Ethnobotanical study of wild medicinal and aromatic plants in Parishing valley district Astore, Gilgit-Baltistan, Pakistan

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Research

Abstract

Background: Rural primary healthcare relies heavily on indigenous wild medicinal flora. This study assessed floristic diversity and documented indigenous knowledge of wild medicinal flora used by rural communities in Parishing Valley, District Astore, Gilgit-Baltistan, Pakistan.

Methods: Ethnobotanical surveys and interviews were conducted with 119 respondents selected by non-probability and snowball sampling from 2021–2024. An open-ended questionnaire recorded botanical and vernacular names, voucher numbers, plant families, life forms, preparation methods, plant parts used, and routes of administration. UV, FUV, RFC, ICF, and FL were calculated using established formulae.

Results: In total, 153 plant species were documented, of which 120 were medicinal and aromatic plants (MAPs); 108 were used to treat ailments grouped into 24 disease categories. The remaining 33 species were used for fodder (19), fuel and timber (7), cultural uses (5), and veterinary purposes (2). Thirty-two species were reported for the first time, and additional uses of 31 MAPs were documented. Asteraceae (30 species) was the dominant family; herbs (79%) dominated life forms, and leaves (32%) were the most used plant part. Decoction (67%) was the most common preparation, administered orally. *Urtica dioica* had the highest UV (0.151), followed by *Berberis orthobotrys* and *Bergenia stracheyi* (0.134 each). RFC ranged from 0.008 to 0.336, with *Berberis orthobotrys* highest (0.336). ICF ranged from 0.25 to 0.85, with gastrointestinal disorders highest (0.85; 128 remedies).

Conclusions: This study documents significant ethnopharmacological applications of MAPs. Species with high UV, RFC, and FL values are recommended for phytochemical investigation, and rare and threatened species require urgent conservation.

Keywords: Ethnobotany; Medicinal plants; Asteraceae; Decoction; Rural communities; Ethnopharmacological

Background

Gilgit-Baltistan (GB) is a geographically important province and is bordered by three mountain ranges: the Himalayas, the Karakoram, and the Hindu Kush. It borders Jammu and Kashmir to the east and southeast, Chitral to the west, China to the north, and Khyber-Pakhtunkhwa (KPK) to the south. The province covers 72,971 km² (GB-EPA, 2022). In GB, 66% of the area

consists of glaciers and rivers, 23% of rangelands, 6% of forests, and the remaining 1% is under cultivation (WASH report, 2022).

Within GB, Astore is a unique district and a hotspot for medicinal and aromatic plants (MAPs). It covers 7,221 km² (Khadim *et al*. 2024a). Astore lies between (Latitude 35.21700°N, Longitude 74.51580°E) of GB, Pakistan. Geographically, it is bordered by Indian-occupied Jammu and Kashmir (IOJK) to the east, Azad Jammu and Kashmir (AJK) to the southwest, Diamar to the southwest, and Gilgit to the north. Administratively, Astore is divided into two tehsils: Tehsil Astore and Tehsil Shountar. Phyto-geographically, Astore lies within the Himalayan Mountain dry temperate and subalpine zones. The population of District Astore was 95,416 according to the 2017 census.

Astore is a single-cropping zone, and agriculture, livestock, and tourism are its main sources of revenue and income. It is well known for its natural resources, including glaciers, freshwater, springs, hot springs, waterfalls, wildlife, fish, forests, MAPs, NTFPs (non-timber forest products), mushrooms, chilgoza pine, birch bark (white paper), mountains, minerals, salajeet, agricultural products, and livestock. Astore's total forest cover is 307 km². Parishing is one of the valleys in District Astore. Parishing Valley is a picturesque, lush green tourism spot in the district. Its awe-inspiring landscapes and breathtaking natural beauty attract tourists and visitors. The valley's inhabitants mainly practice pastoralism and agriculture. They grow the cash crop potato, as well as barley and wheat. The valley has several habitats, including alpine meadows, subalpine meadows, springs, lakes, marshes, swamps, permanent glacier deposits, deep and moderate mountain slopes, rivulets, streams, and cultivated fields. These habitats support rich and equally diverse flora, including alpine pastures, thick forests, NTFPs (non-timber forest products), MAPs (medicinal and aromatic plants), and wildlife. Moreover, in the lower areas of Parishing Valley, a diversity of fruits ripens. In particular, the valley's apples and nuts are popular throughout Astore.

Despite, the high significance of ethnobotanical knowledge and folk wisdom for conservation and sustainable development, significant research gaps remain in the study area. So far, no inclusive numerical ethnobotanical investigation has been carried out in the V-shaped Parishing Valley in District Astore, leaving a significant gap in our understanding of indigenous knowledge of plant species and their utilization, the cultural significance of these plants, and the conservation status of the valley's floral assets. Furthermore, the valley's plants are not documented in any flora which has been published earlier. Although, a few studies have been conducted in some localities of Parishing Valley, no comprehensive study has been carried out. This comprehensive study plays a pivotal role in identifying threatened and endangered plant species and is also essential for in-situ and ex-situ conservation. Additionally, the findings support tangible, sustainable primary healthcare solutions by helping authenticate traditional knowledge-based remedies or cures, providing avenues for drug discovery and drug delivery, and supporting bioprospecting. In nutshell, the study emphasizes the urgent need to conserve an area's cultural and ecological heritage and assets and to promote sustainable development for future generations. Therefore, this study was designed to address these gaps by documenting the medicinally important flora used by the rural communities of Parishing Valley, thereby preserving their rich indigenous knowledge. Furthermore, this investigation highlights culturally and medicinally significant species and recommends them for further phytochemical investigation. With these facts in mind, we selected the present work, "Ethnobotanical Study of MAPS in Parishing Valley District Astore, GB, Pakistan". The specific objectives of this study were: To document the floristic diversity of the study area. To document and preserve the indigenous traditional knowledge of Wild Medicinal and Aromatic plants (WMAPs) and disseminate it. To assess the status of the study area's flora and support biodiversity conservation policies.

Materials and Methods

Study area

Parishing Valley is one of the valleys in District Astore. Administratively, it is part of Union Council Louse, District Astore, GB, Pakistan. It is located 9 km (from the zero point) to the east of the headquarters at Eidgah, Astore, while, according to ancient records, the distance from Dak Bangla (Eidgah) to the last Gutumsar valley is 12 miles (20 km) (Shafee,2000). Geographically, Harcho Valley lies north of Parishing Valley; Shagarthung and allied areas of Tehsil Shountar lie south; Rama Valley and its contiguous areas lie west; and Skardu district and adjacent areas lie east. The valley lies between (Latitude 35. 23872° N, Longitude 74.58550° E) covers an area 411.45 km². Topographically, it is a V-shaped valley surrounded by the lofty Himalayan mountains. The altitude of the valley floor at Louse Bridge (near the zero point) is 2,259 m (above sea level), and Herpola Pass (altitude 5,116 m) is the highest point at the end of the valley. Similarly, the floor at Thang Pine is at 3,605 m, and the highest point near Star Lake is Thang Bala at 3,700 m (Khadim *et al.* 2024 b). The valley remains snow-bound for 2 to 3 months in lower areas and 4 to 5 months in upper areas. Winter temperatures are always below freezing, reaching as low as -12 °C, whereas summers are cool and dry, with an average temperature of 20 to 25 °C. The area lies outside the monsoon range

and receives an average annual precipitation of 469 mm. Total rainfall is 469 mm, with 43.5 cm of annual snowfall. Humidity ranges from 92% to 100%. Temperatures in the valley bottoms range from 35 °C in summer to below -6.3 °C in winter (PMD Station Astore, 2024). Phyto-geographically, Parishing Valley falls within the Himalayan mountain dry temperate zone, which includes the Himalayan alpine zone (4,500–5,500 m), the subalpine zone (3,000–4,500 m), and the temperate mountain zone (1,219–3,000 m). Demographically, Parishing Valley comprises 11 villages with a population of 20,000 persons according to the latest census (Census Report, 2023). The study area is illustrated in (Fig. 1 A, B).

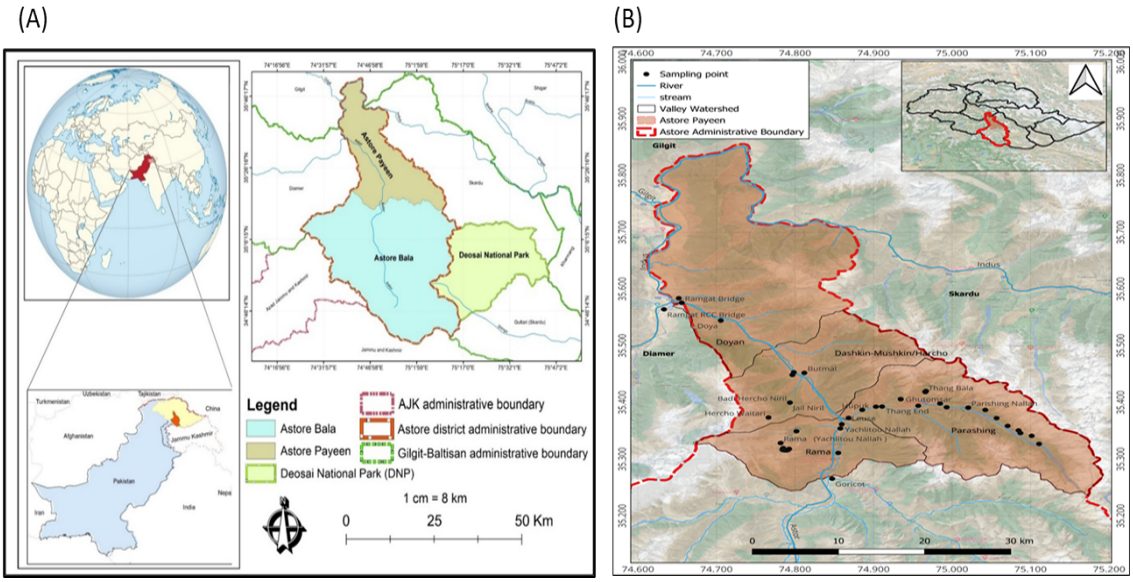


Figure 1. Map of Gilgit-Baltistan province showing the study area (A) , Astore Valley. Study Area, Parishing valley of Lower Astore (B)

Table 1. Respondents detail List (Gender and Age) of Parishing Valley District, Astore GB.

Variable	N	Percentage
Gender		
Male	90	75.6%
Female	29	24.4%
Age		
15-45 years	80	67.2%
46-75 years	23	19.3%
>76 years	16	13.4%
Total	**119**	**100%**

Legend, N= number of respondents

Ethnobotanical Survey, Data Collection and Disease Categorization

Field surveys

From June to September 2021–2024, field trips were organized to document the floristic diversity of the study area. Prior permission was taken from the authorities of the Forest and Wildlife Department, GB, under the Gilgit-Baltistan Forest Department (GB Permit NO. FD/GB/2021-124) no commercial collection or export of plant materials was undertaken to legislation (Forest Act, 1927 and Wildlife Act, 1975), and Karakorum International University (KIU), Office of Research, Innovation & Commercialization (ORIC) and Director Advance Studies & Research (DASR) (KIU/REC/ETH/2026/001) for execution of this study. Both Acts guarantee communities' rights to forests and also provide the right to collect plant species. For this purpose, plant specimens were collected. We also recorded ethnobotanical information on plant species, along with the conservation status of native inhabitants of the plant species present in the study area. The collected plant species and their snapshots from the study area were properly identified, their vernacular names recorded with the help of native herbalists and verified against existing floras and plant taxonomists. Their vernacular or local names and traditional knowledge about the plant taxa were also documented. Exact coordinates were recorded using GPS (Garmin 78x; http://www.garmin.com; ArcGIS 10.8 software), and these readings were used to show the floral distribution and location of Parishing Valley on study-area maps (Biswas, 2017, Bhatt *et al*. 2014). The geographic locations of the localities within the valley are shown in (Fig. 1 A, B).

Specimen collection and identification

Intensive field surveys were conducted over a period of four years (2021–2024) from June to September. We collected plant specimens from the study area, pressed them in a plant press, dried them between newspapers and corrugated sheets, and mounted them on standard herbarium paper sheets. The collected and mounted specimens of plant species were properly identified by (Prof. Dr. Sheer Wali Plant Taxonomist Department of Plant Sciences, KIU, Gilgit-Baltistan, Pakistan) and employing various pre-existing floras, including the West Pakistan Flora written by (Stewart, 1972), Nanga Parbat Flora (NW Himalaya, Pakistan) (Dickore & Nusser 2000), Flora of Pakistan written by (Nasir & Ali 1970–1989; 1989–1991; Ali & Nasir 1993–2022), Flora Iranica (Rechinger, 1957–2001), the online Flora of China, and the Flora of the Union of Soviet Socialist Republics (USSR). The collected plant specimens were submitted to the Karakoram International University Herbarium (KIUH), Department of Biological Sciences, Botany Department, Gilgit-Baltistan, Pakistan, for future reference. The KIUH is now registered in the Herbarium Index. For this purpose, duplicate specimens do not need to be deposited in any other herbarium. Moreover, to comply with KIUH policy, the university's assets cannot be transferred to any other herbarium or university. However, under KIUH rules and regulations, specimens may be uploaded/provided, as needed and with proof, for any research. In this regard, the current Index Herbarium record for KIUH can be consulted at the following link:https://sweetgum.nybg.org/science/ih/herbarium-list/?NamOrganisationAcronym=KIUH.

For life-form classification of the collected flora, we used the Raunkiaer system of life-form categories (Raunkiaer, 1934; Ellenberg *et al*. 1991) for further refinement in the Himalayan region. The conservation status of the study valley was evaluated using the IUCN Red List categories (Version 3.1) and the IUCN 2001 Species Survival Commission report. We also documented the status of various species in this valley by completing pre-designed semi-structured questionnaires and recording local abundance categories (C, CC, and RR) based on field observations.

Interviews with the native inhabitants of the study areas

Ethnobotanical data on plants were gathered through group interviews and semi-structured questionnaires administered to various local people in the study area. In total, 119 local inhabitants (both male and female, without discrimination) were selected using non-probability sampling and snowball sampling methods (Jan *et al.* 2020) with an equal distribution of 14 informant per site (Hupuk, Dachay, Khangrool, Ramkha, Mushk, Phopal, Shapay and Palayat, and Gutumsar except Thang Pain and Bala (21 informants) on basis of population) interviewed in the valley, and relevant information on medicinally important plant species and their traditional practices in the study area was documented. Respondents of both genders provided information. However, male participants outnumbered than female participants, as the study focused mainly on older women in the area. In this regard, respondents ranged mostly in age from 15 to 85 years. Participants included village elders, farmers, homemakers, shepherds and their family members, medical practitioners, herbalists, traditional practitioners, and teachers. All interviews were conducted in the local vernacular language, Shina. No translator was used because the researcher is a Shina speaker. This is illustrated in Table 1.

Ethnobotanical Data Analysis

Use Report (UR)

The term *use report* refers to the use of a medicinally important plant species for an ailment, as reported by the informant. Higher Use Report data indicate greater demand for a species' medicinal value for various ailments; as a result, this suggests a need for conservation to prevent population decline (Shrinitha *et al*. 2025).

Relative Frequency Citation (RFC)

The gathered ethnobotanical data were examined employing the RFC (Relative Frequency Citation) formula: RFC = FC / N. In this formula, FC represents citation frequency, i.e., the number of participants who reported using a particular species, and N denotes the total number of respondents in the ethnobotanical study (Khadim *et al.* 2024). This is determined using Formula:

$$\mathrm{RFC} = \mathrm{FC}/\mathrm{N}$$

Use Value (UV)

For the determination of UV (Use Value), the method of Gentry and Phillips (1993) was employed. Use Value is a numerical index that indicates the relative significance of medicinal plant specimens. The UV value was calculated to assess plant use by local communities and estimate the relative importance of their ethnobotanical uses. It is calculated using Formula:

$$\mathrm{UV} = \sum \mathrm{Ui}/\mathrm{N}$$

Where *Ui*= the number of UVs for a particular medicinal plant specimen *i*, mentioned by each informer; *Ni*= the total number of informers questioned for a particular medicinal plant specimen.

Family Use Value (FUV)

FUV helps estimate the comparative significance of a particular medicinal plant family used in the area under study (Phillips & Gentry 1993). It is calculated through Formula:

$$\text{FUV} = \sum \text{UVs}/\text{Ns}$$

Where, ΣUVs = the total of the UVs of all medicinal plant species in a family, as mentioned by participants/informants; Ns = total number of medicinal plant specimens identified in that particular family.

Informant Consensus Factor (ICF)

The ICF reflected the homogeneity of the collected data. To categorize the disease cure, all available citations were properly arranged. The data were interpreted as follows: if plants were selected randomly or the informant did not explain their use, the ICF value would be low (near 0). If the informant explained the plants' species, communication between informants was present, and proper selection criteria were used, the ICF value would be higher (near 1) (Trotter & Logan 1986). It is determined via Formula:

$$\text{ICF} = [\text{Nur} - \text{Nt}]/\,[\text{Nur} - 1]$$

Where: Nur = number of citations used for each category; Nt = Number of species used.

Fidelity Level % (FL)

FL is the percentage of respondents who indicated using an exclusive plant species to treat a specific disease in the research area (Friedman *et al*. 1986). It is calculated using Formula:

$$\text{FL} = [\text{Np}/\text{N}] * 100$$

Where: Np = the number of citations for a particular ailment, while N = the total number of informants mentioning the species for any disease

Disease categorization: For quantitative analysis, all reported medicinal uses were classified into 24 disease categories based on the health conditions described by the informants. Each use report was assigned to the appropriate category, and the total number of use reports per category was calculated. The 24 disease categories were: gynecological, gastrointestinal, respiratory, orthopedic, hepatic, dermatological, psychological, urinary, hematological, spiritual, cardiac, tonic, hair, antiseptic, skeletomuscular, wound, dental, analgesic, anticancer, aphrodisiac, veterinary, nutritional, aromatic, and fever. This categorization was applied consistently when calculating the Informant Consensus Factor (ICF). Informants recorded the diseases and health conditions they reported using local names and descriptions, then grouped them into these 24 categories for analysis.

Results

Demography of the Informants

In total, 119 informants (including males and females) were interviewed during this ethnobotanical study. Of these, 75.6% were male, and 24.4% were female. The age groups were as follows: 15–45 years (67.2%), 46–75 years (19.3%), and >76 years (13.4%) (Table 1). Elderly persons were particularly rich in traditional knowledge. The respondents' ages ranged from 15 to 85 years. Informants came from various professions and trades, including herbalists, traditional practitioners, hakims, plant traders, shepherds and their family members, farmers, village notables, and teachers (Table 1, Fig. 2).

Floristic analysis

In this floristic study, we reported 153 plant species from the study area, belonging to 43 families and 114 genera. The reported species are highlighted in (Supplementary Table 1, Fig. 3). Of these, 134 medicinal plant species are angiosperms (dicots), 10 are monocots, 8 are gymnosperms, and 2 are pteridophytes. A total of 43 families were documented. Of these, 35 families belong to angiosperms (dicots), 4 to monocots, 2 to gymnosperms, and 2 to Pteridophytes. Regarding genera, 99 genera belong to angiosperms (dicots), 8 to monocots, 5 to gymnosperms, and 2 to Pteridophytes (Fig. 4). Of the 153 reported plants, 120 are medicinal and aromatic plants (MAPs), 19 are used as fodder and forage, 7 are used as fuel and timber, 5 are used for cultural and other uses, and 2 are used for veterinary uses. In addition, of the 120 MAPs, 108 species had recorded usage (Table 2, Fig. 5), but the usage of the remaining 11 medicinal plants in the study area was not clearly defined. Moreover, out of the 108 MAPs, 31 species recorded additional usage documented from the study area for the first time. These species are; *Adiantum incisum, Equisetum arvense*, *Abies pindrow*, *Pinus wallichiana*, *Pistacia khinjuk*, *Saussurea simpsoniana*, *Cichorium intybus*, *Eclipta prostrata*, *Picris hieracioidis*, *Artemisia gmelinii*, *A. brevifolia*, *Sonchus asper*, *Echinops cornigerus*, *Hieracium vulgatum*, *Achillea millefolium, Leontopodium himalayanum, Impatiens thomsonii, Berberis orthobotrys, Silene*

vulgaris, Convolvulus arvensis, *Swertia cordata*, *Ribes orientale*, *Nepeta leucolaena*, *Alcea rosea*, *Orobanche cernua*, *Trifolium repens*, *Plantago major*, *Sinopodophyllum hexandrum*, *Ranunculus attenuates*, *Valeriana hoffmeisteri*, *Prunella vulgaris* (Table 2, Supplementary Table 1). Furthermore, these 32 species are newly reported from the study area for the first time (Table 2). The newly reported species are as under: *Adiantum incisum*, *Equisetum arvense*, *Pleurospermum govanianum*, *Cicerbita astorensis*, *Artemisia desertorum*, *A. foetida, A. japonica, Hieracium umbellatum, Impatiens edgwarthii, Lappula barbata, Rosularia alpestris, Jaeschkea oligosperma, Lamium amplexicaule*, *Trigonella cachemiriana*, *Primula buryana*, *Ranunculus laetus*, *Ceratocephala falcata*, *Crataegus monogyna*, *Prunus jacquemontii*, *Sibbaldia cuneata*, *Salix capusii*, *S. tetrasperma*, *Populus alba*, *Kickxia incana*, *Euphrasia incisa*, *Leptorhabdos parviflora*, *Juncus articulatus*, *Bromus tectorum*, *Poa lahulensis*, *P. angustifolia*, *Piptatherum munroi* and *Saccharum griffithii* (Table 2, Supplementary Table 1).

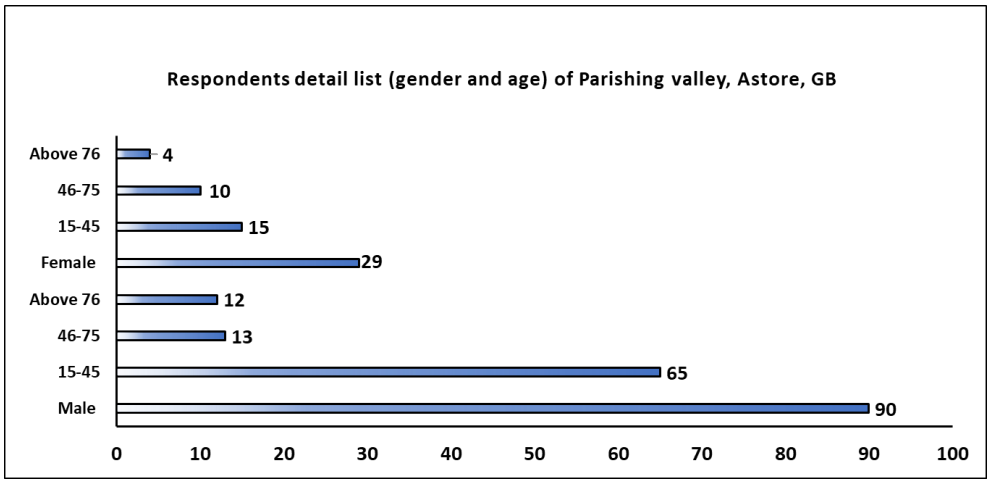


Figure 2. Demographic details of respondents (gender and age) from Parishing Valley, District Astore, Gilgit-Baltistan

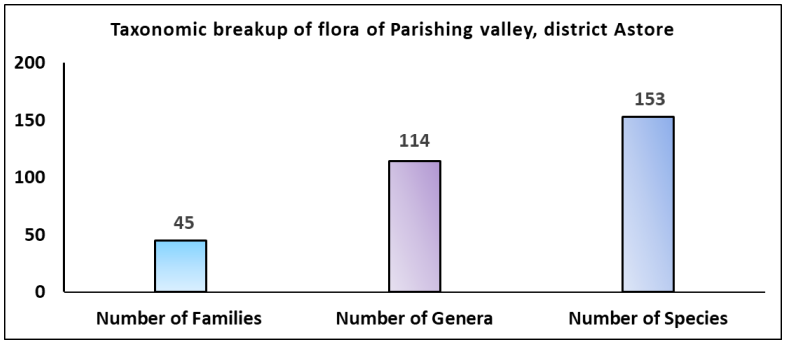


Figure 3. Taxonomic breakup of the flora of Parishing Valley, District Astore.

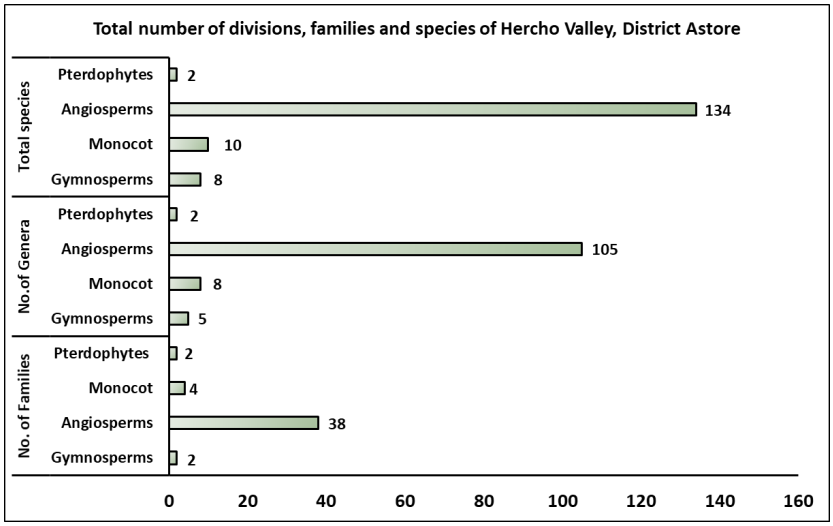


Figure 4. Total number of plant divisions, families, and species recorded from Parishing Valley, District Astore.

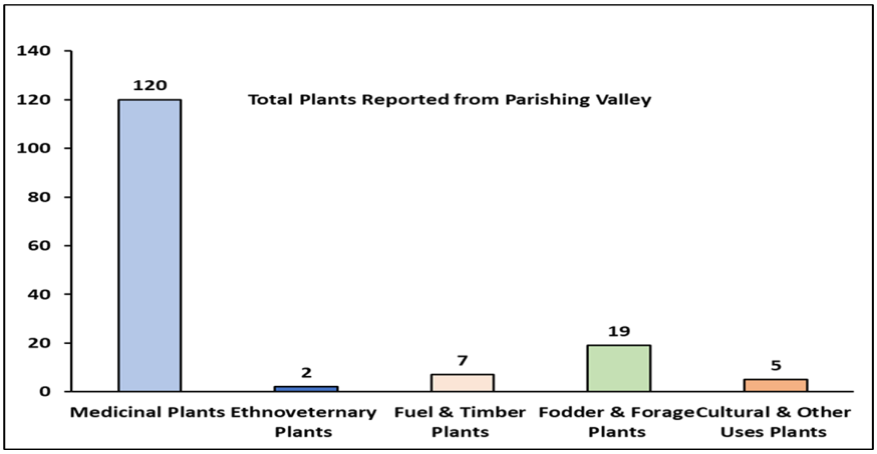


Figure 5. Total plants reported from Parishing Valley; district Astore, Gilgit-Baltistan

Life-forms of medicinal plants

In a floristic study, 153 medicinal plant species have been documented. By habit category, herbs were the most dominant, with 121 species (79%), followed by shrubs (17 species, 11%) and trees (15 species, 10%) (Supplementary Table 1, Fig. 6). Herbs are commonly used because they are readily available, widely distributed in the area, and rich in biologically active compounds. Regarding life forms, the documented plants were classified as follows: Hemicryptophytes 72 (47%), Therophytes 15 (10%), Phanerophytes 16 (10%), Chamaephytes 26 (17%), Nanophanerophytes 14 (9%), and Cryptophytes/Geophytes 10 (7%) (Supplementary Table 1, Fig. 7).

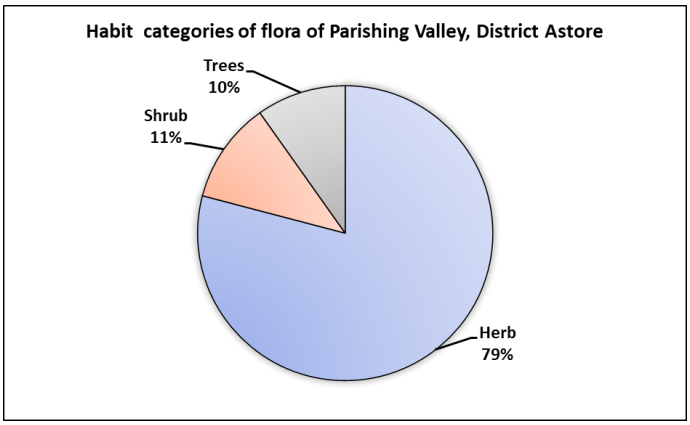


Figure 6. Habit categories of flora recorded from Parishing Valley, District Astore

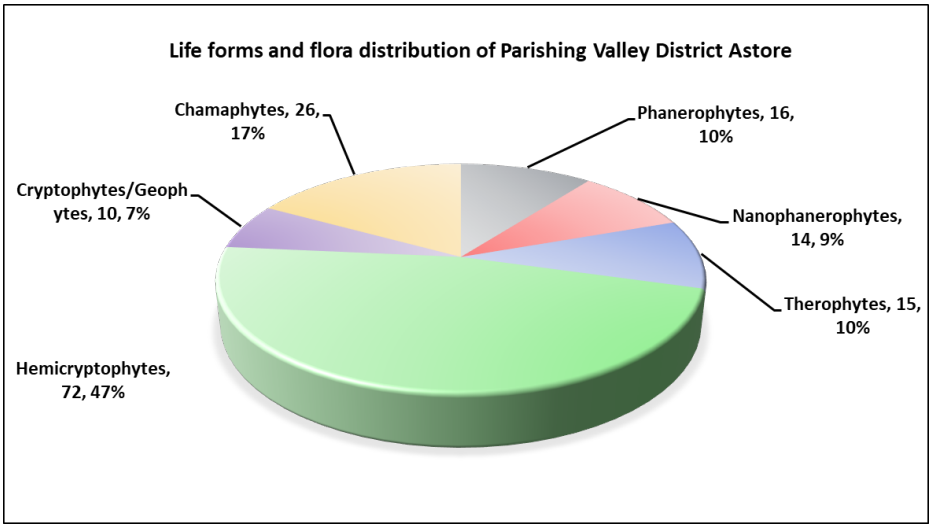


Figure 7. Life forms and floral distribution in Parishing Valley, District Astore

Ethnobotanic uses of different parts of medicinal plants recorded from the study area

For effective, high-quality herbal formulations, collecting the finest plant parts is essential. Of the 108 documented medicinal plants (Table 2), various plant parts were used, including leaves, roots, whole plant, aerial parts, stem, berries, flower, fruit, seed, bark, rhizome, resin, gum, latex, fronds, etc. In addition, for one medicinal plant, reports used more than one plant part. In this connection, the percentage of each part used was calculated by dividing the number of plants (e.g., leaves) used by the total number of plants (108 as the denominator) and multiplying by 100. The findings are as follows: leaves were the most preferred and commonly used medicinal plant part (32%). Leaves were followed by roots/ aconites (25%), whole plants (21%), flowers (15%), aerial parts (8%), fruits (6%), berries (5%), seeds (4%), bark and resin (3%), rhizomes (2%), and gum, latex, and fronds (0.91%) (Fig. 8, Table 2). Leaves were used in bulk due to their abundance, fast growth and rejuvenation, and ease of harvest. They are also a rich source of biologically active compounds such as alkaloids, terpenoids, and phenolic compounds (e.g., ferulic acid found in *Ferula* species), which possess therapeutic properties including antioxidant, anti-cancer, and anti-inflammatory activities.

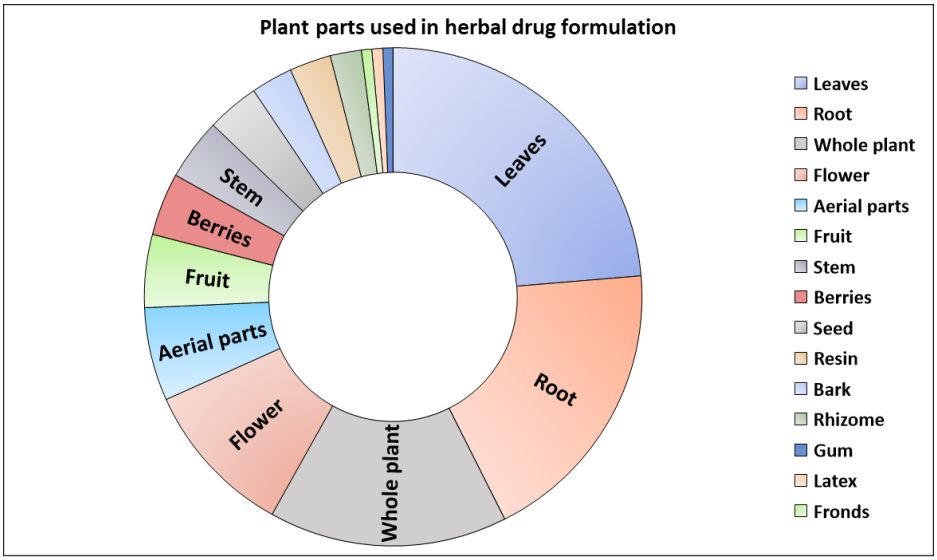


Figure 8. Plant parts used in herbal drug formulation

Mode of utilization of the herbal drugs

The present study area MAPs were prepared in various forms, including decoction (67%), powder (30%), raw (21%), paste (3%), extract (2%), gum and resin (1%), and juice (0.9%) (Fig. 9**,** Table 2). Among these, paste was the most favored because it is easy to prepare and requires no water.

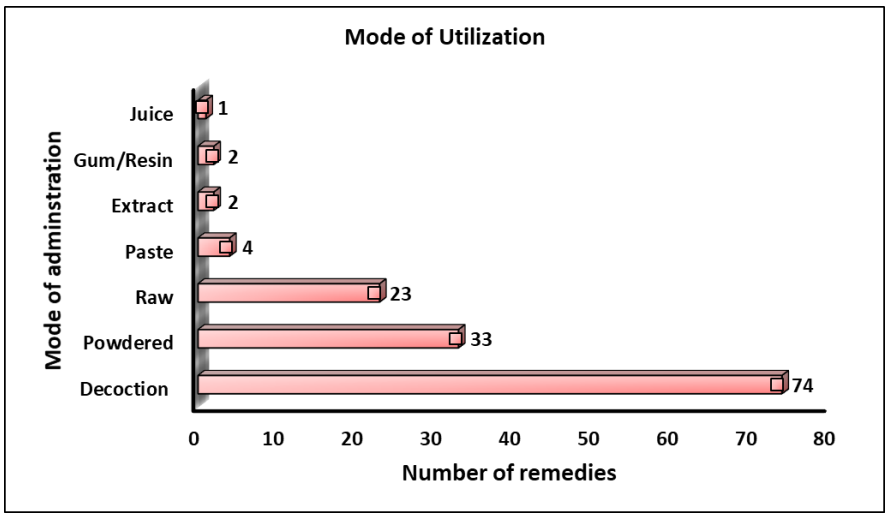


Figure 9. Mode of utilization of herbal drug formulations

Additives/adjuvants usage in different herbal drug formulations in the study area

Mostly, additives are employed to augment the aromatic and medicinal properties, taste, or uniformity of the prepared herbal product with water as a key universal solvent, along with substitutes such as sugar, honey, milk, butter, and other additives.

Status of species: During 'field observation' the status or local abundance categories of plant species were recorded like: 96 species as common, 25 species as very common, 25 species as infrequent, 6 species as rare, and 1 species as very rare. Some wild medicinal plant species like *Picea smithiana, Abies pindrow*, *Pinus roxburghii, Pinus wallichiana, Sinopodophyllum hexandrum*, *Delphinium brunonianum*, and *Dactylorhiza hatagirea* were at risk of decline in the area due to anthropogenic pressures and threats such as, uncontrolled grazing and harvesting, habitat fragmentation, climate change, lack of conservation knowledge in the native communities, etc. (Fig. 10, Supplementary Table 1).

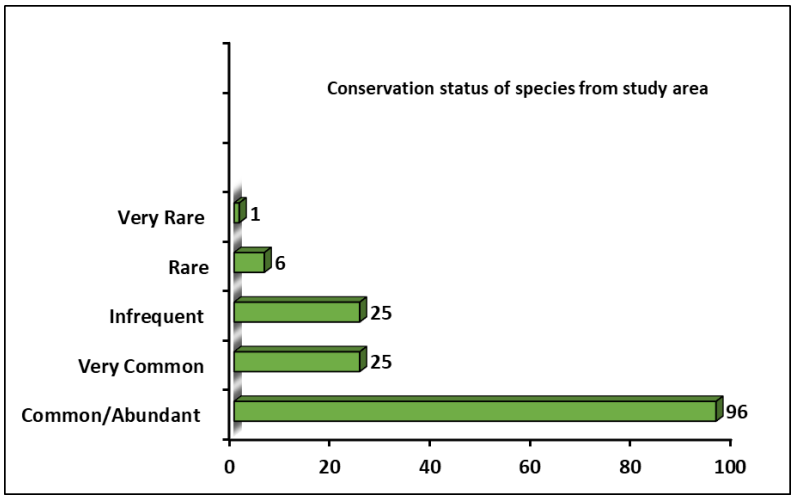


Figure 10. Conservation status of plant species recorded from the study area (Parishing Valley, District Astore)

Phytogeographic zones

Regarding the phytogeographic survey, the study reported four phytogeographic zones like: the desert zone, temperate mountain zone, sub-alpine zone, and alpine zone. Among these, the dry temperate mountain zone recorded the highest number of plant species (122), followed by the sub-alpine zone 114), the desert zone (9), and the alpine zone (5). The study's findings underscore that the dry temperate mountain zone is the most promising area, as it supports a wide variety of species (Fig. 11, Supplementary Table 1).

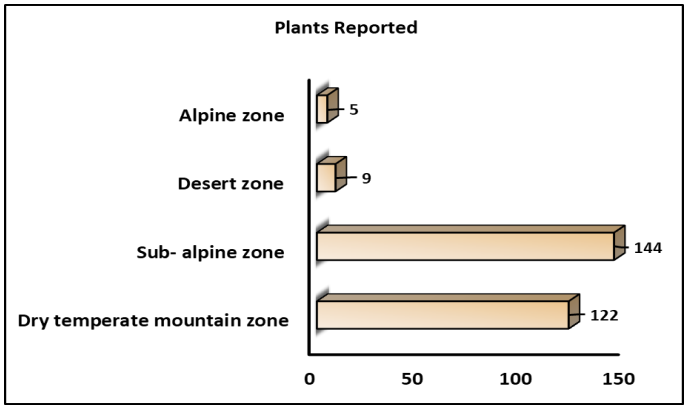


Figure 11. Species distribution across different ecological zones of Parishing Valley, District Astore

Ethnobotanical data

From the study area, 153 plant species, 114 genera, and 43 families have been documented. Table 2 presents the ethnobotanical data, including botanical name, local name, voucher number, part used, mode of administration, disease categories, FC, RFC, UR, UV, and FL.

Quantitative Ethnobotanical Indices

Use Reports (UR)

Regarding the findings of the results, *Urtica dioica* L. was the most commonly mentioned medicinal plant species, employed for eighteen ethnomedicinal practices, followed by *Berberis orthobotrys*, *Bergenia stracheyi, Delphinium brunonianum* (16 use reports each); *Saussurea simpsoniana, Sinopodophyllum hexandrum* (15 use reports); *Cichorium intybus*, *Pinus wallichiana*, *Verbascum thapsus* (12 use reports); *Aconitum violaceum* (11 use reports each); *Picris hieracioides*, *Pulsatilla wallichiana*, *Taraxacum officinale* (10 use reports each); *Dactylorhiza hatagirea*, *Gentianodes tianschanica*, *Rosa webbiana*, *Rumex hastatus*, *Thymus linearis* (9 use reports each (Table 2). The lower number of UVs for these medicinal plant species highlights limited indigenous knowledge, unavailability, or inconspicuousness in the under-study area (Hussain *et al*. 2026).

Relative Frequency of Citation (RFC)

The Relative frequency citation values of medicinal plants employed in this study (RFC ranged from 0.008 to 0.336). *Berberis orthobotrys* has the maximum relative frequency citation value (RFC = 0.336), with 16 use reports for conditions including wound healing, backache, dislocation, fractured bones, intestinal disorders, hepatitis, BP, blood purifier, hernia, headache, analgesic, migraine, and uterine tumor. *Aconogonon alpinum* and *Bistorta affinis* followed, with an RFC value of 0.268, documented in 5 and 7 use reports, respectively, including cancer, anti-tumor, joint pain, asthma, abdominal worms, abdominal problems, bronchitis, chest infections, rhinitis, vomiting, wound healing, and tea. In contrast, *Hylotelephium pakistanicum* and *Rosa indica* were used for cold, fever, headache, eye diseases, pneumonia, stomach problems, and colon cancer, and had the lowest relative frequency citation (Table 2). Higher RFC values indicate that the species are used extensively and help explain the retention of traditional knowledge among local inhabitants of the valley for ethnomedicinal purposes. Additionally, medicinal plant specimens with promising relative frequency citation values should be given priority for pharmacogenetic and phytochemical screening for drug discovery and development.

Use Value (UV)

UV highlights the comparative importance and variety of medicinal plant species in the valley. The highest use value indicates more UVs and more frequent citations. *Urtica dioica* had the highest use value (UV = 0.151), with 18 use reports for treating anti-diabetic, prostate diseases, anti-dandruff, BP, sugar level, vegetable, hemorrhoids, piles, stomach problems, jaundice, fever, hematuria, gout, kidney diseases, skin diseases, cancer, paralysis, and breast cancer. It was followed by *Berberis orthobotrys* and *Bergenia stracheyi* with a use value of 0.134, also with 16 use reports (each) for treating wound healing, backache, dislocation, fractured bones, intestinal disorders, hepatitis, BP, blood purifier, hernia, headache, analgesic, migraine, uterine tumor; wounds, weakness, BP, abdominal pain, ulcer, burning sites, internal wounds, nose bleeding, heart diseases, toothaches, intestinal deworming, acidity, kidney problems, pneumonia, anticancer (Table 2). Higher use values highlight the familiarity and availability of plant species among local people. Conversely, plant species with lower use values indicate rarity or unavailability, diminishing indigenous knowledge, and changing preferences. Additionally, higher use values indicate the usefulness and dependability of medicinal plant species for a particular disease or ailment, suggesting their suitability for advanced research to confirm indigenous traditional knowledge and investigate biologically active compounds.

Family Use Value (FUV)

FUVs were associated with increased species use values, highlighting each family's importance in the valley. The maximum family use value was recorded for Podophyllaceae (FUV = 0.97), represented by one species, *Sinopodophyllum hexandrum*, followed by Berberidaceae (FUV = 0.88), represented by one species, *Berberis orthobotrys*, and Saxifragaceae (FUV = 0.68), represented by two species, namely *Bergenia ciliata* and *B. stracheyi*. In contrast, Asteraceae (31 species; FUV = 0.15) and Rosaceae (11 species; FUV = 0.07) were more represented but did not have the highest family use values (Fig. 12). This highlights that family significance is based on medicinal plant species UVs relative to the number of species within the family. Podophyllaceae, Berberidaceae, and Saxifragaceae are more valued in Pakistan due to their medicinal properties and distribution, with ecological and edaphic factors also influencing resource selection in any area. These results suggest that people prefer the most abundant and accessible species over rare and less common ones for medicinal or food use, as described by the ecological appearance theory.

Informants Consensus Factor (ICF)

The informant consensus factor evaluates the agreement among diverse informants regarding indigenous traditional knowledge, indicating how widely traditional knowledge is shared within a community. For the ICF evaluation, ailments and diseases were categorized into 24 ailment categories (ACs). The informant consensus factor ranged from 0.25 to 0.85, reflecting high traditional knowledge sharing and strong concordance among informants for most medicinal plant species (Fig. 13). In the current study, AC-10 (gastrointestinal problems/disorders) showed the highest ICF value (0.85), with 128 remedies/cures for gastrointestinal/stomach disorders, using 20 medicinal and aromatic plant (MAP) species. The highest ICF

value highlights the efficacy of medicinal plant species employed to treat or cure that particular ailment/disease. Additionally, high ICF values highlight the importance of plant taxa used in various medications and may help identify potent medicinal plant species for screening novel bioactive compounds. In contrast, the lowest ICF value (0.25) was recorded for ailment categories AC-17, AC-18, and AC-19 (ENT, dental, and body aches-related problems), indicating limited information or knowledge sharing and diverse plant selections due to divergence among informers.

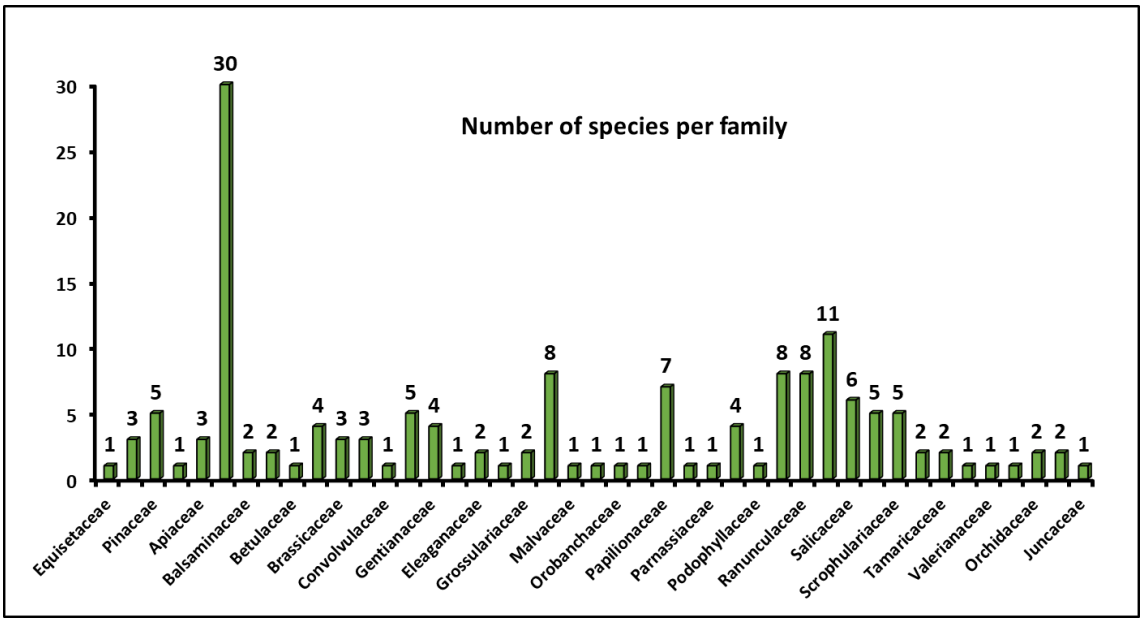


Figure 12. Per-family species count of traditional medicinal plants employed against human diseases

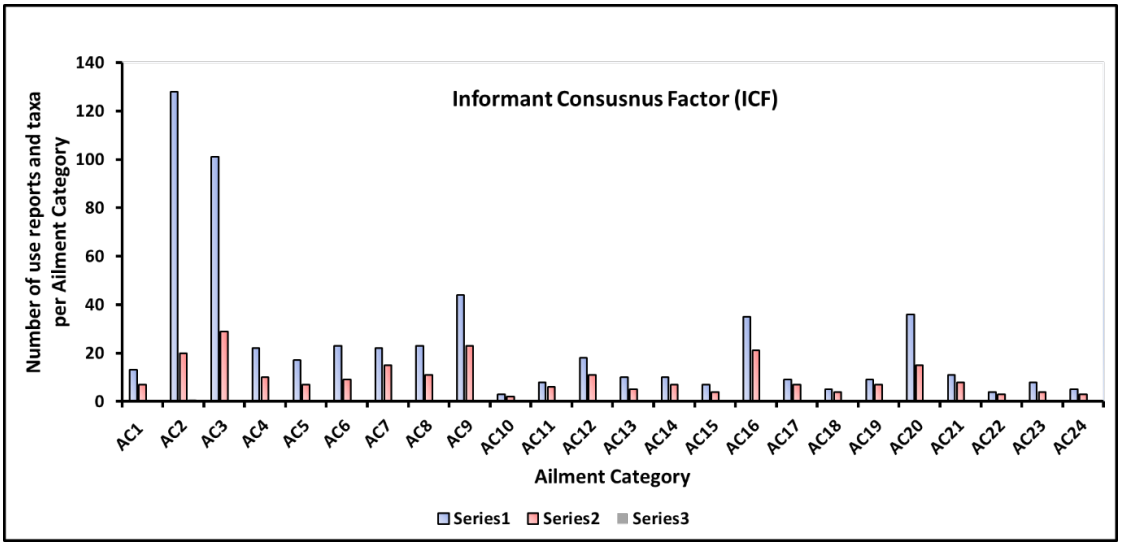


Figure 13. ICF values of traditional medicinal plants used for treating human ailments

Fidelity Level % (FL)

The highly potent medicinal plant species for curing specific disease or ailment categories are identified using the FL %. The FL values in the study ranged from 20% to 85% (Table 2). Higher FL values, such as *Juniperus squamata* at 85%, reflect medicinal plant species that are widely used and frequently employed by many people in an area. In contrast, lower FL values indicate that informants did not reach consensus on the same species. Species containing bioactive compounds with strong therapeutic properties are given higher preference. These species are most suitable for further validation of traditional knowledge through pharmacological examination. Similarly, medicinal plant species with low FL values, like *Impatiens thomsonii* (20% cannot be neglected or overlooked because, despite their low frequency, they face a high risk of loss of traditional knowledge and still offer diverse therapeutic applications (Table 2). However, no species with an FL value near 100% has been recorded.

Table 2. Ethnobotanical data from the Parishing Valley, District Astore, Gilgit-Baltistan.

Botanical Name	Vernacular Name	Voucher No.	Part Used	Mode of Preparation	Disease Category Treated	FC	RFC	UR	UV	FL%
Abies pindrow Royle.	Rai	Mh-23148	Leaves	Decoction	Chest infection, asthma, cough	9	0.075	4	0.033	33
Achillea millefolium Linn.	Akirkarra/Akra	Mh-2374	Whole plant	Powder, Decoction	Wound healing, bleeding, headache, inflammation, pains, stomach troubles, hair thinning, prostate cancer	12	0.100	7	0.058	60
Aconitum violaceum Jacq.Ex. Staf.	Bezhumolo/Kal i mori/Bodo jabati/ Besh kosoor	Mh-2311	Root	Powder	Asthma, heart diseases, cancer, toothaches, abdominal worms, BP, joint pains, swellings, pimples, skin allergies, internal tumors	12	0.100	11	0.092	45
Aconitum violaceum var. weileri (Gilli) Riedl.	Bezhumolo	Mh-2540	Rhizome	Raw, Paste	Arthritis, rheumatism, gout	30	0.252	3	0.025	15
Aconogonon alpinum (All.) Schar.	Gurus/Lamay/ Shee lamay	Mh-2305	Root, Leaves	Powder	Cancer, anti-tumor, joint pain, asthma, abdominal worms	32	0.268	5	0.042	54
Adiantum incisum Forssk.	Potoli-o-jabati	Mh-2490	Root, Fronds	Powder, Decoction	Halitosis, fever, hepatitis, cough, cold	10	0.084	5	0.042	62
Alcea rosea L.	Chama/ Phantochal	Mh-24178	Flower, Leaves	Decoction	Reduce high temperature, fever due to scorching sun	7	0.058	2	0.016	33
Allium fedtschenkoanum Regle.	But-Paloon	Mh-2559	Leaves	Raw	Abdominal pain, stomach problems	4	0.033	2	0.016	40
Anaphalis nepalensis (Spreng) Hand.	Chikee	Mh-2488	Whole plant	Powder	Wound healing, carminative, appetizer	16	0.134	3	0.025	50
Anaphalis virigata Thomson. Ex.C.B.	Chhiki	Mh-2314	Flower	Decoction	Removal of extra fat, fertility control, cough, asthma, abdominal pain, delivery, long hair	14	0.117	7	0.058	70
Aquilegia fragrans var. kanawarensis (Jacquem. ex. cambess.) Riendl.	Shash-ga-nugi phoonar	Mh-2536	Whole plant	Decoction	Blood purifier, diuretic, sweating, anti-parasites, astringent	13	0.109	5	0.042	50
Arnebia euchroma (Royle ex. Benth) I.M. Johnst.	Kono phooner	Mh-2511	Root	Powder	Cough, menorrhagia, lung problems, colon cancer	5	0.042	4	0.033	44

Artemisia brevifolia Wall.ex. DC.	Zunne	Mh-2405	Whole plant	Decoction	Abdominal worms	13	0.109	1	0.008	42
Artemisia gmelinii Web.ex. Stechm.	Khakamos	Mh-2408	Whole plant	Decoction	Insecticide, anti-diabetic, anthelmintic	20	0.168	3	0.025	33
Artemisia rutifolia Stephan ex. Spreng.	Zoon	Mh-2506	Aerial parts	Decoction	Mycosis, antifungal, antibacterial	20	0.168	3	0.025	33
Artemisia santolinifolia Turcz.	Kashray Zoon	Mh-2336	Leaves, Flowers	Powder, Decoction	Intestinal worms, diabetes, stomach burning, toothache, pregnancy stability, amulets	20	0.168	6	0.050	46
Artemisia scoparia Waldst. & Kit.	Jay/Jay kuch	Mh-2339	Leaves	Decoction	Cardiac problems, infant fever, blood cancer	13	0.109	3	0.025	60
Berberis orthobotrys Bien. Ex. Aitch.	Chorko/Cheh-rish	Mh-2385	Root	Powder, Decoction	Wound healing, backache, dislocation, fractured bones, intestinal disorders, hepatitis, BP, blood purifier, hernia, headache, analgesic, migraine, uterine tumor	40	0.336	16	0.134	43
Bergenia ciliata L.	Show shapur	Mh-23167	Rhizome	Decoction	Kidney problems, diuretic, ulcer, stomach disorders, BP, lung cancer	25	0.210	6	0.050	38
Bergenia stracheyi (Hook.F. & Thom.)	Lolo shapur	Mh-2365	Root, Leaves	Decoction	Wounds, weakness, BP, abdominal pain, ulcer, burning sites, internal wounds, nose bleeding, heart diseases, toothaches, intestinal deworming, acidity, kidney problems, pneumonia, anticancer	25	0.210	16	0.134	55
Betula utilis D. Don.	Joji	Mh-2345	Bark	Raw	Ophthalmic disorders, scabies, abscesses, amulets	5	0.042	4	0.033	33
Bistorta affinis (D. Don) Green.	Chomi/ Masloon/Bring kachoo/peer kachoo/Regeel / BaroKuch/ Titery	Mh-2487	Leaves	Decoction	Abdominal problems, bronchitis, chest infections, rhinitis, vomiting, wound healing, tea	32	0.268	7	0.058	53

Carum carvi L.	Hayyo/Kashmiri Hyoo	Mh-2303	Seed	Raw	Dysentery, internal wounds, ulcers, uterine tumors, stomach problems	10	0.084	5	0.042	62
Cedrus deodara G. Don.	Chui	Mh-2327	Resin	Raw	Itching, skin ointment, apoptotic activity	9	0.075	3	0.025	60
Cicer microphyllum Benth.	Khokoni	Mh-2371	Fruit/ Seed, Leaves, Stem	Raw, Decoction	Respiratory disorders, asthma, dermal diseases, allergies, milk production of cattle	4	0.033	5	0.042	75
Cichorium intybus L.	Shantoshah/ Chiti-Ashkinachi	Mh-2337	Leaves, Root	Powder	Abdominal pain, blood purifier, diabetes, pneumonia, asthma, diarrhea, rheumatism, fever, hepatitis, spleen enlargement, breast/face cancer	17	0.142	12	0.100	68
Convolvulus arvensis L.	Hergoli	Mh-2357	Leaves	Decoction	Halitosis, constipation, detergent, pancreatic cancer	6	0.050	4	0.033	57
Conyza viscosa Mill.	Lakani	Mh-2504	Aerial parts	Decoction	Dysentery, sore throat, general tonic	5	0.042	3	0.025	60
Cotoneaster microphyllus Wall. ex. Lindl.	Phoppy	Mh-2485	Root, Leaves	Decoction	Bleeding, pain	3	0.025	2	0.016	40
Cousinia thomsonii C.B. Clarke.	Jachi konay	Mh-2416	Whole plant	Powder	Uric acid reduction, fever shivering	8	0.067	2	0.016	40
Cynoglossum glochidiatum Wall ex. Benth.	Chiery/ Gasmalee	Mh-2514	Aerial parts	Decoction	Male fertility, antiseptic, fragrance	5	0.042	3	0.025	66
Dactylorhiza hatagirea D. Don.	Sala-Punju/Salem Panja/Panja/ Jadugar cher	Mh-2369	Root, Rhizome	Powder, Decoction	Infertility, wounds, nerve tonic, aphrodisiac, backache, stomach problems, impotence, intestinal pain, fatigue	18	0.151	9	0.075	57
Delphinium brunonianum Royle.	Mokhoty	Mh-24153	Flower, Leaves	Decoction	Typhoid, pneumonia, fever, sore throat, malaria, asthma, chest pain, flu, piles, blood circulation, expectoration of mucus, cough, anti-lice, long hair, joint pain, abdominal pain	4	0.033	16	0.134	57

Dianthus orientalis Adams.	Jangli Kach	Mh-2517	Seed	Decoction	Toothaches	3	0.025	1	0.008	33
Echinops cornigerus DC.	Showkono	Mh-2330	Root	Gums & Resin	General tonic for livestock	4	0.033	1	0.008	33
Echinops echinatus Roxb.	Jacheer	Mh-2508	Whole plant	Juice	Abdominal problems, arthritis, cough, analgesic, antioxidant, antibacterial, cervical cancer	12	0.100	7	0.058	70
Eclipta prostrata (L.) L. Mant	Bhangra	Mh-2436	Whole plant	Decoction	Flu, hair fall, jaundice, antiseptic, emetic	6	0.050	5	0.042	50
Elaeagnus umbellate Thunb.	Jangali tamatr	Mh-2523	Fruit	Raw	Cough, digestive problems, general tonic, cardiac problems, stimulator	2	0.016	5	0.042	44
Epilobium angustifolium L.Sp.Pl.	Danoye	Mh-2475	Leaves	Decoction, Paste	Anti-inflammation, skin sores, wound healer, GIT problems	8	0.067	4	0.033	44
Epipactis gigantea Douglas ex. Hook	Plamath	Mh-2367	Root	Decoction	General tonic for severe illness	2	0.016	1	0.008	33
Equisetum arvense L.	Cheiow	Mh-2359	Root, Leaves	Powder, Decoction	Piles, hemorrhoids, urinary problems, anticancer, tuberculosis	9	0.075	6	0.050	50
Fragaria nubicola (Hook. F.) Lindl.	Borsey	Mh-2353	Root	Decoction	Heart diseases, hepatitis, anticancer, diabetes, BP, height, stomach problems, tonic	2	0.016	8	0.067	56
Fraxinus xanthoxyloides Wall. ex G. Don	Kasoner	Mh-2526	Aerial parts	Decoction	Malaria, pneumonia, internal injuries, bone fractures, yellowing of skin	12	0.100	5	0.042	45
Gentianodes tianschanica Rupr.ex Kusn.	Chuk Bilain/Kyloo/ Pyloo/Palamat h/Nilkach	Mh-24149	Leaves, Flower	Powder	Fever, abdominal pain, headache, dehydration, blood purification, pneumonia, diabetes, potency, pain relief	25	0.210	9	0.075	71
Gentianopsis vvedenskyi (Grossh.) Pissjauk.	Pooly	Mh-2522	Root	Decoction	Diarrhea, heartburning, loss of appetite, bloating, digestive problems	20	0.168	5	0.042	50
Geranium pretense L.	Kurat Kachoo	Mh-23117	Whole plant	Decoction	Inflammation, wounds, swellings, tumors, bleeding, nerve problems, uterus problems	5	0.042	7	0.058	63

Geum elatum Wall ex. G. Don.	Toktoko/ Gooli-Molo	Mh-2545	Whole plant	Decoction	Dysentery, diarrhea, astringent, skin burning	4	0.033	4	0.033	57
Hieracium vulgatum Fries.	Choki	Mh-2435	Leaves, Stem	Raw	Blood purifier	5	0.042	1	0.008	25
Hippophae rhamnoides Rousi.	Boru	Mh-23118	Berries, Root	Powder, Decoction, Raw	Lung and kidney cancers, ENT problems, constipation	18	0.151	3	0.025	70
Hylotelephium ewersii (Ledeb.) H. Ohba.	Minichoo/Chao char/Loyoun Shina/Teetar	Mh-2368	Aerial parts	Raw, Decoction	Appetizer	7	0.058	1	0.008	33
Hylotelephium pakistanicum (G.R. Sarwar)	Rabrd Phooner	Mh-2519	Whole plant	Decoction	Cold, fever, headache	1	0.008	3	0.025	37
Impatiens thomsonii Hook.F.	Foutongi	Mh-2391	Seed	Raw	General tonic, delicious taste	2	0.016	2	0.016	20
Juniperus communis L.	Metahri/ Metaroo	Mh-2335	Fruit	Decoction	Stimulant, UTI, diuretic, carminative, anticancer	8	0.067	5	0.042	83
Juniperus excelsa M. Bieb.	Chhili	Mh-2347	Berries	Decoction	Anticancer, UTI	6	0.050	2	0.016	28
Juniperus squamata Lamb.	Chhili	Mh-2501	Berries, Aerial parts	Powder, Decoction	Tuberculosis, arthritis, diabetes, inflammation, diarrhea, liver problems, anti-worms	12	0.100	7	0.058	85
Leontopodium himalayanum DC. Prodr.	Shee chekki	Mh-2420	Flower	Powder, Decoction	Birth control, long hair, fragrance	3	0.025	3	0.025	33
Leontopodium nanum (Hook.f. & Thomson)	Jangali kach	Mh-2510	Whole plant	Decoction	General tonic	3	0.025	1	0.008	33
Lindelofia anchusoides (Lindl.) Lehm.	Sharing	Mh-2512	Aerial parts	Decoction	Headache, fever, skin diseases	8	0.067	3	0.025	50
Mentha longifolia Willd.	Phileel	Mh-2474	Whole plant	Powder	Headache, diarrhea, stomach problems, digestion, blood purifier, anti-emetic	8	0.067	6	0.050	40
Mentha royleana Benth.	Jangali filil	Mh-2301	Leaves	Powder	Abdominal pain, BP, stomach problems	20	0.168	3	0.025	27
Myricaria germanica (L.) Desv.	Huker	Mh-2546	Leaves	Decoction	Pain relief	3	0.025	1	0.008	20
Nepeta discolor Royle.	Koroloo/kororo	Mh-2456	Whole plant	Powder, Decoction	Abdominal pain, acidity, headache, thinness, BP	22	0.184	5	0.042	45

Nepeta leucolaena Bth.ex.Hk.	Gasmali jungeli	Mh-2423	Leaves	Decoction	Constipation, stomach problems	20	0.168	2	0.016	40
Orobanche cernua Loefl.	Taarey	Mh-23106	Stem	Raw	Delicious taste	4	0.033	1	0.008	20
Oxalis corniculata L.	Churkini	Mh-2527	Aerial parts	Decoction	Constipation, ulcer, digestive problems, emollient, brain cancer, small tumors, spermatoria, bleeding wounds, dysentery	6	0.050	10	0.084	50
Oxyria digina (L.) Hill.	Chorkii	Mh-2486	Flower, Leaves	Powder	Abdominal problems, blood purifier, migraine, vomiting, acidity, expectoration of mucus, BP	15	0.126	7	0.058	60
Parnassia nubicola Wall. ex Royle	Gibdagi/Gibdali /Shayee/ Phooner/Mulu s	Mh-2531	Whole plant	Decoction	Digestive problems, boils, snakebite, wounds	18	0.151	5	0.042	45
Picris hieracioides L.	Chityaal	Mh-2492	Root, Leaves	Powder, Decoction	Kidney stone, diabetes, wounds, body pain, black pimples, hepatitis, typhoid, cancer, ulcer, controlling motions	16	0.134	10	0.084	61
Picrorhiza kurrooa Royle Ex. Benth.	Kardo/Kud katki/Kudh	Mh-2556	Root	Decoction	Lower BP, rheumatism, anti-diabetic, abdominal pain, typhoid, severe fever, expectoration of mucus, headache	9	0.075	8	0.067	66
Pinus roxburghii Sarg.	Chiyotu	Mh-2502	Resin, Bark, Seed	Paste, Resin	Skin diseases, asthma, cough, indigestion, TB, bloody diarrhea, liver cancer	11	0.092	7	0.058	66
Pinus wallichiana A.B. Jackson.	Chui	Mh-23147	Gum	Raw	Purgative, expectorant, diuretic, asthma, eczema, piles, bronchitis, ear/tooth ache, scabies, epilepsy, liver/spleen diseases, tuberculosis	11	0.092	12	0.100	60
Pistacia khinjuk Stocks.	Kakaw	Mh-2306	Latex/Resi n, Leaves	Powder, Decoction	Inflammation, eye redness, UTI, burning of urine	8	0.067	4	0.033	40

Plantago major L.	Khapaypato	Mh-2328	Seed, Leaves	Raw, Powder	Kidney stone, dysentery, constipation, boils, toothaches, long hair, liver cancer	30	0.252	7	0.058	58
Prunella vulgaris L.Sp.Pl.	Kalveoth (Kashmiri)	Mh-2524	Flowers, Leaves	Decoction	Anti-neuralgic, sore throat, stomachache, diuretic, tonic, thyroid cancer	23	0.193	6	0.050	60
Pulsatilla wallichiana (Royle) Ulbr.	Kramkotii/ Karmkoty	Mh-2484	Flower, Root	Powder	Joint pain, expectoration of pus, pimples, anti-lice, wounds, delivery, fever, abdominal pain, menstrual disturbance, livestock skin diseases	4	0.033	10	0.084	40
Ranunculus attenuatus Royle.	Koroloo	Mh-2315	Whole plant	Powder	Oozing out of poisonous water from stomach	12	0.100	1	0.008	25
Rheum emodi Wall.	Chountal	Mh-2535	Whole plant	Extract	Asthma, blood purifier, hair color, stomach problems, cytotoxic activity, diarrhea, purgative, astringent	10	0.084	8	0.067	75
Rhodiola heterodonta (Hook.F. & Thom.)	Looeo-shino	Mh-23104	Flower, Root	Decoction, Powder	Rickets, asthma, inflammation, hair growth	2	0.016	4	0.033	66
Rhodiola wallichiana (Hook.f. & Thomson) Boiss.	Jangali Rabard Phool	Mh-2521	Leaves	Decoction	Wounds, burning sites	2	0.016	2	0.016	40
Ribes alpestre Wall.	Shumloo/Hergi li/Churkoo	Mh-23125	Root, Berries, Leaves	Powder, Decoction	Anticancer, fractured joints, headache, migraine, wounds, BP, vitamins, small pox	12	0.100	8	0.067	39
Ribes orientale Desf.	Shatou/ Mayar-shatoo/ Marshatoo	Mh-2341	Fruit/ Berries	Raw, Powder	Motions, constipation, dehydration, anticancer, headache, halitosis, migraine, kidney stone	8	0.067	8	0.067	66
Rosa indica L.	Gulab	Mh-2544	Flowers	Decoction	Eye diseases, pneumonia, stomach problems, fever, colon cancer	1	0.008	5	0.042	45
Rosa webbiana Wall. Ex. Royle.	Shigai	Mh-23156	Fruit, Bark, Flower	Decoction	Tonic, energizer, vitamins, whooping cough, fever, abdominal problems,	4	0.033	9	0.075	57

					ophthalmic diseases, fragrance					
Rubus irritans Focke.	Aichichay/Ichechay	Mh-2363	Fruit, Root	Raw	Energizer, tonic, respiratory problems, typhoid, hepatitis, asthma	2	0.016	6	0.050	40
Rumex acetosa L.	Churkii	Mh-2533	Root, Leaves	Decoction	Stomach problems, constipation, joint inflammation	19	0.159	3	0.025	60
Rumex hastatus (Don).	Churki	Mh-2532	Leaves, Berries, Stem, Root	Raw, Powder, Extract	Hepatitis, jaundice, stomach problems, purgative, bleeding, piles, skin disorders, lung problems, breast cancer	8	0.067	9	0.075	71
Rumex nepalensis Spreng.	Hubabel	Mh-2483	Roots	Decoction	Swellings, joint pains	9	0.075	2	0.016	42
Rumex patientia L.	Hubabal	Mh-2534	Leaves, Root	Decoction	Sore throat, constipation, skin problems	10	0.084	3	0.025	33
Salix alba L.	Biawo	Mh-2554	Leaves, Stem	Raw, Decoction, Paste	Headache, joint pain, general body pain	20	0.168	3	0.025	42
Salix denticulata N.J. Anderss.	Boti-biawo	Mh-2479	Bark	Decoction	Tea, fever, low BP	23	0.193	3	0.025	37
Saussurea simpsoniana Field. Garden.	Booshi Phunar	Mh-2481	Whole plant	Decoction	Asthma, fever, flu, whooping cough, influenza, sore throat, pneumonia, bronchitis, weakness, joint pain, heart diseases, lung problems, abdominal pain, post-birth removal	30	0.252	15	0.126	60
Scorzonera virgata DC. Prodr.	Gori phonar	Mh-2414	Flower	Decoction	Mycosis, anti-inflammation	6	0.050	2	0.016	50
Silene gonosperma (Rupr.) Bocquet.	Phonary	Mh-2518	Flowers	Decoction	Constipation, nasal problems, deafness problems	10	0.084	3	0.025	50
Silene vulgaris (Moench) Gareke.	Gigio-shah/Gigio/ Jabiuo/Shirigo kuch	Mh-2342	Leaves, Flower	Raw, Decoction	Joint pain, constipation, pneumonia, malaria	4	0.033	4	0.033	45

Sinopodophyllum hexandrum (Royle) T.S. Ying.	Ishmandy	Mh-2350	Root, Fruit	Powder	Birth control, wound healing, heart problems, pimples, shivering, cancer, asthma, cough, pneumonia, tuberculosis, typhoid, hypertension, vitamin source, baldness	4	0.033	15	0.126	55
Sonchus asper (L.) Hill.	Khashawii	Mh-2330	Leaves	Decoction, Powder	Blood pressure, fever, body shivering, pain, anticoagulant, cervical cancer	11	0.092	6	0.050	66
Spiraea canescens D. Don.	Darai/Shai	Mh-23161	Stem, Oil	Raw	Pimples, skin infections, injuries	12	0.100	3	0.025	37
Swertia cordata (G. Don)	Mumiran/ Laylow-Jabati	Mh-2370	Whole plant	Decoction	Heart diseases, headache, BP, vomiting	8	0.067	3	0.025	66
Taraxacum officinale Webber.	Ishkaniach/ Hanshah	Mh-2507	Aerial parts	Raw, Decoction	Sexual stimulant, cough, immunity booster, appetizer, inflammation, apoptosis, liver cleaner, LDL cholesterol, gall/urinary stones, brain cancer	16	0.134	10	0.084	41
Taraxacum stewartii Soest.	Lakanay	Mh-2354	Leaves	Raw	Vegetable	8	0.067	1	0.008	33
Thlaspi arvense L.	Bergah	Mh-2516	Seeds	Decoction	Burning of urine, prostate diseases	2	0.016	2	0.016	50
Thymus linearis Benth.	Toomoro	Mh-23131	Whole plant	Decoction	Asthma, cough, BP, expectoration of mucus, height, pain, abdominal disorders, breast cancer	16	0.134	9	0.075	34
Trifolium pratense L.	Chapati Ishpit	Mh-2309	Whole herb	Decoction	Meningitis, pneumonia, fever, sore throat, feverish feeling, arthritis	2	0.016	6	0.050	50
Trifolium repense L.	Ishpit	Mh-23139	Whole plant	Decoction	Cough, cold	3	0.025	2	0.016	40
Urtica dioica L.	Joomi	Mh-23171	Root, Leaves	Powder	Anti-diabetic, prostate diseases, anti-dandruff, BP, sugar level, vegetable, hemorrhoids, piles, stomach problems,	18	0.151	18	0.151	65

					jaundice, fever, hematuria, gout, kidney diseases, skin diseases, cancer, paralysis, breast cancer					
Valeriana hoffmeisteri (Kl.) Clarke	Kilogonoo	Mh-2468	Root	Decoction	Abdominal pain, stomach pain, constipation, antispasmodic, stimulant, tonic, hysteria, epilepsy	20	0.168	8	0.067	66
Verbascum thapsus L.	Romkato	Mh-2312	Leaves, Root	Decoction, Powder	Stomach problems, cough, analgesic, antiseptic, wound healer, diabetes, BP, pulmonary diseases, diarrhea, dysentery, lung cancer, bronchial asthma	9	0.075	12	0.100	58
Viola biflora L.	Lilio	Mh-2557	Whole plant	Decoction	Bronchitis, sore throat, cough, liver and kidney problems, skin disorders, eczema, lung cancer	27	0.226	7	0.058	72

Table 3. Comparison of the present study in Parishing Valley with previous study (Khadim *et al*. 2024 in Parishing valley).

Parameter	**Previous study: Khadim *et al*. (2024)**	**Present study**	**Difference**
Study area	Parishing Valley	Parishing Valley	comparison
Number of species reports	90	153	63
New species reports	-----	32	32 additional reported
Additional medicinal uses	-----	31	31 additional uses
Most Dominant family	Asteraceae	Asteraceae (13 spp.)	Asteraceae (30 spp.)
Dominant life form	Herbs (72%)	Herbs (79%)	
Most-used plant part	Leaves (32%)	------	Same
Main preparation method	Decoction	Decoction	Same
Highest RFC	*Thymus linearis* (0.8)	*Berberis orthobotrys* (0.336)	-----
Highest FL	*Thymus linearis* (97.5%)	*Juniperus squamata* (85%)	-----
Highest ICF	Digestive system (0.91)	Gastrointestinal (0.85)	-----

Discussion

Plants are an essential part of the ecosystem, and humans have used them as medicine since time immemorial. In addition, plant resources have also been used for multiple purposes, including ethnomedicine, ethnoveterinary practices, fodder and forage, fuel and timber, myths and cultural beliefs, and various other applications (Haq, 1983). The present study reported 153 plants in total: 120 MAPs, 19 used as fodder and forage, 7 as fuel and timber, 5 for cultural and other uses, and 2 for veterinary purposes.

Similar studies have been reported from other parts of the same valley, District Astore, Gilgit-Baltistan, Pakistan. For instance, Khadim *et al*. (2024) conducted an ethnobotanical inventory in Parishing Valley and reported 90 wild medicinal plants, belonging to 79 genera and 35 families, used for various diseases. They further reported that Asteraceae was the dominant family with 13 species; herbs (72%) were the dominant life form; decoction (63%) was a prominent method for using MPs; the highest RFC value (0.8) was reported for *Thymus linearis;* the highest FL value (97.5%) was reported for *Thymus linearis;* and the ICF value reported the digestive system (0.91). The findings agreed with the current study in Parishing Valley. The present study also documented 32 ethnobotanical reports not reported in the previous study by Khadim *et al*. (2024), along with 31 additional uses. These findings indicate that continued ethnobotanical investigation can reveal previously undocumented local knowledge, even in an area already studied (Table 3). A similar study was conducted by Hussain *et al*. (2026), who documented 186 wild plants belonging to 62 families and 150 genera, including 105 medicinal plant species with medicinal applications from Hercho Valley, GB, Pakistan. The study further reported that Asteraceae was the dominant family with 26 species (13.9%), herbs were the dominant life form with 84 species (80%), leaves were the dominant plant part used with 27 species (25.71%), and decoction was the most prominent method of use (55.23%). A similar study further reported 52 new species, especially from Astore, and 30 species were documented with additional uses. Moreover, the highest RFC value was reported for *Cicerbita decipiens* var. *multifida* (0.9); the highest UV was reported for *Bergenia stracheyi* (0.83); the highest ICF value was reported for gastrointestinal problems (0.75); and the highest FL value was reported for Aconitum *heterophyllum* (100% FL). These results align with the present study in Parishing Valley, Astore, GB. Similarly, Wali *et al*. (2019) conducted a quantitative medico-botanical expedition in Fairy Meadows National Park (FMNP) and reported 90 plant species belonging to 49 families and 77 genera. The study also reported that the most dominant life form was herb (60%), the most used plant part was leaves (27%), the most common method of preparation was powder (27%), and the highest UV values were found for *Berberis lyceum* (5.47). The study also correlated with the present study on Parishing Valley.

The present study reported that Asteraceae was the dominant family. Asteraceae was the most frequently represented family in the present study area. This dominance may be associated with Asteraceae's ecological adaptability and wide distribution in the study area, particularly its occurrence in diverse habitats and disturbed environments. The frequent availability of these plants may have increased their recognition and utilization by local communities. Similar representation of Asteraceae has also been reported in ethnobotanical studies from mountainous regions of northern Pakistan. However, a family's relative dominance may vary by habitat, season, local availability, and cultural preferences. Similar findings were reported by Khadim *et al*. (2024) from the Theeing Valley of Parishing, who documented 62 plant species and 26 families, with Asteraceae dominant, leaves as the most used plant part, and decoction as the prevalent preparation method. They also reported promising RFC (0.952) and UV (0.905) for *Delphinium brunonianum,* and 100% FL for *Thymus linearis* and *D. brunonianum,* while the highest ICF (0.97) was recorded for UTI.

The present study also reported that herbs were the most dominant life form, leaves were the most used plant parts, and decoction was the dominant form of herbal preparation and used with different adjuvants (Chen *et al*. 2018). Leaves were the most frequently utilized plant part in the present study. This preference may relate to their relative ease of access and collection compared with underground parts such as roots and rhizomes. Harvesting leaves may also allow the plant to survive and regenerate when collection is moderate. However, intensive leaf harvesting may still affect plant growth and reproductive performance in some species (Baidya *et al*. 2020, Panmel *et al.* 2019).

Decoction was the most commonly reported preparation method. This may reflect the traditional practice of extracting medicinal constituents from plant material by prolonged boiling in water. The method is simple, inexpensive, and requires no specialized equipment, making it suitable for household-level traditional healthcare practices. The preference for decoction may therefore reflect both cultural knowledge and practical accessibility.

Although this ethnobotanical investigation covers the full record of medicinal and aromatic plants (MAPs) used by local people and rural communities in the area, it has several limitations. The present study was limited to the villages of Hupuk, Dachay, Khangrool, Ramkha, Mushk, Phopal, Shapay, Palayat, Thang Pain, Bala, and Gutumsar. Similar ethnobotanical studies in other villages and valleys are essential to capture the valley's diverse and rich traditional indigenous knowledge. Furthermore, continuous ethnobotanical monitoring or checks play a key role in ensuring the sustainable utilization of medicinally important flora over time and in assessing the impact of conservation endeavors. Moreover, the study area has cultural values and taboos. Therefore, female participation was limited. The study has sampling bias (90 males vs. 29 females). The study has a clear gender bias and imbalance, with 90 male participants and only 29 female participants. This creates sampling bias because the sample does not adequately represent women in the population. Owing to this, women's health data, such as women's traditional indigenous knowledge (IK) of MAPs, may be underrepresented; health conditions that mainly affect women and MAP uses for gynecological problems (e.g., pregnancy, postpartum care, menopause, and the menstrual cycle) may not be fully documented. Consequently, the study may highlight the male point of view more than women's experiences, reducing the generality and authenticity of the findings. This imbalance can limit the reliability of recommendations associated with women's health. Therefore, it is suggested and recommended that future ethnobotanical studies recruit a more balanced number of male and female participants or use stratified sampling to ensure that women's knowledge and health ethnopharmacological applications are proportionately represented.

Conclusion

This ethnobotanical investigation documented substantial traditional knowledge of medicinally important plants in the study area. The predominance of Asteraceae leaves as the principal plant part, and decoction as the major preparation method reflects locally established patterns of medicinal plant utilization. Compared with previous research, particularly Khadim *et al*. (2024), the present study documented additional ethnobotanical information, including 32 previously unreported records and 31 additional uses. These findings highlight the continuing importance of documenting traditional knowledge and identifying culturally important medicinal plants. However, the reported medicinal uses represent traditional knowledge and should not be interpreted as evidence of pharmacological efficacy without appropriate phytochemical, pharmacological, and clinical investigation. The documented medicinal plants represent a valuable resource for future phytochemical and pharmacological investigations. *Urtica dioica* L. (Highest UV = 0.151) and *Berberis orthobotrys* (highest RFC = 0.336), and the highest FL value is reported for *Juniperus squamata* (85%). These plants are recommended for further phytochemical screening and conservation priority, especially *Urtica dioica* L., *Berberis orthobotrys*, *Juniperus squamata, Sinopodophyllum hexandrum*, *Picea smithiana, Abies pindrow, Pinus roxburghii, and Dactylorhiza hatagirea.*

Moreover, the ethnobotanical research revealed the deep expertise of indigenous communities in understanding the ethnopharmacological applications of wild MAPs. These indigenous communities have accumulated knowledge about MAPs over generations. This valuable indigenous traditional knowledge is passed down orally and is at risk of being lost due to modernization, cultural assimilation, and a lack of preservation through documentation. As this ancestral folk wisdom faces decline due to modern pharmaceuticals, current ethnobotanical research stresses the need to investigate MAPs and tap the potential of these plants. As a result, increased use of wild MAPs poses serious anthropogenic pressures and extinction threats to wild resources, creating challenges for future generations. To promote in-situ and ex-situ conservation, the current study suggested 15 actionable recommendations.

1. Conservation Initiatives: Develop and implement conservation programs for threatened medicinal plant species and their habitats, involving local communities
2. Research & Development: Promote scientific research on the pharmacological properties of local medicinal plants and their potential for economic development. In this regard, provide financial support for young researchers and scholars.
3. Capacity-building Trainings: Provide training to local communities on sustainable harvesting techniques and the importance of conserving medicinal plant resources in the following pattern:

Ownership and participation: Empowering communities and building their capacity ensures that they have a voice in decision-making processes and are actively involved in shaping their own development. When communities feel ownership and participate, they are more likely to take responsibility for their actions and work toward sustainable solutions that meet their specific needs and aspirations.

Sustainable development: Empowered communities are better equipped to address their own challenges and work towards sustainable development. By building their capacity, communities gain the knowledge, skills, and resources needed to identify and implement appropriate solutions. This reduces dependence on external assistance and promotes self-reliance, leading to long-term sustainability.

Local knowledge and expertise: Communities possess valuable local knowledge and expertise that is often overlooked in traditional development approaches. Empowering communities and building their capacity allows them to include this local knowledge, which is crucial for developing contextually appropriate interventions. By tapping into their knowledge and expertise, communities can contribute to more effective and culturally sensitive solutions.

Social cohesion and resilience: Empowered communities are more likely to have strong social cohesion and resilience. When community members are actively engaged in decision-making and feel a sense of ownership, they build stronger bonds and trust. This social cohesion enables communities to work together in times of crisis and adapt to changing circumstances, making them more resilient to shocks and stresses.

Poverty reduction and social justice: Empowering communities and building their capacity can contribute to poverty reduction and social justice. By providing communities with the necessary skills and resources, they can improve their livelihoods, access economic opportunities, and participate in decision-making processes that affect their lives. This helps to address inequalities and promote social justice within communities.

Sustainable resource management: Community empowerment and capacity building are essential for sustainable resource management. By involving communities in managing medicinal plant resources, they become stewards of their environment and are more likely to adopt sustainable practices. This can include sustainable medicinal plant farming, forest management, water conservation, and biodiversity conservation. Empowered communities are also more likely to advocate for their rights and protect their resources from exploitation.

Knowledge sharing and learning: Community empowerment and capacity building promote knowledge sharing and learning. By building community members' capacity, they can acquire new knowledge and skills, which they can share within the community and with external stakeholders. This knowledge exchange fosters mutual learning, innovation, and the co-creation of knowledge, leading to improved practices and outcomes.

1. Legislation and regulations: Advocate for the development and enforcement of regulations to control the unsustainable trade of medicinal plants.
2. Education and awareness: Conduct local awareness campaigns to educate locals about the importance of preserving medicinal plant diversity and sustainable harvesting.
3. Cultivation and economic development: Implement cultivation projects for selected medicinal plants with economic potential, providing an additional income source for local communities.
4. Development of protected areas (PAs): The areas depleted due to over-exploitation of herbs should be protected completely, and side by side, an attempt should be made to cultivate these herbs at different localities and elevations.
5. Preservation of indigenous knowledge: Ethnobotanical surveys of the area should be carried out to learn the medicinal uses of these plants before this information is lost.
6. Identification of hotspots: Hotspot areas should be identified based on medicinal plant diversity, and plans should be developed for their conservation.
7. Identification of endemic species: Protect the areas where endemic species of medicinal plants are found and, side by side, attempts should be made to cultivate these plant species through in-situ conservation methods.
8. Floristic inventories: Complete floristic inventory of the medicinal plants of different areas, Nallahs, Meadows, Lakes, Swamps, Bogs, etc.
9. Establishment of conservation committees: Establish conservation committees at community level for conservation of natural resources of medicinal plants.
10. Establishment of conservation, management and monitoring department: Establish a separate department for conservation, management and monitoring of natural resources, particularly medicinal plants, in collaboration with government and NGOs.

11. Community mobilization for conservation of threatened medicinal plant species
12. Formation of MAPs producer associations: who are directly linked to big buyers for maximizing their net income.
13. Establishment of seed banks, gene banks and botanical gardens.

Declarations

List of abbreviations: A.H - Annual Herb; ACs - Ailment Categories; C - Common; CC - Very Common; CHF - Conservation of Herbaceous Flora; CR - Critically Endangered; EN - Endangered; EPA - Ethnobotanical Plant Assessment; FC - Frequency Citation; FL - Fidelity Level; FUV - Family Use Value; GB - Gilgit-Baltistan; GIS - Geographic Information System; GSE - Global South Economies; HPT - Health Promoting Traits; ICF - Informant Consensus Factor; Inf - Infrequent; KPK - Khyber Pakhtunkhwa; MAPs - Medicinal and Aromatic Plants; N - Total Number of Respondents; Ni - Total Number of Informants for a Specific Plant Species; NTFPs - Non-Timber Forest Products; P.H - Perennial Herb; Ph - Phytochemical; R - Rare; RFC - Relative Frequency Citation; RR - Very Rare; TK - Traditional Knowledge; Ui - Number of Use Reports Cited by Each Informant for a Specific Plant Species; UR - Use Report; UV - Use Value; UVs - Species Use Value; VU – Vulnerable.

Ethics approval and consent to participate: The study was conducted in accordance with ethical principles and guidelines, applicable provisions of the Nagoya Protocol on Access and Benefit-Sharing (ABS), the International Society of Ethnobiology (ISE Code of Ethics) and the IRB (Institutional Review Board) for research (involving traditional knowledge and human participants. Before data collection, Prior Informed Consent (PIC) obtained verbally from 119 informants and from village elders, Mutually Agreed Terms (MAT), Benefit-sharing, Traditional Knowledge (TK) was documented with due respect for the rights and interests of local communities and the necessary legal permissions were obtained from all informants, participants, and stakeholders, exclusively Gilgit-Baltistan Forest Department (GB Permit NO. FD/GB/2021-124) no commercial collection or export of plant materials was undertaken to legislation (Forest Act, 1927 and Wildlife Act, 1975), after clearly explaining the objectives and purpose of the study before the collection and use of biological resources. Moreover, ethical approval and clearance certificate taken from Karakorum International University (KIU), Office of Research, Innovation & Commercialization (ORIC) and Director Advance Studies & Research (DASR) (KIU/REC/ETH/2026/001) for execution of this study.

The study also complies with the Nagoya Protocol and Pakistan ABS regulations. Informants' data were anonymized to protect their privacy and confidentiality. The study was conducted under departmental oversight at Karakorum International University ORIC and DASR, and also with oversight provided by Ex-HoD, Prof. Dr. Sher Wali Khan (Supervisor) and Current HoD, Associate Prof. Dr. Qamar Abbass (Co-supervisor). Participation of the respondents/ informants was entirely voluntary, and the information provided was used only for academic and research purposes. The study followed ethical standards for ethnobotanical research and respected the cultural values, knowledge systems, and intellectual contributions of the local communities and traditional healers who participated. This research is collaborative and respectful, protects cultural and biological diversity, and puts communities in the lead on decisions about their knowledge and resources.

Consent for publication: Not applicable

Availability of data and materials: The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Competing interests: Not applicable

Funding: Not applicable

Author contributions: M.H. designed and conceived the ethnobotanical study, supervised the research, and prepared the original draft of the manuscript. I.H. curated and analyzed the data and revised the manuscript. S.W.K helped revise and improve the manuscript and Q.A. contributed ethnobotanical tools and equipment to identify the plants used in this study. All authors contributed to the article and approved the final version of the manuscript.

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Supplementary Table 1. Cumulative List of Plants distribution in different ecological zones of the Parishing valley and Thang Bala Valley of District Astore, Gilgit-Baltistan.

S#	F #	Family Name	Botanical Name and Voucher Numbers	Genera	Species	Habit	Life form	Parishing Valley	Desert/ Tropical Zone (914-1219)	Temperate Mountain Zone (1219-3000)	Sub-Alpine Zone (3000-4500)	Alpine-Zone (4500-5500)	Status
I. Pteridophytes (Pteridophyta)													
1	**1**	**Polypodiaceae**	*Adiantum incisum* Forssk. Mh-2490	1	1	Herb	He	Pa (Tb)	-	+	-	-	Infrequent
2	**2**	**Equisetaceae**	*Equisetum arvense* L. Mh-2359	1	1	Herb	Ge	Pa	-	+	-	-	Very Common
II. Gymnosperms													
3	**3**	**Cupressaceae**	*Juniperus squamata* Buch-Ham. ex D. Don. Mh-2501	1	03	Shrub	Ch	Pa	-	-	+	-	Very Common
4			*Juniperus communis* subsp. *alpina* (Neilr.) Celak. Mh-2335			Shrub	Ch	Pa	-	-	+	-	Very Common
5			*Juniperus excelsa* M. Bieb. Mh-2347			Tree	Ph	Pa	-	+	+	-	Very Common
6	**4**	**Pinaceae**	*Picea smithiana* (Wall.) Boiss. Mh- 23149	1	1	Tree	Ph	Pa	-	+	+	-	Common
7			*Abies pindrow* Royle.Mh-23148	1	1	Tree	Ph	Pa	-	+	+	-	Common
8			*Cedrus deodara* G. Don. Mh-2327	1	1	Tree	Ph	Pa	-	+	-	-	Rare
9			*Pinus roxburghii* Sarg. Mh-2502	1	2	Tree	Ph	Pa	-	+	+	-	Common
10			*Pinus wallichiana* A.B. Jackson. Mh-23147			Tree	Ph	Pa	-	+	+	-	Common
III. Angiosperms (Dicots)													
11	**5**	**Anacardiaceae**	*Pistacia khinjuk* Stocks. Mh-2306	1	1	Tree	Ph	Pa	+	+	-	-	Very Rare
12	**6**	**Apiaceae**	*Pleurospermum govanianum* (DC.)Benth. Ex.C.B. Clarke. Mh-2503	1	2	Herb	He	Pa	-	+	+	-	Common
13			*Pleurospermum stylosum* C.B. Clarke. Mh-2402			Herb	He	Pa	-	-	+	-	Common
14			*Carum carvi* L. Mh-2303	1	1	Herb	He	Pa	-	+	+	-	Very Common

15	**7**	**Asteraceae**	*Saussurea simpsoniana* Field. Garden. Mh-2481	1	1	Herb	He	Pa (Tb)	-	-	+	+	Infrequent
16			*Cichorium intybus* L. Mh-2337	1	1	Herb	He	Pa (Tb)	-	+	-	-	Common
17			*Conyza viscosa* Mill. Mh-2504	1	1	Herb	Th	Pa	+	+	-	-	Common
18			*Cicerbita astorensis* Roohi Bano & Qaiser Mh-2413	1	1	Herb	He	Pa	-	+	+	-	Infrequent (Endemic)
19			*Tanacetum artemisioides* Sch.Bip.ex.Hk. Mh-2505	1	1	Herb	Ch	Pa	-	+	+	-	Common
20			*Picris hieracioidis* L. Mh-2492	1	1	Herb	He	Pa	-	+	+	-	Common
21			*Eclipta prostrata* (L.) L. MantMh-2436	1	1	Herb	He	Pa	-	+	+	-	Common
22			*Artemisia desertorum* Spreng.Syst. Mh-2349	1	08	Herb	Ch	Pa	-	+	+	-	Very Common
23			*Artemisia rutifolia* Stephan ex. Spreng. Mh-2506			Herb	He	Pa	-	-	+	-	Very Common
24			*Artemisia foetida* (Jacq.) Mh-2406			Herb	Ch	Pa	-	+	+	-	Very Common
25			*Artemisia japonica* Thunb.Mh-2407			Herb	He	Pa	-	+	+	-	Very Common
26			*Artemisia gmelinii* Web.ex. Stechm.Mh-2408			Herb	Ch	Pa	-	+	+	-	Very Common
27			*Artemisia santolinifolia* Turcz. Mh-2336			Herb	Ch	Pa	-	+	+	-	Very Common
28			*Artemisia scoparia* Waldst. & Kit. Mh-2339			Herb	Ch	Pa	+	+	-	-	Very Common
29			*Artemisia brevifolia* Wall.ex. DC. Mh-2405			Herb	Ch	Pa	-	+	+	-	Very Common
30			*Anaphalis virigata* Thomson. E.C.B. Mh-2314	1	02	Herb	Ch	Pa	-	+	-	-	Common
31			*Anaphalis nepelensis* (Spreng.) Hand-Mazz. Mh-2488			Herb	Ch	Pa	-	+	+	-	Common
32			*Taraxacum stewartii* Soest. Mh-2354	1	02	Herb	He	Pa	-	+	_	-	Infrequent
33			*Taraxacum officinale* Webber. Mh-2507			Herb	He	Pa	-	+	+	-	Common

34			*Scorzonera virgata* DC. Prodr. (*S. divericata* Hook.) Mh-2414	1	1	Herb	He	Pa	-	+	+	-	Common
35			*Sonchus asper* (L.) Hill. Mh-2330	1	1	Herb	He	Pa	-	+	-	-	Infrequent
36			*Echinops cornigerus* DC. *(E. echinatus)* Mh-2330	1	2	Herb	Ch	Pa	-	+	-	-	Common
37			*Echinops echinatus* Roxb. Mh-2508			Herb	He	Pa	-	+	-	-	Common
38			*Cousinia thomsonii* Clarke. Mh-2416	1	1	Herb	He	Pa	-	+	+	-	Common
39			*Hieracium umbellatum* L. Mh-2427	1	2	Herb	He	Pa	-	-	+	-	Common
40			*Hieracium vulgatum* Fries. Mh-2435			Herb	He	Pa	-	-	+	-	Common
41			*Achillea millefolium* L.Sp.Pl. Mh-2374	1	1	Herb	He	Pa	-	+	+	-	Infrequent
42			*Aster altaicus* Willd. Mh-2509	1	1	Herb	He	Pa	+	+	+	-	Common
43			*Leontopodium himalayanum* DC. Prodr. Mh-2420	1	02	Herb	He	Pa	-	+	+	-	Common
44			*Leontopodium nanum* (Hook.f. & Thomson) Mh-2510			Herb	He	Pa	-	+	+	-	Common
45	**8**	**Balsaminaceae**	*Impatiens edgwarthii* Hook.F. Mh-2391	1	2	Herb	Th	Pa	-	+	+	-	Very Common
46			*Impatiens thomsonii* Hook.F. Mh-2391			Herb	Th	Pa	-	+	+	-	Common
47	**9**	**Berberidaceae**	*Berberis orthobotrys* Bien. Ex. Aitch. Mh-2385	1	1	Shrub	Np	Pa	-	+	+	-	Infrequent
48			*Sinopodophyllum hexandrum* (Royle) T.S. Ying.Mh-2350	1	1	Herb	Ge	Pa	-	+	+	-	Rare
49	**10**	**Betulaceae**	*Betula utilis* D. Don. subsp. *jacquemontii* (Spach) Kitam. Mh-2345	1	1	Tree	Ph	Pa	-	+	+	-	Common
50	**11**	**Boraginaceae**	*Arnebia euchroma* (Royle ex. Benth) I.M. Johnst. Mh-2511	1	1	Herb	He	Pa (Los)	-	+	+	-	Rare
51			*Lindelofia anchusoides* (Lindl.) Lehm. Mh-2512	1	1	Herb	He	Pa	-	+	+	-	Rare

52			*Lappula barbata* (M. Bieb.) Gurke Mh-2513	1	1	Herb	Th	Pa (Los)	-	+	+	-	Common
53			*Cynoglossum glochidiatum* Wall ex. Benth. Mh-2514	1	1	Herb	Th	Pa	-	+	+	_	Common
54	**12**	**Brassicaceae**	*Alliaria petiolata* (M. Bieb.) Cavara & Grande. Mh-2515	1	1	Herb	He	Pa (Los)	-	+	-	-	Common
55			*Thlaspi arvense* L. Mh-2516	1	1	Herb	Th	Pa	-	-	+	-	Common
56			*Matthiola flavida* Boiss. Mh-2390	1	1	Herb	He	Pa	+	+	-	-	Common
57	**13**	**Caryophyllaceae**	*Dianthus orientalis* Adams. Mh-2517	1	1	Herb	He	Pa	+	+	-	-	Common
58			*Silene gonosperma* (Rupr.) Bocquet.Mh-2518	1	2	Herb	He	Pa	-	-	+	+	Common
59			*Silene vulgaris* (Moench) Gareke. Mh-2342			Herb	He	Pa	-	+	+	-	Common
60	**14**	**Convolvulaceae**	*Convolvulus arvensis* L. Mh-2357	1	1	Herb	He	Pa	-	+	-	-	Infrequent
61	**15**	**Crassulaceae**	*Hylotelephium pakistanicum* (G.R. Sarwar) G.R. Sarwar. Mh-2519	1	2	Herb	He	Pa	-	-	+	-	Common
62			*Hylotelephium ewersii* (Ledeb.) H. Ohba. **(***Sedum ewersii* Ledeb**.)** Mh-2368			Herb	He	Pa	-	-	+	-	Common
63			*Rosularia alpestris* (Kar. & Kir.) A. Boriss. Mh-2520	1	1	Herb	Ch	Pa	-	+	+	-	Infrequent
64			*Rhodiola heterodonta* (Hook.F. & Thom.) Boriss.23104	1	2	Herb	Ch	Pa	-	+	+	-	Common
65			*Rhodiola wallichiana* (Hook.) Fu. Mh-2521			Herb	Ch	Pa	-	-	+	+	Common
66	**16**	**Gentianaceae**	*Gentianopsis vvedenskyi* (Grossh.) Pissjauk. Mh-2522	1	1	Herb	Th	Pa	-	+	+	-	Infrequent
67			*Jaeschkea oligosperma* (Griseb.) Knobloch. Mh-23117	1	1	Herb	Th	Pa	-	+	+	-	Common
68			*Gentianodes tianschanica* Rupr.ex Kusn.Mh-24149	1	1	Herb	He	Pa	-	-	+	-	Infrequent
69			*Swertia cordata* (G. Don) Mh-2370	1	1	Herb	Th	Pa	-	+	-	-	Infrequent

70	**17**	**Geraniaceae**	*Geranium pratense* subsp. *stewartianum* Y. Nasir. Mh-23117	1	1	Herb	He	Pa	-	+	+	-	Very Common
71	**18**	**Eleaganaceae**	*Elaeagnus umbellate* Thunb. Mh-2523	1	1	Shrub	Ph	Pa	-	+	-	-	Common
72			*Hippophae rhamnoides* Rousi. Mh-23118	1	1	Shrub	Np	Pa	-	+	-	-	Common
73	19	**Ericaceae**	*Rhododendron hypenanthum* Balf.F. Mh-2489	1	1	Shrub	Ch	Pa	-	-	+	-	Common
74	20	**Grossulariaceae**	*Ribes alpestre* Decne. ex Jacquem. 23125	1	2	Shrub	Np	Pa (Tb)	-	+	+	-	Infrequent
75			*Ribes orientale* Desf. Mh-2341			Shrub	Np	Pa	-	+	-	-	Common
76	**21**	**Lamiaceae**	*Nepeta paulsenii* Briquet. Mh-2428	1	3	Herb	He	Pa	-	-	+	-	Common
77			*Nepeta leucolaena* Bth.ex.Hk. Mh-2423			Herb	Ch	Pa	-	+	+	-	Common
78			*Nepeta discolor* Royle ex Benth. Mh-2456			Herb	He	Pa	-	+	+	-	Infrequent
79			*Lamium amplexicaule* L. Mh-2422	1	1	Herb	He	Pa	-	+	+	-	Common
80			*Mentha royleana* Benth. Mh-2301	1	2	Herb	He	Pa	-	+	+	-	Common
81			*Mentha longifolia* Willd. Mh-2474			Herb	He	Pa	-	+	+	-	Common
82			*Prunella vulgaris* L. Mh -2524	1	1	Herb	He	Pa	-	+	+	-	Common
83			*Thymus linearis* Benth. Mh-23131	1	1	Herb	Ch	Pa	-	+	+	-	Very Common
84	**22**	**Malvaceae**	*Alcea rosea* L. Mh-24178	1	1	Herb	He	Pa (Tb)	-	+	-	-	Common
85	**23**	**Onagraceae**	*Epilobium angustifolium* L.Sp.Pl. Mh-2475	1	1	Herb	He	Pa	-	+	+	-	Common
86	**24**	**Orobanchaceae**	*Orobanche cernua* Loefl. "*var. pseudo-clarkei.* Mh-23106	1	1	Herb	Ge	Pa	-	+	-	-	Common
87			*Euphrasia incisa* Pennell. Mh-2431	1	1	Herb	Th	Pa	-	+	-	-	Common
88			*Leptorhabdos parviflora* (Bth.) Bth. Mh-2429	1	1	Herb	Th	Pa	-	+	+	-	Common

89	**25**	**Oleaceae**	*Fraxinus xanthoxyloides* (Wall. ex G. Don) DC. Mh-2526	1	1	Tree	Ph	Pa	-	+	-	-	Infrequent
90	**26**	**Oxalidaceae**	*Oxalis corniculata* L. Mh-2527	1	1	Herb	He	Pa	-	+	-	-	Infrequent
91	**27**	**Papilionaceae**	*Oxytropis chiliophylla* Royle ex Benth. Mh-2528	1	1	Herb	He	Pa	-	-	+	-	Common
92			*Trigonella cachemiriana* Cambess. Mh-2430	1	1	Herb	He	Pa	-	-	+	-	Common
93			*Robinia pseudoacaia* L. Mh-2529	1	1	Tree	Ph	Pa	-	+	_	-	Common
94			*Trifolium pratense* L. Mh-2309	1	2	Herb	He	Pa	-	+	+	-	Very Common
95			*Trifolium repens* L. Mh-23139			Herb	He	Pa	-	+	+	-	Common
96			*Medicago sativa* L. Mh-23143	1	1	Herb	He	Pa	-	+	+	-	Very Common
97			*Cicer microphyllum* Benth. Mh-2371	1	1	Herb	He	Pa	-	+	+	-	Common
98	**28**	**Primulaceae**	*Primula buryana* Balf. Mh-2530	1	1	Herb	He	Pa	-	-	+	-	Infrequent
99	**29**	**Parnassiaceae**	*Parnassia nubicola* Wall. ex Royle. Mh-2531	1	1	Herb	He	Pa	-	+	+	-	Common
100	**30**	**Plantaginaceae**	*Plantago major* L. Mh-2328	1	1	Herb	He	Pa	-	+	-	-	Common
101			*Picrorhiza kurrooa* Royle ex. Benth. Mh-2556	1	1	Herb	Ch	Pa	-	-	+	-	Rare
102			*Kickxia incana* (Wall.) Penn. Mh-2433	1	1	Herb	Th	Pa	+	+	-	-	Common
103			*Verbascum thapsus* L. Mh-2312	1	1	Herb	Th	Pa	-	+	+	-	Common
104	**31**	**Polygonaceae**	*Rumex nepalensis* Spreng. Mh-2483	1	04	Herb	He	Pa	-	+	+	-	Common
105			*Rumex hastatus* D. Don. Mh-2532			Herb	He	Pa	+	+	-	-	Common
106			*Rumex acetosa* L. Mh-2533			Herb	He	Pa	-	+	+	-	Common
107			*Rumex patientia* subsp. *pamiricus* (Rech. f.) Rech. f. Mh-2534			Herb	He	Pa	-	+	-	-	Common
108			*Rheum emodi* Wall. Mh-2535	1	1	Herb	He	Pa	-	+	+	-	Common
109			*Oxyria digyna* (L.) Hill. Mh-2486	1	1	Herb	He	Pa	-	+	+	+	Common
110			*Aconogonon alpinum* (All.) Schar. Mh-2305	1	1	Herb	He	Pa	-	+	+	-	Very Common

111			*Bistorta affinis* (D. Don) Green. Mh-2487	1	1	Herb	Ch	Pa	-	-	+	-	Very Common
112	**32**	**Ranunculaceae**	*Aquilegia fragrans var. kanawarensis* (Jacquem. ex. cambess) Riendl. Mh-2536	1	1	Herb	He	Pa	-	-	+	-	Rare
113			*Pulsatilla wallichiana* (Royle) Ulbr. Mh-2484	1	1	Herb	He	Pa	-	-	+	-	Infrequent
114			*Ranunculus laetus* Wall. ex. Hook. f. & Thomson. Mh-2537	1	02	Herb	He	Pa (Los)	-	+	+	-	Common
115			*Ranunculus attenuates* Royle. Mh-2315			Herb	He	Pa	-	+	+	-	Very Common
116			*Ceratocephala falcata* (L.) Pers. *Ranunculus falcatus* L. Mh-2538	1	1	Herb	Th	Pa (Los)	-	+	-	-	Common
117			*Aconitum violaceum* Jacq.Ex. Staf. var. *violaceum* Mh-2311	1	2	Herb	Ge	Pa	-	-	+	-	Common
118			*Aconitum violaceum var.weileri* (Gilli) Riedl. Mh-2540			Herb	Ge	Pa	-	-	+	-	Common
119			*Delphinium brunonianum* RoyleMh-24153	1	1	Herb	He	Pa	-	-	+	+	Common
120	**33**	**Rosaceae**	*Crataegus monogyna* auct. non-Jacq. Mh-2541	1	1	Tree	Ph	Pa (Los)	-	+	-	-	Common
121			*Spiraea lycioides* Parker.Ind. Mh-2542	1	2	Shrub	Np	Pa	-	+	+	-	Common
122			*Spiraea canescens* D. Don. Mh-23161			Shrub	Np	Pa	-	+	+	-	Common
123			*Rosa indica* L. Mh-2544	1	2	Herb	Np	Pa	-	+	+	-	Common
124			*Rosa webbiana* Wall. ex Royle. 23156			Herb	Ch	Pa	-	+	+	-	Infrequent
125			*Cotoneaster microphyllus* Wall. ex. Lindl. Mh-2485	1	1	Shrub	Ch	Pa	-	+	-	-	Infrequent
126			*Prunus jacquemontii* Hook.F. Mh-23160	1	1	Shrub	Np	Pa	-	+	-	-	Infrequent
127			*Geum elatum* Wall ex. G. Don. Mh-2545	1	1	Herb	He	Pa	-	-	+	-	Common
128			*Fragaria nubicola* (Hook. F.) Lindl. Mh-2353	1	1	Herb	He	Pa	-	+	+	-	Common

129			*Rubus irritans* Focke. Mh-2363	1	1	Shrub	Np	Pa	-	+	+	-	Infrequent
130			*Sibbaldia cuneata* Kunze. Mh-2444	1	1	Herb	Ch	Pa	-	+	+	-	Common
131	**34**	**Salicaceae**	*Salix denticulata* N.J. Anderss. Mh-2479	1	05	Tree	Np	Pa	-	-	+	-	Common
132			*Salix capusii* Franch. Mh-2434			Tree	Ph	Pa	-	+	+	-	Common
133			*Salix alba* auct.non L. Mh-2554			Tree	Ph	Pa	-	+	+	-	Common
134			*Salix karelinii* Turcz. ex. Stschegl. Mh-2395			Shrub	Np	Pa	-	-	+	-	Infrequent
135			*Salix tetrasperma* Roxb. Mh-2555			Tree	Ph	Pa	-	+	+	-	Common
136			*Populus alba* L. Mh-23164	1	1	Tree	Ph	Pa	-	+	-	-	Common
137	**35**	**Saxifragaceae**	*Bergenia ciliata* L. Mh-23167	1	2	Herb	Ch	Pa	-	+	+	-	Very Common
138			*Bergenia stracheyi* (Hook.F. & Thom.)Mh-2365			Herb	Ch	Pa	-	+	+	-	Common
139	**36**	**Tamaricaceae**	*Myricaria germanica* (L.) Desv.Mh-2546	1	1	Herb	Np	Pa	-	+	+	-	Infrequent
140			*Tamarix arceuthoides* Bunge. Mh-23170	1	1	Shrub	Np	Pa	-	+	-	-	Infrequent
141	**37**	**Urticaceae**	*Urtica dioica* L. 23171	1	1	Herb	He	Pa	-	+	+	-	Very Common
142	**38**	**Valerianaceae**	*Valeriana hoffmeisteri* (Kl.) Clarke Mh-2468	1	1	Herb	Ge	Pa (Tb)	-	-	+	-	Very Common
143	**39**	**Violaceae**	*Viola biflora* L. Mh-2557	1	1	Herb	He	Pa	-	+	+	-	Very Common
IV. Monocots													
144	**40**	**Orchidaceae**	*Epipactis gigantea* Duthie. Mh-2367	1	1	Herb	Ge	Pa	-	+	_	-	Infrequent
145			*Dactylorhiza hatagirea* D. Don. Mh-2369	1	1	Herb	Ge	Pa	-	+	+	-	Common
146	**41**	**Amaryllidaceae**	*Allium schoenoprasum* L. Mh-2558	1	2	Herb	Ge	Pa	-	-	+	-	Common
147			*Allium fedtschenkoanum* Regle. Mh-2559			Herb	Ge	Pa	-	-	+	-	Common
148	**42**	**Juncaceae**	*Juncus articulatus* L. Mh-2454	1	1	Herb	He	Pa	-	+	-	-	Common

149	**43**	**Poaceae**	*Bromus tectorum* L. Mh-2560	1	1	Herb	Th	Pa (Los)	-	+	-	-	Common
150			*Poa lahulensis* Bull. Mh-2428	1	2	Herb	He	Pa	-	+	+	-	Common
151			*Poa angustifolia* L.Pl. Mh-2424			Herb	He	Pa	-	+	+	-	Common
152			*Piptatherum munroi* (Stapf) Mez. Mh-2370	1	1	Herb	He	Pa	-	+	+	-	Common
153			*Saccharum griffithii* Munro. Mh-2426	1	1	Herb	Ch	Pa	+	+	-	-	Common