



# Ethnomedicinal uses of the Flora of Kohimoor Baba valley, Tribal District Bajaur, Khyber Pakhtunkhwa, Pakistan

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## Databases and Inventories

### Abstract

**Background:** The present ethnomedicinal study was conducted in Kohimoor Baba valley, tribal district Bajaur, Khyber Pakhtunkhwa, Pakistan. The aims of the study were to document the medicinal plant resources and their usage patterns.

**Methods:** To obtain the profile of flora and general information from the local people of the area. The specimens were collected in each visit from the protected vegetation sites. A total of 157 informants including (2 females and 155 males) were interviewed for data collection. The informants recognized 153 plant species in treatment of 71 different diseases. Most of them were aged between 30-70 years. The ethnobotanical data was collected through interviews among the local communities. Documented data was assessed using Informant Consensus Factor (ICF), Use Value (UV) and Fidelity Level (FL), Frequency citation (FC), and Relative Frequency of Citation (RFC).

**Results:** A total of 153 taxa of plants belonged to 64 families were reported as being locally used for medicinal purposes. In collected specimens the 150 species belonged to Angiosperms while the Gymnosperms had one family with two species. However, the Pteridophytes had two families and each family had one species. Amongst the Angiosperms Lamiaceae was the dominant family with 12 species, followed by Asteraceae with 9 species, Fabaceae and Rosaceae with 8 species each. Based on habit wise distribution 91 (59.4%) species were herbs, while 33 (21.56%) were shrubs and 29 (18.95%) were trees. Leaves were the most commonly used plant parts of 69(45.09%) plants, followed by fruits 18 (14%), whole plants 16 (11.76%), roots 15 (9.80%), seeds 8 (5.22%), and bulb 6 (3.92%), latex and gums of 3 (1.96%), rhizome, flower and bark of 2 each (1.30%), while the rest of parts were used in a minor percent. The percentage of taxa used against digestive disorders was (28.57%), respiratory problems (15.58%), nail, skin and hairs diseases (11.68%), muscles and skeletal disorders (9.74%), nervous disorders (7.79%), anodyne (7.79%), body tonicity (6.49%), infectious diseases (4.54%) and (7.14%) for ear, nose and eye diseases. The highest value of informant consensus (0.8) was recorded for heart problems followed by sexual disorders (0.7). There were *Prunus armeniaca* (0.77), *Salix babylonica* (0.76), *Dodonaea viscosa* and *Ficus carica* (0.75), *Vitex negundo* (0.71), *Berberis lycium* (0.68), *Podophyllum hexandrum* had the top Fidelity level.

**Conclusion :** The study was carried out for the first time in the area, which indicated that tribal district Bajaur has abundance of indigenous medicinal plants to cure a broad spectrum of human ailments. It was concluded that extinction and declines in plant diversity is due to a range of factor including heavy biotic interference, anthropogenic activity of humans, deforestation and overgrazing. It is recommended to create awareness in local communities about the conservation of these valuable medicinal plants.

**Keywords:** Ethnobotany, Quantitative assessment, Kohimoor Baba valley, Pakistan.

## Background

Over 10,000 human cultures have thrived throughout history and continue to do so today, each possessing knowledge and wisdom regarding the adaptation of plants to the diverse nature of our planet. Plants possesses various advantages for human in the form of food, medicines, for construction and many other products (Tugume *et al.*, 2016).The use of plants in different cultures and societies as a source of medicines is immemorial. Ancient texts like Vedas and Bible have mentioned a widespread uses of herbal and healthcare preparations (Irfan *et al.*, 2018d). The utilization of medicinal plants for traditional medicine in developing countries has been widely observed as a means of maintaining good health. Additionally, industrialized societies are extracting and developing various types of drugs from plant remedies, contributing to an increased demand for medicinal plants. In societies the herbal therapies are commonly suggested in treatment of minor ailments. As advancement in human civilization many ways of treatment based on plants have been developed (Ullah *et al.* 2022ab). Three quarter of world population depends on plants for their primary health caring (Irfan *et al.* 2019; Irfan *et al.* 2023).

The uses of medicinal plants in the treatment of diseases have created renewed interest in recent times, as herbal preparations have been used throughout history in both human and animal healthcare. For instance, diarrhea is one of the common clinical signs of gastrointestinal disorders caused by both infectious and non-infectious agents and is an important cause of livestock weakening conditions (Ali *et al.* 2017; Irfan *et al.* 2018e). In old African societies, majority of the people depended on traditional medicine, where the traditional health practitioners were the primary source of health care for such communities. The inhabitants used these plants to treat serious ailments like diabetes (Ahmad *et al.* 2016; Umair *et al.* 2017; Ali *et al.* 2023).

Kohimoor Baba valley is situated in the Southeast of district Bajaur and is 16 km away from Bajaur Khar. It is linked on the West by district Mohmand through longest range of hills. In the East bounded by Takht hills, while towards North by plain area of district Bajaur and in South lies Tehsil Barang. The vegetation of Kohimoor Baba was used to be significantly denser in the past. However, various environmental factors, such as overgrazing and the cutting of herbs, shrubs, and trees for domestic purposes, have led to a reduction in diversity. The local population's construction of houses by destructing hillsides is a contributing factor to the decreasing vegetation. Currently, the mountain's vegetation pattern varies from one side to another based on demographic factors.

## Materials and Methods

An ethnomedicinal study was conducted in Kohimoor Baba valley, tribal district Bajaur in March 2021 to November 2022. The research work was completed in three stages, which consists of literature survey, field trips to the study area for data collection and documentation, ethnomedicinal information obtained from local people in Kohimoor Baba valley, tribal district Bajaur, Khyber Pakhtunkhwa, Pakistan.

### Study Area

Tribal district Bajaur lies at the farthest position of Himalayan range of mountains therefore ambiguity and fluctuations are commonly seen in monsoon rains. Majority of the areas is mountainous and has an extreme climate, where the winter season starts at the end of October and continue till March. Winter season is extremely cold and sometime from December to February the temperature falls below freezing point. Its topography is mountainous to sub-mountainous, and climate is semi-arid to arid having both winter and summer seasons. The mean winter temperature is recorded from 5°C to 10°C, whereas mean summer temperature is 23 °C to 36 °C. (Fig. 1).

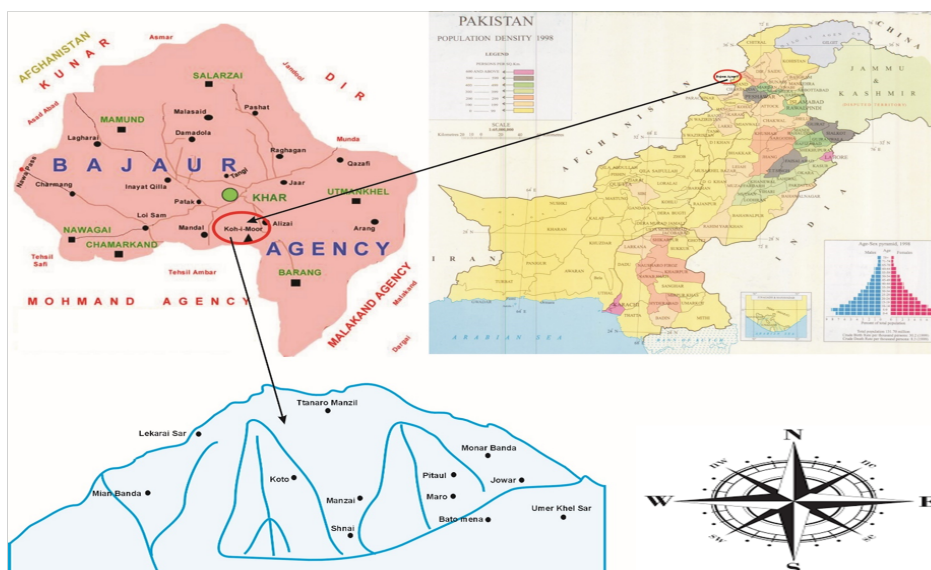


Figure 1. Map of Kohimoor Baba valley, tribal district Bajaur, Khyber Pakhtunkhwa, Pakistan

### Field work

To ensure the maximum collection of the desired plant species and fill the questionnaire, several trips were made in the study sites in spring and summer seasons. To obtain ethnomedicinal profile of the native villagers, general information was obtained from the local people and geographical maps were obtained from the concerned offices.

### Observations

The specimens were collected in each visit from the protected vegetation sites. The specimens were kept in old newspapers and pressed using wooden presses. To ensure sufficient aeration and complete drying of the specimens, the newspapers were gradually changed after every day until all specimens were completely dried. The dried specimens were treated with Naphthalene to avoid them from Pathogenic attacks and quality loss and to preserve them properly. Naphthalene and moth balls application were proved as an effective insect repellent in the Herbarium specimens deposited at the Herbarium of Abdul Wali Khan University Mardan, Pakistan. Mounting of the specimens were made on the Herbarium sheets.

### Interviews

Information regarding local uses of medicinal, fuel wood, timber, fodder plants and plans of miscellaneous uses were documented from different groups of peoples based on their ages. However, preference was given to the information of elder people and traditional healers who had traditional knowledge of various plants and their uses for different diseases.

### Data Analysis

#### **Informant Consensus Factor**

The Informant Consensus Factor (ICF) was developed by Heinrich *et al.* 1998. It is used to check the conformity between plants and informants for each category of diseases. It is represented by the following equation:

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

Where "Nur" show number of use reports for a species in use category and "Nt" represent total number of plants used in a specific disease category. The values of ICF range between (0-1). If the value of ICF is small, it means that the plants are randomly selected or no exchanges of information occur among the individuals. If the value is high, then there is uniform selection or exchange of information among the population about the uses of plants.

#### **Use value (UV) and use report**

The Use value (UV) specifies the species most important in each community. It is calculated by the using the following equation of (Irfan *et al.* 2023).

$$UV = \frac{\sum U}{n}$$

UV refers to the sum of use reports possessed by each informant for a particular species. While the "n" the refer to the No. of informants participated in the survey. UV provides quantitative information of the relative significance of species. High UV

indicates that there are more reports about the uses of a species among the community. Whereas low value of UV indicates there is few use reports of the species.

#### **FL (Fidelity Level)**

The Fidelity Level (FL) refer to the species preferred in the treatment of a diseases. It is developed by Ogeron *et al.* (2018). FL is calculated using the following equation

$$FL = Np/Nx100$$

Np represent the total number of informants describing the plants for a specific ailment, and “N” represent the total number of informants using the species for a given diseases category.

#### **Frequency (FC) and Relative Frequency (RFC) of Citation**

Frequency (FC) and Relative Frequency (RFC) value is suggested to check the most prefer plant species for a disease. It was determining by Ali-Shtayeh *et al.* (2008) using the following equation.

$$RFC = FC/N (0 < RFC < 1)$$

FC shows the importance of a species locally. It is number of informants citing the uses of species divided by the total number of informants participated in interview. A cross-sectional survey was conducted in the western districts of Kabarole, Kasese, Bundibugyo, and Bunyangabu with the help of semi-structured questionnaires for data collection and 24 key informants' interviews with native herbal medicine men/women in the region.

## **Results and Discussion**

### **Demographic data of participants in the study area**

Demographic characteristics of inhabitants are interviewed during face-to-face meeting and discussion. A total of 157 informants (2 females and 155 males) were interviewed. Out of these 53, respondents were aged between 20 to 30 years, 42 were between 30 to 40 years, 43 were aged between 50 to 60 years and 19 were more than 60 years. Four traditional health practitioners (aged between 40 to 75) having information on the uses of medicinal plants. In total 157 informants (2 females, 4 traditional Health healer and 151 males) were interviewed. Four respondents (aged between 50 and 75 years) were traditional health practitioners. These traditional health practitioners or hakims (local term for health practitioners) have information about the traditional uses of plants. They practice diseases and their methodologies are respected and are considered trustworthy among the inhabitants. There are about 50,000 registered traditional health practitioners of plant drugs in Pakistan Known as Tibb-Unanai and most of the rural population depends on these Tabibs for treatments of various diseases with 60% of estimated population seek their treatment using plant products suggested by traditional consultants (Wangchuk and Tobgay, 2015; Irfan *et al.*, 2018g; Ullah *et al.* 2018). Although facts and figures about the uses of plants are noted using repeated field trips. Traditional health practitioners considered their herbal knowledge to be traditional confidences and believed that the medicines would lose their potency if revealed to others instead of their families (Ayub *et al.*, 2023; Ullah *et al.*, 2023). Some people responded that they kept their knowledge secret outside their family circle, and they desire for payment of sharing their traditional knowledge. The majority of individuals interviewed were male (96.16%) due to limitations on the communication and interaction of females with strangers and members outside their community. In tribal areas of Pakistan, only two females (4.10%) were included in the interviews. Therefore, females are restricted to go to markets, cities or any other ceremonial places. Thus, females have less contribution in the present investigation. It is concluded from the data analysis that old aged people have more skills and awareness regarding ethno-medicines. Nearly 90% of the informants said that younger generation have lack of interest in traditional knowledge learning and practicing therefore transfer of knowledge did not take place vertically. It is also noted that some informants have stopped to practice traditional plants practices due to accumulative convenience of allopathic medicines. On average, significantly higher number of medicinal plants are claimed by illiterate people (96 men) showing that in less developed communities' peoples still rely on ethnomedicine (Table 1)

### **Family Status**

Agriculture and forestry serve as crucial resources in the mountainous regions, playing a pivotal role in the livelihoods of the residents. The community relies entirely on plant yields for fodder, fuel wood, and timber, obtained from the forest to sustain their daily lives. Human activities such as grazing and cultivation exert significant pressure on vegetation, contributing to environmental challenges for the local population. The area's inhabitants face glaring shortcomings, including poverty, ignorance, unemployment, and a lack of scientific knowledge in the collection of medicinal plants. About 97% people of the locality live in joint family system whereas only three to five percent live in nuclear families (Table 1).

Table 1. Demographic information of the respondents of Kohimoor Baba valley, tribal district Bajaur, Khyber Pakhtunkhwa, Pakistan

Variables	Categories	No. of informants	Percentage of the informants
Informants Category	Traditional Health Practitioners	4	2.54
	Indigenous Peoples	153	97.45
Gender	Male	151	96.17
	Female	2	4.10
Age	Less than 20 years	0	0
	20-30 years	53	33.75
	30-40 years	42	26.75
	40-50 years	43	27.38
	More than 60 years	19	12.10
Educational Background	Illiterate	155	99.36
	Completed five years' education	0	0
	Completed Eight-year education	1	0.63
	Completed 10-year education	0	0
	Completed 12 years' education	0	0
	Completed 14-year education	0	0
Total Experience of the Traditional health practitioners	Less than 2 years	0	0
	2-5 years	1	25
	5-10 years	3	75

#### Literacy Ratio

The lack of literacy posed a significant obstacle for residents to gather species at the appropriate time, resulting in a decline in the production of fruit trees. Mostly the heads of the families were uneducated. A single individual was found who completed eight years of education. The following table provides a table of literacy status of the survey area (Table 2).

Table 2. Literacy level of the inhabitants of Kohimoor Baba valley, tribal district Bajaur, Khyber Pakhtunkhwa, Pakistan

Educational Background	No. of informants	Percentage of the informants
Illiterate	73	98.63014
Completed five-year education	0	0
Completed Eight-year education	1	1.369863
Completed 10-year education	0	0
Completed 12-year education	0	0
Completed 14-year education	0	0
Completed 16-year education	0	0

#### Family importance value (FIV)

A total of 153 plants species belonging to 64 families were documented during field survey, including 150 Angiosperms (138 Dicotyledonous and 12 Monocotyledons). Gymnosperm had two species in one family while Pteridophytes have two families one species each. In the families the most dominant family was Lamiaceae on medicinal point of view having 12 species (7.84%), followed by Asteraceae, Fabaceae and Rosaceae with 9 species each (17.64%), Solanaceae had 7 Species (4.58%), Rutaceae and Moraceae had 5 species each (6.56%). Apiaceae, Apocynaceae, Brassicaceae, Poaceae, Polygonaceae, and Ranunculaceae had 4 species each (15.68%), whereas Alliaceae, Amaranthaceae, and Euphorbiaceae had 3 species each (5.88%). Anacardiaceae Berberidaceae, Boraginaceae, Convolvulaceae, Fumariaceae, Liliaceae, Meliaceae, Nyctaginaceae, Oleaceae, Papaveraceae, Pinaceae, Plantaginaceae, Rhamnaceae, Salicaceae, Sapindaceae, and Urticaceae had 2 species (20.91%). However, the Acanthaceae, Araceae, Araliaceae, Arecaceae, Asparagaceae, Betulaceae, Capparaceae, Cucurbitaceae, Equisetaceae Fagaceae, Geraniaceae, Iridaceae, Juglandaceae, Lythraceae, Myrtaceae, Nitrariaceae, Platanaceae, Oxalidaceae, Paeoniaceae, Pedaliaceae, Portulacaceae, Pteridaceae, Primulaceae, Rubiaceae, Sapotaceae, Saxifragaceae, Scrophulariaceae, Tamaricaceae, Verbenaceae, Violaceae, Zingiberaceae, and Zygophyllaceae were recorded with one species each (20.91%) as mentioned in Table 3. Due to pharmacological, pharmaceutical and organoleptic properties of the species of these families are highly medicinal (Irfan *et al.*, 2021; Rehman *et al.*, 2023ab). The third reason is that the members of this family are highly prevailed in high lands. This reason is supported by other researchers in their studies in many places (Ali *et al.* 2014; Irfan *et al.* 2018f); while the rest of the families having one or more than one species.

Table 3. Checklist of medicinal plants in Kohimoor Baba valley, tribal district Bajaur, Khyber Pakhtunkhwa, Pakistan.

Botanical Name	Local Name	Life form	Part used	Mode of Utilization	Disease Treated	FL	UV	FC	RFC
<b>Acanthaceae</b>									
<i>Justicia adhatoda</i> L.	Baykanr	S	L	Powder	Eye diseases	0.45	0.03	26	0.15
<b>Alliaceae</b>									
<i>Allium griffithianum</i> Boiss.	Ogakai	H	Bu	Fresh leaves	Eye aches	0.20	0.12	8	0.05
<i>Allium cepa</i> L.	Peyaz	H	Bu	Fresh bulb leaves	Eye diseases, using during journey	0.18	0.07	14	0.09
<i>Allium sativum</i> L.	Ogha	H	Bu	Powder mix with butter	Used in ring worm, help in digestion, initiate sweating and menses, Produce clarity in voice, Asthma, unconsciousness	0.14	0.09	62	0.40
<b>Amaranthaceae</b>									
<i>Achyranthes aspera</i> L.	Butkanda	H	L	Powder	Respiratory problems	0.56	0.09	17	0.11
<i>Amyranthus viridis</i> L.	Chalwae	H	L	Powder	Stop bleeding during menses	0.35	0.07	14	0.09
<i>Spinacia oleracea</i> L.	Palak	H	L	Extraction	Provide freshness to the body, eliminate thirst, Kidney pain, increase level of urination, pain killer, antipyretic	0.14	0.06	74	0.48
<b>Anacardiaceae</b>									
<i>Narcissus tazetta</i> L.	Gule gangas	H	Bu	Decoction	Purgative, Emetic,	0.45	0.08	63	0.40
<i>Pistacia integerrima</i> J. L. Stewart ex Brandis	Shenai	T	L	Decoction	Hepatitis	0.18	0.09	31	0.20
<b>Apiaceae</b>									
<i>Coriandrum sativum</i> L.	Danrya	H	F	Powder	Cough, make the heart and stomach tonic, anti-dysenteric, extraction from green leaves eliminate aches, acnes	0.9	0.08	75	0.48
<i>Daucus carota</i> L.	Gazara	H	R	Vegetables	Eyesight	0.5	0.09	33	0.21
<i>Ferula jaeschkeana</i> (Vatke) Baill.	Skhora	H	R	Powder mix with wheat flour	Aphrodisiac	0.8	0.01	53	0.34
<i>Foeniculum vulgare</i> Mill.	Kagelanay	H	L/S	Dried and grind, Boil in water during winter season	Help in digestion, Efficient in liver, chest and kidney disorders, Provide Tonicity to the stomach, Relief in Diarrhea.	0.11	0.32	28	0.18
<b>Apocynaceae</b>									
<i>Periploca aphylla</i> Decne	Barara	S	Lx	Keep over wounds	Antiseptic	0.15	0.09	28	0.18
<i>Nerium oleander</i> L.	Ganderay	S	L	Powder	Anthelmintic, mix in ointment antiseptic, fill wounds	0.44	0.08	37	0.24
<i>Caralluma edulis</i> (Edgew.) Benth.ex Hook.f.	Pamankay	H	L	Used as vegetable	Diabetes	0.3	0.09	11	0.37

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<i>Calotropis procera</i> R. Br	Spelmai	S	Lx	Powder mix in flour, milk	Toothaches, Anthelmintic, remove joints pain, Backaches	0.9	0.13	52	0.33
<b>Araceae</b>									
<i>Arisaema utile</i> Mart.	Mar jarai	H	L	Extraction	Snake and scorpion bite	0.45	0.04	25	0.16
<b>Araliaceae</b>									
<i>Hedera nepalensis</i> K. Koch	Dh ghro prewata	S	L	Decoction	Liver disorders, Cooling agent, flatulence	0.6	0.09	4	0.17
<b>Arecaceae</b>									
<i>Nannorrhops ritchiana</i> (Griff.) Aitch.	Maizaray	S	F	Powder	Stopping the bleeding during menses, inhaling, Provide help in dysentery and diarrhea	0.2	0.10	47	0.30
<b>Asparagaceae</b>									
<i>Polygonatum verticillatum</i> L.	Noore alam	H	R	Decoction	Back ache, Body tonicity	0.19	0.18	27	0.17
<b>Asteraceae</b>									
<i>Artemisia maritima</i> L.	Tarkha	S	F/L	Powder	Antiworm, remove water from wounds, Antipyretic Blood purifier, ring worm, Stomach aches	0.55	0.17	46	0.29
<i>Carthamus tinctorius</i> L.	Shedana ghna	H	Se	Powder	Body tonicity	0.24	0.12	24	0.15
<i>Cichorium intybus</i> L.	Kashni	H	L	Extraction	Diabetes, Antipyretic, Increase blood level	0.56	0.08	36	0.23
<i>Echinops echinatus</i> Roxb.	Ghunda sare ghna	H	Ro	Powder	Anti-lice	0.27	0.10	24	0.15
<i>Helianthus annuus</i> L.	Nwar paras	H	L	Powder mix with black pepper	Shivering fever	0.16	0.06	7	0.10
<i>Lactuca sativa</i> L.	Salad	H	L	leaves eating with acetic acid	Purify blood, Endemic diseases	0.34	0.07	26	0.16
<i>Matricaria chamomilla</i> L.	Babona	H	Wp	Boil in water	To eliminate wounds inside the body, especially during childbirth provided to mothers, anthelmintic, Backaches, sciatica, Antipyretic	0.8	0.41	12	0.27
<i>Taraxacum officinale</i> (L.) Weber ex F.H. Wigg	Shodapai	H	L	Decoction	Diabetes	0.5	0.12	8	0.05
<i>Xanthium strumarium</i> L.	Bathora	S	Se	Powder	For external use, only; Anodyne, Asthma for which it can be puff in Huqqa	0.12	0.08	46	0.29
<b>Berberidaceae</b>									
<i>Berberis lycium</i> L.	Kwaray	S	R	Powder	Purify blood, Reduce fever,	0.68	0.09	43	0.27
<i>Podophyllum hexandrum</i> Royle	Kakora	H	Rh	Decoction	Liver disorders	0.67	0.15	29	0.18
<b>Betulaceae</b>									
<i>Alnus nitida</i> Mill.	Geray	T	B	Powder	Toothaches	0.6	0.08	25	0.16
<b>Boraginaceae</b>									
<i>Cynoglossum lanceolatum</i> Forssk.	Shmanroz	H	Wp	Decoction	Laxative	0.4	0.02	35	0.22

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<i>Onosma hispida</i> Wall. ex G. Don	Mamola	H	Bu	Extraction	Respiratory disorders, Spasmolytic, Asthma, Blood purification	0.45	0.13	11	0.34
<b>Brassicaceae</b>									
<i>Brassica campestris</i> L.	Sharsham	H	O	Mix with <i>Lawsonia alba</i>	Anti-lice, Athlete foot	0.18	0.07	13	0.08
<i>Capsella bursa-pastoris</i> (L.) Medik.	Bibi pansa	H	Wp	Decoction	Diarrhea, Astringent	0.31	0.50	40	0.25
<i>Eruca sativa</i> Mill.	Jamama	H	L			0.5	0.11	17	0.18
<i>Nasturtium officinale</i> W.T. Aiton	Tarmera	H	L	vegetables	respiratory tract disorders	0.09	0.06	15	0.09
<b>Capparaceae</b>									
<i>Capparis spinose</i> L.	Kharer	H	Wp	Decoction	Anthelmintic	0.15	0.12	12	0.17
<b>Convolvulaceae</b>									
<i>Convolvulus arvensis</i> L.	Perwatai	H	R	Powder	Purgative, Diarrhea	0.25	0.07	28	0.18
<i>Cuscuta reflexa</i> Roxb.	Tar botay	H	Wp	Extraction	Anthelminthic, Purify blood, Hepatitis	0.5	0.06	43	0.27
<b>Cucurbitaceae</b>									
<i>Cucurbita maxima</i> Duchesne	Kado	H	L	Vegetables	Increase blood level, Diabetes	0.7	0.07	26	0.16
<b>Equisetaceae</b>									
<i>Equisetum arvense</i> L.	Bandakay	H	Wp	Powder	Urinary problems	0.41	0.10	47	0.30
<b>Euphorbiaceae</b>									
<i>Euphorbia wallichii</i> L.	Arbai	H	L	Powder mix in Pepper or Honey	Purify blood, Piles, Cough, Flue, Asthma	0.52	0.07	64	0.41
<i>Mallotus philippensis</i> (Lam.)Baill	Kambila	S	L	Dried in shade grind to make powder	Anti-constipation, Anthelminthic, wounds cleaning, its extraction mixes with olive oil increase the growth potential of the hairs.	0.32	0.07	71	0.46
<i>Ricinus communis</i> L.	Aranda	H	L	Roasted over fire, Seeds grind and mix with flours	Acnes, soothing effect on stomach, cough, anthelminthic	0.6	0.36	10	0.13
<b>Fabaceae</b>									
<i>Acacia modesta</i> Wall.	Palosa	T	Fl	Flower waste powder	Anodyne, Body tonic	0.12	0.22	9	0.05
<i>Acacia nilotica</i> (L.) P.J.H. Hurter & Mabb	Palosa	T	G	Gums Mix with wheat flours	Tonic	0.43	0.06	16	0.10
<i>Cajanus cajan</i> (L.) Mill.	Har har	H	Se	Powder, mix with <i>Melia</i> leaves	Helpful in Piles, Increase milk level in women	0.12	0.07	26	0.16
<i>Cassia angustifolia</i> Mill.	Lasपालai	T	F	Powder	Backaches, Sciatica, anthelminthic, head aches	0.56	0.09	41	0.26
<i>Dalbergia sissoo</i> Roxb.	Showa	T	L	Extraction	Purify blood, itching Tetanus, Leprosy, Anthelminthic	0.41	0.07	64	0.41
<i>Indigofera heterantha</i> Wall.	Ghorejho	S	R	Decoction	Abdominal disorders	0.9	0.10	13	0.28
<i>Lathyrus aphaca</i> L.	Korkaman	H	S	Decoction	Wounds healing	0.19	0.06	16	0.10
<i>Robinia pseudoacacia</i> L.	Kikar	T	Ba	Powder	Stop bleeding from mouth, eye aches, burn places, anthelminthic, flue, Diarrhea.	0.17	0.10	67	0.43
<b>Fagaceae</b>									
<i>Quercus incana</i> Roxb.	Serai	T	R/F	Paste	Diabetes, Diarrhea.	0.15	0.14	50	0.32



<b>Fumariaceae</b>									
<i>Fumaria indica</i> L.	Shatara	H	L	Powder	Cough	0.9	0.07	13	0.08
<i>Fumaria indica</i> Fedde	Mamera	H	L	Extraction	Diabetes	0.48	0.13	29	0.18
<b>Geraniaceae</b>									
<i>Geranium wallichianum</i> Oliv.	Sra zela	H	R	Powder, Mix in milk or sugar	Back aches, Body Tonicity	0.10	0.07	26	0.16
<b>Iridaceae</b>									
<i>Iris germanica</i> L.	Gule zumbaq	H	Bu	Infusion	Anodyne, Body tonic	0.7	0.16	31	0.20
<b>Juglandaceae</b>									
<i>Juglans regia</i> L.	Ghuz	T	Ba	Burn to form ash	Keep upon scald surface of the body, Teeth cleaning agent, remove indigestion, Strengthen gums,	0.19	0.13	29	0.18
<b>Lamiaceae</b>									
<i>Ajuga parviflora</i> Benth. in Wall.	Ghuti	H	L	Powder	Laxative, body tonicity, promote memory	0.9	0.06	13	0.18
<i>Ajuga reptans</i> L.	Goti	H	L	Extraction	Dandruff, Cough, Earaches, Throat infection	0.11	0.13	37	0.24
<i>Colchicum luteum</i> L.	Bandas	H	R	Boil in water	Anticancer	0.35	0.14	27	0.17
<i>Leucas cephalotes</i> (Roth) Spreng.	Saleem gaya	H	L	Powder mix with flour	Release pus	0.2	0.11	35	0.22
<b>Liliaceae</b>									
<i>Mentha arvensis</i> L.	Podina	H	L	Extraction	Belly aches, orgasmic, produce sweating, Use in menses	0.3	0.07	55	0.35
<i>Nepeta cataria</i> L.	Chemjo wala	T	L	Powder	Antipyretic	0.13	0.09	11	0.27
<i>Ocimum basilicum</i> L.	Kashmalay	H	S	Boiling, Decoction	constipation, piles, Diarrhea	0.6	0.06	29	0.18
<i>Origanum vulgare</i> L.	Dh ghar kashmalay	H	Wp	Decoction	Digestive problems	0.59	0.13	32	0.20
<i>Otostegia limbata</i> (Benth.) Boiss.	Spen azghay	S	L	Powder	Internal wounds	0.45	0.12	22	0.14
<i>Plectranthus rugosus</i> Wall.	Kharr sperkay	S	L	Powder	Blood clotting agent	0.07	0.07	13	0.28
<i>Salvia moorcroftiana</i> Wall. ex Benth.	Khاردag	H	Se	Extraction mixes in milk	Tonic for stomachs, used for earaches, maturation of acnes, diarrhea, constipation	0.35	0.07	66	0.42
<i>Teucrium stocksianum</i> L.	Yakhkandaz	H	Wp	Infusion	Cholera, Diabetes, Ring worm, Anti-constipation	0.45	0.16	25	0.16
<i>Tulip clusiana</i> Red.	Ghantol	H	L	Extraction from pedicel	Ring worm, Scorpion and flies bite	0.34	0.02	37	0.24
<i>Vitex negundo</i> L.	Marwandai	S	L	Decoction	Reduce heart problems, Belly aches, control vomiting	0.71	0.07	42	0.27

<b>Lythraceae</b>									
<i>Punica granatum</i> L.	Anar	T	F	Powder	Diarrhea, Anti-piles, Tuberculosis, Seeds provide relief in eyesight	0.30	0.15	26	0.16
<b>Meliaceae</b>									
<i>Melia azedarach</i> L.	Hindastana i shandai	T	L	Fresh leaves roasted Fire	Achenes	0.2	0.10	17	0.11
<i>Cedrela serrata</i> Royle.	Sherawnan	S	L	Powder	Digestive problems	0.48	0.08	29	0.18
<b>Moraceae</b>									
<i>Morus alba</i> L.	Toor toot	T	F	Juice	Allergy, Diabetes also improve digestion	0.47	0.11	26	0.16
<i>Morus nigra</i> L.	Spen toot	T	F	Juice	Allergy, Diabetes also improve digestion	0.40	0.42	7	0.04
<i>Broussonetia papyrifera</i> (L.) vent.	Gul toot	T	L	Powder	Febrifuge	0.58	0.03	32	0.20
<i>Ficus racemosa</i> L.	Ormal	T	L	Decoction	Stomach disorders	0.46	0.06	16	0.10
<i>Ficus carica</i> L.	Anzar	T	F	Mix in milk	Expectorant, cough, wormicide, kidney stone, tied over wounds	0.75	0.07	64	0.41
<b>Myrtaceae</b>									
<i>Eucalyptus globulus</i> Labill.	Lachi	T	L	Powder	Cough	0.8	0.13	28	0.18
<i>Myrtus communis</i> L.	Manro	S	L	Powder	Stimulant, Astringent, Alterative	0.45	0.14	21	0.13
<b>Nitrariaceae</b>									
<i>Peganum harmala</i> L.	Spalanay	H	Se	Powder	Evil-eye, Tonic, Blood purifier, Sciatica, Astringent, ear aches	0.3	0.08	72	0.46
<b>Nyctaginaceae</b>									
<i>Boerhavia diffusa</i> L. nom. Cons	Ensat	H	R	Powder	Hepatitis	0.61	0.06	15	0.09
<i>Mirabilis jalapa</i> L.	Gule abasi	H	L	Roasted over fire	Acnes, purify blood, extraction from roots provide relief in emeroids	0.6	0.12	15	0.28
<b>Oleaceae</b>									
<i>Jasminum humile</i> L.	Chanbeli	S	R	Extraction	Headaches, mouth wash, skin diseases	0.22	0.06	23	0.14
<i>Olea ferruginea</i> Royle, Ill.	Khono	T	L/FI	Chewing fresh leaves	Throat and mouth infection, eye aches	0.33	0.14	43	0.27
<b>Oxalidaceae</b>									
<i>Oxalis corniculata</i> L.	Trewakay	H	L	Boil and keep over night	fever, cough, fracture of bones	0.19	0.06	46	0.29
<b>Platanaceae</b>									
<i>Platanus orientalis</i> L.	Chinar	T	B	Decoction	Allergy,	0.17	0.12	45	0.29
<b>Paeoniaceae</b>									
<i>Paeonia emodi</i> Wall. ex-Royle	Mameekh	H	Dp	Powder	Body tonicity, Diuretic, Diabetes, Ulcer	0.11	0.08	45	0.29
<b>Papaveraceae</b>									
<i>Papaver pavoninum</i> Schrenk, Enum.	Redai	H	L	Mix with honey.	Eye aches	0.56	0.06	15	0.09
<i>Papaver somniferum</i> L.	Koknar	H	Lx	Capsule boil in water	Cough, Narcotic, Anodyne, Diarrhea, boil in tea provided to mothers during childbirth	0.6	0.12	33	0.21
<b>Pedaliaceae</b>									
<i>Sesamum indicum</i> L.	Gosay	H	Wp	Roasted in fire with Desi ghee	Body tonicity	0.7	0.07	13	0.18

<b>Pinaceae</b>									
<i>Cedrus deodara</i> (Lamb.) G. Don	Nanzro	T	G	Decoction	Itching, stomach problems, Headaches, anti-colic, Diarrhea	0.12	0.17	29	0.18
<i>Pinus roxburghii</i> Sarg.	Nakhtar	T	G	Boil in Milk	Acnes	0.22	0.14	24	0.15
<b>Plantaginaceae</b>									
<i>Plantago major</i> L.	Ghwa jabai	H	L	Extraction, Seeds	Reduce pain, piles, reduce bleeding from the internal organs, reduce itching of urinary canal, seeds use during severe menses	0.58	0.10	68	0.44
<i>Veronica acinifolia</i> L.	Shmakay	H	Wp	Poultice	Expectorant, Rheumatism	0.35	0.07	26	0.16
<b>Poaceae</b>									
<i>Cymbopogon citratus</i> (DC.) Stapf	Shenchay	H	L	Extraction	use in Tea, Influenza, Paralysis, fever cough	0.9	0.08	53	0.34
<i>Hordeum vulgare</i> L.	Warbasha	H	Se	Powder	Reduce blood pressure, reduce body heat, Eliminate obesity	0.6	0.12	35	0.22
<i>Oryza sativa</i> L.	Shola	H	Se	Eating with milk	Tonic, Reduce thirst, Diarrhea	0.59	0.08	36	0.23
<i>Zea mays</i> L.	Jowar	H	S	Boil	Kidney stone, heart diseases, increase blood level	0.9	0.08	35	0.22
<b>Polygonaceae</b>									
<i>Bistorta amplexicaulis</i> (D. Don) Ronse Decraene	Tarawa panra	H	L	Decoction	Diabetes	0.35	0.13	2	0.01
<i>Polygonum cespitosum</i> Blume.	Palpolak	H	L	Extraction	poisoning water for catching fishes	0.40	0.08	12	0.07
<i>Rheum emodi</i> Mill.	Chungial	H	L	Decoction	Hepatitis	0.23	0.07	23	0.14
<i>Rumex hastatus</i> L.	Tarokay	H	Wp	Ash 1/2 part	Making snuff, also used as a fuel	0.5	0.07	28	0.18
<b>Portulacaceae</b>									
<i>Portulaca oleracea</i> L.	Palak	H	Wp	Vegetables	Demulcent	0.1	0.12	47	0.30
<b>Pteridaceae</b>									
<i>Adiantum capillus-veneris</i> L.	Patho panra	H	L	Green leaves	Expectorant, chest pain, cough, Asthma	0.48	0.06	59	0.38
<b>Primulaceae</b>									
<i>Anagallis arvensis</i> L.	Shanelai	H	Wp	Decoction,	Heart diseases, Liver, worms	0.58	0.08	23	0.14
<b>Ranunculaceae</b>									
<i>Aconitum heterophyllum</i> L.	Kakora	H	L	Extraction	Scabies	0.3	0.01	78	0.50
<i>Caltha alba</i> L.	Makanrpat	H	L	Powder	Laxative	0.3	0.02	51	0.33
<i>Ranunculus muricatus</i> L.	Marghai khfa	H	L	Boil in water	Jaundice	0.8	0.05	19	0.12

<i>Ranunculus nepalensis</i> L.	Dh ghar shalkhay	H	L	Boil in water	Anti-scorbic	0.25	0.02	35	0.22
<b>Rhamnaceae</b>									
<i>Ziziphus jujuba</i> Mill.	Baira	S	F	Extraction from fresh leaves, and boil	Purify blood, can stop diarrhea, Provide tonicity to the hairs	0.6	0.07	38	0.24
<i>Ziziphus nummularia</i> (Burm.f.) Wight & Arn	Manmara	S	L	Powder	Fever, cooling agent, liver disorders, can relief in flatulence	0.35	0.08	47	0.30
<b>Rubiaceae</b>									
<i>Galium aparine</i> L.	Jeshkay	H	Wp	Decoction	Urinary problems	0.5	0.14	15	0.09
<b>Rosaceae</b>									
<i>Cotoneaster microphyllus</i> Wall. ex Lindl.	Mamanra	S	R	Decoction	Hemostatic	0.2	0.06	11	0.27
<i>Duchesnea indica</i> (Andrew) Th. Wolf.	Dh Zmake toot	H	F	Extraction	Laxative	0.41	0.08	32	0.20
<i>Eriobotrya japonica</i> (Thunb.) Lindl.	Lowkot	T	L	Decoction	Diabetes	0.7	0.07	13	0.08
<i>Fragaria nubicola</i> Lindl. ex Lacaita	Balmangai	H	F	Flesh	Carminative	0.56	0.09	23	0.14
<i>Isodon rugosus</i> L.	Krechay	S	L	extraction	Cough		0.11	23	0.14
<i>Prunus armeniaca</i> L.	Khobanai	T	F	Dried ovary	Tonic, stomach, inflammation, piles, Reduce, blood pressure, Anthelminthic	0.77	0.08	78	0.50
<i>Prunus dulcis</i> (Mill.) D. A. Webb	Badam	T	S	Kernel boil in water	Make the belly soft, increase sperm production, cough, helpful in urinary infection, constipation, childbirth	0.4	0.13	37	0.24
<i>Robus friuticosus</i> G.N. Jones	Karwara	S	L	Decoction	internal body pains	0.20	0.07	25	0.16
<i>Rosa bronii</i> Herrm.	Khurach	S	R	Decoction	Abdominal disorders	0.3	0.14	24	0.15
<b>Rutaceae</b>									
<i>Citrus decumina</i> L.	Toranj	S	Fl	Decoction	Eliminate yellowing of eyes, Belly aches in children	0.9	0.06	49	0.31
<i>Citrus medica</i> L.	Nembo	S	J	Mix with mustered oil	Eliminate acnes in head	0.8	0.48	52	0.33
<i>Citrus sinensis</i> (L.) Osbeck	Malta	S	L	Mix in green tea	to eliminate vomiting	0.15	0.06	15	0.09
<i>Skimmia laureola</i> Juss	Nazar panra	S	L	Fresh leaves, oil extraction	Produce smelling, use in soap making	0.67	0.083	24	0.15
<i>Zanthoxylum armatum</i> Mill.	Dambara	S	F	Powder mix with flour	Impaction	0.47	0.12	36	0.23
<b>Salicaceae</b>									
<i>Salix babylonica</i> L.	Wolha	T	B	Powder	Eye aches	0.76	0.11	41	0.26
<i>Populus alba</i> var. <i>caspica</i> Bornm.	Sapeda	T	L	Powder	Reduce body heat, provide freshness to the body, Tonic for brain and heart	0.44	0.06	46	0.29
<b>Sapindaceae</b>									
<i>Aesculus indica</i> (Wall. ex Cambess.) Hook.	Jawaz	S	L	Decoction	Abdominal pains	0.42	0.10	7	0.04
<i>Dodonaea viscosa</i> Jacq	Ghoraskay	S	L	Decoction	Acnes	0.75	0.07	14	0.09

<b>Sapotaceae</b>									
<i>Monotheca buxifolia</i> (Falc.) A. DC.	Gorgora	T	F	Extraction	Kidney stones	0.6	0.11	33	0.21
<b>Saxifragaceae</b>									
<i>Bergenia ciliata</i> (Haw.) Sternb.	Gat panra	H	L	Extraction	Anodyne, Body tonic	0.9	0.07	46	0.29
<b>Scrophulariaceae</b>									
<i>Verbescum thapsus</i> L.	Kharghwag	H	L	Decoction	Acne, reduce heat of the body	0.9	0.06	32	0.20
<b>Solanaceae</b>									
<i>Datura innoxia</i> Mill.	Batora	S	R	Decoction	Remove freckles from the skin		0.07	14	0.09
<i>Lycopersicon esculentum</i> Mill.	Tamater	H	F	Fresh fruits	Anti-constipation, Hepatitis, kill worms of kidneys, helpful in Diabetes and obesity	0.46	0.09	83	0.53
<i>Nicotiana tabacum</i> L.	Tamabaco	H	L	Powder	Produce feeling of thirst, reduce brain humidity, expectorant, tooth aches	0.10	0.07	52	0.33
<i>Solanum nigrum</i> L.	Kachmacho	H	L	Decoction	Disinfect wounds, anthelmintic, hypnotic	0.34	0.14	35	0.22
<i>Solanum surattense</i> Burm. f.	Maraghone	H	F	Decoction	Provide relief in cough, Asthma, fever, muscular pain kidney stones	0.24	0.20	24	0.15
<i>Withania coagulans</i> Dunal.	Khomazora y	S	L/Se	Decoction	Dyspepsia, Bellay aches	0.44	0.45	38	0.24
<i>Withania somnifera</i> (L) Dunal	Kotilal	H	L	Decoction	Body tonicity, Diuretic, Diabetes, Ulcer	0.57	0.08	45	0.29
<b>Tamaricaceae</b>									
<i>Tamarix aphylla</i> (L) Karst.	Ghaz	T	B	Decoction, Powder	Eliminate wort spots	0.6	0.09	11	0.37
<b>Urticaceae</b>									
<i>Debregeasia salicifolia</i> (Roxb. ex D. Don)	Kharawa	S	F	Powder	Skin diseases, mix in oil Eczema	0.20	0.10	19	0.12
<i>Urtica dioica</i> L.	Sezonai	H	L	Powder	Papules on hand and feet's	0.45	0.04	22	0.14
<b>Verbenaceae</b>									
<i>Verbena officinalis</i> L.	Shomakay	H	Wp	Boil in water	Malaria, stomach problems, Vomiting	0.30	0.17	17	0.11
<b>Violaceae</b>									
<i>Viola canescens</i> Wall. ex Roxb	Benawsha	H	Wp	Crude powder	Anti-constipation, Cough, flu, fever, Bronchitis,	0.11	0.21	23	0.14
<b>Zingiberaceae</b>									
<i>Zingiber officinale</i> Roscoe.	Adrak	H	Rh	Powder	Stomach diseases, promote memory, Eliminate mouth sourness	0.18	0.08	48	0.31
<b>Zygophyllaceae</b>									
<i>Tribulus terrestris</i> L.	Karkondai ghana	H	L	powder	Cooling Agent	0.34	0.07	13	0.08

**Key words:** H : Habit; Herbs, S: Shrubs, T: Trees; L: Leaves, F: Fruits, Wp: Whole plant, R: Roots, S: Seeds, Bu: Bulb, Lx: Latex, G: Gums, Rh: Rhizome, Fl: Flower, B: Ba

**Life form**

The analysis of data shows (Fig. 2) that herbs were 91 (59.4%) are the main source of medicines, followed by shrubs were 33 (21.56%) and trees 29 (18.95%) given. Due to moist and temperate climate, the herbs are mostly found along the roadsides, home gardens, farmlands, and in wild habitats. As previously indicated, local people provided consistent information about the cultivation of these herbs in the specified climate. Similar insights of (Musa *et al.* 2022; Sher *et al.* 2023) into herb cultivation have been shared by numerous individuals across the country. The reasons of herbs dominance are its ubiquitous availability and widespread occurrence (Hussain *et al.*, 2018; Irfan *et al.*, 2018c; Iftikhar *et al.* 2019).

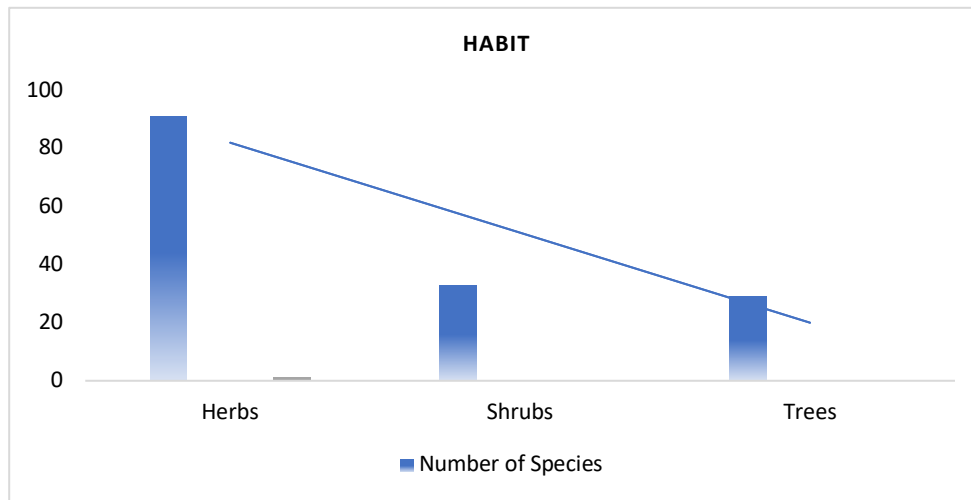


Figure 2. Habit wise distribution of collected species of the study area

**Part Usage of plants parts**

During data collection for herbal preparation, different parts of the plants used treatments were documented (Fig. 3). Leaves are found to be the most commonly used plant parts with 69 plants (45.09%), followed by fruits with 18 plants (14%), whole plant body with 16 plants (11.76%), Roots with 15 (9.80%), Seeds with 8 (5.22%), Bulb with 6 (3.92%), latex and Gums with 3 plants (1.96%), Rhizome, flower and bark with 2 plants each (1.30%) respectively. While combined the leaves and fruits, flower and leaves, seeds and leaves, Roots and fruits, leaves and stem used of one species each (0.65%).

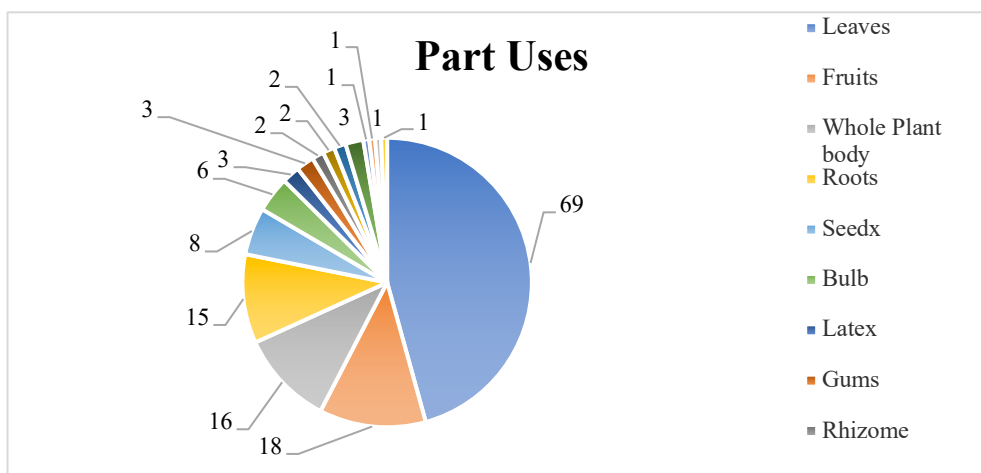


Figure 3. Distribution of medicinal plants parts used in the study area

Leaves are frequently used in herbal manufacturing because of its active metabolites. It is believed that leaves also contain more crude drugs than other parts (Irfan *et al.* 2018b). Beside leaves roots also possess a considerable quantity of biochemical compounds. This information is proved in various parts of the country by various researchers (Albuquerque 2009; Ali *et al.* 2018; Hilou *et al.* 2018). As the leaves were mostly in use, similarly the roots are important, because they contain huge quantity of active bio chemicals than other parts (Baydoun *et al.* 2015; Karim *et al.* 2015; Irfan *et al.* 2018b; Ahmad *et al.* 2019).

### Mode of utilization

Various methods of drug utilization were reported during survey including powder, decoction, extraction, crude form, poultice, infusion, paste, juice, resin, ashes, latex and smoke. Out of this decoction was found to be the most reported mode of drug preparation (Hosseinzadeh *et al.*, 2014; Irfan *et al.*, 2018a).

### Diseases category

The data is for the informant consensus factor (ICF) is which is determined for reported medicinal plants (Table 4). The treated diseases are grouped in to 11 categories to develop a consensus. ICF value ranges from 0.1-0.8. Highest value of ICF recorded for heart disorders (0.8) followed by eye diseases (0.7). The possible reason of ICF for heart disorders may be high altitude, contaminated air, dust particles and spores of herbs and fungi. The disorders may be due to extreme cold, germs and allergy caused by pollens, sand particles and poor hygiene (Ahmad *et al.* 2018; Ghorbani *et al.* 2011; Irfan *et al.* 2017). The notable diseases cured by medicinal plants in the area are gastrointestinal (44%) and respiratory disorders (38%) respectively. In sense of plants used, the highest number was observed for Gastrointestinal tract diseases (28.57%) followed by respiratory diseases (15.58%). It has been unwavering that the local people are particularly interested to use herbal therapies predominantly for the treating GIT and respiratory diseases, while it has also been indicated that precious plant species of these areas have useful traditional therapeutic uses (Table 4). The main reasons for such diseases were found to be unbalance diet and agricultural activities such as pollen allergy, and hard bread eating (Afzal *et al.* 2009; Malik *et al.* 2018; Khan *et al.* 2023). Walking to high altitudes without access to transportation can lead to muscle and skeletal disorders (Abbasi *et al.* 2013; Bano *et al.* 2018; Ijaz *et al.* 2016).

Table 4. The ICF value of diseases treated in Kohimoor Baba valley, tribal district Bajaur, Khyber Pakhtunkhwa, Pakistan

Diseases Categories	Number of use reports	Percentage of use reports	Number of used taxa	Percentage of taxa	ICF
Gastrointestinal tract disorders	52	44.82	44	28.57	0.15
Respiratory diseases	45	38.79	24	15.58	0.23
Muscles and skeletal disorders	23	2.0609319	15	9.74026	0.36
Urinary disorders	15	1.28405	7	4.54545	0.57
Aphrodisiac	5	4.3103448	2	1.2987	0.7
Ear, Nose, Eye diseases	17	14.655172	11	7.14286	0.57
Nail, Skin and Hairs diseases	27	23.275862	18	11.6883	0.26
Heart problems	8	6.8965517	2	1.2987	0.8
Nervous Disorders	4	3.4482759	2	7.79221	0.6
Anodyne	25	21.551724	12	7.79221	0.54
Body Tonicity	20	1.7124005	10	6.49351	0.526
Infectious diseases	8	6.8965517	7	4.54545	0.14

### Fidelity level (FL)

The analysis of fidelity level (FL) specifies the best curing ability of a species against the various specific disorder and also showed the adoptability of a species in particular area, these results had the similarities with previous assessed results of (Abbas *et al.* 2017); higher the value, higher the ability of a specie to treat multiple ailments and vice versa. Fidelity level values for the collected specimens resulted with *Prunus armeniaca* (0.77), *Selix babylonica* (0.76), *Dodonaea viscosa* and *Ficus carica* (0.75), *Vitex negundo* (0.71), *Berberis lycium* (0.68), *Podophyllum hexandrum* and *Skimmia laureola* (0.67), *Boerhavia diffusa* (0.61), *Origanum vulgare* and *Oryza sativa* (0.59), *Broussonetia papyrifera*, *Plantago major*, and *Anagallis arvensis* (0.58), *Withania somniferum* (0.57) while the lowest values were resulted for *Plectranthus Rugosus* (0.07), *Nasturtium officinale* (0.09), *Leucas cephalotes*, *Cotoneaster microphyllus*, and *Melia azedarach* (0.2), *Peganum harmela*, *Caltha alba*, *Rosa bronii*, *Aconitum heterophyllum* (0.3), and *Lynoglossum lanceolatum* 3(0.4) showing their ability to treat various diseases.

**Use Value (UV)**

The use value indicates the relative importance of a species in particular area. Among these the topmost values were resulted for *Capsella bursa-pastoris* (0.50), *Citrus medica* (0.48), *Withania coagulans* (0.45), *Morus nigra* (0.42), *Matricaria chamomilla* (0.41), *Ricinus communis* (0.36), *Foeniculum vulgare* (0.32) *Acacia modesta* (0.22), *Viola canescens* (0.21), and *Solanum surattense* (0.20). Whereas the lowest values were resulted for *Ferula jaeschkeana* and *Aconitum heterophyllum* (0.01), *Caltha alba*, *Tulip clusiana*, *cynoglossum lanceolatum*, *Ranunculus nepalensis*, and *Caltha alba* (0.02), *Justicia adhatoda* and *Broussonetia papyrifera* (0.03), *Arisaema utile*, *Urtica dioica* (0.04), and *Ranunculus muricatus* (0.05). The lowest value of use value (UV) does not specify that the species is not vital for the treatment of various diseases, but it is less used by the locals (Xavier *et al.* 2015; Mehmood *et al.* 2018).

**Frequency citation (FC)**

The Frequency citation for the species included in the study resulted for *Lycopersicon esculentum* (83), *Aconitum heterophyllum* (78), *Aconitum heterophyllum* (75), *Spinacia oleracea* (74), *Peganum harmala* (72), *Mallotus Philippensis* (71), *Plantago major* (68), *Robinia pseudoacacia* (67), *Salvia moorcroftiana* (66), *Euphorbia wallichii*, *Dalbergia sissoo* and *Ficus carica* (64). However, the lowest values were resulted for *Bistorta amplexicaulis* (2), *Hedera nepalensis* (4), *Helianthus annuus*, *Morus nigra*, and *Aesculus indica* (7), *Allium griffithianum* and *Taraxacum officinale* (8), *Acacia modesta* (9), *Ricinus communis* (10). The significance of the lowest use index value should not be overlooked, as these specimens are also utilized based on the approaches adopted by local residents (Ouelbani *et al.* 2018; Khan *et al.* 2018).

**Relative Frequency Citation (RFC)**

The relative frequency citation (RFC) is the derivatives of informants' reports, and this parameter suggests the consistency and the places of species in resident area (Zahoor *et al.* 2017). The highest ranked values of relative frequency citation were resulted for *Lycopersicon esculentum* (0.53), *Aconitum heterophyllum*, and *Prunus armeniaca* (0.50), *Spinacia oleracea* and *Coriandrum sativum* (0.48), *Mallotus Philippensis* and *Peganum harmala* (0.46), *Plantago major* (0.44), *Robinia pseudoacacia* (0.43), *Salvia moorcroftiana* (0.42), *Euphorbia wallichii*, *Dalbergia sissoo*, and *Ficus carica* (0.41), *Allium sativum* and *Narcissus tazetta* (0.40), *Adiantum capillus-veneris* (0.38). The lowest values were recorded for *Bistorta amplexicaulis* (0.01), *Morus nigra* and *Aesculus indica* (0.04), *Allium griffithianum*, *Taraxacum officinale*, and *Acacia modesta* (0.05), *Polygonum cespitosum* (0.07), *Brassica campestris*, *Fumaria indica*, *Eriobotrya japonica*, and *Tribulus terrestris* (0.08).

**Conclusion**

The study documented a diverse array of medicinal plants used by local communities, encompassing 153 taxa from 64 families. Among these, angiosperms dominated, particularly within the Lamiaceae family, exhibiting 12 species. The habit-wise distribution revealed a prevalence of herbs, comprising 59.4% of the species. Leaves emerged as the most frequently utilized plant part, addressing various health concerns such as digestive disorders, respiratory problems, and nail, skin, and hair diseases. The high informant consensus for heart problems and sexual disorders underscores the cultural significance and efficacy of certain plants in addressing specific health issues. Notably, species like *Prunus armeniaca* and *Salix babylonica* demonstrated high fidelity levels, emphasizing their importance in local medicinal practices. Overall, this comprehensive exploration sheds light on the rich botanical knowledge embedded in traditional healing practices and provides valuable insights for conservation and sustainable utilization of medicinal plant resources.

**Declarations**

**Ethics approval:** The ethical committee reviewed and approved the research entitled "Ethnomedicinal plants uses of the Flora of Kohimoor Baba valley, tribal district Bajaur, Khyber Pakhtunkhwa, Pakistan" conducted at Department of Botany, Abdul Wali Khan, University, Mardan, Pakistan.

**Consent for publications:** Not applicable.

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**Data Availability statement:** The figures and tables supporting the results of this study are included in the article, and the original data sets are available from the first author upon request.

**Competing Interests:** The authors declared no competing interests amongst themselves.

**Author's contribution:** SJ designed the project and wrote the first draft of the manuscript, GJ supervised the study, MI & FGJ reviewed and revised the article, FU did the statistical analysis, and MS provided the technical assistance in the article.



**Literature cited**

- Abbas Z, Khan SM, Alam J, Khan SW, Abbasi AM. 2017. Medicinal plants used by inhabitants of the Shigar valley, Baltistan region of Karakorum range-Pakistan. *Journal of Ethnobiology and Ethnomedicine* 13(1):1-15.
- Abbasi AM, Khan MA, Khan N, Shah MH. 2013. Ethnobotanical survey of medicinally important wild edible fruits species used by tribal communities of Lesser Himalayas-Pakistan. *Journal of Ethnopharmacology* 148(2):528-36.
- Afzal S, Afzal N, Awan MR, Khan TS, Gilani A, Khanum R, Tariq S. 2009. Ethno-botanical studies from Northern Pakistan. *Journal of Ayub Medical College Abbottabad* 21(1): 52-7.
- Ahmad A, Ali A, Basit A. (2019). Ethnomedicinal study of various plants in lone valley, district Chitral, KPK, Pakistan. *Journal of Medicinal Plants* 7(3): 24-28.
- Ahmad I, Irfan M, Ali I, Khan J, Saeed SH, Gulfaraz A. 2016. Checklist of some medicinal plants of District Lower Dir, Pakistan. *Journal of Agricultural & Bio-Chemical Science* 1(1):15-22.
- Ahmad M, Zafar M, Shahzadi N, Yaseen G, Murphey TM, Sultana S. 2018. Ethnobotanical importance of medicinal plants traded in Herbal markets of Rawalpindi-Pakistan. *Journal of Herbal Medicine* 11:78-89.
- Albuquerque UP. 2009. Quantitative ethnobotany or quantification in ethnobotany. *Ethnobotany Research and Applications* 7:001-003.
- Ali A, Jan G, Irfan M, Jan FG, Ullah F. 2023. Quantitative Ethnomedicinal study of the Flora of Tehsil Lahor, District Swabi, Khyber Pakhtunkhwa, Pakistan. *Ethnobotany Research and Applications* 25:1-21. doi:10.32859/era.25.64.1-21.
- Ali A, Rashid A, Sultan A, Irfan M. 2017. *Anisochilus carnosus* (L. f.) Wall. ex Benth. (Lamiaceae) - a new generic record for Pakistan. *Plant Science Today* 4(3):102-105.
- Ali M, Khan T, Fatima K, Ali QUA, Ovais M, Khalil AT, Idrees M. 2018. Selected hepatoprotective herbal medicines: evidence from ethnomedicinal applications, animal models, and possible mechanism of actions. *Phytotherapy Research* 32(2):199-215.
- Ali R, Ali BK, Khan MZ, Khan G, Abbas S, Ali EH. 2014. Baseline Study of Vegetation in Doyan valley District Astore, Gilgit-Baltistan, Pakistan. *IJETST* 1:7-19.
- Ali-Shtayeh MS, Jamous RM, Al-Shafie JH, Elgharabah WA, Kherfan FA, Qarariah KH, Nasrallah, HA. 2008. Traditional knowledge of wild edible plants used in Palestine (Northern West Bank): a comparative study. *Journal of Ethnobiology and Ethnomedicine* 4(1):1-13.
- Ayub M, Shah GM, Irfan M, Ullah F, Ullah A. 2023. Ethnomedicinal Study of the Flora of Sellay Pattay valley, District Malakand, Khyber Pakhtunkhwa, Pakistan. *Ethnobotany Research and Applications* 26:1-17.
- Bano A, Ahmad M, Hadda TB, Saboor A, Sultana S, Zafar M, Ashraf MA. 2014. Quantitative ethnomedicinal study of plants used in the Skardu valley at high altitude of Karakoram-Himalayan range, Pakistan. *Journal of ethnobiology and ethnomedicine* 10(1):43.
- Baydoun S, Chalak L, Dalleh H, Arnold N. 2015. Ethnopharmacological survey of medicinal plants used in traditional medicine by the communities of Mount Hermon, Lebanon. *Journal of ethnopharmacology* 173:139-156.
- Ghorbani A, Langenberger G, Feng L, Sauerborn J. 2011. Ethnobotanical study of medicinal plants utilised by Hani ethnicity in Naban river watershed national nature reserve, Yunnan, China. *Journal of Ethnopharmacology* 134(3):651-667.
- Heinrich M, Ankli A, Frei B, Weimann C, Sticher O. 1998. Medicinal plants in Mexico: Healers' consensus and cultural importance. *Social Science and Medicine* 47(11):1859-1871.
- Hilou A, Rappez F, Duez P. 2014. Ethnoveterinary management of cattle helminthiasis among the Fulani and the Mossi (Central Burkina Faso): plants used and modes of use. *International Journal of Biological and Chemical Sciences* 8(5):2207-2221.
- Hosseinzadeh S, Jafarikukhdan A, Hosseini A, Armand R. 2015. The application of medicinal plants in traditional and modern medicine: a review of *Thymus vulgaris*. *International Journal of Clinical Medicine* 6(09):635.

- Hussain W, Ullah M, Dastagir G, Badshah L .2018. Quantitative ethnobotanical appraisal of medicinal plants used by inhabitants of lower Kurram, Kurram agency, Pakistan. *Avicenna Journal of Phytomedicine* 8(4):313.
- Iftikhar S, Ali W, Ullah S, Khan W, Irfan M. 2019. Comparative antibacterial potential of methanolic extract of the leaves of wild and cultivated *Ficus carica* L. *International Journal of Botany Studies* 4(4):139-143.
- Ijaz F, Iqbal Z, Rahman IU, Alam J, Khan SM, Shah GM, Afzal A. 2016. Investigation of traditional medicinal floral knowledge of Sarban Hills, Abbottabad, KP, Pakistan. *Journal of Ethnopharmacology* 179:208-233.
- Irfan M, Ahmad I, Saeed SH. 2017. Traditional medicinal plant knowledge of some spermatophytes of Samar Bagh Valley, Lower Dir district, Pakistan. *Plant Science Today* 4(4):151-153.
- Irfan M, Ali I, Kashf RA. 2018b. Ethnobotanical survey of the flora of Maidan Valley, Lower Dir District, Khyber Pakhtunkhwa Province, Pakistan. *Plant Science Today* 5(2):68-71.
- Irfan M, Ali, D, Jan, G, Murad, W. 2018a. Ethnobotanical survey of the flora of tehsil Balakot, District Mansehra, Khyber Pakhtunkhwa, Pakistan. *Specialty Journal of Biological Sciences* 4(3):7-14.
- Irfan M, Jan G, Jan FG, Murad W, Rauf A, Alsayari, A, Almarhoon, ZM, Mabkhot YN. 2021. Ethnomedicinal and Traditional uses of the Ferns of Khyber Pakhtunkhwa, Pakistan. *Brazilian Journal of Biology* 84:1-20. <https://doi.org/10.1590/1519-6984.250256>.
- Irfan M, Khan I, Ali A, Khan R, Ali A, Jan G. 2018c. Ethnomedicinal uses of the plants of tehsil Laalqilla, district Lower Dir, Khyber Pakhtunkhwa, Pakistan. *Journal of Applied Environmental & Biological Sciences* 8(6):61-66.
- Irfan M, Nabeela, Khan I, Kamil M, Ullah S, Khan S, Shah M, Ali A, Rehman US, Ali R, Ali D, Kausar R, Jan G, & Murad W. 2018d. Ethnobotanical Survey of the Flora of Tehsil Balakot, District Mansehra, Khyber Pakhtunkhwa, Pakistan. *Journal of Applied Environmental and Biological Sciences* 8(8):1-13.
- Irfan M, Nabeela, Kamil M, Khan NA, Ilyas M, Ali A, Ullah S, Shah M, Jan G, Murad W. 2018e. Ethnomedicinal and traditional knowledge of phanerogams of tehsil Munda, district Lower Dir, Khyber Pakhtunkhwa, Pakistan. *International Journal of Biosciences* 13(4):208-218. doi:10.12692/ijb/13.4.208-218.
- Irfan M, Nabeela, Kamil M, Khan NA, Khan H, Khalil S, Ullah S, Shah M, Jan G, Murad W. 2018f. Ethnomedicinal plants uses of tehsil Khall, district lower Dir, Khyber Pakhtunkhwa, Pakistan. *International Journal of Biosciences* 13(4):219-229. doi:10.12692/ijb/13.4.219-229.
- Irfan M, Nabeela, Kamil, M, Khan NA, Ali A, Ullah Z, Ilyas M, Khan U. 2018g. Ethnomedicinal applications of plant taxa by the local communities of tehsil Adenzai, district Lower Dir, Khyber Pakhtunkhwa, Pakistan. *International Journal of Biosciences* 13(5):40-49.
- Irfan M, Nabeela, Khan H, Khan S. 2019. A Review of different Phytochemicals and Pharmacological activities evaluations of *Morus alba* (L.). *Specialty Journal of Chemistry* 4 (2):1-9.
- Irfan M, Ullah F, Haq IU. 2023. Ethnomedicinal and Traditional uses of the Flora of District Lower Dir, Khyber Pakhtunkhwa, Pakistan. *Ethnobotany Research and Applications* 26:1-22.
- Karim R, Abbas Y, Saleem A, Karim F, Abbas S, Hussain E, Ali N. 2015. Baseline Ethno-phytological study in Danyore Valley, Gilgit District, Gilgit-Baltistan, Pakistan. *Journal of Biodiversity and Environmental Sciences*, 7:108-117.
- Khan K, Jan J, Irfan M, Jan FG, Hamayun M, Ullah F, Bussmann RW. 2023. Ethnoveterinary uses of medicinal plants amongst the tribal populations of District Malakand, Khyber Pakhtunkhwa, Pakistan. *Ethnobotany Research and Applications* 25:42:1-24.
- Khan MS, Razzaq AB.2018. Ethnobotanical indices based ethnoveterinary plant profile of Jabban hills, Malakand and Hindu Kush range, Pakistan. *Pakistan Journal of Botany* 50(5):1899-905.
- Malik K, Ahmad M, Zhang G, Rashid N, Zafar M, Sultana S, Shah SN. 2018. Traditional plant-based medicines used to treat musculoskeletal disorders in Northern Pakistan. *European Journal of Integrative Medicine* 19:17-64.
- Musa M, Jan G, Jan FG, Hamayun M, Irfan M, Rauf A, Alsahammari A, Alharbi M, Suleria HAR, Ali, N. 2022. Pharmacological activities and gas chromatography-mass spectrometry analysis for the identification of bioactive compounds from *Justicia adhatoda* L. *Frontiers in Pharmacology* 13:922388. doi:10.3389/fphar.2022.922388.

- Mehmood SI, Majeed S, Jannat Z, Habib T. 2018. Imaging based Ethno botanical studies of district Poonch, Azad Jammu and Kashmir. *International journal of herbal medicine* 6(6): 81-91.
- Ngarivhume T, van't Klooster CI, de Jong JT, Van der Westhuizen JH. 2015. Medicinal plants used by traditional healers for the treatment of malaria in the Chipinge district in Zimbabwe. *Journal of ethnopharmacology* 159:224-37.
- Sher J, Jan G, Israr M, Irfan M, Yousuf N, Ullah F, Rauf A, Alshammari A, Alharbi M. 2023. Biological Characterization of *Polystichum lonchitis* L. for Phytochemical and Pharmacological Activities in Swiss Albino Mice Model. *Plants* 12:1455. <https://doi.org/10.3390/plants12071455>.
- Ogeron C, Odonne G, Cristinoi A, Engel J, Grenand P, Beauchêne J, Davy D. 2018. Palikur traditional roundwood construction in eastern French Guiana: ethnobotanical and cultural perspectives. *Journal of Ethnobiology and Ethnomedicine* 14(1):1-18.
- Ouelbani R, Bensari S, Mouas TN, Khelifi D. 2018. Ethnobotanical investigations on plants used in folk medicine in the regions of Constantine and Mila (North-East of Algeria). *Journal of Ethnopharmacology* 194:196-218.
- Rehman S, Iqbal Z, Qureshi R, Shah GM, Irfan M. 2023a. Ethnomedicinal plants uses for the treatment of respiratory disorders in tribal District North Waziristan, Khyber Pakhtunkhwa, Pakistan. *Ethnobotany Research and Applications* 25:1-16.
- Rehman S, Iqbal Z, Qureshi R, Alomar TS, Almasoud N, Younas M, Irfan M. 2023b. Ethno-Dentistry of Medicinal Plants Used in North Waziristan, Pakistan. *International Dental Journal*. 1-11. <https://doi.org/10.1016/j.identj.2023.10.001>.
- Tugume P, Kakudidi EK, Buyinza M, Namaalwa J, Kamatenesi M, Mucunguzi P, Kalema J. 2016. Ethnobotanical survey of medicinal plant species used by communities around Mabira Central Forest Reserve, Uganda. *Journal of ethnobiology and ethnomedicine* (1):1-28.
- Ullah F, Irfan M, Saeed M. 2023. Quantitative ethnomedicinal study of the Flora of district Swabi, Khyber Pakhtunkhwa, Pakistan. *Ethnobotany Research and Applications* 26: 1–26.
- Ullah K, Alam J, Shah GM, Gul A, Irfan M. 2022a. Ethnomedicinal and traditional uses of the Ferns of Shishikoh valley, District Chitral, Pakistan. *Plant Science Today* 9(3): 687–692.
- Ullah K, Shah GM, Alam J, Irfan M, Qadir G, Ullah B. 2022b. Evaluation of Ethno veterinary Medicinal Plants of Shishikoh Valley; Practices among the Local Community of District Chitral, Hindukush, Pakistan. *Sylwan* 166(2):102-121.
- Ullah S, Khan W, Ali W, Khan MS, Sajad MA, Nabeela, Irfan M. 2018. Antibacterial and antifungal potentials of the various solvents extract of *Quercus incana* fruits. *International Journal of Biosciences* 13(5):438-447. doi:10.12692/ijb/13.5.438- 447.
- Umair M, Altaf M, Abbasi AM. 2017. An ethnobotanical survey of indigenous medicinal plants in Hafizabad district, Punjab-Pakistan. *PloS one*. 2017 Jun 2;12(6): e0177912.
- Wangchuk P, Tobgay T. 2015. Contributions of medicinal plants to the Gross National Happiness and Biodiscovery in Bhutan. *Journal of ethnobiology and ethnomedicine* 11(1):1-3.
- Xavier TF, Kannan M, Auxilia A. 2015. Observation on the traditional phytotherapy among the Malayali tribes in Eastern Ghats of Tamil Nadu, South India. *Journal of ethnopharmacology* 165:198-214.
- Zahoor M, Yousaf Z, Aqsa T, Haroon M, Saleh N, Aftab A, Javed S, Qadeer M, Ramazan H. 2017. An ethnopharmacological evaluation of Navapind and Shahpur Virkanin district Sheikupura, Pakistan for their herbal medicines. *Journal of Ethnobiology and Ethnomedicine* 13(1):1-26.