Novel plant uses and their conservation status in a semiarid subtropical region of Pakistan

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Research

Abstract

Background: The semiarid subtropical regions of Pakistan are known for their diverse native flora used for medicinal and cultural purposes by local communities. Unfortunately, these plants are threatened by improper harvesting, habitat degradation, and fragmentation. To address this issue, this study was designed to corroborate the traditional uses of native flora and the status of their conservation in District Kohat, Pakistan.

Methods: An ethnobotanical approach was used to gather primary information on plant species, including semi-structured questionnaires and corner meetings. Pearson's correlation test and ethnobotanical indices were employed to analyze the importance of documented medicinal flora. Additionally, medicinal flora's conservation status was determined using species inventory, population decline, and IUCN Red List data.

Results: The study revealed an inventory of 103 plant species, with 36 newly reported recipes, 15 other uses, 14 medicinal uses, and 7 specific part uses. Herbs were the most dominant plant type, with leaves and young twigs being the frequently practiced plant parts. *Senegalia modesta* (Wall.) P.J.H. Hurter, *Bauhinia variegata* L., and other species had high fidelity values. The study also found that 44 plant species were highly threatened, 30 moderately threatened, 17 less threatened, and 12 not considered threatened.

Conclusions: The research presents a comprehensive list of plant species and their uses, shedding light on significant cultural and ecological aspects. This study underscores the importance of innovative applications of specific plant species in traditional practices. However, there is a worrisome number of endangered plant species, which require conservation efforts. Overall, the research highlights the significance of sustainable practices in safeguarding this valuable traditional knowledge.

Keywords: Medicinal Plants, Semiarid region, NWEPs, Novel applications, Kohat, Pakistan

Background

The semiarid regions are characterized by limited rainfall and diverse ecosystems, which support a rich diversity of plant species. There has been a long history of using these plants by local cultures. Semiarid regions serve as hotspots of traditional knowledge and biodiversity worldwide, including the Sahel in Africa and the Sonoran Desert in North America (De Albuquerque et al. 2009). As a transition zone between tropical and temperate zones, subtropical areas have a unique mixture of plant species adapted to various environmental conditions. The ethnobotanical exploration in the semiarid subtropical regions, particularly in Pakistan is decisive for discovering innovative plant uses when sustainability and resource diversification are top priorities. Several semiarid subtropical regions of Pakistan, including Baluchistan, Sindh, and Khyber Pakhtunkhwa (KPK), provide exceptional ethnobotanical research opportunities. Plants that grow in these areas are adapted to arid and semiarid conditions and have been traditionally used by Indigenous communities. District Kohat represents the semiarid subtropical region of Pakistan with considerable ethnobotanical potential. Situated at the crossroads of various ecological zones, Kohat features diverse flora supported by its unique soil compositions and microclimates. Furthermore, medicinal plants and their natural habitats must be managed and conserved. Traditional knowledge serves as a bridge to modern applications through ethnobotanical research. Native, wild, and endemic plant species (NWEPs) are utilized worldwide for traditional ethnobotanical purposes. Ethnobotanical knowledge encompasses far-ranging aspects of livelihood, including medicines, food, building tools, rituals, cosmetics, painting, fabrics, easy cash, ornamentation, social life, and divination (Choudhary et al. 2008). Native, wild, and endemic plant species (NWEPs) are valuable and important to ethnomedicine and herbal remedies, especially in remote regions and communities with low socioeconomic status (SES). They have been extensively documented worldwide, reflecting their widespread use. It is estimated that more than half of the world's population relies on ethnomedicine and herbal therapies for the treatment of illnesses and maladies (Macía et al. 2005). In Pakistan, indigenous flora is heavily used for medicinal purposes by more than 60% of the population (Jan et al. 2022). The high usage rate of traditional herbal remedies in the country highlights the cultural significance and accessibility of these remedies to the local population. Globally, subtropical semiarid regions host a wide range of botanical species that contribute to the survival and culture of Indigenous communities. In Pakistan, approximately 6,000 species of higher plants have been identified, with 600 to 700 of these species used in traditional and modern healthcare practices (Shinwari 2010). As recognized for preserving national biodiversity, Pakistan exported a significantly greater percentage of resources, i.e., US$10.5 million annually in 2012, in northern areas (Sher et al. 2014). Approximately 12% of wild plants are used in traditional remedies, with a sizable portion of these plants being exported (Khan Shinwari and Qaiser 2011). The traditional ethnomedicinal knowledge passed down from generation to generation, serves as the foundation of Pakistani folk medicine. However, the pressure of urbanization, rapid globalization, and lifestyle changes have made preserving and transmitting Indigenous knowledge more difficult. Despite this, traditional knowledge is now under threat due to a deficit of resilience and interest among the younger generation (Shinwari 2010; Popović et al. 2016). The critical importance of ethnobotanical research in semiarid subtropical regions is its contribution to preserving cultural heritage and promoting sustainable development. In addition, the imperative of sustainable resource management and the urgent need to mitigate environmental degradation underscores the need to document, understand, and harness the potential of these plants. Several previous studies have shown a significant lack of intergenerational transfer of traditional knowledge, resulting in the loss of an immense volume of invaluable data regarding native plant species due to the limited accessibility of written documents and records (Mirzaman et al. 2023; Manzoor et al. 2023; Gillani et al. 2024). In addition, reports from the same region suggest a significant loss of traditional knowledge, which could hinder the transmission of locally communicated information regarding various plant-based treatment approaches (Shinwari et al. 2011).

In this study, five remote precincts of the subtropical semiarid district of Kohat were evaluated to uncover the novel uses of native plant species, identify significant plant species, assess their ecological roles, and document the potential for sustainable resource diversification. The findings from the ethnographic survey and literature related to the study area suggest that the entire region of Kohat has fertile soils, making it a suitable location for cultivating and conserving therapeutically important plants. Kohat exhibits several types of soil, including limestone, clay, silt, and gypsum, indicating an energetic environment in which plants can flourish (Mirza et al. 2005; Yaseen et al. 2007). A variety of flowering plants are collected for medicinal uses in the semiarid subtropical region of district Kohat (Shinwari et al. 2011). However, sustainable garnering of these medicinal plants is reported to be a major concern in the region, particularly regarding the timing of collection and seasonality (Ilahi 2008). Local populations, including Afghan refugees, have made a significant contribution to traditional knowledge and plant diversity in the area (Shah et al. 2023). However, the floristically imperiled District Kohat offers multiple opportunities for ethno-directed studies in the future. Further studies are needed to understand the biodiversity of the region and its potential uses. Despite the ecological importance of this region, no comprehensive ethnobotanical assessment of medicinal plants and traditional knowledge has been conducted to protect their value and provide conservative measures. The objectives of this study were as follows: (i) to document the indigenous

knowledge of medicinal flora, (ii) to determine the conservation status and compare the preset findings with previously published data and (iii) to analyze the significance of documented medicinal plant species and identify innovative plant through various ethnobotanical indices, viz., the informant consensus factor (FIC), fidelity level (FL), preference ranking (PR), data matrix ranking (DMR), and Pearson product-moment correlation ρ (RHO). The study findings could provide information on conservation, cultural preservation, and sustainable development in subtropical semiarid regions, thus contributing to global efforts to improve ecological resilience and resource sustainability.

Materials and Methods

Gap Analysis

To identify gaps in the study area and analyze the significance of ethnobotanical research while preventing duplication of data, we conducted a thorough search of online databases, including Google Scholar, Sci-Hub, ISI Web of Science, MEDLINE, Science Direct, and Scopus, before commencing the ethnological survey and ecological fieldwork. We collected data using the following terms: “Herbal remedies,” “folk medicines,” “traditional medicines,” “local flora,” “botanical drugs,” “medicinal and aromatic plants,” “Jarma,” “Usterzai” and “District Kohat, KP, Pakistan.” We delimited our search to the topographical boundary of 'District Kohat.' Selection criteria for articles included consideration of climate conditions, vegetation potential, forest areas, and cultural proximity. During the survey, we ensured accuracy in the nomenclature of reported medicinal flora by cross-referencing with reputable sources. This comprehensive literature review in a subtropical semiarid region could provide valuable insight into existing knowledge gaps and facilitate the identification of innovative plant uses through ethnobotanical investigation. The region can also leverage plant uses for sustainable resource diversification by building an innovative foundation.

Study area

This ethnobotanical survey was conducted in Kohat District, a city located in the eastern belt of Khyber Pakhtunkhwa (Pakistan), which extends over an area of approximately 297,300 hectares. According to cardinal directions, the district is bounded by the Jamrud (Peshawar) in the north, Bannu in the south, the Indus River in the east, and Hangu in the west. Kohat is situated between northern latitudes 32° 47' and 33° 53' and eastern longitudes 70° 34' and 72° 17', with a typical height of 558 meters above present sea level (APSL). The district has a population of 169,033 people. District Kohat includes bare and intricate mountainous regions near the borders of District Orakzai and the Frontier Regions of Dara Adam Khel and Bannu (Bhatti and ULLAH 2011). The soil texture in the district of Kohat varies from clay to sandy loam with an alkaline pH. These rocks are primarily composed of silt and sand with a tiny proportion of clay (Fida et al. 2011). Agricultural lands and agro-farms are usually irrigated with water from Kohat Toi, Shahu Khel Nalla, and Kohat Springs. The climatic conditions vary throughout the year (Nasir et al. 2022). During June, the temperature is boiling, ranging between 40°C and 50°C, and extremely cold during January, ranging between 6°C and 18°C (Muhammad et al. 2017). In winter, a wrong west wind known as the "Hangu Breeze" often blows down the Miranzai valley toward Kohat, bringing an enjoyable change in weather between October and February (Haq et al. 2023). Rainfall is expected throughout the year, but August and March are considered the rainiest months, with average rainfalls of 114 mm and 638 mm, respectively (Khan et al. 2022). In terms of humidity, August is considered the most humid month in summer, and December is considered the most humid month in winter (Rashid et al. 2016). District Kohat is quite densely populated and has diverse castes and races. Pashtuns (84%), Hindko, Urdu, and Punjabi speakers (16%) are the most well-known and enduring ethnic groups residing in the area. Kohat is known for its diverse vegetation. However, this indigenous stock of natural beauty is concerned about its safe and research-focused nature due to the numerous risks and challenges posed by human-caused activities.

Fieldwork and household survey data collection

An ethnobotanical survey was carried out in five societies of District Kohat viz. Jarma, Seni Gumbat, Lachi, Dara Adam Khel, and Usterzai (Figure 1). Fieldwork and household survey data collection were conducted between March 2017 and October 2022. The population of the chosen locations was heavily dependent on plants for a diversity of usages, including food, medicine, fodder, building materials, and wood for construction. During the ethnobotanical survey, we analyzed the effects of natural factors, including climate, edaphic conditions, and geography, on the flora of each hotspot. Many endemic, exotic, and natural plant species occupied all the hotspot sites. A diverse flora is found in Jarma and Usterzai, but the inhabitants are unfamiliar with their skyrocketing value. There is a great deal of experience among the residents of Lachi, Dara Adam Khel, and Seni Gumbat concerning the use of plants as medicines and as a means of generating income in poverty (Figure 2). Participatory fieldwork and ethnobotanical indices associated with sample collection and data analysis were used to conduct the ethnobotanical survey. This survey employed simple random sampling; semi structured questionnaires with well-designed questions; open discussions of the findings with local inhabitants, households, herbalists, and healers; and an observational approach. In the context of participatory learning and action (PLA) and a questionnaire, 196 local individuals

were selected, including shepherds, herders, and herbalists who had deep knowledge and experience in Indigenous ethnobotany (Jain 2010). The participants who were interviewed independently gave their verbal consent to provide valuable traditional knowledge in their local languages (Pashto and Hindko) and encouraged them to conserve the primitive culture of traditional medicine. It is important to recognize that the PLA's perspective on many aspects of traditional remedies, as well as the experiences of local people, offered crucial insights. A list of medicinal plants found in selected communities as well as their ethnobotanical uses was developed based on the detailed information collected in the Excel sheet.

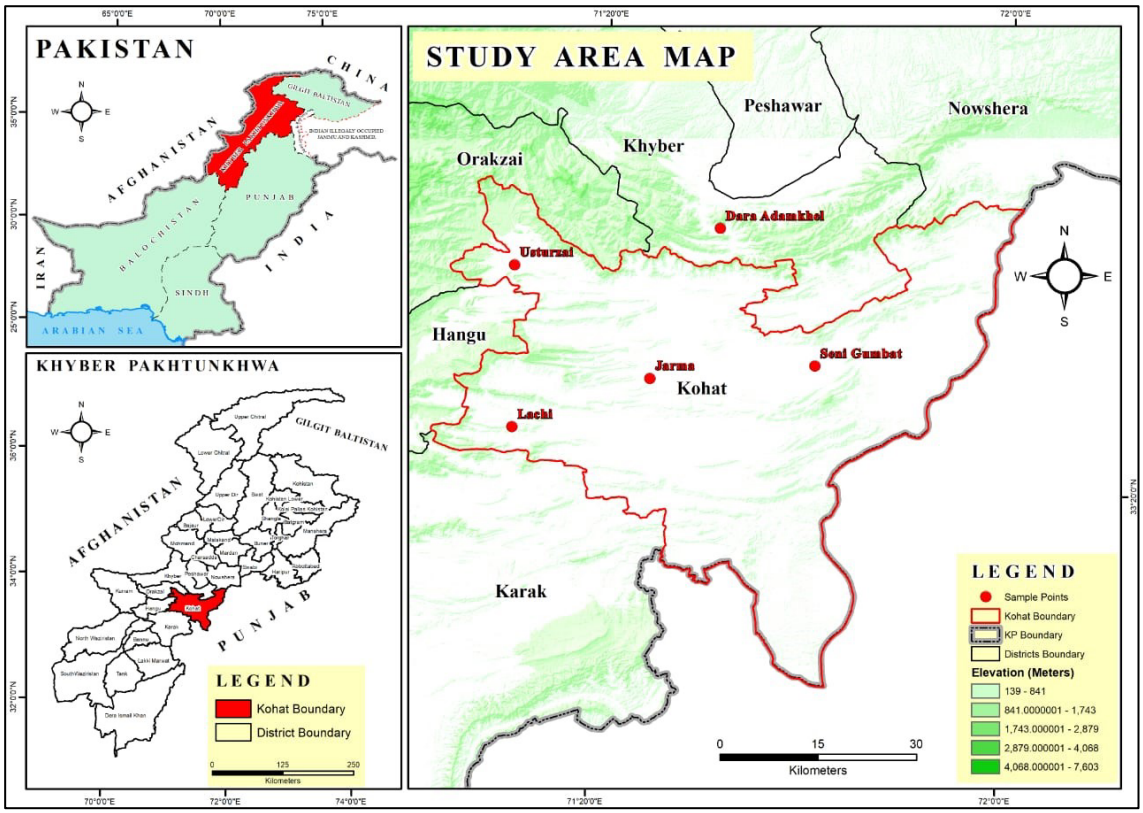

Figure 1. Study area map of Kohat District, Pakistan, showing sample points


Figure 2. Plant diversity sites in the subtropical semiarid region, Kohat, Pakistan.

Monitoring and assurance of data quality (MADQ)

MADQ reflects the accuracy of collecting data about respondents in the study area to reach elevated levels of data collection. Before conducting the ethnobotanical survey, a semi structured open and closed-ended questionnaire was prepared to ensure the quality of the data. Preliminary tests were carried out with 35 key respondents, seven from each study location, to evaluate their traditional plant use knowledge. Authentic data were collected through a minimum of three-monthly visits

between community members and respondents. The original data were stripped of all nonmaterial content, and only verified and relevant information was organized and analyzed.

Quantitative analysis of ethnobotanical data

Using Microsoft Excel 2016, we conducted a detailed analysis of plant taxonomy in various aspects, including part use, the degree of importance, local preferences, and plant forms. Qualitative data were analyzed and presented in graphs and pie charts. A few ethnobotanical indices, including the informant consensus factor, fidelity level, preference ranking, data matrix ranking, and Pearson correlation were used to analyze the significance of documented medicinal plant species. This analysis aimed to identify innovative plant uses through ethnobotanical investigation in a subtropical semiarid region, focusing on sustainable resource management.

Informant consensus factor (F_{IC})

The informant consensus factor (F_{IC}) for the current ethnobotanical survey was calculated using the following formula developed by (Heinrich 2000): $F_{IC} = \mathrm{Nur} - \frac{\mathrm{Nt}}{(\mathrm{Nur}-1)}$

Nur represents the number of use reports (UR) from informants for a particular plant-use category, while Nt represents the number of taxa or total plant species used for that purpose. In this case, the F_{IC} ranges between 0 and 1. A higher F_{IC} (closer to 1) suggests that a larger proportion of people consume a few plant taxa heavily for specific purposes and vice versa (Gazzaneo et al. 2005). As a result of applying the F_{IC} formula to informant reports, 14 ailments were identified as dominant and significantly treated. In this study, F_{IC} values were employed in conjunction with ethnobotanical investigations to identify and validate plant uses for a variety of ailments, thus contributing to the sustainable diversification of resources in the subtropical semiarid zone.

Fidelity level (FL)

The fidelity level is a measure that signifies the importance and authenticity of a medicinal plant species for treating specific ailments by local herbal practitioners. The following equation can be employed to analyze the authenticity of FL:

$$\mathrm{FL}\ (\%) = \left(\frac{\mathrm{Np}}{\mathrm{N}}\right) \times 100$$

Specifically, Np symbolizes the number of respondents who described specific medicinal flora as natural remedies for certain diseases, while N stands for the overall quantity of respondents experiencing plants as natural remedies (Ugulu 2012).

Preference ranking (PR)

Preference Ranking was calculated for nine medicinally important plant species cited as traditional preserves for human and livestock diseases, particularly renal diseases. The significantly preferred medicinal flora for treating renal disorders was determined using the detailed information of 20 randomly selected respondents via the standard method (Qaisar et al. 2013). Based on their effectiveness, informants ranked medicinal plants by selecting the most preferred species (5), the least preferred species (1), and an average of the remaining plants. Using the total scores for each medicinal plant, the results were then summarized for all respondents.

Direct matrix ranking (DMR)

Information on multi-purpose medicinal plants' most exploited diversity was gathered using direct matrix ranking. In total, twenty key respondents with extensive knowledge of medicinal plants were selected for participation in the study. As a direct matrix ranking, participants ranked use values on a 5-point scale (5 indicating best, 4 excellent, 3 good, 2 least used, 1 least used, and 0 not used). In the subtropical semiarid region, every plant species was ranked for sustainable resource diversification using the average of these recorded scores.

Statistical analysis

A Pearson correlation analysis was conducted to determine the relationship between respondents' age, education, and experience using traditional plants (Neyeloff et al. 2012). The Pearson correlation, a non-parametric version of the Pearson product-moment correlation, measures the strength and direction of relationships between two variables.

Results

Ethnographic data

The respondents were grouped according to their age, literacy level, and expertise in traditional plant use. An ethnographic survey revealed a significant correlation between age and traditional knowledge, with informants aged between 55 and 70 years indicating that the highest percentage (21%) of folks possessed the most extensive traditional knowledge in surveyed

communities. The study revealed that over half of the informants' communities lacked formal education, and only a negligible number of people were reported to have received a primary and middle school education (Table 1). In terms of career prospects, a considerable number of jobless respondents inhabited the surveyed communities. The investigation aimed at exploring innovative uses of plants for sustainable resource diversification relies on expertise and traditional knowledge.

Table 1. Ethnographic characteristics of informants in connection with maturity, qualification, and profession (n=196)

Age	Total No. of Respondents	Percentage (%)	Literacy Level	Total No. of Respondents	Percentage (%)	Occupation/ Careers	Total No. of Respondents	Percentage (%)
18-25	21	11	No formal education	102	52	Jobless	54	28
26-35	15	08	Primary	51	26	Farmers	41	21
36-45	36	18	Middle	21	11	Driers	15	08
46-55	29	15	Intermediate	16	08	Merchants	20	10
56-65	41	21	Graduate	06	03	Students	30	15
66-75	34	17	M. Phil	0	0	Businesspers on	15	08
76-85	12	06	PhD	0	0	Shepherds	21	11

Medicinal plant diversity and life forms of the reported species

A total of 103 medicinal plants were identified in the study area, belonging to 86 genera and 48 families. In terms of diversity, the Compositae was reported to be the most diverse family with approximately 10 species; Leguminosae with 8 species; Poaceae with 6 species; Apocynaceae, and Cucurbitaceae with 5 species each; and Amaranthaceae, Brassicaceae, Euphorbiaceae, and Solanaceae each with 4 medicinal plant species (Table 3). In addition, the conservation status of the newly reported taxa was compared to those reported in other regions and Pakistan. The ethnobotanical survey detected 103 medicinal species, including 60 herb species dominating the studied area, along with 21 shrubs, 16 trees, and 6 climbers (Table 2).

Table 2. General aspects of medicinal taxa of District Kohat.

Aspect/Attribute	Trees	Shrubs	Herbs	Climbers	Total No. of taxa	
					No.	Percentage (%)
Life form/Habit	**16**	**21**	**60**	**6**	**103**	**100**
Growth/Reproduction	**16**	**21**	**60**	**6**	**103**	**100**
Annual	0	0	20	4	24	23
Biennial	0	0	3	0	3	3
Perennial	11	15	30	2	58	56
Annual/biennial or perennial	0	2	6	0	8	8
Woody	5	4	0	0	9	9
Ephemeral	0	0	1	0	1	1
Parts use	**27**	**38**	**91**	**8**	**164**	**100**
Leaves and aerial parts (young twigs)	11	15	32	0	58	35
Flowers, floral buds, and inflorescence	1	5	10	1	17	10
Fruits and pods	3	3	9	5	20	12
Stems (stem bark)	4	8	4	0	16	10
Roots (bark), rhizome and legumes	4	6	21	1	32	20
Seeds	3	1	3	1	8	5
Whole plant	0	0	11	0	11	7
Gum and latex	1	0	1	0	2	1
Conservation status	**16**	**21**	**60**	**6**	**103**	**100**
Highly vulnerable	14	14	26	2	56	54
Moderately vulnerable	1	4	16	2	23	22
Less vulnerable	1	3	18	2	24	23

Table 3. Traditional ethnomedicinal data and reported medicinal flora in the Kohat District, Pakistan.

Botanical Name/ Vernacular Name/ {Voucher No.}	**Family Name**	**Habit/ Growth form**	**Parts used, Single or multiple uses**	**Ethnomedicinal Formulation**	**Other uses**	**Medicinal uses (Single or Multiple uses)**	**Side Effects (If any)**	**Novelty**	**Conservation Status (category-wise in the list of IUCN data and the Study Area)**
Abutilon grandifolium (Willd.) Sweet *((A. grandifolium))* **Kanghi/** {BOT-KHS-115}	Malvaceae	Shrub/ Biannual or perennial	Single part: Leaves	In a liter of filtered water, leaves are boiled and then gurgled.	Fodder for domestic animals	Single-use: A remedy for throat infections	The informants claim there is no complication.		Hairy Indian mallow is not available in the list of globally vulnerable species but is moderately endangered in the subtropical region.
Achyranthes aspera L. *((A. aspera))* **Kurashiki/** {BOT-KHS-138}	Amaranthaceae	A shrubby, annual or perennial herb.	Multiple parts: Fruits & Leaves	Fresh leaves are infused by boiling fresh leaves in filtered water, and a powder is made by grinding dried fruits.	Dried whole plants are used as fuel and in the fresh state, they are used as a source for making edible products at home.	Multiple uses: Insect bite, Gonorrhea, and Gastrointestinal infections	Allergic reactions	Other uses	The species is not listed on the IUCN Red List but is reported as highly threatened in the region.
Aerva javanica (Burm.f.) Schult. *((A. javanica))* **Buoi booty/** {BOT-KHS-121}	Amaranthaceae	A semi-shrubby, perennial weed.	Single part: Leaves	A powder-like substance is produced by grinding the leaves after drying, which is then sprinkled on half-fried eggs and taken every night before bedtime.	Fodder for pets can be prepared from fresh leaves and dried can be burnt for domestic targets.	Multiple uses: Treats epilepsy and insanity.	The informants claim no complication.	Recipe	Desert cotton is not categorized in any category of threatened flora but is highly vulnerable in the studied area.
Allium sativum L. *((A. sativum))* **Wooga/** {BOT-KHS-19}	Amaryllidaceae	A perennial and flexible annual aromatic plant.	Multiple parts: Leaves & Roots Clove	Two to three garlic cloves are to be taken orally every day, before sunrise,	As a condiment, they are usually eaten raw or cooked	Multiple uses: Traditionally used to treat tooth infections	Skin rash, itching, or respiratory issues.		Garlic is still not reported as a threatened species on the IUCN Red List.

				in the raw state (2-3 days).		and blood disorders.			Also, no major threats were reported because the species is widely cultivated in the region.
Aloe barbadensis Miller *((A. barbadensis))* **Zarpani/** {BOT-KHS-23}	Liliaceae	Herb/ Perennial	Multiple parts: Leaves & Roots	1. In the proposed protocol, the leaf gel and juice are applied to relevant places once before bed, equal to the area of the blemish, or taken orally for 7-12 consecutive days. 2. A paste made of powdered roots is applied externally as needed for up to 1-3 hours depending on what is needed	It is used as an ornamental plant, in cosmetic beverages, and as an ingredient in skin lotions	Multiple uses: Gels for burns, itching, gynecological disorders, and anti-irritant	Photosensitivity		No record was found on the IUCN Red List but found highly threatened in the surveyed region.
Amaranthus blitum L. *((A. blitum))* **Renzaka/** {BOT-KHS-154}	Amaranthaceae	Herb/ Annual	Multiple parts: Leaves, Fruits & Stem	1. The fresh fruits and leaves are pounded into a powdery mixture. The product is then taken orally twice in 24 hours for approximately three weeks. 2. fresh and soft stems are sliced into 3-5 pieces and taken orally daily for two to seven days.	Fresh leaves are used as a vegetable, i.e., SAGG.	Multiple uses: Hypertension, inflammation, and gastrointestinal infections	Dizziness and headache		The global record of the conservation status of threatened flora lacks data but is locally recorded as threatened.
Anagallis arvensis L. *((A. arvensis))* **Gul Har/**	Primulaceae	Herb/ Annual	Single part: Whole plant	The leaves stems, flowers, and roots of the plant are boiled for an hour, then the	After harvest, the whole plant is dried in	Single-use: Used as a traditional narcotic	Drug Dependence or addiction.	Other uses	Due to data deficiency, widespread distribution,

{BOT-KHS-180}				solution is combined with honey wax and can be prescribed orally once or twice a day for 1-2 weeks.	sunny weather and burned.				and lack of threats this plant is not listed on the IUCN Red List, but it faces many threats in the region.
Apteranthes tuberculata (N.E.Br.) Meve & Liede *((A. tuberculata))* **Pawana or Pamana/** {BOT-KHS-71}	Apocynaceae	A perennial herbaceous succulent plant	Single part: Stem (succulent)	Blended with corn flour, the decoction of the succulent stem is taken orally two times a day for its fast-acting properties.	Fruits are used as vegetables, and the juice of leaves is used as an insecticide.	Multiple uses: Therapeutically used as an anticancer and antidiabetic.	The species is reported with no apparent Side Effects at all.	Recipe	The *Caralluma tuberculata* is not recorded on the list of threatened species but is highly threatened in the studied subtropical semiarid region.
Arachis hypogaea L. *((A. hypogaea))* **Moong Phali/** {BOT-KHS-05}	Fabaceae	An annual or perennial leguminous herb	Single part: Legumes	A mixture of seeds, along with seed coats, is grilled in the sand and the seeds are then mixed with carrot roots in clarified butter to form sweet bars. The sweet bars can be fed orally.	The oils extracted from peanuts are edible, and the green leaves are used as green vegetables.	Single-use: As an aphrodisiac, peanuts are regarded as beneficial.	No complexity is claimed after taking this dose.	Recipe	The peanut plant is listed as Least Concern (LC) on the list of threatened species.
Argemone mexicana L. *((A. mexicana))* **Zer Ghat Gul/** {BOT-KHS-187}	Papaveraceae	An annual or perennial herb.	Multiple parts: Roots Latex & Seeds	Inflammatory diseases, warts, and helminthic infections can be treated for three to four weeks by applying 3-6 drops of root extract externally.	The grass is crushed with fresh green leaves of *Argemone mexicana* and used as feed for cattle.	Multiple uses: Antifungal, anthelmintic, wart-repellent, and antimalarial properties are all cited as properties of this species.	No aftereffect is registered.	Other uses	This plant is not reported in any category of the IUCN Red List but threats in the study area are available.
Argyrolobium roseum	Leguminosae	An annual herbaceous plant.	Single part: Leaves	Taking a tablet of herbal extract every day before breakfast,	Nil	Multiple uses: A novel anti-diabetic,	The informants claim no complication.	Part use & recipe	No record was found in the global

(Cambess.) Jaub. & Spach *((A. roseum))* **Bambal/** {BOT-KHS-123}				and with fodder for animals, for about a week can be an effective treatment.		rheumatoid, and anti-malarial drug for treating animals (NIDDM).			conservation position; however, this species is found highly vulnerable in the study area.
Artemisia indica Willd. *((A. indica))* **Matura/** {BOT-KHS-90}	Compositae	Herb/ Perennial	Single part: Whole plant	The dried leaves stem, and fruits are ground into a concentrated solution. A teaspoon of the extract can be consumed twice daily for two to three weeks.	Insect-repellant benefits are obtained from blistered when combined with Peganum harmala and for its use in treating evil eyes.	Multiple uses: Tonic, eye, and head disorders, and anthelmintic properties have been cited as traditional healthcare properties	The informants claim no tricky situation.	Other uses	Indian Wormwood has no data in the list of globally threatened flora. However, it is reported as highly threatened in the studied region.
Asparagus officinalis L. *((A. officinalis))* **Shughai/** {BOT-KHS-03}	Asparagaceae	Herb/ Perennial	Multiple parts: Aerial parts, Bark & Roots	1. By oral route, fresh juvenile twigs are used twice a day in salads. 2. It is consumed orally for three days by taking about three teaspoons of ground bark twice a day. 3. An aqueous extract of fresh roots should be administered orally after 12 hours. A few drops should be added to a glass of water and taken orally.	This plant can be used as both vegetables and ornaments.	Multiple uses: The plant has been used as an anticancer, antimicrobial, and aphrodisiac	The informants claim no complication.		According to the assessment year 2013, Asparagus is classified as Least Concern (LC) globally, and this appraisal evaluated it as threatened in the studied region.
Melia azadirachta Linn. *((A. indica))* **Daraka/** {BOT-KHS-24}	Meliaceae	Tree/Woody (deciduous or semievergreen)	Multiple parts: Seeds, Bark & Leaves	1. Fresh and fragile stems are ground after drying, mixed with coconut water,	This species is mostly grown in home lawns as an	Multiple uses: The most cited disorders include diabetes, colon	Allergic reactions.	Recipe	Neem trees are currently not at risk of extinction and

				and taken by mouth every morning for a week. 2. A poultice is made by boiling 50 g of fresh leaves in water and mixing them with 20 g of corn flour.	ornamental plant.	inflammation, gastrointestinal problems, tumors, and boils.			are listed as Least Concern (LC) on the list of threatened species.
Bacopa monnieri (Linn.) Wettst. *((B. monnieri))* **Werkharra/** {BOT-KHS-160}	Scrophulariaceae	Herb/ Annual or perennial	Single part: Whole plant	The powder is made by roasting fresh young plants in an electric oven and grinding them. The powder can be taken orally as 2-3 teaspoons daily with milk for fast effects in humans or applied to fodder and fed to cattle for 12-48 hours.	Plants can be used for food, fodder, and ornamental plants.	Multiple uses: It is reported that this plant species is associated with asthma, epilepsy, anemia, and nervous disorders among cattle.	Gastrointestinal Disturbances.		The conservation of conservation status of *B. monnieri* is not globally assessed. However, it is recommended as a highly threatened species among the reported taxa in the studied region.
Bauhinia variegata L. *((B. variegata))* **Kulyar/** {BOT-KHS-186}	Leguminosae	Shrub-like tree/ Perennial (partially deciduous)	Multiple parts: Flowers & Bark	1. The flowers in the fresh state are cooked into bread-like pieces and taken orally for fast-acting properties, 1-2 pieces once or twice a day. 2. A mixture of crushed light stem bark and 50 grams of fodder is taken once every 24 hours for 1-2 weeks.	Typically, plants are used as ornamentals, while flowers are used as food.	Multiple uses: Astringent, purgative, and carminative effects have been reported for fresh flowers. Traditionally, stem bark has been used to treat animals with loose motion.	The informants claim no complication.	Recipes and medicinal uses	This herb is not currently included in any category of IUCN Red List data, although the reports show it severely decreasing species as its cultivation is limited to as an ornamental plant.

Brassica nigra W.D.J. Koch *((B. nigra))* **Shersham/** {BOT-KHS-25}	Brassicaceae	Herb/ Annual	Multiple uses: Root & Seed	1. Root extract is used for abdominal problems, taken orally about two to three teaspoons once a day according to the patient's sensitivity. 2. It is recommended to rub rapeseed oil once before bedtime (Dermal) for 1-2 weeks on shattered skin	In addition to being used for cosmetics, oil extraction for hair and massage, and insect repellent, this species can be used in the home for various purposes.	Multiple uses: 1. Extracts from the root's bark are used to treat constipation. 2. A seed oil emollient that reduces itchiness	Hypertension in rare cases.		Due to insufficient data on its conservation status at the global level, the Black Mustard is not categorized on the list of threatened species.
Brassica oleracea L. *((B. oleracea))* **Phool Gobi/** {BOT-KHS-185}	Brassicaceae	Herb (subshrub)/ Biennial	Single part: Flowers	A powder is made from fresh flowers, which is taken twice a week for 38-50 days along with milk.	Vegetables and fodder are used in this plant.	Multiple uses: It is used therapeutically for piles, as an astringent, and diuretic.	The informants claim no complication.	Part use and medicinal uses	It is listed as data deficient (DD).
Brassica villosa subsp. drepanensis (Caruel) Raimondo & P. Mazzola. *((B. drepanensis))* **Gharani Sharsham/** {BOT-KHS-141}	Brassicaceae	Herb/Biennial	Single part: Fleshy roots	A soup-like solution is made by mixing the extracted juice with 25 ml honey and shaking well. The solution is taken orally for approximately 15 days straight.	They are used for soups, stews, fodder, and canola oil cooking	Single-use: Anemia	The informants claim no complication.		This is classified as an Endangered species at the global level and is severely decreasing in the subtropical semiarid region.
Buxus sempervirens L. *((B. sempervirens))* **Shamshad/** {BOT-KHS-92}	Buxaceae	Shrub/ Perennial (Evergreen)	Single part: Stem bark	In the treatment, bark decoctions are used to make the solution, which is applied to the joint twice daily (dermally) for two to five days.	Domestically, this plant can be used to burn and make furniture.	Single-use: Joint pains	Allergic reactions.	Part use and recipe	The Boxwood is categorized as Least Concern (LC) in the list of threatened flora, while recorded as highly threatened in subtropical

									semiarid regions.
Calotropis gigantea (L.) W.T. Aiton *((C. gigantea))* **Madarang/** {BOT-KHS-188}	Apocynaceae	Shrub/ Perennial (Evergreen)	Multiple parts: Roots, Leaves & Flower	1. It is prescribed two or three times per day for 2-3 weeks to mix root extracts with yogurt. 2. Warm the leaves and apply them externally on the chest once before bed, regularly, and for 24 hours at a time. 3. Fresh flowers can ease stomachaches if taken daily with a meal for 3-5 weeks.	Dyes, cordage, larvicidal properties, and mosquito repellents are all possible with the latex of this species.	Multiple uses: 1. Therapeutically used against dysentery besides abdominal tumors. 2. Also, used in medicines against skin diseases and chest pain. 3. Stomach problems	Neurological Effects, i.e., drowsiness, confusion, hallucinations, or seizures.	Recipe	Giant milkweed is not included in the official taxonomic record of IUCN Red data and there are no major threats in the study region.
Calotropis procera (Aiton) Dryand. *((C. procera))* **Spalmai/** {BOT-KHS-28}	Apocynaceae	Shrub/ Perennial (Evergreen)	Single part: Fruits	Fleshy fruits are softened to form a suspension which is taken orally for fast-acting relief.	Dried whole plants can be used for domestic burning.	Multiple uses: Blood purifier, tonic, and diarrhea treatment reported as therapeutic uses	Allergic contact dermatitis, i.e., skin inflammation, redness, itching, or blistering.		This small crown flower is categorized as Least Concern (LC) in the book of Red List data but is sternly shrinking in the studied region.
Cannabis sativa L. *((C. sativa))* **Bang/** {BOT-KHS-143}	Cannabaceae	Herb/ Annual	Multiple uses: Inflorescence, Leaves & Seeds	After the flowers are half-ripened, they are kept in bundles for about two months and then filtered to make powder, which is packaged and taken orally approximately 1-2 teaspoons before meals.	In addition to marijuana, chars are made from dried leaves.	Multiple uses: The drug has various uses, including stimulant, sedative, hallucinogenic, diuretic, and appetizer.	Drug Dependence or addiction.		No data is available in the list of globally threatened flora.

Capparis decidua Edgew. *((C. decidua))* **Kerarha/** {BOT-KHS-30}	Capparaceae	Shrub/ Perennial	Single part: Stem	Peeled fresh and soft stems are taken with dinner in small pieces of 5-9 for 10-15 days.	Berries are used in pickles and woody stems are utilized as a source of fuel.	Multiple uses: In addition to its anthelmintic and antimalarial properties, this species is known to be an effective toothache treatment.	Allergic reactions		Karira is enumerated as Least Concern in the data book of the Red List and moderately threatened in the study area.
Capsella bursa-pastoris Medik. *((C. bursa-pastoris))* **Tony Zale/** {BOT-KHS-158}	Brassicaceae	Herb/ Annual	Single part: Leaves	This traditional remedy is formulated by boiling fresh leaves in water and a particular concentration of sugar and can be prescribed by oral route three times in 24 hours for 3-4 weeks.	This plant can be utilized as cattle feed.	Multiple uses: Traditionally used as an astringent and stimulant.	The informants claim no complication.		Shepherd's Purse is not recorded in the taxonomic list of globally threatened species, and its conservation status is the least concern in the studied area.
Capsicum annuum L. *((C. annuum))* **Mirch/** {BOT-KHS-93}	Solanaceae	Herb/ Annual	Single part: Fruits	Cinnamon is added to a mixture of several fruits and orally administered for 5-8 days for either gargling or ingesting.	Pickles, ketchup, sauces, etc. are a few culinary applications for peppers.	Multiple uses: This species is highly quoted for the treatment of paralysis and scarlet fever.	The informants claim no complication.		Chili Pepper is registered as Least Concern (LC) by the IUCN in the book of Red List data and is not considered as threatened in the study area.
Carthamus oxyacantha M. Bieb. *((C. oxyacantha))* **Speen azghai/** {BOT-KHS-137}	Compositae	Spiny-leaved annual herb	Single part: Leaves	After collecting fresh leaves dry them and boiled in a pot with milk and sugar to make a concentrated mixture, which is taken in 2-3 tsps two times in 24 hours for 10-12 weeks.	Seed oil can be used for various domestic purposes.	Multiple uses: A traditional treatment for jaundice and skin infections.	Not to be used during pregnancy or breastfeeding.	Recipe	According to the assessment 2019, *C. oxyacantha* is registered as a Data Deficient (DD) species, while it is found moderately

									threatened in the study area.
Celtis sinensis Pers. *((C. sinensis))* **Tagha/** {BOT-KHS-136}	Cannabaceae	Deciduous perennial tree	Single part: Bark	After peeling the bark from fresh stems boiled in water to make a simmer mixture. It is sprayed on hay two times in sunlight for hours for cattle.	The woody stem can be used in furniture and burning.	Single-use: Veterinary abdominal problems.	The informants claim no complication.	Part use, recipe, and medicinal uses.	Japanese Hackberry was recently categorized as Least Concern (LC) in the 2018 in the list of endangered species.
Cenchrus ciliaris L. *((C. ciliaris))* **Gharani wakha/** {BOT-KHS-183}	Poaceae	Grassy perennial herb	Single part: Leaves	For approximately 25 days, 2-3 drops of the decoction are taken orally every day, after the leaves have been brewed in a closed container for 7 weeks.	Traditionally used as fodder and for making hand-fans, handicrafts, and mats in the home.	Multiple uses: diarrhea and vomiting	Allergic contact dermatitis, i.e., skin redness, itching, or blistering.		Buffel grass is classified as Least Concern (LC) in the global taxonomic record of threatened flora and is found to be an extremely declining species in the study area.
Cenchrus setosus subsp. setosus ((C. setosus subsp. setosus)) **Babar wakha/** {BOT-KHS-184}	Poaceae	Grassy perennial herb	Single part: Rhizome	After chopping the rhizomes into slices, they are mixed with powdered Dambara seeds and canned for 2-3 months. They are then taken orally for a period of one to fifteen days at a dose of 1/3 to 1 teaspoon every day.	Also used as a decorative plant, this species provides fodder.	Multiple uses: used locally as a stomach stimulant and to heal skin conditions.	The informants claim no complication.	Part use and recipe	There is no record of missiongrass in the data book Red List endangered species, while found highly threatened in the subtropical semiarid region.
Citrullus colocynthis (L.) Schrad. *((C. colocynthis))* **Tarkha manra/**	Cucurbitaceae	A perennial climber	Multiple parts: Fruits & Seeds	Fruits and seeds are crumpled in a container and cleaned using cotton-made paper.	Nil	Multiple uses: traditionally used as abortifacient and cathartic.	Changes in blood pressure.	Medicinal uses	The Abu Jahl's melon is still not registered in the data book of

{BOT-KHS-5}				The resultant mixture of about 5 ml is introduced into a cutaneal blood vessel for instant action.					endangered species but highly vulnerable in the studied area.
Citrullus lanatus (Thunb.) Matsum. & Nakai *((C. lanatus))* **Andwra/** {BOT-KHS-144}	Cucurbitaceae	Climber/ Annual	Single part: Fleshy fruits	The soft, fleshy, and bitter rind is an oral prescription for one or two weeks, it is ground in a container and taken twice a day.	Succulent pods of watermelon are edible, and the bark or exocarp of fruit is used as fodder for cattle.	Multiple uses: Laxatives and nose bleeding	The informants claim no complication.		Besides globally cultivated vining vegetables, watermelon has no record in the data book of threatened species.
Citrus aurantium (L.) *((C. aurantium))* **Sangtara/** {BOT-KHS-35}	Rutaceae	Shrub/ Perennial	Single part: Leaves	A solution of orange fruits is prepared by grinding and juicing the fruit along with seeds and rind. The solution is taken orally for two to five days, after a gap of 24 hours.	Juicy and citrus fruits are used as fruits.	Single-use: Medicinally used for cooling effects.	The informants claim no complication.		No data is available on the IUCN and no threats in the region.
Cleome brachycarpa M. Vahl-ex-Triana & Planchon *((C. brachycarpa))* **Kari wala/** {BOT-KHS-131}	Cleomaceae	Herb (Subshrub)/ Annual	Single part: Fruits	Adding fresh fruit extract to bath water and soaking the injured part in it for 15-40 minutes once a day is effective.	Fresh plants are fed to cattle as fodder.	Single-use: An ointment with the healing properties of this plant can be used on wounds and injuries.	The informants claim no complication.	Recipe	Short-fruited Spider Flower is enumerated as Near Threatened (NT) in the data set of highly vulnerable species and close to qualifying for Vulnerable status in the study area.
Convolvulus arvensis L. *((C. arvensis))*	Convolvulaceae	Climber (Herb)/ Perennial	Multiple parts: Roots & Flower	1. Bindweed leaves are dried and mixed with a powder-like		Multiple uses: 1. Diuretic properties and	The informants claim no complication.	Recipe	There is no record found in the data book

Parvata/ {BOT-KHS-36}				substance of mint that is taken twice a day with water for two to three weeks. 2. In addition to being used as a wound cleanser, a half-cup of fresh flower tea is prescribed twice a day for 1-2 weeks to alleviate fevers.		treatment of gastrointestinal disorders have been associated with this plant. 2. Reported for its astringent and laxative properties.			of threatened species, however, it is widely used in the study area.
Cucumis sativus L. *((C. sativus))* **Badrang/** {BOT-KHS-41}	Cucurbitaceae	Climber/ Annual	Single part: Fruits	Fresh fruits are ground and juiced into a solution in milk, and 2-3 tsps are prescribed once a daytime for about a week after a gap of 24 hours.	Fruits are globally consumed as vegetables.	Single-use: Cooling effects are provided by the juice of this species.	The informants claim no complication.		No data is available on the IUCN Red List.
Cucurbita melopepo var. fraterna (L.H. Bailey) G.L. Nesom. *((C. fraterna))* **Gharani Kadoo/** {BOT-KHS-56}	Cucurbitaceae	Climber/ Annual	Single part: Fruits	It is best to peel and slice fresh fruits, boil them in water, and mix them with milk, peanuts, walnuts, and dried currants to make jam and preserves. Add about one and a half tsps in 0.24 L of milk and mix it completely. This can be used orally one time in 24 hours one hour before a meal.	Fruits are used as vegetables and in the preparation of confectioneries.	Multiple uses: Traditionally used as a brain stimulant, it also induces hormone secretion.	The informants claim no complication.	Recipe	This wild subspecies is registered as Near Threatened species in the list and is severely declining in the subtropical semiarid region.
Cuscuta reflexa Roxb. *((C. reflexa))* **Akas Bill/** {BOT-KHS-38}	Convolvulaceae	Herb/ Perennial	Single part: Whole plant	After drying fresh leaves simmered in rainwater to form a decoction. The decoction is then blended in pure	Ashes are used for hair removal in female pubic hair.	Single-use: Used to treat skin disorders.	The informants claim no complication.	Other uses	The giant dodder is registered as Least Concern (LC) in the list of globally

				honey and applied to blemish areas once a day for 15 days.					threatened flora and is highly exposed to extinction in the study area.
Cymbopogon citratus (DC.) Stapf *((C. citratus))* **Sharr/** {BOT-KHS-146}	Poaceae	Herb/Perennial	Single part: Roots	Fresh roots of this grass are dried in a shady place for about 7 weeks. Minced the dried roots to create a fine and dry powder. Then mix with barleycorn powder in camel milk. The recommended amount of medicine is about 1 to $1\frac{1}{2}$ per day after meal for about 15 consecutive days.	Women in homes use dried grasses in several types of handicrafts.	Multiple uses: Medicinally used as an analgesic and for the treatment of diarrhea.	The informants claim no complication.	Recipe	Lemongrass has no category in the list of globally threatened flora but is highly threatened in the subtropical semiarid region.
Cymbopogon flexuosus (Nees ex Steud.) Will. Watson *((C. flexuosus))* **Dadan/** {BOT-KHS-117}	Poaceae	A perennial grassy herb	Single part: Inflorescence	It is applied once before bedtime for 1-2 months to the area of the head where hair is lost with a decoction made from green, fresh leaves paired with olive oil and egg yolk.	Both fresh as well as dried grasses are used as fodder and in other handicrafts.	Single-use: This species is highly recommended for the treatment of alopecia (Hair loss).	Respiratory Effects.		Cochin grass is not classified in any category of endangered flora but is highly threatened in the subtropical semiarid region.
Cynodon dactylon (L.) Pers. *((C. dactylon))* **Brava/** {BOT-KHS-07}	Poaceae	A perennial grassy herb	Single part: Inflorescence	Fresh blooms of this grass are mashed, powdered, mixed in mustard oil, and applied to the area with infection.	The straw of this grass is used for thatching needs.	Single-use: Medicinally used to cure rash-affected areas.	The informants claim no complication.	Recipe	Not evaluated in the list of vulnerable flora and moderately threatened in the study area.
Cyperus rotundus L. *((C. rotundus))*	Cyperaceae	A perennial grassy herb	Multiple parts: Rhizome &	1. The fresh rhizomes are dried and chopped, and	Fresh as well as dried plants are used as fodder,	Multiple uses: Fever reducing,	The informants claim no complication.	Recipe (s)	The global taxonomic record of

Brag wakha/ {BOT-KHS-150}			Young aerial parts	half a cup of tea is made from rhizome powder and taken once a day for 24-48 hours after the rhizomes have been eradicated. 2. A fragrant smoke is produced by lightly igniting dried aerial parts along with coriander before bedtime.	and dried plants may be used for burning purposes.	and respiratory disorders			threatened flora has no record for Java grass in the list of threatened flora but is severely declining in the study region.
Dalbergia sissoo DC. *((D. sissoo))* **Shawwana/** {BOT-KHS-44}	Leguminosae	A perennial small tree.	Multiple parts: Leaves & Bark	Fresh and green leaf extracts and stem bark are blended with sweet corn oil and applied topically to the injured skin in concentrations of 50-100 ml twice a day for 2-3 weeks.	It can be used as a source of fuel wood, timber, toothbrush, and shade trees along roadsides.	Multiple uses: Treatment for itchiness and other skin disorders.	The informants claim no complication.		The shisham is registered as Least Concern (LC) in the global taxonomic record of threatened flora and is an extremely shrinking species in a subtropical semiarid zone.
Datura stramonium L. *((D. stramonium))* **Torah/** {BOT-KHS-43}	Solanaceae	An annual or perennial herb	Multiple parts: Leaves, Fruits & Seeds	Simply green dried leaves are chopped into small sticks and then smoldered in ciggies earlier go to sleep two times a week for about two months.	Green and fleshy leaves are warmed and used as polyester.	Multiple uses: Medicinally used as a narcotic, for the treatment of earache and old-age rheumatism.	Skin rash, itching, or respiratory issues.		No record is found in the global taxonomic list of threatened flora data, but there are severely declining species in the study zone.
Delphinium uncinatum Hook. f. & Thomson	Ranunculaceae	A perennial herb	Single part: Aerial parts	Young twigs and green fresh leaves are simmered in one	Domestically used as fodder.	Single-use: Therapeutically used for the	The informants claim no complication.	Recipe and	This species is not assessed although

((D. uncinatum)) **Tora jelma/** {BOT-KHS-182}				litter of filtered water for 30-45 minutes, then squeezed through a cotton sheet, mixed with butter, and given in doses of 2-3 teaspoons twice daily for 2-5 days.		treatment of Menstrual diseases.		medicinal uses.	larkspur is globally close to extinction. The species was reported highly vulnerable in the studied subtropical semiarid region
Dianthus anatolicus Boiss. *((D. anatolicus))* **Karaka/** {BOT-KHS-119}	Caryophyllaceae	A perennial herb	Single part: Leaves	Fresh leaves of Anatolian Pink boiled in the water of coconut along with mint extracts and then inhaled in the form of steam through a straw/pipe every 4 hours.	The whole plant is crushed with wheat straw and used as fodder.	Single-use: Therapeutically used to treat respiratory diseases.	The informants claim no complication.		Turkish Pink is not registered in any category of the IUCN Red List data; however, the present finding claims its high vulnerability.
Dianthus deltoides L. *((D. deltoides))* **Enatoli/** {BOT-KHS-118}	Caryophyllaceae	An evergreen perennial herb.	Single part: Whole plant	The plant as a whole is dried, crushed, and chemically repaired with millet flour after drying in shadow and crushing. The mixture is then taken orally about 2-3 tsps two times a day for about half a month.	Fuel and fodder uses are the domestic use.	Single-use: Anthelmintic	The informants claim no complication.	Medicinal uses	Maiden Pink has no category of global vulnerability assessment; however, the present findings indicate that it faces significant threats within the area.
Digera muricata (L.) Mart. *((D. muricata))* **Tandola/** {BOT-KHS-181}	Amaranthaceae	Herb/Annual	Multiple parts: Leaves & Young shoots	The leaves and young twigs are crumpled and cooked in mineral water to make a suspension. 1-2 teaspoons of the solution are taken once a day, orally, for 5-9 days for bowel complaints.	Used in the home as fodder, food, and vegetables.	Multiple uses: Medicinal uses include astringent, diuretic, and antifungal.	The informants claim no complication.		No record is available in the book of Red List data and highly vulnerable in the study area.

Dodonaea viscosa (L.) Jacq. *((D. viscosa))* **Zerawana/** {BOT-KHS-132}	Sapindaceae	Shrub/ Annual or perennial (evergreen)	Multiple parts: Leaves, Stem & Fruits	1. Fresh and green leaves are used to heal wounds by warming them and applying them to injured parts of the body twice a day for 36 hours a day. 2. The hairy stem is burned with a low flame and high smoke and the smoke is collected into the hollow leaf stalk of Kadoo (pumpkin), which is then inhaled through the nasal cavity for a period of four to five days. 3. It is recommended to cook fresh fruits in rainwater and then mix in fig milk to prepare a gel-like mixture and add 1-2 teaspoons to a cup of tea once a day orally for three weeks.	Plants are burned as fuel, and the ashes of plants are used as a means of removing hair (pubic hair) for females.	Multiple uses: Leaves are recommended for healing wounds. Hairy stem extracts are cited for their inflammatory, toothache, and muscle-healing properties. Fruits are laxative.	The informants claim no complication.	Other uses	Sticky hop bush is registered as Least Concern (LC) in the Book of Threatened Species and moderately endangered in the studied region.
Drosera rotundifolia L. *((D. rotundifolia))* **Kheroba/** {BOT-KHS-179}	Droseraceae	Shrub/ Perennial	Single part: Leaves	It is applied once a day to the skin externally for three to ten days, after crushing fresh leaves and making a paste from them.	It can be used as fodder for domestic animals.	Multiple uses: Leaves are quoted for their medicinal properties and are used against itching, pimples, and boils.	The informants claim no complication.		Roundleaf sundew is registered as Least Concern (LC) in the book of Red List data and is moderately vulnerable in subtropical

									semiarid regions.
Echinops echinatus Roxb. *((E. echinatus))* **Silaba/** {BOT-KHS-133}	Compositae	Herb Annual	Single part: Seeds	A powdered blend of ripe seeds and shadow-dried seedlings are produced and then mixed with peppermint and mint extracts and taken every day for 1-2 weeks.	Plants are burned when they are dried.	Single-use: Renal disorders	The informants claim no complication.		No record is available in the book of Red List data and is highly vulnerable in semiarid subtropical regions.
Ehretia setosa Roxb. *((E. setosa))* **Jonjoona/** {BOT-KHS-148}	Boraginaceae	Tree/ Perennial	Single part: Root Bark	After being dried and peeled, the bark of the root is ground and treated with fine filter paper. 15 grams of the ground bark powder is mixed with flower juice and apricot seed flour and taken orally approximately 20 grams once a day for 2-3 months.	Handicrafts made from stem bark and leaves are used locally as fodder.	Single uses: Highly recommended for the treatment of venereal diseases (STDs).	The informants claim no complication.	Other uses	No record is available in the book of Red List data and is highly vulnerable in semiarid subtropical regions.
Eucalyptus camaldulensis Dehnh. *((E. camaldulensis))* **Lachai/** {BOT-KHS-49}	Myrtaceae	A perennial evergreen tall tree	Single part: Leaves	The poultice of fresh leaves is applied externally to infected (injured) parts once a day after 48 hours with sanitation dermal for 1-2 days to stimulate the immune system.	Nectar from fresh flowers is used in perfumes, and stem bark is used as a thatch for roofing.	Multiple uses: Medicinally this species is used as an antiseptic and aseptic.	The informants claim no complication.	Other uses	River Red Gum is categorized as Near Threatened (NT) in the list of globally threatened flora and moderately endangered in the region.
Euphorbia hirta L. *((E. hirta))* **Chapa tray/** {BOT-KHS-172}	Euphorbiaceae	Annual herbaceous weed	Multiple parts: Whole plant, Leaves & Roots	1. Aqueous extracts of fresh leaves, twigs, and stems are taken with milk twice daily along	Used as fodder.	Multiple uses: Traditionally used to treat gynecological disorders,	The informants claim no complication.		The asthma plant is not registered in any category in the list of

				with 2-3 teaspoons of ashes of olive stems for 1-15 days. 2. As a poultice, warm leaves are applied externally twice daily for 1-2 weeks in a hygienic environment. 3. After drying and mounded, fresh leaves are boiled with turmeric and coconut oil for approximately 30 minutes and polished on itchy skin once before bed every night for 20 to 34 hours.		gonorrhea, boils, pimples, gastrointestinal infections, itching, and skin diseases.			threatened flora but is highly endangered in subtropical semiarid zones.
Euphorbia serrata L. *((E. serrata))* **Doodak/** {BOT-KHS-159}	Euphorbiaceae	A perennial herbaceous weed	Multiple parts: Root & Stem	1. A powdered form of fresh and dried roots is taken as an anthelmintic twice daily by mouth. 2. Sliced stems are boiled for 60 minutes in chilly water and filtered through a coarse sheet. After 24 hours, 1-2 teaspoons are taken with cold milk.	Nil	Multiple uses: Medicinally used as anthelmintic, anticholera, and for the treatment of constipation.	Skin inflammation, redness, itching, or blistering.	Recipe	Tintern spurge is not registered in any category in the list of threatened flora but is moderately endangered in the subtropical semiarid zone.
Ficus drupacea Thunb. *((F. drupacea))* **Inzer/** {BOT-KHS-52}	Moraceae	A woody evergreen Tree/	Multiple parts: Fruits & Leaves	1. The intake of fresh or dried fruits is directly used as a laxative in constipation, taking at least five dried fruits on an empty	Utilized as food, fuel, fodder, and agricultural tools on a domestic level.	Multiple uses: Ripened fruits are considered natural laxatives. Milky substance from green leaves is used as	The informants claim no complication.		*F. drupacea* is recorded as Least Concern (LC) in the book of Red List data and is highly vulnerable in

				stomach for 15 to 24 hours. 2. Milky extract from leaves is mixed with a mixture of butter, fennel, and cardamom and is prescribed orally in 24 hours for 2-3 weeks with green tea.		a traditional remedy for brain tumors.			the studied region.
Ficus populifolia Vahl *((F. populifolia))* **Peepal/** {BOT-KHS-157}	Moraceae	Tree/ Perennial	Single part: Leaves	To treat damaged skin, powdered green, and dried aerial parts are dissolved in water and applied externally twice daily for about a week for about a week.	The hard woody stem is domestically used in musical instruments, furniture, and infrastructures.	Single-use: Domestically used to treat animal diseases.	Skin inflammation, redness, itching.	Recipe	Poplar Fig is registered as Least Concern (LC) in the list of threatened flora by IUCN and is reported as extremely vulnerable in the studied region.
Forsskaolea tenacissima L. *((F. tenacissima))* **Khar Gul/** {BOT-KHS-114}	Urticaceae	Herb/ Annual	Single part: Whole plant	Drying and grinding the entire plant in the shade is the key to their fast effectiveness. About 2 tsps of fine dry particles are prescribed after half an hour of eating a meal to get the benefits.	Green and fresh plants were reported to be used as fodder.	Single-use: Medicinally cited as a traditional drug for gastrointestinal disorders.	The informants claim no complication.		The chamaephyte is not labeled in any category of threatened flora but is highly threatened in the study region.
Glycyrrhiza glabra L. *((G. glabra))* **Khoga wali/** {BOT-KHS-167}	Leguminosae	Shrub/ Perennial	Single part: Root	After drying and boiling the roots for half an hour, they are passed through a coarse sheet to eliminate unwanted materials, and then taken orally	Cattle feed can be prepared from leaves and stems can be as fuel.	Multiple uses: Traditional medicines as a tonic, stomach-ache reducer, and hepatoprotective	The informants claim no complication.		*G. glabra* is registered as the Least Concern in the list of threatened flora and moderately

				approximately 2-3 teaspoons after meals twice a day for one to two months.					vulnerable in subtropical semiarid regions.
Grewia optiva J.R.Drumm. ex Burret *((G. optiva))* **Postawana/** {BOT-KHS-145}	Malvaceae	A deciduous perennial woody shrub	Multiple parts: Bark & Leaves	1. A paste-like substance is made from bark powder, barley flour, and water and takes 2-3 teaspoons every night between bedtime and wake-up time for 1-2 months. 2. Animals are directly given fresh leaves when needed, especially during delivery and childbirth, for quick discharge, usually 20-25 g once every 2-3 hours.	In traditional ropes, the bark is detached from stems and made into fiber.	Multiple uses: Traditional uses include astringent, analgesic, a treatment for disorders of sexual desire, and ease in labor pain.	Respiratory Effects.	Recipe, other uses, and medicinal uses.	No data is available in the list of threatened flora but severely declining in the region.
Gymnosporia royleana Wall. ex M.A. Lawson *((G. royleana))* **Kanjghara/** {BOT-KHS-124}	Celastraceae	A spiny perennial shrub	Multiple parts: Leaves & Stem bark	Boiling fresh leaves and young twigs in water for about 30 minutes and shaking over *Capsicum annuum* and *Momordica charantia* combination of 3-4 teaspoons a day for about a week is the traditional method.	Domestically used as fodder and a source of fuel.	Single-use: Traditionally used as an antibacterial.	The informants claim no complication.	Recipe	The species is not evaluated for its conservation status in the book of Red List data and is found highly endangered in the study area.

Gymnosporia wallichiana (Spreng.) M.A. Lawson *((G. wallichiana))* **Barbara/** {BOT-KHS-125}	Celastraceae	A hardy, evergreen perennial shrub	Single part: Roots	An herbal remedy based on roots that are collected in winter, dried, cleaned, fried in clarified butter, ground up into chocolate, and taken about half an hour before sexual activity for fast-acting effects.	Used as fodder, a source of fuel, and for infrastructure activities.	Single-use: Domestically used as an aphrodisiac.	The informants claim no complication.	Recipe and medicinal uses	*Maytenus wallichiana* is not evaluated in the list of vulnerable flora and is highly threatened in the study area.
Helianthus annuus L. *((H. annuus))* **Meerastarga Gul/** {BOT-KHS-04}	Asteraceae	A tall, fast-growing annual herb	Multiple parts: Bark, Leaves & Flower head	1. Decoction can be prepared by steaming fresh leaves along with sugar and water. Two cups of decoction are recommended two times a day. 2. In addition, a paste-like jell is produced from fresh leaves by grinding them in a mortar and pestle and used as topical medications for sores, boils, and swellings for 2-3 days. 3. Traditionally, edible oils and ripe seeds are used as dry fruits in the treatment of skin disorders. 4. Drink the tea once or twice a day for a couple of weeks on an empty stomach,	Oil extracted from the seeds is edible, and Roasted seeds are used as dry fruits.	Multiple uses: The leaves are used as an expectorant, a diuretic, an antimicrobial, and a lung-disease drug.	The informants claim no complication.	Recipe	The global taxonomic documentary has included sunflower in the category of Least Concern (LC) flora while the present findings recommend it as moderately exposed in the subtropical local hotspots.

				made from fresh flowers and 2-3 teaspoons of water.				
Himalaiella heteromalla (D. Don) Raab-Straube *((H. heteromalla))* **Beral mana/** {BOT-KHS-129}	Asteraceae	Herb/ Annual	Multiple parts: Fruits & Leaves	1. Dry fruit powder can be used as a transient astringent two to three times daily for a period of two to three weeks. 2. Approximately one and a half teaspoons of powder are taken orally for a week consecutively after drying fresh leaves and grinding them.	In addition to the edible fruits, fresh leaves can be used as fodder, and the woody stems are used for firewood.	Multiple uses: It is used for skin disorders and as an astringent in medicine	The informants claim no complication.		Himalayan Thornless Thistle is being enlisted as not endangered or Least Concerned (LC) in the list of globally vulnerable flora by the IUCN and is reported extremely vulnerable in the studied region.
Indigofera heterantha Wall. ex-Brandis *((I. heterantha))* **Gul-e-Lalma/** {BOT-KHS-153}	Leguminosae	Shrub/ Perennial woody (deciduous)	Single part: Flowers	This remedy is made by thoroughly detaching leaves from flowers and cooking them in water to make a homogenous mixture. About ½ tsps are then added to mineral water and taken per 24 hours before sleeping for two to three weeks.	Young twigs are used to build baskets and bridges while dry woody stems are used as fuel.	Single-use: Traditionally used as a tonic.	The informants claim no complication.		Himalayan Indigo is recorded as Least Concern in verified documents of threatened flora and severely endangered in the studied local hotspots
Inula britannica M. Bieb. *((I. britannica))* **Sanya-gul/** {BOT-KHS-171}	Asteraceae	Herb/ Perennial	Single part: Roots	Fresh roots are ground into a powder-like substance and sprinkled on salads once a day for 24-48 hours, followed by oral intake.	Fodder for cattle is made from fresh leaves.	Single-use: Traditionally used for stomach aches.	The informants claim no complication.		British Yellowhead has no record in the list of globally threatened flora but is highly threatened in the study area.

Jatropha curcas L. *((J. curcas))* **Jamala/** {BOT-KHS-170}	Euphorbiaceae	Shrub/ Perennial (Deciduous)	Single part: Bark (stem)	The peeled bark is mounded in a juicer and extracted to produce an extract containing a broad spectrum, which is then taken orally approximately 30 g once or twice a day for seven to sixteen days.	As well as being edible, oil from seeds can be consumed in the factories of soaps, candles, detergents, etc.	Single-use: Medicinally reported as antimicrobial.	The informants claim no complication.	Recipe and medicinal uses	Barbados nut is registered as Least Concern (LC) in the list of threatened flora by IUCN and is reported as moderately vulnerable in the studied region.
Juglans regia L. *((J. regia))* **Ghowaz/** {BOT-KHS-55}	Juglandaceae	Tree/ Woody (Deciduous)	Multiple parts: Bark & Leaves	1. A fresh stem bark extract (20 mL) is mixed with peanut flour (35 g) and currants (25 g) and taken orally 10-20 g once a day with green tea. 2. A decoction of fresh and green leaves, sprinkled and mixed with wheat straw, and administered twice a day for 2-3 hours is all that is needed.	The bark of the roots is used as Dandasa (tooth-cleaner), while the kernel is edible, and used for dyes, furniture, lubricants, and other things.	Multiple uses: Traditionally used in gastrointestinal problems and colic diseases of cattle.	The informants claim no complexity.		Wall-nut is registered as Least Concern (LC) in the list of threatened flora by IUCN and is reported as severely vulnerable in the studied region.
Justicia adhatoda L. *((J. adhatoda))* **Baza/** {BOT-KHS-140}	Acanthaceae	Shrub/ Perennial (Evergreen)	Multiple parts: Leaves, Roots, Flowers & Stem bark	1. Extracts from fresh leaves are combined with a solution of wheat flour, mulberry juice, and mustard oil and administered to the body for 1-2 weeks regularly by taking 2 teaspoons thrice a day. 2. Using fresh roots, a paste-like product is made and applied	The entire plant serves as a source of fuel for a variety of applications.	Multiple uses: Traditionally this species is highly recommended as an expectorant, antimicrobial, antispasmodic, natural remedy for respiratory disorders, rheumatism, peptic ulcers,	The informants claim no complexity.	Recipe	Malabar nut is categorized as Least Concern (LC) in the list of endangered flora and moderately vulnerable in the study area.

				for 3-6 hours externally to wound parts once a day. 3. A cup of nectar from fresh white flowers is collected in the summer, then mixed with 50 grams of honey, and taken with breakfast for 1-2 weeks. 4. An extract is made by peeling the bark from the stem, bathing it in olive oil for 15 minutes, mixing it in an electric juicer, and consuming about half a teaspoon daily in warm water for two to six days.		and nose-bleeding.			
Lantana camara L. *((L. camara))* **Camar Gul/** {BOT-KHS-99}	Verbenaceae	Herb/Annual	Multiple parts: Leaves & Fruits	A decoction is made by boiling leaves and half-ripened fruits together and prescribed orally for two weeks twice a day.	It can be used in gardens, lawns, schools, and offices as an ornamental and aesthetic plant.	Multiple uses: Mouth sores, odontalgia, and gastral problems.	The informants claim no complication.		This model plant species is not listed on endangered flora and is considered less vulnerable in the subtropical region.
Launaea arborescens (Batt.) Murb. *((L. arborescens))* **Mazghakai gulona/** {BOT-KHS-168}	Asteraceae	Herb/ Annual	Multiple parts: Leaves & Roots	A concentrated solution is grinding dried leaves and roots together and mixing them with honey, which can be rubbed over the skin or taken orally two times in 24 hours for about a week.	Whole plants are dried and used for fuel.	Multiple uses: The species is used medicinally for pain relief and as a local remedy for skin disorders, including itching, sores, and boils.	The informants claim no complexity.		Gum Plants are not categorized in the data book of the IUCN Red List but are found highly vulnerable in the studied area.

Lomelosia olivieri (Coult.) Greuter & Burdet *((L. olivieri))* **Kharr Botti/** {BOT-KHS-128}	Caprifoliaceae	Herb/ Ephemeral	Multiple parts: Leaves, Roots & Flowers	1. Fresh leaves along with floral buds are sliced and mixed with forage twice a day and taken one dose of approximately 50 g orally for 24 hours. 2. A broth of fresh bark of root can be orally administered once a day for 3-8 days.	Dried bundles of plants can be the best resource of fuel.	Multiple uses: Dairy cow diseases, diarrhea, and dysentery	Allergic reactions.		Olivier's Spiderwort is not registered in any class of vulnerability assessment and is not threatened in the study region.
Malva neglecta Wallr. *((M. neglecta))* **Pandeerak/** {BOT-KHS-113}	Malvaceae	Herb/ Annual	Multiple parts: Leaves & Roots	The leaves, along with red chili, garlic, and onion, are cooked in water and taken orally, 50-80 g a day, for 3-4 weeks.	The leaves and stems of young plants are used in salads and other culinary preparations.	Multiple uses: It is used as an astringent, laxative, and urine inducer in medicine	The informants claim no complexity.		Common mallow is registered with no major threats (LC) in the list of vulnerable flora and moderately threatened in the study area.
Mentha arvensis L. *((M. arvensis))* **Weelanai/** {BOT-KHS-58}	Lamiaceae	Herb/Perennial	Multiple parts: Leaves, young twigs, Seeds & Flowers	Coconut oil is added to raw leaves and ground into a coarse paste. Wild mint oil is interspersed in oil obtained from *Eruca vesicaria* and taken orally or directly to rash skin for three to four hours.	Fodder, Vegetables, Cosmetics, Drinks, Bubble gum, Creams (toothpaste)	Multiple uses: It is commonly used as an appetizer and as a remedy for skin and gastrointestinal disorders.	The informants claim no complexity.	Recipe	The global taxonomical list of endangered flora has included Corn mint into a category of Least Concern (LC) in the list of threatened flora and highly threatened in the study area.
Momordica charantia L. *((M. charantia))* **Karela/** {BOT-KHS-57}	Cucurbitaceae	Climber/ Annual	Single part: Fruits (immature)	The juice from fruits is squeezed using a juicer machine and consumed once daily for about two weeks	Bitter gourd, along with tomato, and onion are all delicious	Multiple uses: Traditional uses include antibiotics, antimalarials,	Hypoglycemia, i.e., dizziness, weakness, and confusion.		No data is available on the IUCN Red List but found low

Nannorrhops ritchieana (Griff.) Aitch. *((N. ritchieana))* **Mazara/** {BOT-KHS-149}	Arecaceae	Shrubs like climbing palms or small trees/ Perennial	Single part: Leaves	depending on the patient's condition. It is recommended to use 3-5 drops of the extract of green leaves directly in a glass of water or milk when necessary.	ingredients for cooking. In addition to edible fruit, leaves are also used for mats, baskets, and handmade fans.	and diabetes medicine. Single-use: Highly recommended traditional drug for gastroenteritis.	The informants claim no complexity.		threats in the studied area. The IUCN Red List has no official assessment record on the conservation status of *Nannorrhops ritchieana*, however, it is found on the verge of extinction in the study area.
Nanorrhinum ramosissimum (Wall.) Betsche *((N. ramosissimum))* **Zebula/** {BOT-KHS-130}	Plantaginaceae	Herb/ Perennial	Single part: Whole plant	Plants are dried in artificial shade for about one and half months, then pounded into a powder and taken orally for one to seventeen days with two teaspoons of honey per glass of water.	Plants can serve as fodder if they are fresh and green.	Multiple uses: Therapeutically used as an antipyretic and analgesic.	Skin inflammation.	Recipe	No data was found for Betsche in the book Red List Data and highly vulnerable in the subtropical semiarid region.
Olea europaea subsp. cuspidata (Wall. & G. Don) Cif. *((O. cuspidata))* **Gharani Khawan/** {BOT-KHS-63}	Oleaceae	Tree/ Woody (Evergreen)	Multiple parts: Leaves, Bark & Fruits	1. Decoctions (tea) are made by boiling fresh leaves and young twigs in water and are taken by oral cavity two times in 24 hours for about a week. 2. After peeling and drying the bark under shade, it is ground into a powder and taken once a day with milk.	The leaves are used as fodder, while the stems serve as fuel, furniture, and infrastructure.	Multiple uses: It has been reported to be highly effective for treating cough, cold, flu, diabetes, and anemia in all hotspot sites.	Dizziness, weakness, and confusion.	Medicinal uses	Not listed in the list of threatened species but highly endangered in the study region.

				3. Fresh fruits without seeds are pressed in a juice extractor and taken in half a teacup of juice once a day, orally, for 1-15 days.				
Oxalis corniculata L. *((O. corniculata))* **Tak matak/** {BOT-KHS-142}	Oxalidaceae	Herb/ Annual	Multiple parts: Leaves, Roots & Flower	1. Dried fresh leaves are combined with tobacco leaves to create cigarettes, which are then smoked. For respiratory issues, they must be taken orally for 1-2 weeks in a variety of bitter-tasting concoctions, while arthritis and blood illnesses call for half a month. 2. In Chatni, fresh floral leaves are combined with mint and powdered before being shaped into rounder shapes resembling tablets. For respiratory issues, take 1-2 tablets orally, three times a day, for 1-2 weeks; for arthritis and blood diseases, take them for half a month.	Along with wheat straw whole fresh herb is chopped and mixed in fodder and other gastronomic uses.	Multiple uses: Medicinally reported for the treatment of respiratory difficulties, nausea, joint pain, and hemorrhage.	The informants claim no complexity.	Recipe and medicinal uses	Creeping Woodsorrel has no record in the list of threatened species; although it is severely declining in the study area.
Peganum harmala L. *((P. harmala))* **Speelana/** {BOT-KHS-67}	Nitrariaceae	A perennial, herbaceous wild plant with a woody	Multiple parts: Roots & Seeds	1. Dried, fresh roots are ground into a powder-like substance, and the residue is used	The whole dried plant is strung and hung in homes to protect	Multiple uses: Medicinally used as an anthelmintic and for skin disorders	Respiratory abnormalities.	Other uses	Wild rue has no record in the list of globally threatened species and is

		underground stem		externally on blemished skin while the precipitate is rushed in olive oil for external application. 2. Ripe seeds are hammered in a chopper to make a powdery substance and taken approximately 2 tsps once in 24 hours orally for 15 days.	against evil eyes (devil's spirits) and is used as a snake repellent.				highly threatened in the subtropical semiarid region of district Kohat.
Periploca aphylla Decne. *((P. aphylla))* **Birara/** {BOT-KHS-169}	Apocynaceae	Leafless, perennial Silkflower Shrub	Multiple parts: Leaves & Pods	1. A decoction made from soft and delicate leaves is used as a tea for 1 to 5 months with 2-3 teaspoons of boiling extract. 2. The ripe pods along with their mature ovules are minced in mortar and pestle into a fixative, then tied on the skin with the help of cloth for 1-2 weeks in a hygienic and aseptic condition.	Woody-dried stems are used as a source of fuel and coal.	Multiple uses: A traditional remedy for asthma, gastrointestinal discomforts, and skin problems.	The informants claim no complexity.	Part use and recipe	Leafless Silkflower Shrub is recorded as Least concern (LC) in the list of threatened flora and highly vulnerable in the study area.
Pistacia chinensis Bunge *((P. chinensis))* **Shinnai/** {BOT-KHS-152}	Anacardiaceae	A dioecious Perennial medium-sized Tree	Single part: Leaves	A decoction of fresh leaves is used like a face wash and is used once or twice a day at a marked place for 1-3 days.	Food from fruits is edible, and fodder is made from green leaves.	Multiple uses: Rheumatism and scabies are treated with this natural remedy.	The informants claim no complexity.		The global conservationists categorized the Chinese Pistache as Least Concern (LC) while the present findings acclaim it as highly

									endangered in the study area.
Plantago australis Lam. *((P. australis))* **Sagul/** {BOT-KHS-71}	Plantaginaceae	A perennial Herb	Single part: Whole plant	The whole plant after drying is minced in a grinder to make a paste and the paste is used as topical formulation on wounds and boils once a week externally for 1-2 months as a poultice.	It can be used as fodder.	Multiple uses: Among its therapeutic uses is the treatment of warts and skin lesions.	The informants claim no complexity.	Medicinal uses	Plantago is enlisted as Least Concern (LC) in the documents of threatened species and highly endangered in the study area.
Polygala javana DC. *((P. javana))* **Mastana/** {BOT-KHS-112}	Polygalaceae	A perennial wild, much-branched herb	Single part: Roots	After partially drying the roots, they are boiled in coconut oil or filtered water to make a decoction. 2-3 teaspoons can be prescribed two times in 24 hours for about 15 days.	Fresh and green leaves are used in the preparation of fodder for domestic animals.	Multiple uses: A traditional analgesic and diuretic.	The informants claim no complexity.	Medicinal uses	No record was found on snakeroots in the list of threatened flora and moderately threatened in subtropical semiarid regions.
Ptilimnium capillaceum (Michx.) Raf. *((P. capillaceum))* **Desi Ajwain/** {BOT-KHS-120}	Apiaceae	An annual hardy herb	Single part: Leaves	Fresh leaves after drying in an absorbing oven are ground and residue can be advised orally once a day for 2-5 days.	Cattle feed is made from this plant.	Single-use: Gastrointestinal infections	Allergic reactions.		Herbwilliam is registered as Least Concern (LC) in the list, but reports have shown it is highly threatened in the area.
Pupalia lappacea (L.) Juss. *((P. lappacea))* **Pyazi Bhoti/** {BOT-KHS-134}	Amaranthaceae	Herb/ Perennial	Multiple parts: Seeds, Bulbs & Leaves	Oil extracted from seeds along with *Nigella sativa*'s seed oil is mixed with a liquidize made from onion bulb leaves and mustard oil, and	There are a variety of uses for this plant, including culinary preparations, experiments, massage oil,	Multiple uses: This herb is used as an antimicrobial, an aphrodisiac, an anticholera, as well as for skin pitches,	The informants claim no complication.		Forest Burr is not recorded in any category of Red List data, and no major threats were reported because the

				fresh leaves are juiced.	and dressings for salads.	earaches, and nose bleeding.			species is widely cultivated in the region.
Rhazya stricta Decne. *((R. stricta))* **Gunderi/** {BOT-KHS-74}	Apocynaceae	Shrub/Perennial (Evergreen)	Single part: Leaves	A poultice made of warm leaves is used for joint pain for 5-7 days, which should be changed once every 24 hours for 5-7 days with bandages (fleshy leaves).	Hard and woody dried stems are used for burning and heating purposes.	Single-use: Traditionally this species is recommended as an anti-rheumatism	The informants claim no complexity.		No record was found in the list of threatened flora and significantly vulnerable in the studied region.
Ricinus communis L. *((R. communis))* **Arind/** {BOT-KHS-75}	Euphorbiaceae	Shrub/Perennial	Multiple parts: Leaves & Floral leaves	1. As a result of crushing fresh leaves to extract the methanolic juice, 2-3 tsps of the liquor are prescribed orally three times in 24 hours consecutively five weeks, after each meal. 2. Poultices are prepared by lightly heating fresh leaves and placing them on the skin for 1-2 hours to ease pain.	Oil from rip seeds is used as a natural lubricant, the whole plant is used as an ornamental plant, and hollow matured stems are used in musical instruments.	Multiple uses: Medicinal use as an antibacterial and for joint pains, headaches, and chest pains.	Skin allergies	Recipe	Castor bean is not registered in the list and is not vulnerable in the study region as well.
Rumex hastatus D. Don *((R. hastatus))* **Mattak/** {BOT-KHS-147}	Polygonaceae	Herb/ Perennial	Multiple parts: Whole plants, Fruits & Roots	1. After cleaning and rinsing the roots in the water a few times, they are chopped into tiny slices and then cooked in 2-4 liters of coconut water before being purified by using filter paper. The dregs are then combined with	The leaves are used as vegetables, as well as in traditional recipes like chutney, and curry.	Multiple uses: This plant has been used medicinally as an antiasthmatic, fever reducer, stimulant, cough suppressant, and asthma indicative.	The informants claim no complexity.	Other uses	Arrowleaf Dock is not recorded in the globally vulnerable flora, however, the study area is shrinking in terms of its abundance.

				animal fat, and wheat powder, stewed accordingly before consuming 2-3 teaspoons thrice a day for 10-16 days. 2. An extract from fresh fruits and fresh roots can be used daily by putting a few drops in water.				
Rydingia limbata (Benth.) Scheen & V.A. Albert *((R. limbata))* **Kharpaka/** {BOT-KHS-135}	Lamiaceae	Shrub/ Woody	Multiple parts: Flowers & Leaves	1. The fresh flowers (20 g) are cooked in milk and prescribed as an oral regimen for 24-46 hours, 12-1 glasses per day. 2. Chewing fresh leaves to suck their juice is sometimes practiced, then placing the juice for five minutes on injured parts 2 to 5 of the leaves once a day.	A thorny shoot is used as a fence and a woody stem can be used for fuel.	Single uses: Medicinally, this species is recommended for treating mouth diseases such as ulcers and gastric problems.	The informants claim no complexity.	Recipe and other uses.	The tinjute plant is registered as the Least concern (LC) in the list of globally threatened flora and lessening in semiarid subtropical regions.
Sageretia thea (Osbeck) M.C. Johnst. *((S. thea))* **Mamani/** {BOT-KHS-126}	Rhamnaceae	Shrub/ Woody (Evergreen)	Multiple parts: Leaves, & Bark	1. A three-week regimen consisting of taking dried leaves powdered before meals can be prescribed. 2. Stem bark decoction can be prescribed as an oral dose one time a day for two weeks in approximately 15 mL doses.	Fruits are edible, woody stems can be used as a source of fuel, timber, and leaves as fodder.	Multiple uses: Curatively used as a tonic, pain killer, and for hypertension.	The informants claim no complexity.		Chinese sweet plum is not listed in any category of global taxonomic record of threatened flora and is drastically declining in subtropical semiarid regions.

Senegalia modesta (Wall.) P.J.H. Hurter *((S. modesta))* **Palosa/** {BOT-KHS-122}	Leguminosae	A medium-sized deciduous perennial tree	Multiple parts: Gums & Stem	1. In addition to chewing gum, pungeree* is also mixed with gum, and both are chewed for 5-10 minutes, as necessary. 2. A paste made from dried stem powder is applied to relevant teeth	Stem exudates can be used in the formation of hair removal waxes; while the hard woody stems can be used as teeth-cleaning twigs; and honey is made from the nectar of flowers.	Multiple uses: Often used to treat joint pain and to get relief from labor pain. Sometimes used to treat dental pain.	The informants claim no complexity.	Medicinal use.	Phulai has no data in the list of threatened flora but is assessed as highly endangered in the region.
Sideroxylon mascatense (A.DC.) T.D.Penn. *((S. mascatense))* **Gorgora/** {BOT-KHS-161}	Sapotaceae	An evergreen sclerophyllous spiny perennial shrub or small tree	Multiple parts: Leaves & Seeds	1. Fresh aerial parts are grated in dicer to unglue the juice, then 50-7 g of sugar and 4-5 drops of juice are added to warm, filtered water. Better prevention will lead to faster healing. 2. Ideally, fully ripened seeds should be beaten with a hammer in a jar with seeds of apricots and olives, and 1-2 teaspoons taken orally a few times per day for 2-3 weeks.	Fruits are used as food, fresh leaves serve as fodder and woody stems can be used as building materials.	Multiple uses: Efficacious as a purgative, antidiabetic, as well as an antimalarial medicine.	The informants claim no complexity.	Recipe	Mascat Bitterbush is categorized as a Least Concern (LC) species in the list of threatened flora and the present findings recommend it extremely vulnerable species.
Silybum marianum (L.) Gaertn. *((S. marianum))* **Karpota/** {BOT-KHS-156}	Asteraceae	An annual or Biennial herb	Multiple parts: Leaves & Flowers	1. The dried leaves are soaked in milk with a little water containing sugar, ground, and then taken before meals for about 1-2 teaspoons and can	Dried whole plants can be utilized for burning purposes.	Multiple uses: Traditionally used for the treatment of coronary diseases, piles, and liver infections.	Allergic reactions and respiratory effects.		The milk thistle plant is registered as the Least concern species on the list and moderately

				be administered orally per day for 1-2 tsps. 2. A pile tonic is prepared from the juice of flowers in a food processor machine and can be prescribed as an oral dose two times a day consecutively for 20 days.					threatened in the study area.
Solanum nigrum Tausch ex Dunal *((S. nigrum))* **Khorsaba/** {BOT-KHS-26}	Solanaceae	An annual or short-lived perennial herb	Multiple parts: Roots, Leaves & Fruits	1. After cleansing thoroughly, the roots are cooked in olive oil, stored on a shelf for at least 30 days, then taken orally thrice daily after meals for at least eight to twenty days. 2. Fresh leaves and fruits are bandaged as a poultice on the skin with olive oil and applied externally once a day for 12-20 hours.	Ripe fruits are eatable, and fodder can be prepared from green leaves.	Multiple uses: Medicinally used for curing kidney diseases, and skin problems, and as a diuretic.	The informants claim no complexity.	Recipe	Blackberry nightshade is not recorded in the list of threatened flora and no major threats are reported in the study area as well.
Taraxacum officinale F.H. Wigg. *((T. officinale))* **Hersoba/** {BOT-KHS-09}	Asteraceae	Herb/ Perennial	Single part: Rhizome	The rhizome is cooked in rainwater and endorsed about 3-5 tsps in 24 hours for 3 weeks.	Traditionally, green leaves with spinach are cooked as SAAG (a traditional recipe) and are fed to animals.	Single-use: Medicinally reported for the treatment of jaundice.	Heartburn, indigestion, or gastrointestinal ulcers.	Other uses	The dandelion is registered as Least concern (LC) in the list of threatened flora and moderately vanishing in the study area.
Vachellia nilotica (L.) P.J.H. Hurter & Mabb. *((V. nilotica))*	Leguminosae	An evergreen perennial tree	Single part: Seeds	Cakes are made by grinding seeds into powder and baking them.	Timber, fodder	Multiple uses: Astringent, carminative	The informants claim no complexity.	Part use.	Least Concern (LC) globally, but highly threatened in

Keekar/ {BOT-KHS-12}									the study region.
Verbascum thapsus L. *((V. thapsus))* **Orbaso/** {BOT-KHS-163}	Scrophulariaceae	A hairy biennial herb	Single part: Leaves	Fresh leaves are decocted and taken as herbal tea on an empty stomach about half a cup a day.	A dried plant can be used for fuel, while seed powder can be used as a pesticide and insecticide.	Multiple uses: Medicinally used as an astringent and an emollient.	Skin irritations.	Other uses	The great mullein is recorded as the Least concern (LC) in the list and threatened in the study area.
Withania somnifera (L.) Dunal *((W. somnifera))* **Khapianga/** {BOT-KHS-87}	Solanaceae	An evergreen perennial herb or small-sized shrub	Single part: Fruits	A decoction of ripened and dried fruits is boiled in water and given to the patient with honey for 1-2 months on an empty stomach.	Nil	Multiple uses: Traditionally used for the treatment of allergies and asthma.	The informants claim no complexity.		Ashwagandha was registered as a Data Deficient (DD) in the list of threatened flora in 2013 and is significantly vulnerable in the study region.
Zanthoxylum armatum DC. *((Z. armatum))* **Dambara/** {BOT-KHS-155}	Rutaceae	Shrub/ Woody (Deciduous)	Multiple parts: Fruits, Seeds & Leaves	1. The fruits and seeds are ground in a mortar, mixed with yogurt, and taken orally every 24 hours, 2-3 teaspoons. 2. To prepare, chop fresh leaves with green leaves of garlic and onion and combine them with milk (oral) for 2-3 teaspoons for 1-2 weeks.	Ripe fruits containing seeds are used in spices and Chatni (a traditional recipe).	Multiple uses: Therapeutically used as a carminative and for gastrointestinal problems.	The informants claim no complexity.	Recipe	Winged Prickly Ash is enumerated as the Least concern (LC) by the IUCN and is highly threatened in the study area.
Zingiber officinale Roscoe *((Z. officinale))* **Adrak/**	Zingiberaceae	Herb/ Perennial	Single part: Rhizome	To make candy-like small pieces, the peels are pressed in a juicer along with	A spicy condiment pickled in vinegar.	Multiple uses: Medicinal uses include cough	The informants claim no complexity.	Recipe	Ginger was recorded as Data Deficient (DD) in the list

{BOT-KHS-88}				honey and lemon and consumed for three weeks, thrice a day, orally.		treatment and nausea relief.			of threatened flora in 2019 and is significantly endangered in the study region.
Ziziphus nummularia (Burm.f.) Wight & Arn. *((Z. nummularia))* **Jhahrberi/** {BOT-KHS-87}	Rhamnaceae	Shrub/ Woody	Single part: Roots	A decoction of roots is used as an antipyretic and is taken orally approximately 1-2 teaspoons once a day for 10-17 days.	Fodder can be prepared from fresh and green leaves, pods are edible, and mucilage is utilized as an adhesive.	Single-use: Traditional remedy for fever.	The informants claim no complexity.		Wild jujube is registered as the Least concern (LC) by the IUCN and is extremely vulnerable in the study area.
Zygophyllum indicum (Burm.f.) Christenh. & Byng *((Z. indicum))* **Mazghakai/** {BOT-KHS-50}	Zygophyllaceae	Herb/Perennial	Multiple parts: Leaves & Roots	An extract of fresh and green leaves can be mixed in coconut kernel oil and streamed, and a mixture is prepared and taken orally for 1-2 months on an empty stomach.	The dried leaves are burned to expel the devil and gel made from them is used in face washes.	Multiple uses: Used as a homemade remedy against jaundice and other skin disorders.	The informants claim no complexity.	Other uses	No data is available in the global taxonomic record of threatened flora.

Keywords: The underlined text shows the novel applications of the reported medicinal plants ↻ indicating no new data for the corresponding plant species.

Ethnobotanical uses

Our study reported that a diverse array of plant parts is used as medicinal ingredients by the local population via a variety of routes of administration. In particular, the highest percentage consisted of leaves and young twigs (35%), followed by roots, rhizomes, and legumes (20%); fruits, flowers, and stems (10%); whole plants (7%); and seeds (5%) (Table 3). Decoction was the most common dosage route, accounting for 28.93%, followed by consumption at 20.66%. Other common routes included powder (15.7%), paste (11.57%), raw form (9.09%), boiling treatment (7.44%), a poultice (4.13%), latex treatment (1.65%), and smoke application (0.83%) (Figure 3). These findings demonstrate the diverse utilization of plant resources in the studied subtropical semiarid region. In terms of novel applications of the documented medicinal plant species, more than half were reported as recipes, 20% for other uses, 19% for medicinal uses, and 10% for part uses (Fig. 4).

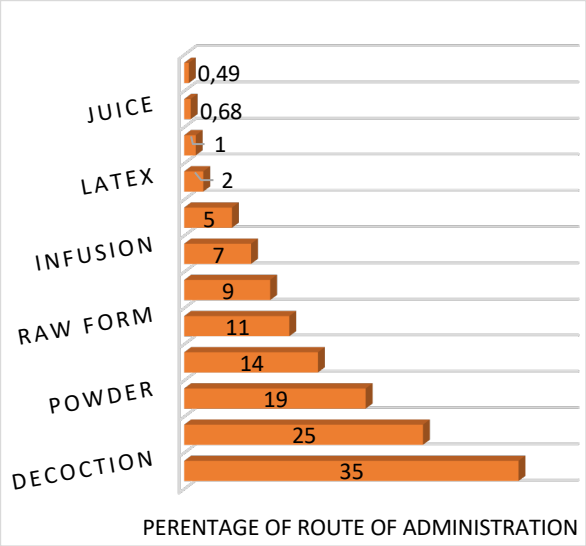

Figure 3. Route of administration of the reported MPs subtropical

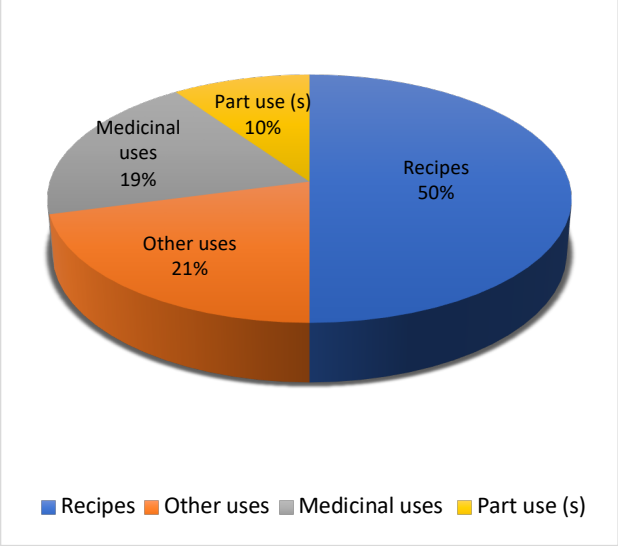

Figure 4. Novel uses of the reported plant species in the semi-arid region

Quantitative analysis and ethnobotany

Documented use reports have revealed various categories of ailments treated with NWEPs. Medicinal uses were grouped into 17 categories and ranked in the order of their F_{IC} values. Gastrointestinal infections had the highest value, followed by blood disorders with F_{IC} value of 0.82, and gynecological disorders with F_{IC} value of 0.80 (Table 4). In this study, we identified 12 medicinal plant species that exhibited high fidelity in their novel traditional uses among the local population in the subtropical semiarid region. Specifically, these plant species exhibited notably high-fidelity values: *S. modesta* (94%), *B. variegata* (89%), B. oleracea (88%), *C. sinensis*, and *D. uncinatum* (85% and 84%) (Table 5). Similarly, medicinal plants were ranked based on their effectiveness in treating gastrointestinal disorders. *V. thapsus* demonstrated the highest value (8), indicating high efficiency, while *R. limbata* had the lowest value (1) (Table 7).

A direct matrix ranking method was employed to investigate the importance of six medicinally important species in the subtropical region. Among the species identified in the DMR, *S. mascatense* was the richest species, ensued by *V. nilotica* (2nd) and *O. ferruginea* (3rd). Additionally, *D. viscosa, Z. nummularia*, and *N. ritchieana* were found to be the least abundant species. Furthermore, several factors associated with high consumption levels were found to make these species useful beyond medicinal purposes, such as firewood, cash income, fencing, construction, fruits and food, and fodder (Table 6).

Table 4. An informant consensus factor (F_{IC}) for documented flora vs complaint sets.

Reported Diseases	Total Use Reports (Nur)	Total MPs reported (Nt)	Difference (Nur-Nt)	F_{IC} = Nur-Nt/(Nur-1)
Gastrointestinal	144	25	19.00	0.83
Blood disorders	198	36	164.00	0.82
Gynecological disorders	165	34	131.00	0.80
Aphrodisiac	141	29	112.00	0.80
Lung infections	150	33	117.00	0.79
Skin diseases	99	23	76.00	0.78
Liver infections	73	17	56.00	0.78
Venereal diseases	52	12	40.00	0.78

Coronary problems	37	10	27.00	0.75
Brain stimulants	65	23	42.00	0.66
Veterinary disorders	110	45	65.00	0.60
Joint disorders	38	16	22.00	0.59
Wounds & Injuries	48	22	26.00	0.55
Cancers & tumors	9	5	4.00	0.50
Renal disorders	45	28	17.00	0.39
Allergies	40	28	12.00	0.31
Respiratory diseases	25	21	4.00	0.17

Table 5. The fidelity of common plant species with novel ethnomedicinal uses.

Species Used	Complaint Categories	Np	N	FL (%)
Senegalia modesta	Joint pain, dental pain, and labor pain	16	17	94
Bauhinia variegata	Astringent. Carminative, purgative, and animal abdominal problems	26	29	89
Brassica oleracea	Piles, astringent, and diuretic	24	27	88
Celtis sinensis	Veterinary abdominal problems	29	34	85
Delphinium uncinatum	Menstrual disorders	16	19	84
Dianthus deltoides	Anthelmintic	24	29	82
Grewia optiva	Astringent, analgesic, labor pain, sexual desire problems.	24	30	80
Jatropha curcas	Antimicrobial	31	39	79
Olea europaea subsp. *cuspidata*	Cough, flu, cold, antidiabetic, and anemia	13	17	76
Oxalis corniculata	Respiratory difficulties, hemorrhage, nausea, joint pain	16	22	72
Plantago australis subsp. *cumingiana*	Warts and skin lesions	23	33	69
Polygala javana	Analgesic, and diuretic	17	25	68

Table 6. Direct matrix ranking (DMR) of highly consumable plant species.

Secies. Name	Uses	Construction	Fencing, Hedge	Fruits, Food	Firewood	Cash income	Fodder	Total Score	Rank category
Vachellia nilotica	Score	45	56	10	50	34	41	236	2nd
Dodonaea viscosa		36	33	5	64	25	39	202	4th
Nannorrhops ritchieana		6	13	56	44	65	2	186	6th
Olea europaea subsp. *cuspidata*		49	22	37	39	43	23	213	3rd
Sideroxylon mascatense		38	27	51	41	53	37	247	1st
Zanthoxylum armatum		26	57	45	33	28	6	195	5th

Table 7. Preference ranking of selected MPs used against gastrointestinal disorders.

Gastrointestinal disorders related to medicinal plants	Respondents (Ra - Rj)										Total	Rank
	Ra	Rb	Rc	Rd	Re	Rf	Rg	Rh	Ri	Rj		
Achyranthes aspera	6	4	5	3	2	7	5	6	4	4	46	2nd
Calotropis gigantea	2	7	3	6	1	4	3	5	2	4	37	5th
Calotropis procera	6	2	5	2	3	7	4	6	0	1	36	6th
Capsella bursa-pastoris	4	3	6	1	5	3	7	2	4	3	37	5th
Gymnosporia royleana	1	5	2	8	3	7	4	6	5	3	44	3rd
Glycyrrhiza glabra	7	4	1	5	7	0	6	3	1	4	38	4th
Rydingia limbata	6	6	4	6	2	3	4	5	7	5	48	1st
Verbascum thapsus	5	2	5	1	2	0	3	1	2	1	22	8th
Zanthoxylum armatum	3	2	3	2	4	6	1	7	2	3	33	7th

Pearson correlation

Pearson correlation analysis indicated a moderate correlation between respondents' age and traditional knowledge (r^2 = 0.63 versus r^2 = 1), while schooling and traditional knowledge had a weaker correlation (r^2 = -0.29 versus r^2 = 0.0). The correlation between traditional knowledge and qualifications remains non-significant; however, age is a better predictor of Indigenous knowledge than qualifications. Additionally, qualifications can help ensure that Indigenous knowledge is respected and responsibly utilized. This is especially true in cultures in which knowledge is passed down over generations (Fig. 5).

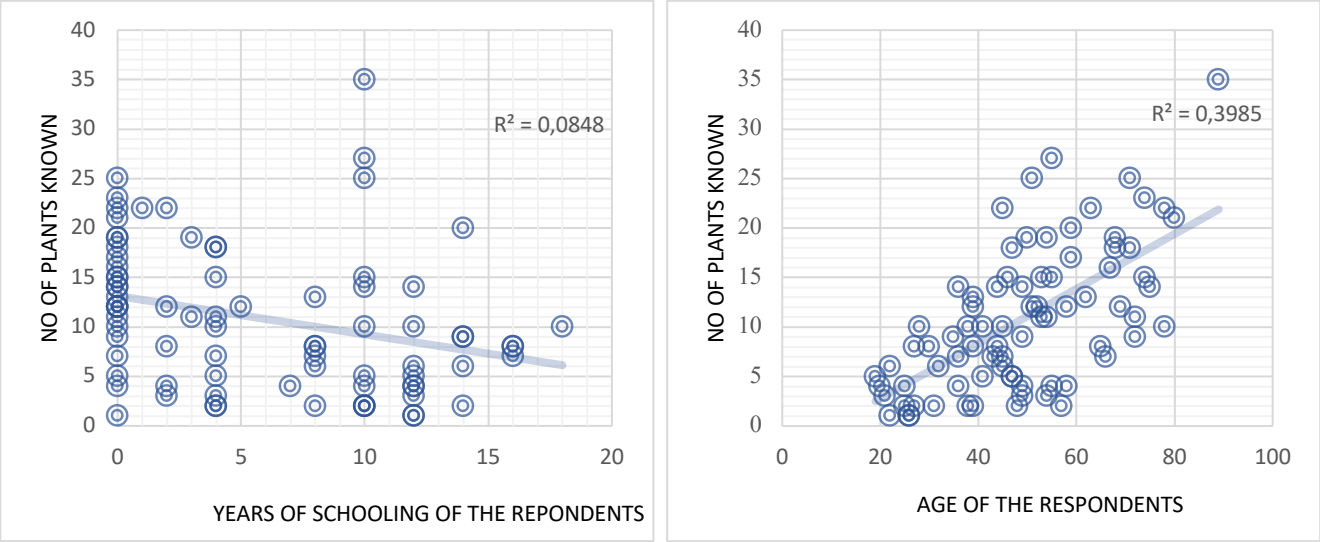

Figure 5. Analysis of the Pearson correlation of (a) respondent qualifications, the number of plants they knew, and (b) the relation between age and traditional knowledge

Conservation status

The status of conservation of medicinally important species was determined based on the species inventory, community-based monitoring, population decline, threats, and IUCN Red List data. Using these criteria, we categorized medicinal plant species as highly, moderately, or less threatened. Among the reported medicinal species, 44 are persistently declining and are categorized as highly threatened in the region. The remaining 30 species were considered moderately threatened, whereas 17 species were on the verge of less threat. In addition, 12 species faced no major threats (Table 3).

Discussion

Ethnobotany in subtropical semiarid regions has uncovered a wealth of traditional knowledge about indigenous plant's medicinal, cultural, and ecological significance. This study serves to bridge the gap between ancient traditional practices and existing scientific beliefs, aiming to expand sustainable resource diversification by deriving innovative plant uses. It is believed that ancient people of remote subtropical semiarid regions possessed profound traditional knowledge of native plants and their medicinal properties. However, the transmission of traditional knowledge from generation to generation has dwindled (Hussain et al. 2013) partly due to cultural loss and limited accessibility of scientific data on medicinal plants. Interestingly, while traditional medicine tends to be ignored by younger generations, the proliferation of scientific innovations and the emergence of new sciences has led to a resurgence of interest (Amjad et al. 2015).

Our study findings corroborate local communities' effective utilization of natural vegetation as traditional remedies. However, Jarma, Dara Adam Khel, and Usterzai may face challenges due to the overharvesting of medicinal plants, potentially leading to declines in their populations. This could decrease the availability of these plants as traditional remedies (Houehanou et al. 2013). This aligns with the findings from a recent survey (Dulal et al. 2022), which underscored the impact of demographic factors such as age and livelihood on the quality of Indigenous knowledge. Consistent with prior research (Abbas et al. 2017), our findings affirm that older people possess significant traditional knowledge compared to younger counterparts. This observation corresponds with broader trends suggesting a declining interest among younger generations in medicinal plant use (Bhaila et al. 2022). Additionally, our analysis revealed a less significant correlation between Indigenous knowledge, literacy level, and the adoption of ancestral traditions. These findings resonate with studies by (Girmay et al. 2021; Hassen 2021), highlighting the urgency of preserving cultural heritage to save diversity and identity.

The quantitative analysis of medicinal plant diversity in the study area provided valuable insights into the community's botanical composition and ethnobotanical uses. We documented 103 medicinal plants, representing 48 families and 46 genera, featuring the region's rich biodiversity. This finding aligns with similar studies conducted in Pakistan, such as those by (Ahmad et al. 2014) and (Javed et al. 2020), which reported comparable levels of plant diversity. The need to document the indigenous flora is underscored by these results, emphasizing the importance of understanding the availability and application of medicinal resources across various ecological contexts. Additionally, our study quantified ethnobotanical uses by documenting the frequency of plant parts used and the routes of administration.

The most commonly used medicinal taxa were from the family Compositeae (Asteraceae), which coincides well with the ethnobotanical descriptions referenced by (Olorunnisola et al. 2013; Nuneza et al. 2021). Although the Asteraceae family is diverse in habits and habitats, most species grow in sunny areas in temperate and subtropical semiarid zones. The Kohat district has the best climate for the growth and reproduction of daisy species (Muhammad et al. 2017). Several factors may contribute to the dominance of legumes in medicinal use, including systematic divergence between high and low altitudes and an overall abundance of plants, shrubs, herbs, and climbers within this family. However, variable weather patterns may lead to different dry, warm, and moist conditions, which provide favorable conditions for Poaceae species, e.g., C. ciliaris, C. citratus, C. citratus, C. dactylon, E. repens and C. setosus subsp. setosus (Panchal et al. 2011). The high number of medicinal plant species in the Fabaceae indicates that the family contains many bioactive compounds, especially because it represents the largest group of angiosperms (Sarwar 2013; Fatima et al. 2018; Bokov et al. 2020; Jančić et al. 2022). These findings are consistent with ethnobotanical and pharmaceutical studies conducted in Pakistan and elsewhere in which herbs were found to dominate subtropical semiarid regions (Kayani et al. 2015; Tugume and Nyakoojo 2019; Aremu and Pendota 2021). Herbs are the most common growth form because of their abundance and diversity in subtropical semiarid areas (Ishtiaq et al. 2022).

Phytochemical analysis of herb species has revealed that secondary metabolites, alkaloids, cyanogenic glycosides, and phenolic glycosides are the major components of medicinal products (Hassan 2012). In the present study, the maximum utilization of leaves was observed based on the traditional practices of residents. These findings were consistent with those of other global studies (Asase, et al. 2010; Signorini et al. 2009; Nadembega et al. 2011). Leaves are the most commonly used herbal remedies, perhaps because of their easy accessibility (Umair et al. 2019). However, leaves are the most metabolically active part of plants; therefore, their use is scientifically and technically justified (Umair et al. 2019). According to Indigenous people, specific parts of plants possess useful medicinal properties, but should be analyzed biochemically and pharmaceutically for further verification. Decoction and concoction accounted for the highest percentage of the route of administration. Comparable results have been reported by (Umair et al. 2019) and (Nadembega et al. 2011), who reported that decoction is the most commonly used method for preparing folk herbal medicines.

Among the documented taxa, more than 40 species were reported for the first time with novel applications, underscoring their potential significance to Indigenous communities and conservation efforts (Ahmad et al. 2017). For instance, the therapeutic properties of olive leaves and fruits have been previously documented, including hypoglycemic and hypotensive effects (Hejrati et al. 2020). Similarly, dried olive fruits have been reported to possess anti-diabetic properties (Liaqat et al. 2021). In addition to being used medicinally, *S. mascatense* is used as fuel, wood, and fodder source in mountainous areas. It has been found that freshly picked leaves are purgative, while fully ripened seeds are antidiabetic and antimalarial. A variety of diseases have been cured by ethnomedicines formulated from *S. mascatense* (Ullah et al. 2016; Haq et al. 2023). The biological and antioxidant activities of plants have been attributed to the presence of phytochemicals (Rehman et al. 2013; Burki et al. 2019). The medicinal properties of *D. viscosa* are well known, and the native people have been using this plant for centuries. A fumigant is used on the stems of this plant to treat rheumatism, and antispasmodic agents are used on the leaves to treat itchiness and fever. The lotion is a combination of leaf and root extracts used to treat sprains, bruises, burns, and wounds to treat toothaches and headaches (Anilreddy 2009). Known locally as Mazara, *N. ritchieana* is beneficial nutritionally and medicinally and is a valuable ethnobotanical resource for making hotpots, brooms, baskets, hand fans, and domestic fuel. Phytochemicals such as flavonoids, alkaloids, and terpenoids can be used to treat diverse types of pathogenic infections (Kumari et al. 2016; Rahim et al. 2023).

The therapeutic efficacy of medicinal plants for treating disorders was systematically evaluated by the quantitative study of F_{IC} values. Comparing the present F_{IC} values with those reported in previous studies conducted in Pakistan (Amjad et al. 2017; Hassan et al. 2020; Ibrahim et al. 2023) enables the recognition of harmony among different communities regarding the efficacy of certain plant species. The findings also revealed high-fidelity values for several plant species, indicating their

cultural significance and the potential to address community health needs. Moreover, direct matrix rankings can be used to quantitatively evaluate species abundance and cultural significance.

Our study adds to a comprehensive understanding of medicinal plant diversity, ethnobotanical knowledge, and conservation concerns in the region by incorporating quantitative analysis and comparisons with recent ethnobotanical studies in Pakistan. Furthermore, these findings will assist in the development of conservation strategies and sustainable management practices for medicinal plant resources.

Conclusion

This research aims to uncover the potential medicinal properties and economic value of various plant species found in subtropical semiarid regions. The study also examines the conservation challenges associated with these plants, which have not been well-documented previously as nontimber forest products. After examining Usterzai, Dara Adam Khel, Seni Gumbat, Lachi, and Jarma, it was found that the first three locations are rich in indigenous medicinal plants while the other two have low abundance and diversity. The study highlights a strong tradition of folk medicine among local communities, which has been passed down through generations. However, the research also indicates a concerning gap in traditional knowledge transmission between older and younger generations.

The study identified over one hundred species of medicinal plants across five locations, with some newly reported medicinal plant uses receiving significant attention. For instance, the leaves of *A. javanica* were used, dried, and ground into a powder-like substance to treat epilepsy and insanity. Additionally, the root bark of a species from the Boraginaceae family (*E. setosa*) is used to treat venereal infections. Interestingly, B. sempervirens has not only medicinal uses for its stem bark and as a poultice for joints, but it also has applications in furniture making and fuel.

However, the study raises concerns about the potential extinction of medicinal plant species due to unsustainable practices such as unscientific use, and overexploitation. This study emphasizes the crucial need to document both plant species and traditional knowledge to preserve cultural traditions and medicinal flora and prevent the loss of valuable knowledge.
Based on the reported medicinal plant uses in the study area and literature, the reported novel applications are likely valid both in the study area and globally.

Declarations

List of abbreviations: Informant Consensus Factor (FIC), Native Wild and Endemic Plant Species (NWEPs), Socioeconomic Status (SES), Federally Administered Areas (FATA), Participatory Learning and Action (PLA), Monitoring and Assurance of Data Quality (MADQ), Fidelity Level (FL), Preference Ranking (PR), Direct Matrix Ranking (DMR), Cyanogenic Glycosides (CNglcs), Non-Insulin Dependent Diabetes (NIDDM), Teaspoons (TSP)
Ethics approval and consent to participate: All participants provided oral consent before the survey was conducted.
Consent for publication: Not applicable.
Availability of data and materials: This manuscript includes figures and tables supporting the study's findings, and the original data sets can be obtained from the first author upon request.
Competing interests: Not applicable
Funding: No funding was received by the authors for this work.
Author contributions: MZ planned the research, conducted the fieldwork, collected, and analyzed the data, and drafted the definitive version of the manuscript. MA supervised and participated in the design of the research and provided suggestions and comments on the manuscript. SB and IU reviewed and edited the manuscript.

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