ASSESSMENT OF INDIGENOUS MEDICINAL PLANTS, DIVERSITY AND THEIR HABITATS WITH REFERENCE TO CONSERVATION IN CHIKAR, AZAD JAMMU & KASHMIR, PAKISTAN

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Dedicated to
My Beloved Parents
&
Leelu

(Acceptance by the Viva Voce Committee)

Title of the Thesis: ASSESSMENT OF INDIGENOUS MEDICINAL PLANTS, DIVERSITY AND THEIR HABITATS WITH REFERENCE TO CONSERVATION IN CHIKAR, AZAD JAMMU & KASHMIR, PAKISTAN

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Declaration

I Jamshaid Rashid (16-FBAS\MSES\S08), Student of MS in Environmental Science (Session 2008-10), hereby declare that the matter printed in the Thesis titled "Assessment of Indigenous Medicinal Plants, Diversity And Their Habitats with Reference to Conservation in Chikar, Azad Jammu & Kashmir, Pakistan" is my own work and has not been published or submitted as research work or thesis in any form in any other university or institute of Pakistan or abroad.

Dated: 04-07-2012

Signature of Deponent

Jamshaid Rashid

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With the name of "Allah Almighty" the most merciful and beneficent, all admiration to Allah who made all things possible that I wanted to do in my life. He has given me strength to complete this manuscript. After Allah Almighty, I also pay modest respect to our last prophet Hazrat Mohammad (peace be upon him) who is a source of inspiration for entire humanity.

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It's my fortune to appreciatively acknowledge the support of some special individuals in my life. Words fail me to express my appreciation to them all. May God bless them with good health and long life! (Ameen).

Jamshaid Rashid

FORWARDING SHEET BY RESEARCH SUPERVISOR

The thesis entitled "Assessment of Indigenous Medicinal Plants, Diversity and their Habitats with Reference to Conservation in Chikar, Azad Jammu & Kashmir, Pakistan" submitted by Mr. Jamshaid Rashid in partial fulfillment of MS degree in Environmental Science has been completed under my guidance and supervision. I am satisfied with the quality of student's research work and allow him to submit the thesis for further process to graduate with Master of Science Degree from Department of Environmental Science, as per IIU rules and Regulations.

Dated: 27.7.2012

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF MEDICAL TERMS

Antibacterial	A compound or material that kills/slows down the bacterial growth
Anti-tussive	Any substance that suppresses cough
Anti-septic	These are anti-microbial materials applied to living tissues or on skin to reduce infections.
Anti-spasmodic	A herb used as muscle spasms suppressor
Anti-phlogistic	Any material or treatment that decreases Inflammation
Anti-rheumatic	A substance that work against rheumatism and rheumatoid disease.
Astringent	An astringent is a substance or chemical compound that have a tendency to contract or tighten body tissues
Carminative	A herb or a herbal preparation that may prevent formation of gas in the gastrointestinal tract or assist in the removal of gas, thereby reduces flatulence
Cholagogue	A cholagogue is a substance that enhances the discharge of bile from body.
Contraceptive	Avoidance of the union of gametes during or after sexual activity
Depurative	Herbs with purifying and detoxifying action

Demulcent	An Herb having high content of mucilage, which helps to relieve and protect inflamed internal body tissues.
Diuretic	A diuretic herb promotes the rate of urination
Emmenagogue	An herb which facilitate blood flow in the pelvis and uterus can also stimulate menstruation
Expectorant	An herb with the property to enhance the amount of secretions for lubricating the irritated respiratory tract
Haemostatic	A substance that stops bleeding.
Narcotic	An herb with sleep-inducing properties
Odontalgic	An herb that reduce pain in or around a tooth.
Sedative	An herb with the property to induces sedation
Stimulant	An herb that induce short-term improvements in either mental or physical function or both.
Styptic	A substance that by contracting tissue helps to seal injured blood vessels
Laxative	A substance that helps loosen the stool and to treat constipation
Vermifuge	Vermifuge is a substance that expels parasitic worms from the body.

ABSTRACT

Indigenous medicinal plants and their threatened habitat at Chikar Azad Jammu and Kashmir area were explored during July 2011 to March 2012. Ethnobotanical knowledge of 82 indigenous medicinal plants species has been documented. In total 38 individuals; 84% males and 16 % women have been interviewed from the area. Observations have been made at the spot by interviewing local people, forest officials and community leaders predesigned through random walks. The vulnerable to harvesting ratio of indigenous plants found in local trade have been calculated. In total 12 indigenous medicinal plant species have been collected for trade from the area out of which 6 medicinal plants have been declared vulnerable to harvesting from Chikar and adjacent area. The vulnerable indigenous species include one tree i.e., *Juglans regia*, a shrub *Berberis lycium* and four herbaceous species include *Aconitum heterophyllum*, *Paeonia emodi*, *Saussurea costus* and one mushroom *Morchella esculanta*. Various threats to natural habitats of medicinal plants have been observed and identified. Drinking water analysed shows positive results and found hygienic for human health and feasible for agriculture. Sustainable harvesting strategy for vulnerable indigenous medicinal plants in trade has been recommended for conservation.

CHAPTER 1

INTRODUCTION

1.1 Azad Jammu and Kashmir

Azad Jammu and Kashmir (AJ&K) occupies an area of 13,297 Km^2 (5,134 $Miles^2$) and it lies between longitude 73^0 - 75^0 and latitude of 33^o - 36^o. Map of Azad Jammu and Kashmir is provided in Figure 1.1. Topographically the area is hilly and mountainous with valleys and stretches of plains. AJ&K is bestowed naturally having thick forests, winding streams, fast flowing rivers that include Jehlum, Neelum and Poonch (Anon, 2011).

1.2 Demography

According to the 1998 population census the state of AJ&K had a population of 2.973 million, which is estimated to have grown to 3.963 million in 2010. Almost all the population includes Muslim community. The Rural to Urban population ratio is 88:12 in AJ&K with population density of 298 persons per Km^2. Literacy rate was estimated to be 55% in 1998 census but now it has been raised to 64%. The infant mortality rate is 56 per 1,000 live births, while the immunization rate for the children under 5 years of age is more than 95% (Anon, 2011).

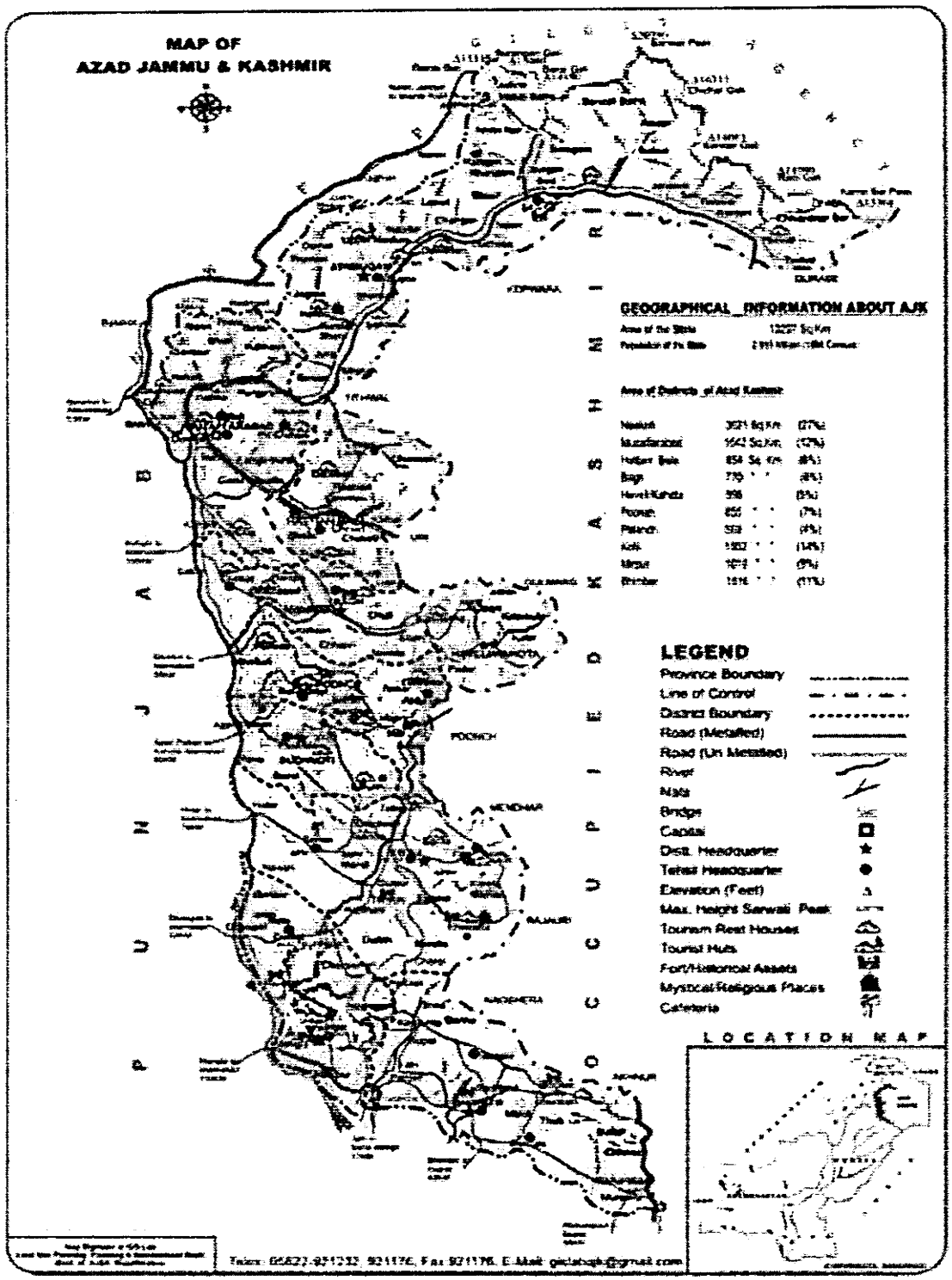


Figure1.1: Map of AJ&K

1.3 Economy

Most of the rural population depends on livestock, agriculture, forestry, and non-formal employment to economize on its subsistence which intern has direct pressure over natural resources. National average per capita income has been estimated to be 1,254 US$. Unemployment in the area ranges from 9.0 to 13%. In comparison to national trends, indicators of social sector especially health and population have not shown much proficiency. However efforts are being made to make up this deficiency change the life style of a common man (Anon, 2011).

1.4 Climate

The climate is sub-tropical to temperate highland type with yearly average rainfall of 1,300 mm. The elevation from sea level ranges from 360 meters in the south to 6,325 meters in the north. The snow line in winter is around 1,200 m above sea level while in summer; it rises to 3,300 m (Anon, 2011).

Average monthly rainfall of Muzaffarabad (Capital of AJ&K) for the year 2011 is provided in Figure 1.2 while Average monthly Temperature of Muzaffarabad (Capital of AJ&K) for the year 2011 is given in Figure 1.3.

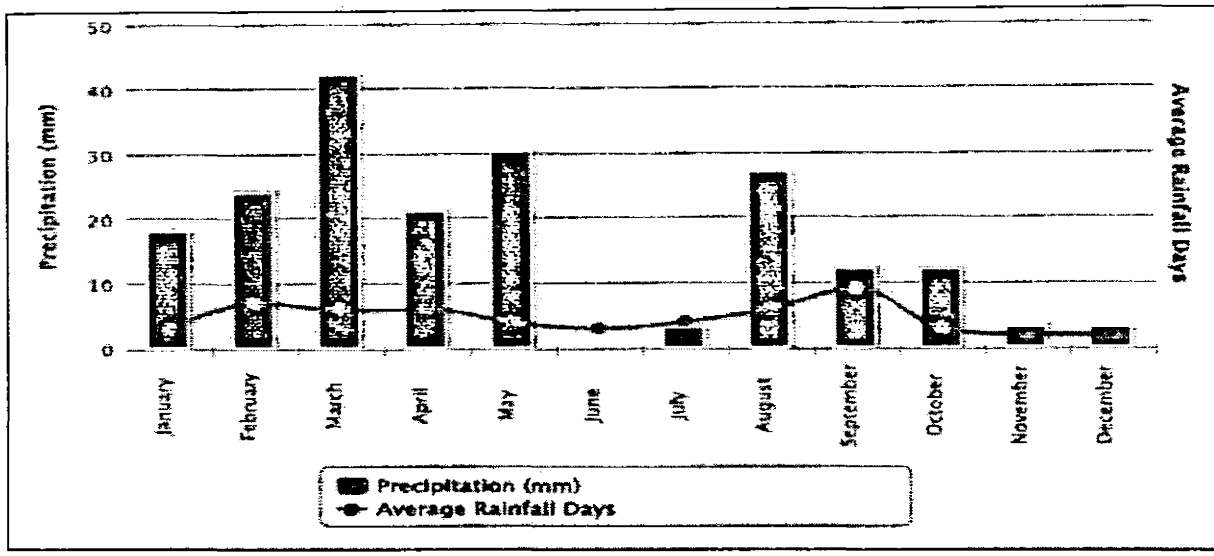


Figure 1.2: Average Monthly Rainfall

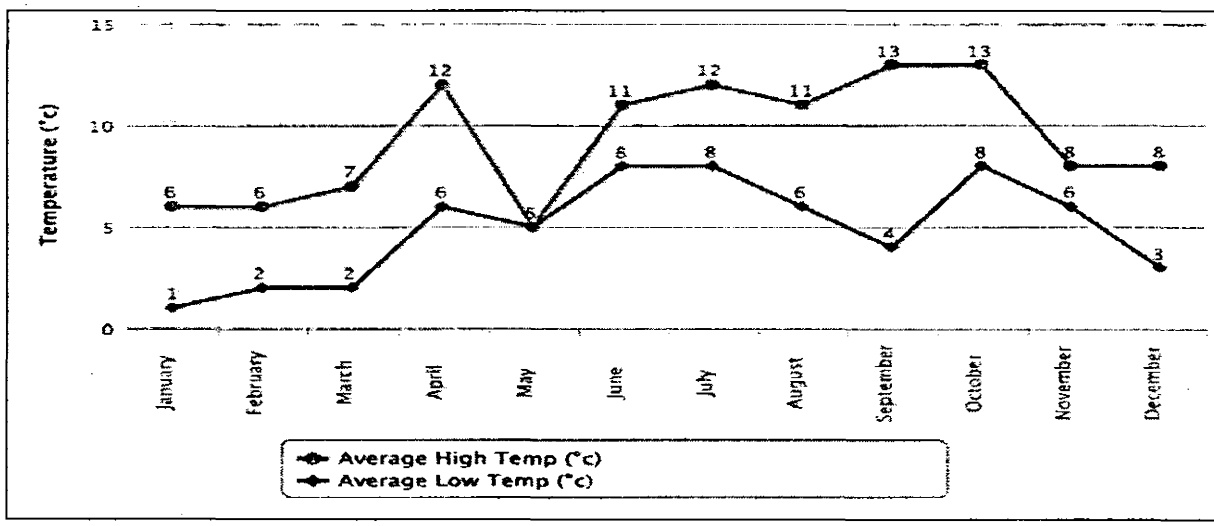


Figure 1.3: Average Monthly Temperature

1.5 Agriculture

Total area under cultivation is around 193,456 hectares out of which 92% area is rain-fed/Barani. About 89% households have very small land holdings having one to two acres. Major crops of

the area include Wheat, Maize, & Rice whereas minor crops include Grams, Pulses, Vegetables and Oil-seeds. Fruits produced in AJ&K include Apple, Pears, Apricot and Walnuts. Agriculture & livestock income ranges between 30-40% of household earnings (Economic survey of Pakistan 2010-11).

1.6 Forestry

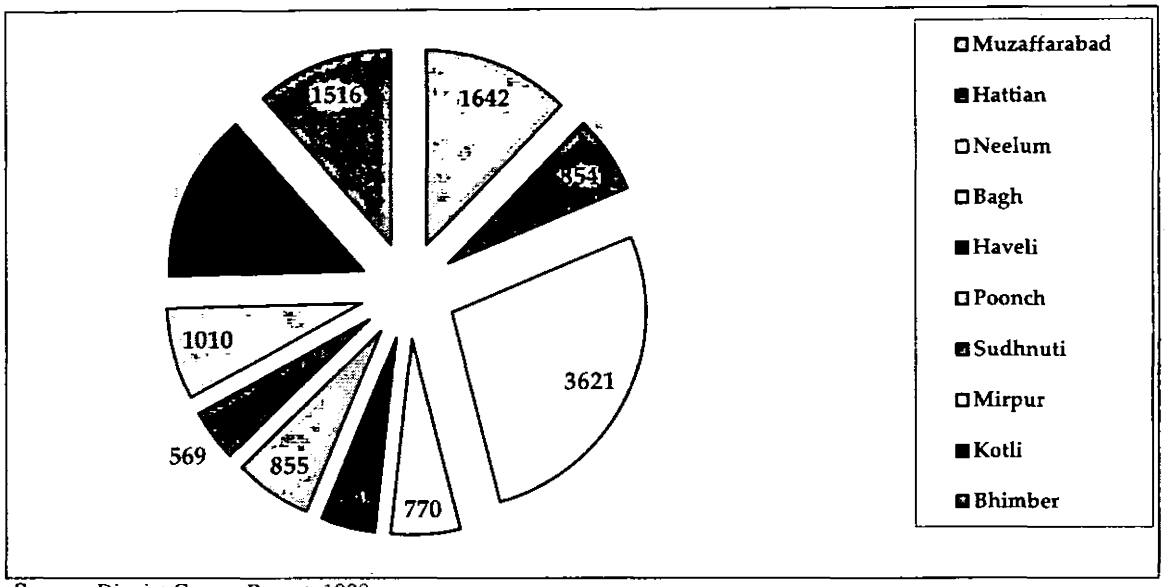
About 42.6% of the total Geographical area (0.567 Million hectares), is under the supervision of the Forests Department of AJ&K. The per capita standing volume is estimated to be 330 ft^3 and per capita forest area is 0.38 Acre. Annually wood demand approximates to be 1.65 million m^3 while sustainable production is 1.94 million m^3.

The locals have traditional rights in terms of use of the forests and on an average three trees can be burnt by one household every year to full fill fuel-wood requirements in the absence of alternate sources like Karosine Oil, LPG etc. Similarly about 5 trees on average are required to construct a house with the wood roofs that needs to be replaced after every 8-10 years (Anon, 2011).

1.7 Administration

Azad Jammu and Kashmir is divided into three main divisions viz; Muzaffarabad, Mirpur & Poonch, and ten administrative districts with Muzaffarabad being the capital of the state. The Muzaffarabad Division constitutes Muzaffarabad, Hattian and Neelum, Rawalakot Division includes Bagh, Haveli, Poonch & Sudhnuti districts whereas districts of Mirpur Division are

Mirpur, Kotli & Bhimber. These ten districts are further divided into 30 sub-divisions (Anon, 2011). District wise area of AJ&K is given in Figure 1.4.



Source: District Census Report, 1998

Figure 1.4: District wise Area of AJ&K (Km^2)

1.8 District Hattian

District Hattian is one of the ten districts of Azad Jammu & Kashmir, Pakistan. Before the establishment of Line of Control which alienated Indian held Kashmir and Pakistan administered Kashmir in 1948, it was the part of Baramula district. After ceasefire between India and Pakistan, it became the part of District Muzaffarabad until 2009. However it was announced as a separate district in July, 2009. The newly established district is the Gateway to Srinagar with 0.3 Million population. Its district headquarter is the town of Hattian Bala. Hattian consists of three Tehsils Chikar, Leepa & Hattian Bala (Anon, 2011).

District Hattian has 13 union councils and 153 villages under its administration. Total area of the District Hattian in comparison to the area of AJ&K is provided in Table 1.1. Roads and air

transport are the only mode of transportation available in AJ&K. The road length available in 1947 and its comparison with the present road length are given in Table 1.2. The Government of AJ&K in association with the Civil Aviation Authority (CAA) of Pakistan has constructed two airports in Muzaffarabad and Rawalakot in order to provide easy and fast mode of travel but at present Flights are suspended (Anon, 2011).

Table 1.1: Area & Population of District Hattian and AJ&K

	Area (Sq.Kms)	Population Census 1998 (Millions)		MICS 2007-08	Projected Population 2010 (million)	Density in 2010 (Persons/ Sq.Km)
		Population	Growth Rate %	House-hold Size		
AJ&K	13,297	2.973	2.41	6.7	3.963	298
District Hattian	854	0.166	2.80	5.8	0.231	270

Projected on the basis of 1998 census.
Sources:- Anon, 2011

Table 1.2: Road Infrastructure details of District Hattian and AJ&K

	AJ&K Road Length (Kms)		Hattian District Road Length (Kms)	
Year	**1947**	**2010**	**PWD**	**LG&RD**
Metalled	100	6390	213	26
Fair-weather	165	6329	275	61
Total	265	12719	488	87
Road Density	0.008	0.48	-	-

Source:-Anon, 2011

The details of Gender wise rural urban population in 1998 and projected details of 2010 are provided in Table 1.3.

Table 1.3: Gender wise Urban Rural Population in District Hattian and AJ&K

	Area	Urban			Rural			Grand Total		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
1998	Hattian	5.329	5.311	10.640	78.861	76.463	155.424	84.190	81.774	166.064
	AJ&K	196.422	175.552	372014	1.298.777	1.301.650	2.600.527	1.495.199	1.477.202	2,972.523
2010	Hattian	0.007	0.007	0.014	0.110	0.107	0.217	0.117	0.114	0.231
	AJ&K	0.261	0.233	0.494	1.732	1.738	3.470	1.993	1.971	3.963

Source: Anon, 2011

Table 1.4 shows the total areas under cultivation in AJ&K and District Hattian while total annual cropped area under different crops in AJ&K and District Hattian is provided in Table 1.5.

Table 1.4: Total Area Under Cultivation

Area	Unit	Area Under Cultivation	Cultivation Area Per Family	Cultivation Area Per Capita
Hattian	Hectares	11801	0.47	0.06
	Acres	29160	1.16	0.14
AJ&K	Hectares	193456	0.65	0.08
	Acres	478031	1.61	0.20

Source: Agriculture Department, Muzaffarabad, 2010

Table 1.5: Annual Cropped Area in AJ&K and District Hattian

Area	Unit	Annual Cropped Area	Area Under Maize Cultivation	Area under Wheat	Area Under Rice	Area Under Jawar	Area Under Millet (Bajra)	Area Under Vegetables
Hattian	Hectares	13359	10701	1707	516	0	0	268
	Acres	33009	26442	4218	1275	0	0	663
AJ&K	Hectares	235067	107303	69341	3436	79	23955	2571
	Acres	580850	265147	171342	8490	195	59193	6354

Source: Agriculture Department, Muzaffarabad, 2010

Table 1.6 provides the types of forest in AJ&K and District Hattian.

Table 1.6: Forest types in AJ&K and District Hattian

(Million Acres)

Area	Coniferous	Scrub Forest	Range Lands	Total
AJ&K	**1.007**	**0.023**	**0.376**	**1.400**
Hattian	0.088	-	0.008	0.096

Source: AJ&K Forest Department, Muzaffarabad (2010).

There is 1 Tehsil Headquater Hospital. 3 RHCs, 12 BHUs, 4 Dispensaries, 14 FAPs, 11 MCH Centers, 5 TB/Leprosy Centers, 4 Dental centers, 23 EPI Centers, and 44 malaria Centers in District Hattian (Anon, 2011).

Table 1.7 shows the number of Hospitals/BHUS/Dispensaries and Rural Health Centers with bedding capacity by government estimates in AJ&K and district Hattain present during the year 2010.

Table 1.7: Details of Government Medical Care Centers In AJ&K and District Hattain

Area	Government					
	Hospital		BHUs/Dispensaries		RHCs	
	No.	Beds	No.	Beds	No.	Beds
AJ&K	**19**	**2249**	**310**	**0**	**34**	**408**
Hattian	1	50	16	0	3	36

Source: Directorate of Health Muzaffarabad

1.9 The Study Area

Tehsil Chikar is the settlement of district Hattian being located at a distance of 16 Km from Muzaffarabad (the capital city of Azad Jammu and Kashmir), in the south. Chikar is located at an elevation of 1,828 meters above sea level. River Jhelum drifts in the north of the area. Geographically Chakhoti sector is in the East, Kohala city in the west and District Bagh in the South. The area is referred to as a part of Jhelum valley, which is formed by river Jhelum. River Jhelum oozes from "Verinag Chashma" from Indian Occupied Kashmir (Anon, 2011).

During winter season in mountainous areas, most of the activities stop because of heavy snowfall. Locals travel to other different lower parts of the country to earn money. Literacy rate is around 50.7%. Urdu is the official language of AJ&K. Pehari language is usually spoken in the area. Beside Pehari, Gojri, Hindko and Kashmiri languages are also common (Anon, 2011).

1.10 Ethnobotanical Explorations and its Applications

Indigenous knowledge about plants of medicinal importance is very old but the phrase "Ethno-botany" was firstly used by an American botanist, John Harshburger (1896), for the relationship of plants with humans to study the plants used by the primitive and aboriginal people. Medicinal plants consist of components of curative values and have been used as remedies for human ailments since long. Recent studies for pathogens resistance against the existing antibiotics and the identification of traditional medication as a substitute form of health care has reopened the research realm for the biological activities of medicinal plants (Arias *et al.*, 2004).

The plants of medicinal importance from Himalayas are very specific, yet their occurrence is scattered and limited to small areas. Medicinal plants can be an important natural resource for preparation of safe drugs and hence can play an imperative role in curing human health by contributing herbal medicines (Dhar *et al.*, 2000).

In the rural and inaccessible areas of Pakistan, more than Seventy percent (70%) of population depends on conventional system of medication obtained from plants. The high cost of allopathic medicine and their probable side effects, influence the people to use the traditional medication (Zaidi, 1998).

It has been estimated that there are 8,000 plant species of medicinal importance in South Asia which are considered as a vital element for conventional health care. More than Eighty percent (80%) of population from Asian continent is dependent on these cheap but effective traditional medications that are used to cure many diseases. In Pakistan, 2, 000 plant species of medicinal importance have been reported yet, very few are being exploited and about 90 percent of the country's medicinal herb supplies are traded in from other countries (Aslam, 2002).

A lot of surveys for the natural plant wealth of Pakistan show that there is plentiful growth of medicinal plants in Murree Hills, Kotli Sattian, Malakand, Kurram Agency, Hazara, Azad Kashmir, Gilgit- Baltistan and Baluchistan. As well as some medicinal plants are also cultivated on farmlands in Punjab, Sindh, Khyberpakhtunkhwa and Kashmir areas (Choudhary et al., 2003).

It has been estimated that there are 6,000 species of wild plant species available in Pakistan, out of which; 3,200 species of medicinal importance are distributed in upper reaches while 1,000 are distributed in lower part (Ameenah, 2005). About 75 crude herbal preparations are extensively exported while 200 species are traded within Pakistan. About 500 tons of medicinal plants are produced in Hazara and Malakand, 38 tons in Azad Kashmir, 24 tons in Gilgit-Baltistan and about 16 tons in Murree Hills, according to the surveys carried out by Pakistan Forest Institute in 1989. Pakistan acquires about 80% of its conventional medicines from higher plants (Choudhary et al., 2003).

1.11 Problem Statement

Tehsil Chikar of district Hattian; although an area with rich biodiversity, but from an ethnobotanical point of view, is one of the least investigated areas of the Kashmir regions. The

importance of plant species of AJ&K cannot be ignored as they contribute a lot for economic development of the area. The lack of awareness and education is one of major factors in extinction of some endangered plant species. It is important to preserve these plant species from economic and ethical perspectives.

1.12 Aims and Objectives of the Study

The aim of this study was to collect and preserve ethnobotanical knowledge of Tehsil Chikar. Keeping in view the important medicinal plant species the present study will be undertaken with the following aim and objectives;

1. Documentation of Ethnobotanical resources of Tehsil Chikar and its allied areas, AJ&K, and suggest measures for preservation of Indigenous knowledge about plants
2. To observe threats to habitat of medicinal plants
3. To analyze the drinking water samples from the areas surveyed.

1.13 Significance of the Study

The relationship between biodiversity and humankind is an everlasting aspect from ancient times. Plants play a fundamental role in provision of various sources like, food, fodder, fuel, medicine etc. Scientists have estimated that at least 100,000 plants are threatened with extinction that constitutes more than one-third of the total known species of plants on the planet earth (Imtiaz, 2000).

The main threats to floral biodiversity today include habitat destruction/degradation due to over-collection and invasive species. The decline in diversity of a plant species can have devastating

effects on ecosystems as a whole, as other species lose their sources of food and shelter. Furthermore, plants play a crucial role in stabilizing soils and help prevent soil erosion.

While the condition is significant, efforts are in progress throughout the world to halt the loss of plant diversity. Education about the importance of plants and for their conservation is required. It is required to document the floral inventory of areas rich in floral biodiversity and their ethno-botanical uses to preserve the indigenous knowledge and conserve the plant biodiversity.

CHAPTER 2

LITRATURE REVIEW

Pakistan has varied climatic conditions and edaphic factors that are the main reason for abundant medicinal plant resources. It has been reported that almost 6000 species of vascular plants occur in Pakistan, and about 1000 species have been identified to have phyto-chemical characteristics. Out of these 350 - 400 species are reported to be traded in different drug markets in Pakistan and are used by leading manufacturing units of Unani and Homeopathic medication. Besides, about 40,000 - 50,000 vaids (practitioner of folk-medicine and Ayurvedic), tabibs (practitioner of Greco-Arabic medicine), and a number of un-registered practitioners available in rural and distant hilly areas use more than 200 drug plants as household remedies for several diseases. In past few years, there has been a steady growth in the requirement for plant-based medicines. This is the main reason for habitat degradation/destruction for most of the valuable flora hence scarcity of a number of valuable medicinal plant species and their wide range of chemical diversity is decreasing at an alarming rate with the present scale of selective extraction from natural habitats (Jabeen et. al., 2009).

Azad Jammu and Kashmir (AJ&K) is naturally very beautiful and has unique ecosystems on Earth. The people of this region are mainly poor and the area is under developed especially after the earthquake of October 2005 people are still striving to build their homes and to make their living better. Locals mostly include farmers or tenant, and also rear livestock. The area's agricultural economy generally depends upon rainfall. Maize and wheat are the main subsistence crops of the area but beans and peas are also cultivated in the region. Among fruits; apricots,

plums, apples, walnuts, pears, peaches, and citrus are grown and are exported worldwide. Most of the people collect morels and medicinal plants for sale in local markets to earn their livelihood. The natives also earn by selling handmade local accessories like as Woolen shawls, Gubba, Namda, Patto, etc. Tourism has greatly developed the socio-economic state of affairs of the region by providing better jobs opportunities to locals. They work in hotels and restaurants, as tourist guides and drivers while some have tourist resorts that provide comfortable accommodation on affordable rates (Hocking, 1958).

It has been reported that vegetation communities in AJ&K keep high ecological significance, as they stabilize the soil of their catchment areas which alternatively play an important role in ecosystem functioning, and are essential in ethical, cultural and aesthetic aspects (Stirling and Wilsey, 2001).

It has been analysed that in Pakistan people mostly rely upon traditional sources of medication especially those living in mountainous areas. They use plants in many ways such as medicines, fire wood, timber, fodder, food, etc. (Hussain and Khaliq, 1996).

It is reported that in Himalayan range almost 70% of medicinal plants and animal's species in the region are wild in nature and 70 to 80% of the local population depend on these conventional medication for health care (Pie and Manandhara, 1987).

An ethno-botaniacal survey of the valley Samahni, AJ&K provided a description of floristic features like life form, leaf size spectra etc. This study was carried out by Hussain and Muhamamad, (2009) in Samahni valley district Bhimber AJ&K. (Pakistan). Field survey was carried out in 2006-2008, using semi-structured interviews employing a check list of questions,

direct observations and biological inventories. In total 120 plant species were recorded that belonged to 46 families. Poaceae was the dominating family with 14 different plant species. Among 120 plant species, most of the plants were reported to be used to cure common diseases like earache, jaundice, fever, flu, diarrhea, cough and other skin problems. Burns of body parts, Snake bite and wound healing are also treated locally with these herbs. Some plants are found to be useful for multiple uses as medicines, furniture, food, fuel, fodder, and shelter. But it was also observed that due to deforestation vegetation is decreasing at a faster rate and the efforts about plant species conservation are limited and at very initial stages (Hussain and Muhammad, 2009).

A survey was carried out during 2002–2004 in the coniferous forest of Northern Parts of Pakistan for the estimation of management practices by locals on the population of three important medicinal plants viz., *Persicaria amplexicaule.* D. Don.,*Valeriana jatamansi* Jones and *Viola serpens* Wall ex Roxb. The aim of study was to identify the impact of ongoing management practices over the population size of medicinal plants. The study depicted that the participation of locals in the obtaining of targeted plants varied with the variation in altitude/elevation. Among the medicinal plants under study *V. serpens* was collected by majority of the locals (83.3%) at the altitude of 2700 m followed by 72% at 2300 m and 37% at 1900 m while *V. jatamansi* was collected by a smaller number of people (18.1%) at an altitude of 1900m and 2300 m each, followed by 8.3% at 2700 m. *P. amplexicaule* was obtained by a minimum number of people (9.1%) at an altitude of 1900 m and 9.6% at 2300 m followed by 8.3% at 2700 m. The study showed that these medicinal plants species have been exploited extensively in the past and are now available very sparsely in some sites of the study area. In addition to that, due to habitat loss by deforestation and encroachment of land for cultivation the species are now

going towards extinction. The study emphasized the conservation of the plants of medicinal importance through trainings and active participation of local communities (Sher et al., 2011).

An ethno botanical research study was carried out in Ayubia National Park in 2006 for identification of Indigenous uses of some important Ethno-medicinal herbs of Ayubia National Park. The people of the area have always used the medicinal herbs as medication and are mainly dependent on the plants in their surroundings for food, fodder, health, medicines, shelter and various cultural purposes. About 21 important herbs belonging to 19 Families were identified which were being used by the local inhabitants for medicinal purposes. 100 informants were interviewed and their views were recorded. It is concluded that the precious ethno-botanical knowledge is becoming extinct at a faster pace and there is dire need to conserve the natural resources of the area through involvement of locals (Syed et al., 2006)

Awan *et al* in 2004 conducted an ethno botanical survey of Daokhu and linked areas of Jhelum Valley and reported 166 plant species out of which ten were reported to be extensively used for various minor ailments.

Imtiaz (2011) reported about 117 plant species belonging to 66 families from Chikar and its allied areas and provided their distribution along with local utilization for various purposes. But he also reported that people of the area are utilizing these plants mercilessly and their abundance is declining at a faster pace.

Shoaib (2005) described the floral wealth of Neelum Valley and reported 132 angiospermic species belonging to 93 genera and 51 families. About all of the plants were used for medicinal purposes, fuel, timber, etc.

Ali and Qaiser (2009) investigated the ethnobotanical resources of Chitral Valley and reported that 83 taxa are being exploited locally for various purposes. Plants were collected from wild and were utilized locally.

Khan *et al.,* 2012 investigated the ethno-botanical knowledge of Poonch valley, AJ&K. Total Fifty Six (56) medicinal plant species belonging to 36 families were reported. The study suggested that the indigenous knowledge related to the recorded species utilization came from females aged above 30 years while the folk medicinal knowledge comes from males.

As the total identified vascular plants estimated between 0.31 to 0.42 million (Prance et. al., 2000 & Bramwell 2002) but still a "World checklist" is required to assess all the taxa according to IUCN criteria and categories as evident from IUCN Red Data List 2008. IUCN Red Data List 2008 contains only 10,779 taxa of vascular plants that represent only a fraction (less than 0.3%) of earth biodiversity (Anon 2008).

Conversely human population is increasing exponentially and consequent urbanization is resulting in overexploitation of resources, habitat loss and reduction in diversity and abundance of natural flora (Western 2001).

Hilton and Taylor (2000) reported that due to human activities the rate of plant species loss has reached to one species per day. It is also predicted that if the present rate of species loss remained the same then all the floral diversity may disappear during the next 50 years; this rate is in contrast 1,000 to 10,000 times greater than natural species extinction rate.

Furthermore studies have revealed that approximately half of the earth flora may be threatened by extinction if evaluated according to IUCN's criteria and categories. According to IUCN's present Red Data List only 19 flowering plant species from Pakistan are listed, of which two are Vulnerable, 11 Least Concern, three Near Threatened and three are classified as Data Deficient (Alam & Ali, 2009).

Ponch valley has been investigated for the use of plants to treat diseases in human and livestock. Total 68 plants species belonging to 44 families were reported to be used medicinally for treatment of approximately 68 diseases (Khan et al, 2012).

Marwat et al., (2012) investigated biodiversity of grassy weeds and their ethno-botanical importance in Dera Ismail Khan (KPK), Pakistan. They reported 28 weed grasses species belonging to 22 genera. They observed that grasses are used as fodder, for thatching and medicinally for treatment of different diseases.

CHAPTER 3

MATERIAL AND METHODS

MATERIAL

Field Note book, GPS, Field plant presser, Old newspapers, Blotting papers, Plastic bottles, Rope, Plant Pruner, Digital Camera.

METHODS

The study comprised of following five steps, keeping in view the study requirements, availability of resources and local conditions.

STEP 1 **PREPARATION FOR FELID SURVEY**

For field survey, Tehsil Chikar, District Hattian, AJ&K was selected. Time frame selected was according to the life cycle of the plants and the season of plant collection, processing and exploitation of the plant products in consultation with the local community.

Fieldwork:

The fieldwork included interviews, observations and transect walks. The details are as under;

Preparation of survey tools and required equipment:

Questionnaires were prepared to get quantitative and qualitative data, participatory approach was adopted to identify the status of the indigenous medicinal plants and their utilization by the locals, pansaries etc. The entire required equipment list was finalized and equipment made available before the field visit. Semi Structured Questionnaire is provided as Annexure A.

STEP 2 UNDERTAKING FIELD SURVEY

The second step was to obtain maximum information in shortest possible time keeping view the resources and study requirements. The field visit encompassed following main components.

Eco-geographical Survey

An eco-geographical survey was the basic need of the study for identification of representative areas with significant species diversity and associated vegetation for investigation of traditional knowledge in collaboration with locals.

Interviews:

Interviews were carried out with local inhabitants, selected informants, the herbalists (Hakims) and the local authorities and societies. (Appendix A.)

In total 38 people were interviewed, gender ratio of the interviewee's is presented in Figure 3.1.

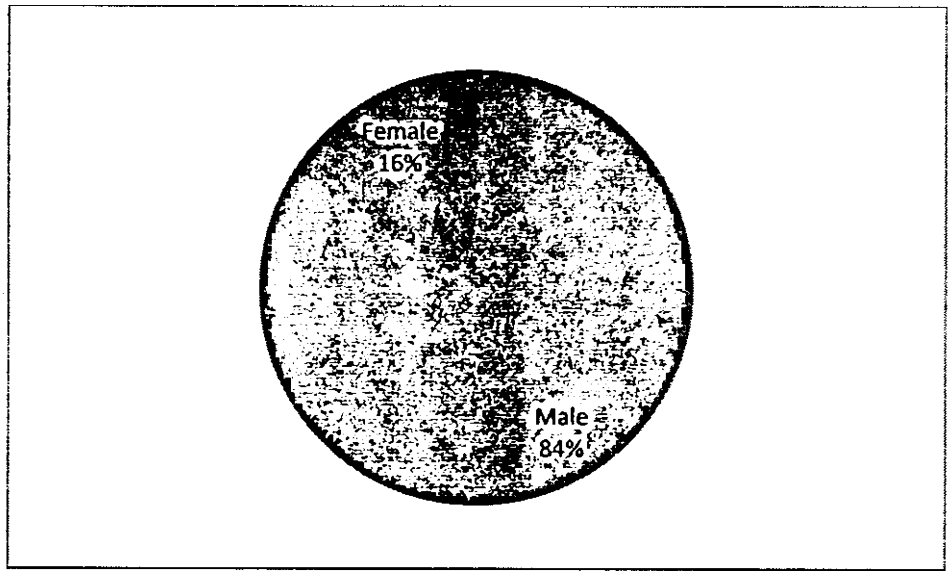


Figure 3.1: Gender ratio of Interviewee's

Age group of the interviewee's is presented graphically as Figure 3.2 while data about plant collectors is provided graphically in Figure 3.3.

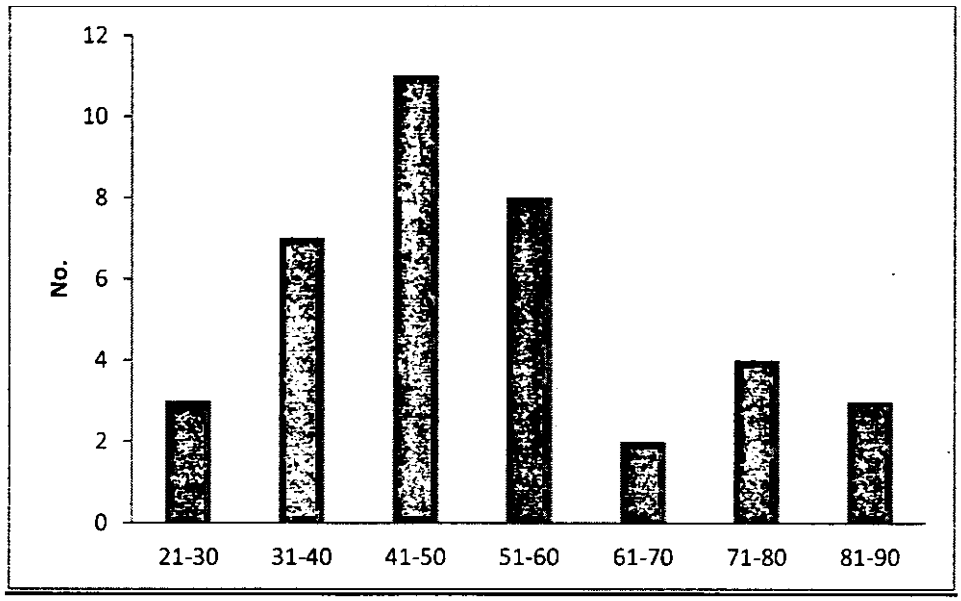


Figure 3.2: Age group frequency of the interviewee's

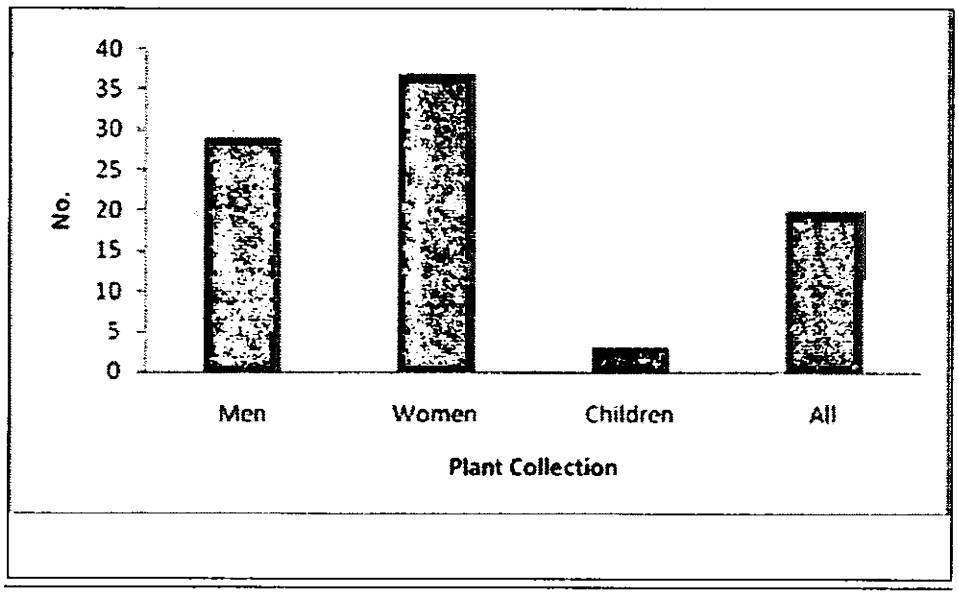


Figure 3.3: Details of plant parts collectors

Collection of Plant Material:

The plant samples were collected and temporarily preserved on site.

Market Survey:

Economical and commercial values of indigenous medicinal plants utilized in the study area have been tested in the market survey. In this regard a questionnaire (Annexure B) was prepared to interview the local plant collectors, medicinal plant sellers (Pansaries) in the local market.

Quantitative approach questionnaire to know about the quantity of plant resources, uses, consumption, availability, economic and market value etc, was adopted (Phillips and Gentry, 1993). Information regarding date and locations of sampling was recorded for immediate reference. Dried plant samples have been preserved and herbarium sheets are prepared after identification and labeling.

Pictography:

Pictures were taken during the survey for future reference. Pictorial presentation is provided (Annexure D).

b. Experimental Design

Water samples from the project area were also collected in washed and clean plastic bottles from Kopra Puthiyan, Chakharyala Bandi Baqalan, Nagni and Qalma Wala Chashma, Near Boys Middle School Sar, Noon Bangla. The results were analyzed from water testing laboratory of National Institute of Health – Islamabad.

The details of water samples at the time of collection are given in Table 3.1;

Table 3.1: Water sampling locations for study

Sample Location	GPS Coordinates	Elevation (m)	Temperature (°C)	pH (Initial)
Kopra Puthiyan	N= 34°10'13.7'' E =73°41'05.6''	1395	37.5	8
Chakharyala Bandi Baqalan	N= 34°10'18.2'' E =73°40'57.2''	1201	28.5	8
Nagni	N= 34°09'34.0'' E =73°38'55.6''	1817	33.4	8
Qalma Wala Chashma, Near Boys Middle School Sar, Noon Bangla	N= 37°07'26.8'' E =73°40'04.2''	1937	30	8

STEP 3 IDENTIFICATION OF PLANT MATERIAL & PRESERVATION

Plants were duly identified by expert taxonomists. Inventory of the plants has been finalized according to literature cited .flora of Pakistan, Ali and Qaiser (1986). Plant specimens have been deposited in the Herbarium of department of Environmental Science, Faculty of Basic and Applied Sciences, International Islamic University, Islamabad, Pakistan.

STEP 4 WATER QUALITY ANALYSES

Water samples were analyzed for physic-chemical characteristics and inferences drawn. Results of the water quality analysis reports are attached (Annexure C).

STEP 5 STATISTICAL ANALYSES

The results have been analyzed statistically and presented graphically in the form of Bar Graphs and Pie Charts using Microsoft Excel.

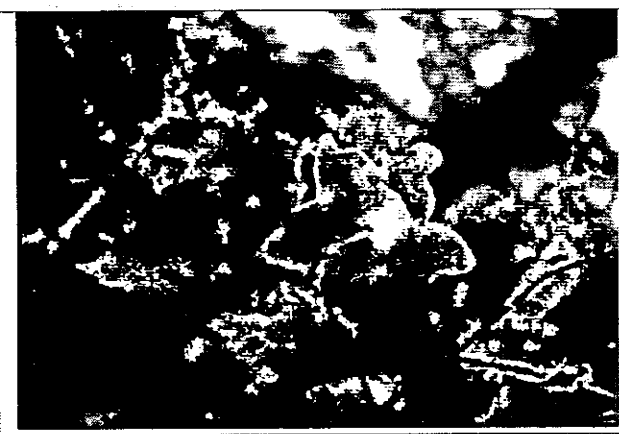
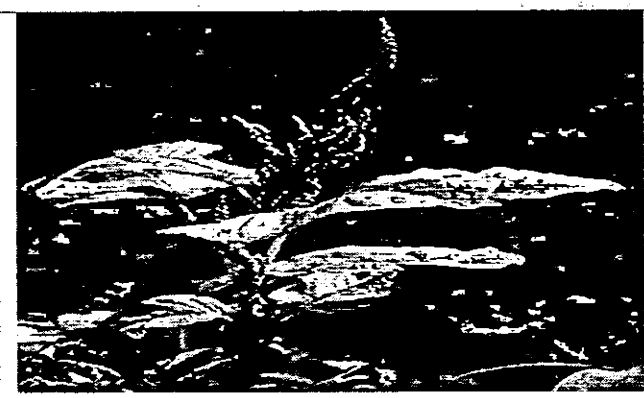
CHAPTER 4

RESULTS AND DISCUSSION

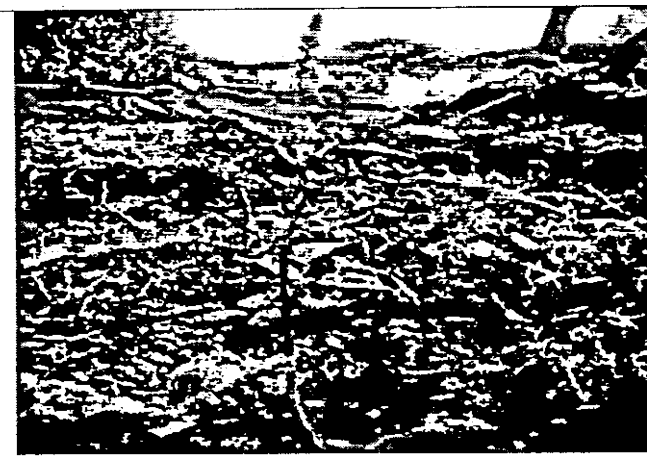
4.1 INDIGENOUS MEDICINAL PLANTS DIVERSITY

In total 82 plant species were collected during the field visits and their medicinal importance documented. Three specimens for each of the plant species were collected temporarily saved in the layers of newspaper. After completion of field visit plants were dried in newspapers, by changing newspapers every day. After the plant samples were completely dry, fungicide treatment was applied to preserve the plants. Then the plants were mounted on the herbarium sheets, and after dual verification identification tags were filled. Herbarium sheets were then finalized for submission to International Islamic University, Islamabad. Details of plant specimen collected are presented in Table 4.1. Map of the survey area is shown in Figure 4.1.

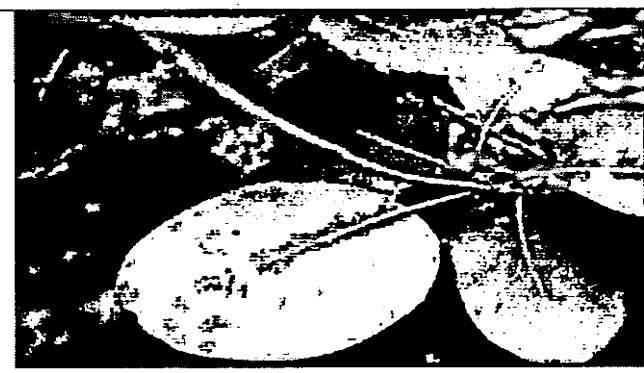
Table 4.1: Ethno-botanical Field Survey Results

Local Name	Ban Till (Violet Flowers)	
Scientific Name	*Strobilianthes attenuate*	
Family	Acanthaceae	
Place of Collection	Sudhan Gali N=34°04'42.5" E=73°44'35.3"	
Occurrence	Sudhan Gali, Noon Bangla	
Elevation (m)	2286	
Ethnobotanical Significance	Leaves are chewed to relieve toothache and jaw swelling. Dry powder is used against pus and apostema. Plant is used as cattle fodder. The roots and leaves are depurative and febrifuge	
Local Name	Ganyar	
Scientific Name	*Amaranthus viridus*	
Family	Amaranthaceae	
Place of Collection	Kopra Puthiyaan N= 34°10'21.6" E= 73°41'06.9"	
Occurrence	Common	
Elevation (m)	1375	
Ethnobotanical Significance	Astringent; Vermifuge, Laxative. Is used as Yellow and Green dyes, also used as pot herb.	
Local Name	Surkh Ganyar	
Scientific Name	*Amaranthus graecizans L.*	
Family	Amaranthaceae	
Place of Collection	Chikar N=34°10'16.5" E=73°41'04.8"	
Occurrance	Common	
Elevation (m)	1218	
Ethno-botanical Significance	Used as anti constipation pot herb	

Local Name	Chalori
Scientific Name	*Digera muricata*
Family	*Amaranthaceae*
Place of Collection	Noon Bangla N=34°07'21.1" E=73°39'06.6"
Occurrence	Kopra Puthiyaan, Chikar
Elevation (m)	1373



Ethno-botanical Significance	The plant is laxative. Leaves and tender shoots are eaten as pot herb.
Local Name	Paanr
Scientific Name	*Rhus cotinus*
Family	Anacardiaceae
Place of Collection	Kopra Puthiyaan N=34°10'19.9" E=73°40'58.5"
Occurrence	Chikar, Kopra Puthiyaan
Elevation (m)	1268

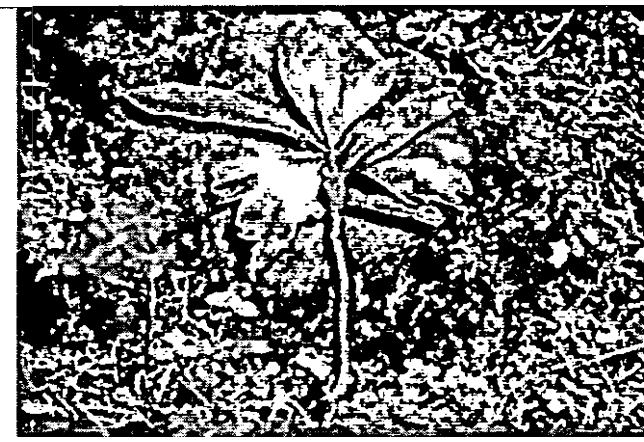


Ethno-botanical Significance	Branches are used as Maswak, Extract is believed to be antiallergic (relieves allergy), antipyratic (relieves fever) and antiparasitic (kills parasites).
Local Name	Sonf
Scientific Name	*Foeniculum vulgare*
Family	Apiaceae (Umbelliferae)
Place of Collection	Sudhan Gali N=34°04'40.7" E=73°44'24.2"
Occurrence	Chikar, Sudhan Gali, Bail, Batangi
Elevation (m)	2252

Ethno-botanical Significance	Seeds are added in variety of food as additive and taste enhancer. Analgesic; Anti-inflammatory; Antispasmodic; Aromatherapy; Aromatic; Carminative; Diuretic; Emmenagogue; Expectorant; Galactogogue; Hallucinogenic; Stimulant; Stomachic.

Local Name	Kankoli
Scientific Name	*Elaeagnus parvifolia* Royle
Family	Elaeagnaceae
Place of Collection	Sudhan Gali N=34°04'43.0" E=73°44'32.0"
Occurrence	Sudhan Gali
Elevation (m)	2277
Ethno-botanical Significance	The fruit is like sumbal; the plant is burnt and used as surma (Kajal) for improving eyesight.

Local Name	Ner
Scientific Name	*Skimmia laureola* (DC.) Sieb. & Zucc.
Family	Rutaceae
Place of Collection	Sudhan Gali N=34°05'22.6" E=73°45'23.3"
Elevation (m)	2510
Ethno-botanical Significance	Cardiotonic; Diaphoretic; Diuretic; Emetic; Expectorant; Parasiticide; Resolvent; Sternutatory. Bark is used for skin diseases. Root paste is used for scorpion sting and snake bite.

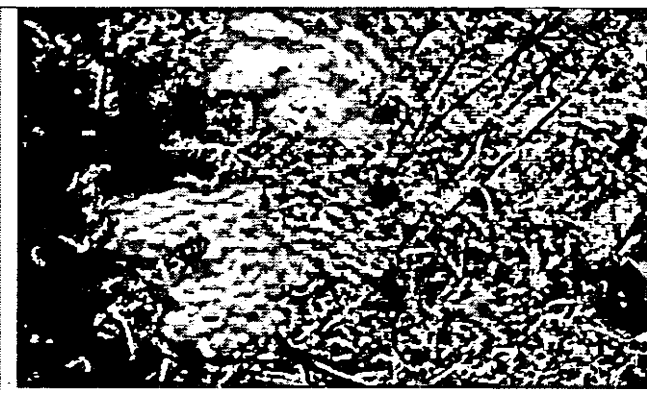


Local Name	Hath Bees/Sanp makai
Scientific Name	*Arisaema tortuosum*
Family	Araceae
Place of Collection	Noon bangla N=34°09'11.7" E=73°38'44.3"
Occurrence	Common
Elevation (m)	1980
Ethno-botanical Significance	Plant is very poisonous, especially the tuber root and fruit when touch with bare hands cause blisters. The tuber is boiled in milk and given to cattle for strength.

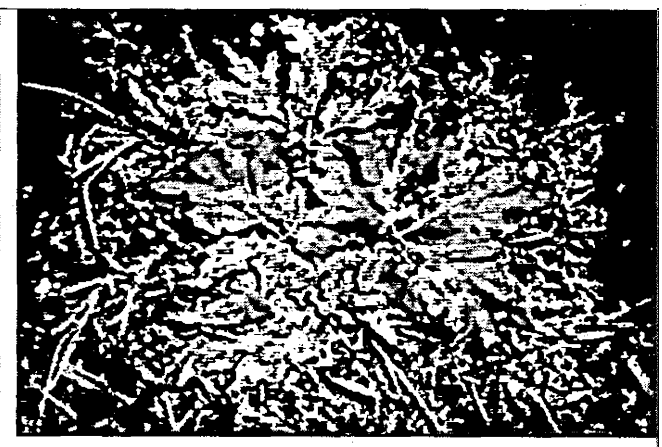
Local Name	Karukreen/ Makhani Booti
Scientific Name	Argyrolobium roseum ssp. roseum
Family	Papilionaceae
Place of Collection	Kopra Puthiyaan N=34°10'23.6" E=73°41'07.7"
Occurrence	Chikar, Noon Bangla, Manja Keri
Elevation (m)	1370
Ethno-botanical Significance	Is used as saag, but when mature the plant if eaten in excess causes dizziness and drunken feeling to cattle.

Local Name	Hund
Scientific Name	*Taraxacum officinale*
Family	Asteraceae
Place of Collection	Kopra Puthiyaan N=34°10'23.4" E=73°41'08.2"
Occurrence	Kopra Puthiyaan, Chikar, Bail
Elevation (m)	1373
Ethno-botanical Significance	Very bitter in taste and is used to treat fever

Local Name	Sultani Booti
Scientific Name	*Achillea millefolium L.*
Family	Astereaceae
Place of Collection	Dera Noon Bangla N=34°08'47.9" E=73°38'39.2"
Occurrence	Noon Bangla, Sudhan Gali
Elevation (m)	2064
Ethno-botanical Significance	Roots of the plant are chewed to relieve toothache. Floral parts are crushed, mixed with sugar and water and taken in case of fever, chest burn and for blood purification.



Local Name	Kuth
Scientific Name	*Saussurea costus* (Falc.) Lipsch
Family	Asteraceae
Place of Collection	Noon Bangla N=34°07'27.4" E=73°39'57.4"
Occurrence	Noon Bangla, Sudhan Gali
Elevation (m)	1958



Ethno-botanical Significance	The roots of the plant are dried and sugar, water and corn floor are added and cooked to make halwa. It is then eaten for back pain and arthritis.

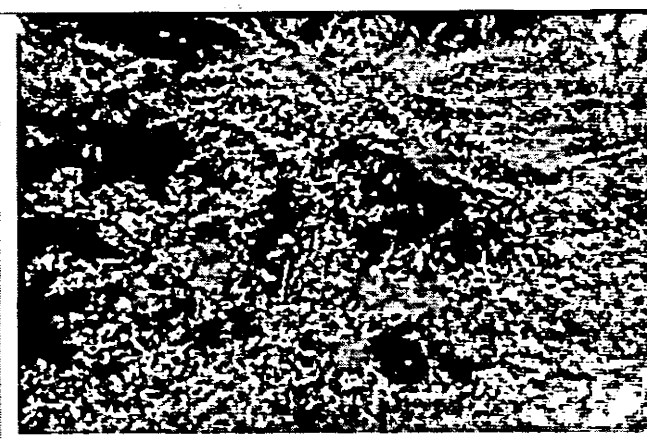
Local Name	Bantill
Scientific Name	*Impatiens edgeworthii*
Family	*Balsaminaceae*
Place of Collection	Chikar N=34°08'50.7" E=73°41'11.0"
Occurrence	Bail, Chikar, Noon Bangla
Elevation (m)	1695

Ethno-botanical Significance	Is used as fodder. Aquas extract is antipyretic

Local Name	Sunblo (white)
Scientific Name	*Berberis lyceum* Royal Var. *subvirescens* Ahrendt
Family	Berberidaceae
Place of Collection	Chikar N=34°08'23.3" E=73°40'09.2"
Occurrence	Chikar, Kopra Puthiyaan, Sudhan Gali
Elevation (m)	1594

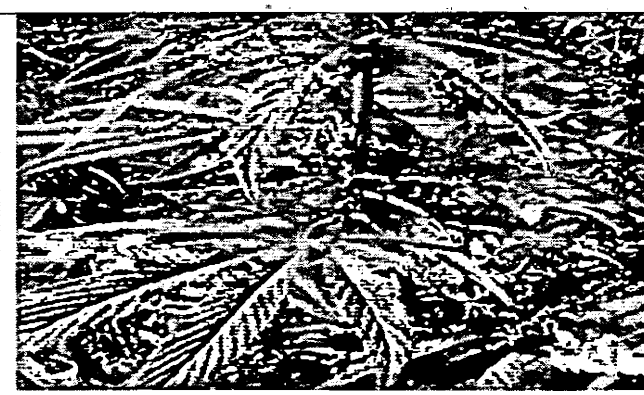
Ethno-botanical Significance	Bark of the plant is boiled in water and eaten for pain killer, paste made of leaves is used as antiseptic and has wound healing properties while the fruit is edible.

Local Name	Sumbloo (Kala Sumbal)
Scientific Name	*Berberis lyceum* Royal Var. *subfascicularis* Ahrendt
Family	Berberidaceae
Place of Collection	Sudhan Gali N=34°07'21.2" E=73°39'39.4"
Elevation (m)	1963



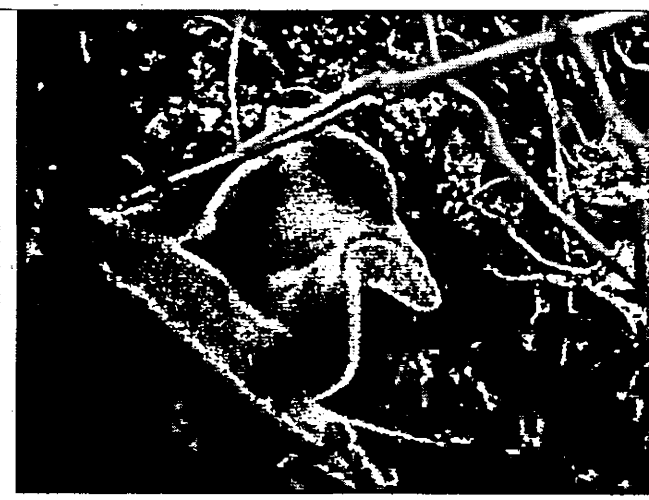
Significance	Bark of the plant is boiled in water and chewed for pain killer, paste made of leaves is used as antiseptic and has wound healing properties while the fruit is edible.
Local Name	Nedrooni
Scientific Name	*Sarcococca saligna (D.Don) Muell.-Arg*
Family	Buxaceae
Place of Collection	Kopra Puthiyaan N=34°10'23.3" E=73°41'08.5"
Occurrence	Chikar, Kopra Puthiyaan, Noon Bangla, Sudhan Gali
Elevation (m)	1364

Ethnobotanical Significance	Plant roots are used as a remedy for Malaria, Diabetes, and for blood purification.
Local Name	Bhang
Scientific Name	*Cannabis sativa* L.
Family	Cannabaceae
Place of Collection	Chikar N=35°10'19.9" E=73°41'01.5"
Occurance	Common
Elevation (m)	1675

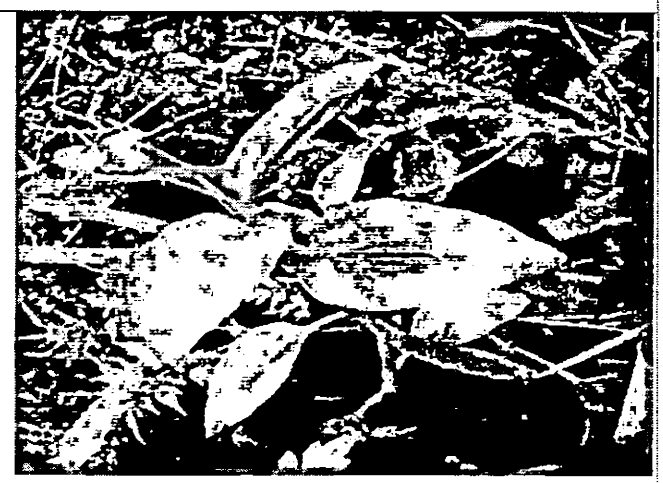


Ethnobotanical Significance	The plant is used as tonic, narcotic and sedative. Leaves are dried, mashed and the extract is drunk for narcotic action. Analgesic; Anodyne; Anthelmintic; Antibacterial; Antiperiodic; Antispasmodic; Cholagogue; Demulcent

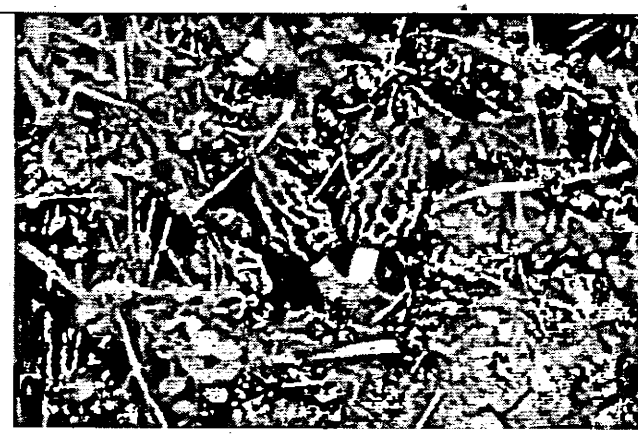
Local Name	Shurli
Scientific Name	*Cantharcellus cibarius*
Family	Cantharellaceae
Place of Collection	Noon Bangla N=34°08'15.9" E=73°38'04.9"
Occurrence	Kopra Puthiyaan, Noon bangle, Sudhab Gali
Elevation (m)	1578
Significance	Mushroom is edible



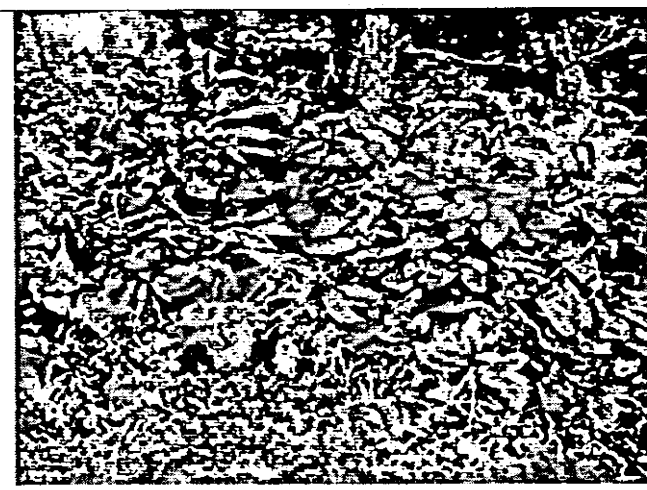
Local Name	Narya
Scientific Name	*Commelina benghalensis Linn.*
Family	Commalinceae
Place of Collection	Kopra Puthiyaan N=34°10'21.8" E=73°41'06.7"
Occurrence	Chikar, Bail, Kopra Puthiyan,
Elevation (m)	1375
Ethno-botanical Significance	Is used as food for animals. As pot weed the leaves have laxative effects.



Local Name	Guchi
Scientific Name	*Morchella esculenta*
Family	Morchellaceae
Place of Collection	Sudhan Gali N=34°04'53.1" E=73°45'20.0"
Occurrence	Salmeya, Noon Bangla, Sudhan Gali
Elevation (m)	2550
Ethno-botanical Significance	Is edible mashroom



Local Name	Guch
Scientific Name	*Viburnum grandiflorum Wall. ex DC*
Family	Caprifoliaceae
Place of Collection	Sudhan Gali N=34°04'53.1" E=73°45'20.0"
Occurrence	Chikar, Noon Bangla, Sudhan Gali
Elevation (m)	2550



Ethno-botanical Significance	Leaves are administered in menorrhagia. Fruit is laxative and blood purifier.

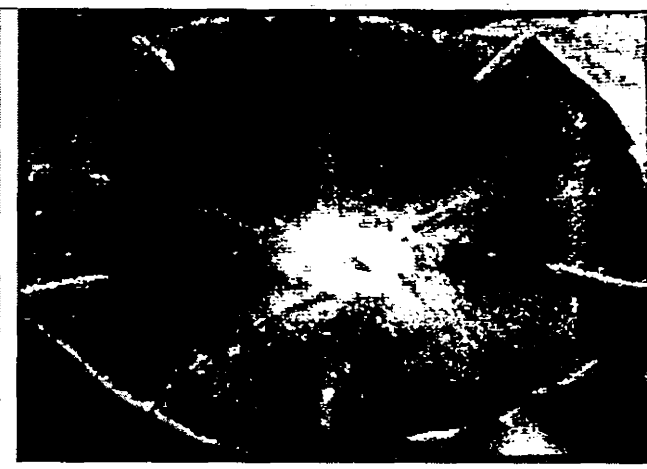
Local Name	Batfa
Scientific Name	*Chenopodium album Linn.*
Family	Chenopodiaceae
Place of Collection	Kopra Puthiyaan N=34°10'21.8" E=73°41'06.7"
Occurrence	Kopra Puthiyan,Chikar
Elevation (m)	1375

Ethno-botanical Significance	Anthelmintic; Antiphlogistic; Antirheumatic; Contraceptive; Laxative

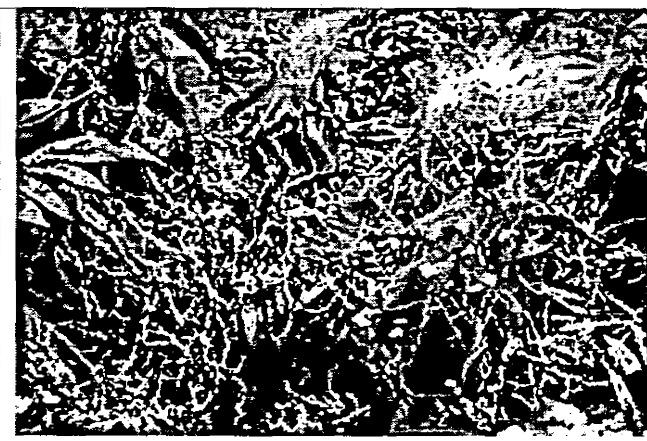
Local Name	Irl
Scientific Name	*Convolvulus arvensis Linn.*
Family	Convolvulaceae
Place of Collection	Kopra Puthiyaan N= 34°10'21.6" E= 73°41'06.9"
Occurrence	Common
Elevation (m)	1375

Ethno-botanical Significance	The root, and also a resin made from the root, is cholagogue, diuretic, laxative and strongly purgative. The dried root contains 4.9% resin. The juice of the root is used in the treatment of fevers. A tea made from the flowers is laxative and is also used in the treatment of fevers and wounds. A cold tea made from the leaves is laxative and is also used as a wash for spider bites or taken internally to reduce excessive menstrual flow.

Local Name	Irl
Scientific Name	*Ipomoea eriocarpa* R. Br.
Family	Convolvulaceae
Place of Collection	Kopra Puthiyaan N= 34°10'19.6" E= 73°41'06.9"
Occurrence	Chikar, Bail, Noon Bangla, Kopra Puthiyan,
Elevation (m)	1375



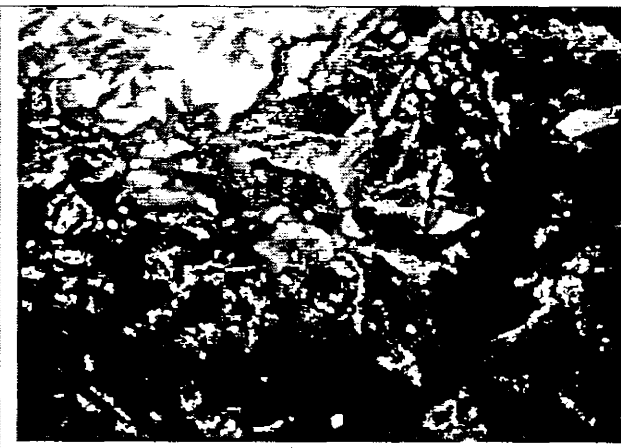
Ethno-botanical Significance	The seed contains small quantities of the hallucinogen. This has been used medicinally in the treatment of various mental disorders.
Local Name	Neela Dhari
Scientific Name	*Cuscuta reflexa Roxb., Pl. Corom*
Family	Convolvulaceae
Place of Collection	Chikar N=34°08'12.7" E=73°40'03.2"
Occurrence	Common
Elevation (m)	1355



Ethno-botanical Significance	Is invasive plant parasite. Whole plant is given to cattle for Takko (Stomach Problem) is also used for jaundice. Anthelmintic; Carminative; Purgative.
Local Name	Kunji
Scientific Name	*Dryoptaris stewartis*
Family	Dryopteridaceae
Place of Collection	Tariyaan top N=34°08'32.5" E=73°38'17.0"
Occurrence	Chikar, Noon Bangla, Manje Keri, Sudhan Gali
Elevation (m)	1763

Ethno-botanical Significance	The twigs are very delicious sabzi. The mature plant is fed to animals for diarrhea

Local Name	Amlok
Scientific Name	*Diospyros lotus* Linn.
Family	Ebenaceae
Place of Collection	Kopra Puthiyaan N=34°10'12.0" E=73°41'03.2"
Occurrence	Common
Elevation (m)	1355



Ethno-botanical Significance	Sedative. The fruit is febrifuge. It is also used to promote secretions. Fruit is used to treat stomach ache and is laxative. Trunk is used as firewood.
Local Name	Dodal
Scientific Name	*Euphorbia helioscopia L.*
Family	Euphorbiaceae
Place of Collection	Kopra Puthiyan N=34°10'21.6" E=73°41'06.7"
Elevation (m)	1374

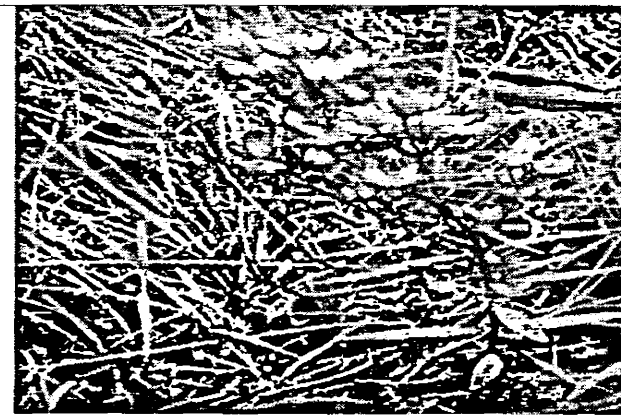
Ethno-botanical Significance	Milky liquid from the plant causes skin blisters
Local Name	Kikar
Scientific Name	*Acacia nilotica (Linn.) Delile*
Family	Fabaceae
Place of Collection	Kopra Puthiyaan N=34°10'12.7" E=73°41'03.8"
Occurrence	Chikar, Kopra Puthiyaan, Bail
Elevation (m)	1370

Ethno-botanical Significance	Fruit is used for pickles, and eaten cooked for anti constipation. Wood is excellent timber for furniture. The bark is astringent.

Local Name	Reen
Scientific Name	*Quercus leucotrichophora*
Family	Fagaceae
Place of Collection	Kopra Puthiyaan N=34°10'16.1" E=73°41'07.6"
Occurance	Chikar, Kopra Puthiyaan, Salmia, Sudhan Gali, Sarbala
Elevation (m)	1374

Ethnobotanical Significance	The bark is used with tea and acts as antibiotic and effective for muscular pain. Wood is used for furniture; leaves are animal feed while fruit looks like bullets hence called reen-goli.
Local Name	Rattan Jog (purple flowers)
Scientific Name	*Geranium wallichianum D. Don ex Sweet*
Family	Geraniaceae
Place of Collection	Dera Noon Bangla N=34°08'37.4" E=73°38'43.4"
Occurrence	Noon Bangla, Sudhan Gali
Elevation (m)	2109

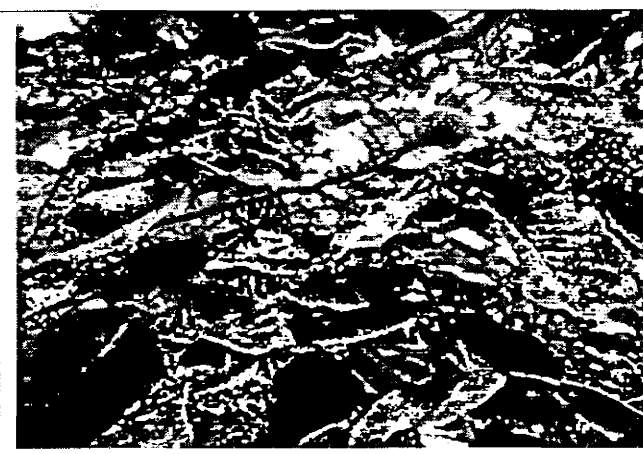
Ethno-botanical Significance	Roots are boiled dried and the powder made from it is used for arthritis
Local Name	Chiraita
Scientific Name	*Swertia paniculata Wall*
Family	*Gentianaceae*
Place of Collection	Noon Bangla N=34°08'16.3" E=73°38'04.9"
Occurrence	Kopra Puthiyaan , Dera Noon Bangla, Manja Keri
Elevation (m)	1579



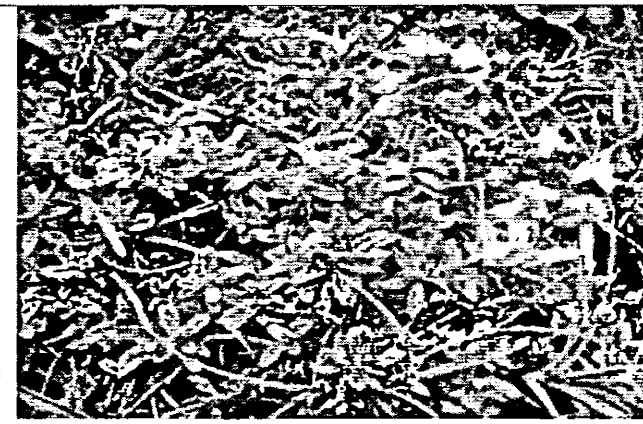
Ethno-botanical Significance	Digestive; Hepatic; Stimulant. Flowers are used in small quantity to make sweet yogurt

Local Name	Chiraita
Scientific Name	*Swertia cordata G.Don*
Family	*Gentianaceae*
Place of Collection	Sudhan Gali N=34°07'31.5" E=73°39'59.1"
Occurrence	Sudhan Gali
Elevation (m)	1974

Ethno-botanical Significance	The plant is mashed and its water is applied as eye ointment.
Local Name	Khorr, Akhrot
Scientific Name	*Juglans regia L.*
Family	Juglandaceae
Place of Collection	Kopra Puthiyan N=34°10'21.5" E=73°41'06.0"
Occurrence	Common
Elevation (m)	1349



Ethno-botanical Significance	Leaves and roots are used for whitening of the teeth and relieve toothache. Wood is used for furniture while fruit is edible.
Local Name	Chikkal
Scientific Name	*Prunella vulgaris* L.
Family	Lamiaceae
Place of Collection	Sudhan Gali N=34°04'49.1" E=73°44'48.1"
Occurrence	Sudhan Gali
Elevation (m)	2392

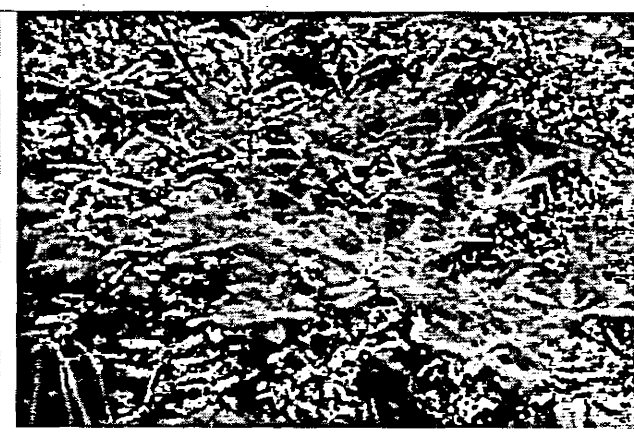


Ethno-botanical Significance	Leaf powder is used for treating ulcers, wounds, and sores. Tea made of leaves is administered for fevers, sore Throat, diarrhea, and internal bleeding.

Local Name	Puth Kanda
Scientific Name	*Otostegia limbata* (Benth.) Boiss.
Family	Labiatae
Place of Collection	Noon Bangla N=34°08'20.1" E=73°38'06.7"
Occurrence	Kopra Puthiyaan, Chikar, Bail, Batangi
Elevation (m)	1647

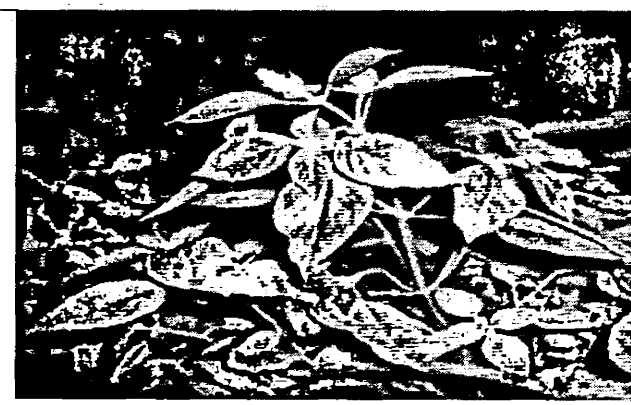
Ethno-botanical Significance	The plant is burnt, cooked and dried in a clay pot the resulting dried ash is used for treatment of eyes.

Local Name	Rechal/ Jandi
Scientific Name	*Indigofera heterantha*
Family	Leguminosae
Place of Collection	Chikar N=34°08'45.5" E=73°42'16.6"
Occurrence	Common
Elevation (m)	1798



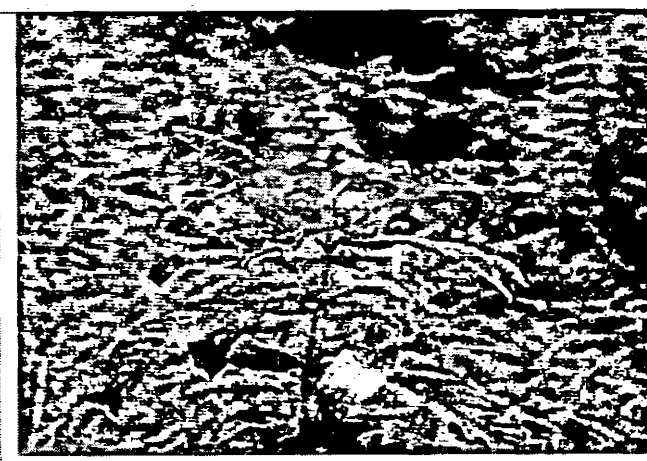
Ethno-botanical Significance	Roots are mashed and boiled made into syrup for soothing effect and stomachache. Branches are used for house cleaning.

Local Name	Babri
Scientific Name	*Ocimum basilicum*
Family	Lamiaceae
Place of Collection	Kopra Puthiyaan N=34°10'16.3" E=73°41'04.9"
Elevation (m)	1220

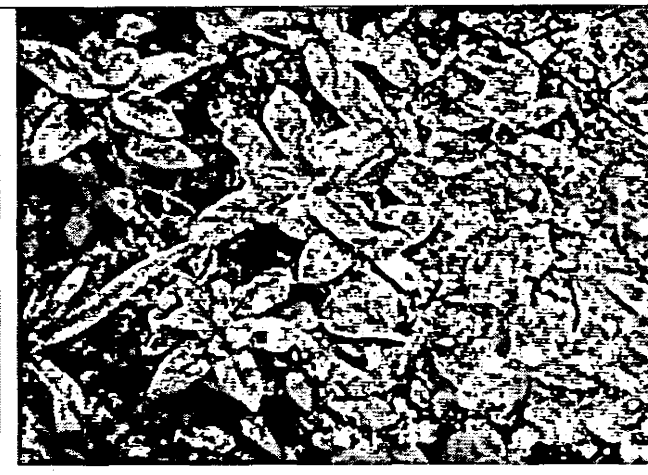


Ethno-botanical Significance	Is used in sauce and added in food for flavor.

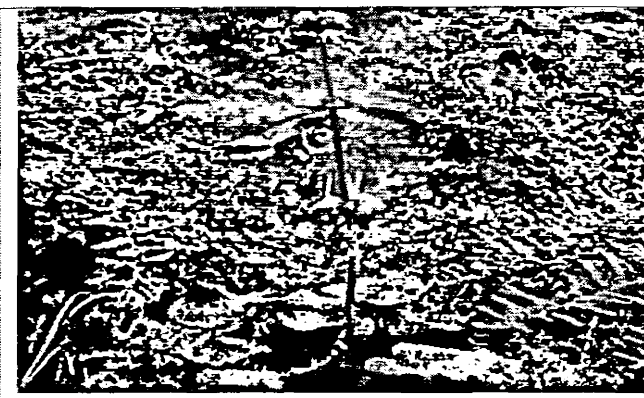
Local Name	Bareena
Scientific Name	*Mentha longifolia* (L.) Hudsun
Family	Lamiaceae
Place of Collection	Kopra Puthiyaan N=34°10'12.5" E=73°41'03.4"
Occurrence	Kopra Puthiyaan, Chikar, Sudhan Gali, Noon Bangla
Elevation (m)	1366



Ethno-botanical Significance	Horse mint leaves are dried and boiled with water, are used against vomit and stomach ache. Herbal tea is made from dried leaves used against diarrhea and dysentery.
Local Name	Podina
Scientific Name	*Mentha royleana*
Family	Lamiaceae
Place of Collection	Kopra Puthiyan N=34°10'22.0" E=73°41'06.9"
Occurrence	Common
Elevation (m)	1372

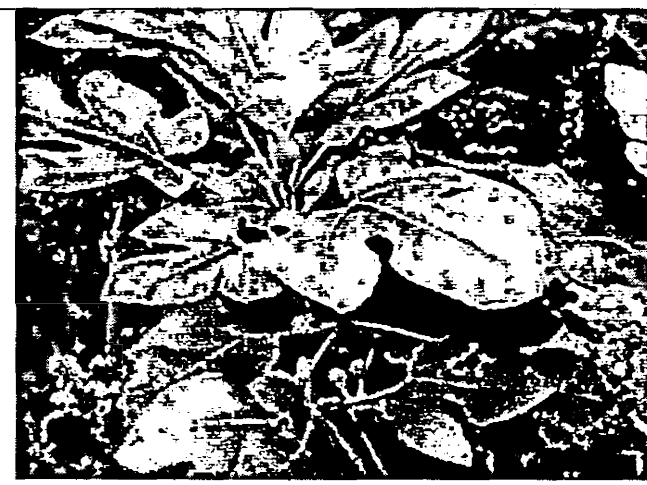


Ethno-botanical Significance	Leaves are dried and used with curd for relieving stomach ache. Antiseptic; Carminative; Febrifuge
Local Name	Kenthi
Scientific Name	*Martynia annua*
Family	Martyniaceae
Place of Collection	Chikar N=34°08'45.5" E=73°42'16.6"
Occurrence	Bail, Batangi
Elevation (m)	1798



Ethno-botanical Significance	Flowers are dried and boiled in water; the syrup is used for arthritis.

Local Name	Phagari
Scientific Name	*Ficus carica*
Family	Moraceae
Place of Collection	Chikar N=34°08'20.9" E=73°40'08.4"
Occurrence	Kopra Puthiyaan, Chikar, Bail, Batangi
Elevation (m)	1374



Ethno-botanical Significance	The plant is the root stock of fig, fruit is used for stomach ache and is laxative, and trunk is used as fuel wood while leaves are animal feed.

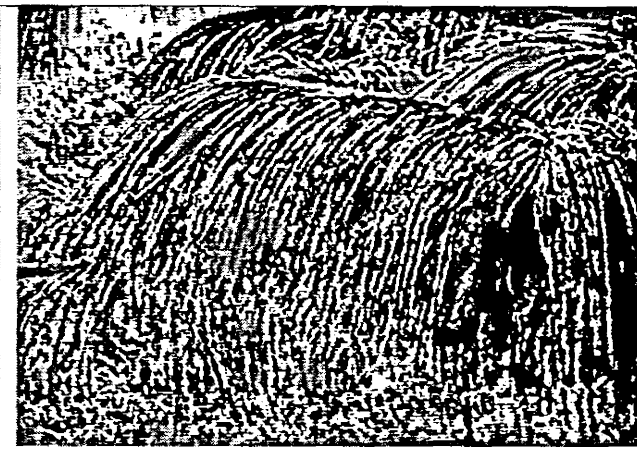
Local Name	Dharek
Scientific Name	*Melia azedarach*
Family	Meliaceae
Place of Collection	Kopra Puthiyan N=34°10'16.7" E=73°41'05.8"
Occurrence	Chikar, Kopra Puthiyaan, Noon bangla, Bail
Elevation (m)	1367

Ethno-botanical Significance	Fruits are poisonous to humans if eaten in quantity. Leaves have been used as a natural insecticide to keep with stored food. Flowers and leaves are used to relieve headache. Decoction of leaves is applied in case of hysteria. Seeds are used against diabetes.

Local Name	Toot
Scientific Name	*Morus nigra*
Family	Moraceae
Place of Collection	Kopra Puthiyan N=34°10'19.1" E=73°41'07.0"
Occurrence	Kopra puthiyaan, Chikar
Elevation (m)	1348

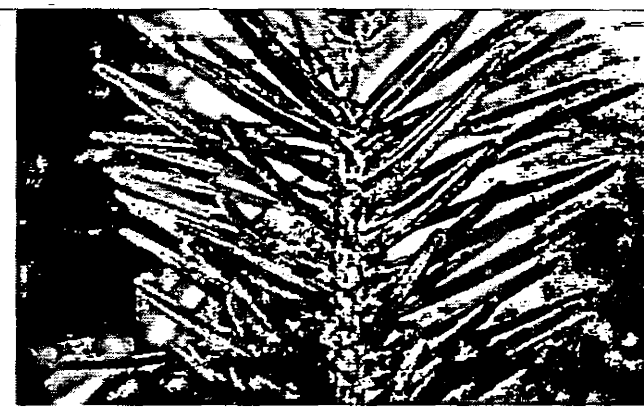
Ethno-botanical Significance	Leaves are used for silk worm farming. Leaves decoction is used for throat infections, fruit is laxative. Trunk is used as timber. Branches are made into baskets.

Local Name	Byar
Scientific Name	*Pinus wallichiana*
Family	Pinaceae
Place of Collection	Kopra Puthiyaan N=34°10'16.3" E=73°41'04.9"
Occurrence	Kopra puthiyaan, Chikar, Bail, Noon Bangla, sudhan Gali
Elevation (m)	1375



Ethno-botanical Significance	Resins from the tree are used in coal tar and paints. Cones yield sweet cone seeds. The tree trunk is used as timber while branches are used as fuel wood.

Local Name	Toung
Scientific Name	*Abies pindrow*
Family	Pinaceae
Place of Collection	Sudhan Gali N=34°04'46.7" E=73°44'45.0"
Elevation (m)	2341



Ethno-botanical Significance	Used as wood source for timber and fuel wood.

Local Name	Chir
Scientific Name	*Pinus roxburghii*
Family	Pinaceae
Place of Collection	Kopra Puthiyaan N=34°10'16.3" E=73°41'04.9"
Occurrence	Chikar, Bail, Batangi, Kopra Puthiyaan
Elevation (m)	1375

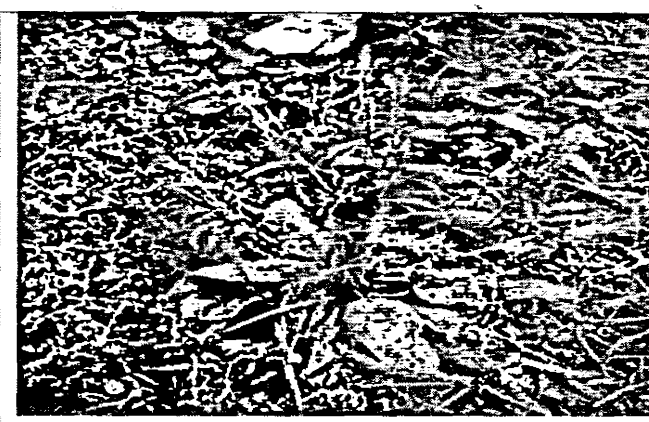
Ethno-botanical Significance	Fresh buds are used for measles treatment. Cones yield sweet cone seeds. Wood is used for timber.

Local Name	Makki ka Boor and Nasar
Scientific Name	*Zea mays*
Family	Poaceae
Place of Collection	Kopra Puthiyaan N=34°10'23.4" E=73°41'07.2"
Occurrence	Common
Elevation (m)	1378
Ethno-botanical Significance	The pollens and hair of corn are boiled in water, cooled and filtered the filtrate is used for the treatment of urinary blockage

Local Name	Batti/ Ispagol
Scientific Name	*Plantago asiatica*
Family	Plantaginaceae
Place of Collection	Chikar N=34°08'22.6" E=73°40'06.7"
Occurrence	Kopra Puthiyan,Chikar
Elevation (m)	1375
Ethno-botanical Significance	Antibacterial; Anti-inflammatory; Antiseptic; Anti-tussive; Cardiac; Diuretic; Expectorant; Haemostatic; Laxative. Cooked along with spinach.

Local Name	Masloon
Scientific Name	*Bistorta amplexicaulis*
Family	Polygonaceae
Place of Collection	Chikar N=34°08'36.2" E=73°40'17.2"
Occurrence	Kopra Puthiyaan, Chikar, Noon Bangla, Sudhan Gali
Elevation (m)	1369
Ethno-botanical Significance	Roots are used for making tea and taken for joint and muscular pain. Root powder is used for stopping nose bleeding.

Local Name	Jandi
Scientific Name	*Rumex nepalensis*
Family	Polygonaceae
Place of Collection	Noon Bangla N=34°07'19.6" E=73°39'01.4"
Elevation (m)	1285



Ethno-botanical Significance	Purgative; Stomachic. Entire plant is mashed with water and left overnight, the paste is drank for soothing effect on liver and jaundice.

Local Name	Hula
Scientific Name	*Rumex acetosa*
Family	Polygonaceae
Place of Collection	Noon Bangla N=34°08'04.7" E=73°38'00.5"
Occurrence	Manja Keri, Karli, Sudhan Gali
Elevation (m)	1738

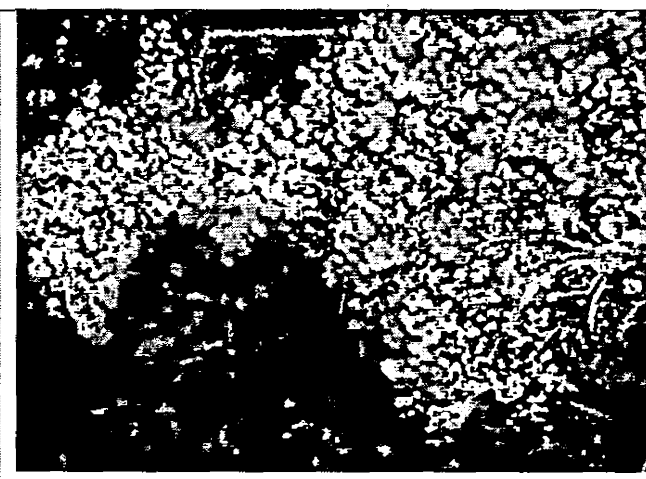
Ethno-botanical Significance	Plant leaves are washed, mashed and applied on flash wounds to stop bleeding.

Local Name	Khatimmal
Scientific Name	*Rumex hastatus*
Family	Polygonaceae
Place of Collection	Chikar N=34°08'23.4" E=73°40'08.2"
Occurrence	Kopra Puthiyaan, Chikar, Bail, Batangi
Elevation (m)	1573

Ethno-botanical Significance	It is cooked with yogurt and fed to animals for worms. Mashed plant leaves are used as tincture, and the plant is fed to the animals with swollen belly as an antibiotic (Aaphra)

Local Name	Ban Sathra
Scientific Name	*Pteris cretica*
Family	Pteridaceae
Place of Collection	Noon Bangla N=34°08'31.5" E=73°38'15.0"
Occurrence	Chikar, Noon Bangla, Sudhan Gali, Menja Kri
Elevation (m)	1763

Ethno-botanical Significance	Is used in roof tops and mud floorings and as animal fodder.
Local Name	Kakwai
Scientific Name	*Adiantum aethiopicum*
Family	Pteridaceae
Place of Collection	Chikar N=34°08'13.7" E=73°40'05.6"
Occurrence	Common
Elevation (m)	1395

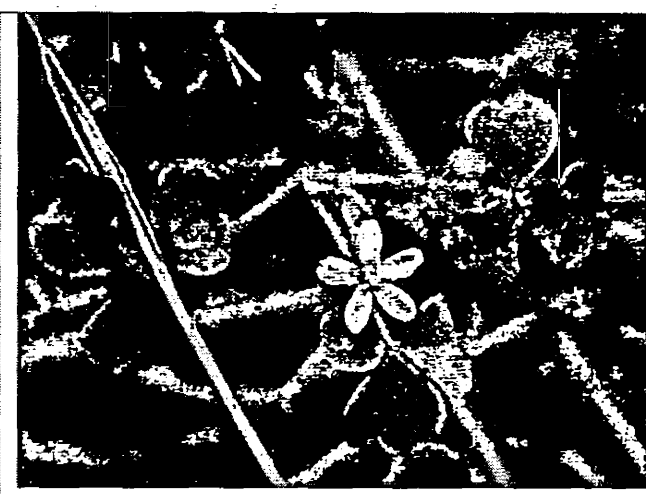


Ethno-botanical Significance	Antirheumatic; Astringent; Demulcent; Emmenagogue; Expectorant; Febrifuge; Haemostatic; Pectoral; Tonic. Its paste in boiled water is used for soothing effect and urinary disorders.
Local Name	Kahu
Scientific Name	*Olea ferruginea* Royle
Family	Oleacea
Place of Collection	Kopra Puthiyaan N=34°10'17.7" E=73°41'04.2"
Occurrence	Kopra Puthiyaan, Bail
Elevation (m)	1329

Ethno-botanical Significance	is a wild type of olive and branches are used for maswak. Fruit is edible while tree is used for fuel wood. Oil obtained from the fruit is used as rubefacient.

Local Name	Chamba
Scientific Name	*Jasminum officinale*
Family	Oleaceae
Place of Collection	Chikar N=34°08'47.8" E=73°41'05.5"
Elevation (m)	1660

Ethno-botanical Significance	Is a wild type of jasmine very fragrant and intense in smell
Local Name	Khatkurla
Scientific Name	*Oxalis corniculata*
Family	Oxalidaeceae
Place of Collection	Kopra Puthiyaan N=34°10'21.7" E=73°41'06.7"
Occurrence	Kopra Puthiyan,Chikar, Noon Bangla, Sudhan Gali
Elevation (m)	1378

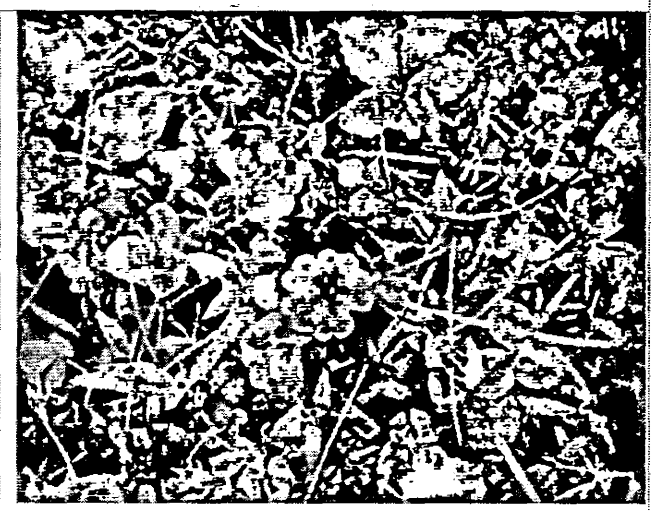


Ethno-botanical Significance	The whole plant is anthelmintic, antiphlogistic, astringent, depurative, diuretic, emmenagogue, febrifuge, stomachic and styptic
Local Name	Sinjli
Scientific Name	*Ziziphus jujuba*
Family	Rhamnaceae
Place of Collection	Kopra Puthiyaan N=34°10'21.0" E=73°41'08.1"
Occurrence	Kopra Puthiyaan
Elevation (m)	1373

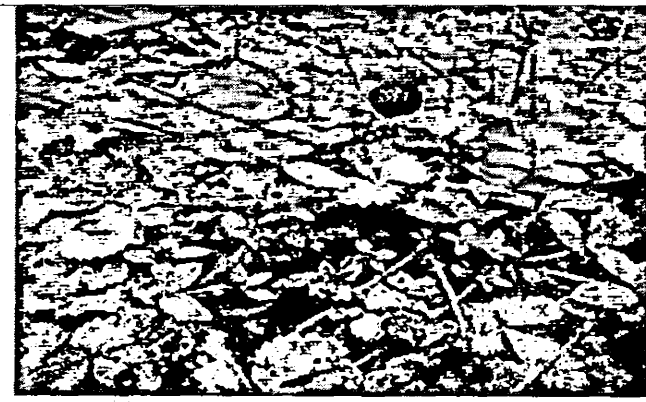
Ethno-botanical Significance	Fruit is similar as Bair; stem is used as fuel wood.

Local Name	Chahl
Scientific Name	*Rosa brunonii*
Family	Rosaceae
Place of Collection	Kopra Puthiyaan N=34°10'20.9" E=73°41'08.4"
Occurrence	Chikar, Kopra Puthiyaan, Bail, Noon bangle, Sudhan Gali
Elevation (m)	1374

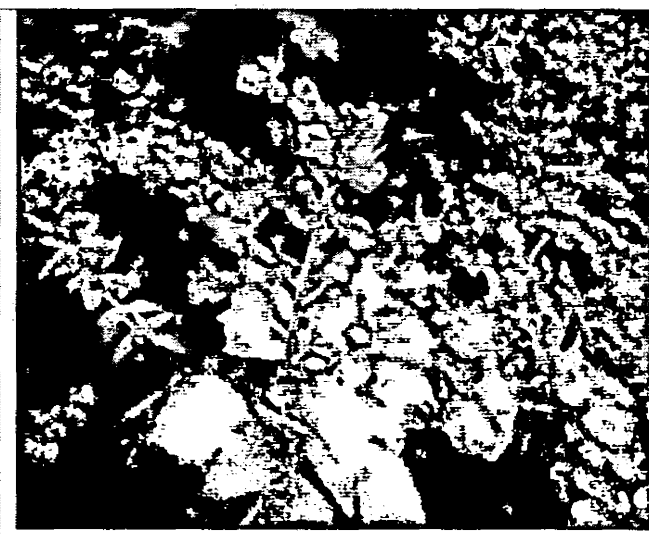
Ethno-botanical Significance	Rose water is applied in case of heat stroke.
Local Name	Rattan Jog (Red Flower)
Scientific Name	*Potentilla nepalensis*
Family	Rosaceae
Place of Collection	Sudhan Gali N=34°04'46.6" E=73°44'48.1"
Occurrence	Sudhan Gali
Elevation (m)	2349



Ethno-botanical Significance	Roots are boiled dried and the powder made from it is used for arthritis, jaundice, kidney and spleen problems.
Local Name	Budi Meva
Scientific Name	*Potentilla indica*
Family	Rosaceae
Place of Collection	Kopra Puthiyaan N=34°10'16.3" E=73°41'04.9"
Occurrence	Kopra Puthiyaan, Chikar, Sudhan Gali
Elevation (m)	1366
Ethno-botanical Significance	Fruit is edible like strawberry and is considered good for eyesight.



Local Name	Garacha
Scientific Name	*Rubus fruticosus*
Family	Rosaceae
Place of Collection	Chikar N=34°08'44.4" E=73°40'54.8"
Occurrence	Kopra Puthiyaan, Chikar, Noon Bangla, Sudhan Gali
Elevation (m)	1377



Ethnobotanical Significance	Has fruit like strawberry. Astringent; Depurative; Diuretic; Tonic.

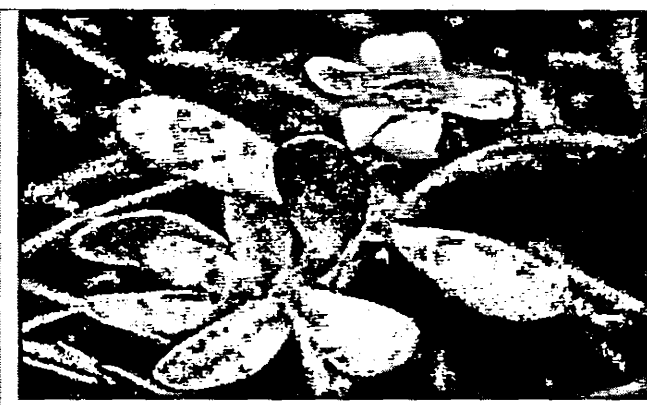
Local Name	Timmer
Scientific Name	*Zanthoxylum armatum*
Family	Rutaceae
Place of Collection	Kopra Puthiyan N=34°10'19.7" E=73°41'07.8"
Elevation (m)	1379

Ethno-botanical Significance	The branches are used as maswak, fruit is used in pickles. Fruit and leaves are used to treat throat diseases of cattle. The bark and fruit extracts are used for treatment of typhoid fever.

Local Name	Reetha
Scientific Name	*Sapindus mukorossi*
Family	Sapindaceae
Place of Collection	Noon Bangla N=34°07'21.9" E=73°39'05.9"
Occurrence	Chikar, Kopra Puthiyaan
Elevation (m)	1375

Ethno-botanical Significance	Is used in a number of herbal medicine, the fruit is used to make rich leather with water and used in shampoos

Local Name	Qulfa
Scientific Name	*Bacopa monnieri*
Family	Scrophulariaceae
Place of Collection	Kopra Puthiyaan N=34°10'22.5" E=73°41'06.0"
Occurrence	Chikar, Kopra Puthiyaan, Bail
Elevation (m)	1373



Ethno-botanical Significance	The plant is washed, mashed and sieved; the resulting syrup is used for liver disorders, and for diarrhea
Local Name	Geedar Tambakoo
Scientific Name	*Verbascum thapsus*
Family	Scrophulariaceae
Place of Collection	Kopra Puthiyaan N=34°10'18.3" E=73°41'02.4"
Occurance	Kopra Puthiyaan , Bail
Elevation (m)	1300

Ethnobotanical Significance	Leaves are dried and used as tobacco and is also used to make naswar.
Local Name	Kach Mach
Scientific Name	*Solanum nigrum*
Family	Solanaceae
Place of Collection	Kopra Puthiyaan N=34°10'16.3" E=73°41'04.9"
Occurrence	Chikar, Kopra Puthiyaan, Bail
Elevation (m)	1367

Ethno-botanical Significance	Leaves are mashed in water and applied externally for worms in children. The plant is Antiperiodic; Antiphlogistic; Diaphoretic; Diuretic; Febrifuge; Narcotic; Purgative and Sedative.

Local Name	Marchola
Scientific Name	*Solanum pseudocopsicum*
Family	Solanaceae
Place of Collection	Kopra Puthiyan N=34°10'19.7" E=73°41'07.8"
Occurrence	Common
Elevation (m)	1374

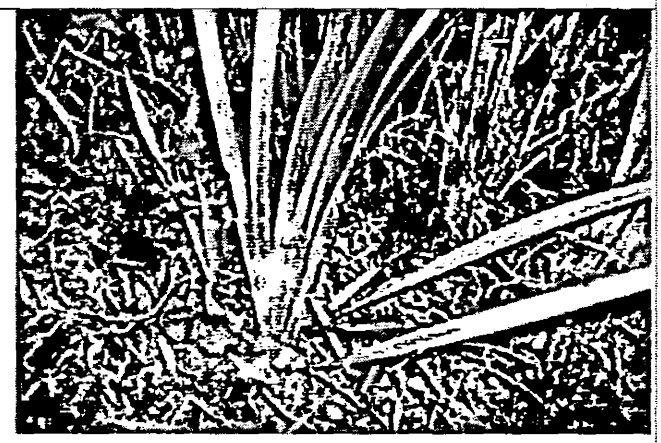
Ethno-botanical Significance	The fruit is added in yellow rice and kuri for flavor and color.
Local Name	Kandyara
Scientific Name	*Solanum surratense*
Family	Solanaceae
Place of Collection	Chikar N=34°10'18.4" E=73°41'02.4"
Occurrence	Common
Elevation (m)	1287

Ethno-botanical Significance	Fruit is dried and along with Marchola used as food additive for natural color. Diaphoretic; Diuretic & Febrifuge
Local Name	Datura
Scientific Name	*Datura stramonium*
Family	Solanaceae
Place of Collection	Chikar N=34°08'54.4" E=73°40'46.2"
Occurrence	Chikar
Elevation (m)	1600

Ethno-botanical Significance	Seeds are highly toxic and cause madness when eaten so people avoid using it, has hallucinogenic properties.

Local Name	Zakhm e Hayat/ Patherchut
Scientific Name	*Bergenia ciliate*
Family	Saxizragaecea
Place of Collection	Noon Bangla N=34°07'31.5" E=73°39'59.1"
Elevation (m)	1974

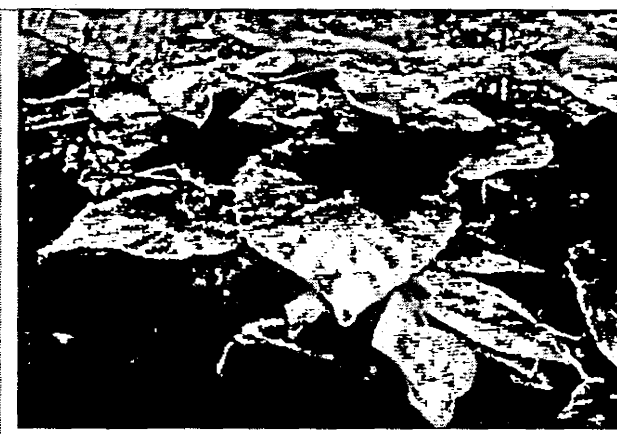
Ethno-botanical Significance	The roots of the plant are dried and sugar, water and corn floor are added and cooked to make halwa. It is then eaten or applied on skin for early pus formation in painful blisters.
Local Name	Barya
Scientific Name	*Typha latifolia*
Family	Thyaceae
Place of Collection	Noon Bangla N=34°06'38.9" E=73°40'29.9"
Occurrence	Noon Bangla, Manja Keri
Elevation (m)	2163



Ethno-botanical Significance	Is used for cattle with swollen belly and stomach ache
Local Name	Kayri
Scientific Name	*Urtica dioica*
Family	Urticaceae
Place of Collection	Sudhan Gali N=34°04'53.2" E=73°45'17.1"
Occurrence	Sudhan Gali, Chikar, Noon Bangla
Elevation (m)	2538

Ethno-botanical Significance	Is an irritating plant, when touched causes rash and inflammation. Root extract of the same plant is used to relieve the inflammation.

Local Name	Gul Naqsh/Banafsha
Scientific Name	*Viola pilosa*
Family	Violaceae
Place of Collection	Chikar N=34°08'48.8" E=73°41'19.1"
Elevation (m)	1996



Significance	Entire plant is used for stomach and intestinal disorders

Local Name	Chooroon
Scientific Name	*Cynoglossum glochidiatum*
Family	Boraiginaceae
Place of Collection	Noon bangla N=34°08'04.6" E=73°38'59.1"
Occurrence	Manja Keri, Sudhan Galli
Elevation (m)	1739

Ethno-botanical Significance	The plant is washed and mashed with water, the filtrate is drunk; usually one to two glasses is enough for treatment of typhoid and fever. It is also used for allergy and pneumonia.

Local Name	Sirgunda
Scientific Name	*Arisaema jaquemontii*
Family	Araceae
Place of Collection	Sudhan Galli N=34°09'15.5" E=73°40'9.1"
Occurrence	Sudhan Galli, Chikar, Noon Bangla
Elevation (m)	1985

Ethno-botanical Significance	The plant is very poisonous especially the tuber root and fruit when touched with bare hands cause blisters. The tuber is boiled in milk and given to weak cattle for strength.

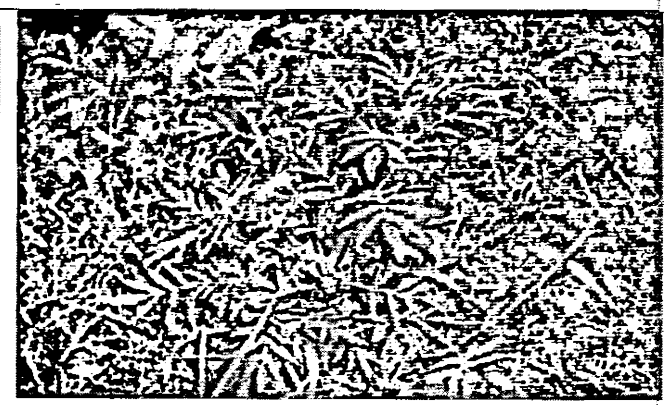
Local Name	Chameeri (sour orange)
Scientific Name	*Citrus limon* (Linn.) Burm.
Family	Rutaceae
Place of Collection	Kopra Puthiyaan N=34°10'21.6" E=73°41'06.9"
Occurrence	Chikar, Bail, Noon Bangla, Kopra Puthiyan,
Elevation (m)	1375

Ethno-botanical Significance	Citrate fruit is used to treat jaundice and contains high concentration of vitamin C. fruit extracts are added in tea for instant relieve from flue.

Local Name	Adhand
Scientific Name	*Cucumis melo var.*
Family	Cucurbiteceae
Place of Collection	Kopra Puthiyan N=34°10'19.7" E=73°41'07.8"
Occurrence	Common
Elevation (m)	1374

Ethno-botanical Significance	Is dried and used as powder for diarrhea

Local Name	Sat barga
Scientific Name	*Tagetes minuta*
Family	Asteraceae
Place of Collection	Sudhan Gali N=34°07'19.9" E=73°39'06.6"
Elevation (m)	1351



Ethno-botanical Significance	The plant is very aromatic and is used traditionally to get rid of domestic dog fleas, the plant is wound into a collar in the dog's neck and in a matter of minutes the fleas ran off. Plant is also used for treatment of hysteria.

Local Name	Sanatha	
Scientific Name	*Dodonaea viscosa*	
Family	Sapindaceae	
Place of Collection	Kopra Puthian N=34°10'23.3" E=73°41'09.2"	
Elevation (m)	1369	
Ethno-botanical Significance	Wood is very tough and high in durability. A red dye is obtained from its fruit.	

Figure 4.1: Map of Survey area

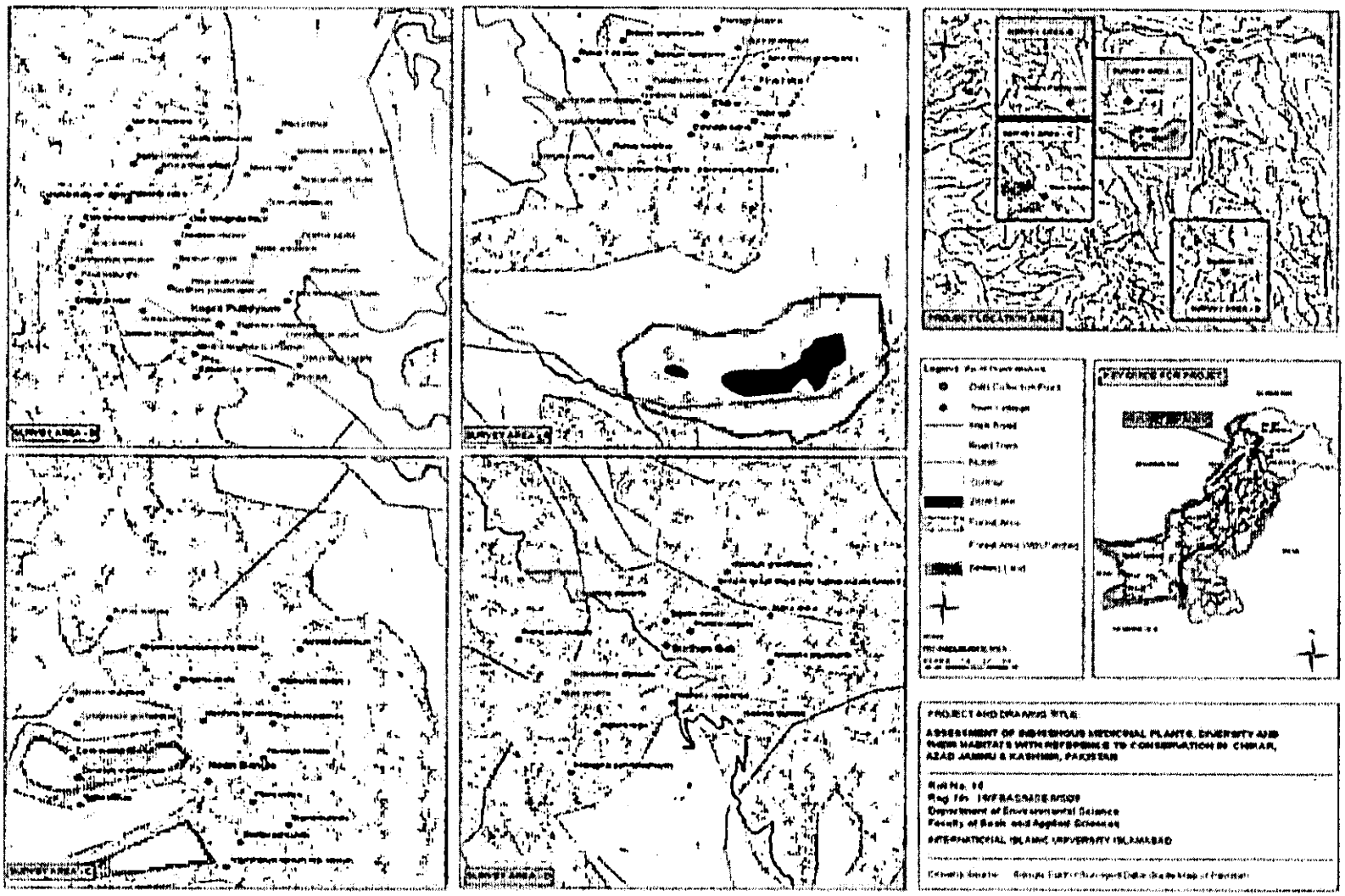


Table 4.2: Main wood, fodder and oil yielding plants of the study area

Sr. No.	Plant Species	Utilization			
		Timber	Fuel Wood	Fodder	Oil yielding
1	*Ziziphus jujuba*		x		
2	*Ficus carica*	x	x		
3	*Quercus leucotrichophora*	x	x		
4	*Pinus wallichiana*	x	x		
5	*Acacia nilotica*	x	x		
6	*Diospyras lotus*		x		
7	*Zea mays*			x	x
8	*Pinus roxburghii*	x	x		
9	*Amaranthus graecizans L.*			x	
10	*Salvia moorcroftiana*			x	
11	*Pteris cretica*			x	
12	*Rumex acetosa*			x	
13	*Cynoglossum glochidiatum*			x	
14	*Typha latifolia*			x	
15	*Sapindus mukorossi*		x		
16	*Carissa opaca*		x		
17	*Juglans regia*	x	x		
18	*Zanthoxylum armatum*		x		x
19	*Olea ferruginea Royle*		x		x
20	*Melia azedarach*		x		
21	*Dryopteris stewertis*			x	
22	*Morus alba*	x	x		
23	*Duodonia viscosa*		x		
24	*Rumex nepalensis*			x	

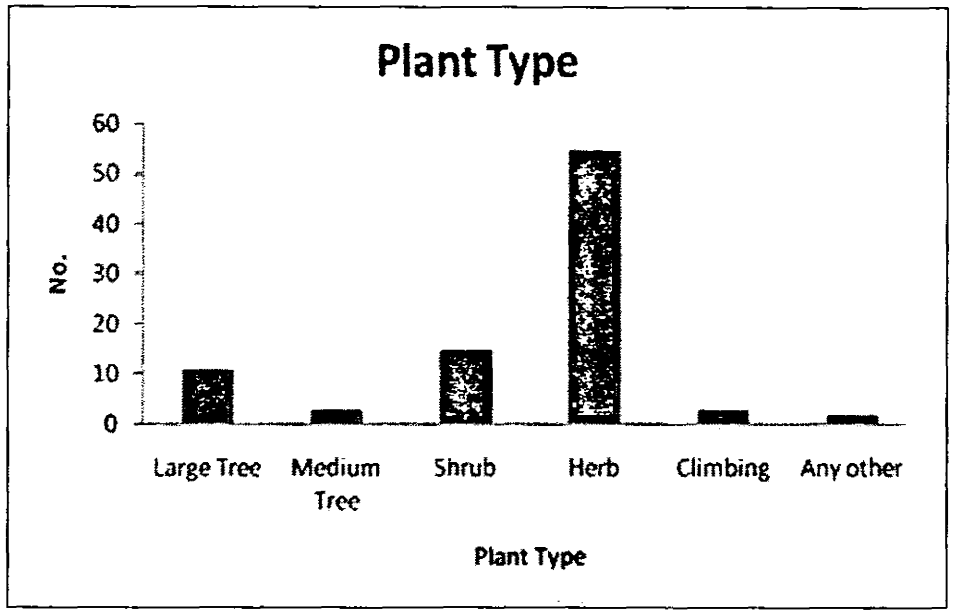


Figure 4.2: Plant Type of collected species

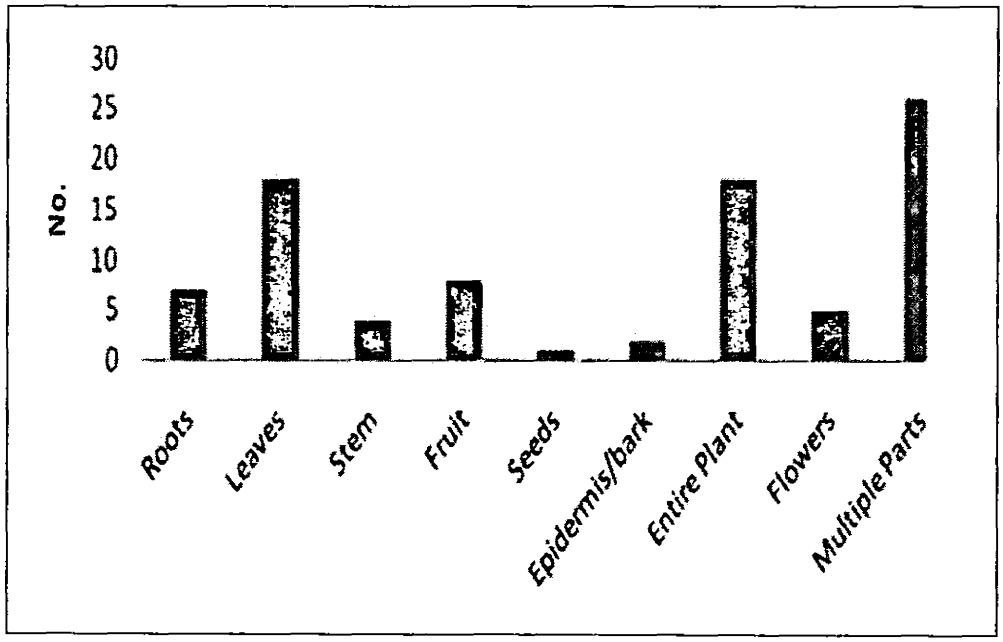


Figure 4.3: Plants Parts Used

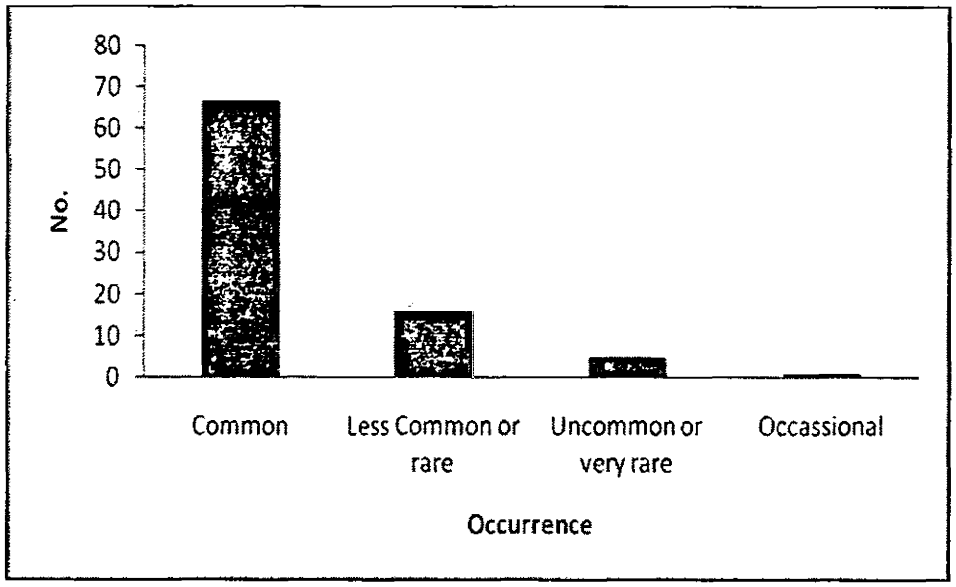


Figure 4.3: Occurrence of collected plant species

4.2 MARKET SURVEY RESULTS

1. Hakeem Asif Zia Ansari **Ansari Dawa Khana Main Bazar Muzaffarabad**

- ✓ Species commonly utilized: Patrees (Aconitum heterophyllum wall), Kuth (*Sassurea lepa*), Chikkel (*Prunella vulgaris*), Zakhm-e-Hayat (*Bergenia ciliata*), Sumbal (*Berberis lyceum*) and Chiraita (Swertia cordata).
- ✓ Medicinal importance of the herbs was confirmed from Hakeem Asif Zia Ansari.
- ✓ Market rates of Patrees were found to be highest among all the plant species discussed.
- ✓ Utilization of the medicinal plants has decreased over past 10 years due to decreased supply and unavailability of labor for collection also due to increases in the trend of using allopathic medicine.
- ✓ Abundance of the herbs has also decreased due to overexploitation and black marketing of the herbs over past few years.

✓ Annual consumption and per Kg price of the different plant species in Ansari Dawakhana is mentioned in Table 4.3.

Table 4.3: Annual consumption and per kg price of reported plant species

Sr. No.	Plant species	Price (Rs. /kg)	Annual Consumption (kg)
1	*Aconitum heterophyllum wall*	1600-3000	5
2	*Saussurea costus (Falc.) Lipsch*	300-420	4-6
3	*Prunella vulgaris*	120-130	4-5
4	*Bergenia ciliate*	260-300	2-3
5	*Berberis lyceum*	60-80	10-12
6	*Swertia cordata*	150-160	2-3
7	*Paeonia emodi*	60-70	10-12

2. Hakeem Kashif Iqbal Hameediya Dawa Khana Main Bazar Muzaffarabad

✓ Species commonly utilized: Kuth (*Sassurea lepa)*, Batpaya, Anjubar (*Bistorta amplexicaulis*), Patrees (Aconitum heterophyllum wall), Rattan Jog (*Geranium wallichianum)*, Mamekh, Chikkal (*Prunella vulgaris)*, Nera (*Nerium oleander*).

✓ Medicinal importance of the herbs was confirmed by Hakeem Kashif Iqbal.

✓ Market price of patrees was highest among the reported species.

✓ Utilization of medicinal plants has decreased over past 10 years.

✓ Supply of medicinal plant species has decreased as people prefer other sources of income than to harvest herbs.

✓ Annual consumption and per Kg price of the different plant species by Hameediya dawa Khana is mentioned in Table 4.4.

Table 4.4: Annual consumption and per kg price of reported plant species

Sr. No.	Plant species	Price(Rs /kg)	Annual Consumption (kg)
1	*Aconitum heterophyllum* wall	2000-3000	7
2	*Saussurea costus*	250-300	6
3	*Prunella vulgaris*	100-120	4-5
4	*Bistorta amplexicaulis*	120-150	8-10
5	*Geranium wallichianum*	70-80	10-12
6	*Skimmia laureola*	150-160	2-3
7	*Paeonia emodi*	60-70	10-12

3. Hakeem Abdul Rehman Rehmaniya Dawa Khana, Main Bazar Muzaffarabad

- ✓ Species commonly utilized: Masloon (*Bistorta amplexicaulis)*, Zakhm.e Hayat (*Bergenia ciliata)*, Kuth(*Sassurea lepa)*, Guchi (*Morchela esculenta)*, Ner (*Skimmia laureola*), Chikkel (*Prunella vulgaris) and Patrees (Aconitum heterophyllum wall)*.
- ✓ Medicinal importance of the herbs was confirmed from Hakeem Alhaj Molvi Abdul Rehman.
- ✓ Market rates of Patrees and Guchi were found to be highest among all the plant species discussed.
- ✓ Utilization of the medicinal plants has decreased over past 10 years due to decreased supply and unavailability of labor for collection.
- ✓ Abundance of the herbs has also decreased due to overexploitation and black marketing of the herbs over past few years. Herbs are collected by untrained people for the contractors who sell them to Naswari Bazar Rawalpindi or wholesale markets in Lahore.
- ✓ Annual consumption and per Kg price of the different plant species in Rehmaniya Dawakhana is mentioned in Table 4.5.

Table 4.5: Annual consumption and per kg price of reported plant species

S.No.	Plant species	Price(Rs /kg)	Annual Consumption (kg)
1	*Bistorta amplexicaulis*	150-160	15-18
2	*Bergenia ciliate*	250-270	3-5
3	*Saussurea costus*	200-350	10
4	*Morchela esculenta*	2000	5-7
5	*Skimmia laureola*	170-180	15-17
6	*Prunella vulgaris*	125-130	7-10
7	*Aconitum heterophyllum* wall	2000-3000	20

Table 4.6: Traded Indigenous Medicinal plants Extraction from Chikar sold in Muzaffarabad Local Market

Sr. No.	Botanical Name	Category	Trade Name	Part Used	Rs/Kg	Consumption Kg/Year
1.	*Aconitum heterophyllum*	Herb	Patrees	Rh	1600-3000	32
2.	*Berberis lycium*	Shrub	Kashmal	B, Be	80	12
3.	*Berginia ciliata*	Herb	Zakhmi hayat	Rh	260-300	8
4.	*Bistorta amplexicaulis*	Herb	Anjabbar	Rh	120-150	28
5.	*Geranium wallichianum*	Herb	Rattan Joth	Roots	70-80	12
6.	*Juglans regia*	Tree	Akhrot	F, L, B	100-120	500
7.	*Morchella esculanta*	Herb	Guchi	WP	2000	7
8.	*Paeonia emodi*	*Herb*	*Mamekh*	*F, T*	*60-70*	*24*
9.	*Prunella vulgaris*	Herb	Chikkal	L	120-130	20
10.	*Saussurea costus*	Herb	Kuth	Root	300-420	22
11.	*Skimmia laureola*	Shrub	Baru	L	150-160	20
12.	*Swertia cordata*	Herb	Chiraita	F, L, S	150-160	3

(Source: Local Market i.e, Ansari Bazar Muzaffarabad)

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.

Table 4.7: Vulnerable to harvesting relationship of Traded Indigenous Medicinal Plants of Chikar AJ&K based on Mathematical Measurements of Supply and Demand

Sr. No	Botanical Name*	Availability	Consumption Kg/Y	Re-Growth	Part Used	Score
1.	*Aconitum heterophyllum*	Medium(1)	32(2)	Medium(1)	Rh(0)	4
2.	*Berberis lycium*	Medium(1)	*12(3)*	Medium(1)	B, Be, R(0)	5
3.	*Berginia ciliata*	More(2)	8(3)	More(2)	Rh(0)	7
4.	*Bistorta amplexicaulis*	More(2)	28(2)	More(2)	Rh(0)	6
5.	*Geranium wallichianum*	More(2)	12(3)	More(2)	Rh(0)	07
6.	*Juglans regia*	Medium(2)	500(0)	Less(0)	F, L, B, R(0)	2
7.	*Morchella esculanta*	Less(0)	7(3)	Medium(1)	WP(0)	04
8.	*Paeonia emodi*	Medium(1)	*24(3)*	Medium(1)	F, T(0)	05
9.	*Prunella vulgaris*	Medium(1)	20(3)	Medium(1)	L(3)	8
10.	*Saussurea costus*	Less(0)	22(3)	Medium(1)	Rh(0)	4
11.	*Skimmia laureola*	Less(0)	20(3)	Medium(1)	L(3)	7
12.	*Swertia cordata*	Less(0)	*3(3)*	Medium(1)	F, L, S(3)	7

KEY: Availability: Less = 0, Medium = 1, More = 2. Consumption/Year: More than 100 Kg = 0, From 50 -99 Kg = 1, From 25 -49 Kg = 2, Less than 25 Kg= 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=0-5= Vulnerable, 6-8= Rare, 9-12= Infrequent, 13-14=Common, 15-16=Dominant.

In remote highland of AJ&K like Chikar the wild medicinal plants are of crucial importance from socioeconomic point of view. Thus traditional botanical knowledge of the local inhabitants is worth to be examined biochemically that may trigger new therapeutic discoveries.

The survey of traditional botanical knowledge resulted in a rich folk knowledge of these wild plants of Chikar. About 70% of the local villagers have admitted that they give first priority to use indigenous medicinal plants for cure of disease. In far flung villages of Chikar, where access to allopathic medicines is meagre, primary health care through plants is very familiar to the local people.

A variety of medicinal plants found blooming during May to September while least from November to February (Fig. 4.2). Therefore field trips for observation and collection would be beneficial during maximum blooming months. There are seven plant species exploited for timber, fifteen for fuel wood, nine for fodder and three as most oil yielding in the area (Table 4.2). About 26 plant species were used extensively with utilization of most of the plant parts. Most of the species are very common in the area however, 5 species are found to be very rare and one plant species (*Zyzyphus jojuba*) occurs occasionally (Fig. 4.3; 4.4).

During the field survey and market survey 12 (Table 4.6 & 4.7) plant parts or whole indigenous plants have been observed as being extracted from Chikar and are sold in local market i.e, Ansari Bazar at Muzaffarabad the gateway through which these plants have been supplied in considerable amount to various national trading centers of Pakistan. Analysis of the nearest local market (Ansari Bazaar Muzaffarabad) survey resulted that one species *Aconitum heterophyllum* have maximum price i.e. Rs. 3,000 per Kg, followed by *Morchella esculanta* and *Saussurea costus* (Rs. 2000 and 420 per Kg) and other species have average price. The data shows that only two species (*Juglans regia*-fruit/bark/root and *Aconitum heterophyllum* –root) have maximum annual consumption i.e 500 and 32 Kgs per annum followed by *Bistorta amplexicaulis* and *Paeonia emodi* i.e. 28 to 24 Kgs per annum and the rest are consumed below (Table 4.6). It looks that *Juglans regia* may be a common species in the area as being heavy consumption rate but it is declared vulnerable due to the trade value and extraction of its bark and root extracted (Table 4.7).

Fuel wood and fodder have been heavily extracted from Chikar. The collectors are women and children, hundreds of whom visit the forest of the valley for fuel wood and fodder daily, except

in winter. There is also considerable release of cattle into the area during the summer months. Other items collected by villagers include medicinal plants, food plants and mushrooms (*Morchella esculenta* species etc.) which are dried and exported, fetching a high price in the Western market (Shinwari & Shinwari, 2006).

In total 12 indigenous medicinal plant species have been collected for trade from the area out of which 6 medicinal plants have been declared vulnerable to harvesting from Chikar and adjacent area. The vulnerable indigenous species include one tree i.e., *Juglans regia*, a shrub *Berberis lycium* and four herbaceous species include *Aconitum heterophyllum*, *Paeonia emodi*, *Saussurea costus* and one mushroom species *Morchella esculanta* (Table 4.7).

4.3 HABITAT THREATS OBSERVATIONS

Following observations have been made in the assessment of reasons identified during the survey responsible for habitat loss in the area by the local people.

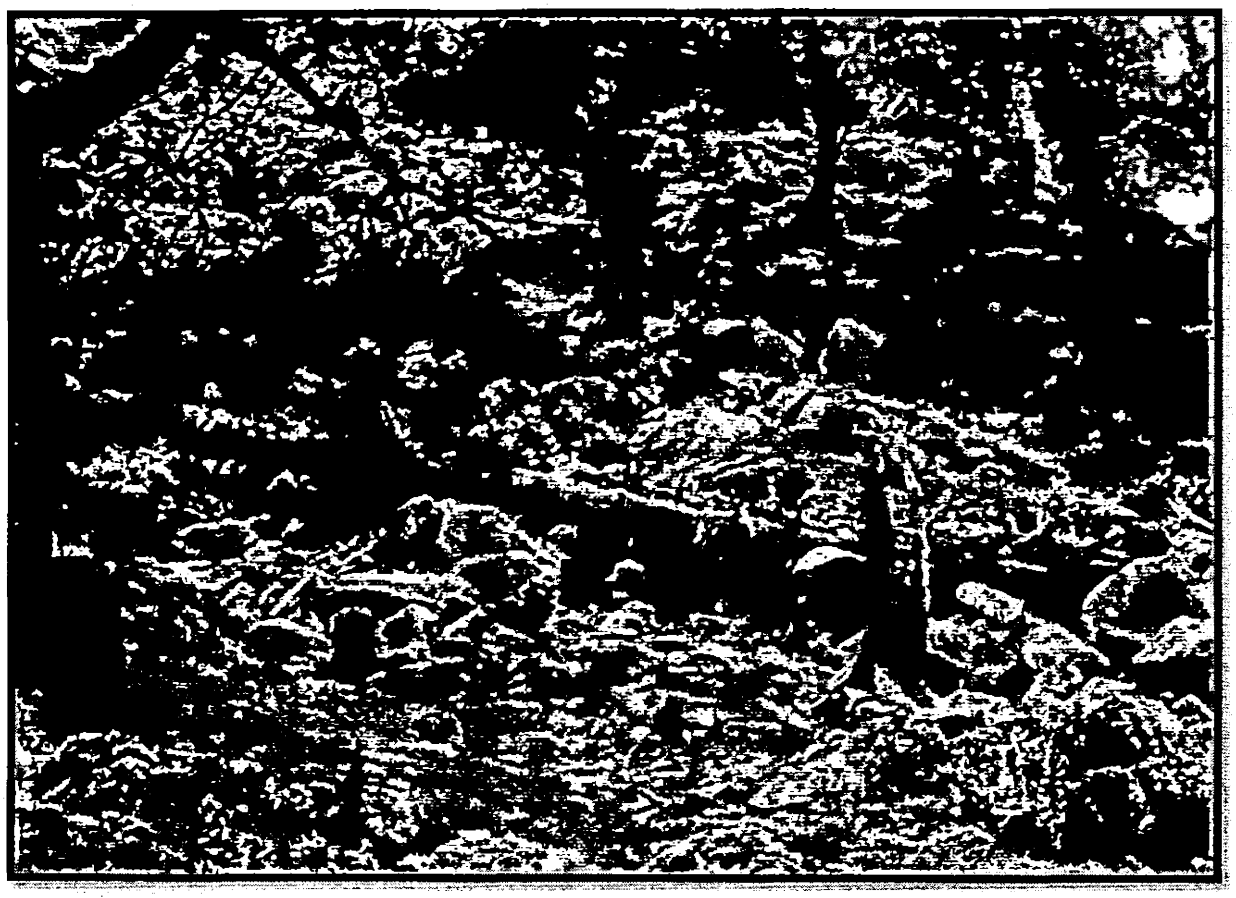
1. SOCIO-ECONOMIC (RESIDENTIAL & COMMERCIAL) AND INFRASTRUCTURE DEVELOPMENT

Clearance of land for human settlements or other non-agricultural practices with a substantial reduction in vegetation cover is the major reason for loss of important plant species. Housing, industrial or tourism development has greater role in biodiversity loss over last few decades in the area.

Road network in the area surveyed is also very poor. Land sliding remains major cause of roads blockage most often. Also most of the projects going on in the area are not related much with the concept of landscape protection.

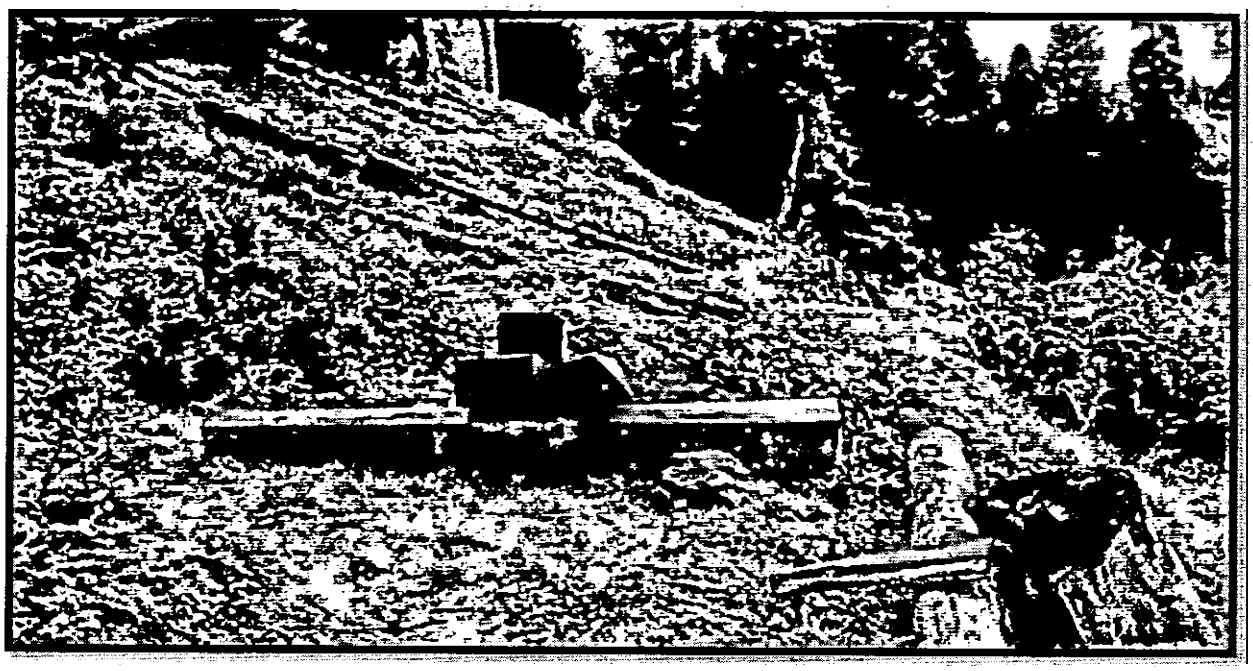
The management for habitat in the forest area is not sustainable and requires accepted locals participation. The top-bottom power delegation system causes intensive natural resource exploitation. Poverty and lack of awareness, along with lack of education, are the main reasons behind deforestation and habitat loss.

It was observed during the survey that locals dig out stones for construction of their houses and this directly lead towards soil/land erosion and hence biodiversity loss. During the survey when generally a question about deforestation intensity was asked, the response was much shocking as according to respondent tree felling on daily basis is a common routine in the area and they almost daily watch about 5-6 timber wood loaded trucks passing by their houses.

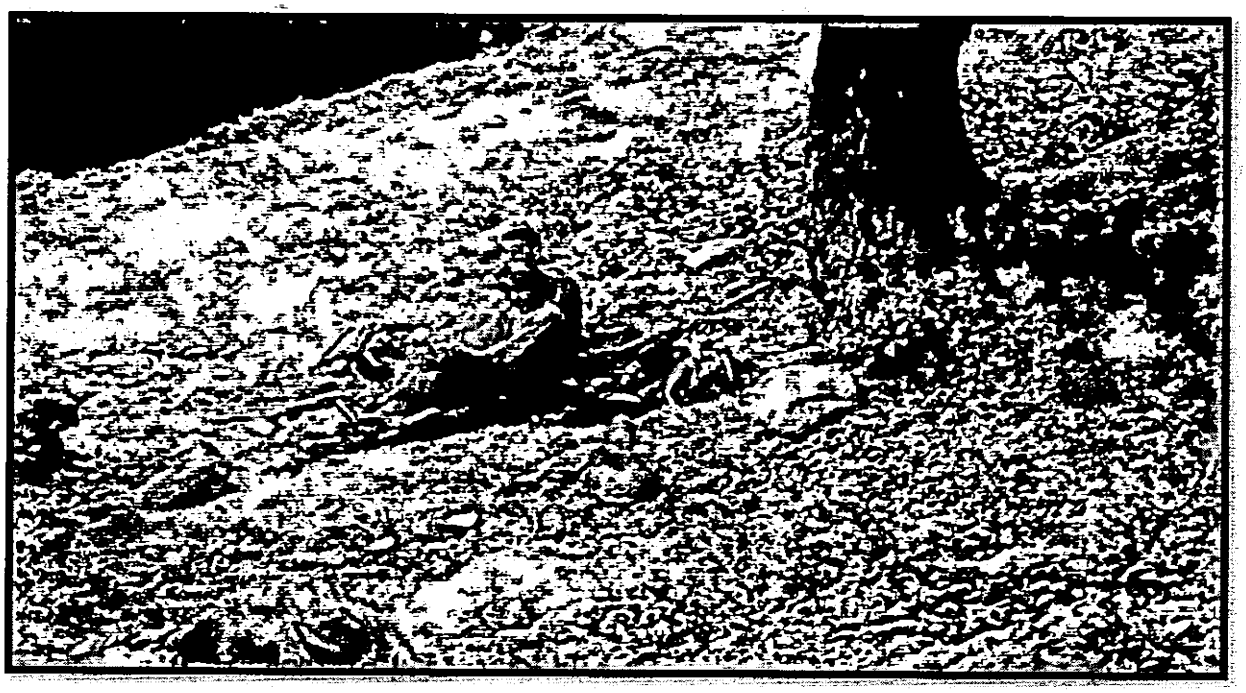


2. LAND CLEARING FOR AGRICULTURE EXPANSION AND INTENSIFICATION

According to present study agricultural expansion and intensification is second major factor behind the reduction in species abundance and diversity. To meet the basic needs of food land clearing has put the natural resources into constant threat and the species with narrow ecological niche are becoming extinct at a faster rate.



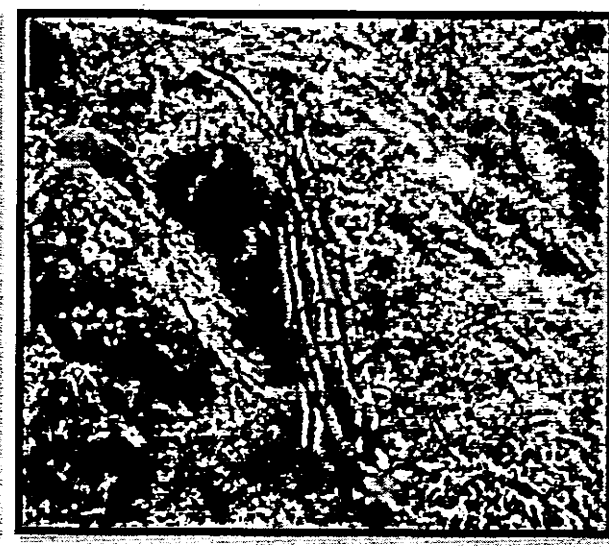
Landless peasants with the desire to look for public forest lands to grow crops to meet their livelihood, most often supported by government officers, are important cause of deforestation.



3. USE OF TREES FOR TIMBER AND FUEL/DEFOERSTATION

Trees are the main shelter providers to the medicinal plants in a forest ecosystem, but as the area is mountainous and for shelter (in roof making timber is required) and fuel, tree cutting is required which in turn destroys the natural habitat of the medicinal plants and hence there growth reduces ultimately giving rise to extinction of species.

According to a respondent in the area, the current annual consumption of timber is three times higher than the annual growth rate, and according to estimates with this consumption rate, all the lumber in the area will be exhausted in the near future.



Most prominently the timber "mafia" generates anti-conservation anger in the area. They act as primary player behind decline in forest cover. These people clear forest land or selectively utilize forests for agricultural purposes, forest products, fuel, timber wood, etc. By building roads and providing access, they open up inhabitable areas to others like landless migrants.

4. HUMAN INTRUSIONS AND DISTURBANCE

The intricate composition of forests in the area offers an immense variety of habitats including trees, shrubs, perennial herbs, bulbs, grasses, climbers, mosses sedges, and lichens. No other habitat in the world have such a wide range of plants, in spite of that poverty and ignorance/lack of awareness compels the locals to take advantage of natural resources that eventually exacerbate problems like deforestation.

Also human activities that change, damage and disturb habitats and species associated due to non-consumptive uses of natural resource (natural flora), these include eco-tourism and recreational activities.

5. METHODS FOR PLANT HARVEST

It is observed that contractors mostly hire females and children for harvesting of medicinal plants species. They are untrained so deliberate and unintentional harvesting effects in biodiversity loss.

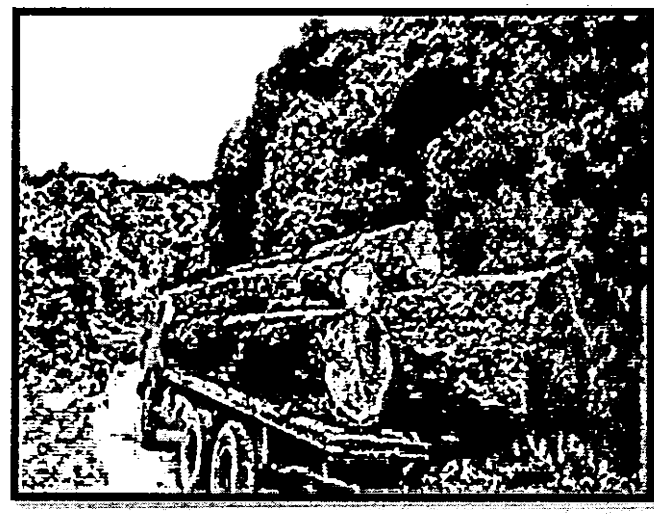
6. OVERGRAZING

Unplanned grazing is a trend in the area. Children between the ages of 8-17 are mostly sent with the domestic animals for their care during grazing. Hooves of animals and unplanned grazing both leads to land erosion and habitat destruction.

There prevails another concept among the people that if they cut down all the trees and shrubs from their own lands then grass production will improve for their animals and now most of the area is totally exposed to soil erosion and degradation.

7. OVEREXPLOITATION

The forest cover clearance, especially of very old trees although yields huge financial revenue but it leads to soil erosion which in turn causes nutrient loss, landslides, increased fire hazards, wildlife habitat degradation and reduction in species diversity, and increased risks from



insects and disease.

Contractors have the license for marketing of the medicinal plant species in the area but due to lack of proper checking they mostly take more amounts of plants then allowed quota. Also due to untrained harvesting methods plants species are under constant threat.

8. FIRE

Though not very common, prominent and recurrent but fire outbreak in a particular area often destroy the biodiversity of the area. Occasionally deliberate fires to remove unwanted weeds and to supply the future crops/fodder with essential nitrogen from the ashes of burnt martial, results in forest fire outbreaks that also result in habitat destruction.

Intentional fires by locals to have the possession of damaged trees are a trend in the area. People willingly set an area on fire and till the arrival of other locals and forest guard to overcome, a major portion gets damaged. Which then from permission of the forest officer, can be cut down by the land owner. Although locals do it to fulfill their fuel demands but it drastically affects the habitat of the area.

9. CLIMATE CHANGE AND WEATHER PATTERNS

According to locals climate of the area is changing, which may be associated with global warming and other rigorous weather/climatic events that are potentially able to destroy a vulnerable species or its habitat.

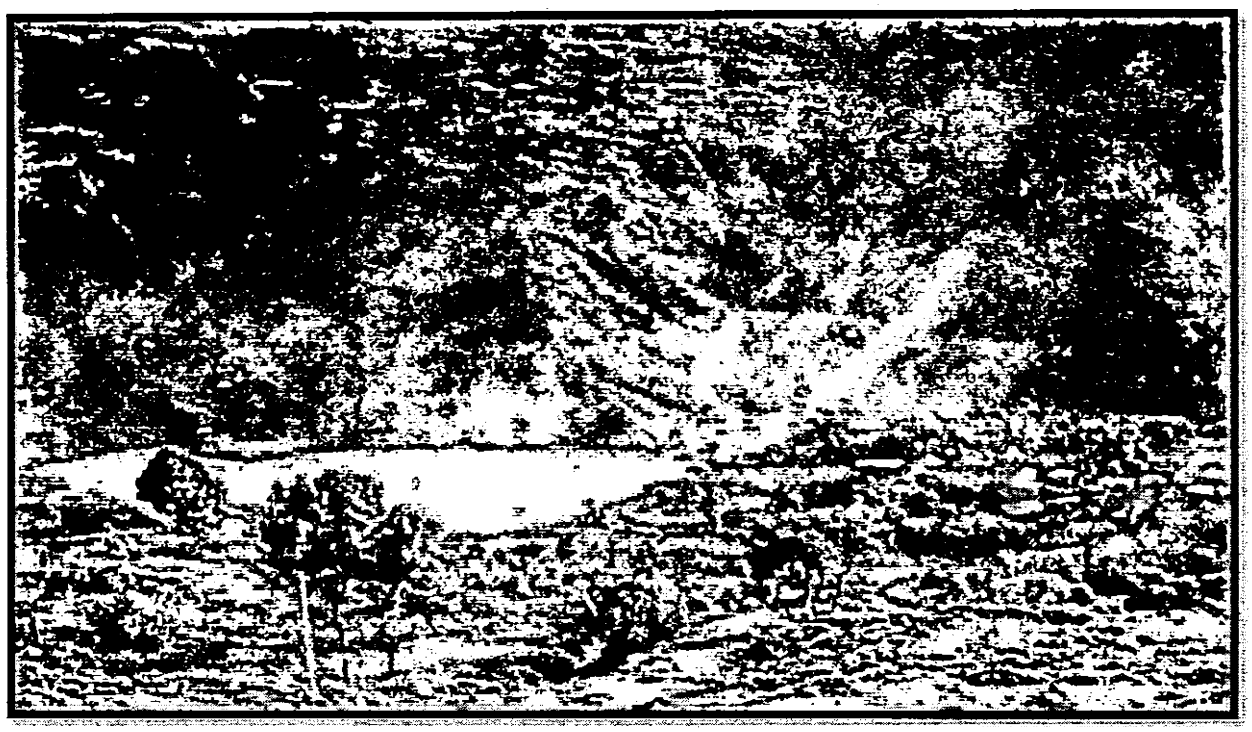
10. SMALL POPULATION SIZES AND OCCURRENCE IN PATCHES

Medicinal plant's small population sizes and patchy populations either naturally or due to anthropogenic activities is also a reason for species extinction. Rare species are more vulnerable to extinction for three main reasons.

- Environmental stochasticity (unpredictable spatio-temporal variation in environment),
- Demographic stochasticity (unpredictability in population growth rate due to random differences among individuals for survival & reproduction within a particular season), and
- Low genetic variability.

11. GEOLOGICAL EVENTS

In recent past the most dreadful catastrophic geological event of October 2005 earthquakes has a major impact on floral species abundance and diversity in terms of habitat loss both naturally and due to anthropogenic activities. Several sites that were previously ethno-botanical hotspots and rich in biodiversity have now been turn into unstable land mass subject to constant land sliding and habitat loss. The area around Zilzal Lake is one such example.



12. BIO-INVASION

Other reasons behind reduction in medicinal plants habitat mostly include;

- Invasive alien plants that may destroy the natural habitat by induction of chemicals etc
- Invasive alien invertebrates and pathogens including viral, bacterial and fungal disease agents, invertebrate herbivores etc.
- Invasive vertebrates including ungulate herbivores such as goats, sheep or cattle; rodents such as rats; monkeys etc.

Utilization of plants for medicinal purposes in Indo- Pak subcontinent is a family property tradition and the ethno-botanical knowledge gained over centuries is kept secretly. Due to recent change in modes of information transfer and increasing generation gap the very important knowledge has been lost.

With the application of scientific knowledge and controlled cultivation some of these endangered plant species can be saved and environmental degradation can be reduced but, unfortunately very little work has been done in Pakistan.

Lack of awareness has wiped out the existing rich flora of surveyed area. There is a dire need to undertake prolific measures to conserve this valuable assets and wealth of medicinal plants.

Our country can benefit from trade of the herbs for utilization as medicinal and therapeutic value in future.

4.4 WATER QUALITY ANALYSIS RESULTS

According to the water quality analysis reports the following results has been obtained. As depicted in the Table 4.8 all the physical parameters are under the permissible limits. pH ranges between 7.1 to 7.9, while Ec ranges between 650 to 748 (IJS/cm). The water quality is very good for plant growth. Chemical parameters of the water samples are presented in Table 4.9. Figure 4.5 shows the comparison of chemical parameters of all the samples.

Table 4.8: Physical parameters of the Water Samples

Physical Parameters	Permissible limits	Results			
		Kopra Puthian	Chakharyala Bandi Baqalan	Nagni	Qalma Wala Chashma Noon Bangla
pH	6.5 - 8.5	7.4	7.9	7.1	7.2
Turbidity	5	5	5	5	5
Conductivity (IJS/cm)	1334	748	657	650	748
Color	Colorless	Normal	Normal	Normal	Normal
Odor	Odorless	Normal	Normal	Normal	Normal
Taste	Tasteless	-	-	-	-

Table 4.9: Chemical parameters of the Water Samples

	Kopra Puthian	Chakharyala Bandi Baqalan	Nagni	Qalma Wala Chashma
Chlorine	-	-	-	-
TOS	561	457	680	785
Hardness	200	170	220	250
Calcium	100	80	130	160
Magnesium	18	19	46	18
Sodium	-	-	14	10
Potassium	-	-	18	28
Chloride	25	30	35	45
Sulphate	15	28	36	20
Nitrate	10	3	8	10

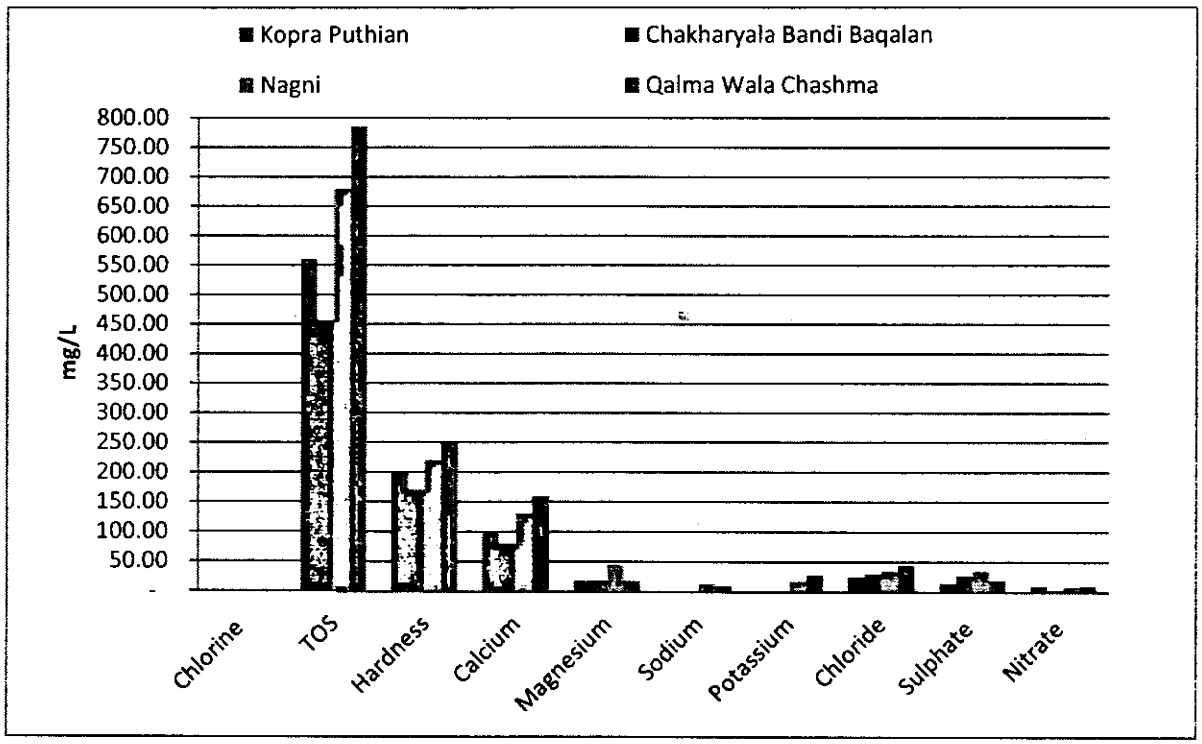


Figure 4.5: Comparison of Chemical parameters of the Water Samples

CHAPTER 5

CONCLUSION AND RECOMMENDATIONS

5.1 CONCLUSION

Biodiversity on earth is very important for mankind. Survival of humans and other animals is not possible without plants as they are main source for balancing ecosystem, nutrition, medicinal aspects and cure for many ailments. Plants represent basic source for food, shelter, medicines, timber, fuel, resins and many other products derived from plants. Plants not only beautify the planet earth but also regulate the geological temperature and purify the air we breathe.

In Pakistan Natural biodiversity loss is taking place at a much faster rate, more specifically over last few decades this trend has been accelerated. The living conditions in the areas surveyed are not satisfactory. Most of locals are deprived of basic necessities of life and experience the worst social, economic & environmental problems. Medicinal plants of the area are extensively used as traditional medicament, separately or in combination with other plant parts by semi literate hakims. These Hakims, Pansaries and nomadic tribes remove a large number of plant species every year. Furthermore over exploitation and non technical extraction may result in extinction of medicinal plants that have become vulnerable to harvesting.

5.2 RECOMMENDATIONS

The ethno botanical survey of the area revealed that the area is rich in floral biodiversity and is a natural reservoir for important wild medicinal plants. During the survey of the research area it

has been concluded that most of the plant species are intensively used locally for treatment of various ailments of minor and major scale. The study revealed that it is very important to not only document the utilization of medicinal plants but also edible parts or plants used as fodder, fuel and dyes. It is required to document and pass this valuable knowledge to next generations.

Lack of conservation strategies, reforestation policies, extensive deforestation and overgrazing are the main reasons behind the damage to floral resource.

Due consideration should be given to conserve this valuable natural resource for future utilization. Low level income villagers can be strongly benefitted by maintaining their conventional customs. Following are certain important recommendations for conservation of floral diversity of the area.

- ✓ It is need of the time to take steps for conservation of plant biodiversity for the conservation of shrubs and ground flora along with the vertebrate and invertebrate fauna they use to support. There must be a high level plantation along with tree management measures for better survival rate of plant species.
- ✓ Fast growing plant species of the area should be cultivated for fuel
- ✓ Large scale reforestation projects should be launched. In this regards collaboration of government is necessary with International Union for Conservation of Nature (IUCN) etc,
- ✓ Awareness among locals should be raised for conservation and Environmental Protection Agency, Forest Department AJ&K, International Union for Conservation of Nature,

World Wildlife Fund for Nature and other NGO's should work together to sustain the natural resources of the area.

- ✓ Area with critically threatened eco-systems should be marked
- ✓ Locals should be made aware and trained with conservation strategies, sustained cultivation and extraction of plants.
- ✓ Habitat loss is the main factor for the loss of various species. Protect population form immediate threats to plants existence
- ✓ Evaluation of population responses to site disturbances
- ✓ Continuous species inventory, particularly in the areas that are protected from development, and monitoring of demographic trends in populations on site representing a range of environmental conditions throughout the range of species. Detailed research on population dynamics verses biodiversity loss and conservation, should be undertaken.
- ✓ Research on indigenous plants should be encouraged to identify endangered/ vulnerable/ threatened species and appropriate legislation must be developed to protect species of critical concerns.
- ✓ Seed banks for important endangered/ vulnerable/ threatened species should be constructed. Priorities for species conservation should be set.
- ✓ For recovery of endangered/ vulnerable/ threatened species methods should be adopted. Though, such programmes should be carefully handled because each species has its own priorities and requirements for growth and rehabilitation.
- ✓ Trade practices should be regulated.

- ✓ Respect should be given, to maintain the knowledge and practices of local communities. Biodiversity management plan should be initiated at the gross root level and built upon the traditional knowledge of local communities.

- ✓ An eco-tourism plan should be developed after biodiversity surveyed and carefully evaluated by the experts.

- ✓ The government should provide Alternate energy resources and substitutes must be provided to the local communities to relieve pressure on floral resources for fuel consumption. Awareness among locals about consumption of tree for fuel wood to be replaced with use of modern fuels should be done.

- ✓ Rotational grazing practice should be encouraged to prevent overgrazing, looping and browsing of vegetation on large scale so that threatened species will have a chance for survival.

- ✓ Unplanned expansion of agricultural areas on steep mountains, black marketing and smuggling of timber and seasonal colonies/grazing camps should be discouraged.

- ✓ The microhabitat of the localities should be thoroughly considered before growing any plantation in bare areas, and careful selection of species should be made.

- ✓ Young men and women can be made aware and should be utilized for their effective role in creating awareness about deforestation and degradation of vegetation caused by ill planned a forestation.

- ✓ Sustainable development of the precious natural resources is highly recommended and for effective conservation local communities must be involved.

If above mentioned recommendations are met then it is anticipated that declining natural biodiversity of the study area can be conserved for future generations.

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APPENDIX A — A LIST OF PEOPLE MET

Sr. No.	Name	Father/Husband Name	Designation/Profession
1	Sheikh M. Khursheed	Faiz Ullah Sheikh	Field Assistant, Mera Mushtiba
2	Begum Jan	Salim Akhtar Shah	House Wife
3	M. Bashir	Abdul Latif	Farmer
4	Ghulam Rasool	Jhandoo	Farmer
5	Shabbir Hussain	Nazir Hussain	Shop keeper
6	M. Rashid	M. Sadeeq	Shop keeper
7	Sarwar Jan	Abdul Rashid	House Wife
8	Azmat Jan	Rahim Ullah	House Wife
9	Tazeem Akhtar	Sheikh M. Khursheed	Lady Health Worker
10	M. Khalil	Nazir Hussain	Driver
11	M. Hussain	Immam Din	Farmer
12	Nazir hussain	M. Hussain	Mason
13	Abdul Rashid	Faiz Ullah Sheikh	Retired Civil Servant
14	Abdul Hameed	Latif Sheikh	Farmer
15	Khadeeja Bibi	Khalid Shams Din	House Wife
16	Khurshaida Bibi	M. Maqsood	House Wife
17	Aziz Ullah	Salam Din	Farmer
18	Gulfaraz Hussain	Abdul Latif	Labour
19	Begum Jan	Nazir Hussain	House Wife
20	Khanum bi	Ahmed Jan	House Wife
21	Feroz Din	Rehmat Ullah	Farmer
22	Sheikh Jan Muhammad	Nizam Din	Retired (Hawaldar) Army Officer
23	M. Anwar	Jan Muhammad	Patwari
24	Seemab Ahmed	Azam khan	Shop keeper
25	Mushtaq Ahmed	Bakhtyaar Khan	Driver
26	Abdul Hameed	Ghulam Ahmed	Farmer
27	M. Munir	Sabir hussain	Shop keeper
28	M. Bostan	Azam khan	Farmer
29	Akbar Hussain	Mir Zaman	Mason
30	Abdul Ghaffar Shah	Shehbaz Hussain Shah	Baildar In Agriculture Dept. Loon Bangla
31	Zeeshan Khursheed	Sheikh M. khursheed	Associate Civil Engineer
32	M. Sadeeq	Mir Aalam	Shop keeper
33	M. Banaras	Nazir Hussain	Baildar in Agriculture Dept. Garhi Doppta

34	Abdul Hameed	Riyaz Ahmed	Farmer
35	M. Yasin	Aalam Din	Transporter
36	Kashif Iqbal	Maqbool ur Rehman	Hakeem
37	Hakeem Asif Zia Ansari	Hakeem Zia Ansari	Hakeem
38	Hakeem Alhaj Molvi Abdul Rehman	Hakeem Abdul Ahad	Hakeem

ANNEXURE A: QUESTIONNAIRE

BY LOCALS OF THE AREA

Location: .....
Date:.....
Name of Collector:.....
Age of the collector:.....
Education Level:.....

1. Local name of plant:.....
2. Scientific name (if Known):.....
3. Type of Plant(Tick one):
    a. Large Tree
    b. Medium Tree
    c. Shrub
    d. Herb
    e. Climbing
    f. Any Other Please Specify
4. Habitat of Plant
    a. Shady
    b. Under Shrub
    c. Any Other Please Specify
5. Uses of the plant species: .....
6. Plant Part Used:
    a. Root
    b. Leaves
    c. Stem
    d. Fruit
    e. Seeds
    f. Epidermis/bark
    g. Entire Plant
    h. Any Other Please Specify
7. Occurrence of Plant:
    a. Common
    b. Uncommon or very rare
    c. Less common or rare
    d. Occasional
8. Utilization and relative abundance of Plant Growth over last ten Year:
    a. Increased
    b. Decreased

c. Remained Unaffected

9. If abundance decreased then what is the reason:
   a. .....
   b. .....
   c. .....

10. Who collect the plant:
   a. Men
   b. Women
   c. Children

11. How plant parts being collected:
   a. Only Required Part collected
   b. Entire Plant uprooted
   c. Uprooting of herbs by hand?
   d. Use of tools?
   e. If Roots are required then what about the remaining plant?

12. Method of plant Utilization/preservation:
   a. Decoction
   b. Dried Decoction
   c. Powder
   d. Specialty dried extracts
   e. Tinctures and other alcohol extracts
   f. Any other please specify

13. Your suggestions about conservation of plants resources:
   a. .....
   b. .....
   c. .....

ANNEXURE B: QUESTIONNAIRE

MARKET SURVEY

Location: .....
Date:.....
Name:.....
Age:.....
Occupation: .....
Education Level:.....

1. Local (regional) name of plant being traded :.....
2. Scientific name (if Known):.....
3. Uses of the plant species: .....
4. Plant Part Used:
    a. Root
    b. Leaves
    c. Stem
    d. Fruit
    e. Seeds
    f. Epidermis/bark
    g. Entire Plant
    h. Any Other Please Specify
5. Occurrence of Plant:
    a. Common
    b. Uncommon or very rare
    c. Less common or rare
    d. Occasional
6. Utilization and relative abundance of Plant Growth over last ten Year:
    a. Increased
    b. Decreased
    c. Remained Unaffected
7. If abundance decreased then what is the reason:
    a. .....
    b. .....
    c. .....
8. If Utilization decreased then what is the reason:
    a. .....
    b. .....
    c. .....

9. Plant availability
    a. Wild
    b. Cultivated
    c. Managed
10. Who collect the plant:
    a. Locals
    b. Traders
    c. Any other
11. Method of plant Utilization/preservation:
    a. Decoction
    b. Dried Decoction
    c. Powder
    d. Specialty dried extracts
    e. Tinctures and other alcohol extracts
    f. Any other please specify
12. Other ingredients of the recipe?.....
13. Trend in the area doing medicinal plant business:
    a. Increasing
    b. Decreasing
    c. Unaffected
14. Quantity of Plant utilization annually?.....
15. Main issues in the business?
    a. .....
    b. .....
    c. .....
16. Your suggestions about conservation of plants resources:
    a. .....
    b. .....
    c. .....

ANNEXURE C: WATER QUALITY ANALYSIS REPORT

National Institute of Health - Islamabad
Nutrition Division
Tel: (92-051) 9255079 Fax: 9255099

(W.H.O. Collaborating Centre for Research & Training in Viral Diagnostics)

Water Testing Laboratory (Chemical)

Reception No.	131	Lab. No.	144	Date	15-09-2011
Name of Client and address:	Jamshaid Rashid,		Chakar, Rattian Bala AJK.		
Source/Location	Spring / Kopra Puthiyan , Tehsil Chikar, AJK				
Brand Name/Manufacturer:			-		

Physical Parameters

Parameters	Result	*Permissible Limits	Parameters	Result	*Permissible Limits/Criteria
pH	7.4	6.5 - 8.5	Colour	Normal	Colourless
Turbidity (NTU)	5	5	Odour	Normal	Odourless
Conductivity (uS/cm)	748	1334	Taste	-	Tasteless

Chemical Parameters

Parameters	Result	*Maximum Permissible Limits	Parameters	Result	*Maximum Permissible Limits
Chlorine (mg/L)	0.0	0.3	Sodium (mg/L)	-	200
TO Solids (mg/L)	561	1000	Potassium (mg/L)	-	100
Hardness (mg/L)	200	500	Chloride (mg/L)	45	200
Calcium (mg/L)	100	200	Sulphate (mg/L)	15	200
Magnesium (mg/L)	18	150	Nitrate (mg/L)	10	10

Result Satisfactory.

Suggested Treatment *(for unsatisfactory samples only)*

Boiling	o	Filtration	o	Chlorination	o
UV Irradiation	o	Desalination	o	pH Neutralization	o

Officer In Charge:

Chief Nutrition Division
N.I.H. Islamabad

National Institute of Health - Islamabad
Nutrition Division
Tel: (92-051) 9255079 Fax: 9255099

(W.H.O. Collaborating Centre for Research & Training in Viral Diagnostics)

Water Testing Laboratory (Chemical)

Reception No.	132	Lab. No.	144	Date		15-05-2011
Name of Client and address:		Jamshaid Rashid,		Chakar, Hattian Bala AJK.		
Source/Location	Spring / Chakbaryala Bandi Baqalan , Tehsil Chakar, AJK					
Brand Name/Manufacturer:				-		

Physical Parameters

Parameters	Result	*Permissible Limits	Parameters	Result	*Permissible Limits/Criteria
pH	7.9	6.5 - 8.5	Colour	Normal	Colourless
Turbidity (NTU)	5	5	Odour	Normal	Odourless
Conductivity (uS/cm)	657	1334	Taste	-	Tasteless

Chemical Parameters

Parameters	Result	*Maximum Permissible Limits	Parameters	Result	*Maximum Permissible Limits
Chlorine (mg/L)	0.0	0.3	Sodium (mg/L)	-	200
TO Solids (mg/L)	457	1000	Potassium (mg/L)	-	100
Hardness (mg/L)	170	500	Chloride (mg/L)	30	200
Calcium (mg/L)	80	200	Sulphate (mg/L)	28	200
Magnesium (mg/L)	19	150	Nitrate (mg/L)	3	10

Result Satisfactory.

Suggested Treatment *(for unsatisfactory samples only)*

Boiling	o	Filtration	o	Chlorination	o
UV Irradiation	o	Desalination	o	pH Neutralization	o

Officer In Charge

Chief Nutrition Division
N.I.H. Islamabad

National Institute of Health - Islamabad
Nutrition Division
Tel: (92-051) 9255079 Fax: 9255099

(W.H.O. Collaborating Centre for Research & Training in Viral Diagnostics)

Water Testing Laboratory (Chemical)

Reception No.	133	Lab. No.	144	Date		15-09-2011
Name of Client and address:		Jamshaid Rashid.		Chakar, Pattian Bala AJK.		
Source/Location	Spring / Nagni , Tehsil Chikar, AJK					
Brand Name/Manufacturer:				-		

Physical Parameters

Parameters	Result	*Permissible Limits	Parameters	Result	*Permissible Limits/Criteria
pH	7.1	6.5 - 8.5	Colour	Normal	Colourless
Turbidity (NTU)	5	5	Odour	Normal	Odourless
Conductivity µS/cm	650	1334	Taste	-	Tasteless

Chemical Parameters

Parameters	Result	*Maximum Permissible Limits	Parameters	Result	*Maximum Permissible Limits
Chlorine (mg/L)	0.0	0.3	Sodium (mg/L)	14	200
TD Solids (mg/L)	680	1000	Potassium (mg/L)	18	100
Hardness (mg/L)	220	500	Chloride (mg/L)	35	200
Calcium (mg/L)	130	200	Sulphate (mg/L)	36	200
Magnesium (mg/L)	46	150	Nitrate (mg/L)	8	10

Result Satisfactory.

Suggested Treatment *(for unsatisfactory samples only)*

Boiling	o	Filtration	o	Chlorination	o
UV Irradiation	o	Desalination	o	pH Neutralization	o

Officer In Charge:

Chief Nutrition Division
N.I.H. Islamabad

National Institute of Health - Islamabad
Nutrition Division
Tel: (92-051) 9255079 Fax 9255099

(W.H.O. Cotaborating Centre for Research & Training in Viral Diagnostics)

Water Testing Laboratory (Chemical)

Reception No.	134	Lab. No.	144	Date		15-09-2011
Name of Client and address:		Jamshaid Rashid,		Chakar, Bartian Bala AJK.		
Source/Location	Spring /Qalma Wala Chashma, Near Boys Middle School Sar, noon Bangla, Tehsil Chikar, AJK					
Brand Name/Manufacturer:				-		

Physical Parameters

Parameters	Result	*Permissible Limits	Parameters	Result	*Permissible Limits/Criteria
pH	7.2	6.5 - 8.5	Colour	Normal	Colourless
Turbidity (NTU)	5	5	Odour	Normal	Odourless
Conductivity (uS/cm)	748	1334	Taste	-	Tasteless

Chemical Paramsters

Parameters	Result	*Maximum Permissible Limits	Parameters	Result	*Maximum Permissible Limits
Chlorine (mg/L)	0.0	0.3	Sodium (mg/L)	10	200
TO Solids (mg/L)	785	1000	Potassium (mg/L)	20	100
Hardness (mg/L)	250	500	Chloride (mg/L)	45	200
Calcium (mg/L)	160	200	Sulphate (mg/L)	20	200
Magnesium (mg/L)	18	150	Nitrate (mg/L)	10	10

Result: Satisfactory.

Suggested Treatment ***(for unsatisfactory samples only)***

Boiling	o	Filtration	o	Chlorination	o
UV Irradiation	o	Desalination	o	H Neutralization	o

Officer In Charge:

Chief Nutrition Division
N.I.H. Islamabad

ANNEXURE D: PICTORIAL PRESENTATION OF INTERVIEWS WITH KEY INFORMANTS

Interview with a Pasturer (Ganga Choti)

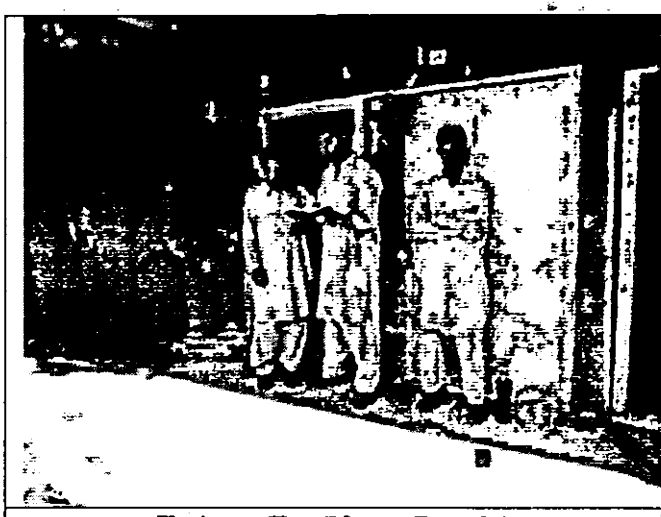
Specimen Collection at Ganga Choti

Local hakim with specimen (Batangi)

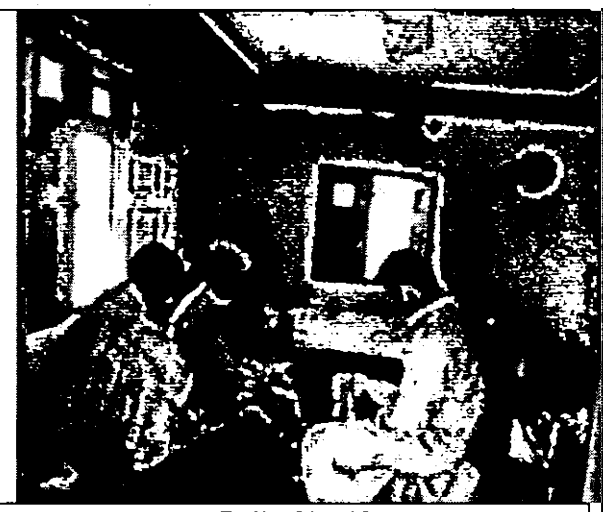
Specimen collected at Noon Bangla

Agriculture office Sudhan Gali

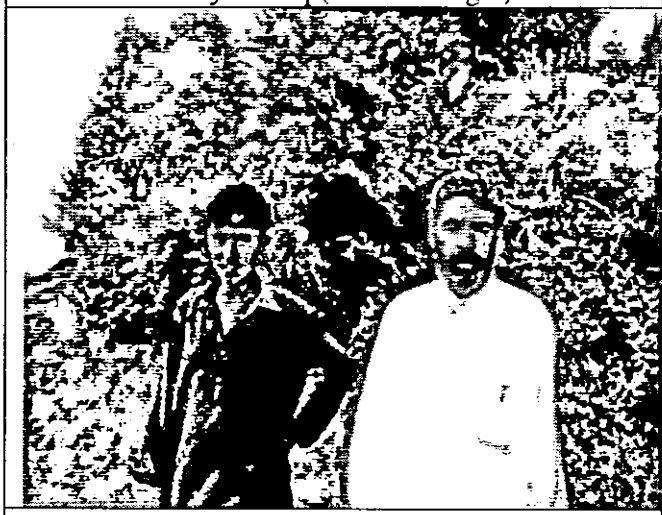
Interviewing local informer (Batangi)



Tariyan Top(Noon Bangla)



Pajja Sharif



Key Informant Dera, Noon Bangla

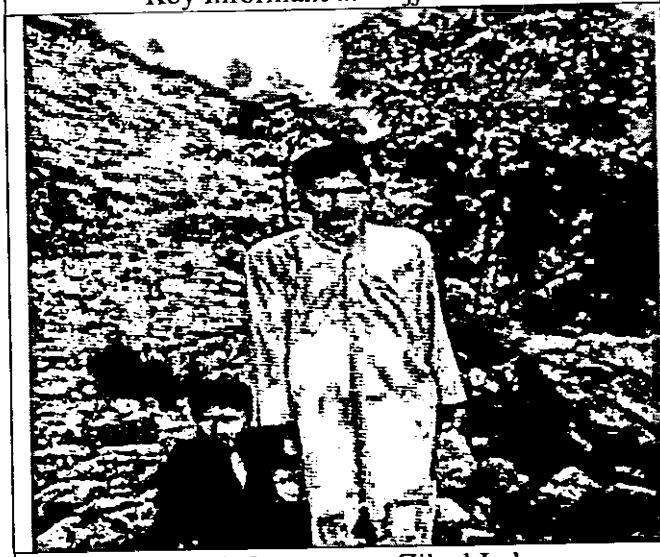
Noon Bangla

Manja keri

Manja keri

Key Informant at Pajja Sharif

Specimen Collected at Ganga choti



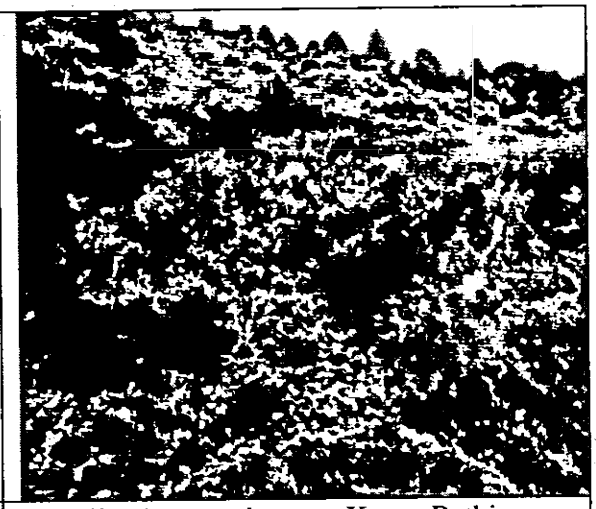
Local informer near Zilzal Lake

Local hunters in Ganga Choti

Specimen collection (Puthiyaan, Chikar)

Taking Water Sample from a Fresh Water spring in Puthiyan Chikar

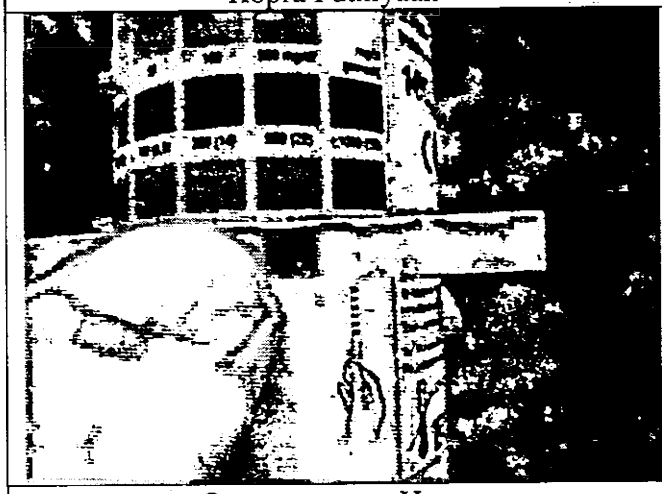
Key informant at Chikar



Collecting specimen at Kopra Puthiyan

Water Wampling from wresh water spring at Kopra Puthiyaan

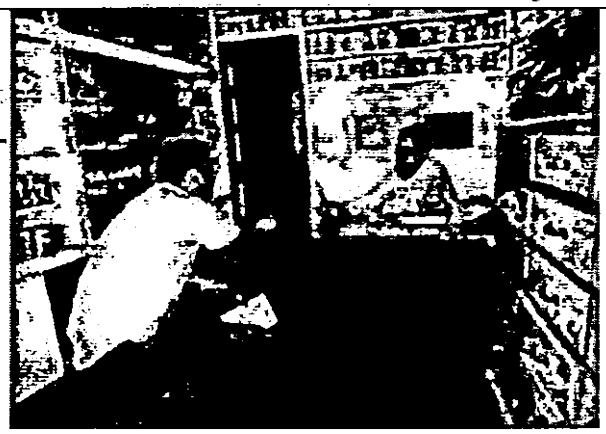
Water sampling from Nagni, Chikar



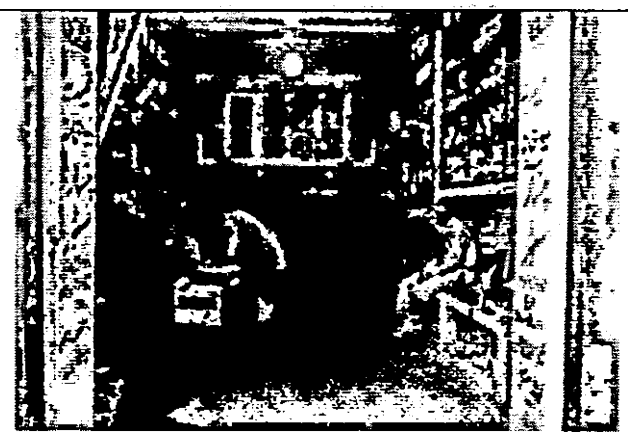
On spot water pH test

Kalma Wala Chashma at Noon Bangla

ANNEXURE E: PICTORIAL PRESENTATION OF MARKET SURVEY



Interview with Local Practioner in Muzaffarabad



A view of Hamidia Dawakhana

Plant identification at Ansari Dawakhana

A meeting with Hakeem Alhaj Abdul Rehman

A view of Rehmania Dawakhana

Meeting with locals in Hamidia Dawakhana