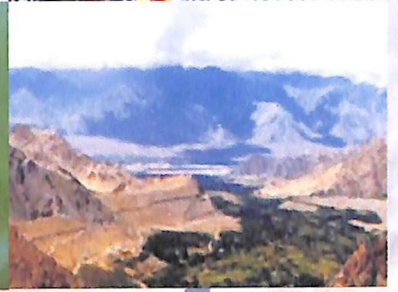


# ETHNOBOTANY & PLANTS OF TRANS-HIMALAYA



OM PRAKASH CHAURASIA  
ZAKWAN AHMED & BASANT BALLABH

# ETHNOBOTANY AND PLANTS OF TRANS-HIMALAYA

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## FOREWORD

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Plants have always been the source of food, medicine and other necessities of life since the beginning of human civilization. As we know India has rich heritage of multifarious uses of plant biodiversity and cold desert trans Himalayan regions are not an exception to it. Majority of Indian cold deserts of trans Himalayas belong to Ladakh (Jammu & Kashmir) and Lahaul-Spiti (Himachal Pradesh). Cold desert parts of the Himalaya are usually recognized as barren and rugged mountains with very sparse vegetation due to characteristic eco-environments.

Ethnobotany is the most recent branch of Botanical sciences, which is further very recent to India and trans Himalayas in particular. The regions are endowed with characteristic plant biodiversity which are closely associated with day-to-day life of local inhabitants. There are only scattered information on ethnobotany of Ladakh and Lahaul Spiti. Field Research Laboratory of Defence Research & Development Organization, Leh - Ladakh has carried out extensive ethnobotanical survey covering far-flung areas of Leh, Nubra, Changthang, Suru, Zaskar and Lahaul-Spiti valleys. The cold desert ethnobotanical wealth has been classified into medicinal, aromatic, edible, fodder, fuel, magico-religious and forest plants enlisting their characteristic growth features and ethnobotanical uses.

It gives me immense pleasure to compliment the tireless effort of the authors Dr. OP Chaurasia, Scientist 'D' and Dr. Zakwan Ahmed, Director and Dr. Basant Ballabh, STA of Field Research Laboratory (DRDO), Leh-Ladakh to compile this most valuable and multifaceted information over decades. The work will be of immense uses to cold desert development agencies, research organizations, educational institutes and to all those interested in development of cold desert trans Himalayas.

(Dr. W. Selvamurthy)



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## INTRODUCTION

Plant Biodiversity has always been the source of food, medicine and other necessities of life since the beginning of human civilization. Our country has a very rich plant biodiversity due to prevailing very highly divergent ecosystem and significant altitudinal variations ranging from sea level to the highest ranges of the Himalayas and allied factors. The Himalayas ranges are one of the best examples, which abound approximately 18,440 species of Angiosperms, Gymnosperms, Pteridophytes, Bryophytes, Lichens and Fungi, of which about 25 percent species are endemic to the Himalayas.

Cold deserts are usually confined to high altitudes and circumpolar regions of the Universe. The major portions under cold desert trans Himalayas belong to Ladakh (Jammu & Kashmir) and Lahaul -Spiti (Himachal Pradesh ) followed by very small portions in Garhwal (Niti and Mana) beyond Badrinath and Nelang in Uttarkashi district of Uttranchal state. A very harsh and characteristic climate prevails in trans Himalayan cold deserts where the summer temperature touches upto 40°C while the winter temperature drops below minus 35°C and are characterized by barren mountains, nail biting winters, low humidity and sparse vegetation. The majority of local tribes of these regions follows Budhism followed by good number of Muslim population in Kargil and Leh districts. The dominant tribes are Boto, Balti, Drogpa, Argons etc. The cold arid regions of Jammu & Kashmir and Himachal Pradesh may be divided into seven major geographical valleys for exploration and enlisting the plant biodiversity viz. Indus, Nubra, Changthang, Suru, Zanskar, Lahaul and Spiti.

The flora of Ladakh and Lahaul-Spiti of trans Himalayan belts comes under alpine and high alpine zones and is dominated by annual and perennial herbs, followed by few stunted shrubs and bushes. The trans Himalayan cold desert has a characteristic vegetation differing from other parts of Himalayas due to prevailing unique climatic conditions and physiography. The vegetative growth



starts at the commencement of summer when the melting snow provides abundant moisture. The alpine mountain slopes, meadows and alpine pasture lands abound in varieties of alpine and high alpine flowers making trans Himalayan barren mountains lush green for brief summer period (June -September). In broad sense, the vegetation of trans Himalayan cold desert may be studied under three categories - Alpine mesophytes, Oasisitic vegetation and Desert vegetation.

Most parts of trans Himalayan cold desert of Ladakh and Lahaul-Spiti are inaccessible and remain cut off from the rest of the world due to rugged and difficult terrain and prolonged subzero temperatures which have forced the local people to be self sustained for most parts of the history. Like other parts of the Himalayas, these regions are considered treasure of medicinal, aromatic and other important plants which have been in use by the local tribes for day to day needs and this long dependence on plant wealth had enriched their knowledge about multifarious uses of plant biodiversity. Much of such valuable information are confined to tribes and ethnic groups. The science of ethnobotany plays an important role in collection and documentation of ethnobotanical wealth of such regions.

Field Research Laboratory (FRL), Leh of Defence Research & Development Organisation has carried out detailed ethnobotanical exploration covering far flung areas and higher passes of Ladakh and Lahaul - Spiti and documented in medicinal, aromatic, edible, aesthetic, fodder, etc based on ethnobotanical studies. The collected plant specimens were identified with the help of available literatures and Botanical survey of India, Dehradun. The ethnobotanical information were verified with local amchi physicians, senior citizens and available literatures.

Since the dawn of history man has been in search of ways to find cure and relief from mental and physical illnesses. India has one of the oldest, richest and the most diverse cultural traditions associated with the uses of medicinal plants. In India, over 7500 plant species are estimated to be used by approximately 4635 ethnic communities for human and veterinary health care across the various ecosystems ranging from Ladakh in the trans Himalayan cold desert to the southern coastal tip of Andaman & Nicobar Islands and from the deserts of Rajasthan & Kutch to the Hills of the north east. The people of Ladakh and Lahul-Spiti of the trans Himalayan region has its own medical system called "Amchi system of medicine" (Tibetan Medicine) and the practitioners are called Amchis (Superior of all). Amchi medicine is based on principally on a skillful uses of plants, minerals and animal products. The important medicinal plant species of Ladakh and Lahaul - Spiti have been collected alongwith therapeutic uses during the botanical survey by the authors, some of them are *Aconitum sp*, *Colchicum sp*, *Corydalis sp*, *Dactylorhiza sp*, *Ephedra sp*, *Hippophae sp*, *Hyoscyamus sp*, *Hypericum sp*, *Inula sp*, *Gentiana sp*, *Podophyllum sp*, *Rhodiola sp*, *Saussurea sp*, etc.

Remoteness, cold desert high altitudes and prolonged frozen winters forced the local inhabitants for the search of edible wild plants. During the ethnobotanical

exploration the authors have collected several such wild plants which are being consumed in the form of cooked as well as raw even now in far flung areas. Some of the potential plant species viz. *Lepidium sp*, *Rhodiola sp*, *Taraxacum sp*, *Urtica sp* have been analysed with respect to their nutritional profile.

Similarly there is a great scarcity of fodder plants and proper cultivation of fodder species is not in practice due to shortage of cultivable land and allied constraints. In addition to it, the natural pastures are also declining day by day due to environmental changes. However, the regions abound in several plant species which are being grazed by local livestock and are also being harvested by the locals for winter fodder. The important fodder plants collected on large scale are *Aconogonum tortuosum*, *Cicer microphyllum*, *Hippophae rhamnoides*, *Prangos pabularia* etc, the nutritional profile also support their fodder value.

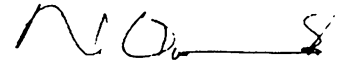
The region is known for several such plants which have aesthetic importance. These plant species are being used as ornamental, cut flowers, dry decoration as well as for aesthetic value, by the locals even now in far flung areas. The important species are *Aquilegia fragrans*, *Epilobium sp*, *Meconopsis sp*, *Primula sp*, *Rosa sp*, etc. Similarly the region abounds with several plants which are being collected by local people as fuel plants, some of them are *Acantholimon lycopodioides*, *Artemisia sp*, *Berberis sp*, *Caragana sp*, *Hippophae rhamnoides* etc.

As we know the region is devoid of natural forest due to several climatic factors, FRL has surveyed and documented the indigenous plants which may be multiplied for afforestation in these cold arid zones. *Hippophae sp*, *Juniperus sp*, *Myricaria sp*, *Sophora sp*, *Tamarix sp*, *Ulmus sp* etc. are the potential forest species of these regions.

The rich diversity in flora and fauna, economically useful species, rare and endangered species, the genetic diversity, high degree of endemism, presence of alien elements in the ecosystems, usefulness of one of world' highest fresh water and brackish water lakes, high altitude passes and unique cultural heritage etc. make the trans Himalayan cold desert ecosystem unique and the most fragile in the world. During the ethno-botanical survey, the authors have observed that the frequency of some of important plants especially medicinal plants of Indian cold desert Himalayas with which it was earlier abound, have considerably declined due to their unscientific exploitation, natural calamities, road construction, uprooting for fuel, overgrazing and other activities. A list of rare, endangered and threatened plant species viz. *Aconitum heterophyllum*, *Bunium persicum*, *Dactylorhiza hatagirea*, *Ephedra gerardiana*, *Podophyllum hexandrum* and *Saussurea lappa* etc. has prepared based on botanical survey of these regions. FRL has actively engaged in collection, evaluation and maintenance of valuable germplasm of important plants. A field gene bank has been established with the objective to standardize, multiply and conserve rare endangered threatened plant species for scientific based sustainable utilization.



Lastly it gives me immense pleasure to appreciate the tireless efforts of the authors Dr OP Chaurasia, Scientist 'D', Dr Zakwan Ahmed, Director and Dr Basant Ballabh, STA of Field Research Laboratory, Leh for documenting and compiling this very valuable research findings based on ethnobotanical studies. The book will be of immense utility to scientists associated with ethnobotany, traditional medicinal systems, environments, horticulture, plant sciences and allied fields.



**(Dr Narendra Kumar)**

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## PREFACE

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Plant biodiversity has been the source of food, medicine and other necessary things for human beings since times immemorial throughout the world. Due to characteristic climate, altitudinal variations and allied factors the Himalayas are endowed with rich biodiversity in flora and fauna which are closely associated to day to day life of local inhabitants of these regions.

Cold deserts are usually confined to high altitudes and circumpolar regions of the world. Indian cold deserts come under the trans Himalayan zone of Ladakh (Jammu & Kashmir) and Lahaul-Spiti (Himachal Pradesh) which are known for their characteristic environment. The region remains landlocked for six months due to heavy snowfall and prolonged subzero winters when the temperature drops below minus 35°C while the temperature touches upto 40°C in summer. The cold arid zones of Ladakh and Lahaul-Spiti of trans Himalayas may be classified into Indus, Nubra, Changthang, Zaskar, Suru and Lahaul-Spiti for systematic ethnobotanical studies.

The trans Himalayan belts are rich in ethnobotanical wealth for which several ethnobotanical explorations were conducted by the authors under various R&D projects to collect and identify plant specimens alongwith traditional knowledge with the objective to scientific based sustainable utilization of ethnobotanical wealth of trans Himalayan regions. The collected plant specimens and ethnobotanical information have been classified and documented in medicinal, aromatic, edible, fodder, ornamental, magico-religious, fuel and forest plants and the present compilation is the outcome of the same.

A total of 704 plant species of 298 genera, belonging to 63 families of ethnobotanical importance have been described alongwith their brief botany, families, habit, habitat and ethnobotanical utility under different chapters viz. medicinal plants, aromatic plants, edible wild plants, fodder plants, ornamental plants, magico-religious plants, fuel plants and forest plants. Besides some general chapters viz. physiography, plant survival in cold desert, ethnobotanical exploration, endangered plants, conservation & sustainable utilization and propagation & cultivation of important plants have also been discussed in the present compilation. In addition, all the listed plant species have been summarized in tabular form in category wise for quick go through the ethnobotanical diversity. The book also includes 438 photographs related to physiography, vegetation and different plant species of ethnobotanical importance, taken by the authors during the botanical exploration.



The present compilation will be extremely useful to researchers and scientists associated with ethnobotany, traditional medical systems, natural products, horticulture, environment and allied fields of plant sciences for scientific based sustainable and commercial utilization for the benefit of society in general and defence forces deployed in these sector in particular.

First of all the authors feel pleasure to express deep sense of gratitude to his excellency Dr A P J Abdul Kalam, Hon'ble President of India and Ex SA to RM, Secy Defence R&D & DG R&D for his earnest motivation and encouragement for ethnobotanical survey & documentation of trans Himalayan plant biodiversity.

We extend our sincere thanks to Shri M Natarajan SA to RM, Secy Defence R&D & DG R&D, Dr W Selwamurthy Chief Controller R&D (LS & HR), DRDO HQ, New Delhi and Dr Narendra Kumar Director Dte of Life Sciences & Secy Life Sciences Res. Board, DRDO HQ, New Delhi for technical guidance and financial support through various R&D projects. The authors greatly appreciate the support of Dr V K Aatre Ex SA to RM, Secy Defence R&D & DG R&D and Dr R V Swamy Ex Chief Controller R&D, DRDO HQ. We would like to express our special gratitude to Dr Brahma Singh Ex Director, FRL & Ex DALs, DRDO HQ for his immense guidance and constructive critics during ethnobotanical survey and its compilation.

It is our pleasure to acknowledge Col S K Sareen, Col D V Singh, Col (Dr) D P Attrey, Col B Raut the then Directors and all officers & staff members of FRL for their inspiration, valuable suggestions and assistance provided during every phase of research as well as during the compilation of the book.

We owe our deep regards to Sowa Rigpa (Amchi System of medicine) Research Centre (CCRAS), National Medicinal Plant Board, New Delhi, Botanical Survey of India Dehradun and Forest Research Institute Dehradun for providing herbarium facilities in identification of plant specimens, verification of ethnobotanical knowledge and allied facilities. During the compilation of the book, the authors consulted several publications, books, journals/periodicals, Ph D thesis regarding ethnobotanical information, we owe deep regards to them all.

We are also very much thankful to Amchis and local inhabitants of Ladakh and Lahaul-Spiti for sharing their valuable information to us during the ethnobotanical exploration. The authors extend our sincere thanks to Forest Department and Wild Life Department Leh, Kargil and Keylong for providing facilities as and when required during field studies. We also acknowledge Ladakh Autonomous Hill Development Council Leh & Kargil, local administration, 14 Corps, 3 Inf Div and 8 Mtn Div for providing necessary facilities during the field work.

(Authors)

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high and extremely arid where lie the cold desert lands of Ladakh and Lahaul-Spiti.

**Ladakh**, the largest, the loftiest, the land between earth & sky and the land of rock ruins, is the remotest part of India. The greatest extent is from northwest to southeast, being 360 km and widest distance is 335 km from Karakoram pass in the north to Rohtang pass in the south and the region is bounded in the north and north east with Tibet, north west with Balistan, in the west with Srinagar and in south with Himachal Pradesh. From the north to south the major ranges are Karakoram, Kailash, Ladakh and Zaskar range. More than 85 % of the area of Ladakh part lies above 5000 m or more above mean sea level. Physiographically the entire region may be classified in five major valleys : Indus, Nubra, Changthang, Suru and Zaskar which lie along the major rivers such as Indus, Shyok, Nubra, Zaskar and Suru rivers. The Indus river is the main river which follows the course from south east to north west through the greater part of the country. The region is famous for several lakes viz. Pangongtso (4,218 m), Tsomoriri (4,511 m), Tsokar (4,530m) etc. Similarly a number of hot springs abound in Ladakh, of which Puga and Panamik are well known.

**Lahaul and Spiti** : The area is separated in the north from Ladakh by Baralacha range and bounded in the east by Tibet and in the south east by Kulu and Chamba while Spiti is separated from Lahaul by a high mountain running towards the north from the mid Himalayan range. The both Lahaul and Spiti have a tenuous link over the Kunzam pass (4500 m). The average elevation of the peaks in Lahaul is between 4550 m and 5400 m. The lowest point is about 2750 m where the river Chenab makes its exit from the district. The region is really three valleys in one Chandra river valley, Bhaga river valley and Chandra - Bhaga river valley (Chenab valley). Spiti region in contrast to Lahaul, is higher in elevation with more rugged and difficult terrain. The average elevation is about 4600 m. Across a broad saddle between Lahaul, Spiti and the routes to Tibet, near the north eastern face of the arc, lies the Baralacha pass which gives both Lahaul and Spiti access into each other and into Ladakh. Closer to the middle of the arc, Lahaul and Spiti are separated from each other by a short off-shoot of the mid Himalayan range, the Kunzam ridge with Kunzam pass. Across the mid Himalaya are the two passes, the Hamptu pass and the Rohtang pass and both these passes lead into a backyard of Lahaul. Three major rivers Chandra, Bhaga and Spiti, with their tributaries, constitute the drainage system of Lahaul and Spiti belts.

### Physical characteristics of cold desert

- Coarse, porous and immature sandy soils prone to wind and water erosions,
- Heavy influx of infra red and ultraviolet radiations
- Low air density - reduced oxygen levels
- Low concentration of atmospheric carbon dioxide

- Short agriculture (cropping) season 5 months (May-Sep)
- Very long freezing winters 5 to 7 months (Nov-April)
- Large variation in seasonal temperature : 40°C to -40°C
- Large diurnal variations in daily atmospheric temperature during cropping season ranging from 0°C to 35°C
- Fast blowing winds 40 to 60 km per hour mainly in afternoon hours,
- Precipitation mostly in the form of snow mainly during winters
- Irrigation water mostly from snow melts, major portion of which is unharvested
- Low relative humidity during growing season
- Soil moisture remains frozen during winters
- Very little to no rainfall.

## Geology

Ladakh lies behind the line of the highest elevation and is a zone composed of a continuous series of highly fossiliferous marine sedimentary rocks, ranging in age from the earliest Paleozoic to the Eocene. As a tectonic unit, the great Himalayan range of which Ladakh forms a part, is made of the root of Kashmir nappe, the principal geanticline within the main Himalayan geocyncline, consisting of the Archean and Precambrian sedimentary rocks together with large bodies of intrusive granites and basic masses.

With the exception of a part of Ladakh, which consist of tertiary rocks and a basin of mesozoic sedimentary rocks on the northern flanks of Zaskar mountain, by far the larger part of the inner mountains is composed of igneous and metamorphosis rocks, granites, gneisses and achiest Spiti shales and Kioto limestone of Jurassic and Monotis shales of Triassic period are found in the central and southern parts of Ladakh, resting on upper Triassic limestone. The evidences for the existence of cretaceous series are obtained from *Gryphae vesiculosa* fossils on Leh-Yarkand road, consisting of calcareous sandstone. During the Tertiary period, retreating waters of Tethys Sea, which left a basin of lower Tertiary deposits from Rupshu to Kargil and Dras, occupied Ladakh. The territories of Ladakh rest over genesis and metamorphic rocks. The salt rock of Ladakh bear evidence of a progressive desiccation of the Changcheno, Dipsang and Lingzhitang at an elevation of produced by the desiccation and silting up of saline lake basin without any outlet. Limestone is the most prevalent rock found in the range separating Rukchu from Zaskar. All valuable minerals are found in Ladakh. The region has huge quantities of gold, silver, iron, mica, precious stones, sulphur and other minerals. Borax is found in huge quantity. Soda is also found in many places in Ladakh.

Similarly Lahaul-Spiti is characterized by the presence of a complete sequence of geological formations dating from the Precambrian to the cretaceous period with short breaks in carboniferous and Jurassic periods and by the occurrence of fossils of ancient vascular plants. The stratigraphic sequence of the formations consists of two groups viz. Schistose group and Calcareous group. The Schistose group comprises biotite-schists, schistose phyllites, phyllites, slates, paragneissic bands, quartzites and quartz-mica-schists. The crystalline limestones, flaggy and slaty limestones, calcareous phyllites, calcareous schists, dark grey phyllites interbedded with limestones.

### Climate

The climate is characterised by great extremes of heat and cold, coupled with excessive dryness. The intensive solar radiation and rarification of the atmosphere cause this southerly wind. The air thus moves towards the North Pole in a southerly current. The highly rarified atmosphere offers so slight a check to the transmission of sun rays that the noon temperature often becomes 25°C to 40°C more than it is any part of India, while during night the temperature falls below freezing points. The temperature shows great fluctuation during the different months of the year. The summer months are short, while the winter months are long with the temperature going as low as -59°C (lowest recorded from Dras), -23°C at Kargil and -30°C at Leh. During prolonged winter the rivers freeze and form natural roads. (Table 1).

Table 1 : Meteorological data at Leh (JAN-DEC 1991-2005)

MONTHS	AV. TEMP (°C)		TEMP (°C) LIMITS	
	Max.	Min.	Max.	Min (%)
JAN	03.1	-11.1	08.4	-30.2
FEB	06.8	-09.1	12.4	-30.0
MAR	08.3	-05.3	18.4	-21.5
APR	14.2	-0.03	22.5	-7.8
MAY	17.6	03.5	27.6	-1.5
JUN	23.5	07.7	34.8	02.0
JUL	27.6	12.0	35.0	08.0
AUG	25.7	12.1	34.2	04.0
SEP	25.5	08.3	30.5	04.0
OCT	15.7	-01.7	25.4	-07.0
NOV	10.1	-07.8	17.4	-13.0
DEC	06.1	-14.8	19.1	-20.5

Source : Climatic data recorded at Field Research Laboratory, Leh.



## Rain and Snow

Rainfall / snowfall pattern, amount and its distribution during the cropping season directly influence the plant biodiversity and agricultural productivity by affecting soil moisture, soil aeration, soil temperature, air temperature and relative humidity. It is surprising to note that the rain is very little in these areas. Except parts of Lahaul valley, in most of valleys of trans-Himalayas, it drizzles for an hour or two at the most three to four times in a year. Snow falls more often but the quantity is not much ever being more than six to eight inches deep. Even in the summer months light snow falls at night in the upper reaches of the mountains is common. Dras, however, which is one of the coldest places in the world, has a very heavy snowfall. Similarly average relative humidity remains around 40% - 50%, which makes the area totally arid. Absence of humidity helps to keep the atmosphere clear. (Table 2).

**Table 2 :** Precipitation (rainfall / snowfall) % RH& wind speed in Leh-Ladakh (1991-2005)

Months	Rain/Snowfall (in cms.)	Relative Humidity (%RH)	Max Wind Speed (knots)
January	1.06	65.0	54
February	1.60	56.8	50
March	0.86	55.2	70
April	0.61	48.1	83
May	0.59	49.3	88
June	0.48	43.9	89
July	1.27	51.4	82
August	1.65	51.9	75
September	0.91	50.0	75
October	0.31	50.8	63
November	0.18	52.8	60
December	0.96	59.9	62

Source : Regularly recorded data at FRL, Leh.

## Wind

The constancy of the prevailing winds in different parts of Ladakh and Lahaul-Spiti is one of the most interesting phenomenon of the nature. During the warmer part of the day the early morning breeze soon transforms into a mighty wind or whirlwind, through the changes produced by the varying diffusion of solar heat through the atmosphere. Due to dry climatic conditions, wind blows with high velocity; sometimes it blows 50 to 60 km per hour mainly in the afternoon, in some lofty parts of the region, with the sandy plateaus.

## Soil

The soils are predominantly sandy, derived from weathered debris of the rocks and are subject to the great diurnal as well as seasonal alteration of temperature which leads to a mechanical disintegration of the rocks, producing an abundance of loose debris. The soils in general have been classified as grey, light arid soils of low fertility status. In most parts the soil is poor in organic matter and nitrogen content. The plant nutrients however, are sufficiently available in the soils due to almost nil weathering of the rocks, which is due to extremely low precipitation and temperature. The soils are rich in potassium and its availability to plants is also high, since the weathered complex containing potash cannot be leached under low precipitation. Micronutrients have been found deficient in most of the villages of Ladakh and there is no practice of application of micronutrients by the farmers of the region. Hence, it becomes necessary to apply all the micronutrients regularly, especially in deficient areas. The soil of Nubra and Drass valleys is morainic, because of glaciers and Kargil soil is black due to grey shale while the soils of arid regions of Lahaul & Spiti are of almost similar nature, texture and quality.

## History, People & Culture

### *In Ladakh*

The earliest settlers in Ladakh were the Droghpa emigrants from Dardistan who occupied the lower reaches of the Indus valley, an area popularly known as Sham. These people brought with them the type of faith and beliefs that had prevailed in Dardistan at the time of their migration. The Mon-Aryan by race-who came later from the Karja or Kulu side and occupied the Rong area with Gya as its capital also brought with them a form of Buddhism which prevailed in their original home at the time. The last wave of immigrants rolled into Ladakh from Tibet side about the close of the 10<sup>th</sup> century. This wave which introduced the Mongolian strand into the racial mosaic of Ladakh eventually became the predominant element in its population and brought with it the form of Buddhism that had by this time been established in Tibet by Indian teachers (Kaul *et al.*, 1995).

### *Mongols : A Race of Tibetan Origin (Jina, 1996)*

It is believed that many tribes from Central Asia : Meyak, (Me-Nyag), Do'ng, etc were among popular nomads who first came from the upper side of Indus valley and settled in Changthang sub-division of Leh district. However the Mongols of Tibetan origin migrated later from Central Tibet during 9<sup>th</sup> century A.D. when Langdarma came into power in Central Tibet. The descendants of Langdarma, their forecommers were able to establish the first political state in Ladakh and ruled upto 1834 (Marx, 1980; Kaul *et al.*, 1995; Koshal, 2000).

### *Dards: An Indo-Aryan Race*

The Himalaya is the original home of many ancient tribes. Like other tribes Dards migrated to inner and outer Himalaya from various entrance points beginning from pre-historic to early Christian era. Ethnologically Dards are of the Indo-Aryan stock (Jina, 1996). There is no definite point and time when Dards, migrated towards Indus valley. However, they came in many batches and established their colonies at Skardu, Dras, Skabuchan and Kha-la-che villages in Ladakh. (Kaul *et al.*, 1995; Jina, 1996). Droghpa ancestors were nature worshippers. They worshipped the sun, the stars, the water and the mountains. They were also animists. Droghpa worships the God of beauty for good health, happiness and joy. (Kapur, 1987; Kaul *et al.*, 1995 and Jina, 1996).

### *Mons : An Ancient Race*

Mons called the inhabitants of the country of Manus (Desi-si-manus). Manus was the country lying between Kulu and Lahaul. Abidin believes that Manus would be Monhali (Manali). In early days there was no king who ruled over whole 'Za-Zung' area. It was divided into many small independent republics, which were ruled by 'Magsporns'. So, there is a possibility that some tribes of Aryan origin migrated from Kulu, Manali, Lahaul and Spiti into Ladakh under different Magsporns and settled down at the upper reaches Kashmir. Later from these Magsporns, their present race Mon developed (Jina, 1996).

Tibetan also believes that the aboriginal tribes were only known as 'Mons', who settled at the north of Tibet, where the whole area was covered with dense forest and high mountains. They had made special distinction with their own identity among the nomads and settled on the upper side of Kashmir in Zanskar (Kaul *et al.*, 1995). Mons are fond of music. It is therefore, certain that Mons were the first settlers and missionaries of Buddhism in lower Ladakh during 1<sup>st</sup> or 2<sup>nd</sup> century A.D. (or may be earlier). Afterwards Mongols came into Ladakh and established their political powers over Ladakh. They extended their Kingdoms upto Zanskar and then Mons became their citizens (Jina, 1996).

### *Baltis : An Ancient Race*

The ancient history of Baltistan proves that Baltis were Buddhists and consisted the elements of Aryan and Tibetan cultures, they were braver than the average western Tibetan. Baltis came in Ladakh during 10<sup>th</sup> century for the first time. But they were then Buddhists, however, they were the first western Tibetans who latter became Mohammedans (Kaul *et al.*, 1995; Jina, 1996).

### *Buddhism*

Buddhism was introduced in Ladakh probably around 3<sup>rd</sup> Century BC when Ashoka sent his missionaries in Ladakh. Many inscriptions of this period have been discovered in Zanskar. Besides, many 'Mon' castles have also been discovered



in Zanskar, which reveals : (a) Buddhism was brought in Ladakh by Buddhist missionaries sent by King Ashoka (b) Mons had arrived in Zanskar earlier than King Ashoka's Buddhist missionaries (c) When the Buddhist missionaries arrived in Zanskar, Mons embraced Buddhism and later propagated it in Zanskar (Jina, 1996 & 2000).

The Buddhists of Ladakh have a number of peculiar customs and social institutions. The most striking of these is polyandry, which has been in vogue in the land almost since its history began. The custom was abolished by law more than four decades ago, but the momentum, acquired for centuries past is not yet exhausted, particularly in the country side.

*Social Customs* : People in Ladakh are simple, honest and very hospitable, particularly in villages. Local beer (Chhang) and Sattu are the main drink and dish of the people. Channng is an important item for the success of every feast. Exhibitions of female dancers frequently form a principal part of an entertainment; but the performers are more remarkable for their costume than their graceful movements (Jina, 1996).

## **In Lahaul & Spiti**

The socio-culture aspects of Ladakh and Lahaul-Spiti are more or less very much similar due to similar topography. The name of Lahaul-Spiti derives from the names of its two divisions viz. Lahaul and Spiti. The term Lahaul has probably originated from the Tibetan word Loh-Yul means the southern country or Lhashi-Yul means the country of Gods. The name Spiti is locally pronounced as 'Ptit' meaning a middle province in Tibetan dialet, appears to have been given to territory on account of its location between the then British India, Kashmir, Tibet and Bashahr.

The people of Lahaul-Spiti are a mixed race. The study of their language, which possesses strong characteristic of the Mundari language, induces philologists to believe that times immemorial, (2000 BC), a Munda-speaking race spread from Bengal and Central India to the frontiers of Tibet (Francke, 1977). The Aryans and semi-Aryans also came from the west and the south. Swangla and Gaddi are the main tribes of Lahaul & Spiti areas.

The features of Lahaulis are a combination of Mongolian and Aryans traits. The men are possessing considerable business acumen while the women are very hard working. The Women are very much involved in agricultural and livestock activities. The people of Spiti area are of Mongoloids and by and large men are lazy and lethargic and like Lahaulis the Spitian women are hard working and are actively involved in most of works.

The traditional dress of the men consists of an undershirt, a long shirt (Cholu) and pajamas. A long piece of cloth (gachi) is often used as belt to keep the cholu

tied to the body. Women wear a jacket over cholu in winter. A scarf or jogi is used as a head-wear. Brownish-red (marron) and dark-brown colours are popular among women. The common ornaments of women are ear-rings made of silver/gold, 'kanthi' (a silver necklace) and 'Chully' or 'long' (a gold nose-ring or nose-pin).

The most ancient religions were probably 'phallus' and snake 'worship' the two representing the creative powers of the Sun and Water. At present, the most common religion followed is a combination of Hinduism and Buddhism. The monasteries have preserved many types of paintings of saints, demons, evil looking beasts, devil masks, Yak's tail and sword, drums and other instruments. The people believe in super natural powers, worship God and Goddesses and obey the orders of haunted men/women.

The staple food of these regions are wheat, barley, buckwheat, potato and meat. Now-a-days rice is getting very much popular. Drinking is very common in these belts and the local beer (lugari) and local whisky (Chhang) are the popular drink. Saltis tea is taken by all aged group.



# 2

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## High Altitude Vegetation

The flora of Ladakh and Lahaul-Spiti of trans Himalayan belts comes under alpine and high alpine zones and is dominated by annual and perennial herbs, followed by few stunted shrubs and bushes. The trans Himalayan cold desert has a characteristic vegetation differing from other parts of Himalayas due to prevailing unique climatic conditions and physiography.

The vegetative growth starts at the commencement of summer when the melting snow provides abundant moisture. Due to brief growing period, majority of plant species are in full bloom during July - August but start disappearing by the end of September. The alpine mountain slopes, meadows and alpine pasture lands abound in varieties of alpine and high alpine flowers making trans Himalayan barren mountains lush green for brief summer period. It is very interesting to note that plants that are in fruit at lower altitudes, may be found in flowering stage at higher altitude.

The vegetation of Ladakh and Lahaul-Spiti differs significantly from the rest of the Himalayas. In broad sense, the vegetation of trans Himalayan cold desert may be studied under three categories - Alpine mesophytes, Oasitic vegetation, Desert vegetation. At the same time the vegetation of Lahaul valley is slightly differing from other parts of Cold desert, because of high humidity and that is why the entire area may be studied under Temperate vegetation, Alpine mesophytes, Oasitic vegetation, Desert Vegetation.

**a) Temperate vegetation :** This vegetation is very much localised and is available between tract of Thiroth and Udaipur of Lahaul valley. The vegetation is characterized by woody elements. The main composition of this vegetation in woody groups are *Pinus wallichiana* (Blue pine), *Picea smithiana* (Spruce), *Cedrus deodara* (Devdiar), *Betula utilis* (Birch), *Juniperus macropoda* (Juniper), *Juniperus recurva* (Juniper), *Juglans regia* (Walnut), *Prunus armeniaca* (Apricot) and different species of *Salix*, *Populus*, *Malus*, *Sorbus* etc.

The major shrub species of this zone are *Berberis pachyacantha*, *Cotoneaster* sp, *Ephedra gerardiana*, *Fraxinus xanthoxyloides*, *Hippophae rhamnoides* var



*turkestanica*, *Hippophae salicifolia*, *Juniperus communis*, *Lonicera sp*, *Rosa macrophylla*, *Rosa webbiana* etc while *Aquilegia fragrans*, *Codonopsis clematidea*, *Galium aparine*, *Geranium pretense*, *Gaultheria tricophylla*, *Inula grandiflora*, *Lepidium sp*, *Origanum vulgare*, *Pedicularis sp*, *Podophyllum hexandrum*, *Primula denticulata*, *Ranunculus lateus*, *Rubus saxatilis*, *Rumex sp*, *Senecio sp*, *Silene sp*, etc. belong to herbaceous as forest undergrowth.

The marshy areas are covered with *Bromus sp*, *Eleocharis palustris*, *Halerpestis sarmentosa*, *Poa sp*, *Polygonum sp*, *Carex sp*, *Scirpus sp*, etc. The common species of meadows and slopes are *Achillea millefolium*, *Capsella bursa-pastoris*, *Heracleum lanatum*, *Origanum vulgare*, *Lotus corniculatus*, *Thymus serpyllum*, *Phlomis bracteosa*, *Trigonella sp*, etc. Similarly the common grasses are *Agrotis sp*, *Bromus sp*, *Carex sp*, *Elymus sp*, *Festuca sp*, *Poa sp*, *Stipa sp*, etc.

**b) Alpine mesophytes :** This zone is also characterized by high humidity and more rainfall. The flora of Suru valley and parts of Lahaul valley shows the characteristic of alpine mesophytes. Majority of plants growing in this zone, are also found in temperate regions. The common mesophytic plant species are *Podophyllum hexandrum*, *Lavatera kashmiriana*, *Lotus corniculatus*, *Astragalus rhizanthus*, *Verbascum thapsus*, *Oxyria digyna*, *Capsella bursa-pastoris* etc. Only about 10% of alpine mesophytes are typical cold desert plants like *Delphinium brunonianum*, *Potentilla sp*, *Leontopodium sp*, *Taraxacum sp* etc. which are widely distributed in high altitude areas.

*Salix daphnoides*, *Morus alba*, *Myricaria elegans* etc. are found along river belts and in marshy depressions. *Prangos pabularia*, *Ferula jaescheana*, *Juniperus macropoda* are dominant on mountain slopes and rocky areas. Among herbs, *Colchicum luteum*, *Tulipa stellata var chrysantha*, *Euphrasia officinalis* are very common.

**c) Oasitic vegetation :** Plants of this zone are generally found near habitations like Kargil, Leh, Khoksar, Keylong, Kaza, Trilokinath, Udaipur etc. and are cosmopolitan in nature. This type of vegetation is represented by a variety of exotic as well as indigenous species, growing near habitation, along water channels, streams, nullahs and in moist places. The common taxa of this vegetation is *Chenopodium foliosum*, *Dianthus anatolicus*, *Epilobium roseum*, *Mentha longifolia*, *Potentilla cuneata*, *Sedum ewersii*, *Rhodiola quadrifolia*, *Lancea tibetica*, *Trifolium pratense*, *Melilotus alba*, *Melilotus officinalis*, *Galinsoga parviflora*, *Stachys tibetica*, etc.

Except *Hippophae rhamnoides* and *Lonicera species*, there is no natural vegetation. The commonest species introduced in these areas, are species of *Salix*, *Populus*, *Juglans*, *Morus*, *Pyrus*, *Prunus* etc.

**d) Desert vegetation :** This zone is characterized by little rainfall, low humidity, extreme fluctuation of diurnal temperature and high velocity winds etc. The long stretches of Ladakh and Lahaul-Spiti regions viz. Central Ladakh,

Puga areas, Tangtse, Kaza, Pin valley are characterized by stunted, cushion type desert vegetation of tufted plants. Due to high velocity winds, which are constantly blowing in these areas, the plants tend to become prostrate, thick woolly, cushion forming, bushy, hardy, spongy and with long deep rooted roots and small leaves. The herbaceous species show a mixture of Tibetan, Siberian, Chinese and Afganistan flora. Majority of plant species are characterized by stunted, cushioned, prostrate, thick woody, spongy and long roots and succulent small leaves.

Common plant species which are growing around barren valleys of Indus, Changthang and Spiti, are *Polygonum avicula*, *Atriplex crassifolia*, *Corydalis flabellata*, *Caragana pygmaea*, *Echinops cornigerus*, *Peganum harmala*, *Capparis spinosa*, *Berberis ulicina*, *Tanacetum sp*, etc. Similarly desertic elements found growing around high passes like Khardungla (5,520 m.), Changla (5,286 m.), Penzila (4,204 m.), Tanglangla (5,255 m.) and Kunzum pass (4500 m) are *Thylacospermum caespitosum*, *Acantholimon lycopodioides*, *Arnebia euchroma*, *Caragana pygmaea*, *Corydalis crassima*, *Dracocephallum heterophyllum*, *Krascheninnikovia ceratoides*, *Meconopsis aculeata*, *Primula rorea*, *Rhodiola imbricata*, *Rosularia alpestris*, *Waldheimia tomentosa*, *Euphorbia tibetica*, *Arenaria bryophylla* *Lindelofia stylosa*, *Nepeta longibracteata*, *Christolea crassifolia*, *Draba setosa*, *Saussurea bracteata*, *Saxifraga sp*, *Waldheimia sp etc.*

Although there are no natural forest in Ladakh and parts of Lahaul-Spiti, there are frequently thickets along streams and along river belts. These have a typical association of *Myricaria sp*, *Hippophae sp*, *Rosa sp*, *Lonicera sp*, etc. The introduced forest species are *Populus*, *Salix*, *Prunus*, *Malus*, etc.

### Cultivated vegetation

A number of cultivated plants of various categories are grown in Ladakh and Lahaul-Spiti which are the major source of economy, besides their own consumption. Besides indigenous cultivated crops, a number of cultivated crops of various utility have been introduced time to time.

*Cereal crops* : The main food crops are *Triticum aestivum* (Wheat), *Hordeum vulgare* (Barley), *Zea mays* (Maize).

*Oil crops* : *Brassica juncea* (Lahi) *Carthamus tinctorius* (Safflower), *Glycine max* (Soyabean), *Helianthus annuus* (Sun flower), *Linum usitatissimum* (Lentil),

*Pulse crops* : *Cicer arietinum* (Black gram), *Lathyrus sp* (Bakla). *Lens esculenta* (Lentil), *Phaseolus aureus* (Moong), *P. mungo* (Urd) *P. vulgaris* (Lobia), *Pisium sativum var. arvense* (Local pea), etc.

*Fruit plant* : *Fragaria grandiflora* (Strawberry), *Juglans regia* (Walnut), *Malus pumila* (Apple), *Morus alba* (Mulberry), *Prunus armenica* (Apricot), *Vitis vinifera* (Grape).

*Vegetable crops* : *Allium cepa* (Onion), *A. porum* (Leek), *A. sativum* (Garlic), *Brassica caulorapa* (Knol khol), *Brassica chinensis* (Chinese cabbage), *B. oleracea*

*var. botrytis* (Cauliflower), *B. oleracea var. capitata* (Cabbage), *B. oleracea var. gemmifera* (Brussels sprouts), *B. oleracea var. italica* (Broccoli), *Beta vulgaris* (Beet root), *Brassica rapa* (Turnip), *Daucus carota* (Carrot), *Raphanus sativus* (Radish), *Helianthus tuberosus* (Sunflower), *Solanum tuberosum* (Potato), *Phaseolus vulgaris* (French bean), *Pisum sativum* (Peas), *Vicia faba* (Broad bean), *Citrullus lanatus* (Watermelon), *Cucumis melo* (Muskmelon), *C. melo var. utilissimus* (Longmelon), *C. sativus* (Cucumber), *Cucurbita moschata* (Pumpkin), *C. pepo* (Summer squash), *Lagenaria siceraria* (Bottle gourd), *Momordica charantia* (Bitter gourd), *Amaranthus tricolour* (Amaranth), *Beta vulgaris var. benghalensis* (Spinach beet), *Brassica juncea* (Vegetable mustard), *Coriandrum sativum* (Coriander), *Mentha piperita* (Mint), *Spinacea oleracea* (Spinach), *Trigonella foenum-graceum* (Fenugreek), *Apium graveolens* (Celery), *Lactuca sativa* (Lettuce), *Petroselinum crispum* (Parsley), *Capsicum annuum* (Capsicum), *Lycopersicon esculentum* (Tomato), *Solanum melongena* (Brinjal), *Abelmoschus esculentus* (Okra), etc.

*Fodder Crops* : *Avena sativa* (Oats), *Brassica juncea* (Mustard), *Medicago falcata* (Lucerne), *M. media* (Lucerne), *M. sativa* (Lucerne), *Pisum sativum* (Peas), *Sorghum vulgare* (Sorghum), *Zea mays* (Maize).

*Ornamental plants* : *Acroclinium roseum* (Paper flower), *Althaea rosea* (Hollyhock), *Antirrhinum majus* (Snapdragon), *Bellis spp* (Daisy), *Calendula officinalis* (Calendula), *Callistephus chinensis* (Aster), *Celosia argentea* (Cock's comb), *Centaurea cyanus* (Corn flower), *C. moschata* (Sweet Sultan), *Chrysanthemum coronarium* (Chrysanthemum), *Clarkia elegans* (Clarkia), *Coreopsis tinctoria* (Coreopsis), *Cosmos bipinnatas* (Cosmos), *Dahlia variabilis* (Dahlia), *Delphinium hybridum* (Larkspur), *Dianthus barbatus* (Sweet William), *D. caryophyllus* (Carnation), *Dimorphotheca sinuate* (Dimorphotheca), *Eschscholzi californica* (California poppy), *Gaillardia pulchella* (Gaillardia), *Gladiolus spp* (Gladioli), *Helianthus annuus* (Sunflower), *Helichrysum bracteatum* (Straw flower), *Iberis amara* (Candytuft), *Impatens balsamina* (Balsam), *Kochia scoparia var. trichophylla* (Kochia), *Lathyrus odoratus* (Sweet peas), *Linaria maroccana* (Linaria), *Linum grandiflorum var. rubrum* (Linum), *Matthiola incana* (Stock), *Mesembryanthemum criniflorum* (Ice flower), *Molucella laevis* (Bells of Ireland), *Papaver rhoeas* (Poppy), *Petunia hybrida* (Petunia), *Pimpinella monoica* (Lady's lace), *Phlox drummondii* (Phlox), *Portulaca grandiflora* (Portulaca), *Rosa indica* (Rose), *Spanoria calabrica* (Saponaria), *Syringa spp.* (Lilac), *Tagetes erecta* (Marigold), *T. patula* (French marigold), *Thuja spp.* (Thuja), *Tropaeolum majus* (Nasturtium), *Verbena hybrida* (Verbena), *Viola tricolor* (Pansy), *Zinnia elegans* (Zinnia).

*Forest plants* : *Betula utilis*, *Elaeagnus angustifolia*, *Hippophae rhamnoides spp. turkistanica* (Seabuckthorn), *Hippophae salicifolia* (Seabuckthorn), *Myricaria squamosa*, *Populus caspica*, *P. ciliata*, *P. deltoides*, *P. euphratica*, *P. nigra*, *P. sylvestris*, *Robinia pseudacacia*, *Salix alba*, *S. angustifolia*, *S. babylonica*, *S. caesia*, *S. daphnoides*, *S. denticulata*, *S. excelsa*, *S. hastata*, *S. sclerophylla*, *S. tetrasperma* etc.