EXPLORATION OF ETHNOBOTANICAL RESOURCES AND THEIR APPLICATION TO CONSERVATION IN BIHA VALLEY SWAT -PAKISTAN

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DEDICATION

I dedicate this work

To

My beloved Mother

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Abstract

An Ethnobotanical survey was conducted in Biha valley-Swat to cover a brief analysis of the ethnobotanical resources during an expedition between March to June 2011. The main objective of study was to document indigenous knowledge about ethnobotanical plant resources of the area and to assess the conservation status of these resources. A total of 102 plants of ethnobotanical importance have been explored from 50 informants. Mainly children and women have been found as gatherers of indigenous wild plants from the valley. About 32 indigenous plants including a mushroom were found to be collected from the valley for trade as non-timber forest product. The surveys were carried out by predesigned questionnaires through random transect walks. The conservation status of non-timber forest products indigenous plants found in local trade have been evaluated through IUCN criterion. According to this assessment, ten plant species including two trees *Pistacia integrrima* and *Juglans regia*, a shrub *Berberis lycium* and six herbaceous species; *Acorus calamus, Paeonia emodi, Podophyllum hexandrum, Rheum austral* and *Valeriana jatamansi* including one Mushroom species *Morchella esculanta* have been found as endangered. Furthermore 19 plant species have been found as vulnerable. A small scaled phytosociological survey for vegetation assessment has also been carried out sampling with the help of GPS.It has been concluded that in upper Biha valley where cultivated land is very limited, home gardens and kitchen gardens establishment may be the best option for *ex-situ* conservation that can be adopted for sustainability of Ethnobotanical resources. While *in situ* conservation measures need community participation. Medicinal plants as crop substitute in lower valley may succeed well. Moreover, the area has a great potential of Eco-tourism. This valley has a habitat favorable for endangered medicinal and economic plants in trade. Sustainable development of this precious natural resource is highly recommended.

1. Introduction

1.1. Mountainous Regions of Pakistan

Pakistan has one of the most prominent and significant mou4ntain ranges of the world. Pamir knot is the most conspicüous spot on the physiographic map of Asia. It comprises of 3,660 m high plateau on which several formidable linear mountain ranges occur over 5000 m covering from all significant directions i.e. Tien Shan, the Kunlun, the Karakorum, the Hindukush and Alai Ranges. The Southern ranges, the Hindukush and Karakorum form the Northern part of Pakistan. Further southward, the Himalayan chain forms an extensive mountain system. In Pakistan the Karakorum and Hindukush mountain ranges contain some of the highest peaks of the world i.e. K2 (8611 m), Nanga Parbat (8126 m), Rakaposhi (7788 m) and Tirich Mir (7690 m). Hindukush mountains ranges extend from the Northeast to Southwest up to Koh-Safed. About two-thirds of Pakistan's surface area is mountainous i.e. 476,000 square kilometers out of the total area of 796,096 square kilometers of the country (Shah & Awan, 2002).

1.2. Phytogeography of Mountains in Pakistan

Over all, there are 4 phytogeographic regions reported in Pakistan that explains the richness and luxury of its flora. About 70% species are from one region and 30% of the species are from two or multi regions. Among the uniregionals, most of the common element is Irano-Turanian element which is (46%), followed by the Sino-Japanese (10%), Saharo-Sindian (9.5%) and Indian (4.5%) elements (Ali and Qaiser, 1986). Generally two phytogeographic regions are found in the mountains of Pakistan (Table 1).

Table 1.1: Phytogeography of the mountainous regions of Pakistan

Name of Regions	Pakistan major areas
1. Irano-Turanian	
i) Western	Waziristan and North Balochistan
ii) Eastern	Upper portions of Gilgit (Hunza, Shimshal etc.) and Chitral or central Asiatic (partly) Wakhan and adjoining Area to the south- east
2. Sino-Japanese	Kashmir, NWFP (Koh Safed, parts of Hazara, Swat) Dir, Chitral (partly), Astor, Naltar, Bagrot Valleys

(Source: Ali & Qaiser, 1986)

Although it is difficult to define discrete habitat types and ecological zones with current state of knowledge about the ecosystems of Pakistan, some habitats with special significance of reference to biodiversity, have been identified as: 1) Indus plains region 2) Riverain 3) Swamps, seasonal Innovations, seepage and Jheels 4) Tropical thorn forests 5) Sand dune desert 6) Dry subtropical semi-evergreen scrub forest 7) Dry temperate semi-evergreen scrub forest 8) Sub-tropical pine forest 9) Tropical dry mixed Deciduous forest 10) Steppe forest in Balochistan hills in Southern latitudes and lower slopes of some Northern ranges 11) Steppe forest in higher ranges 12) Himalayan moist temperate forest 13) Himalayan dry coniferous forest 14) Cold desert and dry alpine zone and 15) Himalayan moist alpine zone (Afzal, *et al.*, 2001).

1.3. The Study Area: Biha Valley - Swat

Swat is the administrative district of the Khyber Pakhtunkhwa of Pakistan. It is covers an area of 8,220 square kilometers, with a population of 1.25 million (Census Report, 1998) and is geographically located between 34P-34' to 34P-42' North latitude, and 72P-15' to 72P-30' East longitude. The District lies in Hindu Kush mountain ranges which climatically resembles the bordering Himalayas mountain ranges. The Sino-Japanese vegetation region extends through Nepal and Kashmir and occupies the valley, except Kohistan area (Eastern Irano-Toranian vegetation region), lying in the North. The physical geographers termed these mountains Hinduraj, while the climatic geographers termed these mountains the Trans-Himalayas (Ahmad & Sirajuddin, 1996).

Floristically self-sufficient in its natural recourses, district Swat is compendium of many gorgeous valleys, with varying altitudinal variations above sea level, ranging from 600m in the South to 6000m, in the North (Mankial peak). District Swat starts from Landakai and is bounded on the Western side by district Dir that joins to it in the lower Swat at Tal-Dardyal and Kamraney pass (Dir), while through Shawar valley in the upper Swat. Eastern side is bounded by Indus Kohistan, Shangla and Buner, they join to it through Shangla pass (District Shangla), Kalail Pass, Jowarai/ Shairatrap pass (District

Buner). Chitral and Gilgit districts bound North side. Chitral gets connected to it through Utror valley that joins Madaklasht valley of district Chitral, through Mahodand to Larspur of district Chitral and Tal Lamothai of district Dir, while through Ushu valley Swat joins through Dadarilli Pass to Terru valley, situated in Gupis/Yasin of district Gilgit, near famous Shindur pass. From Ushu valley a hard pass leads to Kandia in the Indus Kohistan and through and Mankial, Bishigram and Shangla to Indus Kohistan.

The area under research study "Biha" is one of the beautiful valleys of Matta tehsil Swat. The valley is situated in Eastern part of tehsil Matta, which is traced between 35°, 03-95° North and 72°, 17-70° East, is one of the remotest valleys of district Swat.

Relatively, Biha valley is located at a distance 40-42 km from the Saidu Sharif: Head quarter of the district Swat. Half of the valley is bounded by Swat district while half of the valley is bounded by lower Dir district. Gwalerai is the gate way to the valley, accompanied by main villages like Biha, Kharkarai, Doghalghai, Fazal Banda, Barabroo, Pakhanai, Chatekal, Jumnarai, Shordat, Kanati and Swatai. The valley has various altitudinal variations, ranging from 1480m (Gwalerai) to 4170m (Shagosar) above the sea level.

The valley is connected with district Dir in the North West, with Shawar valley in the North and with Rodingar valley of Swat in the East. The valley is surrounded by lofty mountains from all side, except South. Due to altitudinal variation, the area has clear ecological zones, ranging from sub tropical to Alpine. (Beg & Khan 1974)

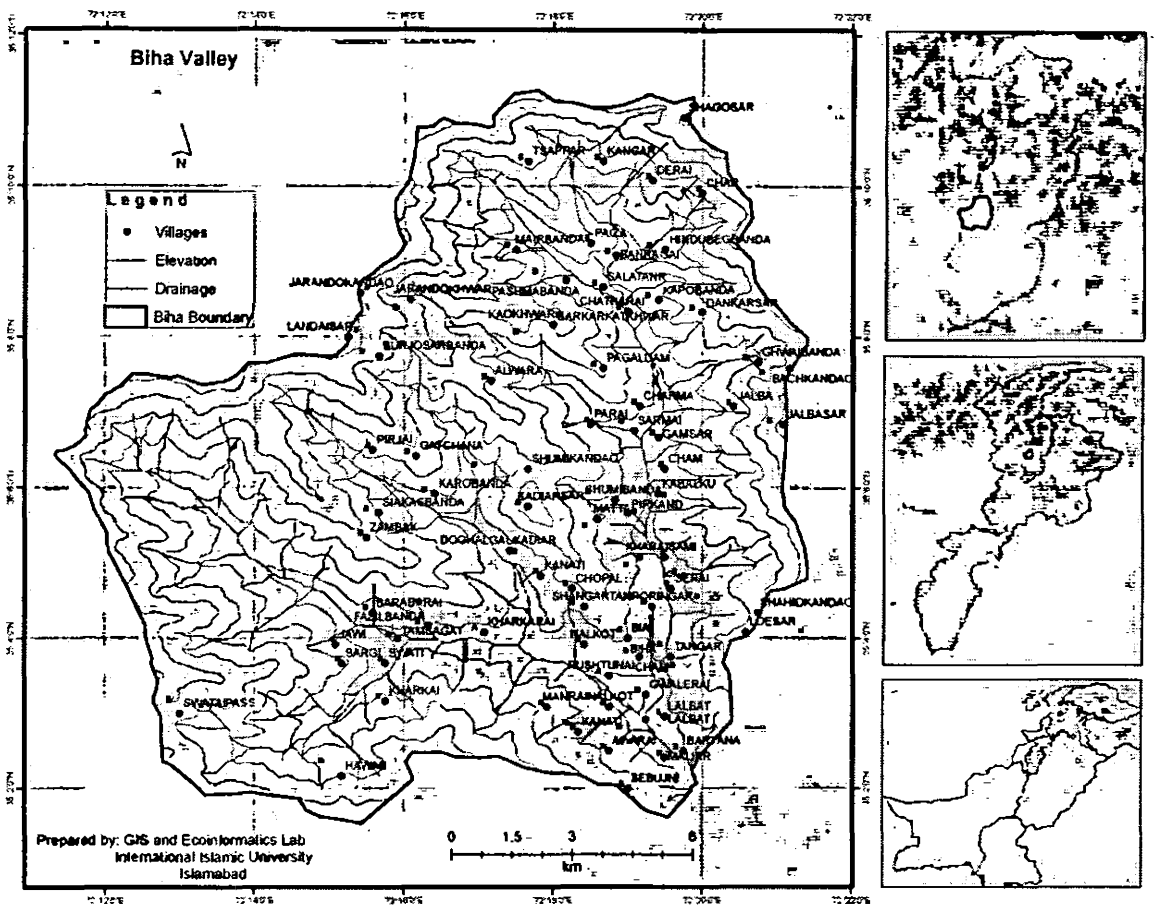

Figure 1: Location Map of Biha valley

1.3.1. Vegetation and Ecology

Various species of plants, characteristic of different altitude are found in Biha valley. There are large numbers of medicinal plants present in the area out of which some have reclined world wide recognition and are regarded as official drugs while others are used in indigenous medicinal system.

The vegetation profile of Biha valley is divided into broad leaves forests, coniferous forests and Alpine flora.

i. Broad leaves forests

This type of forests extends up to 2200 m elevation. Foremost plants of these forests are; *Olea ferruginea* Royle, *Diospyrus lotus* Linn, *Juglans regia* Linn, *Morus alba* Linn, *Melia azedarach* Linn, *Berberis lyceum* Royle, *Rubus fruticosus* Agg., *Plectranthus rogosus* Wall.Ex Bth., *Indigofera heterantha* Wall.ex.Brand., *Viola serpens* Wall., and *Plantago lanceolatum* Linn, Most of theses species are used in traditional system of medicines and some also have commercial values.

ii. Coniferous forests

Coniferous forests cover high mountainous regions and occur between 1900-3200 m elevations. Main representative conifers of the area are: *Pinus wallichiana* A.B.Jackson, *Picea smithiana* Wall Bioss, *Abies pindrow* Royle and *Taxus wallichiana* (Zucc) Pilger. These forests also include some medicinal plants like *Aesculus indica* (Wall.ex Comb) Hook, *Prunus cornuta* (Royle) Carr, *Vibernum graniforum* Wall.ex.DC. and *Skimmia leureola* (DC.) Sieb & Zucc.ex Walp.

iii. Alpine flora

Such type of vegetation is located above 3200 m altitude. Some important species are: *Thymus linearis* Benth, *Berginia cilliata* (Haw) Sternb, *Primula denticulata* Smith, and *Arisaema jacquemontii* Blume which have high medicinal values.

1.3.2. Biotic pressure

The Biha valley is continually facing biotic pressure in appearance of population explosion of humans, deforestation, and overgrazing and terrace cultivation. Man and his agent have ruined the natural vegetation at all elevation through intensive deforestation and cleaning of land for agriculture practices.

1.3.3. Abiotic pressure

The study area faces abiotic pressure including wind throw, land sliding, heavy rainfall, soil erosion and extreme temperature which greatly affect soil fertility and vegetation.

Table 1.2: Meteriological information of Swat (2010)

Months	Temperature in °C	
	Maximum	Minimum
January	1.9	18.9
February	8.1	14.6
March	10.4	25.4
April	14.4	29.4
May	17.5	31.9
June	19.1	35.3
July	21.5	34.0
August	22.3	30.2
September	18.7	28.3
October	13.1	24.4
November	6.4	22.4
December	3.7	17.7

Source: *Meterorological station Saidu Sharif, Swat.*

1.3.4. Agricultural and Horticultural Practices

Geographical, ecological and climatic conditions of the valley are suitable for the following crops; *Zea mays* Linn (**Juwar, Maize**), *Triticum aestivum* Linn (**Ghanum, Wheat**), *Brassica compestris* (Linn) Clapham (**Sharsham, Mustard**), *Oryza sativa* Linn. (**Wereeza, Rice**) and *Phasiolus lonatus* Linn (**Shopar, Beans**).

Commonly cultivated fruits of the valley are *Mallus pumila* Mill (**Manra, Apple**), *Prunus persica* (L) Batch (**Shaltalu, Peach**), *Pyrus communis* Linn (**Nashpati, Pear**), *Prunus domestica* Linn (**Aloocha, Plum**), *Citrus aurantium* Linn (**Nimboo, Bitter orange**), *Diospyrus kaki* Linn (**Amlok, Persimmon**) and *Prunus armeniaca* Linn (**Khoobani, Apricot**).

People cultivated their own vegetables in farming lands. Widely known vegetables of the area are; *Lycopersicum esculantum* Mill (**Tamater, Tomato**), *Solanum tuberosum* Linn (**Aloo, Potato**), *Allium sativum* Linn (**Ooga, Garlic**), *Allium cepa* Linn (**Piaz, Onion**), *Solanum melongena* Linn (**Batingan, Brinjal**), *Abelmoschus esculentus* (L) Moench (**Binday, Lady Finger**), *Nasturium officinale* R.Br (**Talmira, Water cress**), *Raphanus sativus* Linn (**Molay, Radish**) and *Brassica naphus* Linn (**Taipar, Turnip**).

1.3.5. Geology

Geologically the rocks of Biha valley are classified as Pegmatite, Quartz, Ultramorphic and portion of Amphibolite. Soil of the investigated area is both transported and residual type. The foothills have generally deep soil profile consisting of sand and stones. The top hill soils have shallow and eroded soil profile. It is generally sandy or loamy sandy.

1.3.6. Ethnicity and Languages

Total population of the area is 23,405 (USAID, District Health Profile, 2009) in which 12,171 are male and 11,234 female. Inhabitants of Biha includes Sena Khail, Gorsiyan, Miangan, Mulyan and Swatyan

which are the major tribes of area while Sabzadgan, Nayan, Dandan Khail, Katan khail, Sair and Shalmani tribes are found rarely.

Local language of Biha valley is Pashto. However Gujro and Kohistani are also understood in the area. Gujro is an interesting language because it has no alphabets and hence no body can write it, but is actually Punjabi with somewhat different dialect.

1.3.7. Socioeconomy

Agriculture is the main occupation of Biha valley. About 80% of local people depend upon agriculture. However, agricultural products are too less to meet living expenditure. Therefore people have to resort alternative methods for earning their livelihood. A part from agriculture, people are also dependent on livestock, forest/ rangeland products, business and services. In winter most of capable men go to other cities or outside Pakistan for earning their livelihood. Main occupation of women is house hold duties and making handicrafts items like caps, bed sheets etc. In the remote areas of Biha, women fully support their men by taking care of cattle, cutting fuel wood and also help in fields. Literacy rate is very high.

Pakhani & Shurdat along with Biha Khwar.

Pandarkot

Chatekal

Dirt road between Biha and Barabroo.

Swatai

Biha valley from Charai top.

Plate: 1 Ethnobotanical hotspots of Biha valley

1.4. Objectives and Justification

The current study aimed at documentation of enthnobotanical knowledge within Indigenous communities of Biha valley and to study the co-relationship among Indigenous botanical resources, local communities and local market. Assessment of status of ethnobotanical resources and their application to conservation in Biha valley Swat. Also to identify the factors that affect status of indigenous knowledge of ethno-medicinal plants and to identify important locations with respect to ethnobotanical resources through GPS.

The area around Biha valley has already been surveyed and ethnobotanical knowledge has been documented. However the knowledge and quantification about wild plants of this valley is still lacking. Hence, exploration of natural wealth of this valley is of great importance. Similarly information already exists about the area of Biha are sporadic and need to be compile in organized form.

1.5. Ethnobotanical Explorations and its Applications

Like human civilization, indigenous knowledge is also an old concept but the term "Ethnobotany" was for the first time introduced by an American botanist John W. Harshberger in 1896 as the plants study used by prehistoric and indigenous people. Later, Volney H. Johnes (1941) and Rechard Ford (1978) redefined ethnobotany using new ecological terms, from which Ethnobotany was described as "The study in which human directly interact with plant population through its culture. Plants were classified by human population, they learned uses of these plants and also develop beliefs and altitudes, while plant communities are directly affected by human behavior, plants themselves also enforce limitation on humans, these all interactions are the focus of ethnobobany" (Pei, 1995). It is also defined as the organized study of indigenous knowledge of community groups and uses of plants which is locally available for foods, clothing, medicines, or spiritual ways of life. (Encyclopaedia Britannica, 1993).

In other words Ethnobotany is the study of co relationship between plants and local people or in simple words study of aboriginal uses of plants. It is a relationship between botany and cultural anthropology,

studying the role of plants as medicine, nourishment and natural resources. It works as an interdisciplinary perspective based on both social and biological sciences. (Aumeerudy, 1996)

Ethnobotanists consider themselves as an ethnobiologists as these disciplines provide more opportunities to investigate the connections between human being, environment and external factors such as the life behavior and local economies are affected by trade systems. (Lama et al., 2002).

If we compare an early ethnobotanical work with today's work, it is purely explanatory; concerning mainly with making plant lists which are used for different purposes, along with local names and this has been of slight straight use for rural development or conservation. In the field of applied ethnobotany, fundamental subjects are the realistic problems which are related to proper uses of plant resources and that includes the pressure enforced by trading medicinal plants. Communities have also the right to utilize these plant resources in protected areas.

Two basic powers of functional ethnobotany are:

- To gain knowledge about ethnobotany, understanding and educate the people in order to identify, find solutions to conservation issues and sustainable development by playing full roles.
- Indigenous people are basically involved in all steps of research and practical records, thus there will be a better possibility of "buy in" and much strong solutions (Hamilton, 2002).

1.6. Future of Ethnobotical Explorations

The field of ethnobotany is rising day by day. If we look upon the future of ethnobotany, two major challenges are marked. First, those plants will be documented which are mostly used in the society and they are important in all aspects, so that more work should be done on such plants which are very useful in folk beliefs point of view. The ethnobotanist will document not only lists of plant uses but will also record vision of life. Second and most difficult task to understand is how these actions, in return affect the ambient plant life and upon the ecosystem on which whole society is dependent.

One of the important trends in current ethnobotany is association between different fields like botanists, ethnographers and local collectors and western scientists (Baker, 1987). Most commonly faced problem during ethnobotanical inventories is the lack of fluency in local language thus an active collaboration of ethnographers already fluent in native language is necessary.

The future of ethnobotany is mainly focused on the conservation of natural resources which is accepted widely in international circles of conservation. Inventive funding mechanism will required to support conservation status. This requires;

- Community based efforts for motivation of conservation.
- Efforts at national level to ensure that government policies well-matched with such motivations.
- At international level to ensure that wealthy nations of word benefiting from biological resources are able to invest in conserving the productive capacity of these resources (Cunningham, 1990).

Recently ethnobotanical issues are focusing by public and they are giving full attention towards it. Due to increase in interest of public, companies are looking to plan new approaches of food, medicines, and energy resources. University departments are producing well trained ethnobotanists. The future looks very bright for these dedicated scientists as fascinating vital field of research.

1.7. Status of Ethnobotical Explorations in Pakistan

Pakistan has a great variety of plant resources and different ecological zones. Local residents in rural areas used these plants for the past few decades as they are known to possess their medicinal and economic values. Vegetation of Pakistan is quite diverse as it has sandy seashores; blue water, mangroves forests, sandy deserts, barren plateaus, Indus Basin, high mountain ranges and charming valleys, each have their own vegetation. In Pakistan and Kashmir more than six thousands species of flowing plants are reported, a very large number of which is to be found in Kashmir, Northern and North Western Parts of Pakistan. Out of them, about 400-600 are only considered to be used as medicinally.

Although many floristic surveys have been conducted about our local flora but it is very surprising that a very little attention have been given to ethnobotanical studies. Hakeems are mainly concerned with medicinal plants knowledge like supply of floral and vegetative parts, their characteristics, occurrence and distribution in various ecological zones of Pakistan (Shinwari 1996).Few papers have been published on ethnobotany though this field is highly neglected in our country. Hocking (1958-62), the first person who worked in this area, wrote many papers on Pakistan medicinal plants. He reported that about 84% population of Pakistan used traditional medicinal plants for various ailments and was dependent on it. Shinwari and Malik (1989) conducted a field study of medicinal plant consumption of Northeastern Baluchistan. Goodman and Ghafoor (1992) reported an ethnobotanical study of Baluchistan, Province of Southewestern Pakistan. Information was gathered for about 114 different plant species by nomads and village dwellers, and the local hakeems prescribed about 56 species to the local people for different diseases. Haq (1993) conducted an ethnobotanical study in district Mansehra and reported 52 wild and 17 cultivated medicinal plants found locally in the study area.

From current and modern studies it was concluded that the field of ethnobotany is well-established and growing discipline in neighboring countries like China, India and Bangladesh but in our country it is highly neglected. Now this field is improving day by day as strong efforts have been made towards it. Shinwari and Khan, (2000) reported that for a long time the inhabitants of Margalla Hills National Park used medicinal plants for various ailments. They also used these plants for food, shelter, fodder, health care and other cultural activities. A total of 50 species belonging to 27 families have been reported which were used medicinally by the local people of the park.

2. Review of Literature

From the very beginning plants provide a lot of services for us like food, medicines, shelters and fodder for animals, materials for mats and baskets and many other useful items which we used in our daily life. Men make full benefits from plants for their basic needs but usually do not recognize their uses and extensive exploitation resulting in habitat losses and decreased in biodiversity. Thus it was realized by the scientists to record local knowledge, their potential uses and application of indigenous knowledge for the development of human being all over the world. Hence first international congress of Ethnobotany was held in 1998, at Belam, Paro, Brazil. Scientists and local people from 25 countries of the world meet to discuss traditional knowledge importance and its applications for the development and welfare of people.

Since for a long time the inhabitants of Margalla Hills National Park used medicinal plants for various ailments. They also used these plants for food, shelter, fodder, health care and other cultural activities. A total of 50 species belonging to 27 families have been reported which were used medicinally by the local people of the park. Among them two species; *Asparagus adescendens* Roxb. and *Viola canesence* Wall. ex Roxb. were vulnerable to harvesting. (Shinwari & Khan, 2000)

Majority of medicinal plants of Muzaffarabad district are used for treatments of different ailments but there are some other wild plants also which are used as fuel wood, timber, fruit, fodder and vegetables by the local residents. About 53 plant species belonging to 33 families were recorded in which some plants were used against different diseases like cough, bronchitis, stomachache and dysentery. While some plants were laxative, blood purifier and poisonous. (Saghir *et al,* 2001)

In Bulashbar valley, Astore, District Diamer, plant resources were rapidly declined and this was due to over collection, unsustainable harvesting of medicinal plants and their marketing. A total of 33 economic, medicinal and aromatic plants were enlisted along with their occurrence, general distribution and

abundance in the area. Similarly traditional uses and pharmaceutical values of each plant species were also recorded. Two species, *Bunium persicum* and *Ephedra gerardiana,* were suggested for *in vitro* cultivation to obtain immediate profit. While Hippophae rhamnoides could be used for socio-economic encouragement of the local people. (Shinwari & Gilani, 2003)

Women of District Chakwal have rich indigenous knowledge about the uses of medicinal plants that are local vegetation of the area. They believed that these natural resources are easily available, economical and permanent cure for common daily diseases. Indigenous knowledge about local medicinal plants was collected from 50 women of different age groups between 20 and 80 years. Plants were collected and information was gathered from native women like there local names, medicinal uses and part used. (Sultana *et al,* 2006)

People used many plants for treatment of different diseases. Traditional folk medicines have been made from plants by the local people of Sudhan Gali and Ganga Chotti Hills and received prospective benefits. 33 medicinal plants belonging to 17 families were collected and its phonological studies were also recorded. Due to phonological studies, medicinal plants were easily identified in their respective months and that had a positive step towards conservation of natural wealth of the area. (Qureshi *et al,* 2007)

Ethnobotanical surveys have been conducted in Nara Desert, Singh, Pakistan. Thari people of the area used local plants for various diseases. 51 plant species belonging to 28 families were reported. 21 species of these plants have new uses which were first not recorded in folk herbal medicinal literature. These 51 medicinal plants were used for treatment of 44 different types of ailments in which whole plant was used higher (53%) than leaves (18%), roots (14%) and fruits (10%) alone. (Qureshi & Bhatti, 2008)

Traditional medicines (TMs) are still used by Pakistani migrants from Mirpur living presently in Bradford, Northern England. Pakistani migrants in Bradford preferred TMs treatments to conventional

Western medicine. Fifty-six different plant-based remedies are still used among migrants, and more than half of recorded remedies correspond to food-medicines. However, TMs knowledge is decreasing amongst younger generations, and it seems to be dependent on length of time since migration from Pakistan took place. (Pieroni *et al,* 2008)

Most of wild medicinal plant species of Samahni valley were reported to be used for the treatment of sexual diseases in women and also control family size. Decoctions and infusions were prepared from these plants and were taken accordingly to medications. About 68% of people used herbal treatment as first line of treatment and people are still dependent on these plants. Samahni valley was rich in wild medicinal flora but it is gradually decreasing due to exploitation and unsustainable uses of these natural resources (Chaudri & Khan, 2008).

An Ethnobotanical survey was conducted in Ratwal village, District Attock, Pakistan. The area was rich in natural flora but only 43 plant species belonging to 33 families were recorded. Local people were interviewed and through questionnaire it was concluded that they used these natural resources for different purposes like food, shelter, fodder, timber, fuel, health care (Noor & Kalsoom, 2011).

2.1. Ethnobotanical Surveys in Khyber Pakhtoonkhwa

Gokand valley, District Buner is on of the greenish mountainous valley which is rich in natural flora and fauna. Ethnobotanical informations were collected for about 138 species in which 40 plants were cultivated. Local residents used these plants for various purposes like fodder and forage, fuel wood, vegetables, pot herb, timber wood and fruit species. The area was also rich in medicinal plants and wild life. More than 90% of population used fuel wood for their daily uses which were brought from forest and this was a single serious threat for vegetation. (Khan *et al,* 2003).

There is a variety of plants present in Manikhel forests, Orakzai Tirah, Pakistan which are extended up to Hindu Kush Mountain ranges. This work was mainly focused on those plant species which were commonly used either for local purposes or for other daily uses of life. A total of 172 plants belonging

to 80 families were collected which were used by local people for different purposes because the entire population of area were poor. Poor people were totally dependent on these forest resources for their daily requirements. (Ahmad *et al,* 2005)

Most of the plant species are collected from high summer pastures and these focused areas are in great threat due to intense grazing. This survey was conducted in Palas valley in which 139 ethnobotanically important plant species were collected belonging to 72 families. Most of the plants collected were used as a medicine by local people. Among them 10 plants were tradable species which were the source of income for poor people. Apart from that some species had other applications like fodder, fuel wood, food, veterinary medicine, agriculture tools etc. local people of the area should be addressed about the importance of indigenous medicinal plants, their conservation and protection, sustainable collection and reducing the number of livestock to decrease pressure on pastures. (Saqib & Sultan, 2005)

Since from time immemorial, human used medicinal plants for curing different ailments. Even now rural population totally depends on medicinal plants for primary healthcare. An ethnomedicinal study was conducted in Buner district and information was gathered about indigenous knowledge of medicinal plants. Aged people of the area especially women had more indigenous knowledge about medicinal plants as compared to younger generation. About 67% of population was dependent on these medicinal plants for treating different diseases. Most frequently used plants in an area were *Ajuga bracteosa, Acorus calamus, Trachyspermum ammi, Paeonia emodi, Thymus serphylum, Skimmia laureola, Valeriana jatamansi* and *Viola serpens.* (Humayun *et al,* 2006)

Valuable ethnobotanical knowledge is rapidly disappearing due to lack of interest in younger generation and thus this knowledge is restricted to elders only. People of Ayubia National Park used medicinal herbs for various diseases and they used these plants for various purposes like food, shelter, health, medicines, fodder and various other cultural purposes. 21 important plant species belonging to 19 Families were documented which were used medicinally by the residents. *Podophyllum emodi* Wall. ex

Royle and *Viola canescens* Wall. ex Roxb. were reported to be susceptible to harvesting. (Gilani *et al,* 2006)

Ethnobotanical information was gathered from (Khirthar National Park) and it was observed that about 75% of male and 25% of female have knowledge about medicinal plants folk uses. Aged people had more knowledge about plant uses. Local people used about 50 different species for various diseases. They used these plants in crude form as they had multiple uses. Over grazing, up rooting of medicinal plants and deforestation was the main cause of exploitation of natural resources which results poor vegetation cover. (Panhwar & Abro, 2007)

People of Ranyal hills are very poor and lack daily bases facilities like hospital, electricity, gas and coal etc. Thus forests are the main source of fuel wood for them. Ethnobotanical information was gathered from Ranyal Hills District Shangla, Pakistan and 97 plant species were collected. These plants were categorized on the bases of their traditional medicinal and economic uses. Vegetation of the area was under great pressure due to overgrazing of cattle and heavy deforestation which greatly affect natural vegetation. Similarly uprooting of medicinal plants by the local inhabitants for selling and fuel wood purposes was also one of the factors. (Ibrar *et al,* 2007)

A number of allopathic medicines have been developed by different pharmaceutical industries but indigenous phytotherapy is still practicing in many rural areas. About 66 plant species belonging to 45 families have been identified which were used against diseases and in folk cosmetics among tribal communities of North-West Frontier Province. Highly utilized parts of the plants were leaves followed by other aerial parts like fruits, bark, flowers, rhizome, roots, tubers, rind, seed, and bulb. Local residents still used these plants for various skin diseases because of low cost as compared to allopathic medicines. Most of plant species were wild and rare, thus a great attention is needed for their conservation. (Abbasi *et al,* 2010)

Brah, Totay, Pir khel, Mekhband, Kot and Haryankot are one of the beautiful villages of tribal regions of Dargai, Malakand District which have diverse natural flora. Majority of local residents of Hazar Nao forest depend on medicinal plants available in the area for treatment of various diseases. The area was un-explored and indigenous knowledge was still undocumented, therefore about 75 plant species was enlisted and folk uses for various ailments was recorded. Subsequently the area had facing an intense threat of losing important plant species due to deforestation, overgrazing, agricultural expansion, and soil erosion. (Murad *et al,* 2011)

Forests which are our natural wealth are the main source of medicinal plants but due to increase in population deforestation and encroachment of land for cultivation purposes had occurred which greatly affect vegetation and they are declining towards extinction. This study was conducted on population of three medicinal plants viz.: *Persicaria amplexicaule*.D. Don, *Valeriana jatamansi* Jones and *Viola serpens* Wall ex Roxb in coniferous forest of Northern Parts of Pakistan. Gathering of targeted plants by the local people was varied with change in elevation. These three species were collected in great quantity in the past that they are now found rarely in the area. (Sher *et al,* 2011)

22 villages of Chagharzai valley, District Buner was reported in order to find out Indigenous knowledge of medicinal plants. 141 plant species belonging to 26 families was documented which were used as a medicine for various ailments by the local people. Aged people especially the old women had more knowledge about medicinal plants uses as compared to younger generation and thus indigenous knowledge of medicinal plants is depleting day by day. Few species were reported to be used for specific diseases while other was used as in combination. (Alam *et al,* 2011)

2.2. Ethnobotanical Surveys in Swat

About 90% of medicinal plants of Utror-Gabral valley, Swat are brought to local markets at Kalam, madyan, mingora, Pehawar Rawalpindi and Lahore by the local residents for earning their daily live hood. Women, men and children have a great role in collection of these medicinal plants that are poor

and needy. In spite of trading, local people also used these plants for various ailments in their houses. According to aged villagers, these plants were abundant in surrounding of human settlements in the last 20 years but it is now hugely decreased due to over collection for marketing purposes. (Humayun *et al,* 2005)

About 5000 tons of medicinal plants are collected annually from district Swat and more than 500 families are involved in collection processes. Collectors are usually men; women and children. It was reported that from remote Hindu Kush mountain region of District Swat, about 49 medicinal plants species belonging to 32 different families were collected and sold in local markets as well as to national herb markets of Lahore, Karachi and Peshawar and thus play an important role in the economy of area. Out of these 49 total medicinal plants, 24 plant species were Threatened, 9 Endangered, 7 Vulnerable and 8 Rare due to over collection. From market survey it was concluded that status of medicinal plants availability in the market have increased which showed that people are more involved in this business. (Humayun *et al,* 2006)

Morel (*Morchella*) which are grown naturally in temperate forests of Hindu-Kush mountain region of Swat, are collected by local residents in a season. About seven different species are found which is collected the poor people including 33% women, 27% men and 40% children.90% of Morels are collected from Hindukush and Himalayun mountain regions in Pakistan. Forest is the main source where Morel is collected and then brought to market. They are supplied to different parts of the world including Europe and Middle East. In Swat, morels are collected from mid March to June. Prices of Morels depend upon quality, processes of collection and species. Price of dried one kilogram morel fetches Rs.3000 to collector, Rs.10000 to wholesaler, Rs.13000 in National market and Rs. 20000 to 25000 in International markets. Thus very little benefits have got by collectors as compare to international markets. (Humayun *et al,* 2006)

Pakistan has diverse flora and climate. Due to introduction of allopathic medicines, role of medicinal plants has decreased but still it is used as a primary source of health care in rural areas of our country. People of Swat Kohistan used local medicinal plants like other indigenous people of country for curing different ailments. 16 threatened medicinal plants from Kalam, Utror and Ushu were collected and selected for *ex-situ* conservation. For this purposes nursery was builted in Lower swat but only 8 species named *Bergenia ciliata, Dioscorea deltoidea, Bistorta amplexicaulis, Valeriana jatamansi, Valeriana pyrolifolia, Viola biflora, Viola canescens* and *Berberis lycium* survived in new habitate and the remaining failed to germinated. (Humayun *et al,* 2006)

A lot of medicinal plants occur in Swat valley. Local people used these plants for various diseases and also sold them in market in order to get some income. These plants are exported nationally and internationally as well. Thus a great number of decreases in natural flora have been recorded over past 15-20 years and this is due to increased in dependency on these plants. (Hamayun, 2007)

District Swat, Buner and chitral are one of the best regions for natural resources, where local people used plants for medicinal and other ethnobotanical purposes. Ethnobotanical study was conducted in these three regions where the natural flora and indigenous knowledge related to them were documented. Some of the plants like *Valeriana jatamansi, Saussurea spp, Paeonia emodi, Podophylum hexandrum* and *Marchella* spp were under great pressure due to over collection of local communities. Similarly certain plants were also in intense pressure due to over grazing in high summer pastures in the area. These plants are facing a great threat of extinction in future if continuously exploited on such rates. (Khan *et al,* 2007)

Swat is considered to be one of the best collecting and trading centre of important and valuable medicinal plants. It supplies a considerable quantity of certain plants to different trading centers of Pakistan. There are many players involved in trading medicinal plants which is quite diverse and complex. As certain medicinal plants are so valuable and possesses high price in market but mostly

collectors are unaware of it. The price of collected material increases up to 3 or 5 folds when it moves from collectors to national market. (Sher & Hussain, 2009)

Flora of "Shawar Valley" which is located in Northern part of Pakistan is rich in medicinal and aromatic plants (MAPs) and possesses different species. People used these plants for various ailments and other daily products also. Valligers have great dependency on medicinal plants as elevation and remoteness is increases. Majority of children and women are involved in collection of MAPs. But these important MAPs are declining day by day as a result number of threatened and rare species increases and they are moving towards extinction. (Sher *et al*, 2010)

Coniferous forest of Malam Jaba, Swat possesses variety of valuable herbaceous plants. Elder people of area have much ethnobotanical knowledge about medicinal and aromatic plants (MAPs) as compared to younger. They used these plants for different diseases and other daily uses. Plants are varied because altitude and climate of the area have great changes. About 90 different MAPs have been identified though local people not used more than 50 plants, but the number of MAPs is decreasing due to deforestation, over grazing, spontaneous urbanization and improper collection (Sher & Al_yemeni, 2011).

Hakims and tenants have much knowledge about MAPs as compared to general population. Similarly men especially elders have more awareness of its uses than women. Few local collectors and particularly shopkeepers are involved in marketing of MAPs in the area. Considerable amount of these MAPs are collected by the people and then supplied to various domestic and national trading centers like local pansars in Mingora, Peshawar, Islamabad, Lahore and Karachi. As demand and supply of MAPs increases, their prices also increased from year to year. Information collected from study area revealed that children were the main collectors (60%) followed by women (30%) local men (15%) and outsiders (5%). (Sher *et al*, 2011)

2.3. Assessment of Conservation Status and Criteria

There have been several attempts to construct systems for setting priorities for conservation on a national or regional level (Sparrowe & Wight, 1975; Nieme, 1982; Millsap *et al.*, 1990; Daniels *et al.*, 1991, Master, 1991; Avery *et al.*, 1995; Gärdenfors, 1997; Catling & Porebski, 1998). A variety of different criteria, used in different combinations and systems have been suggested. However, Red Lists and Red Data Books of IUCN have been used for over 30 years to draw attention to threatened species the world over. The IUCN categories of threat have become internationally accepted and are now used, in a wide range of settings, by varied groups of people involved in the conservation of biodiversity.

According to Red Data Book of IUCN (1970), the status of commercially important indigenous species (in terms of threatened condition) can be determined using the following four parameters: Availability, Collection, Part Used and Growth. Using these parameters the relative importance of specific medicinal plants can be classified into: Endangered, Vulnerable, Rare, Infrequent and Dominant.

In 1994, IUCN adopted new criteria to assess risks of extinction at a global scale, and it became apparent that they could produce misleading results when applied at regional or national level. Revised criteria are more objective, numerical, and scientific as well as having greater applicability across taxon groups and are meant to be used for all organisms except microorganisms. The consideration for the selection of species are: 1) Global/International recognition of the species; 2) Rapid destruction of its limited habitat; 3) Extensive hunting pressure for food and trade; 4) Representation of each major group; 5) Economic importance of species; and 6) Distribution of species. Revised categories (in 2002) are 'Extinct', 'Critically Endangered', 'Extinct in the Wild', 'Endangered', 'Vulnerable', 'Low risk', 'Data Deficient' and 'Not Evaluated'.

Another approach for prioritization of Medicinal Plants for conservation was developed after analyzing the available information on various aspects of medicinal plants of Indian Himalayan region. Prioritization was based on three indices: (i) use value index (UVI) indicates threats imposed by users, (ii) sensitivity index (SI) reflect conservation concerns of biologists, and (iii) importance value index

(IVI) is the cumulative value of (i) and (ii) to prevent biased approach. Twenty top ranking Medicinal Plants are identified for conservation in each life form (Dhar *et al.*, 2000).

2.4. Phytosociological study

One of the studies in Khandezi Baba which is located at a distance of 2.5 km east of Kohat has been made by sampling and analyzing its vegetation. The area remained protected for a long time due to sanctity of shrine but it has been disturbed in the resent past. It has been examined that *Acacia modesta* will eliminate completely due to biotic interference and will be replaced by *Capparis decidua* which can form a climax with *Salvadora oleoides* (Yousaf and Caughtai, 1976).

An ethnobotanical work has been conducted in Ramli village at Margalla Hills National Park in order to compare level of biotic interference among three different sites of same locality. Remarkable differences were found among these three sites which show that biotic interference on reserved site was greater as compared with sacred site. Wood product ratio on each site was found to be 6:2:1 and similarity index was 10.86%. Smaller qualitative differences in vegetation were found among all the three sites (Shinwari & Khan, 2000).

3. Materials and Methods

The research work was initiated in March 2011 and continued upto June 2011. The sites selected to carry out research work on ethnobotanical resources were; Biha, Kharkarai, Doghalghai, Fazal Banda, Barabroo, Pakhani, Chatekal, Jumnarai, Shurdat, Kanatai, Miarai, Pandarkot, Charai and Swatai of Biha valley, Swat. All these areas selected are ethnobotanical hotspots of Biha valley. Swatai, Fazal Banda, Kharkarai, Biha, Barabroo, Chatekal, Miarai, Pandarkot, Charai, and Charai top has been taken as a focal reference point.

A comprehensive review of relevant literature has been conducted. It has included the subject matter as well as regional studies.

3.1. Field Surveys

The time for field surveys was selected in accordance with life cycle of plants and season of collection, processing and utilization of plant products by the local community. The study trips were arranged from March to June 2011. Fieldwork was totally based on interviews, observations and guided field walk/transect walk.

3.2. Observations

In order to study field condition, keen observations have been made during walk in the upland during growth period. In the meantime all voucher specimens have been collected during flowering stage, pressed and preserved. Thus a file set of local plant voucher specimens have been developed. The same was submitted to Herbarium of International Islamic University, Islamabad.

3.3. Eco-geographical Survey

In collaboration with local forest department and people, an eco-geographical survey has been conducted for identification of representative areas with significant species diversity of indigenous

plants (hot spots) and associated vegetation for investigation of traditional knowledge about plants of ethnobotanical importance prevailing in the ecosystem of Biha valley.

3.4. Survey of Indigenous Knowledge

Interviews have been conducted with local inhabitants, selected informants, herbalists (Hakims) and local authorities and societies. About 150 informants have been interviewed on random basis. A questionnaire (Appendix 1) has been adopted during the survey; in a way to get quantitative and participatory approach about status of indigenous plants and their utilization by the people. A girl student has been involved to interview the women community of the area.

First of all, focal area of Biha valley has been surveyed. Indigenous plants having traditional knowledge of utilization among the people have been selected as reference specimens. Traditional knowledge about indigenous plants of focal area has been checked from other sites selected within Biha valley by conducting the same exercise.

3.5. Market Surveys

Economic and commercial value of indigenous medicinal plants utilized in the study area has been tested in market surveys. In this regard, a questionnaire (Appendix 2) has been adapted to interview local plant collectors, medicinal plant sellers (Pansaries) in local market i.e., Biha Valley and Mingora-Swat. Regarding quantitative approach questionnaire has been asked about quantity of plant resources, uses, rate of sale, consumption, availability, economic and market value etc. (Phillips and Gentry, 1993). Intensive surveys have been conducted.

The outcome of interviews has been rechecked and compared with results of other sites. Variations among information obtained from different sites have been noted.

3.6. Criterion for the Assessment of Species

According to the Red Data Book of IUCN, status of commercially important indigenous species (in terms of threatened condition) in the study area have been determined by using the following four

parameters; Availability, Collection, Growth and Part used providing a total score for each species. Based on this analysis, relative importance of specific indigenous plants has been classified into; Endangered, Vulnerable, Rare, Infrequent and Dominant species (IUCN, 1994). Key adopted was as follows:

Availability	**Collection**
0 = Uncommon or very rare	0 = More than 1000 Kg/year
1 = Less common or rare	1 = Consumed from 500-1000Kg/year
2 = Ocassional	2 = Consumed from 300-400Kg/year
3 = Abundant	3 = Consumed from 100-200Kg/year
Growth	**Part Used**
0 = Regrowth in more than 3 years	0 = Root, Rhizome, Whole plant
1 = Regrowth within 3 years	1 = Bark
2 = Regrowth within 2 years	2 = Seeds, Fruits
3 = Regrowth in 1 year	3 = Flowers
4 = Regrowth in a season	4 = Gum, Latex, Leaves

Total Score

0-4 = Endangered	12-14 = Infrequent
5-8 = Vulnerable	15-16 = Dominant
9-12 = Rare.	

3.7. Phytosociological study

Vegetation of the area was measured systematically by establishing 10 quadrates having size 10 x 10 meters for trees and shrubs and 1 x 1 m quadrates for herbs at random. Absolute and relative values of density, canopy coverage, frequency and importance value for different species were calculated according to Cox (1967) and Muller Dombois and Ellenberg (1974).

Importance value (IV) = RD + RCC + RF

Where

$$\text{RD (Relative Density)} = \frac{\text{Total No. of individuals of a species}}{\text{Total No. of individuals of all species}} \times 100$$

$$\text{RCC (Relative Canopy Cover)} = \frac{\text{Total cover of all targeted species}}{\text{Total cover of individuals of all species}} \times 100$$

$$\text{RF (Relative Frequency)} = \frac{\text{Frequency value for specie}}{\text{Total of all frequency value for all species}} \times 100$$

4. Results

4.1. Ethnobotanical Knowledge about Indigenous Plants

Ethnobotanical knowledge about indigenous plants of Biha Valley has been collected and also verified from other adjacent areas around the valley in Swat.

01) ***Acorus calamus*** Linn. Family: Araceae

Voucher specimen No. HIIUI/11-01 Habit: Herb

Flowering period: June-July Local Name: Skha waja

Part Used: Rhizome Trade Name: Warch

Locality: Biha Status: Endangered

Indigenous uses: Medicinal: Rhizome is used in cough, diarrhea, colic and also for snakebite. Powdered rhizome is mixed with Desi ghee and used by women during irregular menstrual cycle.

02) ***Adiantum capillus-veneris*** D.Don. Family: Polypodiaceae

Voucher specimen No. HIIUI/11-02 Habit: Herb

Flowering period: Non-flowering plant Local Name: Sumbal

Part Used: Frond (leaves) Trade Name: Persyoshan

Locality: Kharkarai Status: Common

Indigenous uses: Medicinal: Locally extract is made from its leaves which is mixed with the extract of *Cichorium intybus* and used for curing fever, backache and also serves as blood purifier. Fronds are used for curing scorpion bites while juice is expectorant and diuretic. It is also used for cleaning and sparkling teeth by the local women.

Other uses: Ornamental.

03) ***Aesculus indica*** (Wall.ex Camb.) Hook.f. Family: Hippocastinaceae

Voucher specimen No. HIIUI/11-03 Habit: Tree

Flowering period: April-May Local Name: Jawaz

Part Used: Whole plant.

Trade Name: Bankhor

Locality: Swatai

Status: Common

Indigenous uses: Medicinal: Fruit powdered is taken with water before breakfast which is considered as anthelmintic. Oil is also extracted from fruits and is externally applied for the treatment of rheumatism.

Other uses: Furniture, agricultural appliances, fuel wood, shade tree and visited by honey bees.

04) ***Ailanthus altissimia*** Swingle.

Family: Simarubaceae

Voucher specimen No. HIIUI/11-04

Habit: Tree.

Flowering period: April-July

Local Name: Backyanra,

Part Used: Aerial parts

Shandai

Locality: Biha

Trade Name: Desi bakai

Status: Common

Indigenous uses: Medicinal: Mature seeds are crushed and oil is extracted from it, which is used for curing skin disease, "aurticaria" locally called "larrama". Juice obtained from bark mixed with milk and taken daily for treatment of dysentery and diarrhea. Also used as anthelmentic.

Other uses: Fuel wood, fodder (goats and sheep) while wood is used for construction and making furniture which is not so strong, also used in making water-mill pulley.

05) ***Ajuga bracteosa*** Wall.

Family: Lamiaceae

Voucher specimen No. HIIUI/11-05

Habit: Herb

Flowering period: March-December

Local Name: Spina boti,Ghra boti

Part Used: Whole plant

Locality: Fazal banda

Trade Name: Kauri booti

Status: Endangered

Indigenous uses: Medicinal: Decoction is prepared from plant powder which is taken before breakfast for the treatment of sore throat purifying blood and as cooling agent. Similarly powdered is cooked with cow's ghee and used in morning time for the treatment of fever and vomiting.

6) ***Ajuga parviflora*** Benth. Family: Lamiaceae

Voucher specimen No. HIIUI/11-06 Habit: Herb

Flowering period: March-June Local Name: Sam boti,Sra boti

Part Used: Whole plant Trade Name: Titpatti

Locality: Barabroo Status: Common

Indigenous uses: Medicinal: Plant is boiled in water; decoction made is used for hepatitis, fever, blood purifier and as cooling agent by the local people.

07) ***Allium sativum*** Linn. Family: Alliaceae

Voucher specimen No. HIIUI/11-07 Habit: Herb

Flowering period: Summer months Local Name: Oogha

Part Used: Cloves Trade Name: Lahsan

Locality: Swatai Status: Common

Indigenous uses: Medicinal: It is very effective in heart diseases. After boiling and cooling decoction is taken twice in a day for lowering high blood pressure, hysteria, flatulence, asthma and whooping cough. Also diaphoretic, diuretic, expectorant and antiseptic.

Other uses: It is famous in the area that if someone keeps "Oogha" with himself, evils (ghost) will stay away from him. Also used in epilepsy. Widely used in cooking because of flavoring agent, fragrant and condiment.

08) ***Amaranthus viridis*** Linn. Family: Amaranthaceae

Voucher specimen No. HIIUI/11-08 Habit: Herb

Flowering period: April-May Local Name: Chalwai

Part Used: Whole plant Trade Name: Ganhar

Locality: Pandarkot Status: Common

Indigenous uses: Medicinal: Decoction of leaves and shoots is prepared and the extract is taken daily after dinner for curing cough and asthma. It is used as emollient.

Other uses: Pot herb, vegetable and fodder.

09) ***Andrachne cordifolia*** (Wall. ex Decne.) Muell. Family: Euphorbiaceae

Voucher specimen No. HIIUI/11-09 Habit: Perennial herb.

Flowering period: March-May Local Name: Krachay

Part Used: Leaves, fruits Trade Name: Kurkan

Locality: Barabro Status: Common

Indigenous uses: Medicinal: Vermifuge for cattle by "Gujar" people but found poisonous in high dose.

Other uses: Fuel wood.

10) ***Aquiligia fragranse*** Benth. Family: Ranunculaceae

Voucher specimen No. HIIUI/11-10 Habit: Herb

Flowering period: July-August Local Name: Samer parna

Part Used: Whole plant Trade Name: Atees

Locality: Charai Status: Common

Indigenous uses: Medicinal: Locally the plant is used to enhance kidney activity.

Other uses: Ornamental, Pot herb.

11) ***Artemisia maritimia*** L. Family: Asteraceae

Voucher specimen No. HIIUI/11-11 Habit: Herb

Flowering period: June-September Local Name: Tarkha

Part Used: Leaves, flower Trade Name: Afsanteen

Locality: Barabroo Status: Common

Indigenous uses: Medicinal: Extraction is prepared while boiling dried leaves in water and after cooling is used for curing dysentery and also in removing round and threadworms. Leaves and flowers are taken with a glass of water as antispasmodic and stomachache. It is also used for curing skin diseases and as cooling agent.

Other uses: Fodder and sweeping dirt's in houses.

12) ***Asparagus officinalis*** L. Family: Liliaceae

Voucher specimen No. HIIUI/11-12 Habit: Herb

Flowering period: May-June Local Name: Tendoray

Part Used: Young shoots Trade Name: Halyn

Locality: Fazal banda Status: Common

Indigenous uses: Medicinal: Plant is used as diuretic and laxative by the local inhabitants. Powder of tubers is boiled in milk and sugar for the treatment of diarrhea and dysentery.

Other uses: Saag of *Asparagus officinalis* is very popular in the area which is eaten with maize bread. Also used in condiments.

13) ***Astragalus anisacanthus*** Boiss. Family: Fabaceae

Voucher specimen No. HIIUI/11-13 Habit: Shrub

Flowering period: April-June Local Name: Pechpach

Part Used: Flower, Leaves Trade Name: Mamol

Locality: Swatai Status: Common

Indigenous uses: Medicinal: Local hakims used this plant in making different medicines and prescribed it for the treatment of cancer. Also used to cure kidney problems.

Other uses: Delicious dish "Saag" is cooked in Desi ghee which is eaten with maize bread. Fodder.

14) ***Avena sativa*** Linn. Family: Poaceae

Flowering period: May-June Habit: Herb

Voucher specimen No. HIIUI/11-14 Local Name: Jamdaray

Part Used: Whole plant Trade Name: Jao

Locality: Kharkarai Status: Common

Indigenous uses: Medicinal: Locally fresh fruit is fried in Desi ghee and cow's milk from which paste is made and is considered as general body tonic. It is also used as sex stimulating agent.

Other uses: Fodder.

15) ***Berberis lycium*** Royle Family: Berberidaceae

Voucher specimen No. HIIUI/11-15 Habit: Shrub

Flowering period: April-June Local Name: Kwaray

Part Used: Root bark & berries Trade Name: Kashmal

Locality: Chatekal Status: Common

Indigenous uses: Medicinal: Dried bark of roots is boiled in water and extract obtained is used in jaundice. It is also used for curing of stomach, liver disorder, intestinal colic, for external and internal wound treatments.

Other uses: Fruits plant, fencing, visited by honey bee and fuel wood.

16) ***Bergenia ciliata*** (Haw.)Sternb. Family: Saxifragaceae

Voucher specimen No. HIIUI/11-16 Habit: Herb

Flowering period: March-May Local Name: Gatpanra

Part Used: Rhizome Trade Name: Zakhmi hayat

Locality: Charai Status: Common

Indigenous uses: Medicinal: Locally the plant is used for discharging of pus in animals while leaves are used as a general body tonic and relief muscular pain. Rhizome is crushed into powder and taken with a glass of water daily as anti-diabetic and expectorant. Root powder is boiled in water for an hour; a gum like substance is prepared which is applied on wounds for healing purposes. It also serves as blood purifier.

Other uses: Ornamental.

17) ***Bistorta amplexicaulis*** (D. Don) Green Family: Polygonaceae

Voucher specimen No. HIIUI/11-17 Habit: Herb

Flowering period: June-September Local Name: Torapanra,Anjabar

Part Used: Rhizome Trade Name: Anjabbar

Locality: Pandarkot Status: Common

Indigenous uses: Medicinal: It is used against sore throat and inflammation of mouth and tongue. Also used as general body tonic.

Other uses: Fodder.

18) ***Cannabis sativa*** Linn. Family: Cannabinaceae

Voucher specimen No. HIIUI/11-18 Habit: Herb

Flowering period: April-September Local Name: Bang

Part Used: Shoots & leaves Trade Name: Ganja

Locality: Kharkarai Status: Common

Indigenous uses: Medicinal: Leaves are tied over the affected part of body for wounds healing. In powdered form, leaves are used as pain relieving agent. Resinous exudation are collected from leaves and flowering tops and then smoked. Infusion of large leaves is mixed with milk or juice of some other fruits and poppy seeds to make "Tandai" a cold drink which is used for narcotic action.

Other uses: Fuel wood, barks for making ropes and visited by honey bee.

19) ***Capsella bursa-pastoris*** (L.) Medik. Family: Brassicaceae

Voucher specimen No. HIIUI/11-19 Habit: Herb

Flowering period: March-June Local Name: Bambesa

Part Used: Aerial parts Trade Name: Chambraka

Locality: Pandarkot Status: Common

Indigenous uses: Medicinal: Paste is made from young leaves when crushed and two table spoons are taken orally with a glass of milk for curing diarrhea. Seeds are used as diuretic and stimulant.

Other uses: Vegetable, Fodder.

20) ***Cedrus deodara*** (Roxb. Ex Lamb.)G. Don. Family: Pinaceae

Voucher specimen No. HIIUI/11-20 Habit: Tree

Flowering period: October-November Local Name: Ranzra

Part Used: Wood oil & gum Trade Name: Deodar

Locality: Swatai Status: Rare

Indigenous uses: Medicinal: 2 or 3 drops of resin extract are added in a glass of milk and taken daily in morning time before breakfast for the treatment of skin diseases. It also serves as cooling agent and blood purifier. *Cedrus* oil is very affective in fever, hair loss and used as carminative.

Other uses: Fuel wood, visited by honey bee.

21) ***Celtis australis*** L. Family: Ulmaceae

Voucher specimen No. HIIUI/11-21 Habit: Tree

Flowering period: March-May Local Name: Tagha

Part Used: Fruit & bark Trade Name: Kharak

Locality: Kharkarai Status: Endangered

Indigenous uses: Medicinal: Plant is used as anthelmentic agent. Wild fruits are edible which are used for the treatment of abdominal pain and allergy.

Other uses: Fuel wood, fodder, agricultural appliances, fruit tree.

22) ***Chenopodium album*** Linn. Family: Chenopodiaceae

Voucher specimen No. HIIUI/11-22 Habit: Herb

Flowering period: January-September Local Name: Sarmay

Part Used: Whole plant Trade Name: Bathu

Locality: Pandarkot Status: Common

Indigenous uses: Medicinal: It is used as carminative, laxative and diuretic agent. Roots are used in jaundice and in urinary problems.

Other uses: Vegetable as cooked its younger shoots in milk and eat with maize bread. Pot herb and fodder.

23) ***Cichorium intybus*** Linn. Family: Asteraceae

Voucher specimen No. HIIUI/11-23 Habit: Herb

Flowering period: July-September Local Name: Hun

Part Used: Root & leaves Trade Name: Kasni

Locality: Pandarkot Status: Common

Indigenous uses: Medicinal: Decoction is prepared from fresh leaves and is mixed with

sugar which is taken orally for curing jaundice and fever. Root powdered is also taken with a cup of milk and is used to treat fever and vomiting.

Other uses: Vegetable.

24) ***Clematis grata*** Wall. Family: Ranunculaceae

Voucher specimen No. HIIUI/11-24 Habit: Climbing herb.

Flowering period: August-September Local Name: Ghrazela

Part Used: Whole Plant Status: Common

Locality: Fazal banda

Indigenous uses: Medicinal: Leaves when split from plant and smell, it causes nausea. Plant decoction is used for jaundice.

Other uses: Fodder (goats and sheep).

25) ***Coriandrum sativum*** Linn Family: Apiaceae

Voucher specimen No. HIIUI/11-25 Habit: Herb

Flowering period: Spring to Summer Local Name: Dhanyal

Part Used: Fruit & leaves Trade Name: Dhania

Locality: Swatai Status: Common

Indigenous uses: Medicinal: Coriander is used as carminative agent. Fruit powder is mixed with sweet and taken with a glass of water for treatment of stomachache. It increases secretion of gastric juice and appetite.

Other uses: Oil is extracted from it, condiments, aromatic and flavoring agent.

26) ***Cotoneaster microphyllus*** Fisch and Mey. Family: Rosaceae

Voucher specimen No. HIIUI/11-26 Habit: Shrub

Flowering period: Mid Spring-late Summer Local Name: Mamanra,kharawa

Part Used: Fruit Trade Name: Mamanra

Locality: Swatai | Status: Endangered

Indigenous uses: Medicinal: Plant fruit is edible which is liked by children very much. Leaves are used for stopping bleeding while fruit is stomachic and expectorant.

Other uses: Fuel wood, fruit plant, fodder, fencing and for shelter in muddy houses.

27) ***Crataegus oxycantha*** G.Koch | Family: Rosaceae

Voucher specimen No. HIIUI/11-27 | Habit: Tree

Flowering period: May-June | Local Name: Changa

Part Used: Aerial parts | Trade Name: Bansangli

Locality: Charai top | Status: Endangered

Indigenous uses: Medicinal: Fruit is edible and a liquid extract is made from it which is used against heart diseases. It also improves blood flow in arteries.

Other uses: Fruit tree, fuel wood.

28) ***Cuscuta reflexa*** Roxb | Family: Cuscutaceae

Voucher specimen No. HIIUI/11-28 | Habit: Herb

Flowering period: August-September | Local Name: Maraz botay

Part Used: Shoots | Trade Name: Aftimun

Locality: Kharkarai | Status: Common

Indigenous uses: Medicinal: Whole plant is crushed, boils in water and patient is asked to take bath with the decoction avoiding using soap for the treatment of scabies. Plant powdered is taken with a cup of milk after meal twice in a day for curing diabetes. Decoction is also used to control urine and purify blood in children.

29) ***Cynodon dactylon*** Linn. | Family: Poaceae

Voucher specimen No. HIIUI/11-29 | Habit: Herb

Flowering period: All year around | Local Name: Kabal

Part Used: Whole plant | Trade Name: Kabal

Locality: Swatai | Status: Common

Indigenous uses: Medicinal: Fresh grass is crushed in pestle and mortar and the juice is given for dysentery, irritation of urinary organs, vomiting and blood purifier. Plant is also used for external bleeding.

Other uses: Fodder which improve quality of milk in mammals. Soil binder and ornamental.

30) ***Daphne mucronata*** Royle | Family: Thymelaeaceae

Voucher specimen No. HIIUI/11-30 | Habit: Shrub

Flowering period: April-September | Local Name: Leeghonay

Part Used: Whole plant | Trade Name: Ruttilal

Locality: Barabroo | Status: Common

Indigenous uses: Medicinal: Locally root decoction is used before breakfast daily as anthelmintic. Poultice made from its leaves are used for sweeping and rheumatism.

Other uses: Fruit plant, fuel wood, ornamental.

31) ***Diospyros kaki*** Linn. | Family: Ebenaceae

Voucher specimen No. HIIUI/11-31 | Habit: Tree

Flowering period: September-November | Local Name: Sor amlook

Part Used: Fruit | Trade Name: Amlook

Locality: Kharkarai | Status: Common

Indigenous uses: Medicinal: Local people used its fruits for laxative purposes. Their fruit is very delicious both in fresh form and in dried forms.

Other uses: Commercial fruit tree, fuel wood and visited by honey bee.

32) ***Diospyros lotus*** Linn. Family: Ebenaceae

Voucher specimen No. HIIUI/11-32 Habit: Tree

Flowering period: October-November Local Name: Tor amlook

Part Used: fruit & seeds Trade Name: Amlook

Locality: Swatai Status: Endangered

Indigenous uses: Medicinal: Local people used their fruits for many purposes e.g. fruits are boiled in milk for a few minutes and the decoction prepared is used twice in a day for curing dysentery and constipation.

Other uses: Fodder, furniture, fuel wood, fruit tree and visited by honey bee.

33) ***Dryopteris juxtapostia*** Christ. Family: Pteridaceae

Voucher specimen No. HIIUI/11-33 Habit: Herb

Flowering period: Non-flowering Local Name: Kwanjay

Part Used: Whole plant Status: Endangered

Locality: Chatekal

Indigenous uses: Medicinal: Saag is prepared from it after cleaning and removing the scales which is laxative and improve digestive power.

Other uses: Vegetable, pot herb, ornamental. Cooked in whey which is a well known dish of the area.

34) ***Eleagnus umbellata*** Thumb. Family: Elaeagnaceae

Voucher specimen No. HIIUI/11-34 Habit: Shrub

Flowering period: April-May Local Name: Ghulam rangay

Part Used: Whole plant Trade Name: Gehain

Locality: Swatai Status: Endangered

Indigenous uses: Medicinal: Decoction is made from plant flowers which are used against heart problem, cough and chest pain by the local people.

Other uses: Fruits plant, firewood and visited by honey bee.

35) ***Eucalyptus lanceolata*** L. Family: Myrtaceae

Voucher specimen No. HIIUI/11-35 Habit: Herb

Flowering period: Jan-Mar/Sep-Oct Local Name: Lachi

Part Used: Dried gummy exudates Trade Name: Lachi

Locality: Biha Status: Common

Indigenous uses: Medicinal: Leaves are used in the form of cigarette for asthma. It is also used as flavoring agent and antibacterial.

Other uses: Furniture, fuel wood, visited by honey bee.

36) ***Euphorbia helioscopia*** L. Family: Euphorbiaceae

Voucher specimen No. HIIUI/11-36 Habit: Herb

Flowering period: January- July Local Name: Mandanroo

Part Used: Root & milky juice Trade Name: Chatriwal

Locality: Kharkarai Status: Common

Indigenous uses: Medicinal: It is considered as poisonous plant because its latex causes swelling on skin and irritation but hakims used it in tablets in combination with other plants which are prescribed as laxative. Also used as cathartic and anthelmintic. For treatment of Eczema (skin disease) paste is made from equal amount of *Euphorbia helioscopia* and *cuscuta reflexa* and applied on affected parts of the body twice in a day.

37) ***Ficus auriculata*** Lour. Family: Moraceae

Voucher specimen No. HIIUI/11-37 Habit: Tree

Flowering period: August-November Local Name: Inzar meva

Part Used: Fruits, latex, leaves, wood | Trade Name: Dhusi

Locality: Charai top | Status: Common

Indigenous uses: Medicinal: Its fruits are used both in dried and fresh forms which act as laxative, demulcent and used in constipation, piles and blood diseases also.

Other uses: Fruits tree, fodder (goats and sheep), fuel wood, visited by honey bee.

38) ***Ficus palmata*** Forssk. | Family: Moraceae

Voucher specimen No. HIIUI/11-38 | Habit: Tree

Flowering period: May-November | Local Name: Inzar

Part Used: Fruit, leaves, wood | Trade Name: Anjeer

Locality: Kharkarai | Status: Common

Indigenous uses: Medicinal: Decoction is prepared from fresh leaves and milk which is given to patient twice in a day for the treatment of measles, dysentery and bladder problem. Similarly its fruits are edible which is considered as to improve digestion. Its latex is used for removing spines and thorns from feet or hands easily.

Other uses: Fodder (goats and sheep), firewood, visited by honey bee. Fruit plant which is considered as holy tree because local people believes that if someone sees its flower, he will become rich.

39) ***Foeniculum vulgare*** Mill. | Family: Apiaceae

Voucher specimen No. HIIUI/11-39 | Habit: Herb

Flowering period: Late Spring/Early Summer | Local Name: Kagainalay

Part Used: Fruit & leaves | Trade Name: Sounf

Locality: Charai | Status: Common

Indigenous uses: Medicinal: Sugar is mixed with fruit powder and is taken orally with a glass of milk for curing dysuria while dried fruit is considered as laxative also. Its leaves

are diuretic, digestive and improve eyesight.

Other uses: Visited by Honey bee. Also used as condiment.

40) ***Fragaria visca*** L. Family: Rosaceae

Voucher specimen No. HIIUI/11-40 Habit: Herb

Flowering period: May-August Local Name: Zmakay toot,

Part Used: Fruit Katal meva

Locality: Chatekal Trade Name: Jangali strawberry

Status: Common

Indigenous uses: Medicinal: Locally fruit is edible which is considered as carminative, laxative and improve digestion.

Other uses: fruit plant, visited by honey bee.

41) ***Fumaria indica*** (Hausskn.) Pugsley Family: Fumariaceae

Voucher specimen No. HIIUI/11-41 Habit: Herb

Flowering period: March-June Local Name: Papra

Part Used: Whole plant Trade Name: Shatara,pitpapra

Locality: Kharkarai Status: Common

Indigenous uses: Medicinal: Decoction is prepared from the leaves which are used twice in a day for blood purification and as a result skin diseases are treated. It is also used for removing worms, as cooling agent and in fever. Whole plant powdered is mixed with honey and is taken daily for the treatment of jaundice. The plant is also given to cattle for controlling diarrhea.

Other uses: Fodder.

42) ***Geranium wallichianum*** D. Don Family: Geraniaceae

Voucher specimen No. HIIUI/11-42 Habit: Herb

Flowering period: July-September

Local Name: Sra zeal

Part Used: Rhizome

Trade Name: Lijaahri

Locality: Charai top

Status: Common

Indigenous uses: Medicinal: Decoction is made from combination of *Geranium* root and pods of *Pistacea integerrima* and is taken daily for curing cough and cold, fever and kidney diseases. Similarly dried powder root is mixed with native hen-egg and is fried in cow's ghee which is used twice in a day for curing Rheumatism. It is also used as tonic for cattle.

Other uses: Visited by honey bee.

43) ***Hedera nepalensis*** K. Koch

Family: Araliaceae

Voucher specimen No. HIIUI/11-43

Habit: Herb

Flowering period: October-April

Local Name: Prewatay,zelai

Part Used: Whole plant

Trade Name: Kurie

Locality: Chatekal

Status: Common

Indigenous uses: Medicinal: Young leaves are dried and after grinding made into powder is boiled with a cup of milk is taken early in the morning for curing diabetes. Decoction is prepared from leaves which are then used for abdominal pain, urinary troubles and as diuretic. It is famous for curing cancer, also used in first aid.

Other uses: Fodder, Ornamental.

44) ***Indigofera heterantha*** Wall. ex Brand.

Family: Papilionaceae

Voucher specimen No. HIIUI/11-44

Habit: Shrub

Flowering period: May-July

Local Name: Ghwareja

Part Used: Whole plant

Trade Name: Kainthi

Locality: Swatai

Status: Common

Indigenous uses: Medicinal: Local people used powder of root with a glass of water for the treatment of scabies while powder of leaves are taken orally with a glass of milk twice in a day for stomach disorders, headache and chest pain.

Other uses: Fuel wood, fencing, fodder (goats and sheep). Similarly young shoots are twisted into ropes to make brooms for cleaning roofs and lawns. Visited by honey bee.

45) ***Juglans regia*** Linn. Family: Juglandaceae

Voucher specimen No. HIIUI/11-45 Habit: Tree

Flowering period: February-April Local Name: Ghoz

Part Used: Fruit, leaves & bark Trade Name: Akhrot

Locality: Chatekal Status: Common

Indigenous uses: Medicinal: Delicious ripened fruit is considered as brain tonic but its nuts can infect throat because of its oily nature. Bark of stem and root which is locally called as "Dandasa" is used as toothbrush for cleaning and shining of teeth while its leaves are used in lips makeup by women of the area.

Other uses: Furniture, fuel wood and also used in dyes.

46) ***Justicia adhatoda*** L. Family: Acanthaceae

Voucher specimen No. HIIUI/11-46 Habit: Shrub

Flowering period: July-October Local Name: Bhaiker

Part Used: Whole plant Trade Name: Arusa

Locality: Charai top Status: Common

Indigenous uses: Medicinal: Roots are used in rheumatism, pneumonia and cough. It is also used in snakebites, eye and ear ailments. Leaves are used as antispasmodic, abortifacient, for curing dysentery in cattle and also applied to reduce swelling. It remove skin diseases and also used in scabies.

Other uses: Visited by Honey bee, poisonous and firewood.

47) ***Malus pumila*** Mill. Family: Rosaceae

Voucher specimen No. HIIUI/11-47 Habit: Tree

Flowering period: April-May Local Name: Manra

Part Used: Fruits, flowers, wood Trade Name: Saib

Locality: Chatekal Status: Endangered

Indigenous uses: Medicinal: The plant fruit is a rich source of iron which act as laxative, expectorant, used in jams and jelly and very effective for heart. Arq-e-Gulab is prepared from its flowers which are used in eye diseases.

Other uses: Commercial fruit tree which play an important role in economy. Agricultural appliances, fuel wood, fodder (goats and sheep).

48) ***Malva neglecta*** Wallr. Family: Malvaceae

Voucher specimen No. HIIUI/11- HIIUI/11-48 Habit: Herb

Flowering period: May-September Local Name: Zangali panerak

Part Used: Whole plant Trade Name: Khubasi

Locality: Swatai Status: Common

Indigenous uses: Medicinal: The plant is used as local vegetable to improve digestion and remove constipation. It is also used for cooling purposes.

Other uses: Pot herb, ornamental and vegetable (Saag).

49) ***Melia azadirach*** Linn. Family: Meliaceae

Voucher specimen No. HIIUI/11-49 Habit: Tree

Flowering period: March-May Local Name: Tora Bankyanra, Shandai

Part Used: Leaves & fruit

Locality: Kharkarai Trade Name: Bakain

Status: Common

Indigenous uses: Medicinal: Powder of fruits is taken orally with milk twice in a day for gastric troubles, fever and cough while decoction of bark is used as antiallergenic. Seeds are used in blood pressure and in rheumatism. Young leaves are used as carminative for cattle. When their abdomen or belly swells up by gas accumulation due to over eating, leaves or fermented fruits are given.

Other uses: Extract is made from leaves which are used by local women for removing hair lice. Fresh leaves are placed by farmers in cereal crops like wheat, rice and pulses for repulsion of insects and other pests. Unripe fruits are placed in its leaves and covered it with bags and placed them in store for ripening, which works like a carbide chemicals. Fodder, furniture, shade tree, ornamental, agricultural appliances and visited by honey bee.

50) ***Mentha longifolia*** (Linn.) Huds. Family: Lamiaceae

Voucher specimen No. HIIUI/11-50 Habit: Herb

Flowering period: May-November Local Name: Venalai

Part Used: Whole plant Trade Name: Venalai

Locality: Chatekal Status: Common

Indigenous uses: Medicinal: Plants powder is mixed with sugar and taken for prevention of vomiting while decoction of leaves is prepared which is used thrice in a day for the treatment of diarrhea in children. Dried leaves are used in chatney which is stomachache and carminative. Powder of leaves is used with boiled eggs for curing tonsils.

Other uses: Visited by honey bee, aromatic and flavoring agent. Used in veterinary medicines.

51) ***Mentha spicata*** L. Family: Lamiaceae

Voucher specimen No. HIIUI/11-51 Habit: Herb

Flowering period: May-November Local Name: Podina

Part Used: Whole plant Trade Name: Podina

Locality: Chatekal Status: Endangered

Indigenous uses: M edicinal: Plants powder is mixed with sugar and taken for the treatment of vomiting, also considered as carminative agent. Leaves decoction is used as mouth wash. It reduces stomach acidity.

Other uses: Fresh leaves are used in chatnies which have a tremendous flavor. Visited by honey bee, aromatic and used in veterinary medicines.

52) ***Morchella esculenta*** L.Pers ex Fr. Family: Helvelaceae

Voucher specimen No. HIIUI/11-52 Habit: Fungi

Flowering period: July- September Local Name: Gujay

Part Used: Whole plant Trade Name: Mantar

Locality: Charai top Status: Endangered

Indigenous uses: Medicinal: Fresh Mushrooms are fried with Desi cow ghee and eaten after dinner which is very effective in general body tonic. It is also used as a food.

Other uses: Mushroom is considered as a delicious and costly food, local people in the season are involved in their collection especially children and younger generation. They are collected from different places, dried properly and then sold it in local market which is then exported to aboard like China, Germany, France, Switzerland and Austria.

53) ***Morus alba*** L. Family: Moraceae

Voucher specimen No. HIIUI/11-53 Habit: Tree

Flowering period: April-September Local Name: Toot

Part Used: Fruit, wood | Trade Name: Bedana

Locality: Swatai | Status: Common

Indigenous uses: Medicinal: Their leaves are used for cleaning throat, also serve as cooling agent while bark is used for removing worms. Fruit is eaten for curing constipation, cough and cold.

Other uses: Furniture, shade tree, fuel wood, fruits tree, edible both in fresh and dried forms. Fodder (goats and sheep). Young branches which are elastic are used in manufacturing of baskets which is locally called as "Tokrai".

54) ***Nasturtium officinale*** R. Br. | Family: Brassicaceae

Voucher specimen No. HIIUI/11-54 | Habit: Herb

Flowering period: April-July | Local Name: Talmira

Part Used: Whole plant | Trade Name: Piryahan

Locality: Kharkarai | Status: Common

Indigenous uses:

Medicinal uses: Young leaves and shoots are cooked in water and are taken as local vegetable for the treatment of constipation, stomachache, diuretic and also used in chest problems. Similarly entire plant is cooked and used against gum diseases.

Other uses: Vegetable, Pot herb.

55) ***Nerium oleander*** L. | Family: Apocynaceae

Voucher specimen No. HIIUI/11-55 | Habit: Shrub

Flowering period: April-October | Local Name: Ghanderai

Part Used: Whole plant | Trade Name: Kanair

Locality: Fazal banda | Status: Common

Indigenous uses: Medicinal: Pasted leaves decoction has been applied externally to treat certain skin diseases.Roots are used for curing snake bites.

Other uses: Visited by honey bee, poisonous and ornamental.

56) ***Olea ferruginea*** Royle. Family: Oleaceae

Voucher specimen No. HIIUI/11-56 Habit: Tree

Flowering period: April-May Local Name: Khona

Part Used: Fruit, bark and leaves Trade Name: Zaitoon

Locality: Swatai Status: Endangered

Indigenous uses: Medicinal: Fresh leaves decoction is retained in mouth for sometime to cure toothache, gum disorders and sore mouth. Similarly the oil extracted from fruits is applied externally for treatment of rheumatism. Younger used toothbrush made from its young shoot and considered as antiseptic.

Other uses: Agricultural appliances, furniture, fuel wood, fodder. It is a holy tree which is grown in shrines and grave yards and local people also used in names like Khona gul, Khona baba etc.

57) ***Oxalis corniculata*** L. Family: Oxalidaceae

Voucher specimen No. HIIUI/11-57 Habit: Herb

Flowering period: March-December Local Name: Tarokay

Part Used: Whole plant Trade Name: Khatbuti

Locality: Kharkarai Status: Common

Indigenous uses: Medicinal: Plant decoction is taken after meal to improve digestion, stomach problems and expel worms. Decoction of leaves is also used against fever, dysentery and sensitive teeth.

Other uses: Vegetable, fodder.

58) ***Paeonia emodi*** Wall. ex Royle. Family: Paeoniaceae

Voucher specimen No. HIIUI/11-58 Habit: Herb

Flowering period: May-June Local Name: Ward,mamekh

Part Used: Fruit & tuber Trade Name: Udsalap

Locality: Charai top Status: Common

Indigenous uses: Medicinal: Rhizome is crushed into powdered and mixed with wheat flour to prepared "Halva" in desi ghee which is used as a general body tonic. Similarly rhizome and root is used to cure backbone problem, vomiting, epilepsy, rheumatism and cathartic. It is also used as blood purifier. "Gujar" people used powder of rhizomes in wheat flour or in bread for cattle to treat digestive problems.

59) ***Parrotia jacquemontiana*** (Dcne.) Rehder Family: Hamamelidaceae

Voucher specimen No. HIIUI/11-59 Habit: Tree

Flowering period: March-May Local Name: Bairange

Part Used: Fruit & tuber Status: Common

Locality: Swatai

Indigenous uses: Other uses: Visited by honey bee, fuel wood, fodder, agricultural appliances and shelter in muddy houses.

60) ***Picea smithia*** (Wall.) Boiss Family: Pinaceae

Voucher specimen No. HIIUI/11-60 Habit: Tree

Flowering period: April Local Name: Kachal,Managazai

Part Used: Wood Trade Name: Rau

Locality: Charai top Status: Endangered

Indigenous uses: Medicinal: Green tea is made from fresh leaves and used once in a day for removing kidney stones. Also used in rheumatism.

Other uses: Furniture, fuel wood. Leaves are used in packing fruits in crates.

61) ***Pinus wallichiana*** A. B. Jackson — Family: Pinaceae

Voucher specimen No. HIIUI/11-61 — Habit: Tree

Flowering period: May-October — Local Name: Sraf,Peoch,Kail

Part Used: Resin, Wood — Trade Name: Chil

Locality: Swatai — Status: Rare.

Indigenous uses:

Medicinal uses: Locally mustard oil is mixed with 3-4 drops of resin and applied on affected skin as a healing agent. Sugary type of exudate is eaten by children. Resin is also used for skin diseases.

Other uses: Fuel wood. Timber wood is considered as second in Pakistan which are used for house building, making furniture, used in match industry, making bridges and beams etc. Turpentine is obtained from trees is applied as protective varnish to wood work while cones are used for ornamental purposes.

62) ***Pistacia integrrima*** Stew.ex Branbis. — Family: Anacardiaceae

Voucher specimen No. HIIUI/11-62 — Habit: Tree

Flowering period: March-May — Local Name: Kakarsingay,Shnai

Part Used: Resin, Whole plant — Trade Name: 'Kakar-Singhi'.

Locality: Fazal Banda — Status: Rare

Indigenous uses: Medicinal: local people used powdered bark and leaves with a glass of water for curing of jaundice. Also used as antibacterial agent. Cones are used for ornamental purposes.

63) ***Plantago lanceolata*** Linn. — Family: Plantaginaceae

Voucher specimen No. HIIUI/11-63 — Habit: Herb

Flowering period: May-July — Local Name: Jabai

Part Used: Leaves and seeds | Trade Name: Balthanga

Locality: Chatekal | Status: Rare

Indigenous uses: Medicinal: Leaf extract is prepared from fresh leaves and is applied to wounds, sores and inflamed surfaces. It also cures stomach problem, dysentery and mouth diseases.

Other uses: Visited by honey bee.

64) ***Platanus orientalis*** Linn. | Family: Platanaceae

Voucher specimen No. HIIUI/11-64 | Habit: Tree

Flowering period: April-May | Local Name: Chinar

Part Used: Leaves & bark | Trade Name: Chinar

Locality: Fazal banda | Status: Common

Indigenous uses: Medicinal: Locally dried bark is crushed into powder and is taken with a glass of milk twice in a day for curing diarrhea and toothache.

Other uses: Fuel wood, furniture, shade tree and ornamental. Locally used in Pashto folk songs i.e. Zama Lalay Chinar De (My lover is like a Plane tree).

65) ***Plectranthus barbatus*** (Andrews) Benth. | Family: Lamiaceae

Voucher specimen No. HIIUI/11-65 | Habit: Shrub

Flowering period: March-May | Local Name: Sperkay,Brootas

Part Used: Stem, flower, leaves, roots | Trade Name: Pathar chur

Locality: Barabroo | Status: Common

Indigenous uses: Medicinal: Dried leaves are chewed in mouth as prescribed by local hakims to get rid of toothache. Similarly it also decreases blood pressure, cough, heart diseases and Kidney stones.

Other uses: Shelter in mud made houses, fodder (goats and sheep), and fuel wood.

Visited by honey bee.

66) ***Podophylum hexandrum*** Wall. ex Royle | Family: Podophyllaceae

Voucher specimen No. HIIUI/11-66 | Habit: Herb

Flowering period: April-May | Local Name: Kakora

Part Used: Fruit & rhizome | Trade Name: Bandkakri

Locality: Charai top | Status: Endangered

Indigenous uses: Medicinal: Locally powder rhizome is used with Desi ghee for curing backbone pain and cancer. Fruit is used as laxative.

67) ***Polygonatum verticellatum*** L. | Family: Liliaceae

Voucher specimen No. HIIUI/11-67 | Habit: Shrub

Flowering period: May-June | Local Name: Baramole, Noor-e-Alam

Part Used: Root | Trade Name: Shakakul

Locality: Pandarkot

Status: Endangered

Indigenous uses: Medicinal: Root is crushed into powder and taken orally with a glass of water in morning time as a general body tonic.

68) ***Polygonum aviculare*** Linnaeus. | Family: Polygonaceae

Voucher specimen No. HIIUI/11-68 | Habit: Herb

Flowering period: March-September | Local Name: Palpolak

Part Used: Roots | Trade Name: Banduke

Locality: Swatai | Status: Common

Indigenous uses: Medicinal: Root is crushed into powder, mixed with sugar and taken daily with a glass of milk twice in a day for general body tonic in female. It is also used as fish poison.

69) ***Portulaca oleracea*** L. Family: Portulaceae

Voucher specimen No. HIIUI/11-69 Habit: Herb

Flowering period: Throughout the year Local Name: Warkharray

Part Used: Shoots Kharkarai Trade Name: Salunak, Lunak,

Locality: Swatai Khurfa

Status: Common

Indigenous uses: Medicinal: Decoction is prepared from the plant which is taken daily before meal for kidney, liver, urinary bladder and lungs problems.

70) ***Prunus armeniaca*** Linn. Family: Rosaceae

Voucher specimen No. HIIUI/11-70 Habit: Tree

Flowering period: March-April. Local Name: Khubanai

Part Used: Fruit, Wood, leaves, seeds. Trade Name: Khubani

Locality: Pandarkot Status: Common

Indigenous uses: Medicinal: Decoction is prepared from dried fruit and used as laxative. Gum is very famous as anticancer. People in the area believed that those who eat its fruit are thought to be long lived.

Other uses: Fodder, fuel wood, fruit tree while seeds are eaten both in fresh as well as in dried forms.

71) ***Prunus domestica*** Linn. Family: Rosaceae

Voucher specimen No. HIIUI/11-71 Habit: Tree

Flowering period: March-April Local Name: Aloocha

Part Used: Fruit, wood, leaves Trade Name: Aloocha

Locality: Pandarkot Status: Common

Indigenous uses: Medicinal: Plant fruit is used in jam and jelly which is laxative. Dried fruit is used in cooking rice and meat as a flavoring agent.

Other uses: Visited by honey bee, condiments, fodder, fuel wood. Fruit pulp is used in chutneys.

72) ***Punica granatum*** Linn. Family: Punicaceae

Voucher specimen No. HIIUI/11-72 Habit: Small tree

Flowering period: April-July Local Name: Anangoray

Part Used: Fruit, bark, leaves Trade Name: Anar

Locality: Kharkarai Status: Endangered

Indigenous uses: Medicinal: Extract prepared from leaves is used for dysentery and skin diseases. Fruit is used as cooling agent and blood purifier, also used in cough and as laxative. Stem and root bark is used as anthelmintic and for mouth wash.

73) ***Pyrus pashia*** Buch. Ham. ex D. Don Family: Rosaceae

Voucher specimen No. HIIUI/11-73 Habit: Tree

Flowering period: April-August Local Name: Tanga

Part Used: Fruits, wood Trade Name: Meldar

Locality: Kharkarai Status: Common

Indigenous uses: Medicinal: Fresh fruit is eaten which are laxative, sedative and reduces fever. It is also used for mouth wash.

Other uses: Fuel wood, visited by honey bee. Plant serves as root stock for grafting of apple and pear.

74) ***Quercus diltata*** Lindle. Ex. Royle Family: Fagaceae

Voucher specimen No. HIIUI/11-74 Habit: Tree

Flowering period: April-May Local Name: Toor Banj

Part Used: Acorns, bark | Trade Name: Serai

Locality: Chatekal | Status: Common

Indigenous uses: Medicinal: Seeds are roasted and used for digestive disorders, asthma and urinary tract diseases.

Other uses: Fuel wood, agriculture appliances, Head of seeds are used as playing cups by children. Fodder and fencing.

75) ***Quercus incana*** Roxb | Family: Fagaceae

Voucher specimen No. HIIUI/11-75 | Habit: Tree

Flowering period: April-May | Local Name: Spen banj

Part Used: Acorns | Trade Name: Ban

Locality: Charai | Status: Endangered

Indigenous uses: Medicinal: Fruit is crushed into powder and given to children before going to bed with water for the treatment of enuresis and dysuria (painful urination).

Other uses: Fuel wood, agriculture appliances, fodder and fencing.

76) ***Rheum australe*** D. Don | Family: Polygonaceae

Voucher specimen No. HIIUI/11-76 | Habit: Herb

Flowering period: June-August | Local Name: Chutial

Part Used: Rootstock, stems, fruit, petioles | Trade Name: Chutial

Locality: Charai top | Status: Endangered

Indigenous uses: Medicinal: Powder of root is mixed with native hen eggs and fried in Desi ghee which is prescribed twice in a day for the removal of kidney stones and other kidney problems. Rhizome is used in fever, asthma and as blood purifier. Leaves are used as laxative and very effective in cough.

Other uses: Vegetable.

77) ***Robinia pseudoacacia*** Linn. Family: Pappilionaceae

Voucher specimen No. HIIUI/11-77 Habit: Tree

Flowering period: March-April Local Name: Keekar

Part Used: Flowers Trade Name: Keekar

Locality: Barabroo Status: Common

Indigenous uses: Other uses: Fodder (Sheep and goats), fencing, visited by honey bee. *Robinia* is planted on sides of the field to reduce soil erosion. Flowers are aromatic and used for ornamental purposes.

78) ***Rosa brunonii*** Lindley. Family: Rosaceae

Voucher specimen No. HIIUI/11-78 Habit: Shrub

Flowering period: May-July Local Name: Khorach,Zangali Gulab

Part Used: Flowers. Trade Name: Jangali Gulab.

Locality: Kharkarai

Status: Common

Indigenous uses: Medicinal: Petals and fruits are applied externally for curing foul ulcer, wounds and injuries. Also used in stomach disorders. Fresh flower decoction is prepared and taken before breakfast for stomach disorders.

Other uses: Flowers are used in manufacturing perfumes. Fencing, ornamental, visited by honey bee.

79) ***Rubus fruiticosus*** Agg. Family: Rosaceae

Voucher specimen No. HIIUI/11-79 Habit: Shrub

Flowering period: February-April Local Name: Karwara

Part Used: Fruits Trade Name: Alish

Locality: Swatai Status: Common

Indigenous uses: Medicinal: Fruit is edible and used as carminative, diuretic, for the treatment of diarrhea, cough and fever. Ripen fruit is eaten to control stomachic and to improve digestion. Extract prepared from fruits is taken daily early in morning for curing Asthma and used as tonic also.

Other uses: Fruit plant, fencing, fodder (Goats and sheep).

80) ***Rumex dentatus*** Linnaeus — Family: Polygonaceae

Voucher specimen No. HIIUI/11-80 — Habit: Herb

Flowering period: March-June — Local Name: Shalkay

Part Used: Leaves & rhizome — Trade Name: Ambavati

Locality: Kharkarai — Status: Common

Indigenous uses: Medicinal: Locally rhizome and leaves are crushed and is applied externally for wounds healing. Also used as diuretic, astringent, demulcent and relieves irritation effect caused by *Urtica dioca.*

Other uses: Used in Saag for its sour taste in order to make it delicious.

81) ***Rumex histatus*** D. Don — Family: Polygonaceae

Voucher specimen No. HIIUI/11-81 — Habit: Herb

Flowering period: June-October — Local Name: Tarokay

Part Used: Whole plant — Trade Name: Chutrica

Locality: Kharkarai — Status: Common

Indigenous uses: Medicinal: Locally leaves are used to enhance digestion and also as cooling agent. Leaves are used as carminative, diuretic, stomachic and flavoring agent.

Other uses: Vegetable and in chutney (enhances digestion).

82) ***Salix babylonica*** Linnaeus — Family: Salicaceae

Voucher specimen No. HIIUI/11-82 — Habit: Tree

Flowering period: February-March | Local Name: Walla

Part Used: Whole tree | Trade Name: Baid-e-Majnoon

Locality: Kharkarai | Status: Common.

Indigenous uses: Medicinal: Leaves are used in fever and as anthelmintic.

Other uses: Fuel wood, cricket bats and light furniture, ornamental. Trees are planted all around the field as mud supporter and to prevent soil erosion.

83) ***Sorbaria tomentosa*** (Lindl.) Rehder | Family: Rosaceae

Voucher specimen No. HIIUI/11-83 | Habit: Shrub

Flowering period: June-July | Local Name: Jijrai

Part Used: Whole plant | Trade Name: Jijri

Locality: Swatai | Status: Common

Indigenous uses: Other uses: Fuel wood, while young shoots are used in making roofs of muddy houses.

84) ***Sarcococca saligna*** (D.Don) Muell. | Family: Buxaceae

Voucher specimen No. HIIUI/11-84 | Habit: Shrub

Flowering period: September-April | Local Name: Ladanrr

Part Used: Leaves | Trade Name: Shangal

Locality: Barabroo | Status: Common

Indigenous uses: Medicinal: Leaves are put in mustard oil and a little heat is given which is applied twice in a day for muscular pain. Leaves infusion are also used for treatment of rheumatism.

Other uses: Fodder and fuel wood, visited by honey bee.

85) ***Silene vulgaris*** (Moench) Garcke | Family: Caryophyllaceae

Voucher specimen No. HIIUI/11-85 | Habit: Herb

Flowering period: June-July

Local Name: Bashka

Part Used: Leaves & shoots, fruits

Trade Name: Barra takla

Locality: Pandarkot

Status: Common

Indigenous uses: Medicinal: Young fresh shoots and leaves are used as a local vegetable for curing stomachache and also used as emollient. Paste made from seeds and leaves are used for whitening of skin.

Other uses: Vegetable.

86) ***Skimmea laureola*** (DC.) Sieb. & Zucc. ex Walp.

Family: Rutaceae

Voucher specimen No. HIIUI/11-86

Habit: Shrub

Flowering period: April-Late June

Local Name: Nazarpanra

Part Used: Leaves

Trade Name: Baru

Locality: Charai top

Status: Common

Indigenous uses: Medicinal: Tea made from its white flowers is given to women during delivery cases and also after meal to cure indigestion. Also considered as an antibacterial.

Other uses: Dried leaves are put on fire to expel evils, evil eyes and also for fragrance.

87) ***Solanum nigrum*** L.

Family: Solanaceae

Voucher specimen No. HIIUI/11-87

Habit: Herb

Flowering period: Throughout the year

Local Name: Karmachu

Part Used: Whole plant

Trade Name: Mako

Locality: Kharkarai

Status: Common

Indigenous uses: Medicinal: Leaves in form of paste is applied to body for treatment of skin diseases while fruit is used against fever. Seeds are used as carminative, tonic and diuretic. Poultice is made from its hot leaves to cure swelling.

Other uses: Vegetable, fodder.

88) ***Spiraea canescens*** D. Don — Family: Rosaceae

Voucher specimen No. HIIUI/11-88 — Habit: Shrub

Flowering period: March-May — Local Name: Spen krachay

Part Used: Whole plant — Status: Common

Locality: Kharkarai

Indigenous uses: Medicinal: Tea made from white flowers which are then given to women during delivery cases.

Other uses: Fodder, visited by honey bee.

89) ***Taxus wallichiana*** (Zucc.)Pilger. — Family: Taxaceae

Voucher specimen No. HIIUI/11-89 — Habit: Tree

Flowering period: February-October — Local Name: Banrraya

Part Used: Aerial parts — Trade Name: Barmi, Thuna

Locality: Charai top — Status: Common

Indigenous uses: Medicinal: Bark is crushed into powder which is taken with a cup of milk daily as antispasmodic and for regulating menstrual cycle in female, leaves are used in bronchial diseases like whooping cough and asthma while fruits are narcotic and antiseptic.

Other uses: Fuel wood, furniture.

90) ***Teucrium stocksianum*** Boiss. — Family: Lamiaceae

Voucher specimen No. HIIUI/11-90 — Habit: Herb

Flowering period: May-September — Local Name: Kwandi botay

Part Used: Whole plant — Trade Name: Kapra

Locality: Charai. — Status: Common

Indigenous uses: Medicinal: Plant leaves are bitter and expectorant. Dried leaves are crushed and decoction is made which is used for curing soar throat. Also used as diuretic and very effective in jaundice.

91) ***Thalicrum falconeri*** Lecoyer. Family: Ranunculaceae

Voucher specimen No. HIIUI/11-91 Habit: Herb

Flowering period: July-August Local Name: Mamera

Part Used: Root Trade Name: Phalijari

Locality: Charai top Status: Common

Indigenous uses: Medicinal: Roots are used as diuretic, tonic and reduce high fever. Also used for eye disorders.

92) ***Thymus linearis*** Benth. Family: Lamiaceae

Voucher specimen No. HIIUI/11-92 Habit: Herb

Flowering period: May-July Local Name: Zangali sperkai

Part Used: Whole plant Trade Name: Ban-ajwain

Locality: Charai top Status: Common

Indigenous uses: Medicinal: At night time elder people prepared a green tea from its leaves and stem, which is taken as a recipe for curing fever, cough and cold. Fruits are also used in cold, cough and digestive troubles.

93) ***Triticum aestivum*** Linn. Family: Poaceae

Voucher specimen No. HIIUI/11-93 Habit: Herb

Flowering period: April-May Local Name: Ghanum

Part Used: Whole plant Trade Name: Kanak

Locality: Swatai Status: Common

Indigenous uses: Medicinal: It is cultivated in the area as a main cereal crop. Grains are roasted in Ghur and used as carminative agent. Flour is fried in Desi ghee and taken with a glass of water for curing diarrhea.

Other uses: Hay is eaten by cattle during winter seasons when there is no fodder available in the area. Similarly women mixed hay with clay plaster as an anticracking agent in muddy houses.

94) ***Ulmus wallichiana*** Planchon. Family: Ulmaceae

Voucher specimen No. HIIUI/11-94 Habit: Tree

Flowering period: March-April Local Name: Kahay

Part Used: Bark Trade Name: Kain

Locality: Swatai Status: Endangered

Indigenous uses: Other uses: Fuel wood.

95) ***Urtica dioca*** Linn. Family: Urticaceae

Voucher specimen No. HIIUI/11-95 Habit: Herb

Flowering period: May-September Local Name: Seezonkay

Part Used: Whole plant Trade Name: Bichu boti

Locality: Charai Status: Common

Indigenous uses: Medicinal: Saag is prepared from plant which is used for curing constipation and also in pulmonary diseases. Locally powder is smoked as cigarette for the treatment of asthma. Leaves are poisonous which causes severe irritation and that can be eased by rubbing leaves of *Rumex*. It can cause allergy also.

Other uses: Fodder which increasing production of milk in cattle.

96) ***Valeriana jatamansi*** Jones. Family: Valerianaceae

Voucher specimen No. HIIUI/11-96 Habit: Herb

Flowering period: March-May

Part Used: Rhizome

Locality: Swatai

Local Name: Shangitai

Trade Name: Mushk-e-bala

Status: Common

Indigenous uses: Medicinal: Rhizome is crushed into powder and mixed in Desi ghee which is used for nervous diseases and also considered as antispasmodic and carminative agent.

Other uses: Visited by honey bee.

97) ***Verbascum thapsus*** Wall. ex DC.

Voucher specimen No. HIIUI/11-97

Flowering period: April-May

Part Used: Whole plant

Locality: Kharkarai

Family: Scrophlariaceae

Habit: Herb

Local Name: Khardag

Trade Name: Jangali thumbako

Status: Common

Indigenous uses: Medicinal: Fresh leaves are cut from plant and mustard oil is mixed with it and put on swelling place of the body as poultice, as it has antibiotic activities. It is also given to cattle for controlling diarrhea and dysentery. Plant flowers are used for curing cough and pulmonary diseases.

Other uses: Visited by honey bee.

98) ***Viburnum grandiflorum*** Wall. ex DC.

Voucher specimen No. HIIUI/11-98

Flowering period: November-June

Part Used: Fruit

Locality: Swatai

Family: Caprifoliaceae

Habit: Tree

Local Name: Asos,Ghozmeva

Trade Name: Guch

Status: Common

Indigenous uses: Medicinal: Fresh and mature fruits are taken for stomach disorders.

Other uses: Fruits plant, fuel wood, fodder and for sheltering in mud made houses.

99) ***Viola serpens*** Wall.ex.Roxb — Family: Violaceae

Voucher specimen No. HIIUI/11-99 — Habit: Herb

Flowering period: November-December — Local Name: Banaqsha

Part Used: Aerial parts — Trade Name: Banafsha

Locality: Chatekal — Status: Endangered

Indigenous uses: Medicinal: Fresh flowers are taken directly for curing sore throat. It is collected for earning cash by the local people because of its high rate in market. Plant is used as anticancer and as carminative agent. Flowers are prescribed by local hakims for the treatment of epilepsy, nervous disorders and also in common colds.

Other uses: Visited by honey bee, ornamental.

100) ***Wikstroemia canescens*** Meissn. — Family: Thymelaeaceae

Voucher specimen No. HIIUI/11-100 — Habit: Shrub

Flowering period: June-September — Local Name: Kathnr

Part Used: Branches — Trade Name: Kathan

Locality: Charai — Status: Common

Indigenous uses: Other uses: Fuel wood while young shoots are used in making roofs of muddy houses.

101) ***Zanthoxylum armatum*** Roxb. — Family: Rutaceae

Voucher specimen No. HIIUI/11-101 — Habit: Shrub

Flowering period: September-November — Local Name: Dambara

Part Used: Seeds, bark & fruit — Trade Name: Timru

Locality: Barabroo — Status: Common

Indigenous uses: Medicinal: Dried fruit is used as carminative which improve digestion and as toothache. Young shoots are used for treatment of gum diseases and making

toothbrushes. Seeds are used as flavoring agent, tonic, used in fever, cholera, and increase saliva secretion. It is also given to cattle for increasing milk production.

Other uses: Fuel wood, fodder and fencing. Seeds are used in "Chutney" while also used as condiments. Sticks are made from its stem which is locally called as "Dambary sotay" for killing snakes and keeps the dogs away.

102) ***Zizypus vulgaris*** L. Family: Rhamnaceae

Voucher specimen No. HIIUI/11-102 Habit: Tree

Flowering period: June-July Local Name: Markhanai

Part Used: Fruit, branches Trade Name: Unnab

Locality: Swatai Status: Common

Indigenous uses: Medicinal: Fruit is edible which is used for the treatment of cough, cold, stomach problems and also serves as cooling agent.

Other uses: Fruit tree, fuel wood, fencing, fodder, and visited by honey bee.

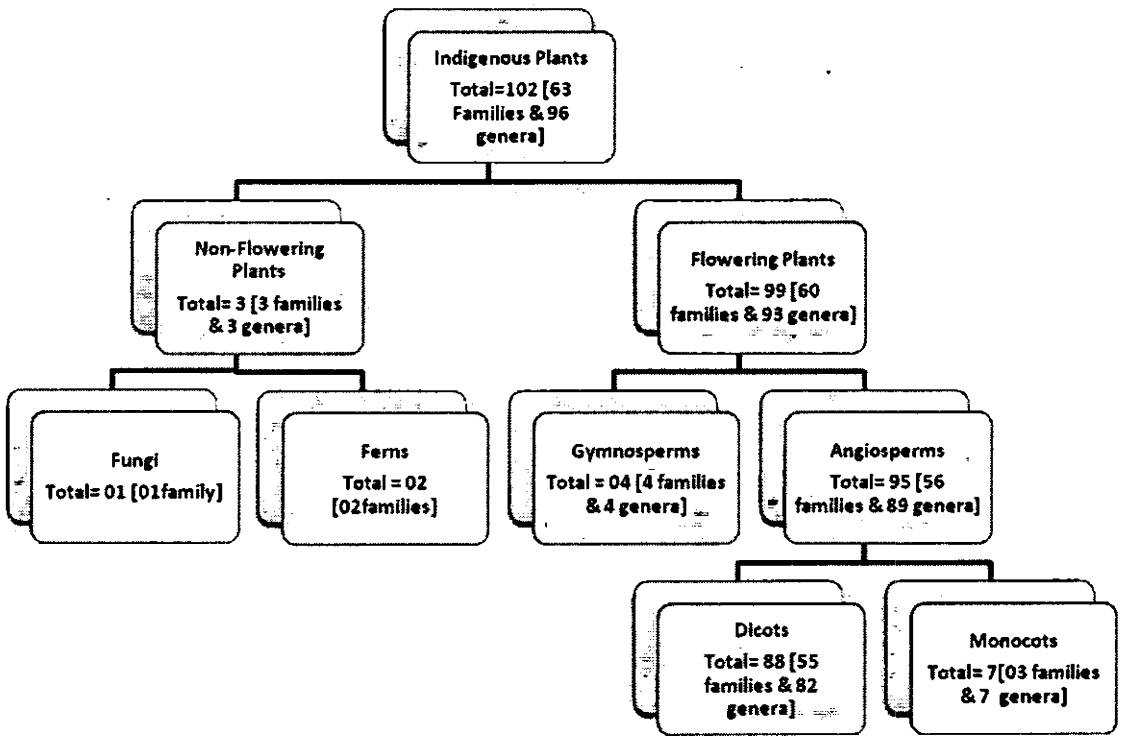

Figure 2: Indigenous Plants Diversity at Biha Valley

Table: 4.1 Summaries of Ethnobotanical uses

S/No	No of Species.	Uses	Percentage
1.	57	Medicinal plants Traded	23.26%
2.	34	Fuel wood plants	13.87%
3.	28	Fodder plants	11.42%
4.	46	Honeybee species	18.77%
5.	22	Fruit yielding Plants.	8.97%
6.	9	Plants used in fencing and hedges	3.67%
7.	17	Plants used in Agricultural tools	6.93%
8.	8	Ornamental plants	3.26%
9.	10	Vegetable/pot herb and spices	4.08%
10.	5	Poisonous plants	2.04%
11.	9	Veterinary medicines	3.67%

Table: 4.2 Indigenous plants used as Fuel wood

S/No	Botanical name	Local name	Family
1	*Aesculus indica*	Jawaz	Hippocastinaceae
2	*Ailanthus altissima*	Bakyana	Simarubaceae
3	*Andrachne cordifolia*	Krachay	Euphorbiaceae

S/No	Botanical name	Local name	Family
4	*Berberis lyceum*	Kwaray	Berberidaceae
5	*Canabis sativa*	Bang	Canabaceae
6	*Celtis australus*	Tagha	Ulmaceae
7	*Cotoneaster microphullus*	Mamanra	Rosaceae
8	*Crataegus oxycantha*	Change	Rosaceae
9	*Daphne macrunata*	Laighonai	Thymeliaceae
10	*Dodounea viscosa*	Ghwaraski	Sapindaceae
11	*Eleagnus umbellate*	Ghulam rangay	Elaeagnaceae
12	*Eucalyptus lanceolata*	Lachi	Myrtaceae
13	*Ficus auriculata*	Inzar meva	Moraceae
14	*Ficus palmata*	Inzar	Moraceae
15	*Indigofera gerardiana*	Ghwareja	Papilionaceae
16	*Justicia adhatoda*	Baiker	Acanthaceae
17	*Melia azedarach*	Tora Bakyana	Meliaceae
18	*Morus alba*	Toot	Moraceae
19	*Parrotia jacquemontiana*	Bairange	Hemamelidaceae
20	*Picea smithia*	Kachar	Pinaceae
21	*Pinus willichiana*	Sraf, Kail, Peoch.	Pinaceae
22	*Platanus orientalis*	Chinar	Platanaceae
23	*Plectranthus barbaratus*	Brootas	Lamiaceae
24	*Punica granatum*	Anangoray	Punicaceae
25	*Quercus dilate*	Tor bang	Fagaceae
26	*Quercus incana*	Tor Banj	Fagaceae
27	*Robinia pseudoacacia*	Keekar	Pappilionaceae
28	*Rubus fruiticosus*	Karwara	Rosaceae
29	*Salix babylonica*	Walla	Salicaceae
30	*Sorbaria tomentosa*	Jijrai	Rosaceae
31	*Sarcococa saligna*	Ladanrr	Buxaceae
32	*Vibernum grandiflorum*	Asos	Caprifoliaceae
33	*Zanthoxylum armatum*	Dambara	Rutaceae
34	*Ziziphus vulgaris*	Markhanai	Rhamnaceae

Table: 4.3 Indigenous Fodder plants

S/No	Botanical name	Local name	Family
1	*Capsella bursa-pastoris*	Bambesa	Brassicaceae
2	*Ailanthus altisisimia*	Backyanra	Simarubaceae
3	*Amaranthus viridis*	Chalwai	Amaranthaceae
4	*Avena sativa*	Jamdaray	Poaceae
5	*Bistorta amplexicaulis*	Anjabar	Polygonaceae
6	*Celtis australis*	Tagha	Ulmaceae
7	*Chenopodium album*	Sarmay	Chenopodiaceae
8	*Cotoneaster microphyllus*	Mamanra	Rosaceae
9	*Cynodon dactylon*	Kabal	Poaceae
10	*Ficus palmate*	Inzar	Moraceae
11	*Fumaria indica*	Papra	Fumariaceae
12	*Indigofera heterantha*	Ghwareja	Papilionaceae
13	*Malva neglecta*	Zangali panerak	Malvaceae
14	*Melia azadirach*	Tora backyanra	Meliaceae
15	*Morus alba*	Toot	Moraceae
16	*Nasturtium officinale*	Talmira	Brassicaceae
17	*Olea ferruginea*	Khona	Oleaceae
18	*Oxalis carniculata*	Tarokay	Oxalidaceae
19	*Pyrus pashia*	Tanga	Rosaceae
20	*Robinia pseudoacacia*	Keekar	Papilionaceae

S/No	Botanical name	Local name	Family
21	*Rubus fruiticosus*	Karwara	Rosaceae
22	*Salix babylonica*	Walla	Saliaceae
23	*Sarcococa saligna*	Ladanrr	Buxaceae
24	*Solanum nigrun*	Karmachu	Solanaceae
25	*Ulmus wallichiana*	Kahay	Ulmaceae
26	*Vibernum grandiflorum*	Asos	Caprifoliaceae
27	*Zanthoxylum armatum*	Dambara	Rutaceae
28	*Zizyphus vulgaris*	Markhanai	Rhamnaceae

Table: 4.4 Indigenous fruit yielding species

S/No	Botanical name	Local name	Family
1	*Berberis lyceum*	Kwaray	Brassicaceae
2	*Celtis australis*	Tagha	Ulmaceae
3	*Daphne mucronata*	Leeghonay	Thymeliaceae
4	*Diospyrus kaki*	Sor amlook	Ebenaceae
5	*Doispyrus lotus*	Tor amlook	Ebenaceae
6	*Eleagnus umbellata*	Ghulam rangay	Elaeagnaceae
7	*Ficus auriculata*	Inzar meva	Moraceae
8	*Ficus palmate*	Inzar	Moraceae
9	*Fragaria vesca*	Zmakay toot	Rosaceae
10	*Juglans regia*	Ghoz	Gujlandaceae
11	*Malus domestica*	Manra	Rosaceae
12	*Morus alba*	Toot	Moraceae
13	*Olea ferruginea*	Khona	Oleaceae
14	*Prunus armeniaca*	Khobanai	Rosaceae
15	*Prunus domestica*	Alocha	Rosaceae
16	*Punica granatum*	Anangoray	Punicaceae
17	*Pyrus pashia*	Tanga	Rosaceae
18	*Quercus incana*	Spen banj	Fagaceae
19	*Rubus fruiticosus*	Karwara	Rosaceae
20	*Solanum nigrum*	Karmachu	Solanaceae
21	*Vibernum grangiflorum*	Asos	Caprifoliaceae
22	*Zizypus vulgaris*	Markhanai	Rhamnaceae

Table: 4.5 Indigenous Honey bee flora of Biha valley

S/No	Botanical name	Local name	Family
1	*Aesculus indica*	Jawaz	Hippocastinaceae
2	*Ailanthus altissimia*	Backyanra	Simarubaceae
3	*Astragalus rustbyi*	Pechpach	Fabaceae
4	*Berberis lyceum*	Kwaray	Berberidaceae
5	*Cannabis sativa*	Bang	Cannabinaceae
6	*Cedrus deodara*	Ranzra	Pinaceae
7	*Coriandrum sativum*	Danyal	Apiaceae
8	*Diospyrus kaki*	Sor amlook	Ebenaceae
9	*Diospyrus lotus*	Tor amlook	Ebenaceae
10	*Eleagnus umbellate*	Ghulam rangay	Elaeagnaceae
11	*Eucalyptus lanceolata*	Lachi	Myrtaceae
12	*Ficus auriculata*	Inzar meva	Moraceae
13	*Ficus palmate*	Inzar	Moraceae
14	*Foeniculum vulgare*	Kagainalay	Apiaceae
15	*Fragaria vesca*	Zmakay toot	Rosaceae
16	*Geranium wallichianum*	Sra zeal	Geraniaceae
17	*Indigofera heterantha*	Ghwareja	Papilionaceae

S/No	Botanical name	Local name	Family
18	*Justasia adhatoda*	Baiker	Acanthaceae
19	*Malus pumila*	Manra	Rosaceae
20	*Melia azadirach*	Tora backyanra	Meliaceae
21	*Mentha longifolia*	Venalai	Lamiaceae
22	*Mentha spicata*	Podina	Lamiaceae
23	*Morus alba*	Toot	Moraceae
24	*Olea ferruginea*	Khona	Oleaceae
25	*Parrotia jacquemontiana*	Bairange	Hemamelideae
26	*Pinus wallichiana*	Sraf, Kail,Peoch	Pinaceae
27	*Plantago lanceolatum*	Jabai	Plantaginaceae
28	*Platanus orientalis*	Chinar	Platanaceae
29	*Plectranthus barbatus*	Brootas, perkai	Lamiacee
30	*Prunus armeniaca*	Khobanai	Rosaceae
31	*Prunus domestica*	Alocha	Rosaceae
32	*Punica granatum*	Anangoray	Punicaceae
33	*Pyrus pashia*	Tanga	Rosaceae
34	*Quercus incana*	Spen banj	Fagaceae
35	*Robinia pseudoacacia*	Keekar	Papilionaceae
36	*Rubus fruiticosus*	Karwara	Rosaceae
37	*Rosa brunonii*	Khorach	Rosaceae
38	*Sarbaria tomentosa*	Jijrai	Rosaceae
39	*Sarcococa saligna*	Ladanrr	Buxaceae
40	*Solanum nigrum*	Karmachu	Solanaceae
41	*Valeriana jatamansi*	Shangetai	Valerianaceae
42	*Verbascum thapsus*	Khardag	Scropulariaceae
43	*Vibernum grandiflorum*	Asos	Caprifoliaceae
44	*Viola serpens*	Banaqsha	Violaceae
45	*Zizyphus vulgaris*	Markhanai	Rhamnaceae
46	*Nerium oleander*	Ghanderai	Apocycaceae

Table: 4.6 Indigenous plants used in making Agricultural appliances

S/No	Botanical name	Local name	Family
1	*Aesculus indica*	Jawaz	Hippacastinaceae
2	*Celtis australis*	Tagha	Ulmaceae
3	*Eucalyptus lanceolata*	Lachi	Myrtinaceae
4	*Juglans regia*	Ghoz	Juglandaceae
5	*Malus pumila*	Manra	Rosaceae
6	*Melia azadirach*	Tora backyanra	Meliaceae
7	*Morus alba*	Toot	Moraceae
8	*Olea ferruginea*	Khona	Oleaceae
9	*Picea smithia*	Kachar	Pinaceae
10	*Pinus willichiana*	Kail, Peoch, Sraf	Pinaceae
11	*Platanus orientalis*	Chinar	Platanaceae
12	*Pyrus pashia*	Tanga	Rosaceae
13	*Quercus dilate*	Tor banj	Fagaceae
14	*Quercus incana*	Spin banj	Fagaceae
15	*Salix babylonica*	Walla	Salicaceae
16	*Taxus baccata*	Banria	Taxaceae
17	*Zizyphus vulgaris*	Markhanai	Rhamnaceae

Table: 4.7 Indigenous Ornamental plants

S/No	Botanical name	Local name	Family
1	*Adiantum capillus-veneris*	Sumbal	Polypodiaceae
2	*Coriandrum sativum*	Danyal	Apiaceae
3	*Daphne micronata*	Leeghonay	Thymeleaceae
4	*Platanus orientalis*	Chinar	Platanaceae
5	*Prunus armeniaca*	Khobanai	Rosaceae
6	*Punica granatum*	Anangoray	Punicaceae
7	*Solanum nigrum*	Karmachu	Solanaceae
8	*Nerium oleander*	Ghanderai	Apocynaceae

Table: 4.8 Indigenous plants used as Vegetable

S/No	Botanical name	Local name	Family
1	*Amaranthus viridis*	Chalwai	Amaranthaceae
2	*Asparagus officinalis*	Tendoray	Liliaceae
3	*Astragalus rustbyi*	Pechpach	Fabaceae
4	*Avena sativa*	Jamdaray	Poaceae
5	*Chenpodium album*	Sarmay	Chenopodiaceae
6	*Cichorium intybus*	Han	Asteraceae
7	*Dryopteris juxtapostia*	Kwanjay	Pteridaceae
8	*Malva neglecta*	Zangali panerak	Malvaceae
9	*Nasturtium officinale*	Talmira	Brassicaceae
10	*Rumex dentatus*	Shalkhay	Polygonaceae

Table: 4.9 Indigenous plants used as Veterinary medicines

S/No	Botanical name	Local name	Family
1	*Coriandrum sativum*	Danyal	Apiaceae
2	*Melia azedirach*	Tora backyanra	Meliaceae
3	*Mentha longifolia*	Venalai	Lamiaceae
4	*Mentha spicata*	Podina	Lamiaceae
5	*Prunus domestica*	Khobanai	Rosaceae
6	*Punica granatum*	Anangory	Punicaceae
7	*Rumex dentatus*	Shalkhay	Polygonaceae
8	*Rumex hastatus*	Tarokay	Polygonaceae
9	*Solanum nigram*	Karmachu	Solanaceae

Table: 4.10 Indigenous Poisonous plants

S/No	Botanical name	Local name	Family
1	*Cannabis sativa*	Bang	Cannabinaceae
2	*Daphne mucronata*	Leeghonay	Thymeliaceae
3	*Euphorbia helioscopia*	Mandanroo	Euphorbiaceae
4	*Polygonum aviculare*	Palpoolak	Polygonaceae
5	*Nerium oleander*	Ghanderai	Apocynaceae

Table: 4.11 Indigenous plants used in Fencing and Hedges

S/No	Botanical name	Local name	Family
1	*Berberis lyceum*	Kwaray	Berberidaceae
2	*Justicia adhatoda*	Bhaiker	Acanthaceae
3	*Quercus diltata*	Tor banj	Fagaceae
4	*Quercus incana*	Spin banj	Fagaceae
5	*Robinia pseudoacacia*	Keekar	Papilionaceae
6	*Rosa brunonii*	Khorach	Rosaceae
7	*Rubus fruiticosus*	Karwara	Rosaceae
8	*Zanthoxylum armatum*	Dambara	Rutaceae
9	*Zizypus vulgaris*	Markhanai	Rhamnaceae

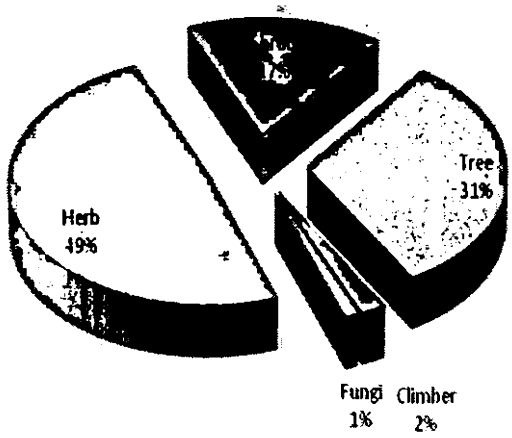

Figure 3: Proportional Representation of life forms

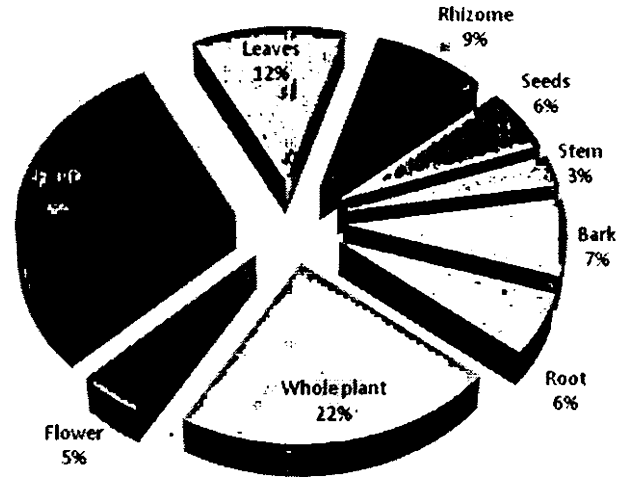

Figure 4: Diversity of Medicinal plant part used

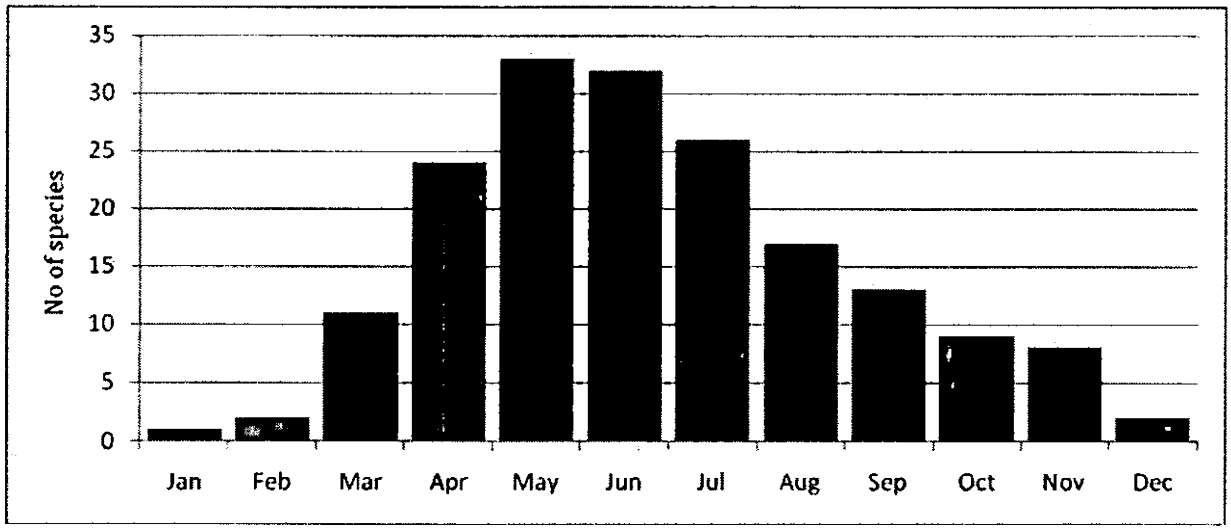

Figure 5: Phenological Variations

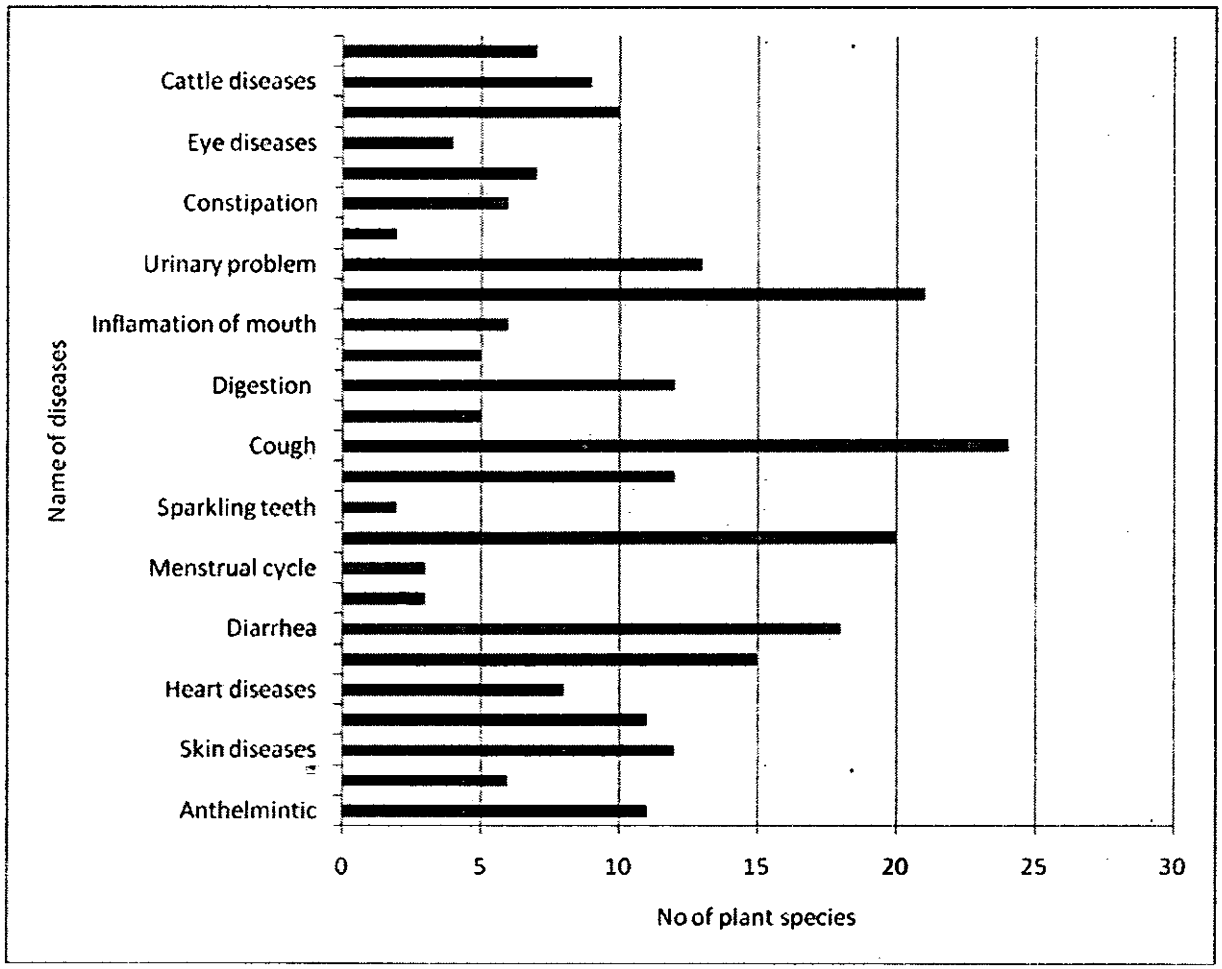

Figure 6: Market Survey of Medicinal Plant

Table 4.12: Extraction of Indigenous Medicinal plants from area

No.	Botanical Name	Local Name	Quantity (Kg)	
			Biha	Mingora
Tree				
1	*Juglans regia*	Ghoz	80,000	2,50,000
2	*Morus alba*	Toot	3,000	8,000
3	*Pistacia integrrima*	Kakar-Singhi.	10,000	50,000
4	*Punica granatum*	Anangoray	80,000	1,90,000
5	*Quercus diltata*	Toor Banj,Beranj	20,000	40,000
6	*Rheum australe*	Chutyal	30,000	70,000
Shrub				
8	*Berberis lycium*	Kwaray	1,00,000	2,00.000
9	*Indigofera heterantha*	Ghwareja	2,000	7,000
10	*Polygonatum verticellatum*	Baramole,noor e alam	5,000	8,000
11	*Rosa moscata*	Khorach,Zangali gulab	2,000	6,000
12	*Skimmia laureola*	Nazarpanra	40,000	1,00,000
13	*Zanthoxylum armatum*	Dambara	20,000	80,000
Herb				
14	*Acorus calamus*	Skha waja	20,000	80,000
15	*Adiantum capillus-veneris*	Sumbal	10,000	70,000
16	*Ajuga bracteosa*	Spina boti,ghra boti	20,000	80,000
17	*Allium sativum*	Oogha	1,00,000	2,70,000
18	*Artemisia maritimia*	Tarkha	10,000	50,000
19	*Berginia ciliata*	Gatpanra	5,000	20,000
20	*Bistorta amplexicaulis*	Torapanra,Anjabar	8,000	15,000
21	*Cichorium intybus*	Hun	3,000	10,000
22	*Coriandrum sativum*	Dhanyal	20,000	80,000
23	*Foeniculum vulgare*	Kagainalay	10,000	50,000
24	*Fumaria indica*	Papra	6,000	20,000
25	*Geranium wallichianum*	Sra zela	9,000	25,000
26	*Hedera nephalensis*	Prewatay,zelai	4,000	8,000
27	*Mentha longifolia*	Venalai	10,000	60,000
28	*Mentha spicata*	Podina	15,000	90,000
29	*Morchella esculanta*	Gujay	2,000	30,000
30	*Paeonia emodi*	Ward,mamekh	10,000	30,000
31	*Plantago lanceolatum*	Jabai	8,000	18,000
32	*Podophylum hexandrum*	Kakora	20,000	40,000
33	*Teucrium stocksianum*	Kwandi botay	25,000	40,000
34	*Thymus linearis*	Zangali sperkai	15,000	40,000
35	*Valeriana jatamansi*	Shangitai	70,000	90,000
36	*Viola serpens*	Banaqsha	30,000	40,000

(Source: Local market Biha & Mingora Bazar Swat).

Table 4.13: Market Value of Indigenous Medicinal plants

No.	Botanical Name	Trade Name	Part Used	Rs/Kg	Biha&Mingora Consumption Kg/Year
Tree					
1	*Juglans regia*	Akhrot	F, L, B.	120	2,50,000
2	*Morus alba*	Bedana	F, W.	200	8,000
3	*Pistacia integrrima*	'Kakar-Singhi'.	WP.	140	50,000
4	*Punica granatum*	Anar	F, S, R.	50	1,90,000
5	*Quercus diltata*	Serai	A, B.	20	40,000
6	*Rheum australe*	Chutial.	R,S , F.	100	70,000
Shrub					
8	*Berberis lycium*	Kashmal	B, Be.	120	2,00.000
9	*Indigofera heterantha*	Kainthi	WP.	40	7,000
10	*Polygonatum verticellatum*	Shakakul	R.	500	8,000
11	*Rosa moscata*	Jangali gulab	F.	80	6,000
12	*Skimmia laureola*	Baru	L.	120	1,00,000
13	*Zanthoxylum armatum*	Timru	S, B, F.	120	80,000
Herb					
14	*Acorus calamus*	Warch	Rh.	160	80,000
15	*Adiantum capillus-veneris*	Persyoshan	WP.	25	70,000
16	*Ajuga bracteosa*	Kauri booti	WP.	30	80,000
17	*Allium sativum*	Lahsan	C.	240	2,70,000
18	*Artemisia maritimia*	Afsanteen	L, F.	60	50,000
19	*Berginia ciliata*	Zakhmi hayat	Rh.	25	20,000
20	*Bistorta amplexicaulis*	Anjabbar	Rh.	120	15,000
21	*Cichorium intybus*	Kasni	R, L.	30	10,000
22	*Coriandrum sativum*	Dhania	F, L.	160	80,000
23	*Foeniculum vulgare*	Sounf	F, L.	220	50,000
24	*Fumaria indica*	Shatara,pitpapra	C.	60	20,000
25	*Geranium wallichianum*	Lijaahri	Rh.	120	25,000
26	*Hedera nephalensis*	Kurie	WP.	30	8,000
27	*Mentha longifolia*	Venalai	WP.	80	60,000
28	*Mentha spicata*	Podina	WP.	80	90,000
29	*Morchella esculanta*	Mantar	WP.	16,000	30,000
30	*Paeonia emodi*	Udsalap	F, T.	40	30,000
31	*Plantago lanceolatum*	Balthanga	L, S.	40	18,000
32	*Podophylum hexandrum*	Bandkakri	F, Rh.	100	40,000
33	*Teucrium stocksianum*	Kapra	WP.	20	40,000
34	*Thymus linearis*	Ban-ajwain	WP.	80	40,000
35	*Valeriana jatamansi*	Mushk-e-bala	Rh.	130	90,000
36	*Viola serpens*	Banafsha	AP.	900	40,000

KEY: R = root, S = stem, L = leaves, F = flower, Fr = fruit, S = seeds, B = bark, T = tuber, Be = berries, A = acorn,

Rh = rhizome, WP = whole plant, W = wood, C = clove, AP = aerial part.

4.2. Conservation Status Assessment of Indigenous Plants traded from Biha valley

An assessment of conservation status of commercially important species found in Biha valley in accordance with IUCN criteria has been presented in table 4.14

Table 4.14: Status of Commercially Important Indigenous species

N0	Botanical Name	Availability	Consumption/Y	Growth Rt	Part Used	Score
Tree						
1	*Juglans regia*	Medium(1)	80,000(0)	Less(0)	F, L, B, R(0)	02
2	*Morus alba*	More(2)	3,000(0)	Less(0)	F, W(0)	08
3	*Pistacia integrrima*	Less (0)	10,000(0)	Less(0)	WP (0)	02
4	*Punica granatum*	More(2)	80,000(0)	Less(0)	F, S(3)	05
5	*Quercus diltata*	More(2)	20,000(2)	Less(0)	A, B(1)	05
Shrub						
6	*Berberis lycium*	More(2)	1,00,000(0)	Medium(1)	B, Be, R(0)	03
7	*Indigofera heterantha*	More(2)	2,000(3)	Medium(1)	WP(0)	06
8	*Polygonatum verticellatum*	Medium(1)	5,000(3)	Medium(1)	R(0)	05
9	*Rosa moscata*	More(2)	2,000(3)	Medium(1)	F(3)	09
10	*Skimmia laureola*	More(2)	40,000(1)	Medium(1)	L(3)	07
11	*Zanthoxylum armatum*	More(2)	20,000(2)	Medium(1)	S, B, F(3)	08
Herb						
12	*Acorus calamus*	Medium(1)	20,000(2)	Medium(1)	Rh(0)	04
13	*Adiantum capillus-veneris*	More(2)	10,000(2)	More(2)	WP(0)	06
14	*Ajuga bracteosa*	Medium(1)	20,000(2)	More(2)	WP(0)	05
15	*Artemisia maritimia*	More(2)	10,000(2)	More(2)	L, F(3)	09
16	*Berginia ciliata*	More(2)	5,000(3)	More(2)	Rh(0)	07
17	*Bistorta amplexicaulis*	More(2)	8,000(3)	More(2)	Rh(0)	07
18	*Cichorium intybus*	More(2)	3,000(3)	More(2)	R, L(0)	07
19	*Fumaria indica*	More(2)	6,000(3)	More(2)	C(3)	10
20	*Geranium wallichianum*	More(2)	9,000(3)	More(2)	Rh(0)	07
21	*Hedera nephalensis*	More(2)	4,000(3)	More(2)	WP(0)	07
22	*Mentha longifolia*	More(2)	10,000(2)	More(2)	WP(0)	06
23	*Mentha spicata*	Medium(1)	15,000(2)	More(2)	WP(0)	05
24	*Morchella esculanta*	Less(0)	2,000(3)	Medium(1)	WP(0)	04
25	*Paeonia emodi*	Medium(1)	10,000(2)	Medium(1)	F, T(0)	04
26	*Plantago lanceolatum*	More(2)	8,000(3)	More(2)	L, S(3)	10
27	*Rheum austral*	More(2)	30,000(1)	Medium(1)	R, S, F(0)	04
28	*Podophylum hexandrum*	Medium(1)	20,000(2)	Medium(1)	F, Rh(0)	04
29	*Teucrium stocksianum*	More(2)	25,000(2)	Less(0)	WP(0)	05
30	*Thymus linearis*	More(2)	15,000(2)	More(2)	WP(0)	06
31	*Valeriana jatamansi*	More(2)	70,000(0)	More(2)	Rh(0)	04
32	*Viola serpens*	Medium(1)	30,000(1)	More(2)	AP, WP(0)	04

KEY: ***Availability***: Less = 0, Medium = 1, More = 2

Consumption/Year: More than 70,000 Kg = 0, From 30,000 -69,000 Kg = 1, From 10,000 -29,000 Kg = 2, Less than 10,000 = 3.

Growth rate: Less = 0, Medium = 1, More = 2.

Part Used: R(0) = root, S(1) = stem, L(3) = leaves, F (3)= flower, Fr (3)= fruit, S(2) = seeds, B(1) = bark, T(0) = tuber, Be(3) = berries, A(1) = acorn, Rh(0) = rhizome, WP (0)= whole plant, W(1) = wood, C(3) = clove, AP (2)= aerial part.

Total Score=0-4=Endangered, 5-8=Vulnerable, 9-12=Rare, 13-14=Infrequent, 15-16=Dominant.

Table 4.15: Average Price per Kg of plants at different market level

No.	Species	Demand	Harvest	Collector rate Rs/Kg	Market rate Rs./Kg		
					Local Market	Whole sale	National Market
Trees							
1.	*Juglans regia*	High	June	100	120	120	175
2.	*Morus alba*	High	September	150	200	120	150
3.	*Pistacia integrrima*	High	June	110	140	130	325
4.	*Punica granatum*	High	August	120	150	150	180
5.	*Quercus diltata*	Low	July	10	20	20	
6.	*Rheum australe*	High	October	80	100	90	100
Shrub							
7.	*Berberis lycium*	High	July	90	120	100	150
8.	*Indigofera heterantha*	Low	June	20	40	30	50
9.	*Polygonatum verticellatum*	High	July	400	500	450	500
10.	*Rosa moscata*	Medium	April	50	80	60	100
11.	*Skimmia laureola*	High	April	100	120	110	150
12.	*Zanthoxylum armatum*	High	June	100	120	110	140
Herb							
13.	*Acorus calamus*	High	Spring	130	160	150	160
14.	*Adiantum capillus-veneris*	Medium	May	20	30	30	100
15.	*Ajuga bracteosa*	High	April	50	80	80	100
16.	*Allium sativum* [1]	High	Winter	220	240	230	250
17.	*Artemisia maritimia*	Medium	July	40	60	50	60
18.	*Berginia ciliata*	Low	June	20	25	25	250
19.	*Bistorta amplexicaulis*	Medium	Autumn	20	35	30	45
20.	*Cichorium intybus*	Low	Spring	20	30	30	60
21.	*Coriandrum sativum* [1]	High	Summer	150	160	120	160
22.	*Foeniculum vulgare* [1]	High	Summer	100	150	120	150
23.	*Fumaria indica*	Medium	May	20	35	30	35
24.	*Geranium wallichianum*	High	July	100	120	110	150
25.	*Hedera nephalensis*	Low	August	20	30	25	50
26.	*Mentha longifolia*	High	April	50	80	60	100

27.	*Mentha spicata*	High	April	50	80	60	100
28.	*Morchella esculanta*	High	April	14000	16000	16000	20,000
29.	*Paeonia emodi*	High	July	30	40	40	50
30.	*Plantago lanceolatum*	Low	August	30	40	40	50
31.	*Podophylum hexandrum*	High	July	70	100	100	400
32.	*Teucrium stocksianum*	Medium	June	10	20	15	30
33.	*Thymus linearis*	High	June	50	80	100	150
34.	*Valeriana jatamansi*	High	July	100	130	120	220
35.	*Viola serpens*	High	April	600	900	700	1000

[1] Cultivated

Table 4.16: Wood smuggling from Biha Valley (Year wise Extraction Tons/Year)

Tree Species	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	Total
Abies pindrow	2.93	7.35	115.60	9.30	14.63	3.41	*	*	*	3.88	157.05
Cedrus deodara	0.70	-	-	-	-	1.82	*	*	*	1.75	4.27
Picea smithiana		-	1.54	7.21	-	1.96	*	*	*	2.80	13.51
Pinus roxburgii	-	-	-	0.66	-	1.38	*	*	*	0.60	2.64
Pinus wallichiana	39.00	8.13	54.54	19.57	32.50	40.11	*	*	*	14.95	208.78
Juglans regia	0.02	0.03	0.25	0.10	0.12	0.03	*	*	*	0.16	0.70
Grand Total	42.64	15.50	171.92	36.84	47.25	48.71	*	*	*	24.13	386.95

* No Extraction due to war on terror, the area has been sealed.
Source: *Matta Forest Range of Swat Forest division.*

4.3 Phytosociological Survey:

Species were stratified into herb, shrub and tree and on the basis of importance value the plant community was established after leading dominants.

Table 4.17: Phytosociological data of plants

No.	Botanical Names	RD	RCC	RF	IV
	Trees				
1	*Aesculus indica*	1.07	4.25	4.29	9.61
2	*Ailanthus altissimia*	0.59	2.32	4.29	7.19
3	*Celtis australis*	2.34	9.27	4.29	15.89
4	*Diospyrus lotus*	1.76	6.95	2.86	11.56
5	*Ficus palmate*	0.1	0.39	1.43	1.91
6	*Juglans regia*	1.76	6.95	5.71	14.42
7	*Melia azadirach*	0.88	3.47	4.29	8.64
8	*Morus alba*	0.1	0.39	1.43	1.91
9	*Olea ferruginea*	0.59	2.32	4.29	7.19
10	*Parrotia jacquemontiana*	2.24	8.88	4.29	15.41
11	*Pinus wallichiana*	2.15	8.49	4.29	14.92
12	*Platanus orientalis*	0.2	0.77	1.43	2.4
13	*Prunus armeniaca*	0.68	2.7	7.14	10.53
14	*Prunus domestica*	0.39	1.54	4.29	6.22

15	*Punica granatum*	0.39	1.54	4.29	6.22
16	*Pyrus communis*	0.49	1.93	2.86	5.28
17	*Pyrus pashia*	0.29	1.16	2.86	4.31
18	*Quercus diltata*	0.39	1.54	1.43	3.36
19	*Robinia pseudoacacia*	0.2	0.77	1.43	2.4
20	*Salix babylonica*	0.88	3.47	2.86	7.21
21	*Vibernum grangiflorum*	1.56	6.18	4.29	12.02
	Shrubs				
22	*Berberis lycium*	2.93	11.58	10	24.51
23	*Cotoneaster microphyllus*	0.2	0.77	2.86	3.82
24	*Indigofera heterantha*	0.2	0.77	2.86	3.82
25	*Plectranthus barbatus*	0.1	0.39	1.43	1.91
26	*Rosa moscata*	0.2	0.77	1.43	2.4
27	*Rubus fruiticosus*	0.2	0.77	1.43	2.4
28	*Sarbaria tomentosa*	1.46	5.79	4.29	11.54
29	*Sarcococa saligna*	0.98	3.86	1.43	6.26
	Herbs				
30	*Ajuga bracteosa*	1.23	1.44	3.45	6.12
31	*Artemisia maritimia*	0.25	0.48	1.72	2.45
32	*Avena sativa*	3.69	3.85	1.72	9.26
33	*Cannabis sativa*	6.63	9.62	3.45	19.7
34	*Capsella bursa-pastoris*	8.6	7.5	6.9	23
35	*Chenopodium album*	2.7	2.4	5.17	10.28
36	*Cynodon dactylon*	4.91	4.33	5.17	14.41
37	*Dryopteris juxtapostia*	1.23	2.4	6.9	10.53
38	*Euphorbia helioscopia*	4.42	4.04	5.17	13.63
39	*Fagonia arabica*	0.49	0.38	3.45	4.32
40	*Fragaria vesca*	1.97	1.44	3.45	6.86
41	*Fumaria indica*	5.9	4.13	6.9	16.93
42	*Lathyrus aphaca*	3.19	3.46	5.17	11.83
43	*Mentha longifolia*	0.74	0.48	1.72	2.94
44	*Mentha spicata*	14.74	7.69	1.72	24.16
45	*Oxalis corniculata*	1.97	2.4	3.45	7.82
46	*Plantago lanceolata*	14.99	15.87	12.07	42.92
47	*Pteridium aquilinum*	0.49	0.96	1.72	3.18
48	*Rumex dentatus*	6.39	9.33	12.07	27.78
49	*Taraxacum officinale*	1.23	0.96	1.72	3.91
50	*Urtica dioca*	3.69	5.77	1.72	11.18
51	*Valeriana jatamansi*	6.14	7.69	1.72	15.56
52	*Viola serpens*	4.42	3.37	3.45	11.24

Key: RD = Relative Density, RCC = Relative Canopy Cover, RF = Relative Frequency, IV = Importance value.

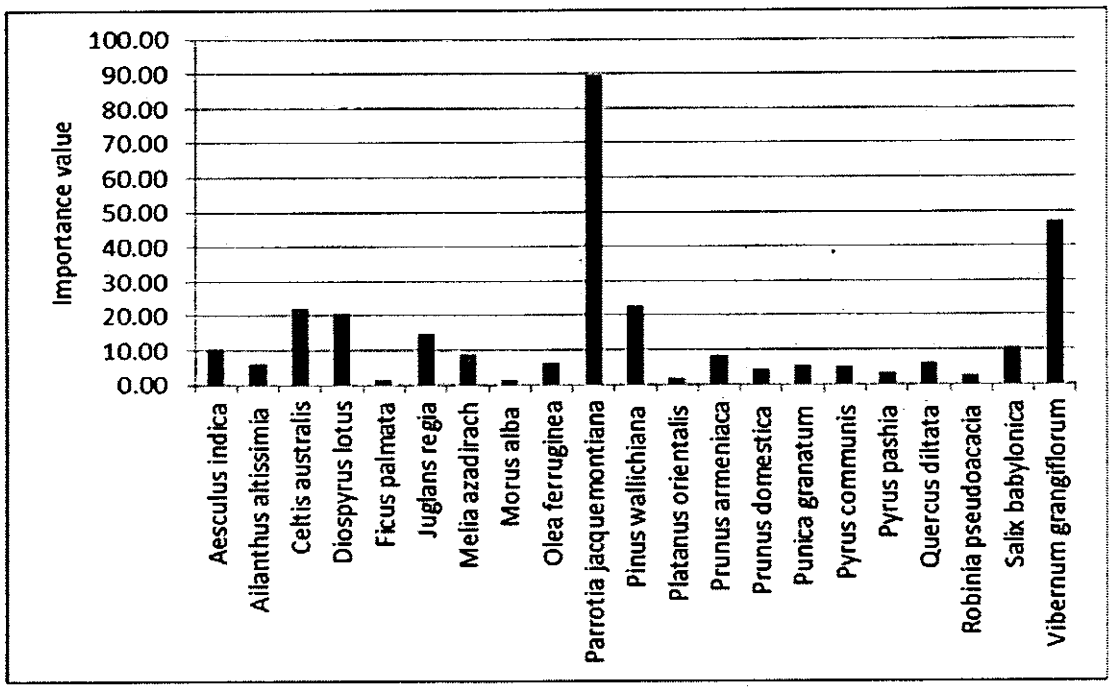

Figure 7: Importance value of Trees

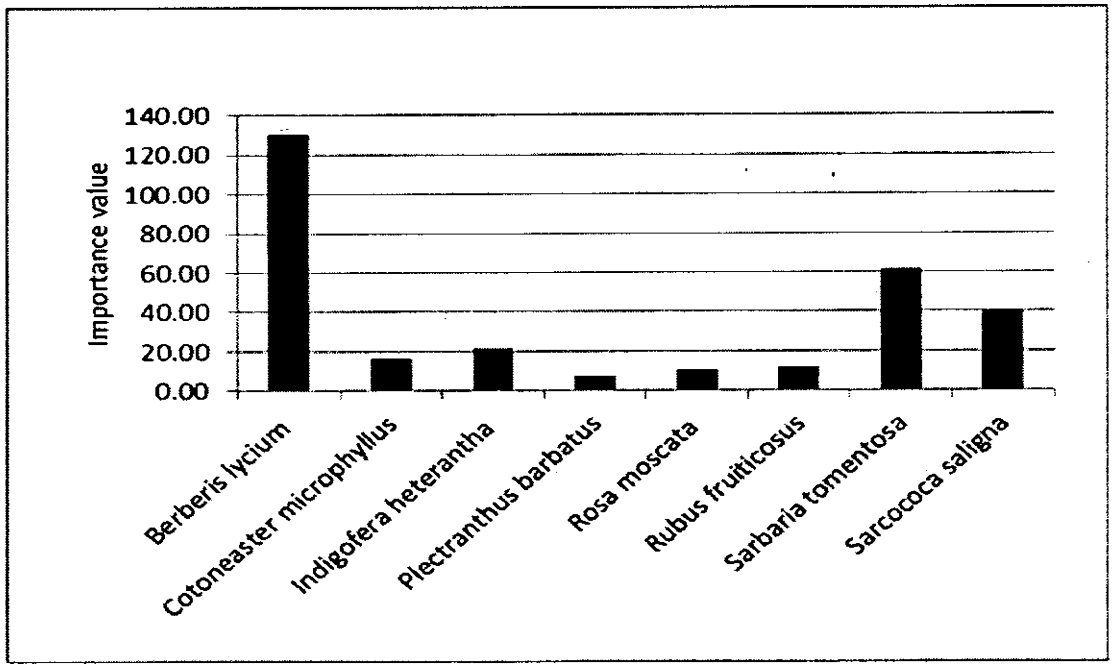

Figure 8: Importance value of Shrubs

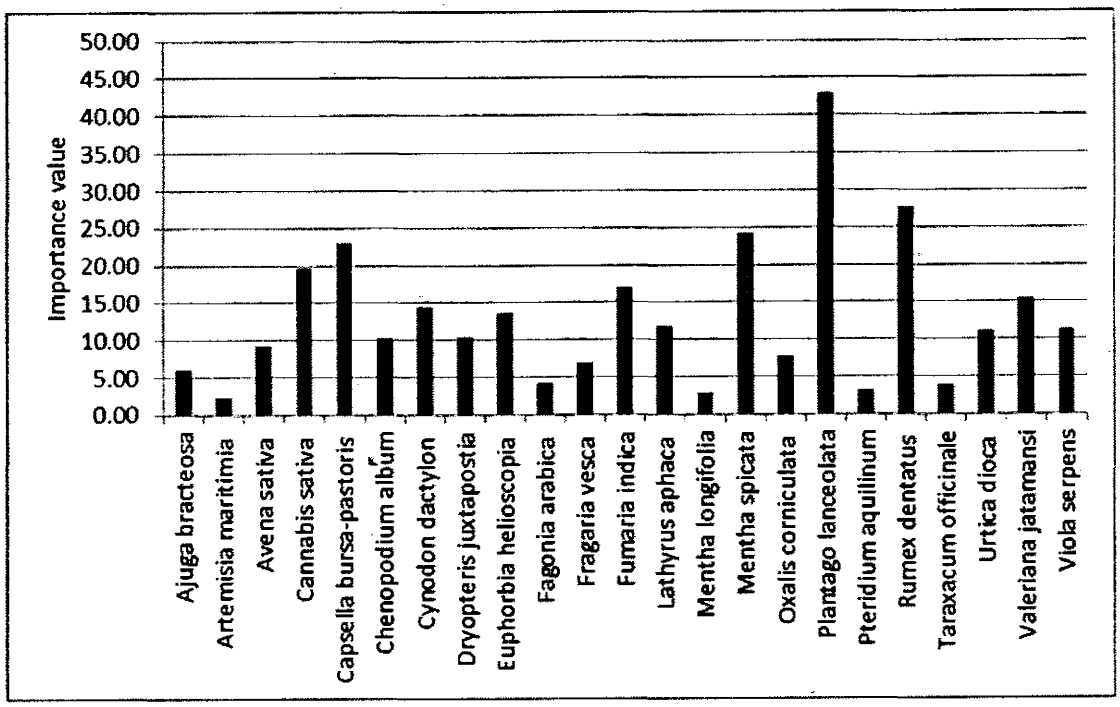

Figure 9: Importance value of Herbs

5. Discussion

In Swat valley, sufficient data has not been found about ethno-botanical resources that needs conservation. However, it is a real fact that one of the most threatened ecosystems is the highland remote areas of Swat valley. It has also been agreed that almost all the forest of valley has been exploited heavily during last two decades including ethno-botanical resources. Previous work of listing threatened species of plants is either fragmentary or out-dated and lying with different NGO's, and various other agencies, which need to be re-evaluated and updated. The use of these earlier lists as a conservation tool is limited by the fact that status of many species remains unclear, particularly of threatened species. It is therefore, very important to have a comprehensive survey of the important vegetation zones like Biha valley of Swat. It will also facilitate to prepare National Red Data Book based on recent IUCN criterion.

Ecological and social changes produced by economic and technological development have laid to a deep transformation of attitudes and values regarding plants (Hynes *et al.*, 1997). Most cultural changes in rural communities are associated with increasing interactions with modern social systems. Consequently, much of the knowledge and use of plant resources, as well as resources themselves, are disappearing in many regions (Berg, 1994; Boom, 1987). Therefore long term conservation of plant resources and the knowledge associated with them is necessary for the benefit of local people and for their potential use by communities at large. As a science of documenting traditional knowledge on the use of plants by indigenous people and assessing human interaction with natural environment, ethnobotany has great potential for contributing to biodiversity conservation in Hindu-Kush-Himalayas.

5.1. Indigenous Knowledge Documentation

For remote areas like Biha valley of Swat, ethnobotanical resources are of great importance in socioeconomic well beings of the people including treatment of various kinds of disorders. Thus systematic documentation of indigenous knowledge about the use of these plant resources by local people and their chemical and biological examination would be useful for the discovery of new therapeutic agents.

Ethnobotanical survey also reveals a rich local knowledge of these indigenous plants resources of Biha valley. About 60% of respondents reported that they prefer herbal treatment by herbalist (Hakim) or self-treatment with locally available medicinal plants. In remote villages Biha valley, where access to modern medicine is limited, traditional healing systems play an integral part in providing healthcare to the local people. The present ethnobotanical survey shows that about 102 plants species (99 indigenous+3cultivated) were found to be of traditional medicinal value. These medicinal species belongs to 63 families and 96 genera (Figure 2). Local people utilize plants as medicines to treat more than 25 ailments. Maximum treatment was found to be given against cough and digestive complaints (c. 23, 21 plants) and fever (c. 20 plants) (Figure 6). Their life forms include 31% trees, 17 shrubs, 49 herbs, 2% climbers and 1% fungi (Figure 3). About 22-28% of the plants were used either in the whole form or in roots form. This triggers the dire need of conserving such ethno-medicinal species through cultivation and regeneration (Figure 4). Maximum Ethnobotanical plant species bloom during April to July (c. 24-33 plants) while least from November to February (c. 7-2 plants). Hence field trips arranged for observation and collection purposes would be beneficial during maximum blooming months (Figure 5). Similarly maximum harvesting pressure has been noted against extraction for trade (22.09%), followed by fuel wood (17.83%) and fodder (11.24%) utilization (Table: 4.1).

5.2. Market Survey

Hindo Kush-Himalayas is one of the major ecological zones from which medicinal plants are collected. It provides most of the country's timber requirements. During last hundred years, these forests have been subjected to major structural changes leading to decrease of about 50% of potential forest areas. Decrease in the forest cover, combined with major changes in community structure has also been responsible for the decline in medicinal plant populations resulting from disturbances of habitats (Siyal, 2003).

During field investigations 32 (Table 4.12) indigenous plants species have been recorded as being extracted from Biha valley which are sold in Mingora city, the gateway through which these plants have been supplied in considerable amount to various national trading centers of Pakistan including Peshawar, Rawalpindi, Quetta, Lahore, Karachi and even abroad.

Analysis of nearest local market (Mingora city) survey revealed that one species (*Morchella esculanta* - Mantar) have maximum price i.e. Rs. 16,000 per Kg, followed by *Viola serpens* and *Polygonatum verticellatum* – Shakakal (Rs. 900 and 500 per Kg) and other species have average price. Data shows that only two species (*Juglans regia-fruit/bark/root*, *Berberis lycium* -root a nd *Punica granatum-fruit/seed*)) have maximum annual consumption i.e 250,000, 200,000 and 190,000 –Kgs per annum followed by *Skimmia laureola* and *Valeriana jatamansi* i.e. 100,000 to 90,000 Kgs per annum and the rest are consumed below (Table 4.13).

Post harvesting processing of material is one of the most important stages in herbal medicines manufacturing. Collectors can add value to their material and make it more acceptable for the conscious buyers, by adopting scientific procedures. Properly packed, clean and good quality herbal material receives higher price in herbal markets. In the international market, especially in European herbal markets, there is a growing demand for originally grown medicinal plants. This certified plant material

receives 3-4 times higher price in the international market. All the selected species collected from wild fulfill the requirements of organic produce, if presented in acceptable form with proper certification. *In-situ* conservation and rotational harvesting is from the natural areas will ensure organic plant materials.

Biha valley is heavily exploited for fuelwood and fodder (herbaceous and from broad-leaved trees). Collectors of fuel wood and fodder are women, hundreds of whom visit valley daily, except in winter. There is also considerable illegal extraction of wood during summer months. It is reported that there is an official system of fees to allow access to collect fuelwood and fodder and to graze stock. Relatively minor items collected by villagers include medicinal plants, food plants and mushroom (*Morchella esculenta* species etc.) which are dried and exported, fetching a high price in European market. There is evidence regarding the extent of collection of indigenous plants. A general survey of the use ethnobotanical resources by local people suggests that the use of indigenous plant is on a small scale and declining, but a detailed study revealed a higher prevalence of medicinal plant use and even some commercial collecting in Biha valley.

5.3. *In-Situ* Conservation Status

Fuel wood and fodder (herbaceous and from broad-leaved trees) have been heavily extracted from Biha valley. The collectors are women and children, hundreds of whom visit forest of the valley for fuel wood and fodder daily, except in winter. There is also considerable release of cattle into the valley during summer months. Other items collected by villagers include medicinal plants, food plants and mushrooms (*Morchella esculenta*) which are dried and exported, fetching a high price in Western market.

According to conservation objectives, unauthorized collection of plant resources, like fuel wood, fodder and medicinal plants, from forest area of Biha valley is undesirable, even then about 386.95 tones of wood have been found extracted illegally during last decade i.e., 2001-2010 except three years of war

against terror in Swat (Table.4.16). However it is found that only small fractions of these cases, perhaps not more than 5 per cent of the actual cases have been registered. The rate is more or less constant and perhaps continues by the same offenders (Matta Forest Range of Swat Forest Division).

With no link between use and responsibility, high and probably ever-growing local demands for fuel wood, fodder and grazing land, it can safely be predicted that the quality of forest will decline unless systems of local resources management are improved. In the long run, there will be no benefits from resource depletion. Fewer resources will be available to the local people and the quality of catchment will deteriorate. This will have serious consequences because poor people in the valley rely on forested area in the area.

The main threats to conservation of medicinal plants in the area are unsustainable harvesting by the local people, illegal collection inside the forests, grazing in high pastures, and collection of pre mature plants and collection of whole underground parts. Previous ecological studies have also revealed vulnerability of important medicinal plants to over harvesting and grazing (Sher, 2010, Humayun, 2007).

5.3.1 Conservation Status Assessment

According to proposed IUCN criteria; out of 42 indigenous plant species regularly extracted for trade, 10 medicinal plants have been found endangered, 19 species were found vulnerable to the Biha valley. The 10 endangered species include two trees i.e., *Juglans regia,* and *Pistacia integrrima* and one shrub *Berberis lycium.* Herbaceous species that were found endangered include *Acorus calamus, Paeonia emodi, Podophyllum hexandrum, Rheum austral, Valeriana jatamansi, Viola serpens* and one Mushroom species *Morchella esculanta* (Table 4.14).

The only medicinal shrub found endangered was *Berberis lycium.* Whole plant was found to be used for different pathological disorders. Its cultivation requires further study. It is usually grown from seed

while vegetative propagation needs study. Its fruit was collected by men, women and children for domestic use and often eaten on the spot. Wild fruit was collected by grazers in the forest. Occasionally, small quantities appear on local market. The demand is high and supply is medium. Study of genetic diversity has been required to be undertaken. Its cultivation can be recommended as live hedges (Shinwari & Shinwari, 2006).

Paeonia emodi is being used in the treatment of rheumatic pain and backache. Its demand is high while supply is low. The germplasm evaluation reported to be crucial, especially in relation to rhizome production and time of harvest. Cultivation of plant as crop under shade is needed. This species prefers to grow in sandy loam and loamy silt soil having slightly acidic properties (Sher, 2002).

Population of *Podophyllum hexandrum* is small in size. It is also over exploited in high altitude Himalayas at its natural stands (Choudhary, *et al.*, 1998). Natural populations of *P. hexandrum* have also been decreasing since 1982 in Garhwal Himalaya (Bhadula *et al.*, 1996). It has been propagated from seeds and rhizome parts. There is an urgent need for sampling evaluation. Demand of plant is high and supply is low. In research, priority should be given to its germplasm exploration, cultivation, regional trials, harvest time reduction (Shinwari & Shinwari, 2006).

Valeriana jatamansi rhizomes and roots are found to be used as mild sedative, in leprosy and as a tonic. The same has also been reported as endangered from Nepal (Bhattarai, 1996). Cultivation and propagation's known but requires further study. Its demand is very high and supply is low. Germplasm evaluation is crucial, especially in relation to rhizome production and time of harvest.

5.3.2. Phytosociological Survey:

A total of 52 plants species were found in the area among which 21 were trees, 8 were shrubs and 23 were herbaceous plants. The study area vegetation has tremendous variations due to changes in altitude and climate. Flora has been divided into trees, shrubs and herbs and 10 quadrates each having size 10 x

10 meters for trees and shrubs and 1 x 1 m quadrates for herbs were taken randomly at different spots in the area.

Many medicinal and aromatic plants are present in the research area but the amount is decreasing day by day due to anthropogenic activities like deforestation, over grazing, unplanned urbanization and unauthorized collection. However distribution of these plants was quite different. A total of 102 plants have been identified in the area but for quadrates sampling only 52 plant species have been reported. From the selected plants *Parrotia jacquemontiana, Berberis lyceum* and *Plantago lanceolata* were present abundantly in the area. *Ficus palmata, Morus alba, Plectranthus barbatus* and *Mentha longifolia* were recorded in few spots, while *Dryopteris juxtapostia, Viola serpens* were restricted to moist and shady places.

The analysis of vegetation under discussion revealed that above species which are found rarely in the area are very sensitive to graving, harvesting and deforestation, thus need to be conserved. Secondly, those people who are involved in collection and marketing of these medicinal plants should be educated that how to manage the vulnerable habitats from where they collect these useful plants and hence increase their daily income.

5.4. Conservation Applications

5.4.1. Limitations in Cultivation

There are certain limitations in cultivation of medicinal plants. In terms of economic feasibility the first step is to conduct cultivation trials of medicinal plant if they would provide reasonable and additional income to the growers. Drug crops cannot compete in income with major food or cash crops. Planting, cultivation or harvesting of medicinal plant crops requires a relatively large investment in human labor and therefore growing them is often not economically feasible. However, some special crops like Cardamom, Clove, Cinnamon etc., come to the markets from regions where climatic conditions are

favorable for their growth and cost of production is also low. Diseases and pests that effect drug crops are as diverse as those that affect other crops. Viruses, wilts, leaf spots, root diseases and others as well insect pests are common among drug and condiment plants. Diseases and pests must be recognized and method of control worked out. Marketing of medicinal plant crude products is another problem, which restrict their cultivation on large scale. There are only a few drug dealers who monopolize the market and there are genuine difficulties faced by the farmers in disposing off their products at reasonable rates (Shinwari & Shinwari, 2006).

In addition to loss of markets, benefits and other conservation incentives for local collectors, cultivation of threatened medicinal plant as a conservation measure also has some other disadvantages, such as the limited range of genotypes selected for cultivation. Separate measures to protect wild populations and wild relatives for evolution and adaptation might be required. Higher cost of research, development and production make it likely that all about a few of the more valuable medicinal plant species will continue to be collected from wild. All wild plant species can not be cultivated. Hence cultivation does not necessarily reduce harvest pressure on all wild populations (Leamaan, 1998).

However, it has been recommended that small scale cultivation by local collectors combined with research on plant ecology required to determine sustainable wild harvest levels and methods for a targeted species will be a better approach for conservation (Pinhiero, 1997).

5.4.2. Conservation through Community Participation

Building on local knowledge and involving local people in conservation and development schemes is a new paradigm which has brought many changes in development and conservation approaches over the last decade (Aumeeruddy, 1997). Among all other forest products, medicinal plants from Himalayan regions are most threatened in this context. Yield of community base approaches for conservation and use of medicinal plants in the Himalayan region is new and requires even more attention today as trade

has increased dramatically. This issue is of major importance not only from a global view point but also in term of livelihood of people living in the areas where these plants originate.

For an effective resource base management through community participation it is important that the resource must have some social and economic value to the community. Communities must also be aware that the resource is in short supply and vulnerable to over exploitation. It is important to ensure that the benefits of resources are equitably shared with communities; sense of ownership can only be generated when community at large sees the benefits coming from resource. Appealing to the communities' social conscience regarding proper use of their natural resources will not be very effective. If monetary value of species can be identified and developed as a managed enterprise for local communities this will create the desired awareness into which interest can be built for the wider enhancement of conservation (Shinwari & Shinwari, 2006).

Forest management through participatory approach recently gained popularity among rural communities in the country. It is spreading its roots gradually in hilly areas of the country. Management efforts are directed to increase productivity of degraded forest and forest products through active involvement of local communities in harvesting, marketing and benefit sharing etc. The inhabitants of hilly areas are poor and depend on non-profitable agriculture and forestry operations.

5.4.3. Conservation through Sustainable Utilization

It is general rule that the effectiveness of herbal medicines depends on chemical constituents present in plant parts. These active constituents are often thermally prone to air and light induced degradation. Microbial and insect infestation of a crude material not only degrades the chemical ingredients but also introduce toxin into the materials. Wrong time and season of collection, adulteration, garbling and poor drying and storage also adversely affect the active constituents. Preserving the optimal quantities of

active chemical ingredients in herbal medicines is one of the major requirements of end users, including herbal pharmaceutical companies and exporters.

Limiting the harvest to a sustainable level is complicated by the conflict of interests between use and protection. It requires an effective management system and sound scientific information. Development of management strategy should include; the assessment of population abundance and distribution; biological studies (growth and regeneration rates, pollination system, seed dispersal, etc); assessment of tenure and access; potential for confusion with similar species; local knowledge and harvest practices; impact of harvest on viability of individuals; yield and market studies; and assessment of regional and global threat based on all available knowledge and expertise (Schippmann, 1997; FAO, 1995).

The management system should include annual harvest quotas; seasonal restrictions; geographical restrictions; restricted harvest of particular plant part or size classes; and continuos monitoring and evaluation of conservation status (Shinwari & Shinwari, 2006).

5.4.4. Harvesting Techniques

There is an optimal time for the collection of plants depending upon their phenology. Optimal timings have a direct link with the part of plant used. There exists a clear relationship between the time of harvesting and impact on plant regeneration and the amount and nature of active chemical constituents present in the plants, which are not constant throughout the year and throughout their lifecycle. Each part of a plant contains different chemical components; therefore collection of incorrect part for a specific purpose will result in a wrong outcome. Rhizomatous plants like; *Paeonia emodi*, *Podophyllum hexandrum* and *Valeriana jatamansi* are harvested by local people in summer and during this period the plant utilizes root chemistry and nutrition for the development of aerial parts especially to produce better reproductive growth (i.e., to give fruits and seeds). This wrong time of collection results in depletion of active chemical constituents and also affects the potential of their sustainability.

Biologically speaking the rhizomes of all these species should be collected / harvested when plant become dormant i.e. in winter or before sprouting i.e. early spring (November to April). During this period the plant converts nutritional chemistry of aerial parts (leaves, stem) into alkaloidal contents and store in roots. Therefore, plant contains maximum percentage of active ingredients in their roots/ rhizomes (Shinwari & Shinwari, 2006).

Poor harvesting techniques often exacerbate the threat to medicinal plant species by causing unnecessary levels of damage. For example, uprooting of plant to use only the aerial parts can cause severe depletion of population levels of species. Similarly, collection of large portions of bark of a tree may lead to plant death.

5.4.5. Post Harvest or Processing Techniques

After collection, drying is the net technical step as part of processing. Incorrect drying may lead to loss of valuable constituents. Proper drying helps in preservation and fixation of active constituents. Presently the inhabitants of valleys dry all plant material in sunlight. The local no proper place for drying and they spread plant material on open floor, where these are contaminated by dust particles and some pathogenic agents. This incorrect drying of plant material may also lead to loss of valuable constituents (Shinwari & Shinwari, 2006).

It is important to understand that the real wealth lies in scientific processing (extraction, standardization, quality control and proper packing) and marketing of herbal material, and not just in collection and cultivation. It is therefore important that small-centralized processing units should be established in the areas where ethnobotanical resources are abundant.

6. Conclusion and Recommendations

6.1. Conclusion

During present study it was observed that ethnobotanical resources at Biha valley are severally affected by year-round continuous grazing by livestock of local communities. Grazing pressure increases during summer season. There is a lot of pressure on plant species in trade from the valley. Cultivation removes pressure from wild habitats. It also has health benefits, as it enables a higher degree of standardization. It makes easier to avoid mistakes in identification and to combat adulteration. Plant conservationists should join and help to create programmes on conservation and supply of medicinal plants, with emphasis on encouraging cultivation and processing. To prevent medicinal and other plants of socioeconomic value from becoming extinct, conservationists will have to embrace this agenda of encouraging cultivation as a form of rural development. This is also important because local consumers, industries and exporters are crazy for more herbal ingredients and such demand is likely to soar while supplies of raw material from wild sources of medicinal and other plants are rapidly shrinking.

The area has a great potential of Eco-tourism. This valley has habitat favourable for endangered medicinal and economic plants. Sustainable development of the precious natural resources is highly recommended.

6.2. Recommendations

The following recommendations have been suggested for future consideration towards ethnobotanical resource conservation in the study area:

1. Over increasing population has always adversely affected the natural environment. All efforts for development would be futile if population increases at the present rate. Detailed research on population dynamics verses biodiversity loss and conservation should be undertaken.

2. Habitat loss is a single largest contributing factor for the loss of various species. Protect the habitat, species will protect themselves. Let the species grow themselves without any interference.

3. Measures should be adopted to provide facilities for research on indigenous plants that are declared as endangered/ vulnerable/ threatened. Proper legislation must be developed to protect these species of critical concerns. Seed banks for important endangered/ vulnerable/ threatened species should be established. Priorities may also be determined about which species should be conserved first.

4. Methods should be adopted for recovery of endangered/ vulnerable/ threatened plant species. However, programmes for reintroduction of species in the wild should be carefully handled because each species has its own priorities and requirements for growth and rehabilitation.

5. Medicinal plants are rich ethnobotanical resource base of Biha valley. Efforts should be made for the conservation of medicinal plants *in situ*. For *ex-situ* conservation, nurseries should be made within the valley to cultivate medicinal plants under same environmental conditions. Concrete measures should be taken for formulating policies that regulate trade practices, the promotion of innovative conservation and sustainable utilization of medicinal plants.

6. Ethnobotanical studies of various traditional indigenous plant species already undertaken must be utilized to make a Biodiversity management plan for the valley. Respect should be given, to maintain the knowledge and practices of local communities and must be preserved. Biodiversity management plan need to be initiated at the gross root level and built upon the traditional knowledge of local communities.

7. A crash programme is required to have sufficient trained manpower (Plant Taxonomists and Ecologists/Ethnobotanists) to obtain further scientifically accurate data.

8. An eco-tourism plan should be developed. This plan should take in to account the result of biodiversity surveys. It is important that no ecotourism plan, be initiated, before the biodiversity studies are completed and carefully evaluated by the experts.

9. Government should provide inhabitants with all the basic requirements of life so that they might not entirely depend upon the natural sources for their livelihood. Alternate sources and substitutes must be provided to the local communities.

10. Overgrazing, lopping and browsing of vegetation can be controlled or reduced on large scale by rotational grazing practice. In this way threatened species will have a chance for survival.

11. Expansion of agricultural spots on steep mountains, black marketing and smuggling of timber and seasonal colonies/grazing camps should be discouraged.

12. Before growing any plantation in bare areas, microhabitat of the localities should be thoroughly studied and judicious selection of species should be made.

13. Young men and women can play an effective role in creating awareness about deforestation and degradation of vegetation caused by ill planned a forestation.

14. Community mobilization is the need of an hour. It should have been started prior to this survey. A social scientist/ethnobotanist may be involved for this purpose. For effective conservation local communities must be involved.

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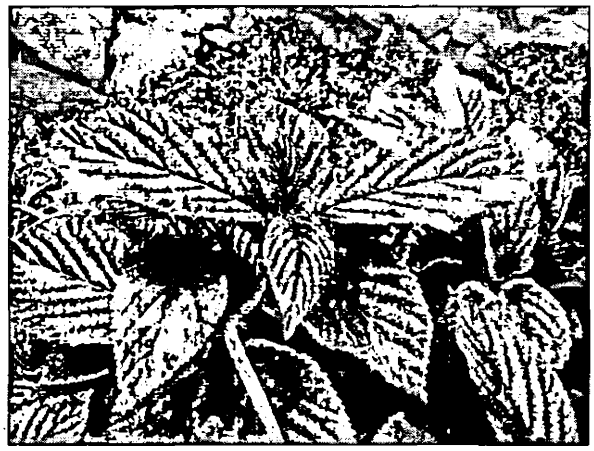
Appendices

Appendix 1: Plates

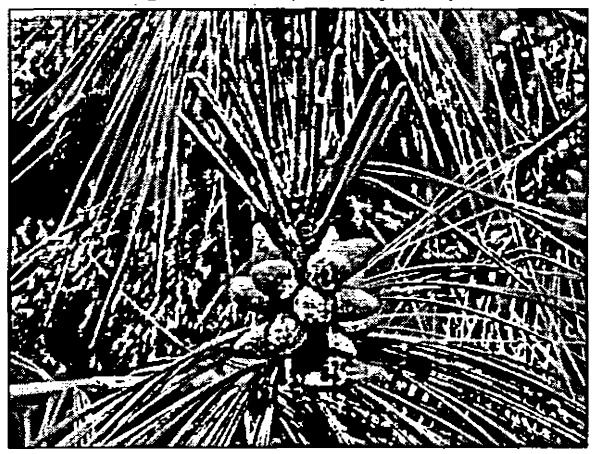
Plate 2: Indigenous plant species diversity in Biha valley

Juglans regia (Ghoz)

Fragaria vesca (Zmakay toot)



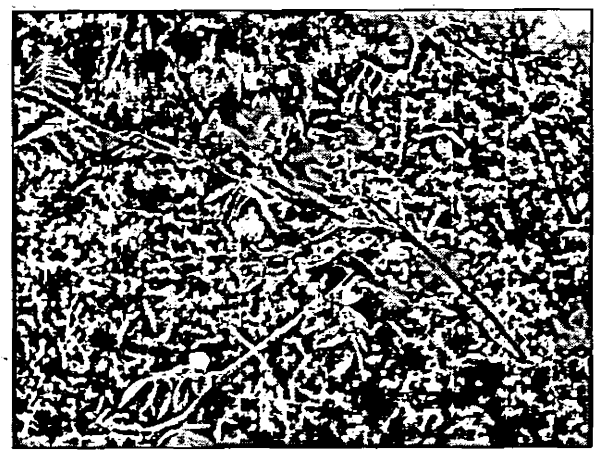
Vibernum grangiflorum (Asos)



Pinus wallichiana (Peoch,Kail)

Valeriana jatamansi (Shangitai)

Astragalus anisacanthus (Pechpach)



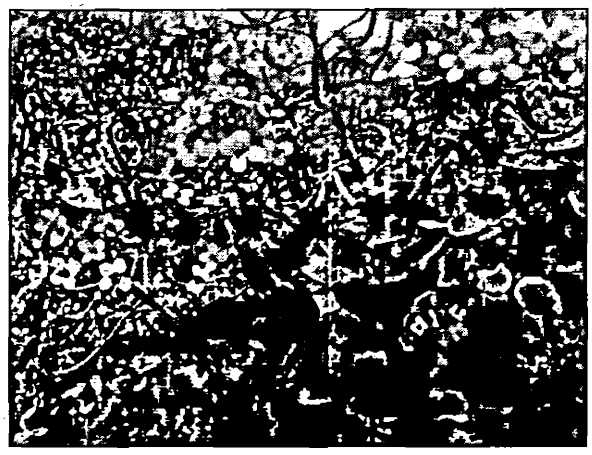
Indigofera heterantha (Ghwareja)

Olea ferruginea (Khona)

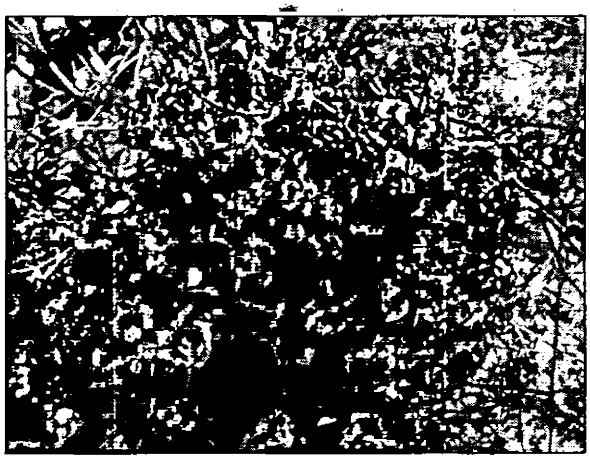
Justicia adhatoda (Bhaiker)

Punica granatum (Anangoray)

Fumaria indica (Papra)

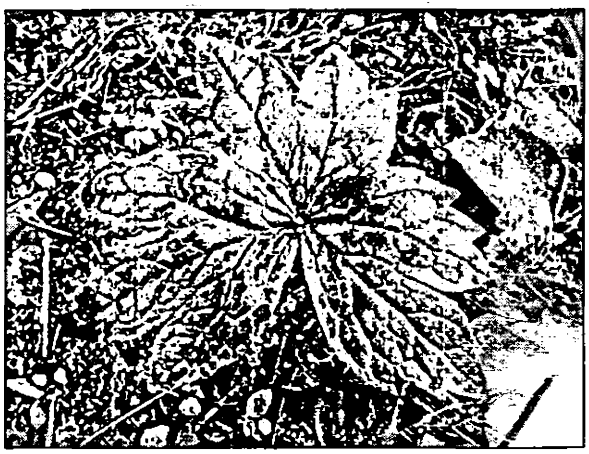


Nasturtum Officinale (Talmira)



Rumex histatus **(Tarokay)**

Berginia ciliata **(Gatpanra)**



Podophylum hexandrum **(Kakora)**

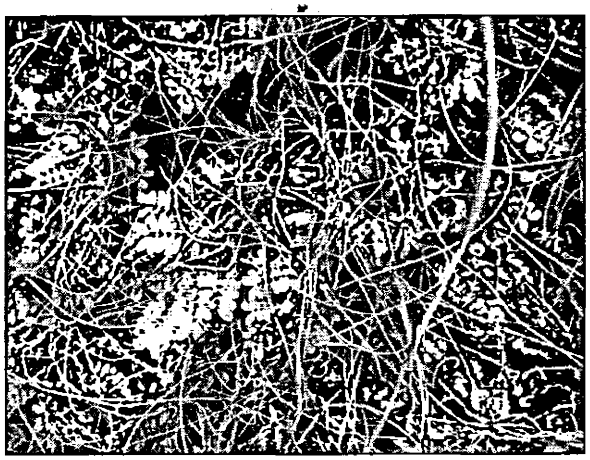
Paeonia emodi **(Ward,Mamekh)**

Malva neglecta **(Zangali panerak)**

Nerium oleander **(Ghanderai)**

Ajuga bracteosa (Spina boti,Ghra boti)

Solanum nigrum (Karmachu)

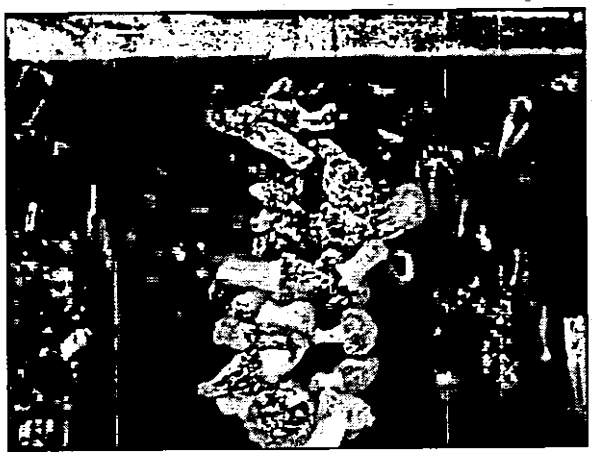


Cuscuta reflexa (Maraz botay)

Diospyrus kaki (Sor amlook)

Hedera nephalensis (Prewatay,Zelai)

Quercus diltata (Toor Banj)

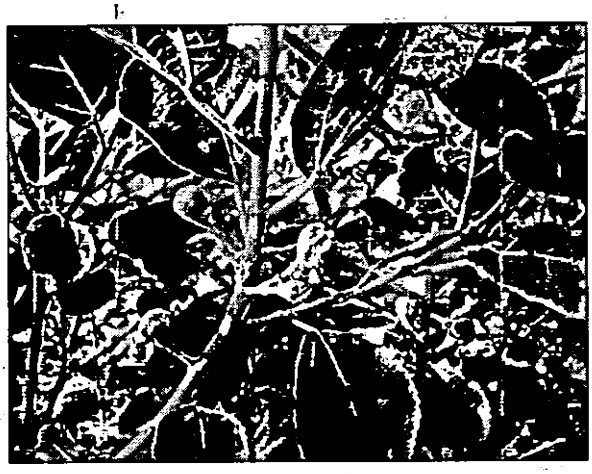


Morchella esculanta (Gujay)

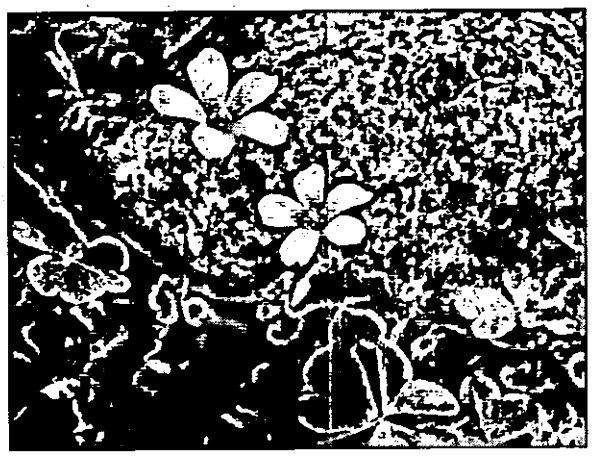
Robinia pseudoacacia (Keekar)

Ajuga parviflora (Sam Boti,Sra Boti)

Rubus fruiticosus (Karwara)



Ficus palmate (Inzar)



Oxalis corniculata (Tarokay)

Appendix 2: Questionnare for Documentation of Ethnobotanical Knowledge about Fodder/ Feul wood Medicinal and Miscellanous Plants

Locality of the Medicinal Plants collection site: ----------

Date: ----------

Name of the collector: ----------

Age of the collector: ----------

Education level of the collector: ----------

Local name of the plant species collected: ----------

Scientific name of the species collected: ----------

Habitat of the species collected: ----------

Uses of the plant species: ----------

Quantity harvested per day/month/year: ----------

Who collects the plant (Child/Woman/Man):----------

Why? ----------

Is it sold? ----------

Quantity sold per day/month/year: ----------

To whom is it sold? ----------

Price/Kg: ----------

Is the plant perceived by the informant to be abundant/common/rare? ----------

Changes in abundance of the plant for the last 10 years (more abundant/same/rare) ----------

Are methods used to regenerate or other wise actively manages the plant? ----------

What? ----------

What kinds of tools are being used for harvesting? ----------

What kinds of traditional methods are being used for the processing of medicinal plants after harvesting?

Are these traditional methods bringing good results? Yes/No----------

If, No. Then what are the problems faced in this regard? ----------

Appendix 3: Questionnare for Local Drug Market Survey

Name of the person doing Medicinal Plants business: ----------

Age: ----------

Name of business: ----------

Locality: ----------

Date: ----------

Type of business: Permanent/Temporary/Ambulatory----------

Percentage of people in the area doing medicinal plant business: ----------

What is the trend of the Medicinal Plant business? Increasing/Same/Decreasing----------

Local/Trade Name of the plant traded: ----------

Geographical name of the source area (village):----------

Vegetation: ----------

Plant part used: ----------

Cultivated status: Cultivated/Managed/Wild----------

Who collects? Yourself/People/Traders----------

Condition of the plant: Fresh/Dried/Preserved----------

Amount obtained/Year----------

Name of other ingredients: ----------

Purchase/Sale price (price/unit) ----------

Brought to the Market: Daily/Weekly/On occasion----------

Estimated quantity: Per business man----------/Whole market----------

Availability: Jan. to Dec. ----------

How much sold now compared to the past: More/Same/Less----------

Why? Less available for harvest/ less depend by buyers/Any other reason----------

What are problems faced by you in this business----------