Quantitative ethnobotanical assessment of plant resources of District Swabi Khyber Pakhtunkhwa, Pakistan

Maqsood Anwar and Naveed Akhtar

Correspondence

Maqsood Anwar[1, 2*] and Naveed Akhtar[1]

[1]Department of Botany, Islamia College Peshawar, Pakistan.
[2]Department of Botany, Government Post Graduate College Swabi, Pakistan.

*Corresponding Author: maqsoodanwarbot@yahoo.com

Ethnobotany Research and Applications 31:28 (2025) - http://dx.doi.org/10.32859/era.31.28.1-22
Manuscript received: 20/02/2025 – Revised manuscript received: 24/06/2025 - Published: 25/06/2025

Research

Abstract

Background: Plants are essential natural resources on our planet, providing food, shelter, fuel, and medicinal constituents for humans. The Indigenous knowledge surrounding these plants is of great scientific and cultural relevance.

Methods: This study was conducted in District Swabi from 2019 to 2020. Field visits and interviews were systematically arranged across the four seasons—spring, summer, autumn, and winter—at eight selected stands. A total of 45 respondents were interviewed, with the majority being elderly individuals aged 65 years and above. The interviews utilized a semi-structured questionnaire format, which included multiple questions addressing the ethnobotanical uses of plants. Relative frequency citation, use value, family use value, and direct matrix ranking were the various quantitative indices used for the assessment of the ethnobotanical data.

Results: In the study area, 177 species from 47 families were identified as ethnobotanically significant plants. The results of the quantitative ethnobotanical study indicated that the relative frequency citation (RFC) values varied from 0.04 to 0.82. The use value (UV) was observed to range between 0.04 and 1.73, and the family use value (FUV) exhibited a range of 0.04 to 1.73. Additionally, the direct matrix ranking (DMR) values for 14 trees were recorded to range between 8 and 33.

Conclusions: Residents of the research area rely on indigenous plants for their basic needs, such as fuel wood and fodder. However, the local flora is under threat as a result of overgrazing and improper harvesting. Effective conservation measures such as controlled grazing, reforestation, and rangeland management are required for long-term plant resource management.

Keywords: Ethnobotany, Assessment, Quantitative indices, Plant resources, Indigenous plants, Indigenous knowledge, Swabi.

Background

Plant resources have always played an important role in human civilization. Plant resources are essential components of both natural ecosystems and human societies, as they provide a variety of uses and benefits. These resources include not only the food we eat, but also building materials, medicine, clothing, and a variety of other uses. Understanding and managing plant resources is critical to maintaining ecological balance and human well-being. Plants have been used for a variety of purposes since the beginning of human civilization, including food production, illness treatment, cattle foraging, fuel wood, decoration, construction, and the collection of various timbered and non-timbered products (Muhammad *et al.* 2016). Ethnobotany has been a part of human life since the beginning of time and provides information about a region's biodiversity. Ethnobotany is the study of human-plant interactions and how they influence one another. Ethnobotanical studies play a vital role in improving the economic standing of remote areas (Barkatullah *et al.* 2009) and improving health care (Nair *et al.* 2005), and are most commonly used in various parts of the world (Sardar & Khan 2009).

Quantitative ethnobotany has emerged as a relatively new area of study, with its inception attributed to Prance and his associates in 1987 (Pepin 1999). This field is characterized by the utilization of quantitative techniques to analyze current data pertaining to the use of plants (Phillips & Gentry 1993). This discipline focuses on assessing the significance of plants and vegetation in human life. A quantitative ethnobotany survey employs quantitative methodologies to analyze existing data on plant utilization (Phillips *et al.* 1994). According to Balick and Cox (1996), over the last hundred years, ethnobotany has emerged as a scientific discipline that studies the relationship between humans and plants from various angles, encompassing fields such as botany, anthropology, public health, pharmacology, ecology, economics and public policy.

There has been a significant increase in interest in quantitative ethnobotany in the last two decades. Researchers have devised and applied quantitative methods to explore various hypotheses concerning the relationships between plants and humans (Reyes-García *et al.* 2006). As a result, pioneering researchers formulated quantitative indices designed to evaluate the cultural relevance and significance of plants (Ong & Kim 2014). These indices in quantitative ethnobotany are utilized to assess plant uses which encompass food sources, the economic worth of plant-based products, veterinary treatments, and remedies for human health problems (Pieroni 2001, Reyes-García *et al*. 2006, Upadhyay *et al.* 2011, Kim & Song 2013).

The objective of this research was to analyze the ethnobotanical knowledge associated with the plant life of District Swabi, Khyber Pakhtunkhwa, Pakistan. The results is expected to provide essential baseline data for future evaluation of plant resources.

Materials and Methods

Study area

District Swabi located between River Indus and River Kabul in the Khyber Pakhtunkhwa province of Pakistan. It is lies between 33°-55' and 34°-23' North latitude and 72°-13' and 72°-49' East longitude and occupies the south and south-west part of Peshawar Valley, with an average elevation ranging from 320 to 2250 meters. It is bounded on east by District Haripur, on north by District Buner, on south by District Attock and on west by District Mardan and Nowshera (Figure 1). The total area of the district is 1,543 Km^2, which can be divided into two distinct geographical regions; hilly area and plains. The hilly area mostly occupy the northern part, while the southern part consists of plains (Anwar *et al.* 2020a). Swabi experiences an extreme climate, characterized by cold winters and intensely hot summers. Temperature begin to rise sharply from May and gradually decline starting in October. June, July, and August are characterized by the highest temperature, which can reach as much as 40°C, in contrast to January, the coldest month, where temperature can decline to 2°C. The monsoon season (July-August) brings the highest rainfall, ranging from 110 to 137 mm, resulting in increase in humidity and temperature. Conversely, October and November are the driest months (Anwar *et al.* 2020b).

Plant collection and identification

The ethnobotanical survey was conducted in District Swabi in four consecutive seasons (spring, summer, autumn, winter) from 2019 to 2020 at eight selected stands. Field trips were made in each season for the collection of plants. The collected plants were dried in papers and mounted on Herbarium sheets. The "*Flora of Pakistan*" (Ali & Nasir 1989-1991, Nasir & Ali 1970-1989) was used to identify each of these plants. Tropicos-Project (www.tropicos.org/Project/Pakistan) the online *Flora of Pakistan*, The *Plant List* (http://www.theplantlist.org/), and *World Flora Online* (https://www.worldfloraonline.org) were then used to confirm the identification. The identified voucher specimen of each plant species was numbered and deposited in the Herbarium of the Department of Botany at Islamia College Peshawar for future references.

Ethnobotanical survey and data collection

Before the survey commenced, essential information about the study area was compiled. During the fieldwork, informants were interviewed in accordance with the methodologies established by Martin (1995). A total of 45 local informants, consisting of 35 males and 10 females, were engaged in the interviews. The selection of informants was accomplished through both random and specific methods. Prior to the interview, informed consent was obtained from each participant, and the aims of the study were clearly appraised. Informants were encouraged to describe the ethnobotanical uses of local plant species. Ethnobotanical information was gathered and recorded using semi-structured questionnaire format and group discussions. In most species, semi-structured questionnaires were employed, while group discussions took place in designated areas where community members assembled for social interactions.

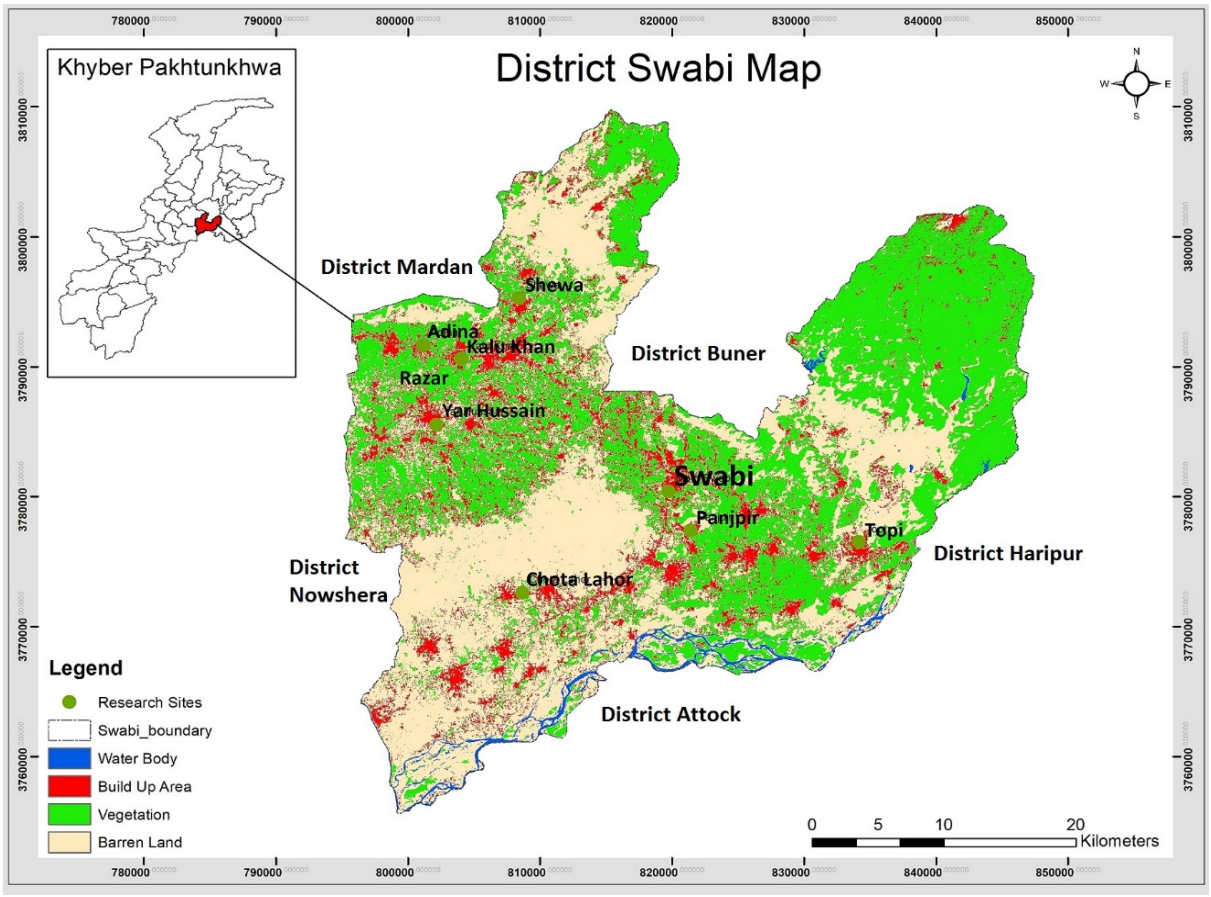

Figure 1. Map of study area showing sites visited during field interview.

Data storage and organization

The information gathered from informants was properly compiled and saved using Microsoft Excel. The informants were classified into six age groups: 26–35, 36–45, 46–55, 56–65, 66–75, and over 75 years. Their education levels were divided into six categories: illiterate, elementary, middle, secondary, higher secondary, and graduate. The occupations of both males and females were grouped into six key categories: housewives, farmers, laborers, shopkeepers, teachers, and hakims. The complete details of informants are shown in Table 1. Furthermore, the ethnobotanical applications were divided into twelve major categories, including medicinal, fuel, fodder, thatching/sheltering, timber, furniture, edible fruit, vegetable, hedge/fencing, ornamental, honey bee, and other uses. Plant parts were also divided into different components, such as whole plant, shoot, branches, stem, root, leaves, bark, flower, fruit, seeds, gum, and latex.

Data analysis

Statistical validation, comparative analysis, and hypothesis testing all depend on the conversion of qualitative data into quantitative data (Hoffman & Gallaher 2008). Various standard metrics exist for the analysis and interpretation of ethnobotanical data. The following quantitative indices were employed to evaluate the collected data.

Table 1. Demographic profile of informants interviewed.

Variables	Categories	Total	Percentage (%)
Gender	Male	35	77.8
	Female	10	22.2
Age groups	26–35 Years	6	13.3
	36–45 Years	7	15.5
	46–55 Years	10	22.2
	56–65 Years	13	28.9
	66–75 Years	6	13.3
	Over 75 Years	3	6.8
Education level	Illiterate	12	26.7
	Elementary	5	11.2
	Middle	8	17.7
	Secondary	10	22.3
	Higher secondary	6	13.3
	Graduate	4	8.8
Occupations	Housewives	10	22.2
	Farmers	17	37.8
	Labors	5	11.2
	Shopkeepers	7	15.5
	Teachers	4	8.8
	Hakims	2	4.5

Relative Frequency Citation (RFC)

The ethnobotanical data collected underwent a quantitative evaluation through the Relative Frequency Citation (RFC) index. This index serves to indicate the local importance of each species and is calculated by dividing the frequency citation (FC), which denotes the number of informants who acknowledged the plant's use, by the total number of informants surveyed (N), without considering the various categories of use (Kayani *et al*. 2014). The RFC was determined using the formula of Barkatullah *et al*. (2018), expressed as;

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

The RFC value can vary from zero, signifying that no informants recognized the plant as beneficial, to one, indicating that all informants acknowledged the plant's usefulness (Sadeghi & Mahmood, 2014, Barkatullah *et al*. 2015).

The Use Value (UV)

The use value signifies the importance of plants that are recognized within local contexts, as highlighted by Ong and Kim (2014). This value is calculated using the formula suggested by Kayani *et al*. (2014), which is expressed as follows;

$$UV = \sum Ui/N$$

In this formula, "Ui" indicates the frequency with which each informant refers to a particular species, whereas "N" represents the overall number of informants participating in the study.

Family Use Value (FUV)

The Family Use Value (FUV) is an index employed to determine the use value associated with a particular family. According to the formula established by Phillips and Gentry (1993), it is expressed as follows;

$$FUV = \sum UV/N$$

In this formula, "∑ UV" signifies the total use values accumulated from all species mentioned within a family, whereas "N" indicates the overall count of species referred to from that family.

Direct Matrix Ranking (DMR)

Direct matrix ranking (DMR) is a method that evaluates the diversity of uses for specific plant species, utilizing data gathered from informants (Martin 1995). A group of 15 key informants was chosen based on their extensive traditional knowledge of plants that hold ethnobotanical significance. These informants were instructed to assign use values to each species, with a scale ranging from 0 (not value) to 5 (best). The scores assigned to each plant were then aggregated to produce total scores, which were subsequently ranked.

Results

Ethnobotanical survey and data collection

The current ethnobotanical survey in the District Swabi documented 177 species of 141 genera and 47 families. Of these families, five were monocots (containing 39 species), and the other forty-two were dicots (containing 138 species). All plant species were arranged in family alphabetical order mentioning their botanical name, voucher number, habits, local name, place or locality, part used, ethnobotanical uses and quantitative ethnobotanical indices (Table 2). Of the 177 species documented, 149 (84.2%) are classified as herbs, with both shrubs and trees each representing 14 species (7.9%) (Figure 2). Within this collection, 141 species (79.6%) are utilized as fodder for livestock, followed by 51 species (28.8%) with medicinal applications, 37 species (20.9%) used for fuel, 28 species (15.8%) serving other purposes, 21 species (11.8%) for thatching or sheltering, 17 species (9.6%) as vegetables, 14 species (7.9%) for ornamental use, 10 species (5.6%) for hedging or fencing, 9 species (5.1%) for timber, 7 species (3.9%) for honey production, 5 species (2.8%) as edible fruits, and 4 species (2.3%) for furniture making (Figure 3). The most commonly used parts of these plants included the whole plants (103 species, 58.1%), followed by shoots (41 species, 23.2%), leaves (30 species, 16.9%), stems (18 species, 10.1%), fruits (17 species, 9.6%), branches (9 species, 5.1%), seeds (7 species, 3.9%), roots (5 species, 2.8%), gum and latex (2 species each, 1.2%), and bark (1 species, 0.6%) (Figure 4).

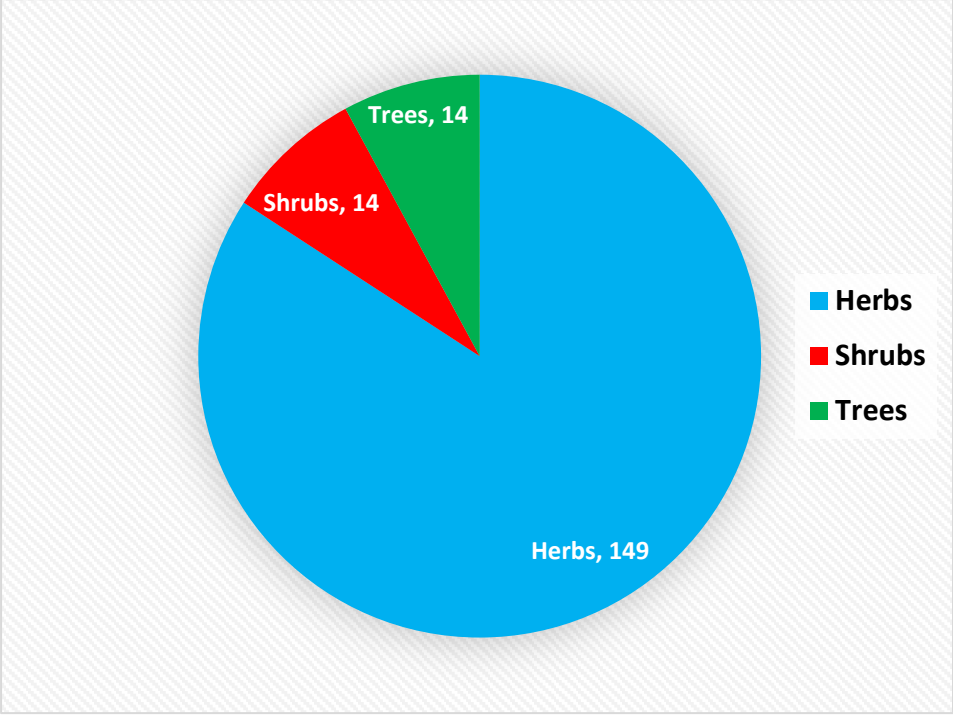

Figure 2. Habits of ethnobotanically important plants collected from District Swabi.

Data analysis

The data collected was subjected to various quantitative indices used in ethnobotany. The following quantitative indices were employed to evaluate the collected data.

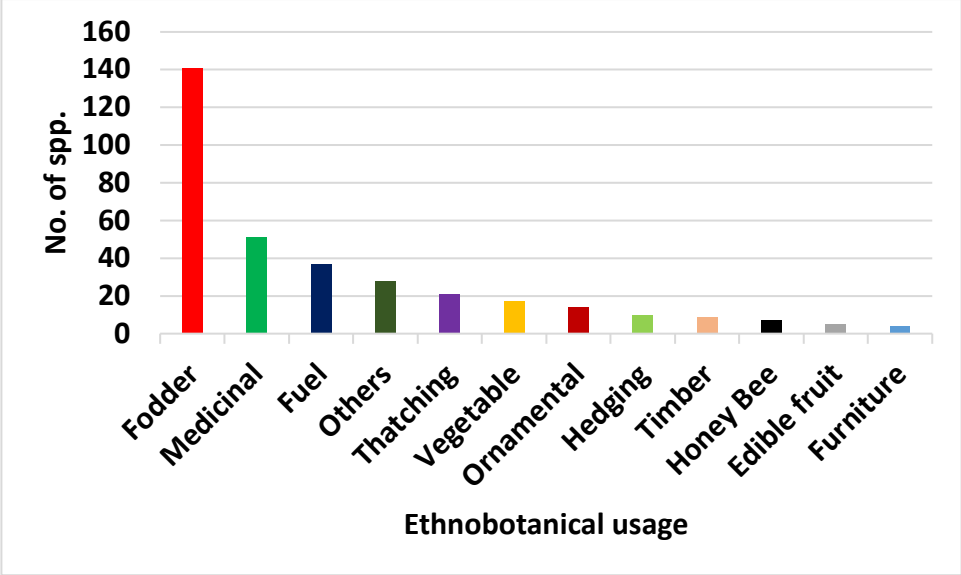

Figure 3. Ethnobotanical uses of the collected plants in study area.

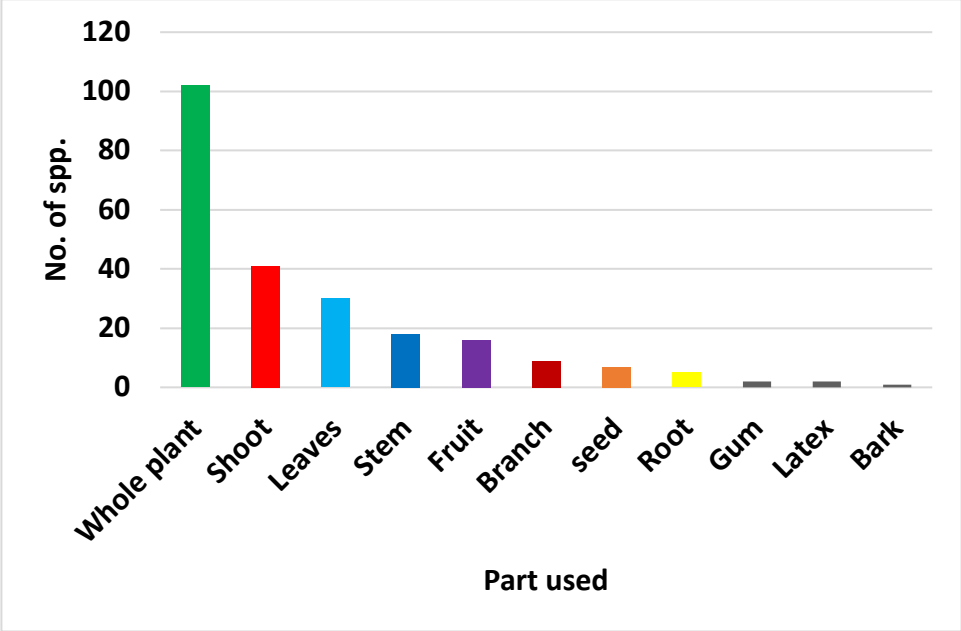

Figure 4. Part use of the ethnobotanically important plants.

Relative Frequency Citation (RFC)

The current study shows that the RFC values varied from 0.04 to 0.82, as depicted in Table 2. *Berberis lycium* obtained the top RFC value of 0.82, followed closely by *Melia azedarach* at 0.78 and *Coriandrum sativum* at 0.71. Other notable species with comparatively high RFC values included *Arachis hypogaea* (0.66), *Dalbergia sissoo* (0.62), and *Medicago polymorpha* (0.58), as well as *Foeniculum vulgare, Morus alba,* and *Morus nigra,* each at 0.55. The ten species with the lowest RFC value were all noted at 0.04.

Use Value (UV)

The present research reveals that the used value (UV) varied from 0.04 to 1.73, as illustrated in Table 2. The highest UV was observed for *Melia azedarach* at 1.73, closely followed by *Berberis lycium* at 1.29 and *Arachis hypogaea* at 1.22. Other notable plants with high UV values included *Coriandrum sativum* (1.15), *Morus nigra* (0.95), *Dalbergia sissoo* (0.93), *Medicago polymorpha* (0.86), *Foeniculum vulgare* (0.85), *Acacia modesta* (0.73), and *Cucurbita moschata* (0.71). The lowest UV value (0.04) were noted for ten species each.

Table 2. Quantitative ethnobotanical profile of plant resources of District Swabi, Pakistan.

Division/Families/Taxa Name/Voucher Number	Place/ Locality	Habit	Local name	Part used	Ethnobotanical uses	Quantitative ethnobotanical indices				
						FC	RFC	Ur	∑Ui	UV
DICOTYLEDONAE										
Acanthaceae										
Dicliptera bupleuroides Nees **M. Anwar 44 (ICP)**	Razar	Herb	Pyazi guly	Shoot	Fodder, Ornamental	5	0.11	2	6	0.13
D. paniculata (Forssk.) I.Darbysh. **M. Anwar 45 (ICP)**	Razar	Herb	Pyazi guly	Whole plant	Fodder, Ornamental	3	0.06	2	3	0.06
Aizoaceae										
Trianthema portulacastrum L. **M. Anwar 46 (ICP)**	Razar	Herb	Insat	Whole plant	Fodder	7	0.15	1	7	0.15
Amaranthaceae										
Achyranthes aspera L. **M. Anwar 47 (ICP)**	Razar	Herb	Jesha	Whole plant	Medicinal	4	0.08	1	4	0.08
Aerva javanica (Burm.f.) Juss. ex Schult. **M. Anwar 48 (ICP)**	Razar	Herb	Spin booty	Shoot	Medicinal, Fodder	5	0.11	2	6	0.13
A. sanguinolenta (L.) Blume **M. Anwar 49 (ICP)**	Razar	Herb	Spin booty	Shoot	Fodder	3	0.06	2	3	0.06
Alternanthera philoxeroides (Mart.) Griseb. **M. Anwar 50 (ICP)**	Swabi	Herb	Obo booty	Shoot	Fodder	2	0.04	1	2	0.04
A. pungens Kunth **M. Anwar 51 (ICP)**	Razar	Herb	Khor booty	Whole plant	Fodder	4	0.08	1	4	0.08
Amaranthus graecizans Cutanda **M. Anwar 53 (ICP)**	Razar	Herb	Khor chalveri	Whole plant	Fodder	3	0.06	3	3	0.06
A. tenuifolius Wall. **M. Anwar 54 (ICP)**	Razar	Herb	Nare chalveri	Whole plant	Fodder	3	0.06	3	3	0.06
A. viridis L. **M. Anwar 55 (ICP)**	Razar	Herb	Chalveri	Whole plant	Medicinal, Fodder, Vegetable	8	0.17	3	12	0.26
Digera muricata (L.) Mart. **M. Anwar 56 (ICP)**	Razar	Herb	Saag	Shoot, Leaves	Fodder, Vegetable	9	0.2	2	10	0.22
Apiaceae										
Coriandrum sativum L. **M. Anwar 57 (ICP)**	Razar	Herb	Dhanya	Leaves, Fruit	Medicinal, Fodder, Vegetable	32	0.71	4	52	1.15
Eryngium coeruleum M. Bieb. **M. Anwar 58 (ICP)**	Razar	Herb	Odi booty	Whole plant	Fuel	4	0.08	1	4	0.08
Foeniculum vulgare Mill. **M. Anwar 59 (ICP)**	Razar	Herb	Kago	Shoot, Fruit	Medicinal, Fodder	25	0.55	3	38	0.85

Asclepiadaceae										
Calotropis procera subsp. hamiltonii (Wight) **M. Anwar 62 (ICP)**	Razar	Shrub	Spalmay	Leaves, Latex	Medicinal	7	0.15	1	9	0.2
Asteraceae										
Aster subulatus (Michx.) Hort. ex Michx. **M. Anwar 63 (ICP)**	Razar	Herb	Kashni	Shoot	Fodder	2	0.04	1	2	0.04
Bidens pilosa L. **M. Anwar 64 (ICP)**	Razar	Herb	Spin guly	Shoot	Fodder	2	0.04	1	2	0.04
Calendula arvensis L. **M. Anwar 65 (ICP)**	Razar	Herb	Zyar guly	Whole plant	Fodder, Ornamental	7	0.15	2	8	0.17
Carthamus oxyacantha M.Bieb. **M. Anwar 66 (ICP)**	Razar	Herb	Zyarha kariza	Whole plant	Fuel	15	0.33	1	15	0.33
Cichorium intybus L. **M. Anwar 70 (ICP)**	Razar	Herb	Kashni	Whole plant	Fodder	4	0.08	1	4	0.08
Cirsium arvense (L.) Scop. **M. Anwar 71 (ICP)**	Razar	Herb	Tora kariza	Whole plant	Fuel	4	0.08	1	4	0.08
Cyanthillium cinereum (L.) H.Rob. **M. Anwar 72 (ICP)**	Razar	Herb	Prewata	Shoot	Fodder	2	0.04	1	2	0.04
Echinops echinatus Roxb. **M. Anwar 73 (ICP)**	Razar	Herb	Ghana kariza	Whole plant	Fodder	5	0.11	1	5	0.11
Erigeron canadensis L. **M. Anwar 74 (ICP)**	Razar	Herb	Nari joka	Whole plant	Fodder, Fuel	5	0.11	2	5	0.11
E. sumatrensis Retz. **M. Anwar 75 (ICP)**	Razar	Herb	Ghata joka	Whole plant	Fodder, Fuel	5	0.11	2	6	0.13
Lactuca dissecta D.Don **M. Anwar 78 (ICP)**	Swabi	Herb	Shoda pay	Whole plant	Fodder	4	0.08	1	4	0.08
Launaea nudicaulis (L.) Hook.f. **M. Anwar 79 (ICP)**	Razar	Herb	Shoda pay	Whole plant	Fodder	4	0.08	1	4	0.08
L. procumbens (Roxb.) Ramayya & Rajagopal **M. Anwar 80 (ICP)**	Razar/Swabi	Herb	Shoda pay	Whole plant	Fodder	4	0.08	1	4	0.08
Pulicaria vulgaris Gaertn. **M. Anwar 82 (ICP)**	Razar	Herb	Zyar guly	Whole plant	Fodder	2	0.04	1	2	0.04
Silybum marianum (L.) Gaertn. **M. Anwar 83 (ICP)**	Razar	Herb	Dhanga kariza	Whole plant	Medicinal, Fodder, Fuel, Hedging/Fencing	19	0.42	4	25	0.55
Sonchus arvensis L. **M. Anwar 84 (ICP)**	Swabi	Herb	Zyar guly	Whole plant	Fodder	4	0.08	1	4	0.08
S. asper (L.) Hill **M. Anwar 85 (ICP)**	Razar	Herb	Shoda pay	Shoot	Fodder	3	0.06	1	3	0.06
S. oleraceus (L.) L. **M. Anwar 86 (ICP)**	Razar	Herb	Shoda pay	Shoot	Fodder	3	0.06	1	3	0.06

Tagetes erecta L. **M. Anwar 87 (ICP)**	Razar	Herb	Gul sakbar	Whole plant	Ornamental	12	0.26	1	12	0.26
Berberidaceae										
Berberis lycium Royle **M. Anwar 90 (ICP)**	Razar	Shrub	Zyar larga	Whole plant	Medicinal, Hedging/Fencing	35	0.82	2	58	1.29
Boraginaceae										
Cynoglossum lanceolatum Forssk. **M. Anwar 93 (ICP)**	Razar/Topi	Herb	Khor booty	Shoot	Fodder	2	0.04	1	2	0.04
Nonea echioides (L.) Roem. & Schult. **M. Anwar 96 (ICP)**	Razar	Herb	Spin gule	Whole plant	Fodder	2	0.04	1	2	0.04
N. edgeworthii A. DC. **M. Anwar 97 (ICP)**	Razar	Herb	Spin gule	Shoot	Fodder	3	0.06	1	3	0.06
Trichodesma indicum (L.) Lehm. **M. Anwar 98 (ICP)**	Razar	Herb	Gowa jabbai	Whole plant	Medicinal, Fodder	4	0.08	2	6	0.13
Brassicaceae										
Brassica rapa subsp. campestris (L.) Clapham **M. Anwar 99 (ICP)**	Razar	Herb	Sharsham	Shoot, Fruit, Seed	Fodder, Vegetable, Ornamental, Honey bee, Others	23	0.51	5	29	0.64
Cardaria draba (L.) Desv. **M. Anwar 101 (ICP)**	Razar	Herb	Spin guly	Shoot	Fodder	3	0.06	1	3	0.06
Coronopus didymus (L.) Sm. **M. Anwar 102 (ICP)**	Razar	Herb	Sakha booty	Shoot	Fodder	5	0.11	1	5	0.11
Eruca sativa Mill. **M. Anwar 103 (ICP)**	Swabi	Herb	Jawawa	Leaves, Seed	Medicinal, Fodder, Vegetable	14	0.31	3	19	0.42
Malcolmia africana (L.) W.T. Aiton var. Africana **M. Anwar 106 (ICP)**	Razar	Herb	Pyazi guly	Shoot	Fodder	4	0.08	1	4	0.08
Nasturtium officinale W.T. Aiton **M. Anwar 107 (ICP)**	Razar/Swabi	Herb	Taramira	Whole plant	Fodder, Vegetable	5	0.11	2	6	0.13
Sisymbrium irio L. **M. Anwar 110 (ICP)**	Razar	Herb	Khoobe kalan	Whole plant	Fodder	5	0.11	1	5	0.11
Cactaceae										
Opuntia dillenii (Ker Gawl.) Haw. **M. Anwar 111 (ICP)**	Razar	Shrub	Zaqom	Whole plant	Medicinal, Hedging/Fencing	8	0.17	2	12	0.26
Cannabaceae										
Cannabis sativa L. **M. Anwar 113 (ICP)**	Razar	Herb	Bhang	Whole plant	Medicinal, Fuel	14	0.31	2	17	0.37
Caryophyllaceae										
Cerastium dichotomum L. **M. Anwar 115 (ICP)**	Razar	Herb	Khakhay	Whole plant	Fodder	12	0.26	1	12	0.26

Silene conoidea L. **M. Anwar 116 (ICP)**	Razar	Herb	Mangooti	Whole plant	Fodder	13	0.29	1	13	0.29
Spergula arvensis L. **M. Anwar 117 (ICP)**	Razar	Herb	Jangali dhania	Whole plant	Fodder	6	0.13	1	6	0.13
Stellaria Media (L.) Vill. **M. Anwar 118 (ICP)**	Razar	Herb	Olalai	Whole plant	Fodder	12	0.26	1	12	0.26
Chenopodiaceae										
Chenopodium album L. **M. Anwar 119 (ICP)**	Razar	Herb	Larmi sarmi	Whole plant	Medicinal, Fodder, Vegetable	12	0.26	3	14	0.31
C. murale L. **M. Anwar 122 (ICP)**	Razar	Herb	Larmi sarmi	Whole plant	Medicinal, Fodder, Vegetable	15	0.33	3	18	0.4
C. strictum Roth **M. Anwar 123 (ICP)**	Razar/Topi	Herb	Larmi sarmi	Shoot	Fodder	7	0.15	1	7	0.15
Cleomaceae										
Cleome viscosa L. **M. Anwar 125 (ICP)**	Razar/Topi	Herb	Hulhul	Whole plant	Fodder	5	0.11	1	5	0.11
Convolvulaceae										
Convolvulus arvensis L. **M. Anwar 126 (ICP)**	Razar	Herb	Prewatay	Whole plant	Medicinal, Fodder	5	0.11	2	6	0.13
Ipomoea cornea ssp. fistulosa (Mart. ex Choisy) D. Austin **M. Anwar 127 (ICP)**	Razar/Topi	Shrub	Pyazi guly	Whole plant	Fuel, Ornamental, Hedging/Fencing, Honey bee	5	0.11	4	7	0.15
I. pes-tigridis L. **M. Anwar 128 (ICP)**	Razar	Herb	Khwara	Shoot	Fodder	2	0.04	1	2	0.04
Cucurbitaceae										
Cucurbita moschata Duchesne **M. Anwar 130 (ICP)**	Razar	Herb	Kadu/Kadoo	Leaves, Fruit	Medicinal, Fodder, Vegetable, Others	22	0.49	4	32	0.71
Euphorbiaceae										
Euphorbia helioscopia L. **M. Anwar 135 (ICP)**	Razar	Herb	Peryandolay	Root, Latex	Medicinal	3	0.06	2	3	0.06
Ricinus communis L. **M. Anwar 138 (ICP)**	Razar	Shrub	Aranda	Branch, Leaves	Medicinal, Fuel, Others	4	0.08	3	6	0.13
Fabaceae										
Acacia farnesiana (L.) Willd. **M. Anwar 157 (ICP)**	Razar	Shrub	Warhoki kikar	Whole plant	Medicinal, Fodder, Hedging/Fencing	5	0.11	3	8	0.17
A. modesta Wall. **M. Anwar 158 (ICP)**	Razar	Tree	Palosa	Gum, Leaves, Stem, Branch	Medicinal, Fodder, Fuel, Honey bee, Hedging/Fencing, Others	24	0.53	6	33	0.73

A. nilotica (L.) Willd. ex Delile **M. Anwar 159 (ICP)**	Razar	Tree	Ghat kikar	Gum, Leaves, Stem, Branch	Medicinal, Fodder, Fuel, Timber, Thatching, Ornamental	17	0.37	6	27	0.6
Albizia lebbeck (L.) Benth. **M. Anwar 160 (ICP)**	Razar	Tree	Sreikh	Leaves, Stem	Fodder, Fuel, Timber, Thatching, Others	11	0.25	5	16	0.35
Alysicarpus ovalifolius (Schumach.) J. Léonard **M. Anwar 178 (ICP)**	Razar	Herb	Alyce	Whole plant	Fodder	5	0.11	1	5	0.11
Arachis hypogaea L. **M. Anwar 179 (ICP)**	Lahor	Herb	Mung pali	Fruit, Seed	Medicinal, Fuel, Others	30	0.66	3	55	1.22
Cajanus cajan (L.) Huth **M. Anwar 180 (ICP)**	Razar	Shrub	Arhar	Leaves, Stem	Medicinal, Fuel, Others	5	0.11	3	5	0.11
Dalbergia sissoo Roxb. Ex DC. **M. Anwar 182 (ICP)**	Razar	Tree	Shawa	Root, Stem, Leaves	Medicinal, Fodder, Fuel, Timber, Thatching, Furniture, Others	28	0.62	7	42	0.93
Lathyrus aphaca L. **M. Anwar 185 (ICP)**	Razar/Swabi	Herb	Zangali mattar	Whole plant	Fodder, Vegetable, Ornamental	5	0.11	3	7	0.15
Leucaena leucocephala (Lam.) de Wit **M. Anwar 161 (ICP)**	Razar	Tree	Jumbay	Stem, Leaves, Fruits	Medicinal, Fodder, Fuel, Thatching, Honey bee	5	0.11	5	8	0.17
Medicago lupulina L. **M. Anwar 186 (ICP)**	Razar	Herb	Nari shapeshti	Whole plant	Fodder	15	0.33	1	15	0.33
M. minima (L.) L. **M. Anwar 187 (ICP)**	Razar/Swabi	Herb	Nari shapeshti	Whole plant	Fodder	12	0.26	1	12	0.26
M. polymorpha L. **M. Anwar 188 (ICP)**	Razar	Herb	Shapeshti	Whole plant	Fodder, Vegetable	26	0.58	2	39	0.86
M. sativa L. **M. Anwar 189 (ICP)**	Razar	Herb	Ghat shapeshti	Shoot	Fodder	15	0.33	1	15	0.33
Melilotus indica (L.) All. **M. Anwar 190 (ICP)**	Razar	Herb	Lewanay	Whole plant	Fodder	11	0.24	1	11	0.24
Rhynchosia minima (L.) DC. **M. Anwar 192 (ICP)**	Razar	Herb	Khor booty	Whole plant	Fodder	5	0.11	1	5	0.11
Sesbania concolor J.B. Gillett **M. Anwar 193 (ICP)**	Razar	Shrub	Genjer	Stem, Leaves, Seed	Fodder, Fuel, Others	5	0.11	3	7	0.15
S. sesban (L.) Merr. Var. *sesban* **M. Anwar 194 (ICP)**	Razar	Tree	Ghat genjer	Stem, Leaves, Seed	Fodder, Fuel, Others	16	0.35	3	18	0.4
Trifolium repens L. **M. Anwar 195 (ICP)**	Razar	Herb	Shaotal	Shoot	Fodder	15	0.33	1	15	0.33
T. resupinatum L. **M. Anwar 196 (ICP)**	Razar	Herb	Shaotal	Shoot	Fodder	15	0.33	1	15	0.33
Trigonella monantha C.A. Mey. **M. Anwar 197 (ICP)**	Razar/Swabi	Herb	Zangali malkhuza	Whole plant	Fodder	8	0.17	1	8	0.17

Vicia hirsuta (L.) Gray **M. Anwar 198 (ICP)**	Razar	Herb	Narai chilo	Whole plant	Fodder	7	0.15	1	7	0.15
V. monantha Desf. **M. Anwar 199 (ICP)**	Razar	Herb	Chilo	Whole plant	Fodder	6	0.13	1	6	0.13
V. peregrina L. **M. Anwar 200 (ICP)**	Razar	Herb	Chilo	Whole plant	Fodder	12	0.26	1	12	0.26
V. sativa L. **M. Anwar 201 (ICP)**	Razar	Herb	Ghata chilo	Whole plant	Fodder	15	0.33	1	15	0.33
Fumariaceae										
Fumaria indica Pugsley **M. Anwar 139 (ICP)**	Razar	Herb	Paprha	Whole plant	Medicinal, Fodder	5	0.11	2	6	0.13
Geraniaceae										
Geranium rotundifolium L. **M. Anwar 141 (ICP)**	Razar	Herb	Panerak booty	Whole plant	Fodder	3	0.06	1	3	0.06
Lamiaceae										
Ajuga bracteosa Wall. ex Benth. **M. Anwar 143 (ICP)**	Razar	Herb	Khwaga booty	Leaves	Medicinal	5	0.11	1	5	0.11
Anisomeles indica (L.) Kuntze **M. Anwar 144 (ICP)**	Razar	Herb	Jangali podina	Whole plant	Medicinal	3	0.06	1	3	0.06
Mentha longifolia (L.) L. **M. Anwar 146 (ICP)**	Razar	Herb	Velanay	Whole plant	Medicinal	15	0.33	1	15	0.33
Micromeria biflora (Buch.-Ham. ex D. Don) Benth. **M. Anwar 147 (ICP)**	Razar	Herb	Nari shamakay	Leaves	Medicinal	5	0.11	1	5	0.11
Salvia plebeia R. Br. **M. Anwar 148 (ICP)**	Razar	Herb	Plawan panrhien parwat	Leaves	Medicinal	4	0.08	1	4	0.08
Vitex negundo L. **M. Anwar 149 (ICP)**	Razar	Shrub	Marwandai	Branch, Leaves	Medicinal, Fuel, Honey bee	4	0.08	3	5	0.11
Malvaceae										
Malva neglecta Wallr. **M. Anwar 151 (ICP)**	Razar	Herb	Panirak	Shoot	Fodder, Vegetable	13	0.29	2	15	0.33
Malvastrum coromendelianum (Linn.) Garcke **M. Anwar 152 (ICP)**	Razar	Herb	Zyar guly	Shoot	Fodder	4	0.08	1	4	0.08
Meliaceae										
Melia azedarach L. **M. Anwar 156 (ICP)**	Razar	Tree	Bakyanra	Stem, Bark, Root, Leaves, Fruit	Medicinal, Fodder, Fuel, Timber, Thatching, Furniture, Others	35	0.78	7	78	1.73
Moraceae										
Broussonetia papyrifera (L.) L'Hér. ex Vent. **M. Anwar 163 (ICP)**	Razar	Tree	Gul toot	Stem, Branch	Fodder, Fuel, Thatching, Others	7	0.15	4	12	0.26

Ficus palmata Forssk. **M. Anwar 164 (ICP)**	Razar	Shrub	Warhoki inzar	Stem, Leaves, Fruit	Medicinal, Fodder, Fuel, Edible fruit	13	0.29	4	25	0.55
Morus alba L. **M. Anwar 165 (ICP)**	Razar	Tree	Spin toot	Stem, Branch, Leaves, Fruit	Medicinal, Fodder, Fuel, Timber, Thatching, Furniture, Edible fruit, Others	25	0.55	8	39	0.86
M. macroura Miq. **M. Anwar 166 (ICP)**	Razar	Tree	Sha toot	Stem, Branch, Leaves, Fruit	Medicinal, Fodder, Fuel, Timber, Thatching, Edible fruit, Others	17	0.37	7	21	0.46
M. nigra L. **M. Anwar 167 (ICP)**	Razar	Tree	Tor toot	Stem, Branch, Leaves, Fruit	Medicinal, Fodder, Fuel, Timber, Thatching, Furniture, Edible fruit, Others	25	0.55	8	43	0.95
Myrtaceae										
Callistemon citrinus (Curtis) Skeels **M. Anwar 168 (ICP)**	Razar	Tree	Brush guly	Whole plant	Fuel, Thatching, Ornamental, Others	9	0.2	4	12	0.26
Eucalyptus globulus Labill. **M. Anwar 169 (ICP)**	Razar	Tree	Laachi	Stem, Branch, Leaves	Medicinal, Fuel, Timber, Thatching, Others	17	0.37	5	21	0.46
Nyctaginaceae										
Boerhavia diffusa L. **M. Anwar 170 (ICP)**	Razar	Herb	Khor booty	Shoot	Fodder	5	0.11	1	5	0.11
B. procumbens Banks ex Roxb. **M. Anwar 171 (ICP)**	Razar	Herb	Khor booty	Shoot	Fodder	5	0.11	1	5	0.11
Mirabilis jalapa L. **M. Anwar 172 (ICP)**	Razar/Topi	Herb	Gul-e-Abbasi	Whole plant	Ornamental	5	0.11	1	5	0.11
Onagraceae										
Oenothera rosea L'Hér. ex Aiton **M. Anwar 173 (ICP)**	Razar	Herb	Pyazi guly	Whole plant	Fodder	2	0.04	1	2	0.04
Oxalidaceae										
Oxalis corniculata L. **M. Anwar 174 (ICP)**	Razar	Herb	Trewaki	Whole plant	Medicinal, Fodder	13	0.29	2	14	0.31
O. pes-caprae L. **M. Anwar 175 (ICP)**	Razar/Swabi	Herb	Ghat trewaki	Whole plant	Fodder	3	0.06	1	3	0.06
Plantaginaceae										
Nanorrhinum ramosissimum (Wall.) Betsche **M. Anwar 205 (ICP)**	Razar	Herb	Lingatay	Whole plant	Fodder, Fuel	9	0.2	2	11	0.24
Veronica persica Poir. **M. Anwar 207 (ICP)**	Razar	Herb	Shna lingatay	Whole plant	Fodder	5	0.11	1	5	0.11
Polygonaceae										
Emex spinosa (L.) Campd.	Razar	Herb	Markunday	Whole plant	Fodder, Fuel	5	0.11	2	6	0.13

M. Anwar 209 (ICP)										
Persicaria barbata var. *gracilis* (Danser) H. Hara **M. Anwar 210 (ICP)**	Razar/Swabi	Herb	Paluplak	Shoot	Medicinal, Fodder	3	0.06	2	5	0.11
Rumex dentatus L. **M. Anwar 213 (ICP)**	Razar	Herb	Shalkhie	Shoot	Medicinal, Fodder, Vegetable	18	0.4	3	23	0.51
Portulacaceae										
Portulaca oleracea L. **M. Anwar 214 (ICP)**	Razar	Herb	Walkharie	Whole plant	Fodder, Vegetable	12	0.26	2	15	0.33
P. pilosa L. **M. Anwar 215 (ICP)**	Razar	Herb	Walkharie	Whole plant	Fodder, Ornamental	15	0.33	2	18	0.4
Primulaceae										
Anagallis arvensis L. **M. Anwar 216 (ICP)**	Razar	Herb	Chak stargi	Whole plant	Fodder	10	0.22	1	10	0.22
Ranunculaceae										
Ranunculus muricatus L. **M. Anwar 217 (ICP)**	Razar	Herb	Chiyachagh	Shoot	Fodder	8	0.17	1	8	0.17
Rhamnaceae										
Ziziphus nummularia (Burm. F.) Wight & Arn. **M. Anwar 219 (ICP)**	Razar	Shrub	Karkanda	Stem, Leaves, Fruit	Medicinal, Fodder, Fuel, Edible fruit, Honey bee	18	0.4	5	24	0.53
Rosaceae										
Rosa chinensis Jacq. **M. Anwar 220 (ICP)**	Razar	Shrub	Gulab	Whole plant	Medicinal, Ornamental, Hedging/Fencing, Honey bee, Others	23	0.51	5	29	0.64
Rubiaceae										
Galium aparine L. **M. Anwar 221 (ICP)**	Razar	Herb	Nari booty	Whole plant	Fodder	7	0.15	1	7	0.15
Scrophulariaceae										
Verbascum thapsus L. **M. Anwar 222 (ICP)**	Razar	Herb	Khardag	Leaves, Fruit, Seed	Medicinal	4	0.08	1	4	0.08
Simaroubaceae										
Ailanthus altissima (Mill.) Swingle **M. Anwar 223 (ICP)**	Razar	Tree	Hindustani bakyanra	Leaves, Stem, Root	Fodder, Fuel, Timber, Thatching, Others	15	0.33	5	21	0.46
Solanaceae										
Datura innoxia Mill. **M. Anwar 224 (ICP)**	Razar	Herb	Batoora	Leaves, Stem, Seed	Medicinal	4	0.08	1	9	0.2
Lycopersicon esculentum Mill. **M. Anwar 225 (ICP)**	Razar	Herb	Tamatar	Fruit	Medicinal, Vegetable, Others	19	0.42	3	23	0.51
Physalis minima L. **M. Anwar 226 (ICP)**	Razar	Herb	Mangoty booty	Whole plant	Fodder	5	0.11	1	5	0.11

Solanum nigrum L. **M. Anwar 227 (ICP)**	Razar	Herb	Kachmachu	Leaves, Fruit	Medicinal, Vegetable	19	0.42	2	23	0.51
S. surattense Burm. F. **M. Anwar 228 (ICP)**	Razar	Herb	Maraghoni	Whole plant	Medicinal	5	0.11	1	5	0.11
Withania coagulans (Stocks) Dunal **M. Anwar 229 (ICP)**	Razar	Shrub	Kotilaal	Root, Leaves, Fruit	Medicinal	7	0.15	1	7	0.15
Tiliaceae										
Corchorus olitorius L. **M. Anwar 231 (ICP)**	Razar	Herb	Sutli booty	Whole plant	Fodder	5	0.11	1	5	0.11
C. tridens L. **M. Anwar 232 (ICP)**	Razar	Herb	Jangali sutli	Whole plant	Fodder	7	0.15	1	7	0.15
Triumfetta pentandra A.Rich. **M. Anwar 233 (ICP)**	Razar	Herb	Warha jesha	Whole plant	Fodder	4	0.08	1	4	0.08
Verbenaceae										
Lantana camara L. **M. Anwar 235 (ICP)**	Razar	Shrub	Mehaky gulay	Whole plant	Ornamental, Hedging/Fencing	8	0.17	2	12	0.26
Verbena officinalis L. **M. Anwar 236 (ICP)**	Razar	Herb	Shamaki	Whole plant	Medicinal, Others	2	0.04	2	2	0.04
Zygophyllaceae										
Tribulus terrestris L. **M. Anwar 237 (ICP)**	Razar	Herb	Markunday	Shoot, Fruit	Medicinal, Fodder	5	0.11	2	6	0.13
MONOCOTYLEDONAE										
Amaryllidaceae										
Allium griffithianum Boiss. **M. Anwar 1 (ICP)**	Razar	Herb	Oraki	Whole plant	Medicinal, Vegetable	7	0.15	2	9	0.2
Commelinaceae										
Commelina benghalensis L. **M. Anwar 3 (ICP)**	Razar	Herb	Pulpolaka	Whole plant	Fodder	3	0.06	1	3	0.06
Cyperaceae										
Cyperus compressus L. **M. Anwar 4 (ICP)**	Razar/Topi	Herb	Dhela	Whole plant	Fodder	5	0.11	1	5	0.11
C. rotundus L. **M. Anwar 5 (ICP)**	Razar	Herb	Dhela	Whole plant	Fodder	5	0.11	1	5	0.11
Juncaceae										
Juncus bufonius L. **M. Anwar 7 (ICP)**	Topi	Herb	Nare wakho	Whole plant	Fodder, Fuel	3	0.06	2	5	0.11
Poaceae										
Apluda mutica L. **M. Anwar 8 (ICP)**	Razar	Herb	Wakho	Whole plant	Fodder	5	0.11	1	5	0.11

Aristida adscensionis L. **M. Anwar 9 (ICP)**	Razar	Herb	Wakho	Shoot	Fodder, Thatching, Others	7	0.15	3	12	0.26
A. cyanantha Nees **M. Anwar 10 (ICP)**	Razar	Herb	Wakha	Shoot	Fodder, Thatching, Others	7	0.15	3	13	0.29
Arundo donax L. **M. Anwar 11 (ICP)**	Razar/Topi	Herb	Nall	Whole plant	Fuel, Thatching, Hedging/Fencing	12	0.26	3	22	0.49
Avena fatua L. **M. Anwar 12 (ICP)**	Razar	Herb	Jamdar	Whole plant	Fodder	17	0.37	1	17	0.37
Brachiaria ramosa (L.) Stapf **M. Anwar 13 (ICP)**	Razar	Herb	Wakho	Whole plant	Fodder	15	0.33	1	15	0.33
Bromus pectinatus Thunb. **M. Anwar 14 (ICP)**	Razar	Herb	Nare jamdar	Whole plant	Fodder	12	0.26	1	12	0.26
Cenchrus biflorus Roxb. **M. Anwar 15 (ICP)**	Razar/Lahor	Herb	Shamlokha	Shoot	Fodder, Fuel	7	0.15	2	11	0.24
C. ciliaris L. **M. Anwar 16 (ICP)**	Razar/Lahor	Herb	Mumlokha	Whole plant	Fodder	12	0.26	1	12	0.26
Chrysopogon aucheri (Boiss.) Stapf **M. Anwar 17 (ICP)**	Razar	Herb	Spin wakho	Shoot	Fodder, Thatching	7	0.15	2	7	0.15
Cymbopogon jwarancusa Schult. **M. Anwar 18 (ICP)**	Razar	Herb	Sargarhay	Shoot	Fodder, Others	7	0.15	2	9	0.2
Cynodon dactylon (L.) Pers. **M. Anwar 19 (ICP)**	Razar	Herb	Kabal	Whole plant	Fodder, Fuel, Ornamental	19	0.42	3	23	0.51
Dactyloctenium aegyptium (L.) Willd. **M. Anwar 20 (ICP)**	Razar	Herb	Wakho	Whole plant	Fodder	10	0.22	1	10	0.22
Desmostachya bipinnata (L.) Stapf **M. Anwar 21 (ICP)**	Razar/Lahor	Herb	Drab	Shoot	Fodder, Thatching, Others	5	0.11	3	6	0.13
Dichanthium annulatum (Forssk.) Stapf **M. Anwar 22 (ICP)**	Razar	Herb	Sra wakho	Shoot	Fodder	7	0.15	1	7	0.15
Digitaria ciliaris (Retz.) Koeler **M. Anwar 23 (ICP)**	Razar	Herb	Tor wakho	Whole plant	Fodder	14	0.31	1	14	0.31
D. sanguinalis (L.) Scop. **M. Anwar 24 (ICP)**	Razar	Herb	Tor wakho	Whole plant	Fodder	12	0.26	1	12	0.26
Echinochloa colona (L.) Link **M. Anwar 25 (ICP)**	Razar	Herb	Wakho	Whole plant	Fodder	11	0.24	1	11	0.24
Eleusine indica (L.) Gaertn. **M. Anwar 26 (ICP)**	Razar	Herb	Ghat wakho	Whole plant	Fodder	7	0.15	1	7	0.15
Eragrostis minor Host **M. Anwar 27 (ICP)**	Razar	Herb	Nare wakho	Whole plant	Fodder	3	0.06	1	5	0.11
Heteropogon contortus (L.) P. Beauv. **M. Anwar 28 (ICP)**	Razar/Lahor	Herb	Barwaza	Shoot	Fodder, Fuel, Thatching, Others	7	0.15	4	11	0.24

Imperata cylindrica (L.) Raeusch. **M. Anwar 29 (ICP)**	Razar	Herb	Spin bambul	Whole plant	Fodder	7	0.15	1	7	0.15
Leptochloa panicea (Retz.) Ohwi **M. Anwar 30 (ICP)**	Razar	Herb	Naram wakho	Whole plant	Fodder	5	0.11	1	5	0.11
Paspalum paspalodes (Michx.) Scribn. **M. Anwar 31 (ICP)**	Razar/Swabi	Herb	Tor kabal	Whole plant	Fodder	6	0.13	1	6	0.13
Perotis hordeiformis Nees **M. Anwar 32 (ICP)**	Razar	Herb	Nare wakho	Whole plant	Fodder	3	0.06	1	5	0.11
Phalaris minor Retz. **M. Anwar 33 (ICP)**	Razar	Herb	Gayaa	Whole plant	Fodder	12	0.26	1	12	0.26
Poa annua L. **M. Anwar 34 (ICP)**	Razar	Herb	Wakho	Whole plant	Fodder, Fuel	12	0.26	2	16	0.35
Polypogon monspeliensis (L.) Desf. **M. Anwar 35 (ICP)**	Razar	Herb	Gayaa	Whole plant	Fodder	5	0.11	1	5	0.11
Rostraria cristata (L.) Tzvelev **M. Anwar 36 (ICP)**	Razar	Herb	Wakho	Whole plant	Fodder	3	0.06	1	3	0.06
Saccharum bengalense Retz. **M. Anwar 37 (ICP)**	Razar/Lahor/ Topi	Herb	Sharghashy	Shoot	Thatching, Hedging/Fencing, Others	8	0.17	3	12	0.26
S. spontaneum L. **M. Anwar 38 (ICP)**	Razar/Lahor/ Topi	Herb	Sharghashy	Shoot	Thatching, Others	9	0.2	2	13	0.28
Setaria pumila (Poir.) Roem. & Schult. **M. Anwar 39 (ICP)**	Razar	Herb	Gayaa	Whole plant	Fodder	7	0.15	1	7	0.15
S. viridis (L.) P. Beauv. **M. Anwar 40 (ICP)**	Razar	Herb	Ghat wakho	Whole plant	Fodder	12	0.26	1	12	0.26
Sorghum halepense (L.) Pers. **M. Anwar 41 (ICP)**	Razar/Lahor	Herb	Dadam	Shoot	Fodder, Thatching	7	0.15	2	11	0.24

Legend:

Quantitative ethnobotanical indices: FC=Frequency Citation, **RFC=**Relative Frequency Citation, **Urs=** Use reports, **∑Ui=** Number of use, **UVs=** Use Values.

Family Use Value (FUV)

In this study, the family use value (FUV) ranged from 0.04 to 1.73. Based on the FUV index, the top seven families were Meliaceae (1.73), followed by Berberidaceae (1.29), Fabaceae (0.74), Cucurbitaceae (0.71), Apiaceae (0.69), Rosaceae (0.64), and Moraceae (0.61). The families with the lowest FUV values were Acanthaceae and Euphorbiaceae (0.09 each), Scrophulariaceae (0.08), along with Boraginaceae, Commelinaceae, and Geraniaceae (0.06 each), while Onagraceae demonstrated the lowest value at 0.04, as shown in Table 3.

Direct Matrix Ranking (DMR)

Table 4 presents the Direct Matrix Ranking (DMR) scores for various tree species, reflecting their diverse applications as recognized by local communities. The DMR values for the 14 assessed tree species varied between 8 and 33. Among these, *Morus nigra* emerged as the most versatile species, achieving a total score of 33 and securing the top position. It was closely followed by *Morus alba*, which gathered a score of 32, placing it second, and *Melia azedarach*, which ranked third with a score of 29. Additionally, *Dalbergia sissoo* and *Morus macroura* were noted for their significant DMR values, scoring 28 and 27 respectively, ranking fourth and fifth. The species with the lowest DMR score, recorded at 8, was *Callistemon citrinus*.

Table 3. Family Use Value (FUV) of the recorded families.

Families	FUV	Families	FUV	Families	FUV	Families	FUV
Meliaceae	1.73	Polygonaceae	0.32	Rubiaceae	0.15	Amaryllidaceae	0.2
Berberidaceae	1.29	Chenopodiaceae	0.28	Verbenaceae	0.15	Asclepiadaceae	0.2
Fabaceae	0.74	Cactaceae	0.26	Fumariaceae	0.13	Malvaceae	0.2
Cucurbitaceae	0.71	Solanaceae	0.26	Lamiaceae	0.13	Convolvulaceae	0.1
Apiaceae	0.69	Caryophyllaceae	0.23	Zygophyllaceae	0.13	Acanthaceae	0.09
Rosaceae	0.64	Brassicaceae	0.22	Asteraceae	0.12	Euphorbiaceae	0.09
Moraceae	0.61	Primulaceae	0.22	Amaranthaceae	0.11	Scrophulariaceae	0.08
Rhamnaceae	0.53	Poaceae	0.22	Cleomaceae	0.11	Boraginaceae	0.06
Simaroubaceae	0.46	Oxalidaceae	0.18	Cyperaceae	0.11	Commelinaceae	0.06
Cannabaceae	0.37	Plantaginaceae	0.17	Juncaceae	0.11	Geraniaceae	0.06
Myrtaceae	0.36	Ranunculaceae	0.17	Nyctaginaceae	0.11	Onagraceae	0.04
Portulacaceae	0.36	Aizoaceae	0.15	Tiliaceae	0.11	---	---

Table 4. Direct Matrix Ranking (DMR) score for fourteen important tree species.

Plant Name	Ethnobotanical uses									Total score	Rank
	A	B	C	D	E	F	G	H	I		
Acacia modesta	3	3	5	0	1	0	1	0	5	**18**	**6**
Acacia nilotica	2	1	3	2	3	0	1	0	0	**12**	**11**
Ailanthus altissima	0	2	4	3	4	1	2	0	0	**16**	**8**
Albizia lebbeck	0	1	3	3	4	0	2	0	0	**13**	**10**
Broussonetia papyrifera	0	4	3	0	3	0	0	0	0	**10**	**12**
Callistemon citrinus	0	0	3	2	2	0	1	0	0	**8**	**14**
Dalbergia sissoo	3	3	5	5	4	5	3	0	0	**28**	**4**
Eucalyptus globulus	3	0	4	3	4	1	2	0	0	**17**	**7**
Leucaena leucocephala	1	3	3	0	3	0	0	0	4	**14**	**9**
Melia azedarach	2	4	5	5	5	4	4	0	0	**29**	**3**
Morus alba	2	4	5	5	5	4	4	3	0	**32**	**2**
Morus macroura	3	4	3	4	4	2	2	5	0	**27**	**5**
Morus nigra	4	4	5	5	5	4	4	2	0	**33**	**1**
Sesbania sesban	0	2	5	0	2	0	0	0	0	**9**	**13**

Total score	**23**	**35**	**56**	**37**	**49**	**21**	**26**	**10**	**9**
Rank	**6**	**4**	**1**	**3**	**2**	**7**	**5**	**8**	**9**

Based on use criteria (0 = no value, 1= least used, 2 = less used, 3 = good, 4 = very good, 5 = best).

Legend: Ethnobotanical uses: A= Medicinal, **B=** Fodder, **C=** Fuel, **D=** Timber, **E=** Thatching, **F=** Furniture, **G=** Agricultural tools, **H=** Edible Fruit, **I=** Honey bee

Discussion

Quantitative ethnobotany focuses on assessing the significance of plants and vegetation in relation to human use. The current survey identified 177 species across 141 genera and 47 families. Among these families, 42 were dicotyledons, comprising 138 species, while 5 were monocotyledons, which included 39 species. Of the 177 recorded species, 149 (84.2%) were classified as herbs, whereas both shrubs and trees accounted for 14 species each, representing 7.9%.

The concept of Relative Frequency Citation (RFC) illustrates the traditional significance of various plant species as reported by informants who reference these species. The plant species that are most frequently cited by community members will exhibit the highest frequency citation values (Kushwaha *et al*. 2018). In this study, the RFC values were observed to range from 0.04 to 0.82, with *Berberis lycium* achieving the highest RFC, followed by *Melia azedarach* and *Coriandrum sativum*. The prominence of *Berberis lycium*, as indicated by its high RFC, has also been corroborated by various researchers across different regions of Pakistan (Barkatullaha *et al.* 2015, Aziz *et al*. 2016, Aziz *et al*. 2017, Rozina *et al*. 2017, Shinwari *et al*. 2017, Ahmad *et al*. 2017, and Hussain *et al*. 2018). Likewise, *Melia azedarach* has been similarly noted for its high RFC by Aziz *et al*. (2017), Rozina *et al*. (2017), and Ali *et al*. (2018) in various regions throughout Pakistan. According to the findings presented in the studies by Zahoor *et al*. (2017), Aziz *et al*. (2017), and Abbas *et al*. (2017), *Coriandrum sativum* emerged as a prominent species based on its Relative Frequency Citation (RFC). Other prominent plants showing higher RFC values were *Arachis hypogaea, Dalbergia sissoo, Medicago polymorpha, Foeniculum vulgare, Morus alba,* and *Morus nigra*. Two studies, one conducted by Nadaf *et al*. (2019) and the other by Ashfaq *et al*. (2019), found *Arachis hypogaea* to be a notable species in their respective research areas. *Foeniculum vulgare* was identified as a key species in the quantitative ethnobotanical studies conducted by Aziz *et al*. (2017), Abbas *et al*. (2017), Ali *et al*. (2018), and Rashid *et al*. (2018). Other researchers have also documented the Relative Frequency Citation (RFC) for *Morus alba* and *Morus nigra*, as documented in the works of Barkatullaha *et al*. (2015), Aziz *et al*. (2016), Hussain *et al*. (2018), Abbas *et al*. (2017), Zahoor *et al*. (2017), Ullah *et al*. (2018), Ali *et al*. (2018), and Umair *et al*. (2019), which confirms our current research results.

The concept of use value (UV) provides insight into the significant species utilized by a community. In this research, UV values ranged from 0.04 to 1.73. The species with the highest UV was *Melia azedarach*, followed by *Berberis lyceum* and *Arachis hypogaea*. Previous studies by Aziz *et al*. (2018) and Ashfaq *et al*. (2019) reported *Arachis hypogaea* exhibiting a higher UV in their respective regions. Additionally, *Berberis lyceum* was noted for its elevated UV by various researchers across different regions of Pakistan (Barkatullah *et al*. 2015, Hussain *et al*. 2018, Aziz *et al*. 2016, Ahmad *et al*. 2017, Aziz *et al*. 2017, Shinwari *et al*. 2017, and Rashid *et al*. 2018). Likewise, *Melia azedarach* was also documented with a higher UV by Barkatullah *et al*. (2015), Aziz *et al*. (2017), Hussain *et al*. (2018), and Ullah *et al*. (2018) in various parts throughout Pakistan. Other prominent plants with significant use values included *Coriandrum sativum, Morus nigra, Dalbergia sissoo, Medicago polymorpha, Foeniculum vulgare, Acacia modesta,* and *Cucurbita moschata*. In the context of quantitative ethnobotany research, *Foeniculum vulgare* and *Coriandrum sativum* emerged as a notable species in the research conducted by Abbas *et al*. (2017), Aziz *et al*. (2017), and Ullah *et al*. (2018). *Acacia modesta* and *Morus nigra* which exhibited higher UV levels, were also recognized as a significant species in the research conducted by Barkatullah *et al*. (2015) and Ullah *et al*. (2018). Additionally, other researchers noted the UV presence in *Morus nigra* during their quantitative ethnobotany studies (Aziz *et al*. 2016, Zahoor *et al*. 2017, Abbas *et al*. 2017, Ali *et al*. 2018, Hussain *et al*. 2018, and Umair *et al*. 2019). These findings corroborate our results.

The Family Use Value (FUV) is a measure used to evaluate the importance of different plant families. It acts as an indicator of cultural significance, which can be used in ethnobotanical studies to assess the value of various biological plant species (Chaachouay *et al*. 2019). This study found that FUV values ranges from 0.04 to 1.73. The FUV index has identified seven most important plant families, starting with Meliaceae, then Berberidaceae, Fabaceae, followed by Cucurbitaceae, Apiaceae, Rosaceae, and Moraceae. Hussain *et al*. (2018) also found the greatest family use value in their study of ten families within the field of quantitative ethnobotany. According to Zougagh *et al*. (2019), the family Juglandaceae exhibited the highest FUV with a value of 0.75, while the family Fabaceae ranked second with a value of 0.71, followed by Myrtaceae at 0.55, Lauraceae at 0.44, and Lamiaceae with the lowest value at 0.33. Chaachouay *et al.* (2019) pinpointed most commonly referenced

families, as per the FUV index were, Lamiaceae, Rosaceae, and Moraceae, based on their area of research. These findings support our results.

The Direct Matrix Ranking (DMR) method evaluates the diversity of usage among different plant species, relying on data collected from informants (Martin 1995). Each tree species is assigned a DMR score that reflects its multipurpose applications as identified by local populations. Among the 14 tree species evaluated, DMR values varied from 8 to 33. The findings showed that *Morus nigra* was the most utilized species, ranking first, followed by *Morus alba* in second place and *Melia azedarach* in third. Furthermore, *Dalbergia sissoo* and *Morus macroura* were positioned fourth and fifth, respectively, based on their high DMR scores. These species are often subject to overexploitation for a variety of uses, including fuel, livestock feed, timber, roofing materials, building construction, farming, and medical applications. Muhammad *et al.* (2016) found that higher-ranking, predominantly woody species are being inappropriately harvested by local communities for different purposes. A DMR analysis performed by Ishtiaq *et al.* (2013) showed that *Dalbergia sissoo* and *Acacia modesta* were the species most frequently used by local people for fuel, construction, and hedges. Mussarat *et al*. (2014) found that, based on DMR analysis, *Morus alba* was the most utilized species, with *Melia azedarach* following closely behind. Their study also identified *Morus alba* and *Dalbergia sissoo* as highly versatile and disappearing species in the region, as indicated by direct matrix ranking. Similarly, the research by Khan *et al*. (2014) highlighted *Morus alba* and *Melia azedarach* as highly multiuse species through DMR analysis. These findings align with our own research.

Conclusion

The current survey identified 177 species across 141 genera and 47 families. Among these families, 42 were dicotyledons, comprising 138 species, while 5 were monocotyledons, which included 39 species. Out of the 177 species that were identified, 149 (84.2%) were herbs, while 14 species each (7.9%), were shrubs and trees. Fodder for cattle was identified as foremost used category, while the most frequently used plant part was whole plant in the study area. In this study, highest RFC was recorded for *Berberis lyceum*, similarly, highest UV was recorded for *Melia azedarach.* The FUV index has identified the seven most important plant families; Meliaceae, Berberidaceae, Fabaceae, followed by Cucurbitaceae, Apiaceae, Rosaceae, and Moraceae. According to DMR, *Morus nigra* was the most utilized species, ranking first, followed by *Morus alba* in second place and *Melia azedarach* in third. The residents of the studied area rely on indigenous plants to meet their primary needs like fuel wood and fodder. However, the local flora is under threat due to overexploitation, overgrazing, and improper harvesting practices. For the sustainable management of plant resources, it is imperative to adopt effective conservation measures such as controlled grazing, reforestation, and the management of rangelands.

Declarations

Ethical approval and consent to participants: Prior to the interviews, informed consent was obtained from each participant, and the objectives of the study were clearly explained.

Availability of data and materials: The plants were collected, dried, identified and mounted on the Herbarium sheets and were deposited in the Herbarium of Department of Botany, Islamia College Peshawar (ICP). All the data obtained from informants during the study are included in the manuscript.

Competing interests: The authors declare that they have no competing interests.

Funding: This research was self-funded, not received any funding from any agency.

Authors' contributions: Maqsood Anwar conducted field work, analyzed data and wrote the manuscript and Naveed Akhtar provided valuable supervision and technical input at every step.

Acknowledgements

The authors are acknowledge all the informants of the research area for providing the ethnobotanical knowledge and relevant information. We are equal thankful to those who helped us in the field survey and plants collection in the research sites.

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 13:53.

Ahmad KS, Hamid A, Nawaz F, Hameed M, Ahmad F, Deng J, Akhtar N, Wazarat A, Mahroof S. 2017. Ethnopharmacological studies of indigenous plants in Kel village, Neelum Valley, Azad Kashmir, Pakistan. Journal of Ethnobiology and Ethnomedicine 13: 68.

Ali A, Badshah L, Hussain F. 2018. Ethnobotanical appraisal and conservation status of medicinal plants in Hindukush Range, District Swat, Pakistan. Journal of Herbs, Spices & Medicinal Plants doi: 10.1080/10496475.2018.1510456.

Ali SI, Nasir YJ. (eds.). 1989-1991. Flora of Pakistan (Fascicle series). Islamabad, Karachi.

Anwar M, Akhtar N. 2020b. Two Way Indicator Species Analysis and Distribution Pattern of Weeds of Maize Crop in District Swabi, Khyber Pakhtunkhwa, Pakistan. Proceedings of the Pakistan Academy of Sciences 57 (4): 41-50.

Anwar M, Akhtar N, Khalid S, Zeb H. 2020a. Eco-Floristic Study of Weed Flora of Maize Crop in District Swabi, Khyber Pakhtunkhwa, Pakistan. Pakistan Journal of Weed Science Research 26(4): 499-506.

Ashfaq S, Ahmad M, Zafar M, Sultana S, Bahadur S, Abbas N. 2019. Medicinal plant biodiversity used among the rural communities of arid regions of northern Punjab, Pakistan. Indian Journal of Traditional Knowledge 18(2): 226-241.

Aziz MA, Adnan M, Khan AH, Rehman AU, Jan R, Khan J. 2016. Ethno-medicinal survey of important plants practiced by indigenous community at Ladha subdivision, South Waziristan agency, Pakistan. Journal of Ethnobiology and Ethnomedicine 12: 53.

Aziz MA, Khan AH, Adnan M, Izatullah I. 2017. Traditional uses of medicinal plants reported by the indigenous communities and local herbal practitioners of Bajaur Agency, Federally Administrated Tribal Areas, Pakistan. Journal of Ethnopharmacology 198: 268-281.

Aziz MA, Khan AH, Ullah H, Adnan M, Hashem A, Abd_Allah EF. 2018. Traditional phytomedicines for gynecological problems used by tribal communities of Mohmand Agency near the Pak-Afghan border area. Revista Brasileira de Farmacognosia 28: 503-511.

Balick MJ, Cox PA. 1996. Plants, People, and Culture: The Science of Ethnobotany. Scientific American Library, WH Freeman & Co., N.Y.

Barkatullah, Ibrar M, Hussain F. 2009. Ethnobotanical studies of plants of Charkotli Hills, Batkhela District, Malakand, Pakistan. *Frontiers of Biology in* China 4: 539-548.

Barkatullah, Ibrar M, Rauf A, Hadda TB, Mubarak MS, Patel S. 2015. Quantitative ethnobotanical survey of medicinal flora thriving in Malakand Pass Hills, Khyber Pakhtunkhwa, Pakistan. Journal of Ethnopharmacology 169: 335-346.

Barkatullah, Khan M, Ahmad H, Khan MS, Razzaq A. 2018. Ethnobotanical indices based ethnoveterinary plant profile of Jabban hills, Malakand, Hindukush range, Pakistan. Pakistan Journal of Botany 50 (5): 1899-1905.

Chaachouay N, Benkhnigue O, Fadli M, El-Ibaoui H, Zidane L. 2019. Ethnobotanical and ethnopharmacological studies of medicinal and aromatic plants used in the treatment of metabolic diseases in the Moroccan Rif. Heliyon 5: e02191.

Hoffman B, Gallaher T. 2008. Importance indices in ethnobotany. Ethnobotany Research and Applications 5: 201-218.

Hussain W, Badshah L, Ullah M, Ali M, Ali A, Hussain F. 2018. Quantitative study of medicinal plants used by the communities residing in Koh-e-Safaid Range, northern Pakistani-Afghan borders. Journal of Ethnobiology and Ethnomedicine 14:30.

Ishtiaq M, Maqbool M, Hussain T, Shah A. 2013. Role of indigenous knowledge in biodiversity conservation of an area: A case study on tree ethnobotany of Soona valley, district Bhimber Azad Kashmir, Pakistan. Pakistan Journal of Botany 45(SI): 157-164.

Kayani S, Ahmad M, Zafar M, Sultana S, Khan MPZ, Ashraf MA, Hussain J, Yaseen G. 2014. Ethnobotanical uses of medicinal plants for respiratory disorders among the inhabitants of Gallies-Abbottabad, Northern Pakistan. Journal of Ethnopharmacology 156: 47-60.

Khan I, Abd Elsalam NM, Fouad H, Tariq A, Ullah R, Adnan M. 2014. Application of ethnobotanical indices on the use of traditional medicines against common diseases. Evidence-Based Complementary and Alternative Medicine doi: 10.1155/2014/635371.

Kim H, Song MJ. 2013. Ethnomedicinal practices for treating liver disorders of local communities in the southern regions of Korea. Evidence-Based Complementary and Alternative Medicine doi: 10.1155/2013/869176.

Kushwaha A, Jain S, Bhojwani K, Kalyani G. 2018. Concise synopsis on quantitative ethnobotanical tools for medicinal plant analysis. International Journal of Pharmaceutical Sciences Review and Research 48(1): 128-132.

Martin GJ. 1995. Ethnobotany: A methods manual. Chapman and Hall, London, UK.

Muhammad Z, Khan N, Ullah A. 2016. Quantitative ethnobotanical profile of understory vegetation in *Acacia Modesta* (Wall) forests of Malakand Division, Pakistan. *Science, Technology and Development* 35(2): 88-93.

Mussarat S, Abd El-Salam NM, Tariq A, Wazir SM, Ullah R, Adnan M. 2014. Use of ethnomedicinal plants by the people living around Indus River. Evidence-Based Complementary and Alternative Medicine doi: 10.1155/2014/212634.

Nadaf M, Joharchi MR, Amiri MS. 2019. Ethnomedicinal uses of plants for the treatment of nervous disorders at the herbal markets of Bojnord, North Khorasan Province, Iran. Avicenna Journal of Phytomedicine 9(2): 153-163.

Nair R, Kalariya T, Chanda S. 2005. Antibacterial activity of some selected Indian medicinal flora. Turkish Journal of Biology 29: 41-47.

Nasir E, Ali SI. (eds.). 1970-1989. Flora of Pakistan (Fascicles series 1-190). Islamabad, Karachi.

Ong HG, Kim YD. 2014. Quantitative ethnobotanical study of the medicinal plants used by the Ati Negrito indigenous group in Guimaras Island, Philippines. Journal of Ethnopharmacology 157: 228-242.

Pepin B. 1999. Epistemologies, beliefs and conceptions of mathematics teaching and learning: The theory, and what is manifested in mathematics teachers' work in England, France and Germany. TNTEE Publications 2: 127-146.

Phillips O, Gentry AH, Reynel C, Wilkin P, Galvez BD. 1994. Quantitative ethnobotany and Amazonian conservation. Conservation Biology 8: 225-248.

Phillips O, Gentry AH. 1993. The useful plants of Tambopata, Peru: I. Statistical hypotheses tests with a new quantitative technique. Economic Botany 47: 15-32.

Pieroni A. 2001. Evaluation of the cultural significance of wild food botanicals traditionally consumed in Northwestern Tuscany, Italy. Journal of Ethnobiology and Ethnomedicine 21: 89-104.

Rashid N, Gbedomon RC, Ahmad M, Salako VK, Zafar M, Malik K. 2018. Traditional knowledge on herbal drinks among indigenous communities in Azad Jammu and Kashmir, Pakistan. Journal of Ethnobiology and Ethnomedicine 14:16.

Reyes-García V, Huanca T, Vadez V, Leonard W, Wilkie D. 2006. Cultural, practical, and economic value of wild plants: a quantitative study in the Bolivian Amazon. Economic Botany 60: 62-74.

Rozina, Ahmad M, Zafar M, Qasim M, Zainulabidin S. 2017. Ethnomedicinal uses of plants for blood purification in district Swabi, Khyber Pakhtunkhwa, Pakistan. Journal of Rural Development and Agriculture 2(1): 41-56.

Sadeghi Z, Mahmood A. 2014. Ethno-gynecological knowledge of medicinal plants used by Baluch tribes, southeast of Baluchistan, Iran. Revista Brasileira de Farmacognosia 24: 706-715.

Sardar AA, Khan ZUD. 2009. Ethnomedicinal studies on plant resources of tehsil Shakargarh, district Narowal, Pakistan. Pakistan Journal of Botany 41: 11-18.

Shinwari S, Ahmad M, Luo Y, Zaman W. 2017. Quantitative analyses of medicinal plants consumption among the inhabitants of Shangla-Kohistan areas in Northern-Pakistan. Pakistan Journal of Botany 49(2): 725-734.

Ullah A, Hassan N, Amin R, Khan A, Shi L, Li M. 2018. Quantitative ethnobotanical survey of medicinal plants used as remedy in Mera, District Charsadda, KP, Pakistan. Journal of Biodiversity and Environmental Sciences 12(5): 163-173.

Umair M, Altaf M, Bussmann RW, Abbasi AM. 2019. Ethnomedicinal uses of the local flora in Chenab riverine area, Punjab province Pakistan. Journal of Ethnobiology and Ethnomedicine 15:7.

Upadhyay B, Singh KP, Kumar A. 2011. Ethno-veterinary uses and informants consensus factor of medicinal plants of Sariska region, Rajasthan, India. Journal of Ethnopharmacology 133:14-25.

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 13:27.

Zougagh S, Belghiti A, Rochd T, Zerdani I, Mouslim J. 2019. Medicinal and aromatic plants used in traditional treatment of the oral pathology: The ethnobotanical survey in the economic Capital Casablanca, Morocco (North Africa*).* Natural Products and Bioprospecting 9: 35-48.