

## **Ethno Botanical Perspective of Medicinal Plants in Mulkhow Valley District Upper Chitral, Pakistan**

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**Abstract:** This paper demonstrates the ethnobotanical perspectives of medicinal plant in Mulkhow valley, district Chitral. The main aim of this research work was to gather information to document the medicinal uses of plants in Mulkhow valley. The results of ethnobotanical perspective contain quantitative information of medicinal plants used by indigenous people in Mulkhow valley. The current study conducted between 2015 - 2016 collected tradition knowledge about the medicinal plant diversity of the valley. In regard to the study, plant materials were collected, information was gathered, and herbarium materials were prepared. Semi structured interviews; questionnaires and personal observation were done for the collection of information. The analysis of result was done by using quantitative indices like fidelity level (FL), use value (UV) and Relative frequency Citation (RFC). A total of 41 species of medicinal plants belonging to 26 families and 38 genera with 25 Angiosperms species and 1 Gymnosperms were identified in the valley. The most common mode of utilization of medicinal plants was observed to be oral for curing purposes. The information gathered mostly come from the old age people but among the young generation the traditional knowledge about the plant diversity seems to be lost.

**Key words:** Medicinal Plants • Relative Frequency of Citation (RFC) • Fidelity Level (FL) • Used Value (UV) • Used Reports (UR) • Chitral • Pakistan

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### **INTRODUCTION**

Throughout the natural passage of daily life, the plants traditional knowledge has always been transferred from one generation to the next generation [1]. This knowledge is therefore assembled via ethnobotany, which is particularly important for the establishment and conservation of the indigenous plant usages [2]. The term ethnobotany including all the facets of relationship of plants and human being or in other way interaction of plants and its ecosystem to the human sciences, which cover the study of fibers, foods, dyes, tan, taboos and

other aspects of plant beneficial and harmful role [3]. In regards to the various ailments treatments plants serve as the most important and high impact source of traditional medicines [4]. To report and record the native utilization of plant resources is the ultimate purpose of ethnobotanical study. Among the world's population a total of 75% dependents on the plant-based drugs for its health care [5]. Medicinal plant usage was reported from millions of populations with minimal access to the basic modern system of treatment to increasingly urban citizens by both the inhabitants of developed and developing countries [6]. Nature being the immense remedial source

of various health problems, as since 1981 about 71% modern drugs have been introduced which were derived from plant sources [7]. Therefore, the plants played significant role in the management and curing of various human ailments and health issues [8]. As an alternative to conventional medicine, the folk remedies are practiced in practice widely. The study of Adeniyi *et al.* [9] showed that almost 80% of world human population in the less developed countries depend upon local folk remedies. While having 9 rich ecological zones Pakistan has the unique biodiversity in the world. The uniqueness in climate, Pakistan has rich medicinal plant diversity spread over a wide range of area with almost bestowed with 5521 plant species including up to 550 medicinally vital plants [10].

In this study, by the cooperation and coordination of local knowledgeable inhabitants, it has been easing to provide relevant knowledge about the local medicinal plants. Therefore the main aim of this recent work is to gather knowledge from local inhabitants regarding the usage of plants in the Valley "Mulchow" district upper Chitral. Besides these the local importance including plant names local usage, use value etc. were also evaluated.

## MATERIALS AND METHODS

**Study Area:** Chitral is the northern district of the Khyber Pakhtunkhwa province of Pakistan. Chitral is situated between 71°12' and 73° 53' East longitude and between 35°13' and 36° 55' North latitude. Chitral shares boundary with Afghanistan in West which extends to North by Wakhan stripe isolating Chitral from Tajikistan [10], Gilgit Baltistan lies in the North East, Ghizur district in South East, District Swat and Dir are enjoined by Lawari Mountains.

**Ethno Botanical Data Collection:** Different localities were visited to collect ethno botanical information from research area in different seasons during 2015 - 2016. Plant samples along with seeds, fruits, flowers and leaves were collected. All the collected samples were dried in shade and then preserved for further studies. Plant specimens were identified using Flora of Pakistan [11], comparing with herbarium specimens and the botanical names were confirmed from The Plant List [12, 13]. The specimen was given voucher number and was then submitted to the Herbarium of University of Peshawar. Total of 80 peoples with different educational rank and age groups from the study area were interviewed. Ethno botanical information's were obtained through semi-structured and

open interviews. The local names of the species were converted into botanical names after consulting with plant diagnosing expert. Polat *et al.* [14] method was followed for the development of questionnaires that was based different aspect of ethno botanical knowledge and information i.e. local names, part use, therapeutic uses, mode of utilization, ethno botanical uses, demographic information of the local peoples like gender, educational status and age. Scientific information such as scientific name, family names, habit and habitat.

**Indices of Ethnobotany:** Indices like FC, RFC, UR, UV and FL were used to assess the ethno-botanical information of medicinal plants.

**Relative frequency Citation (RFC):** Relative Frequency of Citation (RFC) formulas analyze the local importance of every medicinal plant. In RFC the FC indicates No of informants divided by N indicates no of informants [15].

**Use Value:** The formula for UV is  $UV = \sum U_i / N$ , where  $U_i$  indicates the use number given by the informants [16].

**Fidelity Level (FL):** The formula for FL is  $FL (\%) = (N_p / N) \times 100$  where  $N_p$  indicates the no of informants that claim the multiple uses of plants whereas N is no of plants to treat any given ailment [17, 18].

## RESULTS AND DISCUSSIONS

**Demographic Characteristics of the Informants:** The demographic data about the informants are assessed and documented during the discussions and meetings in field. A total of 80 participants including 60 male and 20 female informants were interviewed via semi-structured and open interviewed. Dominant informants that have plenty of knowledge regarding medicinal plants their age varies from 40 to 50. During different field visits it have been observed that most people of the area are not interested in giving knowledge about herbal remedies as they believed that by revealing the recipes the medicines would lose its potency. Also, some people share knowledge on payment as they believed that this precious knowledge transferred from their ancestors to them. In this study it has also been observed that most informants were males as in upper Chitral females were restricted to interact with strangers as well as to go to market places, or any cultural gathering which resulted in less participation of female informants in this study. On the basis of education, illiterate folks are much aware

Table 1: Botanical names, Local names. Habit, Utilization, FC, RF, UR, UV and FL of the species.

S.NO	Family	Botanical Name	Local Name	Habit	Part Used	Therapeutic uses	Utilization	FC N= 80	RFC	UR	UV	FL (%)
1	Anacardiaceae	<i>Pistacia integrimma</i> J.L. Stewart ex Brandis	Binju	T	Gall/ Fruit		Oral	12	0.15	5	0.07	15
2	Asteraceae	<i>Artemisia brevifolia</i> Wall. Ex. D.C	Dron	H	Leaves	Stomach problem and face patches	Oral, external	10	0.13	4	0.05	12.5
		<i>Artemisia parvifolia</i> Roxb ex. D. Don	Kharkhalich	H	Seeds	Abdominal pain, blood pressure	Oral	8	0.1	3	0.04	10
		<i>Chichorium intybus</i> L.	Khasti	H	Roots, flowers	Constipation, fever, typhoid, digestion	Oral	16	0.2	8	0.1	20
		<i>Matricaria chamomila</i> L.	Shirisht	H	Inflorescence	Gastrointestinal disorders, stomachache, gas trouble	Oral	20	0.25	4	0.05	25
		<i>Taraxicum officinale</i> Weber ex F.H.Wigger	Phowo	H	Rhizome, stem	Urinary flow, for kidney problem	Oral	14	0.18	4	0.05	17.5
3	Apiaceae	<i>Ferula narthex</i> Royle	Rau	H	Whole plant	Cough, asthma, toothache, gastric problems	Oral	8	0.1	5	0.07	10
		<i>Foeniculum vulgare</i> Mill.	Bodiong	H	Fruit, leaves, branches	Abdominal pain, stomach burning.	Oral	12	0.15	5	0.07	15
4	Berberidaceae	<i>Berberis lycium</i> Royle.	Chovenj	T	Fruits, roots	Fever,	Oral	14	0.18	6	0.08	17.5
5	Brassicaceae	<i>Capsella bursa-pestoris</i> L.	Jalajali	H	Whole plant	Diuretic	Oral	6	0.08	3	0.04	
		<i>Lepidium sativum</i> L.	Wahjosh	H	Leaves	Abdomen pain	Oral	10	0.13	3	0.04	12.5
		<i>Sisymbrium irio</i> L.	Khelikheli	H	Seeds	Abdominal pain,	Oral	12	0.15	5	0.07	15
6	Capparadaceae	<i>Capparis spinosa</i> L.	Kaveer	H	Flowers, seeds	Abdominal pain, face pack, joint diseases, malaria, stomach ache, typhoid	Oral	15	0.19	6	0.08	18.7
7	Chenopodiaceae	<i>Chenopodium album</i> L.	Darkunakh	H	Leaves, stem	Blood purifier, diarrhea, jaundice, laxative, stomach pain	Oral	9	0.12	6	0.08	11.25
8	Eleagnaceae	<i>Eleagnus angustifolia</i> L.	Shinjoor	T	Fruits, latex	Sore throat, fever, hair tonic	Oral	20	0.25	5	0.07	25
		<i>Hyppophae rhamnoides</i> L.	Mirghinz	S	Whole plants	Eye infection, abdominal pain, fever, hemorrhage, promote nerve repair	Oral	16	0.20	5	0.07	20
9	Ephedraceae	<i>Ephedra Gerardiana</i> Wallich ex C.A.Meyer	Tsumani	S	Fruit	Dried skin, lip cracking, mouth diseases, stomach problem, sunburn, tuberculosis wound healing	Oral	6	0.08	8	0.1	7.5
10	Fabaceae	<i>Rubinia pseudo-acacia</i> L.	Akasi	T	Leaves	animals for stomach swelling	Oral	9	0.12	2	0.03	11.2
		<i>Sophora mollis</i> (Royle.) Bake	Besho	S	Whole plant	To cure pimples, sunburns, swellings, wounds	External	14	0.18	4	0.05	17.5
11	Juglandaceae	<i>Juglans regia</i> L.	Birmogh	T	Bark, root, stem, leaves	Toothache, lips cracks	Oral	20	0.28	5	0.07	27.5
12	Lamiaceae	<i>Mentha longifolia</i> L.	Bane	H	Whole plant	Allergy, blood purification, carminative, diarrhea, dysentery, jaundice vomiting.	Oral	18	0.23	7	0.09	22.5
		<i>Nepeta cataria</i> L.	Mutrich	H	Whole plant	Back ache, injury, inflammation, swelling, sunburn	Oral	14	0.18	5	0.07	17.5
		<i>Origanum vulgare</i> L.	Ishpane	H	Whole plant	Toothache, patches on face,	Oral	10	0.13	4	0.05	12.5
12	Malvaceae	<i>Althea rosea</i> L.	Lain	H	Whole plant	Blood purifier,	Oral	5	0.07	2	0.03	6.25
14	Moraceae	<i>Morus alba</i> L.	Bedana	T	Fruits, leaves	laxative, purgative,	Oral	24	0.3	4	0.05	30
15	Oleaceae	<i>Fraxinus xanthoxyloides</i> (G. DON) Wall. Ex DC	Toor	T	Bark, stem	high fever, reduce astringency,	Oral	7	0.09	3	0.04	8.75
16	Plantagenaceae	<i>Plantago major</i> L.	Brono achar	H	Leaves, seeds	Skin discoloration, dysentery	Oral	18	0.23	4	0.05	22.5
17	Polygonaceae	<i>Rumex hastatus</i> D.Don	Sirkonzo	H	Leaves	Appetizer, purgative, astringent, diuretic	Oral	13	0.17	4	0.05	16.2
18	Rosaceae	<i>Cotoneaster nummularia</i> Fish. & Mey.	Mikeen	T	Fruits	Asthma, blood purifier, cardio tonic, cough, hemorrhage,	Oral/skin	12	0.15	6	0.08	15
		<i>Craetagus songorica</i> K. Koch	Goni	T	Fruits	Cardio tonic,	Oral	10	0.13	3	0.04	12.5
		<i>Prunus armeniaca</i> L.	Zholli	T	Fruits, seeds	Refrigerant, laxative	Oral	22	0.28	4	0.05	27.5
		<i>Prunus amygdalus</i> Dulcis	Badaam	T	Fruits	Stimulant to improve memory,	Oral	18	0.23	5	0.07	22.5
		<i>Prunus domestica</i> L.	Girvalogh	T	Fruits	Refrigerant and laxative	Oral	20	0.25	4	0.05	25
		<i>Rosa webbiana</i> Wall	Throni	S	Whole plant	treat asthma, blood purifier	Oral	12	0.15	3	0.04	15

Table 1: Continued

S.NO	Family	Botanical Name	Local Name	Habit	Part Used	Therapeutic uses	Utilization	FC N= 80	RFC	UR	UV	FL (%)
19	<i>Punicaceae</i>	<i>Punica granatum</i> L.	Dhalum	T	Fruits, pericarp	Diarrhea and dysentery, internal wounds, cooling agent, blood purifier	Oral	24	0.3	5	0.07	30
20	<i>Rubiaceae</i>	<i>Galium aparine</i> L.	Mattar	H	Whole plant	Aperients, diuretic	Oral	6	0.08	2	0.03	7.5
21	<i>Schrophulariaceae</i>	<i>Verbescum Thapsus</i> Medik	Gordogh karo	H	Leaves	Wound healing.	external	8	0.1	4	0.05	10
22	<i>Simaroubaceae</i>	<i>Ailanthus altissima</i> Swingle	Bakayeni	T	Bark, seeds	Anthelmintic, curing dysentery, diarrhea.	Oral	10	0.13	3	0.04	12.5
23	<i>Solanaceae</i>	<i>Solanum nigrum</i> L.	Pirmilik	H	Fruits, whole plant	Skin pimples, freckle, sun block	external	12	0.15	3	0.04	15
24	<i>Urticaceae</i>	<i>Urtica dioica</i> Linn.	Drozono	H	Whole plant	Astringent, anthelmintic.	Oral	4	0.05	2	0.03	5
25	<i>Vitaceae</i>	<i>Vitis venifera</i> L.	Droch	T	Fruits		Oral	20	0.25	3	0.04	25
26	<i>Voilaceae</i>	<i>Voila canescens</i> Wall. ex Roxb.	Melkhon	H	fruit	Fever, headache, constipation.	Oral	8	0.1	4	0.05	10

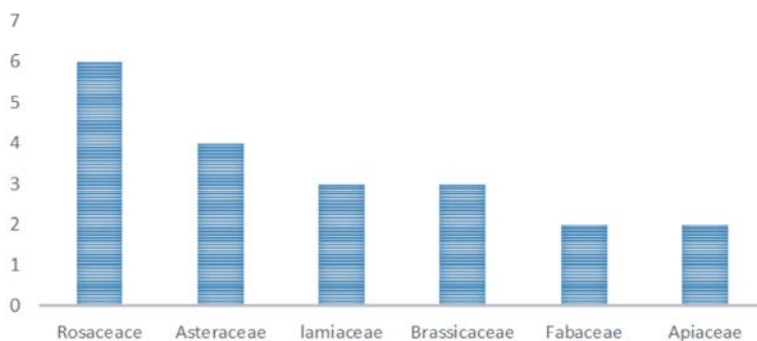


Fig. 1: Most represented families

regarding the local uses of plant as compare to compared to literate people; this decline is due to least interest of educated people on medicinal plants [19, 20].

All the informants were of “khow” origin which is a name typically used for the inhabitants of upper Chitral and majority of the male informants were the local small farmers, unemployed people and housewives, the education level of the informants ranged from illiterate to primary, middle and secondary school education (Table 1).

**Medicinal Plant Diversity in Study Area:** Documented data from field visits includes 41 species from 26 families and 38 genera with 25 Angiosperms species and 1 Gymnosperms (Table 1), with their botanicals, common names and relevant information regarding the informants. In present study the (Fig. 1) showed the dominant family with highest citation is *Rosaceae* (6 species), followed by *Asteraceae* (5 species). The viable distribution of family *Rosaceae* in study area is because of edible fruits which can be easily accessible to the people of this region and also this family contains high concentration of secondary metabolites and more prevalence of its species in study

area [21, 22]. Same results of dominance of this family in other regions of Chitral have been studied by Khan *et al.* [23].

**Life Forms:** During this research it was observed that most of the plants that are used as medicine were herbs (23 species), followed by trees (14 species) and shrubs with (4 species) as shown in (Fig. 2). Herbs are dominant life form of plants that are used by the local people of that area because they are easily available and distributed everywhere. Save reason was also given by the local people during field visits. Aside from this herb also contains active phytochemicals in them so they can be easily used for herbal preparations [24, 25]. Same results are also recorded from similar studies on folk remedies practiced in different areas of Pakistan [25-27].

**Plant Parts Used:** For the preparation of herbal medicines different parts of plants were used as in (Fig. 3). In percent study the most important parts of the plant were fruit (13), leaves (10), whole plants (12), and stem and root with (4) and (3) respectively. While sometimes the local people also used the bark and inflorescence of some of the

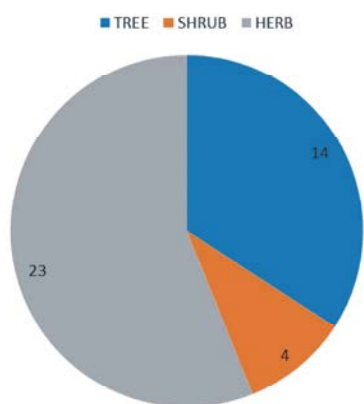


Fig. 2: Plant Habits

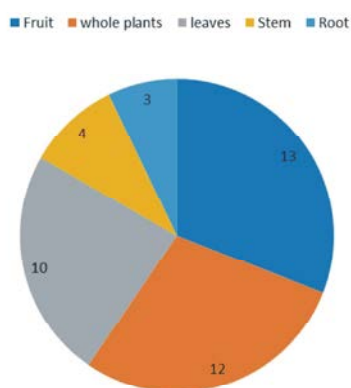


Fig. 3: Parts of the plants used

plants for the remedies of the diseases. Flowers are used most frequently to make herbal preparation because it contains plenty of phytochemicals, active constituents and antioxidants which strengthens the immune system. Fruits are also used commonly because use of this part did not affect the population of the plant species [28, 29]. This study is similar to previously reported medicinal plants of different areas of Pakistan [30, 31]. Besides fruits, leaves are second dominant part of plant which is used by the inhabitant of the area to make medicines because of the presence of highly bioactive compounds in them. This study is similar with the previously published work of Polat and Satıl and Menković *et al.* [32, 33].

### Quantitative Ethnobotanical Analysis

**Use Categories and Use Reports of the Area:** In present study different disease ailments are treated with the help of different plant species. The highest number of use reports is shown by *Chichorium intybus* and *Ephedra gerardiana* (8 reports) which means that this species is commonly used in the study area by the local people. With the help of use reports the important medicinal

plants have been identified from the region. In this study UV ranges from 0.03 to 0.1 (Table 1). It has been observed that species having more uses reported by the people usually have high use value and plants with low use reports have low use value. Highest use value was found for *Chichorium intybus* (0.1). Highest use value indicates that the plant species are more likely biologically active [34, 35]. Thus, having high Use value of plant species indicates the potential for healing for specific disease.

**Fidelity Level:** Values of fidelity level were mentioned in Table 1 values vary from 6.25 - 30%. The leading fidelity level percentage was observed under *Punica granatum* L., and *Morus alba* L. with (30), followed by *Prunus armeniaca* L., and *Juglans regia* L. with (27.5) and *Vitis venifera* L., *Eleagnus angustifolia* L., and *Matricaria chamomila* L., showed 25% of fidelity level. Maximum FL value indicates the choice of informants for treating the particular disease [36-38]. Apart from this, plants with low fidelity level should not be ignored as declining of knowledge is the reason of their low fidelity percentage [39, 40].

**Relative Frequency of Citation:** The result table 1 showed that the family with species has the relative frequency with leading includes; *Prunus armeniaca*, *Juglans regia* L (0.28) each, *Matricaria chamomila* L., *Eleagnus angustifolia* L. *Prunus domestica* L. *Vitis venifera* L., (0.25) each, *Prunus amygdalus* Dulcis., *Mentha longifolia* L. *Plantago major* L. (0.23) each, *Hyppophae rhamnoides* L. (0.20), *Capparis spinosa* L. (0.19), *Taraxicum officinale* Weber ex F.H.Wigger, *Berberis lycium* Royle., *Sophura mollis* (Royle.) Bake (0.18) each, *Rumex hastatus* D.Don. (0.17), *Pistacia integrimma* J. L. Stewart ex Brandis, *Foeniculum vulgare* Mill. *Sisybrium irio* L., *Cotoneaster nummularia* Fish. & Mey., *Rosa webbiana* Wall., *Solanum nigrum* L. (0.15) each. The relative importance of the taxon known by the local inhabitant is the use value of the taxon. The high RFC values shows that these plant species are well known among the maximum number of informants and these are commonly used as medicine [20]. For the future discovery of drugs these highly cited medicinal plants will be further evaluated phytochemically. [41] Previously such studies were performed by [42-46].

**Local Plant Names Review:** While collecting data it was noted that all the plant names were found to be derived from the local Chitrali “Khow” language. Some believed

that some of the names derived from Persian but all the inhabitants of the valley considered all these names in Khowar. Though all the local names plant names were same but very few plants are known by same and different names such as *Matricaria chamomila* L. (shirisht, anu shirisht), *Capsella bursa-pestoris* L. (Jalajali, gujur joshu), *Lepidium sativum* L. (wahjoshu, josh), *Eleagnus angustifolia* L. (shinjoor, sinjoor), *Plantago major* L. (Brono achar, Ispaghol).

### CONCLUSION

The present ethnobotanical study is first ever attempt to compile the rich ethnobotanical flora from Tehsil Mulkhaw District Upper Chitral, that will contribute in protecting world traditional heritage as well as collecting valuable knowledge to generate a local record and improve those previously existing, also contributed in writing pharmacopeia, which is still transferred verbally. The result of this study demonstrated essentially that cultivators and the local people have vital and significant learning as showed by the assortment of species used to treat a few disorders, which can be a valuable hotspot for social event and pharmacological data in the region and compare how societies and civilizations may affect the entire basin's herbal knowledge; this can serve science in numerous fields: medicine, pharmacy and chemistry and biology. Finally, there is a requirement for further research into the viability and wellbeing of conventional prescriptions particularly with respect to home grown medication in the event that it is to be sufficiently incorporated into western drug.

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### REFERENCES

1. Kaval, I., L. Behçet and U. Cakilcioglu, 2014. Ethnobotanical study on medicinal plants in Geçitli and its surrounding (Hakkari-Turkey). *Journal of Ethnopharmacology*, 155: 171-184.
2. Muthu, C., M. Ayyanar, N. Raja and S. Ignacimuthu, 2006. Medicinal plants used by traditional healers in Kancheepuram District of Tamil Nadu, India. *Journal of Ethnobiology and Ethnomedicine*, 2: 43-70.

3. Hazrat, A., M. Nisar, J. Shah and S. Ahmad, 2011. Ethnobotanical study of some elite plants belonging to Dir, Kohistan valley, Khyber Pukhtunkhwa, Pakistan. *Pak J. Bot.*, 43: 787-795.
4. Shuaib, M., S. Ahmed, K. Ali, M. Ilyas, F. Hussain, Z. Urooj, S.S. Shah, T. Kumar, M. Shah and I. Khan, 2018. Ethnobotanical and ecological assessment of plant resources at District Dir, Tehsil Timergara, Khyber Pakhtunkhwa, Pakistan. *Acta Ecologica Sinica*, 11(1): 22-42.
5. Ali, K., Z. Haq and A. Salam, 2016. Ethnobotanical assessment of the medicinal flora of Khyber agency, Pakistan. *Pakistan Journal of Weed Science Research*, 22(4).
6. Brandão, M.G.L., F.A. Acúrcio, R.L.M. Montemor and L.D.P. Marliçre, 2006. Complementary/alternative medicine in Latin America: use of herbal remedies among a Brazilian metropolitan area population. *Journal of Complementary and Integrative Medicine*, 3: 20-41.
7. Newman, D.J. and G.M. Cragg, 2012. Natural products as sources of new drugs over the 30 years from 1981 to 2010. *Journal of Natural Products*, 75(3): 311-335.
8. Thirumalai, T., E. Kelumalai, B. Senthilkumar and E. David, 2009. Ethnobotanical study of medicinal plants used by the local people in Vellore District, Tamilnadu, India. *Ethnobotanical Leaflets* 20-29: 10-20.
9. Adeniyi, A., A. Asase, P.K. Ekpe, B.K. Asitoakor, A. Adu-Gyamfi and P.Y. Awekor, 2018. Ethnobotanical study of medicinal plants from Ghana; confirmation of ethnobotanical uses, and review of biological and toxicological studies on medicinal plants used in Apra Hills Sacred Grove. *Journal of Herbal Medicine*, 2(1): 21-25.
10. Rehman, K., B. Ali and S. Ali, 2015. An ethno botanical perspective of traditional medicinal plants from the Khattak tribe of Chonthra Karak, Pakistan. *Journal of Ethnopharmacology*, 165: 251-259.
11. Ali, S. and E. Nasir, 1970. *Flora of Pakistan*, 2: 01-215.
12. Birku, L., W. Birhanu, G. Bassazin and M. Sewalem, 2019. Applications and Protocols of Recombinant DNA Technology in Medical Science *World Journal of Medical Sciences*, 16(4): 175-183, 2019 ISSN 1817-3055.
13. Najeeb, T.M., A. Elnaeim and T.O. Khider, 2020. Thin Layer Chromatography and Quantification of Total Contents of Phenol, Flavonoid, Tannin, Carbohydrates and Amino Acids of *Heliotropium bacciferum* Forssk Leaves and Stem Extracts *Academic Journal of Plant Sciences*, 13(1): 08-14, 2020 ISSN 1995-8986.

14. Polat, R. and U. Çakılcıoğlu, 2018. Ethnobotanical study on medicinal plants in Bingöl (City center) (Turkey). *Journal of Herbal Medicine*, 11(1): 12-20.
15. Tardío, J. and M.J.E.B. Pardo-de-Santayana, 2008. Cultural importance indices: a comparative analysis based on the useful wild plants of Southern Cantabria (Northern Spain), 62(1): 24-39.
16. Bano, A., M. Ahmad, T.B. Hadda, A. Saboor, S. Sultana, M. Zafar, M.P.Z. Arshad and M.A. Ashraf, 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: 43-50.
17. Friedman, J., Z. Yaniv, A. Dafni and D. Palewitch, 1986. A preliminary classification of the healing potential of medicinal plants, based on a rational analysis of an ethnopharmacological field survey among Bedouins in the Negev Desert, Israel. *Journal of Ethnopharmacology*, 16: 275-287.
18. Alexiades, M.N. and J.W. Sheldon, 1996. Selected guidelines for ethnobotanical research: a Field Manual, 21: 21-31.
19. Kayani, S., I. Ahmed and A. Rashid, 2015. Ethnobotany of medicinal plants among the communities of Alpine and Sub-alpine regions of Pakistan. *Journal of Ethnopharmacology*, 164: 186-202.
20. Legesse, T. and J. Tasisa, 2019. Preliminary Study on Heritability, Genetic Advances and Correlation of Tomato (*Solanum lycopersicum* L.) Germplasms Traits in Bench Maji, Southwest Ethiopia *Academic Journal of Plant Sciences*, 12(3): 73-78, 2019 ISSN 1995-8986.
21. Ali, H. and M. Qaiser, 2009. The ethnobotany of Chitral valley, Pakistan with particular reference to medicinal plants. *Pak. J. Bot.*, 41: 2020-2041.
22. Gottlieb, L., 1982. Conservation and duplication of isozymes in plants. *Science*, 216(4544): 373-380.
23. Ibrar, M., F. Hussain and A. Sultan, 2007. Ethnobotanical studies on plant resources of Ranyal hills, District Shangla, Pakistan. *Pakistan Journal of Botany*, 39(2): 329.
24. Ahmad, M., S. Sultana, F. Hadi, S.B. Hadda, T. Rashid, S.M. Khan, M.P.Z. Khan and G. Yaseen, 2014. An Ethnobotanical study of Medicinal Plants in high mountainous region of Chail valley (District Swat-Pakistan). *Journal of Ethnobiology and Ethnomedicine*, 10(1): 36-40.
25. Abbasi, A.M., A.M. Khan, M.H. Shah, M.M. Pervez and M. Ahmad, 2013. Ethnobotanical appraisal and cultural values of medicinally important wild edible vegetables of Lesser Himalayas-Pakistan. *Journal of Ethnobiology and Ethnomedicine*, 9(1): 60-66.
26. Khan, N., M. Ahmed, A. Ahmed, S. Shaukat, M. Wahab, M. Ajaib, M.F. Siddiqui and M. Nasir, 2011. Important medicinal plants of chitral gol National park (cgnp) Pakistan. *Pak. J. Bot.*, 43: 797-809.
27. Jarić, S., Z. Popović, M. Mačukanović-Jocić, L. Djurdjević, M. Mijatović, B. Karadžić, M. Mitrović and P. Pavlović, 2007. An ethnobotanical study on the usage of wild medicinal herbs from Kopaonik Mountain (Central Serbia). *Journal of Ethnopharmacology*, 111: 160-175.
28. Olowokudejo, J., A. Kadiri and V. Travih, 2008. An ethnobotanical survey of herbal markets and medicinal plants in Lagos State of Nigeria. *Ethnobotanical Leaflets*, (1): 116.
29. Shinwari, M.I. and M.A. Khan, 2000. Folk use of medicinal herbs of Margalla hills national park, Islamabad. *Journal of Ethnopharmacology*, 69: 45-56.
30. Ayyanar. M. and S. Ignacimuthu, 2009. Herbal medicines for wound healing among tribal people in Southern India: Ethnobotanical and Scientific evidences. *International Journal of Applied Research in Natural Products*, 2: 29-42.
31. Bahmani, M., Abdullah and Z. Ahmed, 2014. Ethnobotanical study of medicinal plants used in the management of diabetes mellitus in the Urmia, Northwest Iran. *Asian Pacific Journal of Tropical Medicine*, 7(1): 348-354.
32. Azaizeh. H., S. Fulder, K. Khalil and O. Said, 2003. Ethnobotanical knowledge of local Arab practitioners in the Middle Eastern region. *Fitoterapia*, 74: 98-108.
33. Aziz, M.A., M. Adnan, A.H. Khan, A.A. Shahat, M.S. Al-Said and R. Ullah, 2018. Traditional uses of medicinal plants practiced by the indigenous communities at Mohmand Agency, FATA, Pakistan. *Journal of Ethnobiology and Ethnomedicine*, 14: 2-12.
34. Umair, M., M. Altaf and A.M. Abbasi, 2017. An ethnobotanical survey of indigenous medicinal plants in Hafizabad district, Punjab-Pakistan. *PloS one*, 12: 17-22.
35. Polat, R. and F. Satıl, 2012. An ethnobotanical survey of medicinal plants in Edremit Gulf (Balıkesir-Turkey). *Journal of Ethnopharmacology*, 13(9): 626-641.

36. Menković, N., K. Šavikin, S. Tasić, G. Zdunić, D. Stešević, S. Milosavljević and D. Vincek, 2011. Ethnobotanical study on traditional uses of wild medicinal plants in Prokletije Mountains (Montenegro). *Journal of Ethnopharmacology*, 133: 97-107.
37. Heinrich, M., A. Ankli, B. Frei, B.C. Weimann and O. Sticher, 1998. Medicinal plants in Mexico: Healers' consensus and cultural importance. *Social Science & Medicine*, 47: 1859-1871.
38. Rokaya, M.B., Z. Münzbergová and B. Timsina, 2010. Ethnobotanical study of medicinal plants from the Humla district of western Nepal. *Journal of Ethnopharmacology*, 1(2): 485-504.
39. Islam, M.K., S. Saha, I. Mahmud, K. Mohamad, K. Awang, S.J. Uddin, M.M. Rahman and J.A. Shilpi, 2014. An ethnobotanical study of medicinal plants used by tribal and native people of Madhupur forest area, Bangladesh. *Journal of Ethnopharmacology*, 151: 921-930.
40. Vitalini, S., M. Iriti, C. Puricelli, D. Ciuchi, A. Segale and G. Fico, 2013. Traditional knowledge on medicinal and food plants used in Val San Giacomo (Sondrio, Italy)—An alpine ethnobotanical study. *Journal of Ethnopharmacology*, 14: 517-529.
41. Qureshi, R., Abdullah and R. Ali, 2009. Medico-ethnobotanical inventory of tehsil Chakwal, Pakistan. *Pak. J. Bot.*, 41(2): 529-538.
42. Hussain, K., S.A. hahazad and S. Zia-ul-Hussnain, 2008. An ethnobotanical survey of important wild medicinal plants of Hattar district Haripur, Pakistan. *Ethnobotanical Leaflets*, 5: 90-99.
43. Zheng, X.L. and F.W. Xing, 2009. Ethnobotanical study on medicinal plants around Mt. Yinggeling, Hainan Island, China. *Journal of Ethnopharmacology*, 124: 197-210.
44. Vitalini, S., C. Gardana, P. Simonetti, G. Fico and M. Iriti, 2013. Melatonin, melatonin isomers and stilbenes in Italian traditional grape products and their antiradical capacity. *Journal of Pineal Research*, 54: 322-333.
45. Idrees, F., A. Rehman and M.U. Manzoor, 2019. Breeding and Genetics, University of Agriculture Faisalabad, Pakistan. 13 Progress in Farming and Cultivation of Maize through Nitrogen Management *Academic Journal of Plant Sciences*, 12(1): 13-22, 2019 ISSN 1995-8986.
46. Shalaby, S.I.A., W.M. Ahmed and M.M. Zaabal, 2020. Some Biochemical and Immunogenetic Investigations on Buffaloes Suffering from Chronic Endometritis *Global Veterinaria*, 22(2): 56-62, 2020 ISSN 1992-6197.