



3.0 Cold Deserts of Himachal Pradesh: Unique Habitats and Threatened Plants

¹Vaneet Jishtu & ²G.S. Goraya

¹Division of Ecology and Biodiversity Conservation,
Himalayan Forest Research Institute
Conifer Campus, Panthaghati, Shimla-171 009
jishtu@yahoo.com

²Chief Conservator of Forests,
HP State Forest Department, Talland, Shimla-171 002
gurinder9@hotmail.com

Introduction

The northern flank of Himachal Pradesh (HP), separated by the Great Himalayan range and partly by the Pir Panjal (to the west), forms the southern extension of Indian Cold Desert. A major portion of this land mass has been categorized under the Biogeographic zone 1 *i.e.*, Indian Trans-Himalaya by Rodgers and Panwar (1988), and administratively this area falls under Lahaul & Spiti district of HP. Far from being barren wasteland, as has been erroneously referred in some texts, this region represents a unique ecosystem hosting an array of specialized plants and animals adapted to the harsh conditions prevailing here. This tract is among the sub-continent's last remaining citadels of total wilderness. Along with the unique floral elements several birds and mammals exhibit seasonal migrations up and down the steep mountain slopes and depend on contiguous habitat for their movement. If any of the habitat layers are lost or degraded, numerous biological processes are disrupted. Therefore, conservation of this ecoregion is critical for the conservation of biodiversity not confined here but extending afar of its boundary limits.

This article gives an overview of biophysical features, habitat and vegetation characteristics within cold deserts of HP. A few species of angiosperms, representing these habitats have been appended along with their uses, distribution and threat status.

Biophysical Features

The cold deserts in the HP lie extending between 31° 44' 34" N to 32° 59' 57" N latitudes and 76° 46' 29" E to 78° 41' 34" E longitudes, covering Lahaul & Spiti district and part of Pooch Sub-division in Kinnaur. The altitude ranges from 2400 to 6400m above mean sea level and the area above 5600m remains perpetually under snow. The region exhibits typical alpine characteristics with low vegetation cover and primary productivity and stark seasonality. The region forms an integral part of the Himalayan ecosystem, with interconnected processes that extend from the riparian scrub along the river and stream courses to the high alpine meadows and boulder-strewn scree that spreads over the vast landscape. However, to overcome these environmental stresses, both plants and animals have adapted themselves in many ways. Typical Trans-Himalayan faunal elements include the elusive snow leopard, brown bear, Tibetan wolf, majestic ibex and blue sheep (Plate 3A).

Despite harsh climatic conditions, the cold deserts have been occupied by human beings since the dawn of civilization. Secluded in selected pockets, the indigenous people have managed to eke out their living by adapting themselves to the harshness of their chosen habitat with tradition. The unpleasant face of development and the increasing biotic pressure in recent years along with the lack of appropriate technologies has led to the overuse and degradation of the natural resources of the region. The scarce vegetation cover is steadily getting degraded, and the limited water resources are getting depleted and polluted. Waste accumulation and poor sanitation and hygiene are new problems



of the region, and are leading to health problems among the local people. Firewood is scarce and power inadequate and unreliable for both domestic and occupational use. Very little research interest and technology development has been focused on these regions. Moreover few technologies that have been transferred have frequently not been aligned to the special needs and conditions of the region. Agriculture is done on terraced fields. One of the major features in the region is agro-forestry, under which local people have adopted willows and poplars which are planted along the margins of the agricultural fields. In the Patton sub-valley, however, fruit trees, such as walnut, plum, and peach, are also cultivated. Seabuckthorn (*Hippophae* spp.) is found in smaller patches on the interspaces of the terraces, particularly in those parts of the fields through which the irrigation channels pass (Rawat *et al.* 2006).

Habitat and Vegetation Characteristics

The evolutionary history of landscape features and habitat characteristics in the cold deserts of Western Himalaya is beyond the scope of this article. However, current physical features and eco-climatic conditions reflect a mosaic of numerous habitats and corridors for dispersal of the floral and faunal elements thereby resulting in high degree of biodiversity. Though this particular region does not harbor a spectacularly rich flora like many other biomes of the world in terms of species diversity yet their morphological, ecological and behavioral adaptations are necessarily unique. The region has several focal species of immense conservation importance (Plates 3A & 3B). Some of the interesting features of natural habitats and corresponding vegetation have been described below:

i. *The Moist Meadows of Pir Panjal*

The areas along and immediately north of Pir Panjal range, especially towards Lahaul exhibits characteristic features of alpine moist meadows similar to Greater Himalaya. It forms a transition zone between the moist temperate and alpine habitats. One of the most accessible and typical sites where this habitat can be seen is around Rohtang Pass that forms the beginning of Pir Panjal range. The meadows are dominated by species of *Poa*, *Festuca* and a large number of herbaceous species. A few species of high conservation significance in these habitats include *Primula rosea*, *Meconopsis aculeata*, *Rheum australe*, *Lagotis* spp., and *Bistorta affinis*. The lush green meadows around Rohtang slopes harbor the summer grazing grounds for herds of sheep, goats and mules. These grazing grounds over the years have become vulnerable to unpalatable native species in the company of some ever-increasing invasive elements, belonging mainly to the *Polygonaceae* and *Brassicaceae* family. The unpalatable plant species include *Bistorta vacciniifolia*, *Primula denticulata*, *Meconopsis aculeata*, *Geranium wallichianum*, *Bistorta affinis*, *Geum elatum*, *Impatiens thomsonii*, *Salvia glutinosa*, *Senecio chrysanthemoides* and *Urtica hyperborea*. Some other species like *Anemone rivularis*, *Iris kemaonensis*, *Morina longifolia*, *Potentilla argyrophylla*, *Taraxacum officinale* and *Thermopsis barbata* thrive under these stressed conditions and can be seen in gregarious formations.

ii. *Riverine scrub of Bhaga Valley*

The riverine scrub along Bhaga river is dominated by *Hippophae rhamnoides*, *Salix alba*, *Myricaria elegans* and *Rosa webbiana*. Regions where the adjoining glacial streams meet the river, glacial moraines and scree are covered with good *Juniperus* regeneration, *e.g.*, the area opposite Jispa. At higher altitudes, the snow on the north facing slopes lasts longer into the summers. This results in the formation of special habitats which show a prominent effect on the composition of the flora. *Betula utilis* formation can be observed in moist gulleys among craggy cliffs and slopes, while the adjacent sun facing slopes have drier conditions favouring arid floristic elements like *Juniperus* spp. with undergrowth of *Rosa webbiana*, *Ribes alpestre* and *Lonicera myrtillus*. A good formation of *Juniperus* forest is found around Stingri near Keylong.



iii. *Juniper woodland and sub-alpine Scrub of Miyar Valley*

Miyar forms the North-Western part of Lahaul. This remote fascinating valley of Lahaul is hidden behind the lofty Udaipur Range and remains snow bound for over half the year and is amongst the most inaccessible areas in the region. During the short summer months, however, the alpine passes, mountain slopes, meadows and moraines present a spectacular display of colours as the vegetation bursts into life. Quite a few patches of juniper tree (*Juniperus semiglobosa* Regel) can be seen here, which represents sub-alpine forests in the region. This is one of the featured species of high conservation and religious importance in the valley. In the moist valley area along Miyar rivulet, the cool temperate and sub-alpine zones are dominated by dry zone *Cedrus deodara* in association with gnarled trees of *Juniperus* spp. Other prominent taxa in this zone are stunted associations of *Juglans regia*, *Pyrus baccata*, *Prunus cornuta*, *Berberis* spp., *Rosa webbiana*, *Rosa eglantheria*, *Ribes grossularia*, *Cotoneaster bacillaris*, *Crataegus songarica*, *Populus balsamifera* and *Betula utilis*. The mouth of the valley has a dominant presence of *Datisca cannabina* along the steep river valley and further into the valley the slopes are dotted with a dominance of beautiful flowered *Eremurus himalaica* ('Praey') during the onset of summer (Kapoor & Jishtu 2008).

iv. *Alpine Dry Scrub of Spiti*

Spiti valley, in general is characterized by sloppy mountain deserts with the growing season of 5 – 6 months (April to September). The annual snowfall varies from 150-200 cm with very negligible rainfall. The minimum average temperature during winters touches as low as -30°C. Sub zero temperature prevails from December to February, whereas, around 0.5°C temperature is experienced during winter months. The air is very dry particularly in the summer months. Very high wind velocity in the afternoon and night hours results in heavy soil erosion and soil moisture losses. This area harbours typical alpine dry scrub dominated by *Caragana versicolor*, *Lonicera spinosa*, *Rheum* spp., and *Kraschennikovia ceratoides*. In riverine / moist areas gregarious patches of *Hippophae tibetana* can be seen, especially around Losar upstream of Kaza.

v. *Alpine Mixed Communities of Pin Valley*

Pin Valley, located to the south of Spiti river adjacent to Great Himalayan range, is peculiar in many ways. The vegetation exhibits characteristics of both the Greater and Trans-Himalaya. Common shrubs in the valley are *Rosa webbiana*, *Hippophae rhamnoides* subsp. *turkistanica* ('Charma') and *Salix elegans* ('Changma'). The herbaceous vegetation turns to be profuse during the summers and is predominantly constituted of grasses and sedges. Here, the flora is remarkably rich, prominent taxa being species of *Aquilegia*, *Allium*, *Corydalis*, *Iris*, *Ranunculus*, *Potentilla*, *Pedicularis*, *Saxifraga*, *Sedum* and *Primula*. Numerous plant species thrive in the area, among them many varieties of medicinal plants. In summer, wild flowers create a riot of colours in some areas. One of the important woody species *Juniperus semiglobosa* (~ *J. macropoda* auct.) is reported to have become almost extinct in the valley due to over-exploitation.

vi. *Riverine Scrub of Lingti Valley*

It is the longest side valley in Spiti and is a living geological museum famous for shale's and fossils in a geological history dating back 250 million years. Gya (6794m), the highest peak in HP, stands above the northern head of the valley and present a stupendous monolith where the boundaries of Ladakh, Spiti and Tibet meet. *Hippophae rhamnoides* subsp. *turkistanica* ('Charma') forms the major constituent of riverine scrub in the valley. Common associates are *Myricaria elegans* ('Humbok'), *Rosa webbiana* and *Clematis orientalis*. At places dwarf *Juniper* can be seen lower down in the valley.



Some Taxa of High Conservation Significance

First comprehensive documentation of the flora for Lahaul & Spiti was by Aswal and Mehrotra (1994) who reported 79 families, 353 genera and 985 species of seed plants (Angiosperms and Gymnosperms) from the district. Many of the taxa listed in this work are rare and threatened. Others are extremely valuable for their medicinal properties, e.g., *Allium carolinianum* ('Loadh'), *Artemisia brevifolia* ('Nyurcha'), *Ephedra gerardiana* ('Chhe'), *Heracleum candicans* ('Raswal'), *Meconopsis aculeata* ('Charr-Bongcha'), *Podophyllum hexandrum* ('Omo-Shey'), *Physochlaina praealta* ('Lang Tang') and *Saussurea costus* ('Koonth'). Populations of many of these plants have suffered high depletion rates in the last decade or so. Species of *Arnebia*, *Betula*, *Dactylorhiza*, *Juniperus* and *Podophyllum* are on the threatened list of plants. What is also critical is that some of the plants are endemic to the region and extinction from the region would imply a loss in global biodiversity. Over harvesting for use and trade, destructive forms of harvesting, overgrazing, are some of the causes leading to depletion and fragmentation of the species populations. Very little of the supply of plant material, which constantly falls short of the escalating demand, is from regenerative sources, and much of the harvesting is through destructive collection methods. Collectors' earnings are limited, much of the returns from the sale of the herbs going to middlemen and traders. This also makes them uncaring of the regeneration and long-term survival aspect of the plants. Some of the taxa of high conservation significance in the region are given below:

1. *Podophyllum hexandrum* Royle (Podophyllaceae)

Syn : *Podophyllum emodi* Wall. ex Honig.

Local Name : *Omo-Shey*, *Bankakri*

Erect perennial herb; Stem smooth, fleshy; rhizome short, horizontally creeping, scaly above. Leaves palmate, deeply 3 (5) lobed; sharp toothed, acute, sessile. Flowers white - pink, terminal in bud, supra axillary later. Sepals 3, caducous, petaloid. Petals (4-) 6, obovate-oblong. Berry oblong-ovoid to ellipsoid, scarlet or red, pulpy, many seeded.

Habitat : It is a shade loving plant growing in rich humus; 2000 – 4500 m. Miyar Valley.

Fl. & Fr. : April - May.

Distribution : Throughout Himalayas, Pakistan, India, Afghanistan and China.

Uses : The plant is poisonous but when processed have medicinal properties. Powdered roots in chronic constipation. Ripe fruit edible and also used in tuberculosis and cough.

Threat Status : Listed as Critically Endangered in Appendix II of CITES. Endangered in Uttaranchal, Himachal Pradesh and Jammu & Kashmir as per CAMP Workshop, Shimla.

2. *Capparis himalayensis* Jafri (Capparidaceae)

Syn: *Capparis spinosa* L. var. *himalayensis* (Jafri) Jacobs (Plate 3B)

Local Name: *Rohtokpa* – *Martopka*

Perennial straggling shrub; branches white pubescent, becoming glabrescent. Stipular spines pale yellow, apex recurved. Leaf blade ovate/ suborbicular, as long as wide, fleshy when fresh, later leathery. Flowers in upper axils, solitary. Petals dimorphic, anterior 2 white; posterior 2 yellowish green. Fruit dark green, ellipsoid, with vertical ridges, dehiscent; mesocarp red. Seeds numerous, red brown, reniform, smooth.

Habitat : Plains, desert flats, open drier areas; More common in Spiti valley (Tabo, Hurling, Kaza, Pin valley).

Fl. & Fr. : June - September.

Distribution : NW India, Nepal, NE Pakistan, Tajikistan; SW Asia, Iran Afghanistan, Kazakhstan and China.

Uses : Ripe fruits edible and pickled. Medicinally used for urinary and liver problems.

Threat Status : Data Deficient (DD). Fruit collection has limited its regeneration as most of the fruits are collected for domestic uses. Medicinal.



3. *Colutea nepalensis* Sims (Fabaceae)

Syn : *Colutea arborescens* var. *nepalensis* (Sims) Baker

Shrublet up to 3m tall; Stems pilose, red brown, shining. Leaves stipulate leaflets 7-13, elliptic to ovate, pubescent. Inflorescence 3-5 flowered raceme; flowers yellow. Fruit oblong, distinctively inflated with curved fruit stalk, beaked and pubescent; seed smooth, flat, black to dark brown.

Habitat : Found on scree slopes on the mountains, roadside /riverside gravel; 2600-3300 m; Hurling.

Fl. & Fr. : July - September.

Distribution: Afghanistan, Pakistan, India (J & K, HP, Uttarakhand), Tibet, Nepal.

Uses: Used for making household articles as well as agricultural implements. Fuelwood.

Threat Status: Data Deficient (DD). Having limited distribution mainly in the Spiti Valley.

4. *Crataegus songarica* K. Koch. (Rosaceae)

Syn : *Crataegus oxycantha* auct. non L.

Local Name : *Ramiya, Ramjagh*

Small Tree; Branchlets purplish brown to grayish brown when old. Leaf blade broadly ovate, glabrescent, base cuneate, margin remotely serrate with 2-3 pairs of deep lobes; lobes oblong, apex acute. Corymbs many flowered, white. Fruit a pome; reddish black, pulp yellow, globose to ellipsoid, glabrous; sepals persistent; seeds 2 - 3, smooth.

Habitat : Valleys, field boundaries, thickets; 2800—3600 m. Miyar, Trilokinath.

Fl. & Fr. : May - August.

Distribution : Afghanistan, Kazakhstan; SW Asia (Iran).

Uses : Fruit edible and considered cardiac tonic. Wood used for making handles, walking sticks and for engraving (Anonymous 1986).

Threat Status : Data Deficient (DD). Populations have dwindled considerably and only individual trees are found sporadically in the vicinity of Udaipur in Lahaul.

5. *Rosa webbiana* Wallich ex Royle (Rosaceae)

Local Name : *Shaybala, Chuua, Sia*

Spinescent Shrub; Branchlets purple-brown; prickles present, yellow, terete, straight. Leaves 3–4 cm; stipules adnate; leaflets 5–9, suborbicular, glabrous, margin serrate at upper part, entire near base, apex rounded. Flowers solitary, red or rose, rarely 2-3, fasciculate. Fruit a nodding hip, bright-red, subglobose or ovoid, glabrous, with persistent, spreading sepals.

Habitat : Forests, scrub, meadows, valleys, slopes, fields; 2200 - 4200 m. Common across the region.

Fl. & Fr. : June - September.

Distribution : Afghanistan, NW India, Kashmir, Mongolia, W Nepal.

Uses : Peeled young stems and ripe fruits edible. Finds use in religious customs to ward away evil spirits. Thorny stems used as bio fence. Dried stems used as firewood. Flowers offered in gompas and used as stomachic in Lahaul (Koelz 1979).

Threat Status : Data Deficient (DD).

6. *Onosma hispida* Wall. ex G. Don (Boraginaceae)

Syn : *Onosma hispida* var. *kashmiricum* (I.M. Johnston) I. M. Johnston

Local Name : *Khomig, Ratanjot*

Perennial Herb; Stems many, hollow, and densely hairy. Basal leaves linear to oblanceolate, middle cauline leaves often larger uppermost smaller. Inflorescence a terminal cyme. Bracts lanceolate, leaf-like, but smaller. Calyx densely



hairy; lobes lanceolate. Corolla creamish-white to light yellow, tubular-campanulate, puberulous outside, deflexed. Nutlets shiny.

Habitat : Usually occurs near glacial moraines and drier slopes; 3200 – 4200 m. It is mainly distributed in western areas of Lahaul bordering Pangri area of Chamba and is occasionally met in drier parts of Kinnaur.

Fl. & Fr. : May - September.

Distribution : Kashmir, parts of Himachal Pradesh, Pakistan, Afghanistan, Iran, westward to Syria, Turkey and Europe.

Uses : Medicinally, the plant has cooling, laxative, anthelmintic, and alexipharmic effects and is also used in treating diseases of the eye, disorders of the blood, bronchitis, and abdominal pain (George 1972). The plant is also used as a dye (Supiriya 1994) and root mixed with mustard oil as a hair tonic (Rawat & Pangtey 1987).

Threat Status : Data Deficient (DD). Limited and specific distribution.

7. *Rheum australe* D. Don (Polygonaceae)

Syn : *Rheum emodi* Wallich ex Meisner

Local Name : *Archo, Tuksu, Goggul*

Stout Perennial Herb; Stem sulcate, glabrous, pubescent at nodes. Petiole of basal leaf equal to blade or slightly longer, pubescent; leaf blade broadly ovate, basal veins 5-7, base cordate, margin entire, apex obtuse. Stem leaves ovate, narrow; ocrea large. Panicle large, branched; perianth purple-red. Fruit ovoid-ellipsoid, base subcordate; wings purple-red. Seeds ovoid.

Habitat : Grassy slopes; 3000-4300 m. Miyar, Jispa, Lingti valley.

Fl. & Fr. : August - October.

Distribution : China, India, Myanmar, Nepal, Pakistan, Sikkim.

Uses : Stems and petioles chewed to avoid high altitude uneasiness and also to quench thirst. Root as dye for woolen products (Sood *et al.* 2001)

Threat Status : Endangered in Uttaranchal, Himachal Pradesh and Jammu & Kashmir as per CAMP Workshop, Shimla.

8. *Ephedra intermedia* Schrenk ex C. A. Meyer (Ephedraceae)

Syn : *Ephedra intermedia* var. *tibetica* Stapf.

Local Name : *Chhee, Somlata, Tse*

Dwarf Shrublet; Stems dense branched, erect to spreading. Branches yellowish or bluish green, pruinose. Leaves in whorls of 3. Male cones up to 8, whorled, usually clustered at nodes, often sessile; bracts in 3-4 pairs/ whorls. Seed cones ellipsoid to oblong-ovoid, globose, red, fleshy. Berry ovoid, red. Seeds 2-3, ovoid/elongate-ovoid, concealed by bracts.

Habitat : Found in grasslands, deserts, river valleys, floodplains, sandy beaches, cliffs, and other dry, sandy or rocky places; 2800-4600 m; Hul, Gue.

Fl. & Fr. : May - September.

Distribution : Afghanistan; Kazakstan; Kyrgyzstan; Mongolia; Pakistan; NW India; Russia; Tajikistan; Turkmenistan; Uzbekistan; SW Asia and China.

Uses : Fresh twigs as toothbrush and burnt twigs ash as snuff (Koelz 1979). Medicinally to cure liver disorders and for cardiac ailments. Uprooted to burn as fuelwood.

Threat Status : Data Deficient (DD). Not very common having limited distribution.

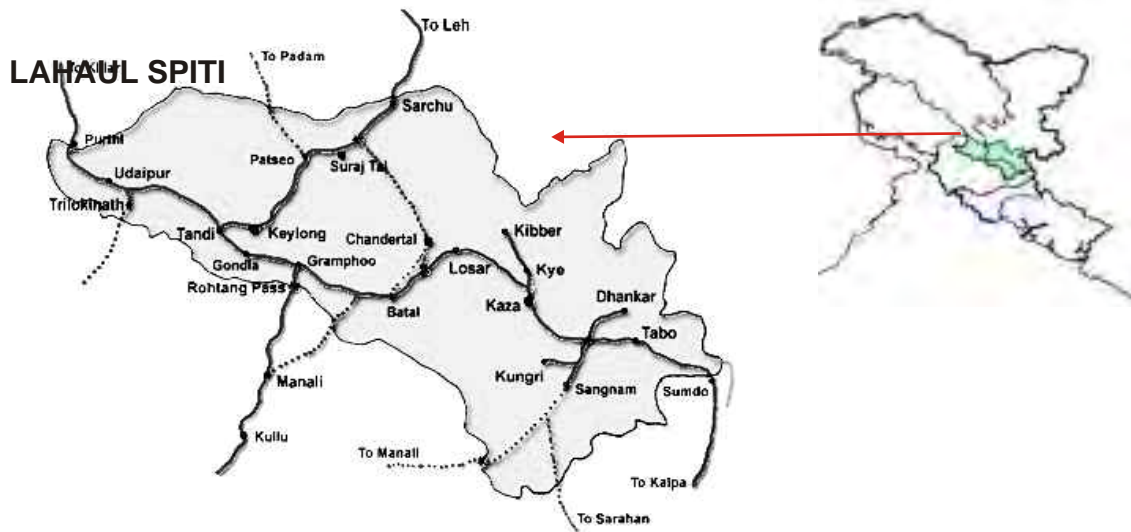
9. *Betula utilis* D. Don (Betulaceae)

Syn : *Juniperus macropoda* auct. Boiss.

Local Name : *Shiag, Bhojpatra*



Plate 3A Lahaul-Spiti: Important Localities and Habitats



Alpine pastures of Gete (Kibber)



Asiatic Ibex in its habitat



Miyar Valley (Lahaul)



Plate 3B
Threatened Plants of Lahaul-Spiti



Capparis himalayensis



Ephedra intermedia



Colutea nepalensis



Crataegus songarica



Dactylorhiza hatagirea



Rheum australe



Onosma hispidum



Medium sized to small deciduous trees; Bark whitish, papery, peeling off in layers. Leaves ovate, base rounded, margins irregularly serrated, woolly haired below when young. Male flowers in reddish catkins; female spikes solitary. Fruiting bracts 3 lobed; Nutlets winged.

Habitat : Drier mountainous regions in shaded moist pockets; near the river basin of Mudgram area; 2800 4300 m. Ghandal, Pomerang, Mudgram, Khanzar.

Fl. & Fr. : July – October.

Distribution : Pakistan, NW Himalaya, Nepal, SW China.

Uses : Bark used as aromatic and for wrapping food, lighting fire and in religious functions. Twigs as brooms and in roof thatching of houses. Medicinally used as antiseptic, carminative and as contraceptive. Also used in hysteria and jaundice.

Threat Status : Critically Endangered (CR) in J&K; Endangered (EN) in Himachal Pradesh and Near Threatened (NT) in Uttaranchal as per CAMP Workshop, Shimla.

10. *Juniperus semiglobosa* Regel. (Cupressaceae)

Syn : *Juniperus macropoda* auct. Boiss.

Local Name : *Shukpa, Shur*

Monoecious medium sized trees; Stem gnarled. Leaves on upper branches scale like, opposite, decussate, broadly ovate, closely appressed, on the lower branches subulate, pungent. Male cones terminal on branchlets, scales imbricate. Berries subglobose, blue black when ripe. Seeds 3 5, brownish yellow, testa thick.

Habitat : Forming forests in Lahaul (Stingri) and sporadic in the inner drier valleys of the Lahaul and Spiti; 2000 4200 m. Stingri, Poh, Pattan Valley, Miyar Valley.

Fl. & Fr. : May – October.

Distribution: S.W. Europe, Caucasus, Iran, Arabia, Afghanistan, Baluchistan, NW Himalaya, Nepal.

Uses : Used as Incense and to cleanse the house. It finds use in all religious and cultural ceremonies as it is sacred to the community.

Threat Status : Endangered in Uttarakhand, Himachal Pradesh and Jammu & Kashmir as per CAMP Workshop, Shimla (Polunin & Stainton 1984, Aswal & Mehrotra 1994, Kapoor & Jishtu 2008).

The *taxon*, according to IUCN red list categories is Data Deficient (DD), *i.e.* when there is inadequate information to make a direct or indirect assessment of its risk of extinction based on its distribution (IUCN 1993). Therefore these plant taxa may be well studied, and its biology may be well known, with appropriate data on abundance and distribution. Listing of taxa in this category indicates that more information is required and acknowledges the possibility that future research will show that a threatened classification is appropriate. Basic knowledge of these threatened habitats and their floristic composition is of fundamental importance to biodiversity conservation (Arkadiusz & Sylwia 2006). It will be especially helpful in active management of rare plant communities, estimation of restoration possibilities and to assess their effective conservation. Floristic surveys are indispensable in analysing the environmental conditions of threatened habitats and the flora thriving there.

Major Threats and Conservation Strategies

i. **NTFP Collection** : Traditionally, people of the region are engaged in little mountain farming and animal husbandry. Collecting medicinal plants from various mountain ecosystems is an important part of their traditional medicine system, but only trained medicine men or *Amchis* do this. However, some people are engaged in collection of medicinal plants for augmenting their income. Large-scale collection of the fodder and fuelwood from this ecoregion by the local people for storage and use during the prolonged cold winters is a substantial threat, especially because the floral



species in the region are very slow to regenerate. Some plants like *Myricaria elegans*, *Colutea nepalensis*, *Rosa webbiana* and species of *Caragana* are destructively harvested for fuel wood and other domestic uses by the local inhabitants. There is no exact figure to show how many and how much of the plants are collected from different habitats in the region. In recent years, due to increased domestic market demand, over harvesting of wild plants is a common problem world-over resulting in the threat to some of these species.

ii. **Habitat Alteration** : Land use change is seen as the main factor to cause the habitat loss for native flora in the region. The loss of habitat is being seen as one of the major causes of threats to biodiversity, and there are numerous threatened species of plants distributed in the region, e.g. *Betula utilis*, *Juniperus* spp., *Arnebia euchroma*, *Allium* spp., *Saussurea* spp., etc. Like in other parts of the state the people in the cold deserts too are directly engaged in animal husbandry, agriculture and horticulture. The cattle and sheep population is almost three times the humans, coupled with hordes of additional sheep and goats of the nomadic graziers coming to the alpine regions each summer. Moreover, the wild populations of wild sheep and goats have increased over the years due to complete ban on hunting. Protected areas that overlap the region are Pin Valley National Park, Rupri Bhabha Wildlife Sanctuary and Kibber Wildlife Sanctuary. Therefore, there seems to be a great pressure on the alpine pastures of the cold deserts. Indiscriminate use of the grazing areas has therefore resulted in critically low biomass availability along with the emergence of weeds that have threatened the native species. Pastures Meadow steppe and scrub ecosystems are the special habitats for some rare medicinal flora in the region. Due to overgrazing, vegetation degradation occurs in many areas of this region.

Distinct plant assemblages can be identified in the moist alpine vegetation that is strongly aggregated by altitudinal variations suggesting the presence of distinct zones of the alpine flora. Elevation and specific locations are the dominant environmental gradients underlying the species composition in these specific habitats. Hence, the alpine pasture habitat in the cold deserts is not only a group of grasses but is an ecosystem in itself. Here, the survival of this habitat is directly related to the survival of native flora, fauna and the inhabitants of the region. All the three components therefore, interact with each other and maintain the dynamic equilibrium within an ecosystem. Some of the strategies for long term conservation of threatened taxa in the region include enhanced monitoring of the effects of exploitation for species, particularly for the species under trade.

Conservation in such areas can not be achieved without the involvement of local communities, who are directly dependent on these resources for their livelihood. Their involvement in management would certainly help in conservation. These communities could be encouraged to set aside some habitats for *in situ* conservation of high value medicinal plants. Efforts are needed to establish cold desert conservatorium / medicinal plant gardens, MPCA's in the region. There is a need to focus on the development of packages for cultivation of economically important medicinal plants with modern techniques including tissue culture and genetic engineering.

References :

- Anonymous. 1986. *The useful plants of India*. Council of Scientific and Industrial Research, New Delhi.
- Arkadiusz, N. & Sylwia, N. 2006. Anthropogenic habitats can shelter threatened plants. pp. 107-115. *In*: Dan Gafta & John Akeroyd (eds.) *Nature Conservation: Concepts and Practice*. Springer Berlin Heidelberg.
- Aswal, B.S & B.N. Mehrotra. 1994. *Flora of Lahaul-Spiti: A Cold Desert in North West Himalaya*. Bishen Singh Mahendra Pal Singh, Dehra Dun.
- George, W. 1972. *A Dictionary of the Economic Products of India*, Vol. V, Cosmo Publications, Delhi.
- IUCN. 1993. *Draft IUCN Red List Categories*. IUCN, Gland, Switzerland.



- Kapoor, K.S. & Vaneet Jishtu. 2008. Flora of Miyar Valley-Lesser known Lahaul. *Himachal Forest Research Institute Booklet* No. **029**.
- Koelz, W.N. 1979. Notes on the ethnobotany of Lahaul, a province of the Punjab. *Quatr. J. Crude Drug Res.* **17**: 1-56.
- Polunin, O. & A. Stainton. 1984. *Flowers of the Himalayas*. Oxford University Press, New Delhi.
- Rawat, G.S. & Y.P.S. Pangtey. 1987. A contribution to the ethnobotany of Alpine regions of Kumaon. *J. Econ. Tax. Bot.* **11**: 139-148.
- Rawat, Y.S., Santaram, S. Oinam, Subhash, V., C. R., P.C. Kuniyal & J.C. Kuniyal. 2006. Willow (*Salix fragilis* L.): A Multipurpose Tree Species under Pest Attack in the Cold Desert of Lahaul Valley, Northwestern Himalaya, India. *AMBIO* **35** (1): 43-48.
- Rodgers, W.A. & H.S. Panwar. 1988. *Planning a Wildlife Protected Area Network in India*. Vols. I & II. Wildlife Institute of India, Dehradun.
- Sood, S.K., Ram Nath & D.C. Kalia. 2001. *Ethnobotany of Cold Desert Tribes of Lahaul-Spiti (N.W. Himalayas)*. Deep Publications, New Delhi.
- Supriya, K. B. 1994. *Handbook of Medicinal Plants*. Vol. III, Pointer Publishers, Jaipur. pp. 1689-1699.