

BIODIVERSITY AND CULTURAL HERITAGE: AN ETHNOMEDICINAL ASSESSMENT OF THERAPEUTICALLY AND ECONOMICALLY IMPORTANT PLANTS IN ALIZO, DISTRICT BAJAUR, PAKISTAN

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Abstract

Alizo is a rural locality in Tehsil Uthmankhel, District Bajaur, Malakand Division, Khyber Pakhtunkhwa, Pakistan. This study documents indigenous knowledge and ethnomedicinal uses of local flora in the area. Ethnobotanical fieldwork was conducted over 13 months (March 2023–April 2024) through repeated surveys for plant collection and community-based documentation. Plant specimens were mainly collected during flowering and fruiting stages to ensure accurate identification. Traditional knowledge was recorded using semi-structured interviews with approximately 250 informants (men and women) aged 25–90 years. In total, 77 medicinal plant species belonging to 42 families were documented for the treatment of diverse ailments. Lamiaceae was the most represented family, indicating its high therapeutic and cultural importance in local healthcare practices. Quantitative indices were applied to assess species significance: the highest Use Value (UV) was recorded for *Coriandrum sativum* (0.87), while the lowest UV was for *Plantago major* (0.43). The highest Relative Frequency of Citation (RFC) was observed for *Cotoneaster microphyllus* (0.48), whereas the lowest RFC (0.14) was reported for *Duranta erecta* and *Plantago lanceolata*. Most remedies were prepared in crude form, reflecting a strong dependence on traditional medicine and minimal industrial processing. The documented data provide a baseline for future pharmacological screening, conservation priorities and sustainable utilization of medicinal plant resources, while supporting the preservation of ethnobotanical knowledge in the region.

INTRODUCTION

Medicinal plants have been integral to human health care since antiquity, forming the basis of traditional medical systems such as Ayurveda, Unani and tribal ethnomedicine (Razzaq *et al.*, 2024; Siddique *et al.*, 2021). These botanicals

produce a diverse array of secondary metabolites including alkaloids, flavonoids, terpenoids and phenolic compounds with demonstrated therapeutic activities against infections, oxidative stress, inflammation and chronic diseases. The enduring reliance on medicinal plants across

cultures underscores their cultural, economic and pharmacological relevance (Razzaq *et al.*, 2024). Most of people are engaged with trade of beneficial medicinal plants throughout the world due to common use of the local people (Shah *et al.*, 2025a; Elisabetsky, 1990). Particularly, people of the rural areas have been using indigenous plants as important medicines from long times, as these information has been transferring from generation to generation. Among the last many years, the habitats of medicinal plants are restricted due to increase of population and use of raw materials by various pharmaceutical companies in Himalayas (Tandon, 1996).

The connection between plants and human cultures is not restricted to use the plants for clothing, food and shelter but also use for spiritual ceremonies, health care and ornamentation (Schultes, 1992). Since from long time, man is dependent on plants for the curing of different diseases and abnormalities. These dealings of the local people and plants leads to the founding of tradition information of plant, especially allopathic medicine (Shah *et al.*, 2025b; Ahmad *et al.*, 2006). Conservation of medicinal plant diversity and ethnobotanical heritage is

therefore critical, not only for preserving cultural legacy but also for sustainable drug discovery and development. It is essential to collect traditional information of the plants, any traditional conservation practices and their distributions are needed to conserve medicinal plants of the study area.

Alizo area is situated in Bajaur at a distance of few kilometers from Khar (headquarter). Among the newly tribal merged districts of Khyber Pakhtunkhwa, Bajaur is the smallest district. The total area of the District is 1,290 Km². Bajaur is located in Khyber Pakhtunkhwa, at northwestern side of Pakistan. It is of about 200 kilometers north of Peshawar. The study area lies at altitude of 1126 meters above the sea level and exists geographically between 34°-30° and 34°-58° latitudes and 71°-11° and 71°-30° longitudes (Shah *et al.*, 2025b). The climate of the area is very extreme, extremely chill and cold in winter and sometimes temperature reaches below freezing point. The summer season lasts from May to October, hottest month is July. The region has also agricultural lands, receiving about 800 mm of average rain fall per annum (Shah *et al.*, 2025c; Aziz *et al.*, 2018).

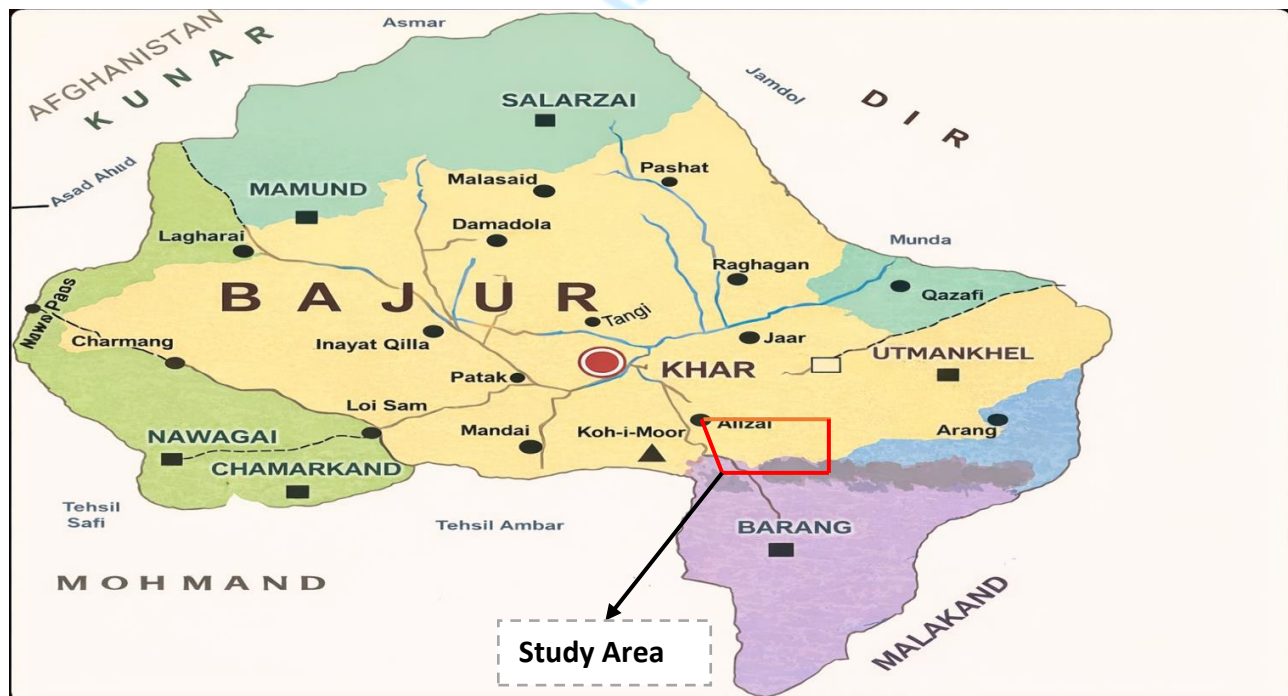


Fig. 1. Map of Bajaur showing study area (Alizo).

METHOD AND MATERIALS

Collection of plant specimens and ethnobotanical information

To document ethnomedicinal information from the study area, multiple field visits were conducted to Alizo, Tehsil Uthman Khel, District Bajaur, from March 2023 to April 2024. The plants were frequently collected in fruiting and flowering stages. For collecting data almost two hundred and fifty resourceful peoples were interviewed and collected information from different regions of research area which included both male and female and their ages were ranges from 25 to 90 years. Questions were addressed about the medicinal uses, methods of administration and preparation of drugs, diseases that they cured, local names and their habitats from the old peoples of the area.

Preservation and identification

The collected plants were pressed carefully in shade condition in plant presser, dried properly

and then pasted on herbarium cards following the standard methods (Bridson and Forman, 1989; Ali, 2010). The plants were identified through available online flora and with the help of Flora of Pakistan by Tropics project (Nasir and Ali, 1970-1989; Ali and Nasir, 1990-1991). The Collected plant samples were submitted in the Department of Botany’s Herbarium Bacha Khan University Charsadda for references and future record.

Socio-Demographic data

A total of 250 people were interviewed in which both male and female were involved. Mostly the respondents were related to field of farming. The competency, gender and age of the defendant were assessed.

Gender wise distribution of the respondents

In total 43 female and 107 male respondents were interviewed. Most of the female were housewife and male were farmers (Fig. 2).

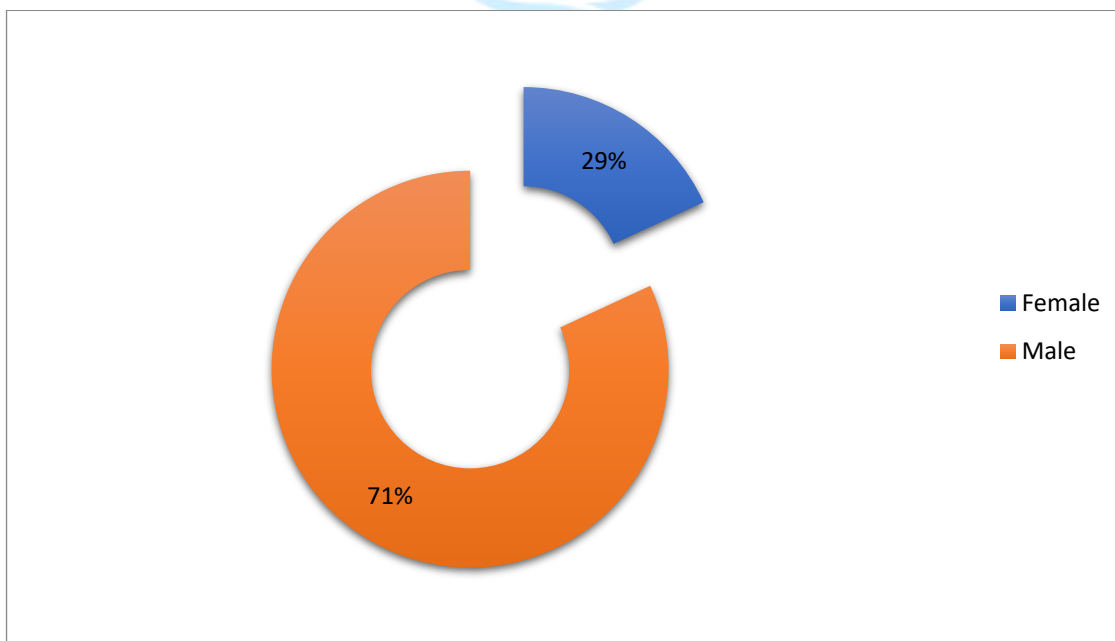


Fig. 2. Gender wise distributions of the respondents of the area

Age wise distribution of the respondents

In the research area, 250 informants were grouped on the basis of age. Classified as 25 to 36 years were 26 informants, 37 to 50 years were 49

informants, 51 to 75 years were 117 informants and from above 75 years 58 informants were interviewed (Fig. 3).

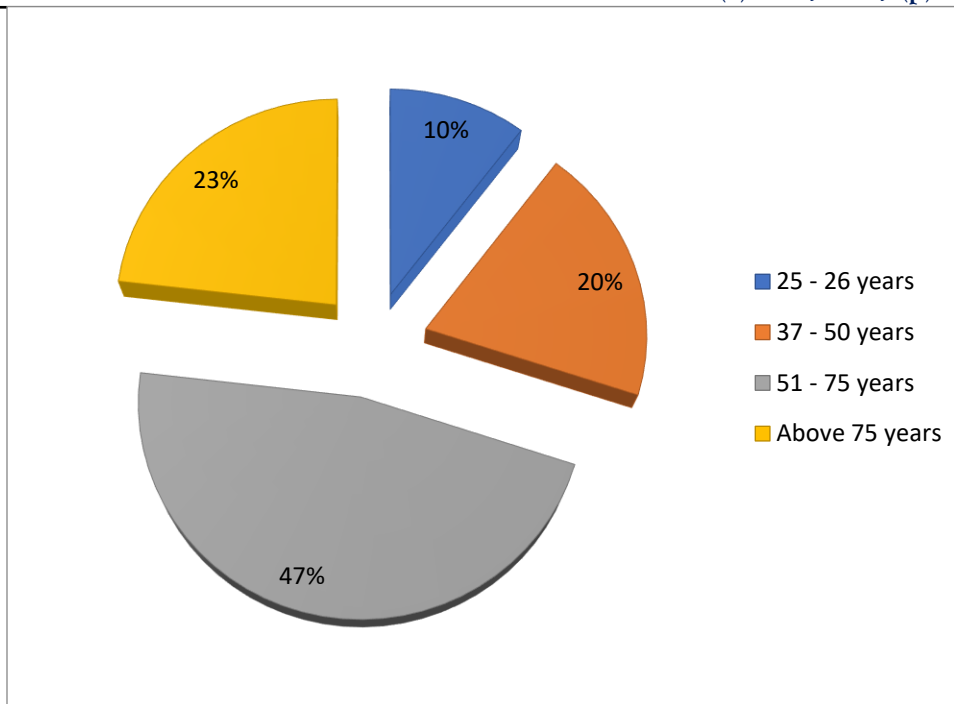


Fig. 3. Age wise distributions of the respondents of the research area

Quantitative ethnobotanical indices

Quantitative ethnobotanical indices help researchers to measure the cultural significance of plants based on local knowledge. Following indices were assessed.

Frequency of Citation (FC)

The number of informants who mention a particular plant species for any use.

FC=Number of informants who mentioned the species.

Relative Frequency of Citation (RFC)

The importance of a species in relation to the total number of informants interviewed.

Formula:

$$RFC = \frac{FC}{N}$$

Where N = total number of informants.

Use Reports (UR)

Total number of uses mentioned for a given plant species across all informants (each use per informant counts separately).

Formula:

$UR = \sum(\text{number of use-categories reported by each informant for the species})$

Use Value (UV)

A measure of the relative importance of a plant, based on the number of use-reports in relation to the number of informants.

Formula:

$$UV = \frac{UR}{N}$$

Where UR = total use reports, N = total number of informants.

A higher UV means the species is more culturally important and widely used.

RESULT AND DISCUSSION

Medicinal plants diversity

A total of 77 ethnomedicinal valuable plant species belonging to 42 families were collected from the research areas that are used by the local people for curing of different diseases (Table No. 1). The plants were arranged alphabetically with their voucher number, local name, family, botanical name and part used of medicinal plants. The leading family was Lamiaceae,

represented by 9 plants species followed by Solanaceae having 5 species, Brassicaceae have 4 species, Asteraceae, Poaceae, Amaranthaceae and

Roseaceae have 3 species each, while the remaining families have little contributions (Fig. 4).

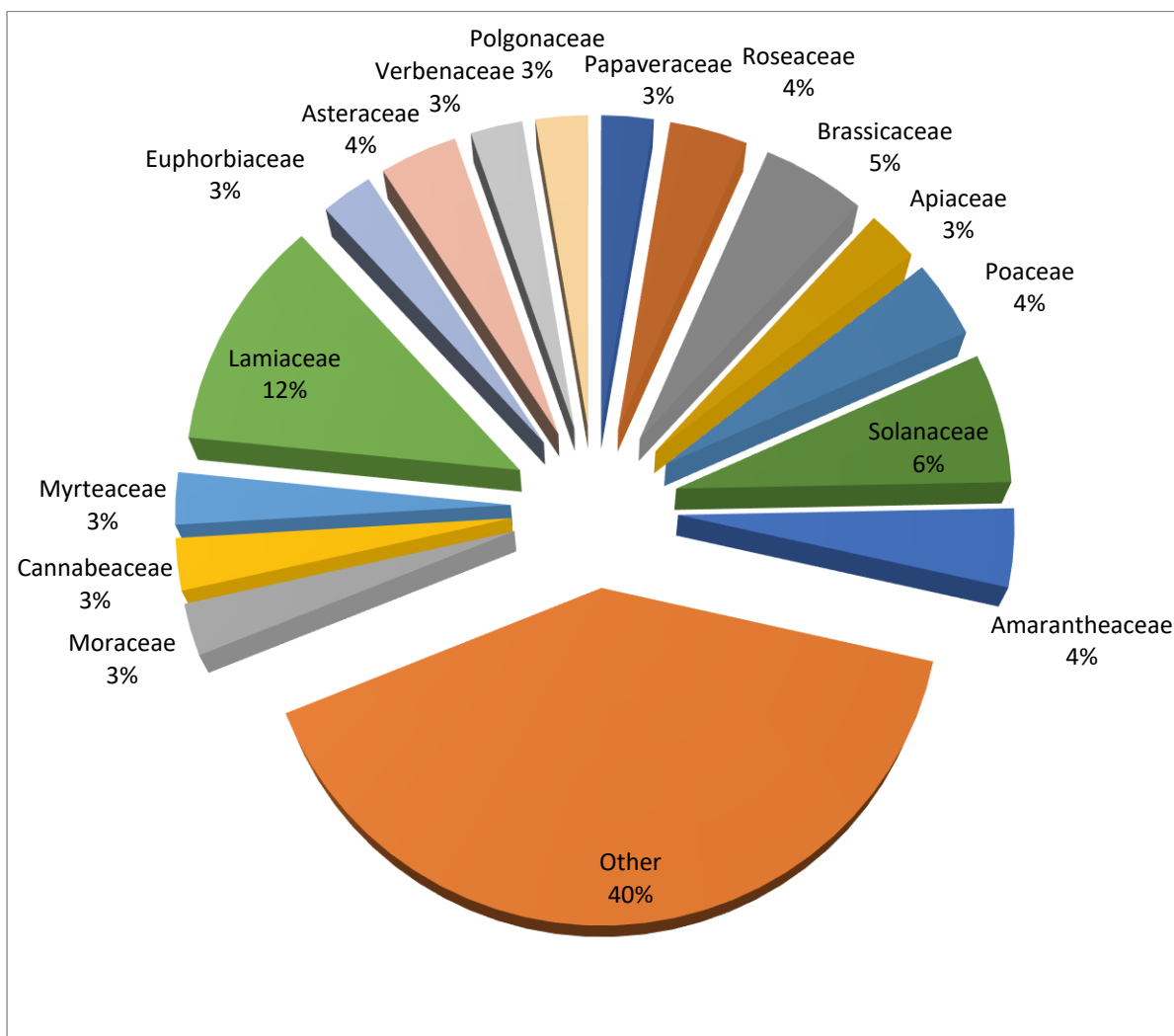


Fig. 4. Showing family wise representation of plant present in the research area

Plant parts used for ethnobotanical purposes

On the basis of part used (Fig. 5) 16 plants species were used as a whole plant (20.78%), followed by leaves for 15 species (19.48%), 7 plants for Fruit (9.09%), Seeds, roots and Gums for three species each (3.89%), 2 plants for bark (2.59%) and flower, grains, Gloves, stem, Latex for one species each (1.30%). Some plant were also reported which are used for more than one

parts such as; Stem, leaves and Seed, leaves for 5 plant species (6.49%), followed by Leaves and fruits for 4 plants (5.19%), Latex, fruits and bark, leaves for 2 plants each (2.60%), Capsule and Seed, Leaves and branches, Leaves and Root, Fruit and Bark for 1 plant species each (1.30%). Only one plant species used for three parts that is Fruit, stem and leaves (1.30%).

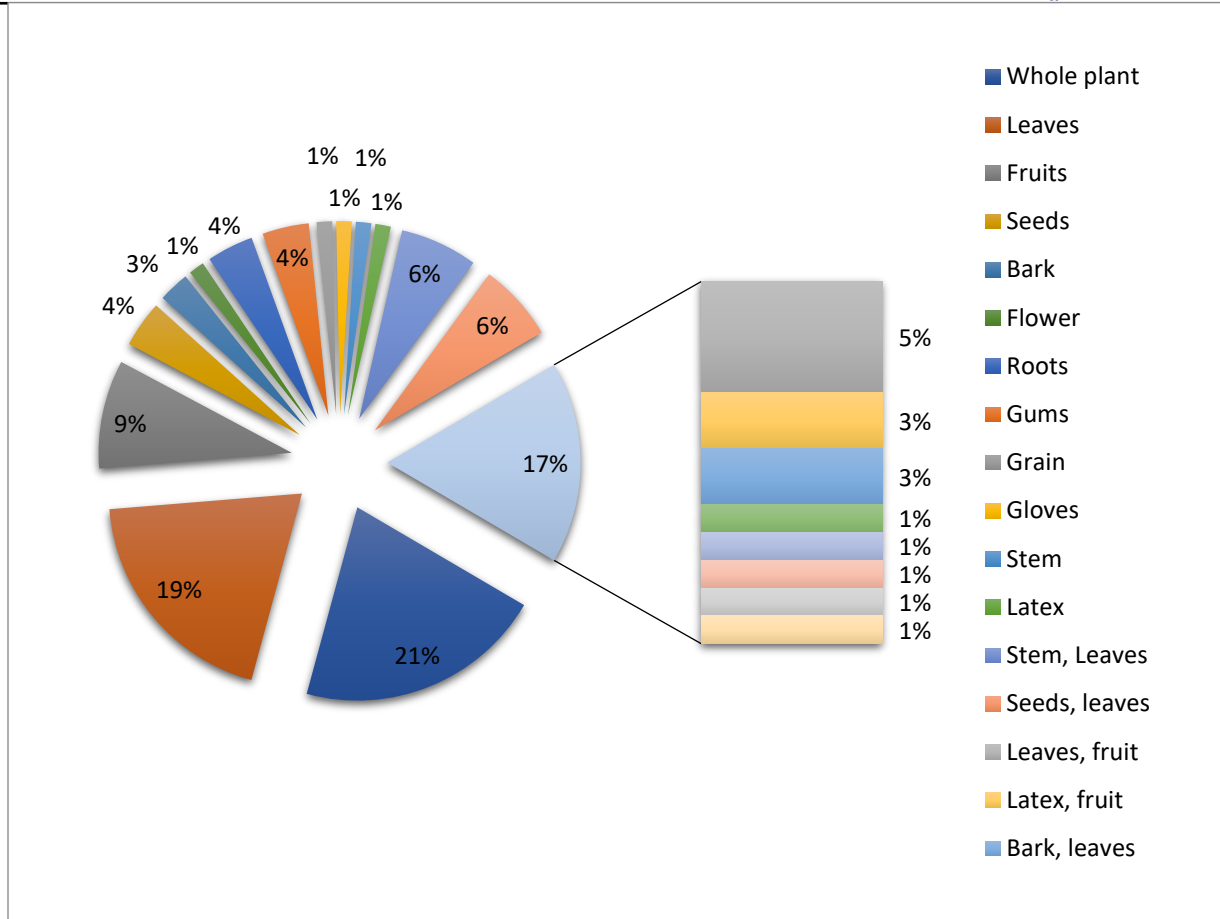


Fig. 5. Showing plant parts used in research area for various diseases

Medicinal plants are abundant in the study area. Especially medicinal plants are important source of income because these plants are used to treat different disorders as well as for further purposes like furniture, fodder, food and shelter etc. Traditional knowledge concerning the use of

medicinal plants is not equally distributed among the people and it was observed that old age people and Hakims are more knowledgeable in comparison with young generation about the utilization of medicinal plants.

Table No. 1. Complete description of voucher number, family name, botanical name, local name, parts used, disease treated, frequency of citation, relative frequency of citation, use reports and use value are as listed below

Voucher Number	Botanical Name	Local Name	Family	Parts Used	Disease treated	FC	RF C	UR	UV
HBKU-960	<i>Acacia modesta</i> Wall.	Palosa	Fabaceae	GM	Sexual tonic, improve fertility rate and inflammation	90	0.36	62	0.69
HBKU-961	<i>Acacia nilotica</i> (L.) Delile.	Kikar	Mimosaceae	GM	Bone pain, wound healing and treating skin diseases	65	0.26	30	0.46
HBKU-962	<i>Ajuga bracteosa</i> Wall.	Goote	Lamiaceae	WP	Stomach disorder and hepatitis	72	0.29	42	0.58
HBKU-963	<i>Allium sativum</i> L.	Oga	Amaryllidaceae	CS	Lower body blood pressure	109	0.44	80	0.73
HBKU-964	<i>Alternanthera pungens</i> Kunth.	Insut	Amaranthaceae	WP	Skin problems	45	0.18	23	0.51
HBKU-965	<i>Aptenia cordifolia</i> (L.f.) Schwantes	Warkhary	Aizoaceae	LS	Stomach disorder	62	0.25	45	0.73
HBKU-966	<i>Artemisia maritima</i> L.	Tarkha	Asteraceae	SM, LS	Digestive problem	77	0.31	39	0.50
HBKU-967	<i>Avena sativa</i> L.	Jawdar	Poaceae	WP	Improves digestion in animals	85	0.34	64	0.75
HBKU-968	<i>Brassica campestris</i> L.	Sharsham	Brassicaceae	SS	Kills worms in children	107	0.43	83	0.78
HBKU-969	<i>Calendula arvensis</i> L.	Ziar Gulay	Asteraceae	LS, FS	Muscle spasms, increases central nervous system activity and produce sweat	45	0.18	29	0.64
HBKU-970	<i>Calotropis procera</i> (Aiton) W.T.Aiton	Spulmai	Apocynaceae	LS	Skin itches and scabies	85	0.34	64	0.75
HBKU-971	<i>Cannabis sativa</i> L.	Bhang	Cannabaceae	SM, LS	Narcotic and control body pain	44	0.18	30	0.68
HBKU-972	<i>Capsicum annuum</i> L.	Marchaky	Solanaceae	FS	Kills worms in adult	42	0.17	29	0.69
HBKU-973	<i>Celtis australis</i> L.	Tagha	Cannabaceae	FS, BK	Lower body temperature	59	0.24	40	0.67
HBKU-974	<i>Chenopodium album</i> L.	Sarmay	Amaranthaceae	WP	Stomach problem in animals	65	0.26	33	0.50
HBKU-975	<i>Citrus limon</i> (L.) Burm.f.	Nembo	Rutaceae	LS, FS	Removing of kidney stone	78	0.31	39	0.50
HBKU-976	<i>Citrus sinensis</i> (L.) Osbeck.	Malta	Rutaceae	LS	Removing kidney stone	49	0.20	29	0.59
HBKU-977	<i>Convolvulus arvensis</i> L.	Perwaty	Convolvulaceae	WP	Milk production and digestive problems	115	0.46	92	0.80
HBKU-978	<i>Coriandrum sativum</i> L.	Dania	Apiaceae	LS, SS	Kidney and digestive problems	104	0.42	90	0.87

HBKU-979	<i>Cotoneaster microphyllus</i> Wall. ex Lindl.	Momanara	Roseaceae	RS	Stomach disorder and hepatitis	121	0.48	93	0.77
HBKU-980	<i>Cucumis sativus</i> L.	Badrang	Cucurbitaceae	FS	Loss weight in human	43	0.17	20	0.47
HBKU-981	<i>Cupressus sempervirens</i> L.	Sarwa	Cupressaceae	FS	Sight problem	42	0.17	19	0.45
HBKU-982	<i>Cynodon dactylon</i> (L.) Pers.	Kabal	Poaceae	WP	Kidney disorder in animals	89	0.36	72	0.81
HBKU-983	<i>Datura stramonium</i> L.	Datura	Solanaceae	LS, SS	Narcotic and pain control agent	86	0.34	45	0.52
HBKU-984	<i>Dodonaea viscosa</i> (Linn.) Jacq.	Ghwarasky	Spindaceae	LS	Kills worms in human	101	0.40	76	0.75
HBKU-985	<i>Duranta erecta</i> L.	Karindy	Verbenaceae	LS, BH	Cleaning of teeth	34	0.14	18	0.53
HBKU-986	<i>Dysphania ambrosioides</i> (L.) Mosyakin & Clemants	Skhaboty	Amaranthaceae	LS	Stomach disorder	41	0.16	19	0.46
HBKU-987	<i>Equisetum arvense</i> L.	Bandaky	Equisetaceae	WP	Kidney stone and urine problem	69	0.28	41	0.59
HBKU-988	<i>Eucalyptus camaldulensis</i> Dehnh.	Lachi	Myrtaceae	LS	Digestive disorder, appetizer and itching	87	0.35	63	0.72
HBKU-989	<i>Euphorbia helioscopia</i> L.	Mandaro	Euphorbiaceae	LX	Swelling and treat intestinal worms	79	0.32	57	0.72
HBKU-990	<i>Ficus carica</i> L.	Inzar	Moraceae	LX, BH	Kidney problem and diabetes	103	0.41	79	0.77
HBKU-991	<i>Ficus palmate</i> Forssk.	Inzar	Moraceae	LX, FS	Fungal infection and gastrointestinal problems	85	0.34	66	0.78
HBKU-992	<i>Fumaria parviflora</i> Lam.	Shatara	Papaveraceae	SS, LS	Athlete foot and lower body temperature	77	0.31	59	0.76
HBKU-993	<i>Heracleum candicans</i> Wall. ex DC.	Skhwara	Apiaceae	RS	Heat production in animals	84	0.34	65	0.77
HBKU-994	<i>Juglans regia</i> L.	Ghuz	Juglandaceae	BK, LS	Cleaning of teeth	83	0.33	70	0.84
HBKU-995	<i>Lipidium didymium</i> L.	Sakhabotay	Brassicaceae	WP	Pimple and itching in animals.	64	0.26	49	0.76
HBKU-996	<i>Luffa aegyptiaca</i> Mill.	Toory	Cucurbitaceae	FS	Lower diabetes	37	0.15	19	0.51
HBKU-997	<i>Lycopersicum esculentum</i>	Tamater	Solonaceae	FS	Blood problems	71	0.28	42	0.59

	L.								
HBKU-998	<i>Malva neglecta</i> Wallr.	Panderak	Malvaceae	WP	Removing of kidney stone	89	0.36	67	0.75
HBKU-999	<i>Matricaria discoidea</i> DC.	Babona	Asteraceae	WP	Control burning effect in the liver	44	0.18	23	0.52
HBKU-1000	<i>Melia azedarach</i> L.	Toorashand ai	Meliaceae	BK	Digestive problems, stomach disorder and astringent	92	0.37	70	0.76
HBKU-1001	<i>Mentha arvensis</i> L.	Podina	Lamiaceae	LS, ST	Digestive problems and vomiting	99	0.40	81	0.82
HBKU-1002	<i>Mentha longifolia</i> L.	Enaly	Lamiaceae	LS	Digestive problems and vomiting	102	0.41	85	0.83
HBKU-1003	<i>Mentha spicata</i> L.	Podina	Lamiaceae	LS	Digestive problems and antispasmodic	85	0.34	68	0.80
HBKU-1004	<i>Mirabilis jalapa</i> L.	Gulabasi	Nyctaginaceae	LS	Externalwounds	42	0.17	21	0.50
HBKU-1005	<i>Myrtus communis</i> L.	Manrho	Myrtaceae	LS	Stomach disorder	76	0.30	54	0.71
HBKU-1006	<i>Nasturtium officinale</i> W.T. Aiton.	Tarmera	Brassicaceae	LS	Stomach disorder and burning effect	44	0.18	22	0.50
HBKU-1007	<i>Ocimum basilicum</i> L.	Kashmalay	Lamiaceae	LS	Externalwounds	64	0.26	46	0.72
HBKU-1008	<i>Olea ferruginea</i> Royle.	Khona	Oleaceae	LS, FS	Kidney problems and sore throat	99	0.40	80	0.81
HBKU-1009	<i>Oxalis corniculata</i> L.	Trewaky	Oxilidaceae	WP	Improvement of digestion	63	0.25	32	0.51
HBKU-1010	<i>Papaver somniferum</i> L.	Koknar	Papaveraceae	SS, CL	Narcotic and pain control agent	59	0.24	40	0.68
HBKU-1011	<i>Pinus roxburghii</i> Sarg.	Nakhtar	Pinaceae	GM	Skin and eye issues	61	0.24	32	0.52
HBKU-1012	<i>Plantago lanceolata</i> L.	Ghawajabai	Plantaginaceae	LS	Constipation, dysentery and coughing	35	0.14	18	0.51
HBKU-1013	<i>Plantago major</i> L.	Ghwajabai	Plantaginaceae	LS, LS	Gastric problems	39	0.16	17	0.43
HBKU-1014	<i>Prunus dulcis</i> (Mill.) D.A Webb	Badam	Rosaceae	SS	Headaches and skin conditions.	37	0.15	21	0.57
HBKU-1015	<i>Punica granatum</i> L.	Anagoray	Punicaceae	FS, LS, SM,	Diabetes, skin issues and male fertility	43	0.17	20	0.46
HBKU-1016	<i>Opuntia dillenii</i> (Ker Gaw) Haw.	Zuqam	Cactaceae	SM	Inflammation and diabetes	55	0.22	24	0.43
HBKU-1017	<i>Ricinus communis</i> L.	Randa	Euphorbiaceae	SS, LS	Skin disorders and promoting lactation	67	0.27	37	0.55
HBKU-1018	<i>Rosa moschata</i> Herrm.	Zangligulab	Rosaceae	FR	Fertility of women	56	0.22	39	0.70
HBKU-1019	<i>Rumex dentatus</i> L.	Shalkhay	Polygonaceae	WP	Stomach problems	80	0.32	43	0.53
HBKU-1020	<i>Rumex hastatus</i> D. Don.	Taruky	Polygonaceae	WP	Stomach problems	78	0.31	42	0.54

HBKU-1021	<i>Salix denticulate</i> Andersson.	Wala	Salicaceae	BK	Internal body infection and cough	56	0.22	35	0.62
HBKU-1022	<i>Salvia moorcroftiana</i> Wall. ex Benth.	Khardug	Lamaiaceae	LS, RS	Externalwounds	49	0.20	32	0.65
HBKU-1023	<i>Silene conoidea</i> L.	Mangoty	Caryophyllaceae	WP	Treat skin issues like pimples	82	0.33	60	0.73
HBKU-1024	<i>Sisymbrium irio</i> L.	Genger	Brassicaceae	SS	Cool Internal temperature of the human body	84	0.34	48	0.57
HBKU-1025	<i>Solanum nigrum</i> L.	Kach Machu	Solanaceae	FS	Kidney problem and pain	98	0.39	76	0.78
HBKU-1026	<i>Stellaria media</i> (L.) Vill.	Chaghanak	Caryophyllaceae	SM, Ls	Ringworm.	56	0.22	40	0.71
HBKU-1027	<i>Tamarix aphylla</i> (L.) Karst.	Ghaz	Tamaricaceae	BK, LS	Fertility of women	79	0.32	63	0.79
HBKU-1028	<i>Taraxacum officinale</i> F.H. Wigg.	Shodapae	Lamaceae	LS	Kidney problem and fever	45	0.18	22	0.49
HBKU-1029	<i>Teucrium stocksianum</i> Boiss.	Yakandaaz	Lamiaceae	WP	Stomach disorder	60	0.24	30	0.50
HBKU-1030	<i>Trifolium repens</i> L.	Shawtal	Papilionaceae	WP	Coughs and fevers	39	0.16	27	0.69
HBKU-1031	<i>Triticum aestivum</i> L.	Ghanum	Poaceae	GS	Improve rate of fertility	87	0.35	61	0.70
HBKU-1032	<i>Verbena officinalis</i> L.	Shomaky	Verbenaceae	LS	Control fever and spots in animals	43	0.17	28	0.65
HBKU-1033	<i>Vitex negundo</i> L.	Marwandai	Lamiaceae	SS, LS	Digestive problems	64	0.26	44	0.69
HBKU-1034	<i>Vitis vinifera</i> L.	Kwar	Vitaceae	LS, FS	Externalwounds	53	0.21	34	0.64
HBKU-1035	<i>Withania somnifera</i> (L.) Dunal.	Kotilal	Solanaceae	FS	Fertility of women	79	0.32	49	0.62
HBKU-1036	<i>Ziziphus oxyphylla</i> Edgew.	Elani	Rhamnaceae	RS	Hepatitis, liver diseases and inflammation	67	0.27	43	0.64

Note:

RS ~~~~ Roots, FS ~~~~Fruits, LS ~~~~Leaves SS ~~~~ Seeds, GS ~~~~ Grains, WP ~~~~ WP, BK ~~~~ Bark, SM ~~~~ Stem,
Gm ~~~~Gums, CS ~~~~ Cloves, FR ~~~~ Flower, CL ~~~~ Capsule, ST ~~~~ Shoot, LX ~~~~ Latex, BH ~~~~ Branches.
FC ~~~~ Frequency of citation, RFC ~~~~ Relative frequency of citation, UR ~~~~ Use reports,
UV ~~~~ Use value.

Use Value (UV)

The Use-value (UV) is used to express the comparative significance of each plant species based on the documented uses from the local informants of research area. In the current study the maximum use value of *Coriandrum sativum* L. (0.87) while the minimum use value of *Plantago major*, *Opuntia dillenii* (0.43) was recorded. Others values between maximum and minimum were also shown in the Table 1.

Relative frequency of citation

It showed the ethnomedicinal value of plant species which is based on their popularity among the local peoples of the study area. The maximum RFC value was recorded for *Cotoneaster microphyllus* which was 0.48 while minimum was recorded for *Duranta erecta* and *Plantago Lanceolata* which was 0.14. Values for Others weeds species was among them (Table 1).

The area is deficient with sufficient veterinary services, so conventionally various plants are used as veterinary medicines such as fresh roots of *Heracleum candicansis* given to goat, cow, and sheep as sexual tonic and to improve the speed of fertility. The leaves decoction of *Eucalyptus camaldulensis* is given to cattle against digestive disorder and as appetizer. *Triticum aestivum* L is given to animals to improve rate of fertility. *Salix denticulata* bark is given to all type of cattle to treat internal body infection and cough. Leaves of *Chenopodium album* is used for stomachic for animals (Shah *et al.*, 2025d).

The study area is under a strong biotic pressure like erosion, fuel wood collection, deforestation and overgrazing. The loss of valuable plant in the area is increase by degradation of habitat. Due to inappropriate management by local communities of medicinal plant of medicinal plant reduce the possibility of survival of important plants; therefore the area requires proper conservation and management of these important plants especially the medicinal plants.

CONCLUSION

Ethnobotany plays an important role in living world. Without plants, life is impossible which is directly or indirectly depended on plants. My research work revealed that the research area has a lot of medicinal plants but the knowledge about medicinal plants is limited to elderly persons and traditional healers of the studied area. The local people which are unaware of the significance of these plant species due to which many species like *Heracleum candicans* Wall, *Ajuga bracteosa*, *Ricinis communis*, *Mentha longifolia*, *Aptenia cordifolia*, *Plantago lanceolata*, *Papaver somniferum*, *Cannabis sativa*, *Pinus roxburgii*, *Plantago major*, *Melia azedrach*, *Puntia dillenii* and *Acacia modesta* are being endangered. For this purposes to avoid further loss of rare, endangered and endemic species, their conservation is necessary. So, it is necessary to restore and document the remains of old medicinal knowledge and to protect this knowledge for next generations.

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