# Ethnobotanical indigenous knowledge of Tehsil Charhoi, District Kotli, Azad Jammu and Kashmir, Pakistan

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## Databases and Inventories

## Abstract

*Background:* Wild plants are used a lot by the local people of Azad Jammu and Kashmir (AJ&K), Pakistan, for different purposes in daily life. It has been published by various researchers that AJ&K, Pakistan is enriched with wild medicinal flora on the basis of surveys conducted in various parts but some areas are still unexplored.

*Methods:* The present study was conducted from March 2019 to April 2020 and 60 native informants were interviewed from different sites of Tehsil Charhoi. Ethnomedicinal data was collected using a semi-structured questionnaire.

*Results:* In ethno-botanical survey total 100 species of plant were documented that belonging to 52 families and 90 genera. Moraceae was the dominant family in the study area that included 7 species (13.46%). In present ethno-botanical survey total 16 plant parts were utilized for preparation of traditional remedies against for various ailments. The most used plant parts were leaves (28%), followed by roots (18%), fruits (12%), bark, seeds and whole plants (8% each), stems (4%), flowers, wood and latex (3% each), and resin, rhizomes, pods, tubers, gum and aerial parts (1% each). We evidenced a total 18 kinds of preparations curing various diseases with paste (59%) being the most common. The Use Value (UV) index ranged from 0.2 to 0.96. Highest UV was reported for *Cuscuta reflexa* Roxb. (0.96) whereas lowest UV was reported for *Rhamnus triquetra* (Wall) Brandis. The Relative Frequency of Citation (RFC) values ranged 0.03 to 0.55. The highest RFC value was obtained for *Ficus benghalensis* L. (0.55) while *Gloriosa superba* L. (0.03) had the lowest value. The Informant Consensus Factor (ICF) values ranged 0.21 to 0.68. Diseases were classified into 17 different categories. The high ICF value recorded for jaundice and hepatitis whereas low ICF value for cardiac problems. The highest Fidelity Level (FL) value of *Viola canescens* Wall (97.1%) was helpful for colds, flu, coughs, constipation, and jaundice. In present study out of 100 medicinal plant species 30 plant species were also utilized for other than medicinal purposes like vegetable, fruit, fodder, fuel, furniture, making agriculture tools, house thatching, walking sticks and handicrafts. In direct matrix ranking of multipurpose species (DMRMS) *Dodonaea viscosa* (L.) Jacq. r nked first according to information provided by 10 informants.

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*Conclusion:* It has been concluded that Tehsil Charhoi, District Kotli, Azad Jammu and Kashmir are rich sources of wild plants used to treat various ailments. There is need to build awareness among local people about the value of medicinal plants and the publication of ethno-botanical information forms the basis for the development of innovative drugs.

*Keywords:* Charhoi, Indigenous, Ethnobotany, Wild, Kotli

## Background

Green plants are the transducers and primary producers on this planet earth and all animals including human beings are dependent upon them. Medicinal plants are being used to treat almost all types of ailments from prehistoric times (Akinyemi *et al.* 2006, Wagay *et al.* 2014). Plants are utilized as primary medications to cure various diseases even in most of the rural areas of well-developed countries (Chitme *et al.* 2004). Most of the allopathic medicines are based on medicinal plants (Qureshi *et al.* 2007, Ajaib & Khan 2014). Almost 2000 species of plants were utilized in Homeopathy, Ayurvedic and Unani systems of medicines (Kritikar & Basu 2001). Residents of far-flung areas are often dependent on ethnomedicinal knowledge for the cure of various diseases. Plants also provide food, shelter, fodder, firewood, and lumber (Abbas *et al.* 2020). Ethnobotanical knowledge preserved in the form of documentation with the efforts of the ethnobotanists before its extinction will be highly useful for future generations (Rao & Henry 1997). An ethnobotanical study also aids in the identification of the aromatic and medicinally important plants, hence forming the basis for drug discovery. Allopathic drugs are mostly derived from the extracts of these ethno-medicinally important plants (Rashid & Arshad 2002). Chemicals produced in plants contain wide range of medicinal properties (Wagh & Jain 2020). Interactions between humans and plants have long been described as a major factor in human civilization, especially in the medical field (Yeung *et al.* 2020). Pakistan has different climatic, ecological zones and topography. The flora of Pakistan and Azad Jammu and Kashmir is very diverse nearly; there are various types of flowering and non-flowering plants present. It is reported that about 6000 wild flowering plant species are present in Pakistan and Azad Jammu and Kashmir among them 600 are most commonly utilized as good source of medicines (Khan *et al.* 2012). According to a report made by WHO, 65-80% people of whole world utilized plant for primary health care (Calixto, 2005). In Pakistan about 80% people lives in rural areas and medicinal plants are readily available there (Ahmad *et al.* 2016). Plants are being used in treatment of various diseases and phytochemicals are bringing used in making of synthetic medicines (Aggarwal 2003). Folk knowledge related to use of plants transmitted orally from one generation to another (Malik & Singh 2019). The traditional ethnobotanical knowledge held by hakims, old age people and passed to the younger generation with the help of verbal communication (Amiri & Joharchi 2013). The literature on the usage of medicinal plant species in ethnobotanical studies empowers us for the formulation of modern medicines which are being used for the treatment of various diseases and for the preservation of these medicinal plants (Calzada & Bautista 2020).

Amjad *et al.* (2020) documented ethnobotanical uses of 150 plant species having medicinal values. Altaf *et al.* (2019) explored ethnomedicinal importance of 97 plants that were utilized as therapeutic agents in Tehsil Wazirabad, Gujranwala, Pakistan. Ajaib *et al.* (2016) recorded 100 plant species that were utilized to treat various ailments in Puna Hills, Tehsil Samahni, Azad Jammu and Kashmir. Sulaiman *et al.* (2020) investigated 109 traditional medicinal plants of Gokand, District Buner, Pakistan. Ahmad*et al.* (2012) studied floristic and ethnobotanical research in Senhsa, District Kotli, Azad Jammu and Kashmir, recorded total 112 plant species that belong to 97 genera and 51 families having medicinal importance. Ajaib *et al.* (2015) investigated the ethnobotanical examination of the medicinal plants of Village Darguti, Tehsil Khuiratta, District Kotli of Azad Jammu and Kashmir, total 100 species of plants were found that were belonging to 47 families having ethnobotanical values. Ajaib and Khan (2014) explored ethnobotanically important trees of District Kotli, Azad Jammu and Kashmir, total 50 species of trees were recorded, related to 49 genera and 24 families. In dicot Moraceae was a very common family having 9 species of plants. We found only one gymnosperm family Pinaceae whereas all other angiosperm families, 2 monocot and 47 dicot tree species having medicinal values. Mahmood *et al.* (2011) conducted ethnomedicinal research in the Bhimber District of Azad Kashmir and a total of 48 plant species of 22 families were recorded using for ethnomedicinal purposes. Saghir *et al.* (2001) investigated ethno-botanical knowledge of Chikar and kindred areas of Muzaffarabad, Azad Jammu, and Kashmir, total 54 plant species were recorded in his study that belonged to 48 genera of 44 families having ethnobotanical importance. Ishtiaq *et al.* (2021) explored 150 plant species that belonging to 58 families having ethnobotanical importance.

According to above mentioned importance and information about medicinal plants, this study helps to records ethno-botanical knowledge of Tehsil Charhoi, District Kotli, Azad Jammu and Kashmir where such work has not

been done up to now and to protect the threatened species and record the ethno-botanical data of those threatened species. This study also helps to create attentiveness among indigenous people about the usage and conservation of ethnobotanically important plant species.

## Materials and Methods

### Study Area Description

Azad Jammu and Kashmir is region of Kashmir under the control of Pakistan. It is also known as Pakistan Occupied Kashmir (POK) having total area of 13,297 Sq. Kilometers and is situated in the North-East of Pakistan and North-West of India. The Azad Jammu and Kashmir consists of 10 Districts and 32 Tehsils. This state is rich with natural resources and most of the area is hilly. The highest peak of state is Sarwali (6326 m) located in Neelum valley.

The present study was conducted during 2019-2020 in different sites of Tehsil Charhoi, District Kotli, Azad Jammu &Kashmir. The present survey was conducted in Charhoi, Kotli Sohlan, Panjan, Narmah, Dahmal, Kotehra Khanka, Narakot, Saneh Baneh, Narmah, Palahal and Kaladab. Geographically present study area located near latitude 44° 19'44.42" N and longitude 74°1 '21" E (Figure 1).


Figure 1. Map of Study area Tehsil Chahoi, District Kotli, Azad Jammu and Kashmir

Charhoi is Tehsil in Kotli District and is one of the most beautiful valleys in Kashmir. The valley of Charhoi is surrounded by high mountains all around. The mountains are covered with Cheer (Pine) plants (*Pinus roxburghii* Sarg.) that increase the beauty of this area. It is 64 kilometers from Mirpur and about 40 kilometers from khuiratta. Narakot, Sanyah, Kaladab, chahwala, Dhamal Bazar, Khanka Kotera, Panjni, are the main places of this area. The temperature of this area varies according to season. The June and July are warmest months of the year. In June the average temperature is 41℃. January is the coldest month, with temperatures averaging 10.1℃. It is bounded by

Indian Occupied Kashmir (Cease Fire Line) in the East, in the south Union Council Poona of Tehsil Samahni, in the North District Kotli, Tehsil Khuiratta of District Kotli is between the East and North, and in the west Union Council Islamgarh of Tehsil Chakswari. The area varies in climate from subtropical type to humid with an average rainfall of about 92.5 mm per month. The average altitude of this area is 840m and it lies in a sub-tropical zone (Anonymous 2020).

**Material description**

The present study area visited after regular intervals to collect ethnobotanical data. Plant specimens were collected from natural habitats, including complete vegetative and floral characters and took pictures of the habitat and plant that helped in identification. Collected plants were dried, pressed, stored, and finally placed on standard herbarium sheets according to the technique as described by Miller and Nyberg (1995). Field notebook, pencil, cutter, newspapers, plant presser, polythene bags, digging tools and digital camera were used for collection of information.

**Collection of data from field**

Ethnomedicinal data was collected using a systematic questionnaire. The local inhabitants were interviewed to get data about the use of plants for medicine, food, fuel, fodder, and shelter etc. All ethnomedicinally important plant species were arranged with names of families, names of species, common names and parts utilized. During investigation, data was collected from native people of Tehsil Charhoi, District Kotli, Azad Jammu & Kashmir. Mostly data was collected from old age people that were familiar about the usage of plants. Most people of this area easily understand Kashmiri language so during the questionnaire this language was used. A new generation of locals who are unaware of the importance of herbal medicines and ethnobotanical knowledge is limited to the elderly. After old age people ethnobotanical knowledge of this area may be extinct so documentation is needed to preserve the data for future generations. The ethnomedicinal information was primarily collected from Herbal practitioners (Hakeems) of this area and additionally information was harvested from housewives. The collected specimens were identified with the help of available floristic literature (Ahmad *et al.* 2012, Amjad 2015, Ajaib & Khan 2014, Amjad *et al.* 2017, Amjad & Arshad 2014) and Flora of Pakistan and the collected specimens were classified in accordance of Bentham & Hooker classification. Later the doubtful plant specimens were confirmed by deposited herbarium specimens at the Department of Botany Herbarium, University of Gujrat Pakistan. The Plant List (www.theplantlist.org) was used to obtain the correct nomenclature of collected species of study area. The plant specimens were submitted to Herbarium, Department of Botany, University of Gujrat, Gujrat Pakistan after pasting voucher numbers.

**Analysis of data**

The ethno-botanical data was evaluated with the help of different quantitative indices to test the similarity and validation, such as Use value (UV), Relative frequency of citation (RFC), Informant consensus factor (ICF), Fidelity level (FL), DMR and Family Index (FI).

**Use Value (UV)**

The relative importance of given species was collected from the area determined by Use Value (UV). The Use Value (UV) was calculated with the help of a formula extracted from previous paper of Umair *et al.* (2017).

$$UV = \Sigma Ui / N$$

Where, Ui = Informant mentioned number of uses of a given species. N = Total number of informants.

**Relative frequency of citation (RFC)**

It indicates the medicinal importance of plants of specific area which is measured in the form of relative frequency of citation (RFC) by following the protocol of Umair *et al.* (2017).

$$RFC = FC / N$$

Where, FC is the informants reporting the number of uses of a species. N = is the total number of informants.

**Fidelity level (FL)**

The fidelity level (FL) of the records, illustrates percentage of informers demanding the any use of a specific plant for the similar main purpose or ailment group and compared with entire described practices of all species of plant

to treat the similar group of ailments. Its formula is as under and extracted from previous work of Amjad *et al.* (2017).

FL (%) = (Np / N) X 100

Where, Np is the number of people who claim to use the plant species for a disease. N = is the number of people who use plants for any kind of disease.

**Informant consensus factor (ICF)**
Informant consensus factor (ICF) was determined for every group of ailments to recognize compromise of informers on the described ethno-medicinal usages for every group and ICF was calculated by following formula of Giday *et al.* (2009).

Nur - Nt / (Nur - 1)

Where, Nur is the number of use reports for any disease category. Nt = is the number of species used.

**Direct matrix ranking (DMR)**
Data matrix ranking (DMR) analysis was measured to find the several usages of given plants. DMR analysis describes multiple usages of one plant for various purposes as told by the local communities. Plant species used for several dedications other than medicinal use. For example, food, vegetables, fodder, fuel, and shelter (Ishtiaq *et al.* 2013).

**Family index**
Family Index (FI) with maximum number of plant species used belonging to a specific family was calculated from collected records and designated in graphic approach. The ranking of plant families is based on the number of species (Rahman *et al.* 2020).

## Results and Discussion

**Documentation of ethno-botanical flora**
The present research work was conducted during 2019-2020 to collect ethno-botanical knowledge of Tehsil Charhoi, District Kotli, Azad Jammu and Kashmir. During a field survey total 100 plant species were collected that belong to 52 families and 90 genera. Similarly, Ajaib *et al.* (2015) studied 100 plant species of Darguti, Tehsil Khuiratta, Azad Jammu and Kashmir. Shabir *et al.* (2017) investigated 98 plant species of Devi Gali, District Poonch, Azad Jammu and Kashmir. The most dominant family was Moraceae in the study area including 7 species (13.46%). According to previous research of Ajaib and Khan (2014) Moraceae was dominant family in District Kotli that including 9 species. The second most dominant family in the study area was Euphorbiaceae that including 6 species (11.53%). Solanaceae and Asteraceae includes 5 species in each (9.61%), Amaranthaceae and Lamiaceae included 4 species in each (9.61%), Brassicaceae, Mimosaceae, Papilionaceae, Rhamnaceae and Apocynaceae included 3 species in each (5.76%), Acanthaceae, Asclepiadaceae, Caesalpiniaceae, Malvaceae, Menispermaceae, Poaceae, Pteridaceae and Tiliaceae includes 2 species in each (3.84%), while remaining families includes 1 species in each (Figure 2). The present ethno-botanical flora was including only 1 Gymnosperm, 2 Pteridophytes and 97 Angiosperms (Ajaib & Khan 2014). Details on all species are given in Table 1.

**Demographic data of Informants**
In present survey total 60 native informants were selected for ethno-botanical data collection. Among them, 30 men (50 %), 20 women (33.33 %) and 10 herbal practitioners (16.16 %) were interviewed to collect ethno-botanical data. The informants were belonging to 3 main age groups (i) 20 to 40, (ii) 40 to 60 and (iii) 60 to 80 years old. Most of the informants were between age group 60-80 (30), 20 between age group 40-60 and 10 between age group 20-40 year (Figure 3). Similarly, Tesfaye et al. (2020) investigated traditional medicinal plants used in Ethopia. In this survey 48 herbal practitioners (37 men and 5 women) of different age groups (30 to 80 years) were randomly selected for the collection of ethnobotanical knowledge. Data collected by semi-structured interview or open-ended questions, information related to plants were collected and write on field notebook. Most of ethno-botanical was collected from old age peoples because old age peoples were more familiar about use of medicinal plants as compared to young generation. The traditional ethnobotanical knowledge held by hakims, old age people and passed to the younger generation with the help of verbal communication (Amiri and Joharchi, 2013).

Table 1. Plant names, family names, mode of preparation and uses

| Family name | Botanical name | Common name | Habit | Cultivated status | Part used | Mode of preparation | UV | RFC | Uses |
|---|---|---|---|---|---|---|---|---|---|
| Amaranthaceae | *Achyranthes aspera* L. UOG-788 | Puth Kanda | H | Wild | Whole plant, Ash, Leaves, Roots | Decoction, Powder, Ash | 0.91 | 0.53 | Rheumatic, diabetic, cough, asthma, skin irritation, joints pains, piles, boil, abscess, stomachic, digestant, pneumonia, toothache, anti-fertility. |
| Fabaceae | *Acacia modesta* Wall. UOG-790 | Phalai | T | Wild | Wood, Leaves, Resin | Paste | 0.74 | 0.43 | Waist pain, clean teeth, tonic and stimulant. |
| Pteridaceae | *Adiantum capillus-veneris* L. UOG-791 | Maidenhair fern | H | Wild | Fronds | Tea, Paste | 0.36 | 0.18 | Antidandruff, astringent, febrifuge, cough, bronchitis, snakebites, headache, chest pains. |
| Pteridaceae | *Adiantum incisum* Forssk. UOG-792 | Putramchari | H | Wild | Fronds | Paste, Juice | 0.33 | 0.16 | Cough, diabetes, skin diseases, fever. |
| Amaranthaceae | *Aerva javanica* (Burm. f.) Juss. ex J.A. Schultes UOG-793 | Boi | S | Wild | Leaves and roots | Paste, Decoction, Extract | 0.53 | 0.13 | Pimples, kidney disorders, rheumatism, toothache, eye problems. |
| Lamiaceae | *Ajuga integrifolia* Buch.-Ham. UOG-794 | Kori buti | H | Wild | Leaves, Roots | Juice, Extract, Powder | 0.57 | 0.33 | Stomachache, blood purifier, abdominal pain, malaria, jaundice, mouth ulcer, burns, boils, stop bleeding, inflammation, dysentery, diarrhea. |
| Fabaceae | *Albizzia lebbeck* (L.) Bth. UOG-795 | Shirin | T | Wild | Seeds, Leaves, Bark | Powder, Smoke, Extract | 0.62 | 0.36 | Headache, Kehn, stomach pain, antiseptic, cough, pile, diarrhea, eye problems, boil, diabetes. |
| Amaryllidaceae | *Allium jacquemontii* Kunth UOG-796 | Jangli Piyaz | H | Wild | Bulb | Extract | 0.66 | 0.33 | Blood cholesterol level, digestive system, circulatory system. |
| Amaranthaceae | *Amaranthus viridis* L. UOG-797 | Gunahr | H | Wild | Leaves, Seeds | Extract, Infusion, Sap | 0.73 | 0.36 | Constipation, anti-snake bite, laxative, backache, purify blood, eye infection. |
| Apiacceae | *Anethum graveolens* L. UOG-798 | Soya | H | Cultivated | Whole plant | Powder, Raw seeds | 0.6 | 0.3 | Increase milk production in females, useful in digestion. |
| Acanthaceae | *Barleria cristata* L. UOG-799 | Kali Barenker | S | Wild | Leaves, Root | Juice, Decoction, Paste | 0.63 | 0.31 | Anemia, tooth pain, inflammation, wound, snake bite, fever, diabetes, tuberculosis, cold, flu, diaphoretic, antibacterial and expectorant. |
| Bombaceae | *Bombax ceiba* L. UOG-800 | Simbal | T | Wild | Wood, Bark, Fruit, Root | Paste, Powder, Juice | 0.8 | 0.46 | Body weakness, increase muscle strength, pimples, skin lesions, sore joins, diarrhea, constipation, piles, gynaecological disorder, stomach ache, kidney and bladder ulcer. |
| Fabaceae | *Bauhinia variegata* L. UOG-801 | Kalyar | T | Wild | Flowers, Floral buds, | Juice, Decoction, Paste | 0.86 | 0.43 | Diarrhea, dysentery, wound, skin disorders, ulcers, worms, dyspepsia, piles, regularize |

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|---|---|---|---|---|---|---|---|---|---|
| | | | | | Leaves, Bark, Roots | | | | menstrual cycle, carminative, obesity, laxative, anthelmintics, tonic. |
| Brassicaceae | *Brassica campestris* L. UOG-802 | Sarson | H | Cultivated | Leaves, Whole plant, Seed oil | Decoction, Powder, Oil | 0.7 | 0.23 | Constipation, leucorrhoea, menstrual disorder, body weakness, antimicrobial and anti-lice. |
| Nyctaginaceae | *Boerhavia diffusa* L. UOG-803 | Tangri | H | Wild | Roots, Whole plant | Powder, Decoction, Paste, Juice | 0.55 | 0.41 | Jaundice, ulcers, eye disorders, dysentery, arthritis, respiratory diseases, diabetes, inflammation, anemia, gonorrhea. |
| Papilionaceae | *Butea monosperma* Taub. UOG-804 | Chachra | T | Wild | Leaves,Flower, Seeds, Gum | Juice, Decoction | 0.9 | 0.45 | Diarrhea, dysentery, ulcers, swellings, ringworm, cold, cough, boils, pimples, wounds, leucorrhoea, control bleeding, abortion pain, wormicide. |
| Buddlejaceae | *Buddleja asiatica* Lour. UOG-805 | | S | Wild | Leaves, Wood, Bark, Root, Whole plant | Juice, Decoction, Paste | 0.53 | 0.13 | Skin diseases, malaria, reduce fever, premature abortion, tumors. |
| Asclepiadaceae | *Calotropis procera* (Aiton) Dryand. UOG-806 | Akk | S | Wild | Root, Flower, Latex, Bark | Paste, Powder, Juice | 0.86 | 0.43 | Earache, arthritis, skin diseases, snake bites, leprosy, elephantiasis, cold, cough, asthma. |
| Cannabaceae | *Cannabis sativa* L. UOG-807 | Bhang | H | Cultivated/ Wild | Flowers, Leaves, Fibers | Powder | 0.8 | 0.33 | Asthma, tetanus, hemorrhages, gonorrhea, nervous disorders, narcotics, painkiller, nausea, vomiting. |
| Apocynaceae | *Carissa spinarum* L. UOG-808 | Granda | S | Wild | Fruit, Leaves, Roots | Decoction, Powder, Extract | 0.85 | 0.28 | Asthma, jaundice, kidney pain, cardiac problems, stimulant, urine blockage, urinary bladder, remittent fever, liver disorders, blood deficiencies, wounds, sores, stomachic, purgative |
| Caricaceae | *Carica papaya* L. UOG-809 | Popita | T | Cultivated | Leaves, Fruits, Seeds | Juice, Extract, Paste, Decoction | 0.76 | 0.31 | Dengue fever, digestion, diarrhea, high blood pressure, diabetes, hypertension, warts, wounds, dysentery, vermifuge. |
| Fabaceae | *Cassia fistula* L. UOG-810 | Amaltas | T | Wild | Pods, Leaves, Bark, Seeds | Pulp, Juice | 0.66 | 0.16 | Abdomen pain, habitual constipation, purgative, laxative, malaria, diabetes, blood poisoning, skin problems. |
| Apocynaceae | *Catharanthus roseus* (L.) G. Don. UOG-811 | Sada bahar | H | Ornamental | Leaves, Flower, Root, Stem | Decoction, Juice, Extract | 0.84 | 0.35 | Diabetes, wounds, dysmenorrhea, piles, nasal and mouth bleeding, high blood pressure, irregular menstruation, dysentery, diarrhea, anticancer. |
| Vitaceae | *Cayratia trifolia* (L.) Doman UOG-812 | Amalbel | S | Wild | Fruit, Leaves, Roots | Decoction, Paste, Juice, Infusion | 0.7 | 0.23 | Snake bite, fever, boils, aphrodisiac, scurvy, muscular pain, itch, dandruff, inflammation, diabetes, ulcer, blood purifier, carminative, expectorant. |

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|---|---|---|---|---|---|---|---|---|---|
| Chenopodiaceae | *Chenopodium album* L. UOG-813 | Bathu | H | Wild | Leaves, Seeds, Roots, Stems | Poultice, Juice, Tea, Paste | 0.8 | 0.33 | Bug bites, rheumatic joints, feet swelling, urinary problems, sunburn, bloody dysentery, stomachache, diarrhea, burns, constipation. |
| Asteraceae | *Cirsium arvense* (L.) Scopoli. UOG-814 | Leh | H | Wild | Root, Leaves | Paste, Decoction, Chewing | 0.46 | 0.11 | Toothache, astringent, tonic, antiphlogistic, hepatic, worms, antiplogistic, indigestion. |
| Menispermaceae | *Cissampelos pareira* L. UOG-815 | Battal Bel | H | Wild | Root, Leaves, Rhizome | Decoction, Paste, Juice, Infusion | 0.82 | 0.48 | Relief tooth pain, leucorrhoea, snake bite, carminative, astringent, diuretic, expectorant, sedative, febrifuge, oblivision, gastrointestinal problems, fever, cold, typhoid fever, anti-conjunctivitis. |
| Labiatae | *Colebrookea oppositifolia* Smith. UOG-816 | Chitti Suhali | S | Wild | Leaves, Root | Juice, Poultice, Decoction | 0.4 | 0.06 | Wounds, bruises, fever, headache, dysentery, epilepsy, ulcers. |
| Commelinaceae | *Commelina benghalensis* L. UOG-817 | Chura | H | Wild | Leaves, Root | Decoction, Juice, Sap, Poultice | 0.72 | 0.3 | Skin swelling, leprosy, laxative, infertility, stomach problems, eye ailments, burns and sore throat. |
| Malvaceae | *Corchorus aestuans* L. UOG-818 | Jangli jute | H | Wild | Whole plant, Leaves, Seeds | Extract, Sap | 0.4 | 0.06 | Gonorrhea, stomach ache, pneumonia, urethral discharges, headache. |
| Cuscutaceae | *Cuscuta reflexa* Roxb. UOG-819 | Neela tari | H | Wild | Whole plant | Powder, Juice, Infusion, Decoction | 0.96 | 0.48 | Astringent, purgative, anthelmintic, baldness, wound, anti-lice, hair tonic, diarrhea, itches, sores, gout, joint pains, skin itching, jaundice, skin diseases, cough, blood purification, fever, menstruation bleeding. |
| Cyperaceae | *Cyperus rotundus* L. UOG-820 | Deela | Sd | Wild | Leaves, Rhizome, Root | Paste, Extract | 0.76 | 0.38 | Wounds, fever, increase milk secretion, treat stomach, bowel and inflammatory diseases |
| Poaceae | *Cynodon dactylon* Pers. UOG-821 | Khabal | H | Wild | Whole plant | Decoction, Juice | 0.64 | 0.26 | Fever, syphilis, dropsy, astringent, antiseptic, liver problems, cough, diarrhea, dysentery, headache and stomachache, wounds, nose bleeding. |
| Papilionaceae | *Dalbergia sissoo* DC. UOG-822 | Tali | T | Wild | Leaves | Juice, Decoction | 0.45 | 0.15 | Vomiting, piles, and obesity, eye pain, abdomen pain, gonorrhea, jaundice, skin diseases. |
| Solanaceae | *Datura innoxia* Mill. UOG-823 | Datura | H | Wild | Leaves | Juice, Smoke, Poultice | 0.6 | 0.2 | Snake bite, antiseptic, sedative, narcotic, asthma, dandruff, antispasmodic, boils. |
| Amaranthaceae | *Digera muricata* (L.) Mart UOG-824 | Tandla | H | Wild | Leaves, Flower, Seed | Paste, Decoction | 0.73 | 0.36 | Constipation, renal disorders, digestive problems, urinary disorders. |
| Sapindaceae | *Dodonaea viscosa* (L.) Jacq. UOG-825 | Sanatha | S | Wild | Leaves | Infusion, Extract, Paste | 0.75 | 0.25 | Wound, abotificient, febrifuge, cold, sore throat, itching. |

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|---|---|---|---|---|---|---|---|---|---|
| Euphorbiaceae | *Euphorbia hirta* L. UOG-826 | Dudhi kalan | H | Wild | Leaves, Latex, Whole plant | Paste, Decoction | 0.55 | 0.41 | Cough and asthma, diarrhea, wounds, inflammations and ulcers, warts, leucorrhea, skin problems. |
| Euphorbiaceae | *Euphorbia prostrata* Aiton. UOG-827 | Dudhi | H | Wild | Whole plant | Powder, Juice, Chewing, Decoction | 0.33 | 0.16 | Diabetes, labor pain, warts, abscesses, abortion, gonorrhea, headache. |
| Moraceae | *Ficus auriculata* Lour. UOG-828 | Tossy | T | Wild | Leaves, Fruits, Roots, Latex, Bark | Paste, Juice, Powder, Infusion | 0.88 | 0.36 | High blood pressure, cuts, wounds, diarrhea, dysentery, cholera, mumps, vomiting, diabetes, jaundice. |
| Moraceae | *Ficus benghalensis* L. UOG-829 | Bohr | T | Wild | Leaves, Fruit, Hanging root, Milky latex, Bark | Powder, Milk, Extract, Infusion | 0.94 | 0.55 | Flu, spermatorrhoea, premature ejaculation, sexual desire, dysentery, diarrhea, diabetes, tonic, cooling. |
| Moraceae | *Ficus palmata* Forssk. UOG-830 | Phagwar | T | Wild | Fruit, Leaves | Sap, Powder, Decoction | 0.9 | 0.15 | Laxative, demulcent, lung and bladder disorders, warts, diabetes, ulcers. |
| Moraceae | *Ficus rasimosa* L. UOG-835 | Rumbal | T | Wild | Leaves, Fruits, Latex, Root | Chewing, Decoction, Paste | 0.85 | 0.28 | Bile, diabetes and diarrhea, piles, stomachic, carminative, hemoptysis, tonsils. |
| Moraceae | *Ficus religiosa* L. UOG-836 | Peepal | T | Wild | Bark, Fruit, Leaves | Paste, Ash, Powder, Infusion, Decoction, Extract, Sap | 0.77 | 0.45 | Inflammation, diarrhea, dysentery, asthma, infections of skin and ulcers, cholera, wound, diabetes, scabies, cracked heals. |
| Moraceae | *Ficus semicordata* Buch.-Ham. ex Sm. UOG-837 | Panjal | T | Wild | Fruit, leaves, Latex | Juice, Paste | 0.82 | 0.48 | Headache, fever, menstrual disorders, constipation. |
| Flacourtiaceae | *Flacourtia indica* (Burm. f.) Merr. UOG-838 | Koko | S | Wild | Fruits, Leaves, Roots, Bark | Decoction, Ash, Paste | 0.65 | 0.21 | Diuretic, astringent, anthelmintic, snake bites, body pain, kidney problems, cough, diarrhea, arthritis, digestion, appetizer, jaundice, vomiting, nausea, headache, |
| Rubiaceae | *Galium aparine* L. UOG-839 | Kori buti | H | Wild | Leaves,Whole plant | Paste, Juice, Extract | 0.26 | 0.06 | Kidney stones, skin troubles, face wash, wound, stop bleeding, anticancer. |
| Colchiaceae | *Gloriosa superba* L. UOG-840 | Charkiara | H | Wild | Tuber, Root, Leaves | Paste, Juice, Ash, Decoction, Sap | 0.6 | 0.03 | Stimulant, abortifacient, anthelmintic, leprosy, antidote to snake poison, earache, toothache, asthma, wounds, pimples, malaria, abdominal problems, reduce abortion. |
| Tiliaceae | *Grewia optiva* J. R. Drumm. UOG-841 | Dahman | T | Wild | Leaves, Fruit, Bark | Extract, Sap | 0.46 | 0.23 | Smooth delivery, constipation, oxidative stress, neurological disorders, diabetes. |
| Celasteraceae | *Gymnosporea royleana* Wall. ex M. A. Lawson UOG-842 | Pataki | S | Wild | Leaves, Seeds, Roots | Powder, Decoction, Infusion, Sap | 0.33 | 0.16 | Gastro-intestinal problems, dysentery, vermifuge, toothache, catarrh, sores, mouth infections, eye problems. |

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|---|---|---|---|---|---|---|---|---|---|
| Araliaceae | *Hedera nepalensis* K. Koch UOG-843 | Banjali | Climbing shrub | Wild | Leaves, Fruit | Decoction | 0.53 | 0.26 | Cathartic, stimulant, diaphoretic, febrile disorders, rheumatism, skin problems, diabetes. |
| Convolvulaceae | *Ipomea pes-tigridis* L. UOG-844 | Pulichuvali | H | Wild | Leaves, Seeds, Roots, Whole plant | Poultice, Smoke, Juice, Decoction | 0.4 | 0.06 | Boils, sores, pimples and tumors, bronchial spasm, dropsy, rabies dog bites, hemoptysis. |
| Acanthaceae | *Justicia adhatoda* L. UOG-845 | Baikar | S | Wild | Leaves, Root | Juice, Decoction | 0.8 | 0.33 | Inflammation, antispasmodic, expectorant, cough, pneumonia, dysentery, diarrhea, glandular tumors. |
| Plantaginaceae | *Nanorrhinum ramossisimum* (Wall.) Betsche. UOG-846 | Khunger booti | H | Wild | Whole plant | Powder, Paste | 0.56 | 0.28 | Diabetes, diuretic, break kidney stones, fever, rheumatism, snake and scorpion bites, inflammation. |
| Anacardiaceae | *Lannea coromandelica* (Houtt.) Merr. UOG-847 | Kamliya | T | Wild | Resin, Bark, Fruit, Leaves | Powder, Juice, Paste | 0.46 | 0.23 | Dysentery, fever, stomach pain, astringent, toothache, gum problems, inflammation, body pains, wounds, skin diseases, stop bleeding, tetanus. |
| Mimosaceae | *Leucaena leucocephala* (Lam.) de Wit. UOG-848 | Babul | T | Wild | Leaves, Root, Bark, Seeds | Decoction, Paste | 0.66 | 0.16 | Cough, measles, intestinal worms, abortifacient, diabetes. |
| Brassicaceae | *Lepedium sativum* L. UOG-849 | Halon | H | Cultivated | Leaves, Seeds | Chewed, Paste, Seeds, Decoction | 0.71 | 0.41 | Cough, asthma, sore throat and headache, chapped lips, sunburn, liver disorders, appetizer, digestive disorders. |
| Euphorbiaceae | *Mallotus philippensis* (Lam.) Mull. Arg. UOG-850 | Kamela | T | Wild | Leaves,Fruit, Root, Bark | Powder, Juice, Decoction, Paste | 0.88 | 0.51 | Measles, mumps, threadworms, ascaris, anthelmintic, cathartic, purgative, carminative, bronchitis, jaundice, spleen enlargement, piles, skin diseases, ulcer, diarrhea. |
| Malvaceae | *Malva parviflora* L. UOG-851 | Sonchal | H | Wild | Whole plant, Seeds, Roots | Poultice, Decoction, Seeds | 0.68 | 0.28 | Inflammations, sores, boils, cough, bladder ulcer, dandruff, demulcent. |
| Malvaceae | *Malvastrum coromandelianum* (L.) Garcke UOG-852 | Baddi Brear | S | Wild | Leaves, Flowers, Rhizome | Paste, Decoction, Powder | 0.4 | 0.06 | Dysentery, sores, inflammations, wounds, diaphoretic, carbuncles, dysentery, cough, lungs diseases, jaundice, fever, diarrhea, muscular pain. |
| Martyniaceae | *Martynia annua* L. UOG-853 | Bhindoo | S | Wild | Leaves, Fruit | Juice, Paste | 0.25 | 0.083 | Epilepsy, sore throat, alexetric, insects bites, wounds. |
| Meliaceae | *Melia azedarach* L. UOG-854 | Dahrek | T | Wild | Leaves, fruit, Bark, Root, Heart wood | Juice, Pulp, Infusion, Extract, Paste | 0.95 | 0.31 | Blood purification, tonic for stomach and liver, spleen enlargement, ascariasis, dandruff, eczema, ringworms, skin itching, malaria, antiseptic and febrifuge. |

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| Lamiaceae | *Mentha longifolia* (L.) L. UOG-855 | Jangli Podina | H | Wild | Leaves, Flowering stem | Powder, Extract, Paste, Tea | 0.92 | 0.38 | Flu, fever, vomiting, dysentery, asthma, antiseptic, refrigerant, carminative, stimulant, diuretic, liver and spleen disorders, wounds. |
| Moringaceae | *Moringa oleifera* Lam. UOG-856 | Suhanjana | T | Cultivated | Leaves, Pods, Flowers, Roots | Pills, Extract, Pickle | 0.85 | 0.28 | Diabetes, rubefacient and vasccant, antipyretic, stomach disorders, high blood pressure. |
| Moraceae | *Morus nigra* L. UOG-857 | Kala toot | T | Wild | Leaves, Fruit, Bark, Root | Decoction, Juice, Raw fruit | 0.9 | 0.15 | Cough, anthelmintic, purgative, vermifuge, diarrhea, anemia, digestion, strengthen bones, improve immunity, cardiovascular disorders. |
| Apocynaceae | *Nerium oleander* L. UOG-858 | Gandira | S | Wild | Bark, Leaves, Roots | Paste, Oil, Decoction, Powder | 0.36 | 0.18 | Arithritis, heart tonic, hemorrhoids, ulcers, skin diseases, scabies, inflammation, epilepsy, leprosy. |
| Oleaceae | *Olea ferruginea* Wall. ex Aitch. UOG-859 | Kao | T | Wild | Leaves, roots | Extract, Decoction, Tea | 0.84 | 0.35 | Diabetes, toothache, antiseptic, astringent, stomachache, fever, malaria. |
| Lamiaceae | *Rydingia limbata* (Benth.) Scheen & V.A.Albert UOG-860 | Chiti Ptaki | S | Wild | Leaves | Powder, Extract | 0.33 | 0.16 | Mouth ulcer, wounds, mouth sores, throat pains, eye and skin diseases. |
| Oxalidaceae | *Oxalis corniculata* L. UOG-861 | Khati buti | H | Wild | Leaves, Shoot, Whole plant | Paste, Extract, Juice | 0.75 | 0.25 | Scurvy, appetite, malaria, jaundice, hepatitis B, blood purification, abdominal pain, boils, abscesses wound, weeping eczema, inflammation. |
| Asclepiadaceae | *Periploca aphylla* Decne. UOG-862 | Batta | S | Wild | Bark, Milky juice | Decoction, Juice, Paste | 0.46 | 0.11 | Purgative, stomachic, fever, blisters of pus and tumors stomachic, fever. |
| Euphorbiaceae | *Phyllanthes emblica* L. UOG-863 | Amla | T | Wild | Fruit | Powder, Juice | 0.93 | 0.23 | Diabetes, high blood pressure, cooling, astringent, laxative, diuretic, diarrhea, dysentery and eye problems. |
| Euphorbiaceae | *Phyllanthus niruri* L. UOG-864 | Jangli amli | H | Wild | Fruit, Leaves, Root, Seeds | Poultice, Infusion, Paste, Seeds | 0.35 | 0.11 | Stones of urinary tract, dysentery, ulcers, inflammations, diuretic, diabetes, sores, wounds, ringworms, febrifuge, bruises. |
| Solanaceae | *Physalis minima* L. UOG-865 | Sun berry | H | Wild | Fruit, Leaves, Root, Whole plant | Juice, Extract, Paste, Chewed, Decoction | 0.48 | 0.2 | Appetizer, diuretic, laxative, tonic, anticancer, earache, headache, itches, febrifuge, vermifuge, abdomen pain. |
| Pinaceae | *Pinus roxburghii* Sarg. UOG-866 | Cheer | T | Wild | Leaves, Fruit, Resin | Extract | 0.6 | 0.3 | TB, chronic bronchitis and gangrin of lungs. |
| Plumbaginaceae | *Plumbago zeylanica* L. UOG-567 | Chitra | S | Wild | Whole plant, Roots, Leaves | Juice, Decoction, Powder, Paste | 0.25 | 0.083 | Tuberculosis, syphilis, gonorrhea, throat, mouth and chest inflammations, diarrhea, dyspepsia, piles, scabies. |

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| Fabaceae | *Pueraria tuberosa* (Willd.) DC. UOG-868 | Bandhari | Climbing Shrub | Wild | Root, Tuber | Paste, Powder | 0.8 | 0.33 | Cuts, inflammation, epilepsy, sperm count, skin complexion. |
| Euphorbiaceae | *Ricinus communis* L. UOG-869 | Arnoli | S | Wild | Seeds | Paste, oil | 0.86 | 0.21 | Constipation, leprosy, syphilis, inflammation, carbuncles and boils, control birth. |
| Rhamnaceae | *Rhamnus triquetra* (Wall) Brandis UOG-870 | Gount | S | Wild | Bark, Fruit | Juice, Paste | 0.2 | 0.05 | Diarrhea, dysentery, purify blood, scabies, boils. |
| Rosaceae | *Rubus ellipticus* Sm. UOG-871 | Akhre | S | Wild | Fruit, Root | Paste, Juice | 0.45 | 0.26 | Carminative, tonic, wounds, fever, gastric problems, diarrhea, dysentery, cough, colic and sore throat, astringent. |
| Poaceae | *Saccharum benghalense* Retz. UOG-872 | Saroot | H | Wild | Aerial part, Root | Extract | 0.6 | 0.3 | Astringent, refrigerant, emollient, diuretic, purgative, aphrodisiac, treat burning sensation, dyspepsia, sexual weakness, piles, respiratory problems and gynaecological. |
| Asteraceae | *Saussurea heteromalla* (D. Don) Handel-Mazzetti UOG-873 | Kali ziri | H | Wild | Leaves, Roots, Seeds | Paste, Extract | 0.4 | 0.2 | Leucoderma, wounds, fever, colic, carminative, horse-bites. |
| Caryophyllaceae | *Silene conoidea* L. UOG-874 | Dabri | H | Wild | Leaves, whole plant | Juice | 0.33 | 0.16 | Ophthalmia, wounds, emollient, fumigant. |
| Asteraceae | *Silybum marianum* (L.) Gaertn. UOG-875 | Kandyari | H | Wild | Leaves, Seeds | Infusion, Extract, Seeds | 0.73 | 0.18 | Chest, throat infections, stimulant, expectorant, liver and gallbladder diseases, liver disorders, skin protection. |
| Brassicaceae | *Sisybrium irio* L. UOG-876 | Khoob kalan | H | Wild | Seeds, Aerial parts | Decoction, Poultice, Infusion, Extract, Seeds | 0.45 | 0.26 | Measles, small pox, typhoid fever, throat and chest affections, cholera, diarrhea, inflammation and wounds. |
| Solanaceae | *Solanum americanum* Mill. UOG-887 | Kachmach | H | Wild | Leaves, Fruit, Stems, Roots | Decoction, Juice, Extract, Infusion, Tincture | 0.83 | 0.41 | Digestive problems, jaundice, ulcer, skin problems dysentery, asthma, fever, boils, sores, wounds and leucoderma, toothache, neurologic pains, eye diseases, diarrhea, rabies, headache and ringworm. |
| Solanaceae | *Solanum surattense* Burm. f. UOG-888 | Mokri | H | Wild | Fruit, Leaves, Root | Decoction, Paste | 0.86 | 0.43 | Pneumonia, joints pain and other body pain, scabies, ringworm, expectorant, skin diseases. |
| Myrtaceae | *Syzygium cumini* (L.) Skeels. UOG-889 | Tala | T | Wild/Cultivated | Fruit, Seeds, Bark | Powder, Juice, Extract | 0.9 | 0.45 | Diabetes, diarrhea, asthma, bronchitis, ulcers, diarrhea and dysentery. |
| Combretaceae | *Terminalia bellirica* (Gaertn) Roxb. U0G-890 | Baira | T | Wild | Fruit, Bark, Gum, Seed | Paste, Fruit, powder | 0.84 | 0.35 | Asthma, astringent, purgative, rheumatic swellings, diuretic, demulcent, inflammation, digestive, respiratory disorders, constipation. |

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| Menispermaceae | *Tinospora sinensis* (Lour.) Merr.<br>891 | Garon | Climbing Shrub | Wild | Stem, Bark, Root | Extract, Juice, Chew, Powder | 0.93 | 0.23 | Fever, aphrodisiac, antiperiodic, diarrhea, arithritis, asthma, diabetes. |
| Asteraceae | *Traxacum campylodes*G. E. Haglund<br>UOG-892 | Peeli buti | H | Wild | Leaves, Roots, Fruits, Latex | Paste, Juice, Decoction, Extract | 0.36 | 0.18 | Inflammation, joints pain, diabetes, heart problems, liver disorders, intermittent fever, chronic hepatitis, hypochondria, laxative, promote appetite, jaundice and purify blood, boils and other skin infections. |
| Asteraceae | *Tridax procumbens* (L.) L.<br>UOG-893 | Kanphuli | H | Wild | Leaves | Powder, Paste, Sap, Decoction | 0.25 | 0.083 | Antiseptic, dysentery, bronchial catarrh, diarrhea, diabetes, inflammation, bleeding, sores and ulcers. |
| Boraginaceae | *Trichodesma indicum* (L.) Lehm.<br>UOG-894 | Handusi | H | Wild | Roots, leaves, whole plant | Juice, Paste | 0.5 | 0.25 | Ear pain, wound, cough, cold, fever, vomiting and urinary problems, dysentery, wounds, joints pain, inflammation. |
| Scrophulariaceae | *Verbascum thapsus* L.<br>UOG-895 | Gidar tobacco | H | Wild | Leaves, Inflorescence, Root | Paste, Smoke, Tea, Ash, Decoction | 0.73 | 0.36 | Asthma, sore throat, cold, dysentery, hemorrhoids, inflammation, sunburn, cough, asthma, wounds. |
| Violaceae | *Viola canescens* Wall.<br>UOG-896 | Banfsha | H | Wild | Flower, Root, Whole plant | Powder, Decoction, Extract | 0.91 | 0.53 | Fever, flu, constipation, laxative, skin abrations, jaundice. |
| Lythraceae | *Woodfordia fruticosa* (L.) Kurz.<br>UOG-897 | Tavi | S | Wild | Flowers, Leaves, Roots | Smoke, Extract, Powder, Juice | 0.66 | 0.16 | Vermifuge catarrh and headache, fever, tranquilizer, anticancer, dysentery, skin burning, headache. |
| Solanaceae | *Withania somnifera* (L.) Dunal.<br>UOG-898 | Ashgand | S | Wild | Root, Fruit, Leaves | Powder, Extract, Paste | 0.93 | 0.46 | Diuretic, tonic and aphrodisiac, sexual problems and promotes urination, spermatorrhoea, narcotics, ulcer, swelling, diuretic, joints pains, skin sore, inflammations, insomnia, stress and anxiety. |
| Rubiaceae | *Wendlandia heynei* (Schult.) Santapau & Merchant<br>UOG-899 | Okan | T | Wild | Leaves, Fruits | Powder, Decoction | 0.43 | 0.21 | Heal wounds, amenorrhea, antispasmodic and febrifuge. |
| Rutaceae | *Zanthoxylum armatum* DC.<br>UOG-900 | Timber | S | Wild | Leaves,Fruit | Chewing, Paste | 0.9 | 0.45 | Stomach problems, condiment and carminative, toothache, tonic, stimulant and antirheumatic, musche spasms, chest problems, leucoderma. |
| Rhamnaceae | *Ziziphus jujuba* Mill.<br>UOG-901 | Jahnd | T | Wild | Leaves, Fruit, Root | Decoction, Powder | 0.45 | 0.26 | Diabetes, menorrhagia, haemorrhages, seminal weakness, dyspepsia, fever, wounds, ulcers. |
| Rhamnaceae | *Ziziphus oxyphylla* Edge.<br>UOG-902 | Mimyaon | S | Wild | Root, Fruit, Leaves | Decoction, Juice | 0.84 | 0.35 | Jaundice, diabetes and liver problems, hypertension and gas troubles, allergy, intestinal worms. |

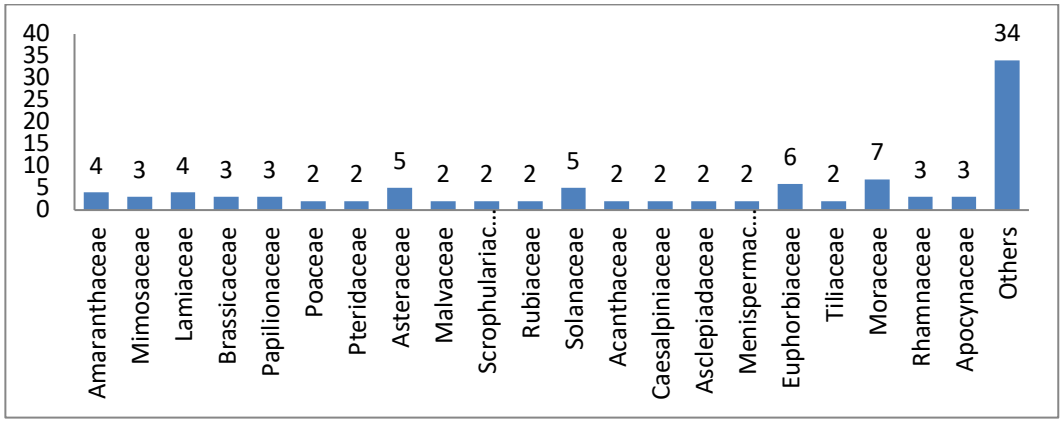


Figure 2. Graphical representation of family index (FI) with highest number of species used in present study area

**Diversity of plant parts used**

Total 16 plant parts were used in present study to prepare various traditional remedies for the cure of diverse ailments. The most frequently used plant parts for preparation of herbal remedies were leaves (80 species, 28%), followed by roots (53 species, 18%), fruits (34 species, 12%), bark and seeds (23 species, 8% in each), whole plant (22 species, 8%), stem (13 species, 4%), flower (10 species, 3%), wood and latex (9 species, 3% in each), resin (3 species, 1%), rhizome, pods, tuber, gum and aerial parts (2 species, 1% in each) (Figure 3). In most of the cases more than one part of the same plants were used for preparation of different herbal remedies. Similar findings were also recorded by the earlier studies which had been conducted in the region of Azad Jammu and Kashmir and Indonesia (Ishtiaq *et al.* 2021, Supiandi *et al.* 2019). Leaves are widely utilized in preparation of herbal medicines due to presence of active secondary metabolites (Ghorbani 2005, Bano *et al.* 2014) and leaves also useful for preparation of various herbal products in many communities around the world. Similarly leaves were dominant plant part used for preparation of herbal medicines in Kel village, Azad Jammu and Kashmir (Ahmad *et al.* 2017). The leaves are the most common and preferred components used in medical preparations due to their easy handling and stability (Rodrigues *et al.* 2020).

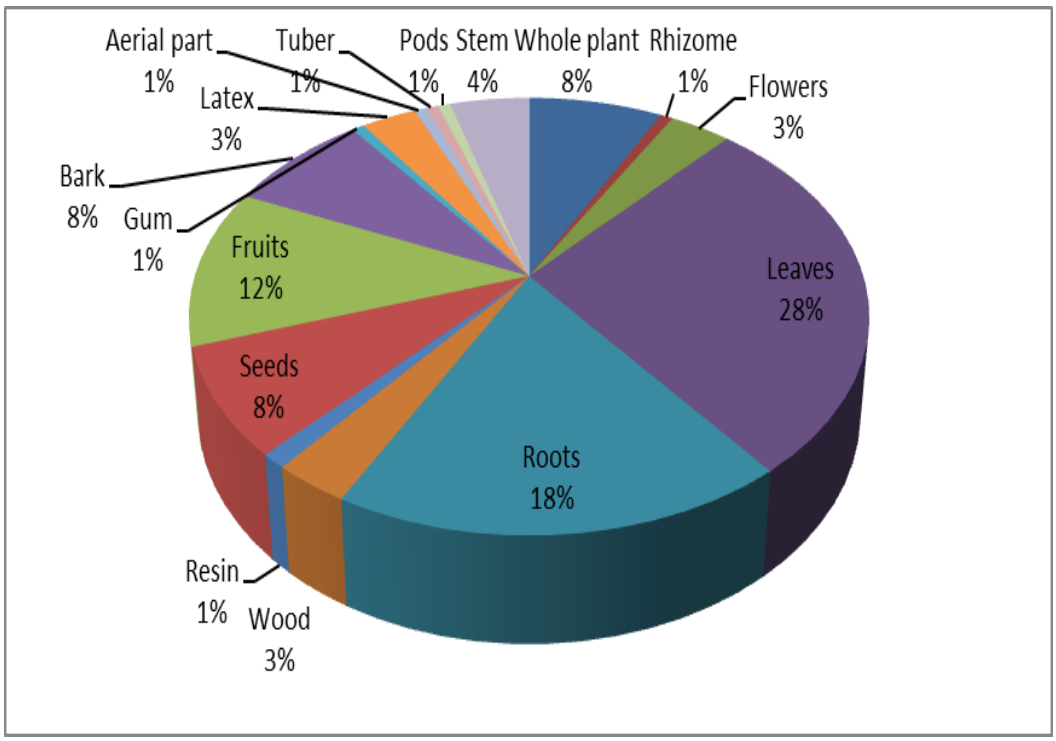


Figure 3. Percentage of plant parts used for preparation of herbal remedies

**Diversity in mode of administration of herbal remedies**

In present study total 18 kinds of mode of preparation of herbal remedies were used to cure various diseases. The most frequently preparation methods used for herbal remedies were paste (59 records, 59%), followed by decoction (54 records, 54%), powder and extract (34 records, 34% in each), juice (49 records, 49%), infusion (15 records, 15%), poultice (11 records, 11%), sap (8 records, 8%), Chewing (7 records, 7%), ash (5 records, 5%), oil (3 records, 3%), pickles (2 records, 2%), pills and tincture (1 records, 1% in each) (Figure 5). The dosage of herbal remedies were varied on the basis of disease type, age of patients, physical health of patients, severity of disease, and experience of herbal practitioners (hakims). Some of the plant parts were used with other ingredients like honey, water, butter or milk to cure various diseases. Faruque *et al.* (2018) reported that paste was the first highest mode of preparation in their study area.

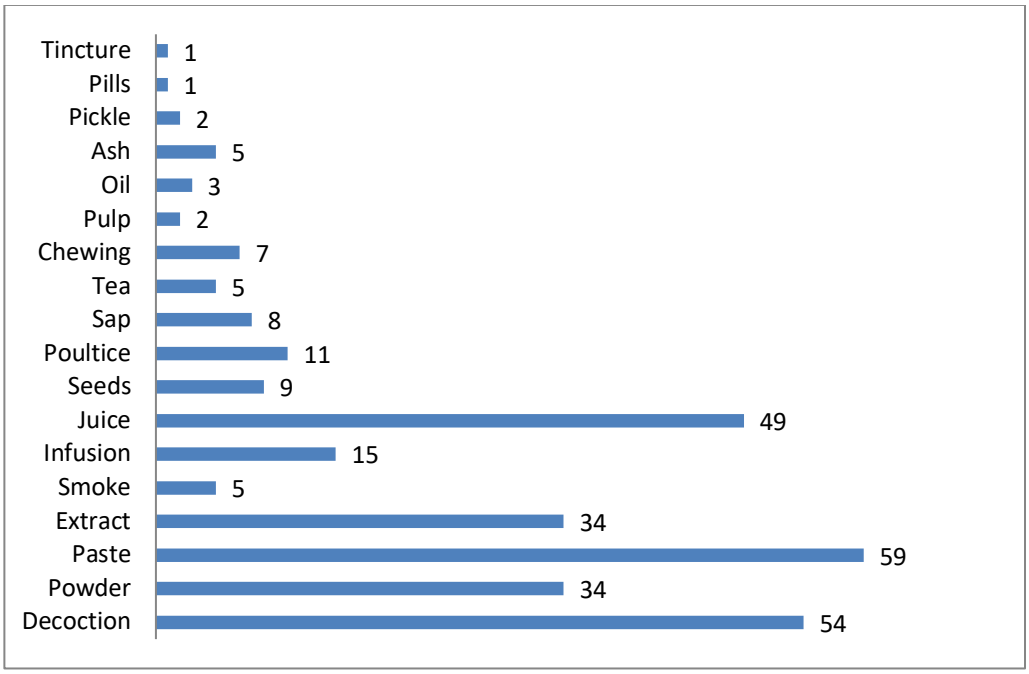


Figure 4. Mode of preparation used in present study area

**Use Value (UV)**

The use value (UV) index was applied to explore the ethno-botanical uses with respect to the previously reported medicinal plant species. In our study the calculated range of UV index was from 0.2 - 0.96. The highest UV was reported for *Cuscuta reflexa* Roxb (0.96), followed by *Melia azedarach* L. (0.95), *Ficus benghalensis* L. (0.94), *Tinospora sinensis* (Lour.) Merr. and *Withania somnifera* (L.) Dunal (0.93 each) and *Achyranthes aspera* L. (0.91) respectively (Table 2). The high use reports of species indicate a strong relationship and dependence of local people on indigenous flora to treat various diseases and livelihood (Kayani *et al.* 2014).

**Relative Frequency of Citation (RFC)**

In present study, RFC value of reported plant species ranged from 0.03 to 0.55. The RFC highest value was calculated for *Ficus benghalensis* L. (0.55), followed by *Achyranthes aspera* L. and *Viola canescens* Wall. (0.53 each), *Mallotus philippensis* (Lam.) Müll. Arg. (0.51) and *Ficus semicordata* Buch.-Ham. ex Sm. (0.48). The high RFC value of these medicinal plant species indicates that local people of study area use these plant species to cure various ailments and have a close association between local people and these plant species. The high RFC plant species were famous among local inhabitants of study area (Table 1). RFC indicates the importance of plant species with respect to information provided by local informants about use of plant species (Vitalini *et al.* 2013). Plant species having high RFC and UV should be exposed for further investigation such as pharmacological evaluation and phytochemical screening for commercial drug preparation (Mukherjee *et al.* 2012).

**Informant Consensus Factor (ICF)**

The ICF value was calculated against each disease category based on use reports, and it ranged from 0.21 to 0.68. The diseases were classified into 17 different categories (Table 2). The high range of ICF values recorded in study area confirms the higher dependability of local people on native flora especially for jaundice and hepatitis, cancer

and tumors, circulatory system disorders, nervous disorders whereas low ICF value for cardiac problems reflected lesser consistency of informer's knowledge (Lin & Mvelase 2002). Often few species have high use value and are only used for one disease category, reflecting high value of ICF (Madikizela *et al.* 2014), whereas the treatment of a particular disease category is conducted with high number of plant species confirms disagreement among the informants, reflecting a low value of ICF.

**Fidelity Level (FL)**

Plants having higher fidelity level (FL) value were mostly utilized on constant basis than those plants which had lower FL value. Species with high FL indicates their widespread use to treat a particular dominant disease of the area. In this study, the species having the highest FL value was *Viola canescens* Wall. (97.1%) used in fever, flu, cough, constipation, and jaundice (Farooq *et al.* 2019) followed by *Withania somnifera* (L.) Dunal. (96.6%) used in sexual problems, narcotics, ulcer, swellings, and joints pain, *Phyllanthus emblica* L. (96.4%) used in diabetes, high blood pressure, diarrhea, and dysentery, *Cuscuta reflexa* Roxb. (96.0%) used in fever, cough, blood purification, jaundice, skin problems, *Melia azedarach* L. (95.8) used in blood purification, malaria, skin disorders, febrifuge, *Ficus auriculata* Lour. (94.1%) used in high blood pressure, diabetes, jaundice, wounds, diarrhea, dysentery, vomiting, cholera, and mumps, *Cathranthes roseus* (L.) G. Don. (88.4%) used in diabetes, wounds, piles, high blood pressure, diarrhea, dysentery and anticancer, *Carissa spinarum* L. (87.5%) used in asthma, jaundice, kidney pain, cardiac problems, and liver disorders, *Ziziphus oxyphylla* Edgew. (85.7%) used in jaundice, diabetes, liver problems, allergy, and intestinal worms, *Butea monosperma* Taub. (82.3%) used in diarrhea, dysentery, ulcer, swellings, cold cough, boils, pimples, wound and abortion pain, *Bauhinia variegata* L. (78.9%) used in diarrhea, dysentery, skin problems, piles, and ulcer, *Achyranthes aspera* L. (66.6%) used in rheumatic, diabetes, cough, asthma, skin problems and toothache and *Barleria cristata* L. (56.5%) used in anemia, tooth pain, inflammation, diabetes, and fever. Plants having high value of Fidelity Level are recognized as model plants and hence can be used in further ethnopharmacological research (Hassan-Abdallah *et al.* 2013), (Table 3)

**Multipurpose Species**

In present study, out of 100 medicinal plant species, 30 species were used for other than medicinal purposes like vegetable, fruit, fodder, fuel, furniture, making agriculture tools, house thatching, walking sticks, hedge and fencing, construction, and handicrafts (Table 4). The number of uses varies from 2 to 7. The highest number of use plant is *Dodonaea viscosa* (L.) Jacq. that is use as fodder, fuel, hedge, and fencing, making agriculture tools, house thatching, walking sticks and handicrafts. The most common plant part use is wood and mostly plant species used as fuel (22%) (Table 8). Similarly, Ajaib *et al.* (2010) conducted ethnobotanical study of useful shrubs of District Kotli, Azad Kashmir in which plant species used as fuel, shelter, fodder, and agriculture tools.

**Direct Matrix Ranking of Multipurpose Species (DMRMS)**

In direct matrix ranking (DMR) (Table 5) of other than medicinal values of plants *Dodonaea viscosa* (L.) Jacq. ranked 1$^{st}$ according to information provided by 10 informants of study area, followed by *Pinus roxburghii* Sarg. (2$^{nd}$), *Morus nigra* L. (3$^{rd}$), *Olea ferruginea* Wall. ex Aitch. (4$^{th}$), *Acacia modesta* Wall. (5$^{th}$), *Grewia optiva* J.R.Drumm. ex Burret (6$^{th}$), *Carissa spinarum* L. (7$^{th}$), *Ficus auriculata* Lour. (8$^{th}$), *Dalbergia sissoo* DC. (9$^{th}$), *Bombax ceiba* L. (10$^{th}$). According to Khan et al., (2012) *Morus nigra* L., *Ficus auriculata* Lour. And *Olea ferruginea* Wall. ex Aitch., *Morus nigra* L., *Grewia optiva* J.R. Drumm. ex Burret were used as fruit and fodder respectively like our study. Some plant species in our study were used as muswak to clean teeth such as *Dodonaea viscosa* (L.) Jacq., *Olea ferruginea* Wall. ex Aitch. *Zanthoxylum armatum* DC. and *Acacia modesta* Wall. Similar study conducted by Khan *et al.* (2011) ethnobotany of some useful plants of Poonch valley Azad Kashmir in which *Olea ferruginea* Wall. ex Aitch., *Acacia modesta* Wall. and *Zanthoxylum armatum* DC were used as muswak to clean teeth. Khan *et al.* (2010) described that *Dodonaea viscosa* (L.) Jacq.used as wound healing, astringent, house thatching, fuel wood, fencing, toothbrushes and house cleaning brushes like our findings. *Pinus roxburghii* Sarg. used as timber, fuel wood, house building and medicinal purposes (Khan *et al.* 2010). *Morus nigra* L. used as fodder, tonic, cough, throat irritation, making agriculture tools, furniture, and fuel (Ajaib & Khan 2014) like our study.

Table 2. Informant Consensus Factor (ICF) of most common disease categories

| Use categories | Uses under each category | Nt | Nur | Nur-Nt | Nur-1 | ICF |
|---|---|---|---|---|---|---|
| Respiratory disorders | Cough, asthma, pneumonia, cold, flu | 42 | 54 | 12 | 53 | 0.22 |
| Cardiovascular disorders | cardiac problems | 16 | 20 | 4 | 19 | 0.21 |
| Digestive disorders | Stomachic, digestant, dysentery, diarrhea, laxative, Constipation, dyspepsia, vomiting, cholera, nausea, appetizer | 41 | 57 | 16 | 56 | 0.28 |
| Skin problems | Skin irritation, boils, abscess, pimples, burns, inflammation, wound, lesions, sores, itches, warts, scabies, cracked heals | 36 | 48 | 12 | 47 | 0.25 |
| Sexual problems | Gonorrhea, Spermatorrhoea, premature ejaculation, sexual desire | 14 | 18 | 4 | 17 | 0.23 |
| Female problems | Menstrual disorder, regularize menstrual cycle, leucorrhea, menstruation bleeding, increase milk secretion, abortion, labor pain, gynecological disorder | 11 | 20 | 9 | 19 | 0.47 |
| Bites | Snake bites, scorpion bites, dog bites | 24 | 38 | 14 | 37 | 0.37 |
| Malaria and Fever | Malaria, fever, Dengue fever, typhoid fever | 20 | 29 | 9 | 28 | 0.32 |
| Cancer and tumors | Cancer and tumors | 4 | 12 | 8 | 12 | 0.66 |
| Diabetes | Diabetes | 26 | 43 | 17 | 42 | 0.40 |
| Jaundice and Hepatitis | Jaundice and Hepatitis | 6 | 17 | 11 | 16 | 0.68 |
| Pain | Joints pain, waist pain, toothache, stomachache, headache, backache, body pain, arthritis | 32 | 51 | 19 | 50 | 0.38 |
| Circulatory system disorders | Blood purifier, Blood cholesterol level, anemia, High blood pressure, blood poisoning | 12 | 35 | 23 | 34 | 0.67 |
| Ulcers | Mouth ulcer, kidney ulcer, bladder ulcer | 14 | 27 | 13 | 26 | 0.5 |
| Gastric problems | Carminative, anthelminthic, anthelmintics | 16 | 32 | 16 | 31 | 0.51 |
| Nervous disorders | Narcotics, painkillers, insomnia, sedative, | 3 | 6 | 3 | 5 | 0.6 |
| General disorders | Piles, tonic, stimulant, anti-fertility, kidney problems, eye problems, stop bleeding, antiseptic, antibacterial, expectorant, obesity, mumps, tetanus, liver disorders, epilepsy, Tuberculosis. | 34 | 47 | 13 | 46 | 0.28 |

Table 3: Fidelity level (FL) values of commonly reported medicinal plants of study area

| Scientific name | Local name | Disease categories | Ip | Iu | FL (%) |
|---|---|---|---|---|---|
| *Achyranthes aspera* L. | PuthKanda | Rheumatic, diabetic, cough, asthma, skin irritation, joints pains, piles, boil, abscess, stomach pain, digestant, pneumonia, toothache, anti-fertility. | 12 | 18 | 66.6 |
| *Barleria cristata* L. | Kali Barenker | Anemia, tooth pain, inflammation, wound, snake bite, fever, diabetes, tuberculosis, cold, flu, diaphoretic, antibacterial and expectorant. | 13 | 23 | 56.5 |
| *Bauhinia variegata* L. | Kalyar | Diarrhea, dysentery, wound, skin disorders, ulcers, worms, dyspepsia, piles, regularize menstrual cycle, carminative, obesity, laxative, anthelmintics, tonic. | 15 | 19 | 78.9 |
| *Butea monosperma* Taub. | Chachra | Diarrhea, dysentery, ulcers, swellings, ringworm, cold, cough, boils, pimples, wounds, leucorrhea, control bleeding, abortion pain, anthelminthic. | 14 | 17 | 82.3 |
| *Carissa spinarum* L. | Granda | Asthma, jaundice, kidney pain, cardiac problems, stimulant, urine blockage, urinary bladder, remittent fever, liver disorders, blood deficiencies, wounds, sores, stomachic, purgative | 7 | 8 | 87.5 |
| *Catharanthus roseus* (L.) G. Don. | Sada bahar | Diabetes, wounds, dysmenorrhea, piles, nasal and mouth bleeding, high blood pressure, irregular menstruation, dysentery, diarrhea, anticancer. | 23 | 26 | 88.4 |
| *Cissampelos pareira* L. | Battal Bel | Relief tooth pain, leucorrhea, snake bite, carminative, astringent, diuretic, expectorant, sedative, febrifuge, oblivion, gastrointestinal problems, fever, cold, typhoid fever, anti-conjunctivitis. | 10 | 19 | 52.6 |
| *Cuscuta reflexa* Roxb. | Neela tari | Astringent, purgative, anthelmintic, baldness, wound, anti-lice, hair tonic, diarrhea, itches, sores, gout, joint pains, skin itching, jaundice, skin diseases, cough, blood purification, fever, menstruation bleeding. | 24 | 25 | 96.0 |
| *Ficus auriculata* Lour. | Tossy | High blood pressure, cuts, wounds, diarrhea, dysentery, cholera, mumps, vomiting, diabetes, jaundice. | 16 | 17 | 94.1 |
| *Gloriosa superba* L. | Charkiara | Stimulant, abortifacient, anthelmintic, leprosy, antidote to snake poison, earache, toothache, asthma, wounds, pimples, malaria, abdominal problems, reduce abortion. | 6 | 13 | 46.1 |
| *Melia azedarach* L. | Dahrek | Blood purification, tonic for stomach and liver, spleen enlargement, ascariasis, dandruff, eczema, ringworms, skin itching, malaria, antiseptic and febrifuge. | 23 | 24 | 95.8 |
| *Phyllanthes emblica* L. | Amla | Diabetes, high blood pressure, cooling, astringent, laxative, diuretic, diarrhea, dysentery, and eye problems. | 27 | 28 | 96.4 |
| *Viola canescens* Wall. | Banfsha | Fever, flu, cough, constipation, laxative, skin abrasions, jaundice. | 34 | 35 | 97.1 |
| *Withania somnifera* (L.) Dunal. | Ashgand | Diuretic, tonic and aphrodisiac, sexual problems and promotes urination, spermatorrhoea, narcotics, ulcer, swelling, diuretic, joints pains, skin sore, inflammations, insomnia, stress, and anxiety. | 29 | 30 | 96.6 |
| *Ziziphus oxyphylla* Edgew | Mimyaon | Jaundice, diabetes and liver problems, hypertension and gas troubles, allergy, intestinal worms. | 12 | 14 | 85.7 |

Table 4. Plant species having multipurpose used other than medicinal values

| Plant species | Local name | Part used | Cultural uses | | | | | | | | | | No. of uses |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | V | F | Fo | Fu | Fn | C | HF | AT | HT | S | HC | |
| *Acacia modesta* Wall. | Phalai | L, W | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| *Albizzia lebbeck* (L.) Bth. | Shirin | L, W | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| *Bombax ceiba* L. | Simbal | W, F | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 4 |
| *Bauhinia variegata* L. | Kalyar | L, Fd | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| *Buddleja asiatica* Lour. | Bhati | W | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 |
| *Carissa spinarum* L. | Granda | Wh, L, F | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 3 |
| *Dalbergia sissoo* DC. | Tali | W | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 4 |
| *Dodonaea viscosa* (L.) Jacq. | Sanatha | W | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 7 |
| *Ficus auriculata* Lour. | Tossy | L, F, W | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| *Ficus benghalensis* L. | Bohr | L, F | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 4 |
| *Ficus palmata* Forssk. | Phagwar | L, F | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| *Ficus racemosa* L. | Rumbal | L, F | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 4 |
| *Ficus religiosa* L. | Peepal | L | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| *Ficus semicordata* Buch.-Ham. ex Sm. | Panjal | L, F | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| *Flacourtia indica* (Burm. f.) Merr. | Koko | L, F | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| *Grewia optiva* J. R. Drumm. | Dahman | L, F, W | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 |
| *Leucaena leucocephala* (Lam.) de Wit. | Babul | L, W | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| *Mallotus philippensis* (Lam.) Mull. Arg. | Kamela | W | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 3 |
| *Melia azedarach* L. | Dahrek | L, W | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| *Morus nigra* L. | Kala toot | L, F, W | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 4 |
| *Olea ferruginea* Wall. ex Aitch. | Kao | W | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 2 |
| *Pinus roxburghii* Sarg. | Cheer | W | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 4 |
| *Rubus ellipticus* Sm. | Akhre | Wh, F | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 2 |
| *Saccharum benghalense* Retz. | Saroot | Cu | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 2 |
| *Wendlandia heynei* (Schult.) Santapau & Merchant | Okan | W | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 3 |
| *Zanthoxylum armatum* DC. | Timber | F, W | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 2 |
| *Ziziphus jujuba* Mill. | Jahnd | L, F | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 2 |
| **Total** | | | **3** | **12** | **17** | **18** | **5** | **4** | **3** | **5** | **4** | **6** | **6** | |

**Cultural uses:** *V* vegetable, *F* fruit, *Fo* fodder, *Fu* fuel, *Fn* furniture, *C* construction, *HF* hedges and fencing, *AT* agricultural tools, *HT* house thatching, *S* walking sticks, *HC* handicraft.

**Part used:** *L* leaves, *W* wood, *Fd* floral bud, *F* fruit, *Wh* whole plant, *Cu* culms.

Table 5. DMR of dominant woody plant species having other than medicinal values (information collected from 10 informants)

| **Uses** | ***Dodoaeae viscosa*** | ***Pinus roxburghii*** | ***Dalbergea sissoo*** | ***Carissa spinarum*** | ***Ficus auriculata*** | ***Grewia optiva*** | ***Olea ferruginea*** | ***Acacia modesta*** | ***Bombax ceiba*** | ***Morus. nigra*** |
|---|---|---|---|---|---|---|---|---|---|---|
| **V** | 0 | 0 | 0 | 0 | 6 | 0 | 0 | 0 | 0 | 0 |
| **F** | 0 | 8 | 0 | 10 | 10 | 4 | 0 | 0 | 0 | 10 |
| **Fo** | 10 | 0 | 0 | 10 | 8 | 10 | 8 | 10 | 0 | 10 |
| **Fu** | 10 | 10 | 10 | 0 | 6 | 10 | 7 | 10 | 3 | 10 |
| **Fn** | 0 | 9 | 10 | 0 | 0 | 0 | 0 | 10 | 0 | 0 |
| **AT** | 10 | 0 | 0 | 0 | 0 | 0 | 10 | 0 | 0 | 0 |
| **HT** | 8 | 7 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **C** | 0 | 8 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **HF** | 6 | 0 | 0 | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| **WS** | 7 | 0 | 0 | 0 | 0 | 0 | 9 | 0 | 2 | 0 |
| **HC** | 6 | 0 | 3 | 0 | 0 | 5 | 0 | 0 | 6 | 8 |
| **Total** | 57 | 42 | 23 | 25 | 24 | 29 | 34 | 30 | 11 | 38 |
| **Rank** | **1st** | **2nd** | **9th** | **7th** | **8th** | **6th** | **4th** | **5th** | **10th** | **3rd** |

## Conclusion

It was concluded that the region of Tehsil Charhoi, District Kotli, AJ&K is rich source of wild medicinal plant species. The aim of the present research to explored ethnobotanical indigenous knowledge of present area. This research established the traditional knowledge of medicinal plants used in Tehsil Charhoi District Kotli AJ&K was low or facing erosion. There is, therefore, an urgent need to document this information, as it is rapidly disappearing due to influence of western medicines and other reasons and other reasons including socio-cultural issues and our exploitation coupled with rapid deforestation. The main reason of deforestation is fire. The fire force the other wild animals too migrate to other allied areas. Therefore, there is need to aware local people to stop happening of fire. Due to all these reasons, there is need to collect ethnobotanical data and published to develop a database of medicinal plants for future research and potential development of new drugs. This publication helps to save ethnobotanical data of this area for future generations. There is need to create awareness among the local people for the collection of these medicinal plants and control deforestation.

## Declarations

***List of abbreviations:*** Not applicable.

***Ethical approval and consent to participate:*** This study was approved by the Departmental Research and Review Committee (DRRC) and Ethics Committee of Advanced Studies and Research Board (ASRB), University of Gujrat, Pakistan.

***Consent for publication:*** Not applicable

***Conflict of interests:*** The authors declare that they have no conflict of interests.

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***Authors' contributions:*** UA, KH designing of the study and proposed the study area; KH, MA and II participated in the collection of field data and identification of plant samples. MM and JZ identified the plant species reference herbarium and flora. JK analysed the data and wrote the initial draft of the manuscript. All the authors participated in writing and giving feedback on the manuscript and approved the final version of the manuscript.

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