

ETHNOBOTANICAL STUDIES ON PLANT RESOURCES OF HAZAR NAO FOREST, DISTRICT MALAKAND, PAKISTAN

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ABSTRACT

An ethno-botanical survey was carried out to collect information on traditional uses of plant resources of Hazar Nao forest, Malakand, Pakistan. About 90 vascular plant species, belonging to 56 families were utilized by the local people for various indigenous uses. Out of these 90 plants, 72 were used as medicinal, 50 as fuel wood species, 32 as fodder plants species, 22 as edible fruit, 29 species for attraction of honey bees, 10 species utilized in agricultural tools, 11 species for fencing, eight species as timber, eight species reported as ornamental, eight species used for thatching and sheltering, seven species as vegetable and pot herb, six species were reported poisonous, four species important for veterinary medicines and 20 plant species had miscellaneous uses such as making of ropes, wooden spoons, kites, fans and brooms. Plant remedies are mainly prepared through infusion, decoction and concoction and administered through oral route or applied to skin. Data analyses indicated that the remedies were used to treat gastro-intestinal disorders, respiratory diseases, skeleto-muscular problems, cutaneous complaints, blood circulatory diseases and many others. Field observations showed that deforestation, over grazing, agricultural expansion and unscientific collection, processing and preservation of natural vegetation are the major threats in the investigated area. Measures for the conservation of plant resources of Hazar Nao forest are urgently needed.

Keywords: Ethnobotanical uses, Hazar Nao Forest, Malakand, Pakistan, plant resources

INTRODUCTION

Plants have been used as folk medicine throughout the world (Smitherman *et al.*, 2005). Indigenous people living in particular areas depend on the use of plants or plant parts to fulfill their needs and often have considerable knowledge on their uses (Acharya and Acharya, 2010). It has been estimated that up to 90% of the world's

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population in developing countries depends primarily on herbal medicine for basic health care needs (WHO, 2002). Traditional use of plant and plant resources is rapidly increasing due to having no side effects, easily accessible at affordable prices and sometime the only source of health care available to the poor (Acharya *et al.*, 2009). Mennis (2006) analyzed the socio economic relations between people and vegetation. He concluded that modernization is not only straining natural resources but also impacting the quality of life for many people. However, the major issue in this technological era is the loss of indigenous knowledge which may serve as a guideline for many scientists all over the world as they continue to research on plant-based therapeutics.

Pakistan lies between 60° 55'to 75° 30' East longitude and 23° 45' to 36° 50' North latitude, covering an area of 80,943 km². Pakistan is gifted with a variety of plant resources due to a variety of climatic zones, landscapes and multiple ecological regions (Haq *et al.*, 2010). It has been estimated that about 600 to 700 species out of the total reported 6000 species of higher plants are used for medicinal purposes. The indigenous use of plants is a common practice but ethnobotanical studies are still on documenting level (Shinwari, 2010). Various studies have been carried out on the ethnobotany of medicinal and other useful plants in different parts of Pakistan (Durrani and Hussain, 2006; Ibrar *et al.*, 2007; Qureshi *et al.*, 2007; 2008; Rahmatullah and Bhatti, 2008). Some medicinal and ethnobotanical studies also have been carried out in the nearby regions of the study site. Shinwari *et al.* (2003a, 2003b) worked on the ethnobotanical studies of Swat. Ali and Qaisar (2009) listed the indigenous use of 83 taxa from Chitral district. Barkatullah *et al.* (2009) conducted ethnobotanical survey of Charkotli Hills, Batkhela. Sher and Hussain (2009) documented the inventory of economic and medicinal plants of Mallam Jabba valley, Swat. Zabihullah *et al.* (2006) reported 82 plant species for different ethnobotanical purposes from Kot Manzary Baba valley. It is worthy to note that more than 10% of the flora of Pakistan is endangered (Shinwari *et al.*, 2002) due to population pressure, poverty and poor quality of the natural resource-base, breakdown of social institutions and lack of land use plans (Shinwari, 2010). The multipurpose use of plants have resulted over-exploitation and over-harvesting of medicinal plants wealth.

The main objective of the present study was to document the indigenous knowledge of plants of Hazar Nao forest, Malakand before the information are lost. Our findings will provide scientific base for further research in the field of pharmacology, pharmacognosy, ecology, molecular systematic, water shed and wild life management.

Study area

The tribal region, Malakand is located at 34° 35' North latitude and 71° 57' East longitude. It is bounded on the North by Dir, on Northeast by Swat and East by Buner district, on the South the area is bounded by Mardan and Charsadda districts and on West by Mohmand and Bajaur Agencies (Chaghtai and Ghawas, 1976). Malakand extends from the rugged and partly glaciated mountain ranges of the Hindukush down to northern edge of the Peshawar basin. Malakand is the gateway to Dir, Chitral, Swat districts and federally administered tribal areas (FATA) which are very famous for tourism. Hazar Nao is one of the most important and scenic mountain of Malakand with about 2727 m elevation (Zabihullah *et al.*, 2006). It is located at about 23 km in West of Dargai and has rich archaeological sites and thick forest. The inhabitants of the area mostly depend upon agriculture for their subsistence. However, agricultural products are too less to meet the expenditure of the tribal communities. Therefore, the people have to resort to alternative methods (forest resources) for earning their livelihood. The women support their men by taking care of cattle, cutting fuel wood as well as in the fields. They also make handicrafts items like caps, bed sheets, baskets, brooms, wooden spoons and kites etc. Consequently, the forest is under severe biotic pressure. A forest reserve should be a constant source of maintaining genetic diversity of plants and animal and these resources should be available to man through proper conservation (Ibrar *et al.*, 2007).

MATERIALS AND METHODS

Regular field surveys were conducted in different seasons during 2003 and 2004 in eight different villages of District Malakand including Barha, Kot, Haryan kot, Gari usmani khel, Totay, Pir Khel, Meena and Meeh band around the Hazar Nao forest. Information on the traditional uses of plants were gathered from the local people of the community through formal and informal interviews and questionnaires. The interviews were based on informal small talks with individuals and groups and consequently 300 formal interviews were conducted and accomplished.

For medicinal plants, we gave priority to the elderly people of the localities. Those medicinal recipes were listed which were repeated by at least 5 persons. Voucher herbarium specimens were collected, dried and identified with help of local available literature (Nasir and Ali, 1970-1979; 1980-1989; 1970-1995; Ali and Qaisar, 1993-2009) and using herbarium of Biological Sciences, Quaid-i-Azam University, Islamabad. They were accessioned and submitted in the herbarium, Department of Biological Sciences, Quaid-i-Azam University, Islamabad.

RESULTS AND DISCUSSION

Plants diversity

A total of 90 vascular plant species, belonging to 56 families were collected and identified which are used by the inhabitants of Hazar Nao forest for various indigenous uses. Among them Pteridophytes (Adiantaceae) and Gymnosperms (Pinaceae) were represented by one family each whereas Angiosperms had 54 families. Out of the 54 Angiosperm families 3 (Aracaceae, Liliaceae and Poaceae) were monocotyledonous and the rest of the 51 families were dicotyledonous. The families Euphorbiaceae and Moraceae were the most represented (6 species each) followed by Poaceae (5 species). Lamiaceae had 4 species, while Asteraceae, Rosaceae and Solanaceae comprised of three species each. Adiantaceae, Amaranthaceae, Apocyanaceae, Aracaceae, Asclepiadaceae, Boraginaceae, Buxaceae, Liliaceae, Mimosaceae, Papilionaceae and Rhamnaceae were represented by 2 species each. However, the remaining 38 families had one species each (Table-1).

Ethnobotanical information indicates that about 72 plants are administered as medicine for human ailments. The second major use of these plants is as fuel wood species (50). Thirty two species are used as fodder plants, twenty two as edible fruit, twenty nine species attract honey bees. Ten species are utilized in making agricultural tools, eleven species are used for fencing and hedging, eight as timber, eight species are ornamental, eight species are used for thatching and sheltering, seven as vegetable and pot herb. Six species are reported poisonous, four species are important for veterinary medicines while twenty plant species had miscellaneous uses such as making of ropes, wooden spoons, kites, fans and brooms (Table-1).

The percentage of utility of medicinal plants was 80%, fuel wood species 56%, fodder plants 36%, plants yield edible fruits 24%, honey bee species 32%, plants yield agricultural tools 11%, hedge plants 12%, timber wood species 9%, ornamental plants 9%, thatching and sheltering species 9%, pot herb species 9%, poisonous plants 7%, veterinary medicines 4% and plants used for miscellaneous purposes 22% (Figure 1). The plants were classified into four growth forms, namely trees 34 (38%), herbs 27 (30%), shrubs 26 (29%) and herbaceous climbers represent the least 3 (3%, Figure 2). The study area in the district of Malakand is also indicated in a map (Figure 3).

Medicinal plants

In total 72 plant species were identified to be medicinally important. Almost all parts of the plant such as roots, stem, bark, leaves, flower, fruits and seeds are utilized by local inhabitants for different purposes. However, it depends on the need of the user and type of the plant. Herbs are often used as whole but the use of shrubs

and trees is limited to a particular part. It was noted that the traditional healers process the medicinal plants for different remedies mainly through infusion, decoction, concoction and powdering. Different substances such as juices, sugar, soap, wheat flour, mustard oil, honey, desi ghee (Butter) and milk are added to the plant or plant part during the preparation of medicinal remedies. The remedies are mainly taken through oral route or applied to the skin and wounds (Table-2). It is worthy to note that most plants are administered individually while some are utilized as compound remedy in admixture.

The study also revealed that most plant species have multiple uses while some plants are used for curing only one specific disease. For example, about 100 gm of the powdered rhizome of *Berberis lycium* is mixed with 100 gm of black pepper (*Piper nigrum*) and 1000 gm of Desi ghee and the remedy so prepared is used for Backache, pharyngitis as well as for intestinal colic wounds. The latex collected from the root, leaves and stem of *Calotropis procera* is mixed with Bajra (*Pennisetum typhoides*) and is given against asthma and cholera where as the stem is used as Maswak (tooth paste) to cure dental problem (pyorrhoea). Infusion of *Cuscuta reflexa* and *Euphorbia helioscopia* is applied over the affected part to cure eczema while the decoction of *Cuscuta reflexa* is useful against scabies. Similarly *Punica granatum* is used for gastrointestinal disorders, blood circulatory diseases and respiratory illness. The stem resin of *Pinus roxburghii* was found to use against snake bite. It is contrary to the report of Zabihullah *et al.* (2006) who documented *Pinus roxburghii* as fuel wood species but found *Ariseama jacquemontii* to be used against snake bite from the nearby region of the investigated area. *Ariseama jacquemontii* is reported as poisonous plant in our results.

A folk medicinal use in the study area is an outcome of the people's own experience and they mostly depend on medicinal plants due to lack of basic health care units. There is still a community with entire folk culture using the surrounding medicinal resources. They use medicinal plants by themselves to treat many kinds of diseases on the basis of their indigenous knowledge and mostly by the advice of elders. Data analysis indicates that the medicinal plants were used to treat many diseases such as gastro-intestinal disorders (diarrhea, dysentery, constipation and stomach-ache), respiratory diseases (asthma and cough), skeleto-muscular problems (rheumatism, backache and pain), cutaneous complaints and blood circulatory diseases (Table-2).

Fuel wood species

The inhabitants of the area mainly depend upon the plants for fuel wood due to the lack basic facilities such as coal and gas. They use 50 plant species as fuel wood. *Dodounea viscosa* and *Pinus*

roxburghii are extensively exploited for commercial purposes and these two taxa are showing drastic decrease in the area. The other common wild fuel wood species include *Acacia modesta*, *Acacia nilotica*, *Berberis lycium*, *Bombax ceiba*, *Ficus* species, *Melia azedarach*, *Morus alba*, *Olea ferruginea*, *Pistacia chinensis*, *Phyllanthus emblica*, *Quercus incana* and *Ziziphus numularia*. Our results are in consonance with the records of Ibrar et al. (2007) and Barkatullah et al. (2009) who reported almost the same plants as fuel wood species from other parts of Malakand division.

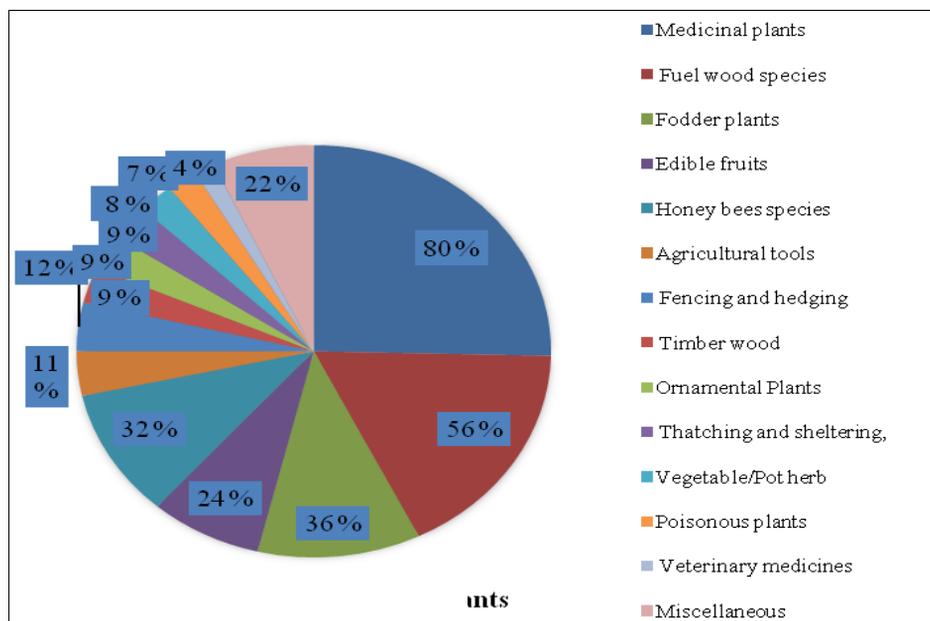


Figure 1. Percentage use of plants.

Fodder and forage species

The livestock feed on 32 (36%) plant species. These plants include *Apluda mutica*, *Convolvulus arvensis*, *Cynodon dactylon*, *Cymbopogon jwarancusa*, *Fumaria indica*, *Morus alba* and *Rubus fruticosus*. The leaves of *Acacia modesta*, *Acacia nilotica*, *Ailanthus altissima*, *Melia azedarach*, *Morus alba* and *Ziziphus numularia* are used as fodder for goats and sheep. The use of most of these plants as fodder species are also reported by Zabihulla et al. (2006), Jabeen et al. (2009) and Haq et al. (2010). The local people harvest herbaceous plants (mostly grasses), cut and tied them into small bundles. These bundles are dried and stacked over each other and used in winter and rainy seasons.

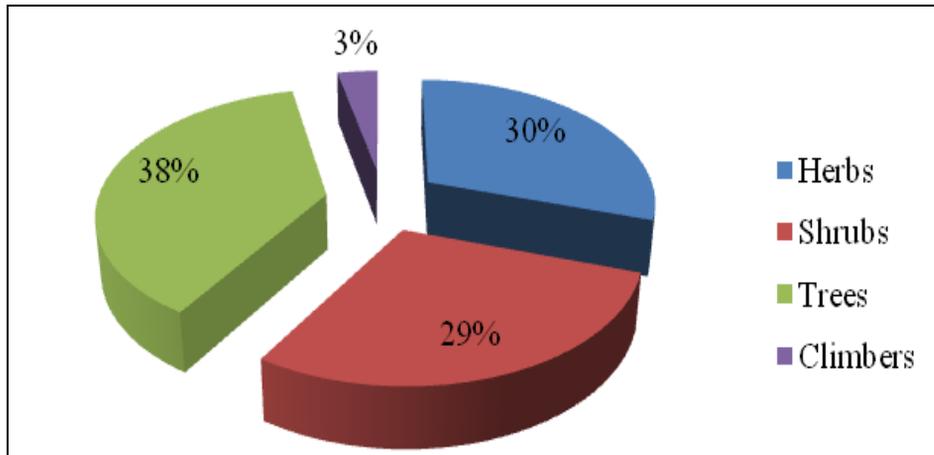


Figure 2. Habit of medicinal plants.

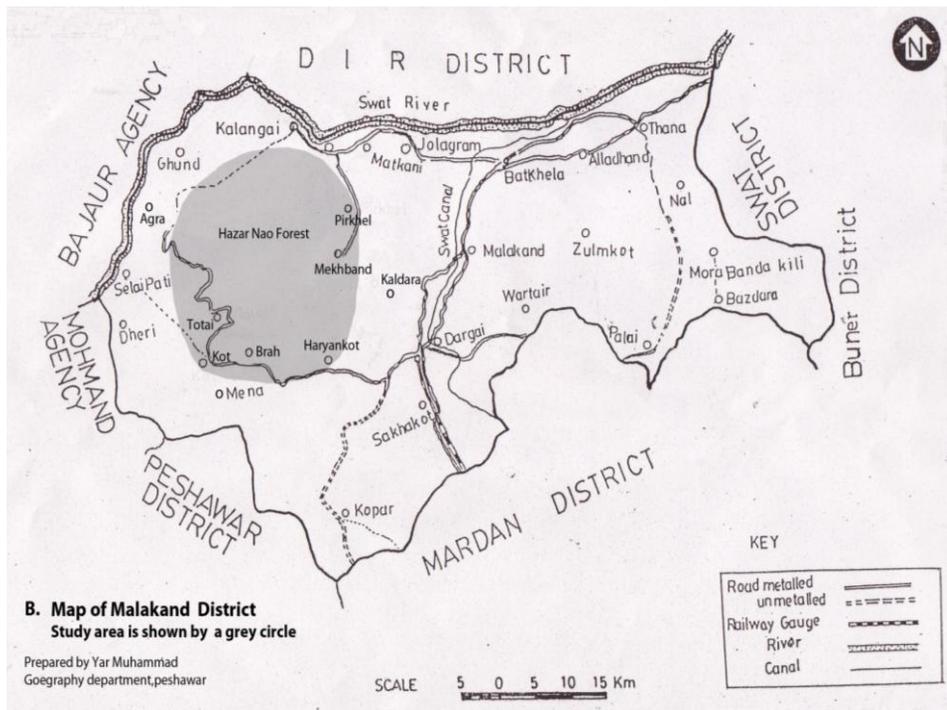


Figure 3. Map of District Malakand, Khyber Pakhtunkhwa, Pakistan.

Fruit yielding species

There are 22 (24%) plant species, which yield edible fruits. The most important fruit yielding plants are *Berberis lycium*, *Ficus carica*,

Ficus palmata, *Monothecha buxifolia*, *Morus alba*, *Phoenix dactylifera*, *Phyllanthus emblica*, *Prunus persica*, *Punica granatum*, *Pyrus pashia* and *Ziziphus numularia*. Our analysis is consistent with the records given by Zabihulla et al. (2006) and Jabeen et al. (2009).

Vegetable and pot herb species

Local people cultivate many plants as vegetable. However, few wild plants such as *Amaranthus viridis*, *Bauhinia variegata* and *Oxalis corniculata* are used as vegetable and pot herb. Our findings agree with those of Barkatullah et al. (2009) and Ibrar et al. (2007).

Honey bee species

The bee flora comprises 29 species having 32% of the total studied plants. The flowers have large petals with scents, which attract honey bee. The main honey bee species were *Acacia modesta*, *Acacia nilotica*, *Butea monosperma*, *Calotropis procera*, *Melia azedarach*, *Otostegia limbata* and *Ziziphus numularia*.

Plants used in making agricultural tools

Ten plant species are utilized in making agricultural tools, which comprise 11% of total reported species. They are used for making ploughs, wheels, carts, pullies, sickle handles, knife handles, and other useful tools.

Plants used in fencing and hedges

Local people are using some plant species for fencing and hedges such as *Acacia modesta*, *Acacia nilotica*, *Otostegia limbata*, *Rubus fruticosus* and *Ziziphus numularia*. These plants are usually spiny, thorny or bushy to prevent stray animals not enter to cultivated fields or herd sheds.

Timber yielding species

A total of eight timber wood plants were reported from the study area. The most important timber yielding plants were *Acacia modesta*, *Acacia nilotica*, *Melia azedarach*, *Platanus orientalis* and *Pinus roxburghii*.

Ornamental plants

The wild ornamental plants include *Adiantum capillus-veneris*, *Adiantum incisum*, *Bombax ceiba* and *Platanus orientalis*.

Plants used for shelter and thatching

The branches and leaves of *Arundo donax*, *Bombax ceiba*, *Dodounea viscosa* and *Saccharum spontaneum* are used locally for shelter and thatching.

Poisonous plants

Six species such as *Ariseama jacquemontii*, *Buxus wallichiana*, *Nerium oleander* and *Ricinus communis* were considered poisonous either to man or livestock.

Table-1. Ethno-botanical information on plant resources of Hazar Nao Forest, Malakand, Pakistan.

No.	Botanical name	Family	Ethnobotanical uses													
			A	B	C	D	E	F	G	H	I	J	K	L	M	N
1.	<i>Justicia adhatoda</i> L.	Acanthaceae	+	+	-	-	-	-	-	+	-	-	+	-	-	-
2.	<i>Adiantum capillus-veneris</i> L.	Adiantaceae	-	+	-	-	-	-	-	-	-	-	-	+	-	-
3.	<i>Adiantum incisum</i> Forsk.	Adiantaceae	-	+	-	-	-	-	-	-	-	-	-	+	-	-
4.	<i>Achyranthus aspera</i> L.	Amaranthaceae	-	+	-	-	-	-	-	-	-	-	-	-	-	-
5.	<i>Amaranthus viridis</i> L.	Amaranthaceae	-	+	+	+	-	-	-	-	-	-	-	-	-	Vegetable
6.	<i>Pistacia chinensis</i> Bunge	Anacardiaceae	+	+	-	-	-	-	-	-	+	-	-	-	-	-
7.	<i>Ammi visnaga</i> (L.). Lam	Apiaceae	-	+	-	-	-	-	-	-	-	-	-	-	-	-
8.	<i>Nerium oleander</i> L.	Apocyanaceae	-	+	-	-	-	-	-	-	-	-	+	-	-	-
9.	<i>Rhazya stricta</i> Decne	Apocyanaceae	+	+	-	-	-	-	-	-	-	-	-	-	-	-
10.	<i>Ariseama jacquemontii</i> Blume	Araceae	-	-	-	-	-	-	-	-	-	-	-	+	-	-
11.	<i>Phoenix dactylifera</i> L.	Arecaceae	+	+	-	-	+	+	-	-	-	+	-	-	-	Branches used for making kites
12.	<i>Nannorrhops ritchiana</i> Griff	Arecaceae	-	+	+	-	-	-	-	-	-	-	-	-	+	Leaves used for making ropes, mats and fans
13.	<i>Calotropis procera</i> (Willd.) R.Br.	Asclepiadaceae	+	+	+	-	-	-	-	-	-	+	-	-	-	Plant ash is used for dyeing of cloths
14.	<i>Periploca aphylla</i> L.	Asclepiadaceae	-	+	-	-	-	-	-	-	-	-	-	-	-	-
15.	<i>Conyza bonariensis</i> L.	Asteraceae	+	-	+	-	-	-	-	-	-	+	-	-	-	-
16.	<i>Echinops echinatus</i> Roxb.	Asteraceae	-	+	-	-	-	-	-	-	-	-	-	-	-	-
17.	<i>Xanthium strumarium</i> L.	Asteraceae	+	+	-	-	-	-	-	-	-	-	-	-	-	-
18.	<i>Berberis lycium</i> Royle.	Berberidaceae	-	+	-	-	-	-	-	-	-	+	-	-	-	-
19.	<i>Bombax ceiba</i> L.	Bombacaceae	+	-	-	-	-	+	-	-	+	-	+	-	-	Silk used in pillows
20.	<i>Ehretia serrata</i> Roxb.	Boraginaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
21.	<i>Trichodesma indica</i> (L.) R.Br.	Boraginaceae	+	-	-	-	-	-	-	-	-	-	-	-	-	-
22.	<i>Buxus wallichiana</i> Baill	Buxaceae	+	+	-	-	-	-	-	-	-	-	-	+	-	Wood used for making wooden spoons
23.	<i>Sarcococca saligna</i> (D. Don) Muecll	Buxaceae	-	+	-	-	-	-	-	-	-	-	-	-	-	-
24.	<i>Bauhinia variegata</i> L.	Caesalpinaceae	+	+	+	+	-	-	-	+	-	+	-	-	-	Vegetable
25.	<i>Canabis sativa</i> L.	Canabaceae	+	+	-	-	-	-	-	-	-	-	-	-	-	-
26.	<i>Maytenus royleanus</i> Wall. ex. Lawson	Celastraceae	+	-	+	-	-	-	+	-	-	+	-	-	-	-
27.	<i>Chenopodium ambrosioides</i> L.	Chenopodiaceae	-	+	+	+	-	-	-	-	-	-	-	-	-	Vegetable
28.	<i>Convolvulus arvensis</i> L.	Convolvulaceae	-	+	+	-	-	-	-	-	-	-	-	-	-	-
29.	<i>Cuscuta reflexa</i> Roxb.	Cuscutaceae	-	+	-	-	-	-	-	-	-	-	-	-	-	-
30.	<i>Andracne cordifolia</i> (Done) Mucll	Euphorbiaceae	-	-	-	-	-	-	-	-	-	-	-	-	+	-
31.	<i>Euphorbia prostrata</i> L.	Euphorbiaceae	-	+	+	-	-	-	-	-	-	-	-	-	-	-
32.	<i>Euphorbia helioscopia</i> L.	Euphorbiaceae	-	+	-	-	-	-	-	-	-	-	-	+	-	-
33.	<i>Mallotus philipensis</i> (Lam.) Mucll.	Euphorbiaceae	+	+	+	-	-	-	-	-	-	-	+	-	+	-

No.	Botanical name	Family	Ethnobotanical uses															
			A	B	C	D	E	F	G	H	I	J	K	L	M	N		
34.	<i>Phyllanthus emblica</i> L.	Euphorbiaceae	+	+	-	-	+	-	-	-	-	-	-	-	-	-	-	Oil used to make the hair healthy
35.	<i>Ricinus communis</i> L.	Euphorbiaceae	+	+	-	-	-	-	-	-	-	-	-	+	-	-	-	
36.	<i>Quercus incana</i> Roxb.	Fagaceae	+	+	-	-	+	-	-	+	-	+	-	-	-	-	-	
37.	<i>Flacourtia indica</i> (Berm.) Merrill.	Flacourtiaceae	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	
38.	<i>Fumaria indica</i> (Hausskn.) H.N.	Fumariaceae	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	
39.	<i>Ajuga bracteosa</i> Wall. ex. Benth.	Lamiaceae	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	
40.	<i>Colebrookia oppositifolia</i> Smith.	Lamiaceae	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	
41.	<i>Origanum vulgare</i> L.	Lamiaceae	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	washing utensils
42.	<i>Otostegia limbata</i> (Benth.) Bioss	Lamiaceae	+	+	-	-	-	-	+	-	-	+	-	-	-	-	-	
43.	<i>Asparagus plumosus</i> L.	Liliaceae	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	
44.	<i>Asparagus adscendens</i> L.	Liliaceae	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	
45.	<i>Woodfordia fruticosa</i> (L.) S. Kurz	Lythraceae	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	
46.	<i>Melia azedarach</i> L.	Meliaceae	+	+	+	-	-	+	-	-	-	+	-	-	-	+	-	Leaves are used for removal of hair lice
47.	<i>Tinospora cordifolia</i> Miers	Menispermaceae	-	+	-	-	-	-	-	-	-	+	-	-	-	-	-	
48.	<i>Acacia modesta</i> wall	Mimosaceae	+	+	+	-	-	+	+	-	-	+	-	-	-	-	-	
49.	<i>Acacia nitotica</i> L.	Mimosaceae	+	+	+	-	-	+	+	-	-	+	-	-	-	-	-	
50.	<i>Ficus carica</i> L.	Moraceae	+	+	+	-	+	-	-	-	-	-	-	-	-	-	-	Latex used for removal of spines/ thorns
51.	<i>Ficus glomerata</i> L.	Moraceae	+	+	+	-	+	-	-	-	-	-	-	-	-	-	-	
52.	<i>Ficus religiosa</i> L.	Moraceae	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	
53.	<i>Ficus benghalensis</i> L.	Moraceae	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	
54.	<i>Ficus palmata</i> Forrsk.	Moraceae	+	+	+	-	+	-	-	-	-	-	-	-	-	-	-	
55.	<i>Morus alba</i> L.	Moraceae	+	+	+	+	+	-	-	+	-	+	-	-	-	-	-	
56.	<i>Myrsine africana</i> L.	Myrsinaceae	-	+	-	+	+	-	-	-	-	-	-	-	-	-	-	Leaves used as flavoring agent and appetizer
57.	<i>Myrtis communis</i> L.	Myrtaceae	+	+	-	-	+	-	+	-	+	-	-	-	-	-	-	
58.	<i>Olea ferruginea</i> Royle	Oleaceae	+	+	+	+	+	-	-	-	+	-	-	-	-	-	-	
59.	<i>Oxalis corniculata</i> L.	oxalidaceae	-	+	+	+	-	-	-	-	-	-	-	-	-	-	-	Extraction of plant is used for cleaning of rusted vessels. Leaves are used as vegetable
60.	<i>Butea monosperma</i> (Lam.) P. Kuntra	Papillionaceae	+	+	-	-	-	-	-	+	-	+	-	-	-	-	-	
61.	<i>Indigofera gerardiana</i> Wall. ex Brand	Papillionaceae	+	-	+	-	-	-	-	-	-	+	+	-	-	-	-	Wood ash used in making snuff. Young branches used in making ropes and brooms
62.	<i>Pinus roxburghii</i> sergent	Pinaceae	+	-	-	-	-	+	-	-	-	-	-	-	-	-	-	Cones used for decorative purposes, resin used in preparation of turpentine oil

No.	Botanical name	Family	Ethnobotanical uses													
			A	B	C	D	E	F	G	H	I	J	K	L	M	N
63.	<i>Platanus orientalis</i> L.	Platanaceae	+	+	-	-	-	+	-	+	-	-	+	-	-	Plant name is used in Pashto songs. Leaf is a symbol of Kashmir.
64.	<i>Arundo donax</i> L.	Poaceae	-	+	-	-	-	-	+	-	+	-	-	-	-	Making dip pens
65.	<i>Cynodon dactylon</i> (L.) pers.	Poaceae	-	+	+	-	-	-	-	-	-	-	+	-	-	
66.	<i>Apluda mutica</i> L.	Poaceae	-	-	+	-	-	-	-	-	-	-	-	-	-	
67.	<i>Cymbopogon jwarancusa</i> (Jones) Schult.	Poaceae	-	-	+	-	-	-	-	-	-	-	-	-	-	
68.	<i>Saccharum spontaneum</i> L.	Poaceae	-	-	-	-	-	-	-	-	+	+	-	-	-	Making Brooms, baskets.
69.	<i>Rumex hastatus</i> D. Don	Polygonaceae	-	+	-	-	-	-	-	-	-	-	-	-	-	Used in chatneys and as a flavoring agent
70.	<i>Punica granatum</i> L.	Punicaceae	-	+	-	-	+	-	-	-	-	+	-	-	-	Flower juice used for dying, seeds in condiments
71.	<i>Sageretia thea</i> L.	Rhamnaceae	-	+	-	-	-	-	-	-	-	-	-	-	-	
72.	<i>Ziziphus numularia</i> (Burm.f) W. Arn.	Rhamnaceae	+	+	+	-	+	-	+	+	-	+	-	-	-	
73.	<i>Prunus persica</i> (L.) Batch.	Rosaceae	+	-	+	-	+	-	-	-	-	+	-	-	-	
74.	<i>Pyrus pashia</i> Hom. Ex. D.	Rosaceae	+	+	-	-	+	-	-	+	-	+	-	-	-	
75.	<i>Rubus fruticosus</i> L.	Rosaceae	+	+	+	-	-	+	+	-	+	-	-	-	-	
76.	<i>Dodounea viscosa</i> (L.) Jacq.	Sapindaceae	+	+	-	-	-	-	+	-	+	-	-	-	-	
77.	<i>Monothea buxifolia</i> (Falc) A.	Sapotaceae	+	-	+	-	+	-	-	-	-	+	-	-	-	
78.	<i>Verbascum thapsus</i> L.	Scrophulariaceae	-	+	-	-	-	-	-	-	-	+	-	-	-	
79.	<i>Ailanthus altissima</i> (Mill) Swingle.	Simarubaceae	+	+	+	-	-	-	-	-	-	+	-	-	-	
80.	<i>Solanum nigrum</i> L.	Solanaceae	-	+	+	-	+	-	-	-	-	-	-	-	-	
81.	<i>Solanum surrattense</i> Burm. f.	Solanaceae	-	+	-	-	-	-	-	-	-	-	-	-	-	
82.	<i>Solanum incanum</i> L.	Solanaceae	+	-	-	-	-	-	-	-	-	+	+	-	-	
83.	<i>Helicteres isora</i> L.	Sterculiaceae	+	+	-	-	-	-	-	+	-	+	-	-	-	
84.	<i>Grewia optiva</i> J.R. Drum.	Teliaceae	+	-	-	-	-	-	-	-	-	-	-	-	+	
85.	<i>Daphne mucronata</i> Royle	Thymeliaceae	+	+	-	-	+	-	-	-	-	-	+	+	-	
86.	<i>Celtis australis</i> L.	Ulmaceae	+	+	+	-	+	-	-	+	-	-	-	-	-	
87.	<i>Debregeasia salicifolia</i> Forssk.	Urticaceae	+	+	-	-	+	-	+	-	+	-	-	-	-	
88.	<i>Lantana camara</i> L.	Verbenaceae	+	+	-	-	+	-	-	-	-	+	-	-	-	
89.	<i>Viola canescens</i> wall. ex. Roxb.	Violaceae	-	+	-	-	-	-	-	-	-	-	-	-	-	
90.	<i>Vitis jacquemontii</i> R. Parker.	Vitaceae	-	+	-	-	+	-	-	-	-	-	-	-	-	

Keys, A: Fuel Wood, B: Medicinal, C: Fodder, D: Pot herb, E: Fruit yielding plants, F: Timber, G: Hedge and fences, H: Plants used for Agriculture tools, I: Thatching and sheltering plants, J: Honey bee species, K: Ornamental plants, L: Poisonous plants, M: Plants used in veterinary medicines, N: Miscellaneous.

Table-2. Diversity of medicinal plants inventoried during the survey.

Scientific name	Part used	Disease treated	Route of admin.	Mode of preparation	Therapeutic indications
<i>Acacia modesta</i>	Bark	Backache	Oral	Decoction, Concoction (bark gum, wheat flour and desi ghee)	Skeletal diseases
<i>Acacia nilotica</i>	Flowers	Earache	dermal	Concoction (flowers and mustard oil)	ENT diseases
<i>Achyranthes aspera</i>	Whole plant	Boils, fracture bones, tonsillitis	dermal	Concoction (gur and soap)	Cutaneous, skeletal, respiratory diseases
<i>Adiantum capillus-veneris</i>	Fron	Expectorant, emetic, diuretic	Oral	Infusion	Respiratory, gastrointestinal and urinary diseases
<i>Adiantum incisum</i>	Fron	Fever, cough, diabetes, dermatitis	Oral	Infusion	Respiratory, blood circulatory and cutaneous diseases
<i>Ailanthus altissima</i>	Bark	Dysentery, diarrhea	Oral	Infusion	Gastrointestinal diseases
<i>Ajuga bracteosa</i>	Whole plant	Sore throat, dyspepsia	Oral	Decoction	Gastrointestinal diseases
<i>Amaranthus viridis</i>	Whole plant	Laxative, abscesses, boils	Oral, dermal	Decoction, concoction (mustered oil)	Gastrointestinal and cutaneous diseases
<i>Ammi visnaga</i>	Dry fruit	Cough, asthma	Oral	Maceration	Respiratory diseases
<i>Arundo donax</i>	Rhizome	Emollient and diuretic	Oral, dermal	Decoction	Urinary and cutaneous diseases
<i>Asparagus plumosus</i>	Root tubers	Diarrhea and dysentery	Oral	Decoction	Gastrointestinal diseases
<i>Asparagus adscendens</i>	Stem and leaf	Diuretic, Jaundice and congestive liver	Oral	Infusion	Urinary and blood circulatory diseases
<i>Bauhinia variegata</i>	Bark and seeds	scrofula	Dermal	Decoction (sulphur and mustard oil)	Respiratory diseases
<i>Berberis lyceum</i>	Rhizome	Backache, pharyngitis, colic wounds	Oral, dermal	Concoction (black pepper and desighee), decoction	Skeletal and gastrointestinal diseases
<i>Buxus wallichiana</i>	Whole plant	Antirheumatic, purgative, febrifuge, diaphoretic	Oral	Infusion	Skeletal, gastrointestinal diseases and fever
<i>Butea monosperma</i>	Whole plant	Backache, vermifuge, gonorrhea	Oral	Powder, Concoction (plant gum with desi ghee and nashasta)	Skeletal gastrointestinal and urinary diseases
<i>Calotropis procera</i>	Whole plant	Asthma, cholera, earache, pyorrhea	Oral, dermal	Concoction, infusion	Respiratory, dental, cutaneous and gastrointestinal diseases
<i>Canabis sativa</i>	Leaves	Antispasmodic, narcotic	Oral, dermal	Decoction, concoction (juice or milk and poppy seeds)	Muscular diseases

Scientific name	Part used	Disease treated	Route of admin.	Mode of preparation	Therapeutic indications
<i>Celtis australis</i>	Fruit	Colic	Oral	-	Gastrointestinal diseases
<i>Chenopodium ambrosoides</i>	Leaves and stem	Backache, motions	Oral, dermal	Powder, Concoction (chicken soup)	Skeletal and gastrointestinal diseases
<i>Colebrookia oppositifolia</i>	Leaves and roots	Ulcer, wounds and epilepsy	Oral, dermal	Infusion	Cutaneous and brain diseases
<i>Convolvulus arvensis</i>	Whole plant	Epilepsy, sexual debility	Oral	Infusion, decoction	Brain and sexual diseases
<i>Cuscuta reflexa</i>	Whole plant	Scabies, eczema and inducing sterility	Oral, dermal	Infusion, Decoction and concoction (<i>E. helioscopia</i>)	Cutaneous and sexual diseases
<i>Cynodon dactylon</i>	Whole plant	External bleeding, nose & urinary bleeding, jaundice	Oral, Dermal	Infusion	Blood circulatory diseases
<i>Daphne mucronata</i>	Fruit	Rheumatism	Oral	Poultice	Skeletal diseases
<i>Debregeasia salicifolia</i>	Aerial parts	Eczema, dermatitis	Dermal	Powder	Cutaneous diseases
<i>Dodonaea viscosa</i>	Leaves	Swelling, joints pain, boils	Oral, topical	Infusion	Cutaneous, skeletal and gastrointestinal diseases
<i>Echinops echinatus</i>	Whole plant	Cough, dyspepsia, jaundice, hysteria	Oral	Infusion	Gastrointestinal, blood circulatory diseases and Neurotic disorder
<i>Euphorbia prostrata</i>	Whole plant	Ring worm	Dermal	Infusion	Cutaneous diseases
<i>Euphorbia helioscopia</i>	Whole plant	Eczema	Dermal	Concoction (<i>Cuscuta reflexa</i>)	Cutaneous diseases
<i>Ficus carica</i>	Leaves and fruit	Measles, dysentery, bladder problems and verrucas	Oral, dermal	Decoction, infusion	Respiratory, gastro intestinal, urinary and cutaneous diseases
<i>Ficus glomerata</i>	Bark, leaves and fruit	Gums, stomachic carminative and diarrhea	Oral	Infusion	Dental problems, Gastro intestinal diseases
<i>Ficus religiosa</i>	Bark, fruit	Asthma, constipation, vomiting, bladder diseases	Oral	Decoction	Respiratory, gastro intestinal and urinary diseases
<i>Ficus palmata</i>	Fruit	Laxative, lungs and bladder problems	Oral	-	Gastro intestinal ,blood circulatory and urinary diseases
<i>Ficus benghalensis</i>	Aerial roots	Diarrhea, diabetis	Oral	Infusion	Gastro intestinal and blood circulatory diseases
<i>Fumaria indica</i>	Whole plant	Blood purification, goiter	Oral	Decoction	Blood circulatory diseases
<i>Helicteres isora</i>	Seeds	Colic infections, dysentery	Oral	Maceration	Gastro intestinal diseases
<i>Justacia adhatoda</i>	Leaves, flowers	Cough, asthma, bronchitis, tuberculosis, rheumatism	Oral	Decoction	Respiratory, skeleto-muscular diseases

Scientific name	Part used	Disease treated	Route of admin.	Mode of preparation	Therapeutic indications
<i>Lantana camara</i>	Whole plant	Tetanus, antispasmodic, carminative, diaphoretic, diabetes	Oral	Decoction	Nerve, respiratory, blood circulatory and gastrointestinal diseases
<i>Mallotus philippensis</i>	Whole plant	Wounds, cuts and bruises	Dermal	Infusion	Cutaneous diseases
<i>Morus alba</i>	Fruit and leaves	purgative	Oral	Infusion	Gastro intestinal diseases
<i>Myrsine africana</i>	Fruit	carminative	Oral	-	Gastro intestinal diseases
<i>Myrtis communis</i>	Leaves & fruit	Stomach problems, tonic	Oral	Infusion	Gastro intestinal diseases
<i>Nannorrhops ritchiana</i>	Leaves	Dysentery, diarrhea	Oral	Maceration	Gastrointestinal diseases
<i>Nerium oleander</i>	Leaves	Bleeding gums, dental pain	Oral	Maceration	Dental problems
<i>Olea ferruginea</i>	Leaves and fruit	Toothache, rheumatism, bones dislocation	Oral, dermal	Infusion, decoction	Dental and skeletal diseases
<i>Origanum vulgare</i>	Whole plant	Earache, toothache and diuretic	Oral	Infusion	ENT, dental and urinary diseases
<i>Otostegia limbata</i>	Leaves	Wounds, gum diseases	Oral	Infusion	Dental and cutaneous diseases
<i>Oxalis corniculata</i>	Whole plant	Stomach troubles, rusted vessels	Oral	Infusion	Gastro intestinal and blood circulatory diseases
<i>Periploca aphylla</i>	Whole plant	Constipation, swellings, tumors	Oral, dermal	Decoction, infusion	digestive, cutaneous
<i>Phoenix dactylifera</i>	Fruit	Tonic, aphrodisiac, laxative	Oral	-	Gastrointestinal and sexual diseases
<i>Pinus roxburghii</i>	Stem resin	Ulcer, snake bite	Oral	Infusion	Cutaneous diseases Snake bite
<i>Pistacia chinensis</i>	Stem gum	Ruptured heels	Dermal	Concoction (mustered oil)	Skeletal diseases
<i>Platanus orientalis</i>	Bark	Blisters, toothache, diarrhea	Oral, dermal	Powder, Concoction (powdered bark with wheat flour and soap)	Gastrointestinal , dental and cutaneous diseases
<i>Punica granatum</i>	Leaves, bark, fruit and seeds	External bleeding, anthelmintic, dysentery, expectorant	Oral, dermal	powder	Cutaneous, gastrointestinal and respiratory diseases
<i>Pyrus pashia</i>	Fruit	Sedative and laxative	Oral	-	Gastrointestinal diseases Sedative
<i>Quercus incana</i>	Bark and fruit	Cracked bones, urinary infections	Oral, dermal	Powder, Concoction (desighee)	Skeletal and urinary diseases
<i>Rhazya stricta</i>	Whole plant	Rheumatism, syphilis	Oral	Infusion	Genital and skeleto-muscular diseases,
<i>Ricinus communis</i>	Seeds	Purgative, constipation	Oral , dermal	Infusion, concoction (seeds oil with milk)	Gastrointestinal diseases

Scientific name	Part used	Disease treated	Route of admin.	Mode of preparation	Therapeutic indications
<i>Rubus fruticosus</i>	Leaves and fruit	Asthma, cough and diarrhea	Oral	Infusion	Respiratory and gastrointestinal diseases
<i>Rumex hastatus</i>	Shoot	Carminative, purgative, stomach troubles and diuretic	Oral	Infusion	Gastrointestinal and urinary diseases
<i>Sarcococca saligna</i>	Leaves and shoots	Laxative, blood purifier, muscular pain	Oral	Infusion	gastrointestinal, blood circulatory and skeletal diseases
<i>Sageretia thea</i>	Root	Jaundice	Oral	Infusion	Blood circulatory diseases
<i>Solanum nigrum</i>	Whole plant	Expectorant, diarrhea and diabetes	Oral	Infusion	Respiratory, blood circulatory and gastrointestinal diseases
<i>Solanum surratense</i>	Whole plant	Cough, asthma, expectorant, stomachache, diuretic, gonorrhoea	Oral	Infusion	Respiratory, urinary and gastrointestinal diseases
<i>Tinospora cordifolia</i>	Shoot	Cough, jaundice and sexual tonic	Oral	Infusion	Respiratory, circulatory and sexual diseases
<i>Trichodesma indica</i>	Roots	Body swelling	dermal	Powdered, infusion	Cutaneous diseases
<i>Verbascum thapsus</i>	Leaves, Flowers	Asthma, joints pain, boils	Oral, dermal	Decoction	Respiratory, skeletal and gastrointestinal diseases
<i>Vitis Jacquemotii</i>	Fruit	Laxative	Oral	-	Gastrointestinal diseases
<i>Viola canescens</i>	Whole plant	Purgative, anticancer, febrifuge, diaphoretic	Oral	Decoction	Gastrointestinal and other diseases
<i>Woodfordia fruticosa</i>	Flowers and bark	Cold, nose bleeding and sun stroke	Oral	Infusion, decoction	ENT and respiratory diseases
<i>Xanthium strumarium</i>	Leaves	Malaria	Oral	Decoction	Infective diseases
<i>Ziziphus numularia</i>	Leaves	Scabies and boils	Oral	Infusion	Cutaneous and gastrointestinal diseases

Veterinary medicines

Four plants are used as veterinary medicines, which is 4% of the total plants of the area. These plant species include *Grevia optiva*, *Mallotus phillipensis*, *Melia azedarach* and *Nannorrhops ritchiana*. It is worthy to note that all these species are administered in gastrointestinal disorders of the cattle.

In the beginning plant use was restricted to food, medicine and shelter but with the passage of time dependency on plants increased instantly and man explored the multi-purpose use of plants (Haq et al., 2010) such as food, medicines, fodder and forage for cattle, fuel wood, furniture, timber and domestic items. Even in the present age of science and technology, people still rely on traditional system of healthcare throughout the world due to very less side effects, as compared to the modern allopathic medicines and easily available at low prices (Khan, 2003). That is why plants are exploited and consumed extensively, resulting major threats to the plant wealth but giving no attention to their conservation. Therefore, there is a need to preserve medicinal plants on the basis of ethnobotanical knowledge gained through local community (Said, 1994).

The study area is blessed with a wealth of plants which are being used for ethnobotanical purposes. The inhabitants of the area are poor and lack basic facilities such as gas, coal, health care units and electricity. They depend on nearby forest to fulfill their needs such as medicine, timber, fuel wood, food, fodder and shelter. All most all the species reported from the research site are found in the nearby forest. However, it is noted during the field surveys that the local people have to collect these plants that had earlier been easily available close to their villages. They have no or very insufficient knowledge about proper time and method of collection, preservation and storage of medicinal plants. The plants are collected without any care. They uproot the herbs, cut the shrubs and large trees without any scientific approach, making their recovery very hard or even impossible. Preservation (drying) is done by the traditional healers in very crude form. The elder women usually dry the plants/ plant parts on house floor for few days. These plants are very exposed to the environment and contaminate easily.

The insects, fungi and bacteria may infect the plants due to lack of proper place for storage and preservation which leads to the extinction of the plant wealth. Additionally, intense deforestation, overgrazing, fuel wood, agricultural expansion and soil erosion are the major threats to the loss of medicinal resources. The plants such as *Acacia modesta*, *Acacia nilotica*, *Asparagus plumosis*, *Bauhinia variegata*, *Berberis lycium*, *Calotropis procera*, *Olea ferruginea*, *Phoenix dactylifera*, *Rhazya stricta*, *Viola canescens* and *Ziziphus*

numularia are extensively exploited by the local people for their various ethnobotanical uses. It has been observed during field study that the population of these plants is decreasing at alarming rate. Certain other plants such as *Dodounea viscosa*, *Nannorrhops ritchiana* and *Pinus roxburghii* are at the verge of extinction because these plants are extensively exploited for commercial purposes. These plants would likely to be depleted in wild, if no conservation strategy adapted for the area. Immediate measures for conservation are needed to protect the flora of the study area from becoming extinct. It is highly recommended that the local community should be educated and trained regarding the pre and post harvest methods, as well proper use and cultivation of available plant resources. In-situ and ex-situ conservation method can be practiced to avoid further depletion of rare plants. Local people can be involved to cultivate sustainable species, control regular grazing and to apply conservation strategies.

CONCLUSION

The people of the locality prepare plant remedies mainly through infusion, decoction and concoction and administer them through oral route or to skin. The ethno-botanical plant remedies are used to treat gastro-intestinal disorders, respiratory diseases, skeletal-muscular problems, cutaneous complaints, blood circulatory diseases etc. Deforestation, over grazing, agricultural expansion and unscientific collection, processing and preservation of natural vegetation are the major threats to the medicinal flora of the locality. It is extremely important to take strong measures for the conservation of plant resources of the Hazar Nao forest, Malakand, Pakistan.

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