (55), whereas *Azadirachta indica* had the highest usage value index (0.61). According to the research, plants such as *Terminalia belerica*, *Terminalia arjuna*, *Cassia fistula*, *Butea monosperma*, *Phyllanthus emblica*, *Morus laevigata*, *Bauhinia variegata*, and *Flacourtia indica* are threatened species with a severely reduced population that could eventually disappear from the area if reclamation measures are not taken for their conservation.<sup>14</sup> The inhabitants used 167 species from 140 genera and 55 families for a variety of uses. In comparison to trees (31.13%), shrubs (23.95%), climbers (5.38%), and lianas (0.59%), herbaceous plants were utilized more frequently (38.92%). Ninety-four percent of the plant species were growing in their natural environments. The greatest number of species (48) were grown as cereals, followed by (28) lumber, (25) condiments, (18) for grain preservation, (17) for dyes, etc.<sup>15</sup> A study was conducted in the vicinity of the Mangla dam in the District of Mirpur Azad, Jammu and Kashmir. Using a semi-structured questionnaire, 40 informants and 5 Hakims were asked about their medical knowledge. According to data analyzed using FL, *Vitis vinifera*, which was employed most frequently, had a fidelity level of almost 94%, while *Spinacia oleracea* had the greatest fidelity level of

95%.<sup>16</sup> The indigenous communities in the research region made considerable use of 110 medicinal plants from 49 families to address 20 major illness categories. With 9.09 percent of medicinal plants, the Asteraceae family was the largest contributor. Nine medicines were utilized for animals, while 166 remedies were employed for human ailments, according to their observations.<sup>17</sup>

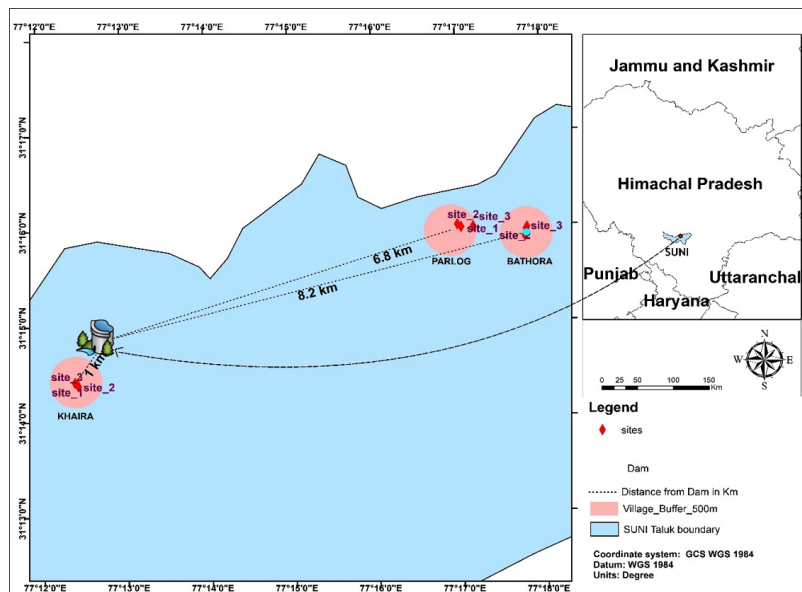
To investigate the use of ethnomedicinal plants by tribal populations in the Assamese districts of Dima Hasao and Karbi Anglong, a total of 12 research publications published between 2004 and 2020 were examined. The majority of cures (35%) were made from plant leaves, with *Morinda angustifolia* Roxb. being the species that local herbalists prescribe the most frequently (UV=5.00).<sup>18</sup> 206 informants provided a total of 124 ethnomedicinal plant species, which were arranged in 112 genera across 60 families. The most common plant parts used to prepare herbal medicine were leaves (49.19%) and herbs (49.19%), whereas the most widely utilized formulation was decoction (61.21%). Of the known species, the most prevalent families were Asteraceae (11). Burns, cuts, wounds, and digestive disorders had the greatest ICF value (0.94), whereas *Lepionurus sylvestris* had the highest FL (91%). The most often used ethnomedicinal plant was *Oroxylum indicum* (6.25), *Blumea lanceolaria* (1.12), and *O. indicum* (0.29) had the highest RFC value.<sup>19</sup>

Due to the enormous richness of hydel potential, Himachal Pradesh can develop economically. However, increased hydroelectric power projects in richer biodiversity areas have exploited the economically important floral diversity.<sup>5</sup> The construction of dams in the Himalayan regions is the greatest threat to biological diversity and is responsible for the loss of traditionally used medicinal plants. Moreover, the indigenous knowledge of the use of a few unknown plants in the region is vanishing. Therefore, the documentation of eco-friendly traditional knowledge is needed to aware local people about the importance of these species and their conservation. The goal of the current study was to record the floristic diversity that is economically significant as well as the related traditional knowledge that will aid in these species continued protection.

**Materials and Methods**

**Study Area**

The study was conducted in the Mandi and Shimla districts of Himachal Pradesh. The Sunni Dam Hydro Power project is proposed on the river Satluj, in districts Shimla and Mandi of Himachal Pradesh situated at a latitude of 31° 14' 53" N and longitude of 77° 12' 39" E (Fig 1). It is situated between the higher Himalayas in the north and the Dhauladhar range in the south in the inner lesser Himalayas.



**Fig. 1:** Map showing the locations of selected villages in the dam catchment area

A total of three villages closer to the vicinity of the dam were taken into consideration. Two out of the three villages were under the jurisdiction of district Shimla and the remaining came under district Mandi. The study area is situated in the young mountain chain which is characterized by a rapid down-cutting valley. The weather conditions in the study area are sub-tropical in the lowlands and temperate uphill. The summer season starts from March to May and is said to be a dry period with drizzle from time to time. The monsoon season begins in the last week of June and goes on till the last week of September. The distance of village Bathora from the Sunni Hydropower dam site is about 237 metres. Moreover, from the village Khaira, the dam is at a distance of about 400 metres whereas the village Parlog of district Mandi is at a distance near to 320 metres.

#### Data Collection

The ethnobotanical survey was conducted during the year 2021-2022. The respondents involved in the survey were made aware of the main objectives of the study and individual consent was obtained from each and every respondent before any publication of the paper. Figure-1 shows the study area's map.

#### Socio-Demographic Details of the Respondents

A total of 134 respondents participated in the questionnaire survey, of which 80 participants were male and 54 were female. 105 were literate and 29 were illiterate. Out of 134 respondents 94 respondents were above the age of 50 years. The respondents belonged to different groups of ages and various professions namely farmers, government employees as well as businessmen.

#### Sampling Technique

Multistage random sampling Sampling was employed to conduct the socio-economic survey in the study area and around 134 respondents were interviewed for the purpose. The study area has three villages (two from Shimla district and one from Mandi district) adjoining the dam. Around 48 households were selected from each village. The ethnobotanical study was done by using a pre-tested questionnaire schedule. A detailed survey of local inhabitants of all three villages was carried out to collect information on economically important plant diversity. The older people were given foremost importance as they had a deep knowledge

regarding the ethnobotanical importance of the local flora. The utilization pattern of plant diversity has also been documented through the associated traditional knowledge of local inhabitants of the study area and concerned literature respectively.

#### Statistical Analysis

The data collected on ethnobotanically important plant species and their utilization in the study was statistically analysed.

#### Make use of Value

The following formula is used to calculate the relative importance of plant species:

$$UV_i = \sum U_i / N_i \quad \dots(1)$$

Where,

$U_i$  -The number of uses for a particular species that each responder mentioned

$N_i$  -Total number of informants<sup>20,21</sup>

#### Relative Frequency of Citation

It is determined by applying the following formula

$$RFC = FC/N \quad \dots(2)$$

Where,

FC- is the number of species informants

N -represents the total number of research participants.<sup>22</sup>

#### Fidelity Level

It is calculated using the formula

$$FL = N_p / N \times 100 \quad \dots(3)$$

Where,

$N_p$  -is the precise quantity of citations for a given condition.

N -is the total number of informants of species for any disease.<sup>23</sup>

#### Results

##### Life form and Habit

The taxonomic description of recored flora is given in Table 1. A total of 77 species of ethnobotanically significant plants from 40 families and 72 genera were identified. 76 of them were identified as

Angiosperms, while one species was identified as a Gymnosperm. The species recorded in the study area were diversified within the bounds of distinct growth forms i.e., such as Trees Herbs, and Shrubs with the highest being trees (28 spp.) followed by herbs (28 spp.) and shrubs (21spp.).

Out of total 74 species were used for medicinal purposes which also had additional uses such as 19 timbers, 08 agricultural implements, 37 fuel-wood, 29 fodder, 29 wild edibles/food, 07 fibre, 06 religious, 06 dye as shown in Fig 2.

**Table 1: Taxonomic description of ethno-botanically important floristic diversity in the study area**

	Family	Genera	Species	Herbs	Shrubs	Trees
Angiosperm	39	71	76	28	21	27
Gymnosperm	01	01	01	-	-	01
Total	40	72	77	28	21	28

**Identified Species and Importance for Treating Disease**

Based on a survey carried out in the study area and previous literature the use of species for treating various diseases is summarized in this section. The bark of *Toona ciliata* is used in treating dysentery and healing wounds. The bark and flower of *Bauhinia variegata* treat inflammation, and skin diseases and help in healing wounds. Leaves of *Dalbergia sissoo* are used to treat Enzootic Hematuria in cattle and sheep, oil is used to treat wounds, and leaves are used to treat eye pain and swelling and skin diseases. Seeds, fruits, bark, leaves, and roots of *Syzygium cumini* are used against teeth and gum diseases as an antiulcer, anti-dysenteric and blood purifier. The bark and roots of *Acacia catechu* are used in treating cough, diarrhea, and piles and are also useful in treating body pain. The leaves and bark treat wounds and skin infections and decoction is used as a blood purifier. The fruit of *Ficus palmata* is used to treat constipation. *The whole plant of Bombax ceiba* is used for skin problems. The fruit of *Phyllanthus emblica* is chewed against cold and cough. The flowers and leaves of *Butea monosperma* is used to treat eye and skin problems. The resin and bark of *Pinus roxburghii* are applied to boils and heal cracked heels. The fruits and leaves of *Mangifera indica* are used against respiratory problems. The decoction of leaves and fruit of *Celtis australis* are used in the treatment of heavy menstrual bleeding. The bark paste of *Grewia optiva* is used for fracture bandage in cattle and leaf extract is used to treat indigestion. Root latex is used to treat cholera, mumps, vomiting, and diarrhea,

while roasted figs (*Ficus ariculata*) are used to treat dysentery and diarrhea. Consuming the extract of soaked leaves of *Ficus religiosa* cures cardiac problems, and leaves tied to bleeding wounds stop the bleeding. Seed, leaves and bark of *Prunus persica* are used in the treatment of blood diseases. The fruits of *Sapindus mukorossi* are used in the treatment of snake bites and seeds are used in treating freckles and tan. The decoction (*Mallotus philippinens*) is used to treat stomach pain and is also beneficial in cooling the body. The leaves of *Eriobotrya japonica* are used to alleviate inflammation and stomach issues. The leaves of *Eriobotrya japonica* are used to treat stomach problems and inflammation. The leaves of *Psidium guajava* are used against stomach infection, pain and wound healing against oral ulcers and swollen gums. The seeds of *Aesculus indica* are used in treating skin diseases, piles and headache. The bark of *Ailanthus excelsa* is used in treating asthma, and dysentery, and the leaves and bark are used as a tonic after labour. The leaves of *Albizia lebbeck* are used to strengthen teeth and gums, bark is used as a blood purifier, and roots act as anti-inflammatory agents. The fruit extract of *Ficus racemosa* is used to treat diabetes and asthma, and powder of leaves is mixed with honey to treat infections. The roots and bark of *Ficus benghalensis* in the form of decoction treat skin disorders, dysentery and inflammation. The leaves of *Murraya koenigii* treat dysentery, diarrhoea and act as a pain reliever. *Ziziphus mauritiana* is used as a tonic for stomach aches and for boil treatment. The leaves and roots of *Carissa carandas* act as an antiseptic and treat abdominal pain. The leaves

of *Adhatoda vasica* are used to ripe wounds and flowers are used in treating bronchitis and cough. The root juice of *Asparagus racemosus* is used as a laxative. The paste and powder of fruit and seeds of *Zanthoxylum armatum* are used against dental problems. The stem, leaves and roots of *Euphorbia royleana* are used against loose motion and ear pain. The leaves of *Melissa officinalis* are used against indigestion. The stem and leaves of *Lantana camara* are used to treat malaria, chicken pox and asthma. The flower juice of *Punica granatum* treats nose bleeding and indigestion. The juice of *Citrus limon* helps in indigestion and promotes weight loss and dental problems. The seeds, fruit, leaves and roots of *Berberis vulgaris* treat jaundice, and bacterial dysentery and heal wounds and piles. The stem, leaf and root of *Dodonaea viscosa* heal wounds and toothache. The leaves of *Lonicera angustifolia* treat headaches and diabetes. The leaf extract of *Rumex hastatus* is used to stop wound bleeding and dysentery. The leaves of *Mirabilis jalapa* and *Agave americana* are used against inflammation. The flower juice of *Woodfordia fruticosa* is used to treat stomach pain. The root juice of *Rubus ellipticus* is used against uterine infection. The fine leaf paste of *Vitex Negundo* relieves muscle aches and joint pain and leaf decoction treats asthma and cough. *Ipomea carnea* is used in skin diseases and wound healing. The leaves of *Berberis lycium* an infusion is used for the treatment of skin problems and jaundice. The leaves, flowers, stem, bark and seeds of *Mentha sylvestris* treat dysentery, indigestion and headache. The roots of *Saccharaum spontaneous* boiled and given to treat constipation, piles and lactation. The leaves of *Chenopodium album* are used to treat ulcers, and also act as a blood purifier. The bud pastes and leaves of *Cannabis sativa* protect against vomiting, also used as a drug in medicine. The *Martynia annua* heals wounds, sore throat, cough and fever. The seeds and leaves of *Sesamum indicum* act as an anti-bacterial and treat soreness and swelling. The roots of *Cenchrus ciliaris* treat body pain, wounds and urinary infections. The powder of *Cuscuta reflexa* treats wounds, fresh juice treats skin rashes and paste controls hair fall. The stems, leaves and roots of *Tinospora cordifolia* are used in case of a snakebite, bone fracture, jaundice and dysentery. The juice of *Cynodon dactylon* is applied to cuts to stop bleeding, also used to treat snake bites and cramps. The leaves of *Eriophorum comosum* treat

diarrhoea and headache. The flower of *Musa sp* is used to treat diabetes and dysentery. The leaves, stem, and roots of *Urtica dioca* treat cardiovascular disorders, Glucose homeostasis, arthritis, and anemia. The *Dicanthium annulatum* is used in the treatment against smallpox. The *Parthenium hysterophorus* treats skin disease, malaria, fever and headache. The root of *Bambusa bambos* is used for joint pain, the leaves are used against menstrual pain and worms and the young sprouts are cooked and effective against nausea, indigestion and wound infection. The stem of *Sida cordata* treats pimples, indigestion, cuts, wounds, and urinary infections. The root juice of *Achyranthes bidentata* is used to treat, toothache, and also helps in easing menstrual pain. The leaf juice of *Eupatorium adenophorum* is applied to heal cuts. *Desmodium elegans* decoction of roots treats inflammation, jaundice, and fever. Decoction of leaves (*Adhatoda zeylanica*) helps in dealing with cough and cold. The juice of *Solanum indicum* is used in the treatment of ringworm and also treats chest pain, asthma, and chronic fever. The *Oxalis corniculata* improves digestion and heals piles. The *Erigeron annus* treats indigestion, colds, coughs, and headaches. The *Synedrella nodiflora* treats inflammation and ear pain.

#### Make use of Value

According to Table 2, the species' usage values that were documented in the research region varied from 0.25 to 1. In contrast to *Synedrella nodiflora*, which had the lowest use value, *Mentha sylvestris* had the greatest. Moreover, other species with high use values were *Grewia optiva* (0.95), *Ficus benghalensis* (0.95) *Tonna ciliata* (0.90), *Bauhinia variegata* (0.90), *Carissa carandus* (0.90), *Ficus racemosa* (0.85), *Cannabis sativa* (0.85), *Berberis lycium* (0.8), *Punica granatum* (0.75). The species with high use value indicates that these species if affected will have a greater loss to the community.

#### Citations' Relative Frequency

The Relative Frequency of Citation of (RFC) of different species ranging from 0.012 to 0.116%. The RFC was highest for *Phyllanthus emblica* (0.116%), followed by *Grewia Optiva* (0.110%), *Toona ciliata* (0.104%), *Butea monosperma* (0.104%), *Dalbergia sisso* (0.093%) and *Bauhinia variegata* (0.081%). *Phyllanthus emblica* fruit is used to treat coughs and colds. The leaf extract

of *Grewia optiva* having the second highest RFC is used to treat indigestion. The bark of *Toona ciliata* is used against dysentery and also aids in wound healing. *Butea monosperma* is used to treat skin and eye problems. The bark and flowers of

*Bauhinia variegata* are used in healing wounds, inflammation and skin-related problems. The oil of *Dalbergia sissoo* is used in healing wounds whereas the leaves are used against eye swelling, pain and skin diseases.

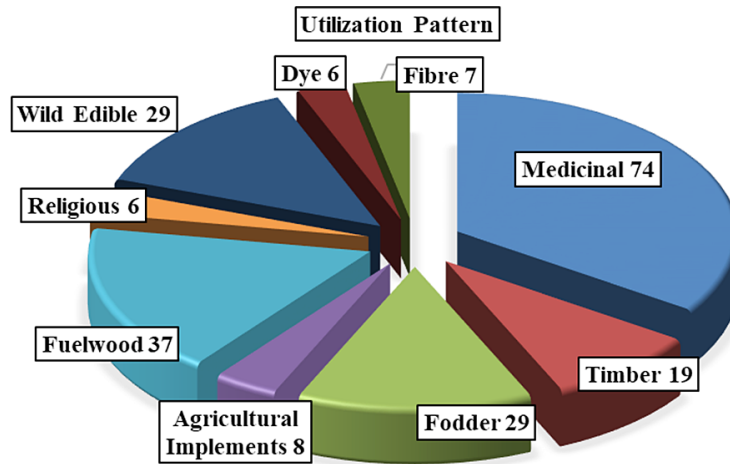


Fig. 2: Community utilization pattern of recorded plant species

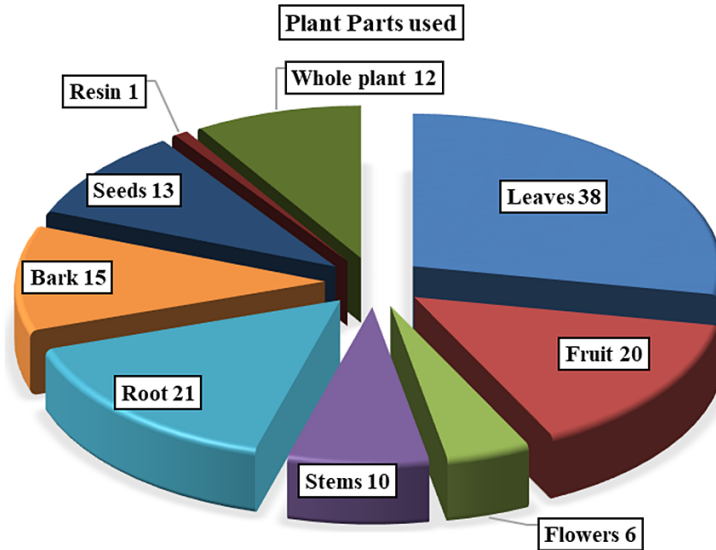


Fig. 3 Parts used of recorded plant species

**Level of Fidelity**

The species that informants choose most for curing ailments are determined by the fidelity level. The fidelity level (FL) in the current investigation varied from 25% to 100%. The species that the informants preferred the most against various ailments in the

study area with 100% fidelity level were *Bauhinia variegata*, *Murraya koenigii*, *Mentha sylvestris*, *Grewia optiva*, *Citrus limon* which were used against healing wounds, treating dysentery diarrhoea, headache, indigestion and dental problems.

**Table 2: Ethnobotanically important plant species along with their medicinal values**

S. No	Family	Name of the species	Local Name	Habit	Index of Use value	The frequency of citations	Citations Relative Frequency	Fidelity Level (%)
1	Meliaceae	<i>Toona ciliata</i>	Tuni	Tree	0.90	2.09	0.104	90
2	Fabaceae	<i>Bauhinia variegata</i>	Kachnar	Tree	0.80	1.62	0.081	100
3	Fabaceae	<i>Dalbergia sissoo</i>	Shisham	Tree	0.70	1.85	0.093	85
4	Myrtaceae	<i>Syzygium cumini</i>	Jamun	Tree	0.65	1.39	0.070	75
5	Fabaceae	<i>Acacia catechu</i>	Katha Khair	Tree	0.45	0.81	0.041	95
6	Bignoniaceae	<i>Jacaranda mimosifolia</i>	Gulmohar	Tree	0.60	0.58	0.029	70
7	Moraceae	<i>Ficus palmata</i>	Phagra	Tree	0.65	1.39	0.070	90
8	Malvaceae	<i>Bombax ceiba</i>	Semal	Tree	0.70	2.09	0.104	75
9	Phyllanthaceae	<i>Phyllanthus emblica</i>	Amla	Tree	0.90	2.32	0.116	65
10	Arecaceae	<i>Phoenix sylvestris</i>		Tree	0.45	0.58	0.029	45
11	Fabaceae	<i>Butea monosperma</i>	Dhak	Tree	0.75	2.09	0.104	70
12	Coniferae	<i>Pinus roxburghii</i>	Chir Pine	Tree	0.35	0.70	0.035	85
13	Anacardiaceae	<i>Mangifera indica</i>	Mango	Tree	0.70	1.39	0.070	95
14	Fabaceae	<i>Leucaena leucocephala</i>		Tree	-	-	-	90
15	Cannabaceae	<i>Celtis australis</i>	Khirak	Tree	0.80	1.27	0.064	100
16	Malvaceae	<i>Grewia optiva</i>	Beul	Tree	0.95	2.20	0.110	75
17	Moraceae	<i>Ficus ariculata</i>	Tiamble	Tree	0.5	1.62	0.081	75
18	Moraceae	<i>Ficus religiosa</i>	Peepal	Tree	0.65	1.39	0.070	65
19	Rosaceae	<i>Prunus persica</i>	Aaru	Tree	0.80	1.74	0.087	45
20	Sapindaceae	<i>Sapindus mukorossi</i>	Ritha	Tree	0.55	1.39	0.070	30
21	Euphorbiaceae	<i>Mallotus philippinensis</i>	Rohini	Tree	0.45	1.27	0.064	30
22	Rosaceae	<i>Eriobotrya japonica</i>	Loquat	Tree	0.60	1.27	0.064	85
23	Myrtaceae	<i>Psidium guajava</i>	Amrud	Tree	0.70	1.16	0.058	55
24	Sapindaceae	<i>Aesculus indica</i>	Goon	Tree	0.40	1.62	0.081	60
25	Simaroubaceae	<i>Ailanthus excelsa</i>	Mahanimb	Tree	0.50	1.39	0.070	45
26	Fabaceae	<i>Albizia lebeck</i>	Siris	Tree	0.70	0.93	0.046	50
27	Moraceae	<i>Ficus racemosa</i>	Goolar	Tree	0.85	0.70	0.035	65
28	Moraceae	<i>Ficus benghalensis</i>	Barh	Tree	0.95	1.39	0.070	100
29	Rutaceae	<i>Murraya koenigii</i>	Curry Patta	Shrub	1.00	2.20	0.110	75



30	Rhamnaceae	<i>Ziziphus mauritiana</i>	Ber	Shrub	0.80	1.74	0.087	65
31	Apocynaceae	<i>Carissa carandas</i>	Karaunda	Shrub	0.90	1.27	0.064	70
32	Acanthaceae	<i>Adhatoda vasica</i>	Basuti	Shrub	0.90	0.81	0.041	55
33	Asparagaceae	<i>Asparagus racemosus</i>	Shatavari	Shrub	0.80	0.93	0.046	25
34	Rutaceae	<i>Zanthoxylum armatum</i>	Trimul	Shrub	0.50	1.74	0.087	55
35	Euphorbiaceae	<i>Euphorbia royleana</i>	Senhur	Shrub	0.75	1.27	0.064	50
36	Lamiaceae	<i>Melissa officinalis</i>	Balm	Herb	0.65	1.51	0.075	35
37	Cactaceae	<i>Opuntia monocantha</i>	Naag fani	Shrub	0.35	0.70	0.035	85
38	Verbenaceae	<i>Lantana camara</i>	Phul lakri	Shrub	0.90	2.09	0.104	90
39	Lythraceae	<i>Punica granatum</i>	Anar	Shrub	0.75	1.85	0.093	100
40	Rutaceae	<i>Citrus limon</i>	Lemon	Shrub	0.70	2.20	0.110	75
41	Berberidaceae	<i>Berberis vulgaris</i>	Kashmal	Shrub	0.80	1.27	0.064	65
42	Sapindaceae	<i>Dodonaea viscosa</i>	Vilayati mehndi	Shrub	0.45	1.97	0.098	55
43	Caprifoliaceae	<i>Lonicera angustifolia</i>	Pirlu	Shrub	0.50	1.51	0.075	65
44	Polygonaceae	<i>Rumex hastatus</i>	Malora	Shrub	0.60	0.23	0.012	30
45	Nyctaginaceae	<i>Mirabilis jalapa</i>	Gulabas	Herb	0.30	0.70	0.035	25
46	Lythraceae	<i>Woodfordia fruticosa</i>	Dhairo	Shrub	0.40	1.27	0.064	25
47	Rosaceae	<i>Rubus ellipticus</i>	Aiselu	Shrub	0.45	1.04	0.052	40
48	Lamiaceae	<i>Vitex negundo</i>	Bana	Shrub	0.35	0.81	0.041	35
49	Asparagaceae	<i>Agave americana</i>	Rambansa	Shrub	0.70	0.70	0.035	30
50	Convolvulaceae	<i>Ipomea carnea</i>	Badoh	Shrub	0.55	0.70	0.035	70
51	Berberidaceae	<i>Berberis lycium</i>	Kashmal	Shrub	0.8	0.93	0.046	100
52	Lamiaceae	<i>Mentha sylvestris</i>	Pahadi Pudina	Herb	1.00	2.32	0.116	70
53	Poaceae	<i>Saccharum</i> spontaneous	Kaans	Grass	0.75	1.51	0.075	60
54	Amaranthaceae	<i>Chenopodium album</i>	Bathuwa	Herb	0.65	1.27	0.064	90
55	Cannabaceae	<i>Cannabis sativa</i>	Bhaang	Herb	0.85	2.32	0.116	65
56	Martyniaceae	<i>Martynia annua</i>	Ulta Kanta	Herb	0.55	1.85	0.093	60
57	Pedaliaceae	<i>Sesamum indicum</i>	Safed til	Herb	0.4	1.51	0.075	70
58	Poaceae	<i>Cenchrus ciliaris</i>	Anjan	Grass	0.45	1.16	0.058	65
59	Convolvulaceae	<i>Cuscuta reflexa</i>	Amar bel	Herb	0.60	1.27	0.064	55
60	Menispermaceae	<i>Tinospora cordifolia</i>	Giloy	Herb	0.25	1.27	0.064	90
61	Poaceae	<i>Cynodon dactylon</i>	Doob Ghas	Grass	0.85	1.04	0.052	55
62	Cyperaceae	<i>Eriophorum comosum</i>	Phurke jhar	Grass	0.55	0.70	0.035	85
63	Musaceae	<i>Musa sp</i>	Banana	Herb	0.70	1.62	0.081	70

64	Urticaceae	<i>Urtica dioica</i>	Bichoo booti	Herb	0.45	2.20	0.110	65
65	Poaceae	<i>Dicanthium annulatum</i>		Grass	0.55	0.58	0.029	55
66	Poaceae	<i>Dactyloctenium aegyptium</i>		Grass	0.45	0.93	0.046	65
67	Asteraceae	<i>Parthenium hysterophorus</i>	Gajar ghas	Herb	0.80	1.74	0.087	80
68	Poaceae	<i>Bambusa bambos</i>	Bamboo	Herb	0.35	0.70	0.035	65
69	Malvaceae	<i>Sida cordata</i>	Bhuinii	Herb	0.65	1.16	0.058	65
70	Amaranthaceae	<i>Achyranthes bidentata</i>		Herb	0.70	1.27	0.064	60
71	Asteraceae	<i>Eupatorium adenophorum</i>	Sahasrabuti	Herb	0.60	0.81	0.041	55
72	Fabaceae	<i>Desmodium elegans</i>	Chamlai	Shrubs	0.30	1.04	0.052	45
73	Acanthaceae	<i>Adhatoda zeylanica</i>	Basuti	herb	0.65	0.93	0.046	45
74	Solanaceae	<i>Solanum indicum</i>	Jangli Bhatta	Herb	0.75	0.70	0.035	35
75	Oxalidaceae	<i>Oxalis corniculata</i>	Changeri	Herb	0.15	1.27	0.064	45
76	Asteraceae	<i>Erigeron annuus</i>	Phuntha	Herb	0.45	0.70	0.035	30
77	Asteraceae	<i>Synedrella nodiflora</i>	Cinderella	Herb	0.25	0.46	0.023	90

### Discussion

The study focused on the application of plant species by the local community and also the utilization pattern of these species. One of the major intents of this study is to address, put into writing, and preserve the native knowledge of plants as well as to ensure that the developmental project has no greater impact on the species present in the study area so that it does not get extinct and are available for future generation.<sup>24,25</sup> The utilization of the ethno botanically beneficial plant species has been put into practice since the age-old by the locals of the particular community for immense uses mainly medicine, timber, fuel, fodder, food, dye, agricultural implements as well as religion. A total of 77 species of ethnobotanically significant plants from 40 families and 72 genera were identified during the study. In the present study leaves of *Murraya Koenigii* are used against dental problems which are in agreement with.<sup>26</sup> The species namely *Mangifera indica*, *Butea monosperma*, *Syzygium cumini*, *Ficus benghalensis*, *Tinospora cordifolia*, *Psidium guajava* were similarly reported for medicinal usage.<sup>27</sup> The study revealed that leaves are the most used plant part among all the parts, which was confirmed with the study conducted in the Maroag region of Himachal Pradesh.<sup>28</sup> The usage and habit patterns of recorded plant species align with the study conducted in Nepal region.<sup>29</sup> Species namely *Berberis lycium*, *Cannabis sativa*, *Chenopodium album*, *Cynodon dactylon*, *Oxalis corniculata*, *Parthenium hysterophorus* reported medicinal value similar to the previous study.<sup>4</sup> The plant parts used for the species *Ailanthus excelsa*, *Albizia lebbek*, *Asparagus racemosus*, *Ficus benghalensis*, *Ficus religiosa*, *Mallotus philippensis*, *Martynia annua*, *Phyllanthus emblica*, *Woodfordia fruticosa*, *Vitex negundo*, *Psidium guajava*, *Lantana camara* in the present study are in agreement with.<sup>1,3</sup> Curry Patta and Pahadi Pudina were the most used species in the study area. The highest (2.32) frequency of citation was obtained for Pahadi Pudina, Bhaang and Amla. The leaves of 36% of plant species were mostly used for treating various diseases.

### Conclusion

A total of 77 economically important species were documented in the study area. Of these, 74 were used as medicine, 37 fuelwoods, 29 fodder, 29 wild edible, 19 timber, 8 agricultural implements, 7 fibres,

6 religious and 6 were dyes. The study highlighted the species with greater use value (Curry Patta and Pahadi Pudina) in the local community which needs to be protected by introducing and planning various conservation practices. Furthermore, the development project is more likely to impact species that are very significant ethnobotanically. Thus, methods need to be adopted to conserve the ethno- botanically important plant species and their documented usages against various ailments for future generations. The present study provides baseline data for future documentation of species with high ethnobotanical importance after the project work is over. As a result, this research would be regarded as a useful instrument for any future studies in this field.

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#### Conflict of Interest

The author(s) do not have any conflict of interest.

#### Data Availability Statement

The authors confirm that the data supporting the findings of this study are available within the article.

#### Ethics Statement

This research did not involve human participants, animal subjects, or any material that requires ethical approval.

#### Informed Consent Statement

This study did not involve human participants, and therefore, informed consent was not required.

#### Author Contributions

- **Sakshi Chauhan:** Conceptualization, Methodology, Investigation, and Writing - Original Draft.
- **Rajeev Kumar Aggarwal :** Conceptualization and Methodology, Supervision.
- **Hukam Chand:** Conceptualization, Formal analysis, Writing - Original Draft.

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