

MEDICINAL USES OF PLANTS BY THE INHABITANTS OF KHUNJERAB NATIONAL PARK, GILGIT, PAKISTAN

BABAR KHAN^{1,2}, ABLIMIT ABDUKADIR¹, RAHMATULLAH QURESHI³ AND GHULAM MUSTAFA²

¹Xinjiang Institute of Ecology & Geography, Chinese Academy of Sciences, Urumqi 83001 China¹

²World Wide Fund for Nature, Pakistan, Gilgit, Northern Areas, Pakistan.

³Department of Botany, Pir Mehr Ali Shah Arid Agriculture University, Murree Road, Rawalpindi, Pakistan.

Abstract

Like many other mountain communities, people living in the peripheries of Khunjerab National Park (KNP) have been using plant resources for food, medicine, shelter, fuel and other purposes since long. The present study was carried out to record the most common medicinal and aromatic plants (MAPs) and their traditional uses by the local inhabitants from the study area. A total of 43 plant species belonging to 40 genera and 28 families were recorded from Dhee, Barkhun, Shimshal and Khunjerab pastures during field visits conducted in 2006-2008, which are being used by the people of the area for the preparation of herbal recipes. In all, Asteraceae family contributed the highest number of species (11.63%), followed by Fabaceae, Lamiaceae and Rosaceae (9.30% each), Chenopodiaceae and Elaeagnaceae (4.65% each). Twenty nine diseases were treated by the reported species. Maximum number of species were employed for treating fever (9 spp.), followed by cough, in digestion (5 spp. each), wounds, eye infection, abdominal pain, jaundice, blood pressure and diarrhea (4 spp. each). The study area is a fragile ecosystem which is rapidly degrading due to excessive grazing and over exploitation by the inhabitants for their customary needs. In order to protect the dwindling floral resources and their classical uses, concrete conservation measures *i.e.*, education and awareness, integration of traditional knowledge with modern healthcare and *ex situ* conservation of threatened species, supporting local livelihoods and rural economy is inevitable.

Introduction

The use of plants as a source of medicine is as old as human civilization. The specific use of plants and the method of application for a particular ailment were passed on orally generation to generation. This practice through updating and refinement led to develop herbal pharmacopoeias (Balunas & Kinghorn, 2005).

There are approximately 300,000 species of vascular plants in the world today and almost over 30% of the total has been used as plant based remedies. Millions of traditional people still use plants as sources of food, clothing, shelter, fuel and medicine and roughly around 80% of world population still relies on herbal medicine. Most importantly the trend of using traditional medicines is increasing again (Anon, 2008).

Since late 50s, almost 80% of the country's population in general and the people in remote areas in particular, are directly dependant on herbal medicines for all types of medicinal needs (Hocking, 1958). In the Karakorum-Himalayan mountain ranges, at least 70% of the medicinal plants and animals consist of wild species and of which 70-80% of the population depends on traditional medicines for health care (Pie & Manandhar, 1987). Gilgit, Astore and other parts of Gilgit-Baltistan are rich in plant and cultural diversity, yet have been poorly studied ethnobotanically (Qureshi *et al.*, 2006). Like many other mountain areas of the world, rural people in Pakistan, particularly in the remote areas of Gilgit-Baltistan are also relying variously on native plant resources to fulfill their daily life needs in one or the other way (Qureshi *et al.*, 2001). Sometimes they have been using timber to build their shelters, collect firewood to cook food and keep living places warm, use grasses and herbs as medicine to treat themselves and their livestock against diseases, graze their livestock, make agricultural tools to cultivate their land, craft household dining utensils and even musical instruments to pass leisure time (Khan & Miraj, 2003). In some remote villages, women still use wild berries, flowers and stem decoctions as valuable cosmetics to keep their face, hands and feet protected against germs, infections and cold. This knowledge, no doubt they have gained by trial and error

over the past centuries is indeed priceless and irreplaceable (Rao & Jamir, 1982; Qureshi *et al.*, 2002).

Research studies conducted from various parts of the country are in agreement that the flora in connection with indigenous knowledge is diverse and needs to be documented (Bhatti *et al.*, 2001, 2002; Qureshi *et al.*, 2001, 2009; Qureshi & Bhatti, 2008; 2009; Khan & Khatoon, 2007; Ahmad *et al.*, 2009).

The mountain communities of Khunjerab, Shimshal, Misgar and Chipursan valleys do have a long history of using local herbs to meet their daily life needs but very little is known about the local flora (Qureshi *et al.*, 2011) and its traditional use. With the passage of time, modernization and unwise exploitation have fast declined this resource and related knowledge everywhere in the world, and so in the communities of Khunjerab National Park. Due to ever increasing disturbances and pressures on natural ecosystems coupled with loss of interest amongst various groups, especially in youngsters there is a decline of the native flora and its potential uses in the area. Therefore, present study is a first attempt to record plant species of high medicinal and aromatic values of Khunjerab National Park along with their conventional uses by the mountain communities of Khunjerab valley.

Materials and Methods

Semi-structured interviews were carried out using questionnaires during 2006-2008 in Shimshal and Khunjerab valleys from elders, shepherds/herders and school teachers, including both men and women to collect medico-ethnobotanical information (Martin, 1995; Qureshi, 2004). MS Excel spreadsheet analysis was conducted to calculate simple averages, percentiles and mean values and to make needful tables and graphs (McCullough & Heiser, 2008). During the field survey, plant specimens were also collected which were pressed, dried, preserved, mounted on herbarium sheets. They were identified with the help of floristic material (Nasir & Ali, 1970-1989; Ali & Nasir, 1990-1991; Ali & Qaiser, 1993-2008; Matthew, 1981-83). The determined specimens were deposited in the Department of Botany, Pir Mehr Ali Shah Arid Agriculture University, Rawalpindi.

*Corresponding author E-mail: rahmatullahq@yahoo.com; phytotaxonomist@gmail.com

Study area: Khunjerab National Park (KNP) lies in the extreme north of Pakistan ($72^{\circ} 52' 33.21''$ E, $36^{\circ} 56' 11.63''$ N to $76^{\circ} 03' 26.96''$ E, $36^{\circ} 13' 24.24''$ N) covering 4455.06 Sq Km area (GOP, 2010) bordering with the China's Tax Korgan National Nature Reserve (TNNR) in the north

along Pakistan - China border (Fig. 1). It ascends from 2439 meters at Passu - entry to Shimshal valley up to 4880 meters at Khunjerab Pass, comprising three major valleys including Khunjerab, Gujerab and Shimshal (Khan, 1996).

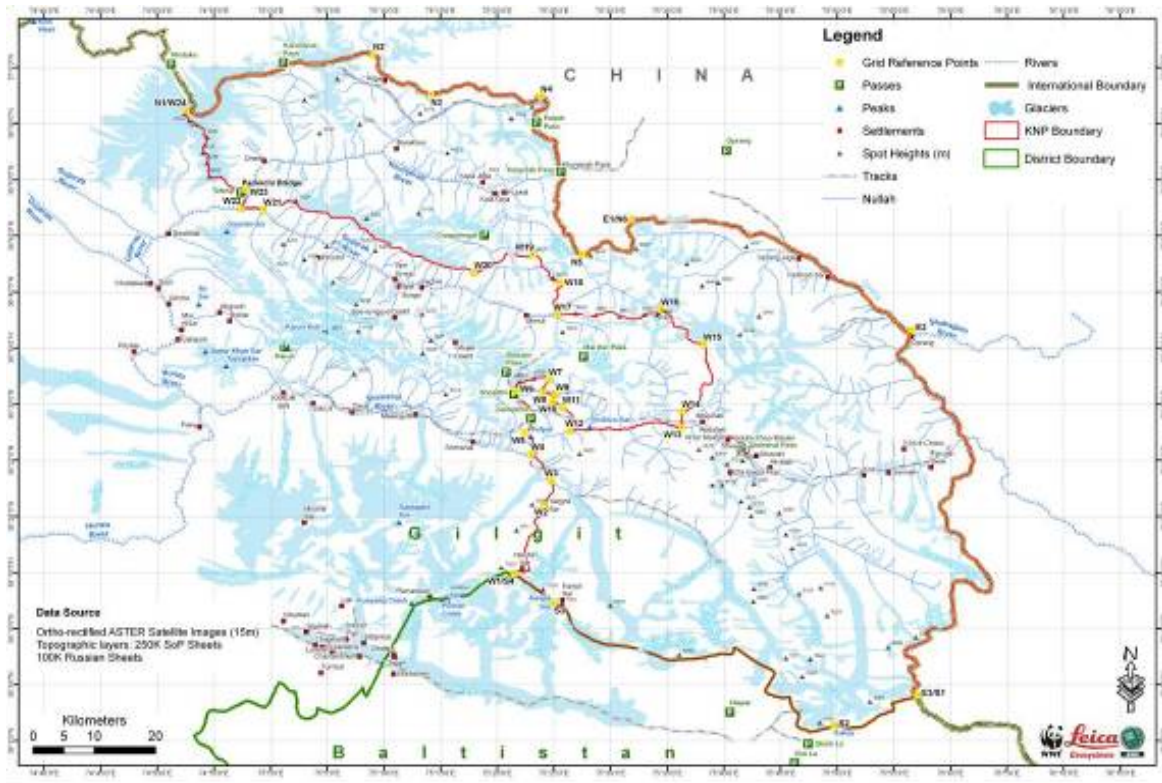


Fig. 1. Map of Khunjerab National Park, Pakistan.

Climate: The climate of the study area is continental-Mediterranean type with least influence from easterly monsoon and major precipitation received through westerly winds (Khan, 1996). The average annual rainfall is 140.73 mm per year with the mean maximum of 23.66 mm during the months of May and June and mean minimum of 2.26 mm and 3.0 mm in January and November, respectively.

Temperatures are characterized by hot summers, cold winters and great seasonal differences in higher altitudes. The average minimum monthly temperature is $\pm 4^{\circ}\text{C}$ in December and January, contrary to an average maximum monthly temperature of $\pm 25.19^{\circ}\text{C}$ during July and August (Steinbauer & Zeidler, 2008).

Vegetation: Park area mostly consists of huge mountains with snow covered peaks, ravines, valleys and streams. Soil erosion, landslides, and glaciers are common, mostly

characterized by stony beds surrounded by gravelly or barren hill slopes. Some valleys have sparse vegetation and grasses while large plants like bushes and trees can only be seen in river beds and along water channels and streams. *Artemisia* exists predominantly; *Birch* (*Betula utilis*), *Myricaria elegans* and *Salix pycnostachya* are found along the river beds only (Khan, 1996).

Results

A total of 43 plant species belonging to 40 genera and 28 families were recorded from the study areas, which are known to be employed medicinally by the people of the area for the preparation of herbal recipes. All the plant species are alphabetically arranged and their botanical names, vernacular names, parts used, occurrence and medicinal uses are provided as follows:

- | | |
|-----------------------------|---|
| Family: Alliaceae | |
| 1. Botanical name: | <i>Allium carolinianum</i> DC. |
| Vernacular name: | Kachpauk |
| Part used: | Leaves, bulbs |
| Occurrence: | Rarely seen in open sunny places at higher elevation in the pastures of Dhee, Koksil and Shimshal valleys |
| Folk Medicinal used: | Fresh leaves and bulbs cooked as vegetable used for flue, fever and cough. |

- Family: Amaranthaceae**
2. **Botanical name:** *Aerva lanata* Juss.
Vernacular name: Shutpask
Part used: Whole plant, flowers
Occurrence: Rarely seen in some catchments of Khunjerab valley.
Folk Medicinal used: Flowers and sometimes the whole plant are burnt into fire to get ash which is applied on wounds to heal. Sometimes its presence prevents attack of insects and pests.
- Family: Asteraceae**
3. **Botanical name:** *Anaphalis triplinervis* (Sims.) C.B. Clarke
Vernacular name: Yeepwoosh
Part used: Leaves, flowers
Occurrence: Common in the entire valley
Folk Medicinal used: Dried flowers and leaves are used as herbal tea for flu, fever and nausea. Dried flowers are burnt to produce smoke that is considered useful for eye infections and diseases.
4. **Botanical name:** *Artemisia brevifolia* Wall. ex DC.
Vernacular name: Taroqtpesk
Part used: Leaves, flower
Occurrence: Common on dry slopes
Folk Medicinal used: Flowers and leaves are commonly used as veterinary medicine.
5. **Botanical name:** *Cichorium intybus* L.
Vernacular name: Caroop
Part used: Roots, flowers
Occurrence: Common in moist places at lower elevations in the entire valley.
Folk Medicinal used: The decoction of flowers and roots is given to cure typhoid, malaria, abdominal pain and obstructions.
6. **Botanical name:** *Taraxacum officinale* F.H. Wiggers
Vernacular name: Talkhiting
Part used: Leaves
Occurrence: common on agricultural lands and in gardens
Folk Medicinal used: The decoction of dried leaves and roots is used for the treatment of jaundice and pneumonia.
7. **Botanical name:** *Tragopogon dubius* Scop.
Vernacular name: Kreel woosh
Part used: Flower
Occurrence: Common in moderately moist to wet areas at lower elevations in Shimshal and other parts of Khunjerab valley.
Folk Medicinal used: Juice of flowers is given to treat ear infections and diseases, especially amongst children.
- Family: Berberidaceae**
8. **Botanical name:** *Berberis lycium* Royle
Vernacular name: Zolg
Part used: Roots, leaves, fruits
Occurrence: Rarely found in the lower reaches of Khunjerab and Shimshal valleys, mostly along stream banks and moist places.
Folk Medicinal used: Root bark is considered effective for treating fractured bones, displaced joints and wounds. Fresh leaves, fruits and dry roots are taken as remedy for backache. Leaves extract is given to relieve urinary tract infections.
- Family: Betulaceae**
9. **Botanical name:** *Betula utilis* D. Don
Vernacular name: Furze
Part used: Bark
Occurrence: Common in sub alpine pastures of Barkhun, Shimshal and Khunjerab.
Folk Medicinal used: The bark is used to store butter, ghee and cheese and to write amulets and other important deed documents. Fumes of the bark given to children for prevention of evil deeds.
- Family: Capparidaceae**
10. **Botanical name:** *Capparis spinosa* L.
Vernacular name: Kappar

Part used: Floral bud, fruit
Occurrence: Occurs in low and dry areas of Khunjerab valley.
Folk Medicinal used: Fresh fruits and floral buds are cooked as vegetable and given to typhoid and malaria patients. The fruit is boiled to make herbal tea given in flu and fever. The pulp of ripened fruit is applied on skin to protect face against sun burn.

Family: Chenopodiaceae

11. **Botanical name:** *Chenopodium album* L.
Vernacular name: Sheleet
Part used: Whole plant
Occurrence: Found at lower altitudes in Khunjerab and adjacent catchments.
Folk Medicinal used: Leaves and fresh stems are used as vegetable to treat constipation.
12. **Botanical name:** *Chenopodium botrys* L.
Vernacular name: Khord
Part used: Whole plant
Occurrence: Common at lower elevations in Khunjerab and adjacent valleys.
Folk Medicinal used: Young plants are given as vegetable to cure constipation. Flowers and leaves are dried, grinded and mixed with wheat flour to treat stomach and digestive disorders.

Family: Cupressaceae

13. **Botanical name:** *Juniperus excelsa* M. Bieb.
Vernacular name: Yarz
Part used: Berries, leaves
Occurrence: Found in sub alpine pastures at mid elevations in Khunjerab, Shimshal, Barkhun and other valleys.
Folk Medicinal used: The decoction of fresh berries is used for abdominal pain. Leaves are burnt and the ash is mixed with grinded tobacco to make snuff. Its leaves are still considered sacred and burnt to produce smoke to prevent houses from evil spirits.

Family: Elaeagnaceae

14. **Botanical name:** *Elaeagnus aungustifolia* L.
Vernacular name: Sisk
Part used: Fruit, gum
Occurrence: Found at lower elevations near cultivated fields.
Folk Medicinal used: Fruits used in deficiency of vitamin C to children. The gum is used as Shampoo as tonic for long, healthy and silky hairs.
15. **Botanical name:** *Hippophae rhamnoides* L.
Vernacular name: Zakh
Part used: Berries
Occurrence: Common in Shimshal, Dhee, Barkhun and other parts of Khunjerab.
Folk Medicinal used: Berries are given in high blood pressure supposed to reduce cholesterol, irregular palpitation, kidney and urinary problems, reproductive disorders like infertility in women.

Family: Ephederaceae

16. **Botanical name:** *Ephedera gerardiana* Wall. ex Decne.
Vernacular name: Yemook
Part used: Leaves, stem
Occurrence: Found on dry plains and slopes of Khunjerab.
Folk Medicinal used: Leaves are grinded to make powder snuff and as repellent to keep livestock off debarking juvenile stage. Extracts from young stems is used to protect face from sunburn.

Family: Fumariaceae

17. **Botanical name:** *Corydalis crassifolia* Royle
Vernacular name: Sackros/Zarvosh
Part used: Whole plant
Occurrence: Common found in Shimshal and Khunjerab,
Folk Medicinal used: The plant is unpalatable so kills the animal if foraged and hence harmful for livestock.

Family: Fabaceae

18. **Botanical name:** *Astragalus strictus* Grah. ex Benth.
Vernacular name: Zhop/Thope
Part used: Leaves, flowers

- Occurrence:** Common in highland pastures of Khunjerab and Pamir; Zardgorbin, Yozghil and other pastures of Shimshal.
- Folk Medicinal used:** Leaves and flowers have been used as food supplement to increase the milk productivity in livestock.
19. **Botanical name:** *Medicago sativa* L.
Vernacular name: Ucharg
Part used: Whole plant
Occurrence: Commonly grown as fodder, fresh leaves are used as vegetable and given to livestock as fodder.
Folk Medicinal used: The plant is said to increase milk productivity in livestock
20. **Botanical name:** *Melilotus alba* L.
Vernacular name: Sinjhi
Part used: Aerial parts
Occurrence: A rare species in Khunjerab National Park.
Folk Medicinal used: The paste of aerial parts is used externally for inflammations and joint pains.
21. **Botanical name:** *Sophora mollis* (Royle) Baker
Vernacular name: Popshing
Part used: Whole plant
Occurrence: A wild shrub growing on dry slopes at lower altitudes in the entire valley.
Folk Medicinal used: Being less palatable sometimes kill animals if foraged excessively. Leaves paste and young braches are used externally for skin allergies and as antiseptic material. It is commonly used as an insecticide and pesticide.
- Family: Grossulariaceae**
22. **Botanical name:** *Ribes alpestre* Decne.
Vernacular name: Shumlooh
Part used: Roots, fruits
Occurrence: Less common in the project area.
Folk Medicinal used: The powder of roots is used for the backache, joint pain. The fruit is supposed to be a remedy for the Jaundice.
- Family: Lamiaceae**
23. **Botanical name:** *Mentha longifolia* (L.) Hud.
Vernacular name: Whadan
Part used: Leaves, flowers
Occurrence: Found in moist and shady places.
Folk Medicinal used: Dried leaves and flowers are used as remedy for jaundice, fever, asthma and high blood pressure.
24. **Botanical name:** *Mentha royleana* Wall. ex Bth.
Vernacular name: Gudunj
Part used: Leaves, flowers
Occurrence: Common on cultivable lands in Shimshal valley.
Folk Medicinal used: Flowers and leaves are dried, ground and mixed with barley to use as remedy for digestive disorders, abdominal pain, backache and maternal deliveries.
25. **Botanical name:** *Nepeta floccosa* Bth.
Vernacular name: Buzlanj
Part used: Leaves, flowers
Occurrence: Found in open sunny places at higher elevation.
Folk Medicinal used: Leaves and flowers are boiled in water and given to reduce fats, temperature and to stop hair fall.
26. **Botanical name:** *Thymus linearis* Benth.
Vernacular name: Tumuro
Part used: Leaves, flowers
Occurrence: A perennial plant found almost in all alpine and sub alpine pastures.
Folk Medicinal used: Flowers and leaves are collected during summer days and dried to make herbal tea which is reported as highly effective for cold, fever and cough.
- Family: Malvaceae**
27. **Botanical name:** *Malva neglecta* Wall.
Vernacular name: Shanishah

- Part used:** Whole plant
Occurrence: Rarely seen in park area.
Folk Medicinal used: The decoction of plant is used for the treatment of constipation and other digestive problems.
- Family: Orchidaceae**
28. **Botanical name:** *Dactylorhiza hatagirea* (D. Don) Soo.
Vernacular name: Narmada
Part used: Roots, rhizomes
Occurrence: Found in moist place along Dhee stream in Khunjerab valley.
Folk Medicinal used: The roots and rhizomes are considered having aphrodisiac activity and said to be used in sexual debility.
- Family: Plantaginaceae**
29. **Botanical name:** *Plantago lanceolata* L.
Vernacular name: Sepgilk/Yeeps
Part used: Leaves, seeds
Occurrence: Found in Dhee, Barkhun and other catchments of Khunjerab.
Folk Medicinal used: Ash of fresh leaves is applied to cure burn injuries/wounds and infections. The seeds are given to diarrhea and fever patients.
- Family: Poaceae**
30. **Botanical name:** *Hordeum vulgare* L.
Vernacular name: York
Part used: Grains/seeds
Occurrence: Commonly cultivated in Shimshal and Khujerab valleys.
Folk Medicinal used: The flour of grains is used for bread making and recommended for jaundice and high blood pressure.
- Family: Primulaceae**
31. **Botanical name:** *Primula macrophylla* D. Don
Vernacular name: Benufsha
Part used: Whole plant, leaves, flowers
Occurrence: Common on high land pastures of Khunjerab valley.
Folk Medicinal used: The powdery deposition from the flower stalks and ventral sides of leaves is used to cure eye infections, irritations and diseases. The decoction of plant is also considered to be effective for cough and asthma.
- Family: Punicaceae**
32. **Botanical name:** *Punica granatum* L.
Vernacular name: Dolum
Part used: Flowers, fruit, seed, bark
Occurrence: Species is rarely seen in the valley bottoms.
Folk Medicinal used: Juice of the fruit is given to treat jaundice, diarrhea and nose bleeding. Fruit pulp and seeds are useful for stomach disorders. The dried pulverized flower buds are used as a remedy for bronchitis. Its bark is used to improve digestive disorders in livestock.
- Family: Polygonaceae**
33. **Botanical name:** *Rheum tibeticum* Maxim. ex Hook. f.
Vernacular name: Sheepod
Part used: Stem
Occurrence: The plant is rarely seen on moist slopes in upper reaches of Khunjerab valley.
Folk Medicinal used: Fresh young stems are used as vegetable during the summer days acting as mild laxative relieving constipation.
- Family: Ranunculaceae**
34. **Botanical name:** *Clematis orientalis* L.
Vernacular name: Chindrik
Part used: Leaves, flowers, fruits
Occurrence: Common in alpine and sub alpine pastures of Shimshal, Barkhun and Khunjerab valleys.
Folk Medicinal used: Dried fruits and flowers are fried in oil and mixed with flour and water to make a thin soup used mostly to cure diarrhea and dysentery. Fresh leaves are also crushed to make paste and applied to treat eczema.

- Family: Rosaceae**
35. **Botanical name:** *Comarum salesovianum* (Stephan) Asch. & Graebner
Vernacular name: Noghurdoom woosh
Part used: Flowers
Occurrence: Occurs in open sunny pastures at higher elevation.
Folk Medicinal used: Flowers are given in eye infections.
36. **Botanical name:** *Potentilla eriocarpa* Wall. ex Lehmann
Vernacular name: Amber
Part used: Leaves, flowers
Occurrence: Found in Shimshal and other parts of Khunjerab valley.
Folk Medicinal used: Leaves and flowers are used to treat eye disorders and infections.
37. **Botanical name:** *Potentilla microphylla* D. Don
Vernacular name: Zatspirg
Part used: Leaves, seeds
Occurrence: Rarely seen in upper reaches of Dhee, Shimshal and Khunjerab.
Folk Medicinal used: Seeds and leaves are used to cure wounds and bone fractures in livestock and also used as insect repellants.
38. **Botanical name:** *Rosa webbiana* Wallich ex Royle
Vernacular name: Chereer
Part used: Fruits, seeds
Occurrence: Common in lower areas of Khunjerab valley.
Folk Medicinal used: Ripened fruits are used as digestive. Seeds are given to treat veterinary diseases.
- Family: Saxifragaceae**
39. **Botanical name:** *Saxifraga hirculus* (Decne.) C.B. Clarke
Vernacular name: Sitbark
Part used: Whole plant
Occurrence: Common on moist slopes between 2600 - 3000m *a.s.l.* in the pastures of Khunjerab, Dhee, Shimshal and Barkhun valleys.
Folk Medicinal used: The decoction of plant is given in fever, diarrhea, cough, chest complaints and pulmonary disorders.
- Family: Solanaceae**
40. **Botanical name:** *Solanum nigrum* L.
Vernacular name: Gabilo
Part used: Fruits, seeds
Occurrence: A rare species seen at lower elevations in the outskirts of Khunjerab.
Folk Medicinal used: Mature fruits and seeds are used to treat throat inflammation.
- Family: Tamaricaceae**
41. **Botanical name:** *Myricaria squamosa* Desvaux
Vernacular name: Targ
Part used: Leaves, flowers
Occurrence: Seen along streams and river beds in Shimshal and Khunjerab valleys.
Folk Medicinal used: The powder of flowers and leaves is dusted on wounds to cure injuries of both human being and livestock.
- Family: Valerianaceae**
42. **Botanical name:** *Valeriana wallichii* DC.
Vernacular name: ----
Part used: Roots
Occurrence: Common in project area.
Folk Medicinal used: The powder of roots is given in cough, asthma, and heart diseases.
- Family: Zygophyllaceae**
43. **Botanical name:** *Peganum harmala* L.
Vernacular name: Spandur
Part used: Whole plant, roots, leaves
Occurrence: Found in dry plains of Shimshal and Khunjerab.
Folk Medicinal used: The juice of fresh roots is given in jaundice. The same mixing with rice water is given to treat menorrhagia. The paste of leaves, stem and roots is applied on snakebite. Its smoke is used as fragrance and also as insect repellent.

Discussion

Ethnobotanical study of Khunjerab, Shimshal and Barkhun valleys showed a scattered but rich diversity of plant species and their classical uses by the mountain communities of the study area. Despite its peculiar cold arid climatic conditions, barren habitats, stressful short growing season and higher altitude, some 151 plant species were recorded (Qureshi, 2006), and of them, 43 species belonging to 40 genera and 28 families were found to be of high medicinal and aromatic values. The study also reveals that having no other options, the inhabitants of the area have been using the available plant resources for human medicine (30 spp.); veterinary medicine (4 spp.); cosmetics and decoration (7 spp.); food (10 spp.); poison, insecticides and pesticides (6 spp.). Two species got high spiritual and cultural values as well.

Likewise, majority of the mountain people in the remote valleys of Shimshal, Khunjerab, Misgar and Chipursan had been using traditional medicines that were acquired from herbs usually collected from the local pastures. Twenty nine diseases were treated with 43 plant species (Table 1). Maximum number of species were employed for treating fever (9 spp.), followed by cough, digestive (5 spp. each), wounds, eye infection, abdominal pain, jaundice, blood pressure and diarrhea (4 spp. each) while rest of diseases were treated by fewer species.

Due to over-exploitation of plant species, medicinal plant resources are disappearing from the pastures very fast. On the other hand, use of herbal medicines is diminishing and eventually the knowledge concerning important medicinal plants and their conventional uses is also vanishing fast. *Hakeems* and *Pansaries* (traditional herbal merchants) have almost gone from the area, and hence a limited proportion of the local wisdom, knowledge and skill related with medicinal plants, their use and method of

preparation are confined to a few village elders and shepherds in the entire valley. Easy access to allopathic medicine even in remote villages, lack of interest among youngsters to acculturate traditional practices and lack of awareness about the health and conservation values, harsh climatic conditions, and after all the grazing of pastures by domestic herds beyond their carrying capacities (Butz, 1996), could possibly be some of the reasons for the fast depletion of locally available medicinal plants in the study area.

All parts of the plants are used for the preparation of various indigenous recipes/formulae by the people. However, leaves were the mostly used part (24.7%) in preparing herbal drug, followed by flowers (21.9%) and whole plant and fruits (13.7 spp. each), while rest of the parts were infrequently used (Fig. 2). In addition, all plants are singly used for vocal and internal application in treating various diseases. This study is in agreement of Qureshi & Bhatti (2008).

Table 1. Showing diseases treated by number of plant species.

S. No.	Disease treated	No. of species	Percentage
1.	Fever	9	11.69
2.	Cough	5	6.49
3.	Digestive	5	6.49
4.	Wounds	4	5.19
5.	Eye infection	4	5.19
6.	Abdominal pain	4	5.19
7.	Jaundice	4	5.19
8.	Blood pressure	4	5.19
9.	Diarrhea	4	5.19
10.	Flue	3	3.90
11.	Asthma	3	3.90
12.	Backache	3	3.90
13.	Constipation	3	3.90
14.	Veterinary uses	2	2.60
15.	Fracture	2	2.60
16.	Skin burn	2	2.60
17.	Lactagogue	2	2.60
18.	Joints pain	2	2.60
19.	Nose bleeding	2	2.60
20.	Nausea	1	1.30
21.	Pneumonia	1	1.30
22.	Ear infection	1	1.30
23.	UTI	1	1.30
24.	Hair tonic	1	1.30
25.	Poisonous	1	1.30
26.	Skin allergy	1	1.30
27.	Sexual debility	1	1.30
28.	Menorrhagia	1	1.30
29.	Snakebite	1	1.30

The climate parameters like temperature, precipitation, wind direction and evapo-transpiration determine conditions for vegetation. Some of the local herders and other respondents were of the view that some species have almost vanished from their pastures during the last couple of years, due to less precipitation and prevailing drought conditions. There is already strong evidence that plant species are shifting their ranges in altitude and latitude as a response to changing regional climates (Parmesan & Yohe, 2003). If climatic factors such as temperature and precipitation change in a region beyond the tolerance of a species phenotypic plasticity, then distribution changes of the species may be inevitable (Lynch & Lande, 1993).

The natural resource base in the Hindu Kush-Himalayas is deteriorating more rapidly than many other global regions, but receives lesser attention internationally

than the other ecosystems (Shinwari, 2005). Medicinal plants, especially are valued for human and animal disorders and 80% of the local population still depends on these for their health problem but such knowledge is not documented and is rapidly disappearing (Inam, 2004).

Conclusion

Like many other mountainous areas of the world, Pakistan's northern mountain region is adequately rich in plant diversity, and since ages people living in the remote villages have been using plant species for food, medicine, shelter, fuel, fodder, cosmetics, detergents, etc. Owing to ever increasing numbers of livestock on pastures, easy access to allopathic medicines and lack of interest among youngsters to adopt traditional practices, the species of high medicinal, aromatic and economic value are

depleting very fast, and the knowledge concerning their traditional uses is vanishing too or is confined to elder men, women and shepherds in the remotest villages only. Contrarily, wild herbs, shrubs and trees are and will continue to be the only sources of fodder, firewood and timber in the study area. Nevertheless, it can be

anticipated that with more and more access to modern healthcare and allopathic medicine, not only the indigenous knowledge of traditional medicine but also the medicinal plant resource will completely exterminate from the area, merely in the spirit of modernization.

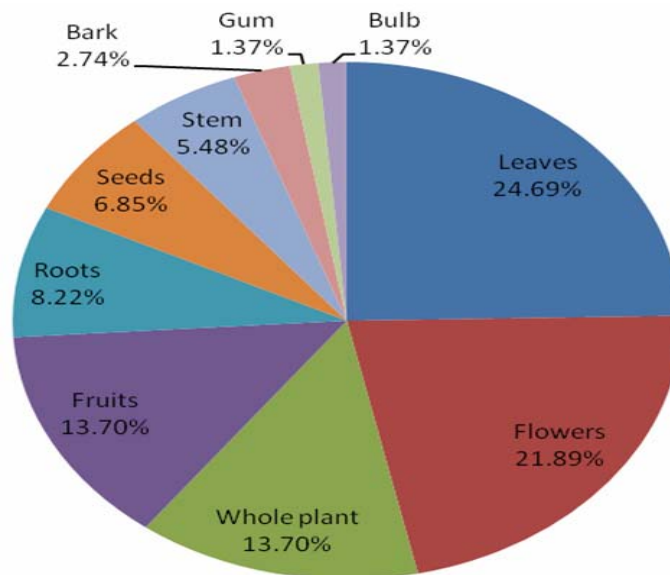
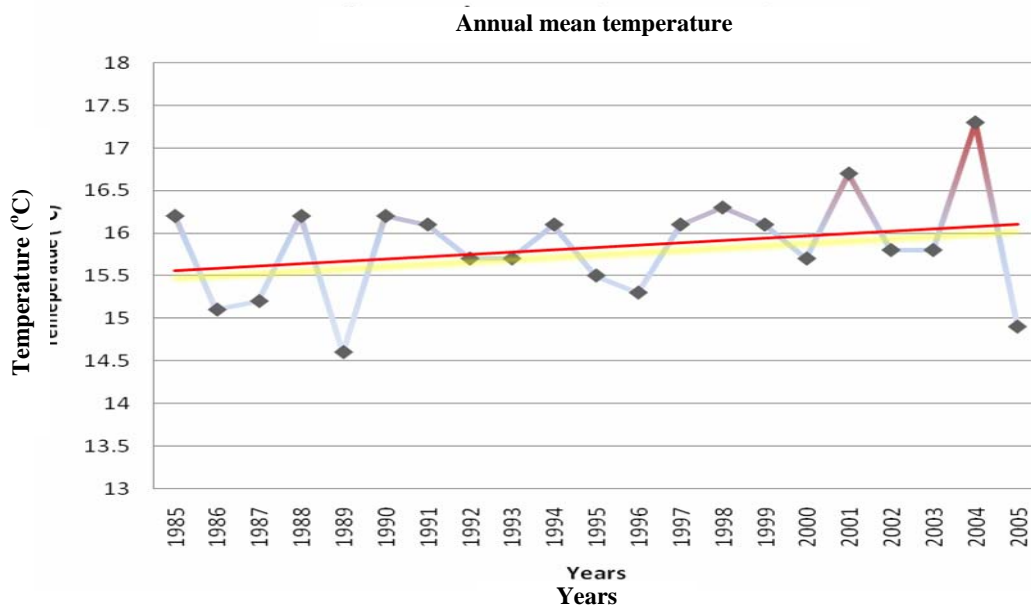


Fig. 2. Indicating parts used for the preparation of herbal medicines.

An emerging conservation issue: Though not studied directly but felt indirectly that changing global temperature and precipitation may affect species distribution and diversity in the area. Met data acquired from the nearest station (Gilgit) for the last twenty years (1985-2005) showed a slightly inclined trend in the annual mean temperatures, which appears to be a potential threat for some of the heat sensitive plant species and may prolong herder's stay in the pastures, resultantly putting more pressure on plant resources during the years to come

(Davis & Shaw, 2001; Lynch & Lande, 1993; Parmesan & Yohe, 2003).

In order to protect the depleting floral resource and related traditional knowledge, some concrete measures including but not limited to fostering awareness, conducting field research, integrating traditional knowledge with modern healthcare and *in-situ/ex-situ* conservation of plant resources supporting mountain livelihoods and rural economy is imperative.



Acknowledgement

Authors are thankful to WWF-Pakistan, Gilgit office and the directorate of Khunjerab National Park for providing financial assistance and logistical support to conduct this study.

References

- Ahmad, M., R. Qureshi, M. Arshad, M.A. Khan and M. Zafar. 2009. Traditional herbal remedies used for the treatment of diabetes from district Attock (Pakistan). *Pak. J. Bot.*, 41(6): 2777-2782.
- Ali, S.I. and M. Qaiser (Eds.). 1993-2008. *Flora of Pakistan*, University of Karachi, Missouri Botanical Garden Press, USA.
- Ali, S.I. and Y.J. Nasir (Eds.). 1990-1991. *Flora of Pakistan*, Islamabad, Karachi.
- Anonymous. 2008. The World Health Report - primary health care (Now more than ever). WHO Press, 20 Avenue Appia, 1211 Geneva 27, Switzerland.
- Anonymous. 2008. The World Health Report 2008: primary health care (Now more than ever). WHO Press, World Health Organization, 20 Avenue Appia, 1211 Geneva 27, Switzerland
- Balunas, M.J. and A.D. Kinghorn. 2005. Drug discovery from medicinal plants, *Life Sciences*, 78: 431-441
- Bhatti, G.R., R. Qureshi and M. Shah. 2001. Ethnobotany of Qadan Wari of Nara Desert. *Pak. J. Bot.*, 33(special issue): 801-812.
- Bhatti, G.R., R. Qureshi and M. Shah. 2002. Ethnomedicinal Observation of *Cymbopogon jawarancusa* (Jones) Schult., in Nara Desert (Sindh), Proc: *Workshop on Curriculum Development in Applied Ethnobotany*, WWF. pp. 34-39.
- David-Butz. 1996. Symbolic and instrumental dimensions of pastoral resource use in Shimshal, Northern Pakistan. *The Canadian Geographer Le Geographe Canadien*, 40(1): 36-53.
- Davis, M. B. and R.G. Shaw. 2001. Range shifts and adaptive responses to quaternary climate change. *Science*, 292: 673-679.
- GOP. 2010. Notification No. F&A-B (4)/F/2001 dated: 30-04-2010. Secretary Forest, Wildlife and Environment, Provincial Government of Gilgit-Baltistan, Pakistan. pp. 1-12.
- Hocking, G.M., 1958. Pakistan Medicinal Plants 1. Quarterly Planta. Material Vegetation 9: 103/119.
- Khan, A.A. 1996. *Management Plan for Khunjerab National Park*. WWF-Pakistan, Ferozepur road, Lahore, Pakistan
- Khan, S.W. and S. Khatoon. 2007. Ethnobotanical studies on useful trees and shrubs of Harramosh and Burgort Valleys in Gilgit Northern Areas, Pakistan. *Pak. J. Bot.*, 39(3): 699-710.
- Lynch, M. and R. Lande. 1993. Evolution and extinction in response to environmental change. In: *Biotic Interactions and Global Change* (Eds.): P.M. Kareiva & J. Kingsolver. Sinauer Associates Inc., Sunderland, MA, USA, pp. 234-250.
- Martin, G.J. 1995. *Ethnobotany: A People and Plants Conservation Manual*. Chapman & Hall, London.
- Matthew, K.M. 1981-83. *Flora of Tamilnadu Carnatic*. The Rapinat Herbarium, St. Joseph's College, Tiruchirappalli 620002, India, 1-3.
- McCullough, B.D. and D.A. Heiser. 2008. On the accuracy of statistical procedures in Microsoft Excel 2007, *Computational Statistics and Data Analysis*, 52: 4570-4578.
- Nasir, E. and S.I. Ali. (Eds.). 1970-1989. *Flora of Pakistan*, Islamabad, Karachi.
- Parnesan, C. and G. Yohe. 2003. A globally coherent fingerprint of climate change impacts across natural systems, *Nature*, 421: 37-42.
- Pie, S.J. and N.P. Manandhar. 1987. *Sources of some local medicines in the Himalayan Regions*. Himalayan Ecosystems, 97 - 112.
- Qureshi, R. 2004. *Floristic & Ethnobotanical Study of Desert Nara Region, Sindh*. PhD dissertation. Department of Botany, Shah Abdul Latif University, Khairpur, Sindh, Pakistan. Vol. II:
- Qureshi, R. 2006. *Floral Baseline Study of Khunjerab National Park*. WWF-Pakistan, GCIC complex, NLI colony, Jutial Gilgit, Pakistan.
- Qureshi, R. and G.R. Bhatti. 2008. Ethnobotany of plants used by the Thari people of Nara Desert, Pakistan. *Fitoterapia*, 79(6): 468-473.
- Qureshi, R. and G.R. Bhatti. 2009. Folklore uses Amaranthaceae family of Nara Desert, Sindh, Pakistan. *Pak. J. Bot.*, 41(4): 1565-1572.
- Qureshi, R., A. Waheed, M. Arshad and Tallat Umbreen. 2009. Medico-Ethnobotany of Tehsil Chakwal. *Pak. J. Bot.*, 41(2): 529-538.
- Qureshi, R., G.R. Bhatti and M. Shah. 2001. Ethnomedicinal properties of *Aloe baradensis* Mill., with particular reference to the people of Nara Desert, *Hamdard Medicus*, XLIV(3): 46-50.
- Qureshi, R., W.A. Khan, G.R. Bhatti, B. Khan, S. Iqbal, M.S. Ahmad and M. Abid. 2011. First report on the biodiversity of Khunjerab National Park, Pakistan. *Pak. J. Bot.*, 43(2): 849-861
- Qureshi, R.A., M.A. Ghufuran, K.N. Sultana, M. Ashraf and A.G. Khan. 2006. Ethnobotanical Studies of Medicinal Plants of Gilgit District and Surrounding Areas. *Ethnobotany Research & Applications*, 5: 115-122.
- Rao, R.R. and N. S. Jamir. 1982. Ethnobotanical Studies in Nagaland. I: Medicinal Plants. *Economic Botany*, 36(2): 176-181.
- Steinbauer, M. J. and J. Zeidler, 2008. *Climate change in Northern Areas Pakistan—impacts on glaciers, livelihoods and ecosystems*. WWF – Pakistan. pp. 5-15.

(Received for publication 30 April 2010)