Ethnomedicinal uses and conservation status of medicinal orchids from Western Himalayas of Azad Jammu & Kashmir, Pakistan

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Research

Abstract

Background: The medicinal orchid species of the Himalaya are of great importance due to their various medicinal properties. These orchids have been used for centuries by the local communities in the region for their medicinal benefits. The Himalayan orchids are particularly unique because they have adapted to the extreme environmental conditions of the high altitude and harsh weather. Unfortunately, due to habitat loss and overharvesting for commercial purposes, many orchid species are now threatened with extinction. The main objective of this research was to identify, document ethnomedicinal uses and find conservation status of medicinal orchids used by local inhabitants of western Himalayas, Azad Jammu & Kashmir, Pakistan.

Methods: Interviews were conducted with 80 residents (30 women and 50 men) using a semi-structured questionnaire. Relative frequency of citation (RFC), use value (UV), fidelity level (FL), informant agreement ratio (IAR), plant parts value (PPV) and conservation status were used to express the results.

Results: The research area is home of 18 orchids that are significant from an ethnobotanical perspective. The tuber (40%) and root (30%), followed by the rhizome (15%), were the most favored plant parts amongst the species that were recorded. The highest RFC was recorded for *Habenaria intermedia* (0.69) while *Gymnadenia orchidis* had the lowest 0.05. The UV was between 0.04 to 0.56. *Habenaria intermedia* was found to possess the highest UV (UV 0.56) whereas *Cypripedium cordigerum* had the loweest UV (0.04). The highest FL was found in *Dactylorhiza hatagirea* (68.75%) and *Goodyera repens* had the lowest FL (6.25%). The highest IAR value is 1.00, which contributes to digestive disorders, liver diseases, gout, urinary tract infection, antibacterial, analgesic, skin diseases, tuberculosis, and diabetes. *The main plant parts used by the locals for ethnomedicine are tuber, root, rhizome, and leaves. The conservation status showed that 61 % species are vulnerable, 31% are endangered and 6% are near to threatened.*

Conclusion: According to ethnobotanical study, the native people of the researched area are knowledgeable about the practices of orchids, and both the plants and the native knowledge need to be protected.

Keywords: Medicinal Plants, Western Himalayas, Conservation Status, Endangered Species

Background

The utilization of plants as traditional remedies presents a viable alternative to conventional medicine, especially for individuals residing in rural areas of developing nations (Ekor 2014; Hayta *et al*. 2014; Umair *et al*. 2017; Mahomoodally *et al*. 2018). Numerous medicinal compounds have been discovered in plants, and pharmaceutical companies have even sourced new drugs from medicinal plants. However, the emergence of drug-resistant pathogens and novel diseases presents an ongoing challenge for researchers, as pathogens are constantly evolving. Despite this challenge, the study of ethnomedicinal plants has experienced significant growth in recent decades (Ayyanara & Ignacimuthub 2011).

In East Asia, using herbal remedies has a long history and is believed to have limited adverse effects and high efficacy (Malik *et al*. 2019). The family Orchidaceae is one of the most distinct and highly evolved groups of angiosperms, with around 29000 species (grouped into approximately 880 genera) that are located all over the globe (Pant 2013). There is ethnobotanical importance to orchids. The ability of orchids to treat certain diseases or disorders is well documented (Mishra *et al*. 2013). In many traditional Chinese remedies, orchids are used. The use of orchid extracts has been associated with several health-promoting advantages over time, including diuretic, anti-inflammatory, anti-carcinogenic, hypoglycemic, antimicrobial, anticonvulsive, relaxing, neuroprotective, and antivirus activities (De *et al*. 2015).

Orchids, in various forms, have significant importance in traditional medicine. They can help reduce swelling, detoxify the body, heal damaged tissue, and address other health conditions. They are consumed as boiled or paste plant parts, either alone or in combination with other foods (Gutiérrez 2010). These plants contain secondary metabolites that possess strong phytochemical and pharmacological properties, which contribute to their therapeutic qualities (Umair *et al*. 2017). Nonetheless, there has been limited research done on the potential medical applications of Orchidaceae, particularly for local populations, when compared to other plant families (Aswandi & Kholibrina 2021). In the Himalayan region, there is also a great number of orchids used in herbal medicines. For example, *Dactylorhiza hatagirea* is used by the local people of Himalaya to stop bleeding and is helpful in the healing process of wounds. The fresh rhizome of *Satrium nepalense* is used in the treatment of cuts and wounds and helpful in the healing process. In South Korea and some other countries, *Gastrodia* species rhizome is used as anti-convulsive. In Malaysia, the leaves of the *Nervilia* species are used by women after childbirth to avoid possible sickness (Pant & Rinchen 2012). The World Health Organization (WHO) estimates that traditional medicine serves as the primary form of care for about 80% of the world's population (Ekor 2014). People in poor or even emerging nations frequently rely on conventional treatments using indigenous plants because modern medications are too expensive, at least until a serious problem arises (Umair *et al*. 2019). Pakistan has more than 600 plant species that are medicinally important (Shaheen 2003) and commonly used by the people as herbal medications, with the exception of some large cities (Yaseen *et al*. 2015). With time, Pakistan's ethnobotany is expanding, and scientists there have put a lot of effort into their studies (Umair *et al*. 2017). Even still, inhabitants in the study area place a great deal of value on wild plants. The locals receive food, medication, and utilize plants as well as other ethnobotanical opportunities as sources of income. Despite the fact that there are numerous priceless plant species, a significant portion of them are lost each year due to ineffective collecting and conservation methods, potentially resulting in species extinction and habitat degradation. Additionally, it is crucial to obtain information about the use, harvesting, and conservation of wild plants, as noted by Qureshi in 2012. The present study aimed to (i) document several traditional ethnomedicinal Orchids from the western Himalaya region of Azad Jammu & Kashmir, (ii) identify plant species with ethnomedicinal significance that are used to treat a variety of ailments, and (iii) assess the conservation status of Orchids in the aforementioned region of western Himalaya, Azad Jammu & Kashmir, Pakistan.

Material and Methods

Study area

The state of Azad Jammu and Kashmir comprises about 13500 km^2 and is located between 33° and 36° N and 73° to 75° E (Figure 1). The landscape of the region is predominantly hilly and mountainous, with deep gorges and rough, undulating terrain. The region's northern districts, including Sudhnoti, Poonch, Bagh, Hattian, Muzaffarabad, and Neelum, are typically hilly, whereas Bhimber, Mirpur, and Kotli in the south are flatter. The region boasts stunning natural features including thick forest, swift rivers, and twisting streams. The Poonch, Jhelum, and Neelum rivers are the three primary rivers that pass through this region. Mirpur, Poonch, and Muzaffarabad are the three administrative divisions, whereas Bhimber, Mirpur, Kotli, Sudhnoti, Poonch, Bagh, Haveli, Neelum, Hattian, and Muzaffarabad are the ten districts. The state's capital is Muzaffarabad. A wide range of meteorological conditions may be found in Azad Jammu and Kashmir depending on height (360 m south to 6325 m north). Its climate ranges from arid subtropical (South) to humid temperate (North). The average annual rainfall is between 1000 and 2000 millimeters. Snow makes about 30 to 60 percent of the precipitation in northern

areas. The snow line is around 1200 meters high in the winter and 3300 meters high in the summer. The average temperature of the area ranges from 20 °C to 32 °C in summer and 04 °C to 07 °C in winter (Ahmad *et al*. 2017).

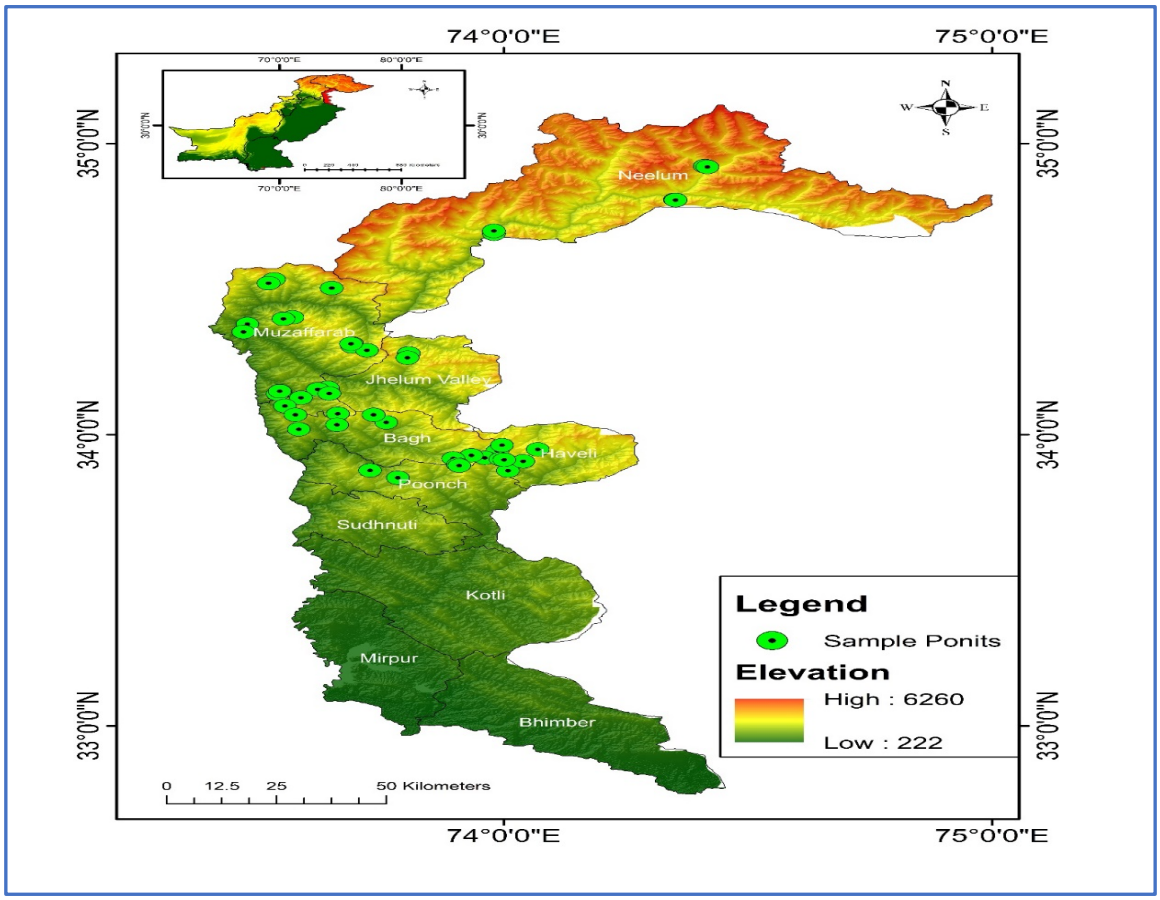

Figure 1. Geographical location map of the study area

Plant collection and identification

Field trips were conducted from April to August in 2021 and 2022, to ensure the comprehensive exploration of the medicinal flora specimens were collected, pressed and dried following herbarium specimen preservation protocols. Specimens were identified with the help of flora of Pakistan (Stewart 1972; Nasir & Ali 1970-1992), the flora of China, the flora of India, and by comparing with specimens of AKSH herbarium, University of Azad Jammu & Kashmir under the supervision of expert taxonomist. The plant names were authenticated and validated by using online data sources (https://powo.science.kew.org/results).

Ethnobotanical investigation

Field surveys were conducted to collect ethnobotanical data of the family Orchidaceae in the study area using a semi-structured questionnaire. Ethnobotanical data was collected during April to October of years 2021-2022. Questionnaires were distributed among the local inhabitants of each site. In total, 80 informants (50 men and 30 women) were interviewed after obtaining their oral prior informed consent. The informants included teachers, farmers, hunters, wood sellers and forest and agriculture workers. All the informants participated voluntarily and shared their utmost. Each informant was kept alone to feel free during the interview. A “guided tour” technique was also employed, consisting of walking through the forest to observe the locals. A local community member, who knew the norms and traditions of the society, was kept along as a guide.

Quantification of ethnomedicinal data

The quantification of ethnomedicinal data was done by using the following ethnobotanical indices:

Relative Frequency Citation (RFC)

The relative frequency of citations, which does not take the variable, i.e., use-category, into account, was used to calculate the local significance of each plant species (Birjees *et al*. 2022). It was calculated using the following formula:

$$RFC = FC/N$$

FC is the proportion of respondents who mentioned using a particular species. N represents the overall number of informants who took part in the study.

Use Value (UV)

The index is used to find out the relative importance of each species locally used as a remedy. It combines the frequency with which a species is mentioned with the number of uses mentioned per species and is often used to highlight prominent species of interest (Zenderland *et al*. 2019). It is calculated with the help of the following formula (Phillips *et al*. 1994; Jan *et al*. 2021):

$$UV = \sum U/n$$

Where n is the total number of informants interviewed for that particular plant and ∑U is the number of uses mentioned by each informant for the given plant species. It is higher when more uses of a plant are reported and lower when fewer uses of a plant are reported (Yabesh *et al*. 2014).

Fidelity Level (FL)

It specifies the percentage of respondents who mentioned the uses of particular plant species against a particular disease in the study area. Following the method described by Friedman *et al*. (1986), the FL of several orchid species for several diseases was determined from the data collected:

$$FL = Ip / Iu \times 100$$

Here, "Ip" stands for the overall number of respondents who cited the plant for any use, whereas "Iu" reflects the number of respondents who specifically specified the usage of a specific plant.

Informant Agreement Ratio (IAR)

According to (Heinrich *et al*. 1998), the informant agreement ratio (IAR) was determined using the formula below:

$$IAR = Nur - Nt / Nur – 1$$

Where IAR is the Informant Agreement Ratio, Nur is the number of mentions in each category and Nt is the number of taxa used in each category. The values for the factor range from 0 to 1.

Plant Part Value (PPV)

The (Chaachouay *et al*. 2019) method was used to find out the relative value of the various sections of a certain medicinal plant. The following formula was used to establish plant part value (PPV):

$$PPV = RU/Rupp$$

Here, "RU" stands for the total number of medical plants uses (including all of its parts) specified by the respondent, while "RUpp" stands for the total number of medicinal plants uses for each given portion.

Conservation status

The conservation status of plants was calculated according to the International Union for Conservation of Nature (IUCN) Criteria 2001 (Hussain *et al*. 2022). Plant availability, growth, yearly collection for species, plant parts used, population size, decline, distribution, and major threats faced by the plant species were considered. Moreover, species importance value index calculated as sum of relative density, frequency and cover and species use values were used to find the conservation score. Based on conservation score and use value, five different conservation categories were formed. The species whose conservation score ranged from 0-0.2 were considered critically endangered, those who fall between 0.2-0.4 were endangered, 0.4-0.6 vulnerable, 0.6-0.8 near threatened and 0.8-1.0 least concern.

Table 1. Conservation score and Conservation Category

Conservation Score	Category
0-0.2	Critically Endangered
0.2-0.4	Endangered
0.4-0.6	Vulnerable
0.6-0.8	Near Threatened
0.8-1.0	Least Concern

Results and Discussion

In this study, we interviewed 80 indigenous individuals, including farmers, dayiahs, housewives, laborers, teachers, students, (from elementary school to university), shepherds, merchants, hakims, and herbalists, among others. There were 50 male and 30 female informants. The interviewed informants ranged in age from 30 to above 60 years. These respondents were then divided into four age groups based on year intervals and six literacy categories. Many of the informants were between the ages of 51 and 60, and it was shown that this age group possesses the most ethnomedicinal knowledge regarding medicinal plants, followed by those between the ages of 51 and 60. There was a decrease in ethnic knowledge among informants aged 20-30 years. Modern lifestyle may be the cause of this new generation preferring allopathic treatments over natural therapies (Sargin 2015). Furthermore, a declining tendency in respondents' Ethno-medicinal knowledge was seen with a rising literacy rate, according to literacy categorization. This is because educated individuals prefer a more modern healthcare system over the conventional healthcare system (Jan *et al*. 2017). Similar results were also described by other authors (Jan *et al*. 2017; Bhatia *et al*. 2014).

Table 2. Demographic information of respondents

Indicator	Distribution of respondents	
	Number	%age
Gender		
Female	30	37.5
Male	50	62.5
Age in years		
31-40	7	17.5
41-50	23	28.75
51-60	36	45
Above 60	14	8.75
Profession		
Farmer	5	6.25
Herb vendor	19	23.75
Herbalist/hakeems	8	10
Nomadic	42	52.5
Teachers	6	7.5
Education		
Illiterate	37	46.25
Primary (1-5)	14	17.5
Secondary (6-10)	11	13.75
Intermediate (11-12)	6	7.5
Bachelors (13-16)	9	11.25
Higher Education	3	3.75

Table 3. Scientific names, IVI, Conservation status, conservation category, parts used and medicinal uses of orchids

Botanical name	Voucher No.	Local / English names	IVI Value	Conservation status	Conservation Category	Parts used	Medicinal remarks
Calanthe plantaginea Lindl.	5101	Christmas orchids	9.13	0.692	Vulnerable	Rh	Dry powder mixed with milk is used as an aphrodisiac and tonic.
Cephalanthera longifolia (L.) Fritsch	5100	Sword-leaved	9.87	0.717	Vulnerable	R	Rhizome is mixed with maize flour to promote milk production livestock. Aphrodisiac tonic.
Cymbidium macrorhizon Lindl.	5103	boat orchid	11	0.770	Vulnerable	Rh	The decoction prepared from rhizome of the plant is used in treatment of boils and can be used as diaphoretic.
Cypripedium cordigerum D. Don	5104	Lady's slipper	8.07	0.696	Endangered	R	Tonic, edible as a vegetable.
Dactylorhiza hatagirea (D. Don) Soó	5105	Himalayan Marsh Orchid	11.59	0.696	Endangered	Tb	Tuber paste is used against fever. Fractures are healed with powder. Decoction is used to treat abdominal pain. Tuber can be used as a stimulant by mixing it with milk or honey, or it can be consumed raw.
Epipactis helleborine (L.) Crantz	5110	Broadleaf helleborine	5.62	0.563	Endangered	Tb	Root juice is used for the treatment of insanity and gout. It is used as aphrodisiac.
Goodyera repens (L.) R.Br.	5115	Creeping lady's-tresses	9.13	0.686	Endangered	R	For curing syphilis, irregular menstruation, and as blood purifier.
Gymnadenia orchidis Lindl.	5116	Fragrant orchid	9.75	0.731	Vulnerable	R	Tuber powder is used to cure liver, UTI, and gastric problems. Pseudobulb powder is used to treat wounds and cut.
Habenaria digitata Lindl.	5118	Hirvi Habe-amari	7.28	0.653	Vulnerable	Ep	Fodder, analgesia, anti-inflammatory.
Habenaria furcifera Lindl.	5119	Forked Habenaria	5.38	0.590	Endangered	Tb	Used against cuts wounds in skin also used to treat poisonous insect bites, to make a paste, tubers powder is combined with water and applied externally. The tubers may also be used as tonic to improve body fluids.
Habenaria intermedia D. Don	5120	Bog orchids	9.11	0.433	Endangered	Tb	Root and leaves powder are effective against blood diseases. Used as an aphrodisiac, rejuvenating, and vitiating agent for pitta (metabolic activities) and vata (below the umbilicus) dosha (ayurvedic energy forces).
Herminium monorchis (L.) R. Br.	5121	Musk Orchid	5.71	0.627	Vulnerable	R	Root powder used as Tonic.

Botanical name	Voucher No.	Local / English names	IVI Value	Conservation status	Conservation Category	Parts used	Medicinal remarks
Malaxis muscifera (Lindl.) Kuntze	5123	Fly Bearing Malaxis	6.17	0.606	Vulnerable	R, Lf	Bulb paste is used during burning, sores diathesis fever and as tonic.
Neottia listeroides Lindl.	5125	Twayblades	10.96	0.629	Vulnerable	Tb	As aphrodisiac for curing styptic dysentery, febrifuge, tonic, burns, debility, and used in sterility
Platanthera edgeworthii (Hook. f. ex-Collett)	5128	Kannada	18.43	0.910	Near Threatened	Pb	Rhizome and leaves powder paste cure blood disorders and provide cooling.
Satyrium nepalense D. Don	5130	Sanp boti	15.63	0.873	Vulnerable	Rh, Lf	Dried tubers are used as a dysentery tonic. Tuber juice works well for cuts and wounds and is effective against fever. Used as aphrodisiac, energizing tonic, and for curing dysentery and malaria.
Spiranthes sinensis (Pers.) Ames	5131	Chinese spiranthes	16.12	0.819	Vulnerable	Tb	Effective against snake bite, tuberculosis sore throat, diabetes, and cough. Powder used as energizer and helpful in headache.
Zeuxine strateumatica (L.) Schltr.	5132	Soldiers orchid	8.88	0.690	Vulnerable	Tb	Root dry powder used as tonic, also used against fever.

Rural areas of Azad Jammu & Kashmir's primary healthcare system heavily rely on indigenous medicinal herbs. Our findings showed that a total of 18 plant species in the Orchidaceae family were utilized for various therapeutic purposes. Medicinally significant species have been utilized to address issues with the liver, kidneys, and digestive system. While certain species were used to treat diabetes and skin conditions, others were used as aphrodisiacs. The use of orchids in the treatment of severe illnesses such as asthma, piles, diarrhea, colds, fevers, diabetes, feminine disorders, blood diseases, and fractures, among others. When compared to pharmaceutical medicines, it was shown that older persons (50 to 70 years) preferred using traditional medicinal herbs to cure their illnesses. The medical applications of plants were also discovered to be geographically related. For instance, it was discovered that residents of Lawat, Machiara Arang Kail, Shounter, Daokhan, Lasdanna, Haveli, Khawaja Tarar, and Brathwarleepa valley had a greater knowledge of medicine. *More than 70% of local inhabitants were involved in the collection, usage, and exploitation of medicinal plants from their pastures and forests. Due to limited resources and a lack of alternative medicinal sources, there is an intense dependence on medicinal plants. The local population relies on natural remedies because they are widely accessible and affordable (Munsi et al., 2010).*

Relative Frequency of Citation (RFC)

RFC's value was in the range of 0.05% to 0.69%. *Habenaria intermedia* displayed the highest RFC (0.69%). RFC values depict the relative use-based popularity of several species in the research region. Asthma, piles, diarrhea, colds, fevers, diabetes, feminine problems, blood illnesses, and fractures are just a few of the conditions that these species have been shown to be effective in treating, according to their significant values. *Gymnadenia orchidis* and *Herminium monorchis* both had minimal RFC values of 0.05% (Table 3). The RFC demonstrates how knowledgeable the tribes were about the curative properties of specific plant species. Furthermore, it shows widespread application and efficacy with minimal adverse effects (Hussain *et al*. 2018). Previous findings also support the findings of present study (Mlilo & Sibanda 2022; Bai *et al*. 2022; Mohamed *et al*. 2022; Haq *et al*. 2022; Munir *et al*. 2022).

Use Value (UV)

Based on their uses, the use value was determined to examine the significant plant species. UV levels in this investigation varied from 0.06 to 0.56. *Habenaria intermedia* was found to have the highest reported use value (UV=0.56) followed by *Neottia listeroides* (0.30) and *Dactylorhiza hatagirea* (0.21) respectively. *Herminium monorchis* had the lowest UV values 0.05. Since locals are familiar with their characteristics and commonly use them in a variety of applications, plants that are more abundant naturally in a certain location are examined in detail. According to Yaseen (2019), it is important to assess and show the pharmacological efficacy of ethnomedicinal species with high UVs and RFCs values. Although plants with low UVs are significant (Amjad *et al*. 2017), their low values indicate that locals are unaware of their uses, which inhibits the transmission of information to beneficiaries. (Table 4).

Table 4. Relative Frequency of Citation (RFC) and Use Value (UV)

Species	**FC**	**N**	**RFC=FC/N**	**∑U**	**N**	**UV=∑U/n**
Dactylorhiza hatagirea	25	80	0.31	17	80	0.21
Epipactis helleborine	10	80	0.13	13	80	0.16
Gymnadenia orchidis	4	80	0.05	5	80	0.06
Habenaria intermedia	55	80	0.69	45	80	0.56
Malaxis muscifera	8	80	0.10	9	80	0.11
Habenaria edgeworthii	17	80	0.21	13	80	0.16
Satyrium nepalense	5	80	0.06	7	80	0.09
Spiranthes sinensis	15	80	0.19	17	80	0.21
Zeuxine strateumatica	8	80	0.10	7	80	0.09
Cephalanthera longifolia	4	80	0.05	7	80	0.09
Cymbidium macrorhizon	5	80	0.06	4	80	0.05
Habenaria furcifera	7	80	0.09	8	80	0.10
Habenaria digitata	5	80	0.06	6	80	0.08
Calanthe plantaginea	6	80	0.08	8	80	0.10
Cypripedium cordigerum	5	80	0.06	3	80	0.04
Herminium monorchis	4	80	0.05	4	80	0.05
Neottia listeroides	10	80	0.13	24	80	0.30
Goodyera repens	11	80	0.14	9	80	0.11

Fidelity level (FL)

The informant consensus regarding the use of particular plant species for particular purposes was determined using the FL (Siddique *et al*. 2021).When FL data are analyzed, it is revealed that the most popular orchid species *Dactylorhiza hatagirea* (FL 68.75), *Habenaria edgeworthii* (FL 43.75), *Spiranthes sinensis* (FL 31.25) *Gymnadenia orchidis* (FL 31.25), *Zeuxine strateumatica* (FL 18.75), *Habenaria furcifera* (FL 15), *Malaxis muscifera*, (FL 12.5), *Epipactis helleborine* (FL 12.5), *Habenaria intermedia* (FL 6.25) and *Habenaria digitata* (FL 6.25) (Table 5). The higher FL shows that these plants are preferred by the local communities for the treatment of a specific disease. This is a very useful criteria for the selection of most preferred plants for a particular disease (Hussain *et al*. 2019).

Table 5. Fidelity Level (FL) of different species Orchids for different diseases/ailments in western Himalayan of AJK, Pakistan

Plant species	LP	LU	FL %=(lp/lu)*100
Dactylorhiza hatagirea	55	80	68.75
Epipactis helleborine	10	80	12.5
Gymnadenia orchidis	25	80	31.25
Habenaria intermedia	5	80	6.25
Malaxis muscifera	10	80	12.5
Habenaria edgeworthii	35	80	43.75
Satyrium nepalense	5	80	6.25
Spiranthes sinensis	25	80	31.25
Zeuxine strateumatica	15	80	18.75
Cephalanthera longifolia	5	80	6.25
Cymbidium macrorhizon	5	80	6.25
Habenaria furcifera	12	80	15
Habenaria digitata	5	80	6.25
Calanthe plantaginea	5	80	6.25
Cypripedium cordigerum	5	80	6.25
Herminium monorchis	5	80	6.25
Neottia listeroides	5	80	6.25
Goodyera repens	5	80	6.25

Informant agreement ratio (IAR)

The informant agreement ratio (IAR) is a metric for assessing how well-suited specific plants are for treating a given disease. IAR values for orchids show that the highest IAR value is 1.00 against diabetes for various conditions. Blood disease had the second highest IAR score (93), followed by gastric (0.92) and aphrodisiac disease (0.91) respectively. The orchid possesses strong anti-diabetic, anti-lipidemic, anti-microbial, and antioxidant properties, according to IAR value (Table 6).

Table 6. Informant Agreement Ratio (IAR)

Disease Type	Nt	Nur	Nur-Nt	Nur-1	IAR = (Nur - Nt) / (Nur – 1
Fever	3	25	22	24	0.92
Fractures	1	10	9	9	1.00
Tonic	7	55	48	54	0.89
Gout	1	5	4	4	1.00
Liver Diseases	1	10	9	9	1.00
Aphrodisiac	4	35	31	34	0.91
UTI	1	5	4	4	1.00
Gastric/dysentery/Diarrhea	3	25	22	24	0.92
Blood diseases	2	15	13	14	0.93
Rejuvenating	1	5	4	4	1.00
Ayurvedic	1	5	4	4	1.00
Burning	2	5	3	4	0.75
Energizer	2	5	3	4	0.75
Antibacterial	1	5	4	4	1.00
anti-inflammatory	1	5	4	4	1.00
Analgesic	1	5	4	4	1.00
skin diseases	1	5	4	4	1.00

Gynecological disorders	2	11	9	10	0.90
Milk production in animals	1	13	12	12	1.00
Tuberculosis	1	6	5	5	1.00
Diabetes	1	7	6	6	1.00
Effective against snake and insect bites	2	9	7	8	0.88

Plant Part Value (PPV)

The findings of the Plant Part Value (PPV) test showed that the main plant parts used by the locals for ethnomedicine are tuber, root, rhizome, and leaves. The highest PPV was 40% showed by tubers second and third highest were root 30% and rhizome 15 (Figure 2).

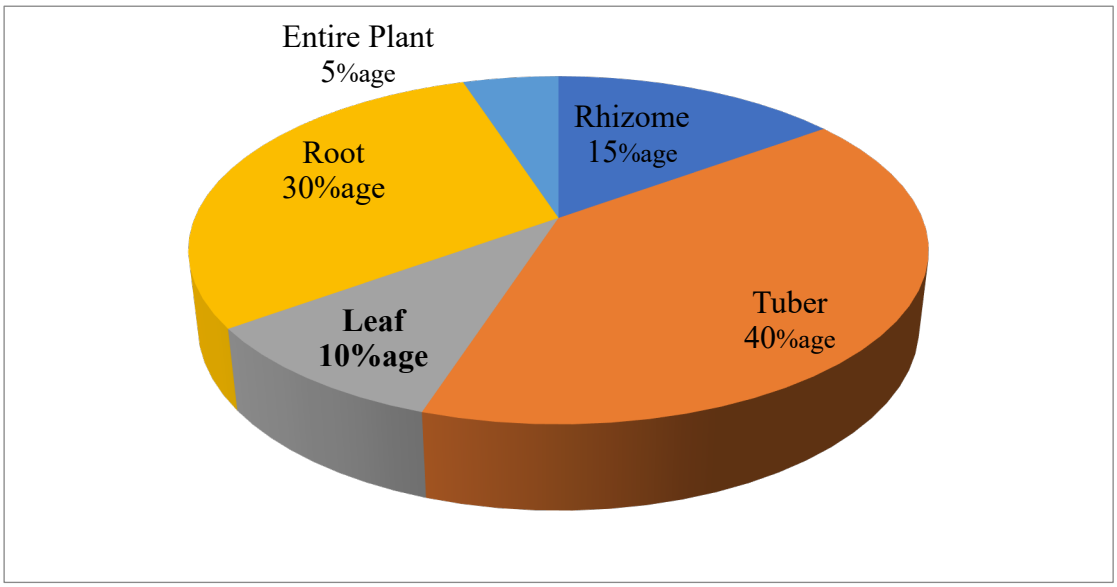

Figure 2. *Plant part value index*

Mode of administration

The results of the ethnobotanical survey indicated that the preparations of orchids used in treatment of diseases include oral intake as powder with water, applied as or poultice and decoction in water (Figure 3).

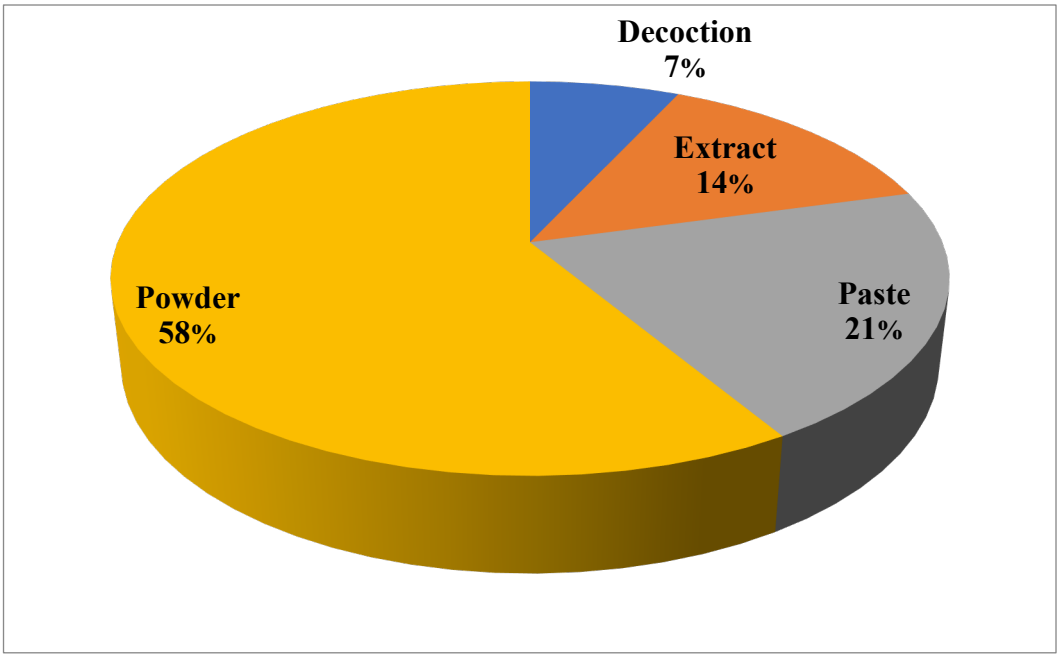

Figure 3. Mode of administration of the studied plants

Assessment of conservation status

The conservation status of family Orchidaceae was calculated by conservation score and category with the help of IVI value and use-value. Five different categories were formed based on conservation score. Species whose conservation score ranged from 0-0.2 were considered critically endangered, while those whose conservation score ranged from 0.2-0.4 were endangered. Moreover, species with conservation score ranging between 0.4-0.6 were deemed vulnerable, and those with a 0.6-0.8 score considered as near threatened (Figure 4). A conservation score in the range of 0.8-1.0 was assigned category as least concern. According to conservation score, 61% orchids were vulnerable, 33% were endangered and 6 % were threatened. By utilizing the importance value index in the study area, phytosociological studies offer a great foundation for understanding distribution as well as conservation measures of sparsely and rarely distributed species across the various environmental gradients (Negi *et al.* 1992).

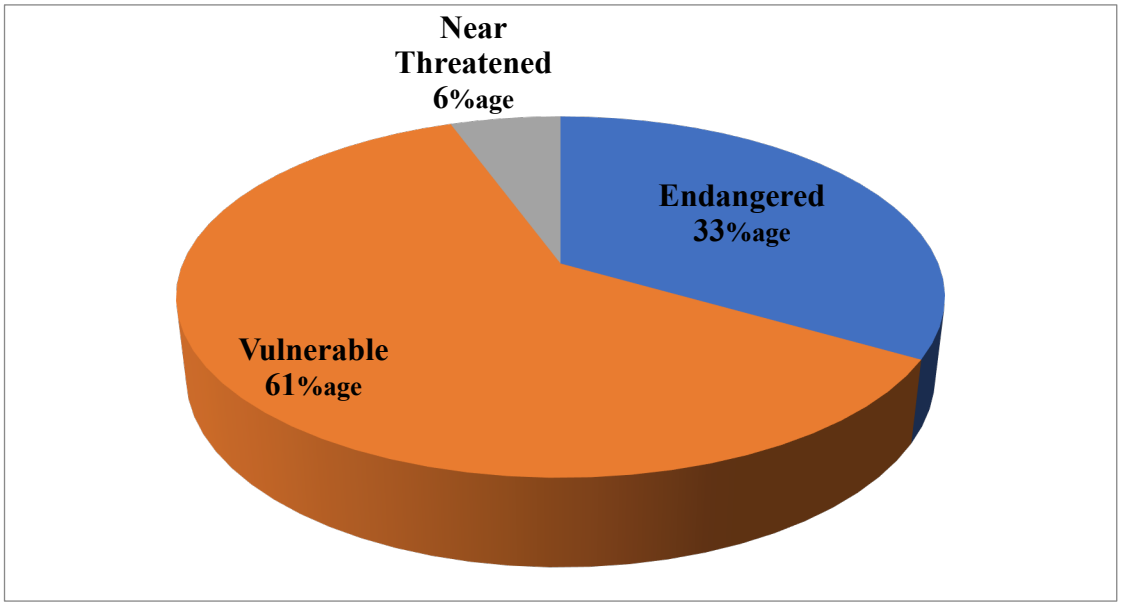

Figure 4. Assessment of conservation status

Conclusion

The findings of this study indicated that the residents of Western Himalayas, Azad Kashmir, are familiar with medicinal uses of orchids. They used orchid species to variety of health conditions because they are affordable and easily accessible. Although young people are less eager to learn about it, older people were extremely educated about the traditional uses of these plants. However, the residents in the research region must also be aware of the sustainable usage of medicinal plants to ensure their long-term and ongoing availability. The first step towards creating effective treatments for diseases is the preservation of these plant species. Improving the sustainable use and preservation of indigenous knowledge of beneficial medicinal plants may help to raise the standard of living for those who live in poverty. In order to create conservation strategies, it is essential to recognize the threatened and endangered species. Therefore, it is essential to preserve local knowledge about valuable plants and their therapeutic applications before they vanish completely.

Declarations

List of abbreviations: RFC= relative frequency of citation, UV= use value, FL= Fidelity Level, IAR= Informant Agreement Ratio, PPV= Plant Part Value

Ethics approval and consent to participate: This study did not involve the export of any animal or plant material. Information was obtained from the participants. All informants were orally consented.

Consent for publication: Oral permission was taken from all the authors.

Availability of data and materials: The manuscript contains all the data.

Competing interests: We declare that there is no conflict of interest.

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Authors' contributions: KH, and IUID designed the study; KH and SA conducted the fieldwork, AM and SS conducted the main statistical analysis; KH wrote the manuscript, KSA and RWB revised the data analysis and the manuscript; all authors read, corrected, and approved the manuscript.

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