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## Treasure and Tragedy of the Kashmir Himalaya

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**Abstract:** Biological interventions and sequential eco-edaphic changes have depleted the habitats of essential and commercially valuable medicinal plants, hence paved the way to invasive alien species, thereby infuriating the bio-resource diminution and deprivation. The present communication is an attempt to draw attention to the importance of some threatened medicinal plants of Kashmir Himalaya and the various threats they are forced upon. In total 12 species belonging to 11 families have been surveyed, assessed and analyzed for their importance and threat status. The study revealed that the already restricted populations of these threatened species are squeezed further by various natural and anthropogenic factors, above and beyond being subjected to over-exploitation. All these causative factors if not addressed without more ado, the day is not far away when this precious legacy will be lost for ever. It is indeed a grave situation for these species which calls for the recoup whatever is left. There is a buzz for the execution of global slogan and it is the need of hour to conserve these gems in today's world of bioprospecting.

**Key words:** Medicinal plants, importance, threat, exploitation, survey, Kashmir Himalaya

### INTRODUCTION

The Valley of Kashmir is acknowledged for its impenetrable, miscellaneous forests and forest products all over the world. The potential saleable and ethnic use of some of these alpine and sub-alpine herbs in medicine through folklore as well in the documented form of Rag-Veda, Ayur Veda dates back to 3000-1000 BC and was in all probability the only means of curing and/or protecting the evolving human populations from the diseases. The therapeutic properties of these herbs is reflected from the view that most of these possess the bioactive principles, anti-cancer as well as anti-ageing (*anti-oxidant*) properties apart from antipyretic, asthmatic, diuretic and other properties (Kaul, 1997). North west Himalaya is gifted with a rich treasure of remedial and other imperative herbs (Dhar and Kachroo, 1983; Kaul, 1997; Nawchoo and Bhat, 1989). Owing to the above mentioned properties these herbs are being explored, exploited and smuggled out of their extraction of active components to be used in many life saving drugs natural habitats for (Rai *et al.*, 2000). Such abiotic and biotic interferences modify their territory at an alarming rate which consequently alter the structural and functional attributes of an ecosystem (Wafai and Nawchoo, 2001) including the disturbances with phonological events such as initiation of flowering, the synchronization of flowering, the length of flowering, variation in flower abundance (Opler *et al.*, 1980; Borchert,

1983; Inouye and McGuire, 1991; Milton, 1992; Beaubien and Johnson, 1994; Dominguez and Dirzo, 1995; Inouye *et al.*, 2002) apart from shakiness in isoplethy. Additionally, forest degradation by human habitations, cultivation, construction of roads in the heart of forests, tourist resorts are largely accountable for habitat disturbances apart from ecological disturbances in these areas, accordingly transforming the physico-chemical environment, consequently provide openings for invasive species. Such a precarious signal according to Mooney and Darke (1989) in nutshell results in the conception of a new Biological order with favoured organisms i.e., with extensive ecological amplitude and adaptability, which are being found in mounting abundances all around the globe in such areas. Once the alpine and sub-alpines are invaded by these new-fangled plant species, the productive diversion of dense and diverse areas is over.

Unabated as the plant extraction and habitat degradation continues to exist, the day is not far away when we loose our precious legacy. It is indeed a decisive situation for these important and productive species which calls for the salvage of whatever is left. Consequently, it is the need of hour to congregate information about their various aspects, develop suitable prescription and panacea for these maladies particularly those which have been already ranked as critically endangered (CR) by various agencies like IUCN, UNEP, WWF, CAMP etc. and formulate solemn attempts to

conserve these gems. The current study analyzes threat status, distribution, habitat characteristics, life form, medicinal and ethno medicinal importance of some significant and endangered medicinal plant species of the Kashmir Himalaya.

## MATERIALS AND METHODS

The present endeavor is the result of extensive botanical exploration of outstandingly diverse and productive areas of northwest Himalaya-(Sonamarg, Amarnath, Phalgham, Kokernag, Gulmarg, Aharbal, Munwarsar and Verinag) during the blooming season (June-September) of 2004 and 2005. The sub alpine and alpine habitats of these ranges with varied eco-edaphic conditions were surveyed. Usually 4-5 specimens of each species were collected, from different localities, mostly flowering ones and the field data was recorded in field note book. The specimens were processed using the field press and brought to the Department of Botany for further processing and identification etc. For medicinal and ethno-botanical information the local tribals (*Gujjars* and *Bakarwals*) conversant with the use of these plants were consulted. They were shown the live specimens of different species and asked for the usage and method of usage of these plants and their commercial potentials. The ambiguity, if any was cleared by repeating the same process with elderly and experienced persons of the concerned areas. Each species has been presented with an author citation, family name, english and vernacular

name, threat status, part used, ethno medicinal use and usage methodology and chemical constituents (wherever known).

**Observation:** Ours attempt reveal that many important and valuable medicinal herbs which once used to dwell extensive distribution range have now been constrained to limited, fragmented, inaccessible and isolated pockets of the Kashmir Himalaya, due to multiple factors including the reduction in the total forest area. This precious wealth we possessed is now being ruined at an alarming rate as a result of extraction, over-exploitation and smuggling for the commercial purposes, besides habitat modification. Some precious medicinal plants dealt in the present study are rare (Table 1; IUCN/UNEP/WWF, 1980; IUCN, 2000; Anonymous, 1998) but they are still in a state where they if managed can serve the humankind irreplaceably.

## Medicinal and ethno botanical usage of selected plants

*Aconitum heterophyllum* Wallish ex Royle

**Family:** Ranunculaceae; English name: *Indian Atis*; Vernacular name: *Patis, Patris*; Commercial: *Atish*; Part used: Tuber; Life form: perennial herb; Habitat: moist but well drained soils.

**Distribution:** Distributed in Northwest Himalaya at altitudes ranging from 2000-3350 m. It is also cultivated in Himachal Pradesh, Uttranchal and Jammu and Kashmir.

Table 1: Distribution of selected medicinal plants in surveyed areas and their threat status

Species name	Gulmarg	Kokernag	Ganesh top	Pasi	Brari-marg	Rayil	Thajwas	Shesh-nag	Lidarwat	Status
Altitude (m)	2300-3700	Ducksum 2700-3500 m	3850-4200 m	3000-3150 m	3240-3450 m	3000-3350 m	3050-3500 m	3000-3550 m	2500-3140 m	
<i>Aconitum chasmanthum</i>	+	-	+	-	-	+	-	-	-	CR
<i>A. heterophyllum</i>	+	+	-	+	+	+	+	-	-	CR
<i>Aquilegia navalis</i>	+	+	-	-	-	-	+	-	+	CR
<i>Atropa acuminata</i>	+	+	-	-	-	-	-	-	-	CR
<i>Arnebia benthamii</i>	-	+	-	-	-	+	+	-	-	CR
<i>Arnebia euchroma</i>	-	-	-	+	+	-	+	-	-	EN
<i>Bergenia ligulata</i>	+	+	-	+	-	+	+	-	+	VU
<i>Gentiana moorcotiana</i>	+	+	-	+	+	-	+	+	-	NE
<i>Inularacemosa</i>	+	+	-	+	+	-	+	-	+	CR
<i>Mecanopsis aculeata</i>	+	+	-	-	-	-	+	-	-	EN
<i>Picrorhiza kurrooa</i>	+	-	-	-	-	-	+	-	-	EN
<i>Polygonum alpinum</i>	+	+	-	-	+	+	+	-	+	CR
<i>Podophyllum hexandrum</i>	+	+	-	-	+	+	-	-	+	CR
<i>Rheum emodi</i>	+	+	-	+	+	+	+	-	+	EN
<i>Rhododendron campanulatum</i>	+	+	-	+	+	+	+	-	+	EN
<i>Saussurea costus</i>	+	+	-	-	+	+	+	-	+	CR
<i>Saussurea saccara</i>	-	-	-	-	-	-	-	-	-	CR
<i>Verbascum thapsus</i>	+	+	-	+	+	+	+	-	+	NE
<i>Viola odorata</i>	+	+	-	+	-	-	+	-	+	NE

+: Present, -: Absent, CR = Critically endangered, EN = Endangered, VU = Vulnerable, NE = Not Evaluated

**Medicinal use:** Oldest aconitine drug in India; roots are used as an astringent, a valuable febrifuge, a bitter tonic especially given after chronic malaria and fevers. It is reported to be used against diarrhea, dysentery and chronic enteritis (Anonymous, 1948; Kaul, 1997). Powdered root mixed with honey is effective for children suffering from cough, cholera, and fever and vomiting (Chatterjee and Prakash, 1991; Singh *et al.*, 1983; Kapoor, 2000).

**Ethno medicinal use:** A common crude drug of highlanders in the Himalaya. The tribal's of Himalaya harvest mature roots at the end of growing season and store them for different uses. It is mainly used for treatment of gastric disorders and high fevers. The root powder is put in tooth cavities against toothaches (Nawchoo and Bhut, 1989).

**Chemical constituents:** Atisine (0.4%) in roots (Lawson Topps, 1937-c.f. Anonymous, 1948), crystalline alkaloids; heteratisin ( $C_{22}H_{33}O_5N$ ) and hetisin ( $C_{20}H_{27}O_3N$ ) (Jalob and Craig, 1937-c.f. Anonymous, 1948).

*Adiantum apillus-veneris* Linn.

**Family:** Adiantaceae; English: *Maiden-hair fern*; Vernacular name: *Hansraj* (Hindi); *Geutheer* (Kashmiri); Part used: Whole plant; Life form: perennial herb; Habitat: Moist shady places

**Distribution:** North and South India.

**Medicinal use:** Whole plant is used as demulcent, expectorant, diuretic, febrifuge and also used as a hair tonic (Singh and *et al.*, 1983). The fronds are powdered and given with honey against bad cold (Kaul, 1997).

**Ethno botanical uses:** The tribal people of high altitude use it for treatment of chest diseases and sometimes recommend it for over coming hair loss.

**Chemical constituents:** 3, 4-epoxyfilicane, 21-hydroxyadiantone, adiantone, astragaline, isoquercitrin, kaempferol, methyl cinnamate, cincole, camphor and propanol d-pinene (Kapoor, 2000).

*Arisaema jacquemontii* Blume

**Family:** Araceae; English name: *Cobra plant*, *Snake lily*, *Green dragon*; Vernacular name: *Surp*; Part used: Tubers; Life form: Perennial herb; Habitat: Moderately moist and shady places.

**Distribution:** Northwest Himalaya.

**Medicinal uses:** At present it is recommended for the treatment of skin infections caused due to cold temperatures

**Ethno botanical uses:** Local tribals- *Gujjar* and *Backarwals* have labeled it as poisonous plant. The tubers are collected and chopped; the pout ice formed is used on chronic boils as a remedy. The water extract of the bulbs is used to get rid of skin eruptions (Kachroo *et al.*, 1977).

*Arnebia benthamii* (Wall. ex G. Don) I.M. Johnston.

**Family:** Boraginaceae; English name: *Pan*; Vernacular name: *Kahzaban*, *Gaozaban*; Part used: Whole plant; Part used: Whole plant Life form: Perennial herb; Habitat: moderately-dry, open shady places.

**Distribution:** Northwest Himalaya

**Medicinal uses:** A traditional medicinal herb of Ayurvedic and Unani system of medicine. Plant is mainly used for the treatment of cardiac disorders; the sherbat and jam from flowering shoots are used in the treatment of tongue and throat diseases (Singh and Kachroo, 1976). In Unani system it is one of the ingredients of most of the composite medicines, used for the treatment of high fevers. The flowers are particularly reported to have soothing effect on patients with heart ailments. Gule Kahzaban is a very costly medicine (Morton, 1977; Kaul, 1997). It is supposed to possess anti-oxidant activity (Ganai, 2005).

**Ethno medicinal uses:** The tribals in the Himalayas collect huge quantity of herb especially the inflorescences dry and boil it to prepare a special type of tea without milk, locally known as Khawa to cure the chest infections especially in children.

*Atropa acuminata* Royle ex Lindley

**Family:** Solanaceae; Vernacular names: *Suchi* (Sanskrit); *Sag-Angur* (Hindi); *Yubrug* (Bengali); *Tolkivacha* (German); *Luffah*, *Yabriyssanum* (Unani); *Luffah* (Persian); English: *Indian belladonna*. Part used: Roots and Leaves. Life form: Perennial herb; Habitat: in moderately-moist, shady habitats.

**Distribution:** Northwest Himalaya.

**Medicinal uses:** The plant has the same medicinal

properties as the European *Atropa belladonna*. The roots and leaves are used as a sedative, antispasmodic, narcotic and mydriatic (Kaul, 1997); they are valuable antidotes in opium and muscarine poisoning. The dried leaves are smoked as an antispasmodic. The extract prepared from the leaves causes the pupil of the eyes to dilate and is used in ophthalmic surgery. The root is generally used externally; it is used as an anodyne for rheumatism, lumbago and local inflammations (Anonymous, 1948).

**Chemical constituents:** It contains alkaloids hyoscyamine and atropine (Kapoor, 2000).

*Bergina ligulata* (Wall.) Engl.

**Family:** Saxifragaceae; Vernicular name: Zakhmi-hayat, Palpout; Part used: Root; Life form: Perennial herb; Habitat: Moist, shady habitats, especially on or around rock.

**Distribution:** North West Himalaya

**Medicinal uses:** Roots powder either in dried form or as paste is used for the treatment of fevers, diarrhea and cough. Root paste is externally used as an anti-septic on ruptured wounds (Vishvanath and Mankad, 1984; Sivarajan and Balachandran, 1994)

**Ethno botanical uses:** The root powder after being thinly dissolved in water is consumed in large quantities to dissolve the stones of kidney.. Root paste is used to cure cuts and wounds. Tea prepared from roots is taken as cardiac tonic (Kaul, 1997).

**Chemical constituents:** Bergenin and beta-sistosterol (Kapoor, 2000).

*Inula racemosa* Hook f.

**Family:** Asteraceae; English : Manu; Vernicular name: Poshkar, Mannepatter; Part used : Roots and foliage; Life form: Perennial herb; Habitat: moderately dry, shady rocky slopes.

**Distribution:** Afghanistan to C. Nepal

**Medicinal use:** Antihelmenthic, antiseptic, expectorant and diuretic (Kaul, 1997).

**Ethno medicinal use:** The roots are collected for usage as an aromatic source. The dry roots are as insect and pest

repellants. Medicinally the powdered roots and dried foliage is used as an anti-spasmodic, hypotensive and for treatment of cardiovascular and liver troubles. It is used for treatment of respiratory tract disorders, foul ulcers, and chronic bronchitis and as an antiseptic.

**Chemical constituents:** The root oil contains alantolactone which is used as anathematic and antiseptic. Roots contain inulin (10.1%) and roylene (3%). It decreases the blood pressure and stimulates peristaltic movements of intestine (Kapoor, 2000).

*Picrorhiza kurrooa* Royle ex Benth

**Family:** Scrophulariaceae; Vernicular name: Kaud, Katki, Kuru, Hanglang (Ladakhi); Part used: Rhizomes; Life form: Perennial herb; Habitat: open, moist rocky slopes.

**Distribution:** Pakistan to Uttar Pradesh (India).

**Medicinal uses:** The rhizomes and roots are used for the treatment of bilious dyspepsia, as stomachic, as laxative. It has also been reported to be an important liver protectant and immuno-stimulant. It has also been used as an dysenteric and also in treatment of asthmatic disorders. The excessive consumption of the drug is reported to increases gastric secretion thus diminishes the force of heart beat (Kaul *et al.*, 1989; Kaul, 1997).

**Chemical constituents:** The active principle from the rhizomes has been identified as picroside I and picroside II, kutkoside-a new glycoside. Picrorhizin is also reported to be its bitter principle as glucosidovanilloyl glucose (Kapoor, 2000).

*Polygonum alpinum* All.

**Family:** Polygonanceae; Vernicular name: Chuka ladur, Mehemekey Chitahola; Part used: Roots/foliage; Life form: Perennial herb; Habitat: moist, open places among grasses.

**Distribution:** North West Himalaya.

**Medicinal use:** The roots of the plant are used in homeopathy for treatment of dysentery. The dried roots collected in the month of October is reported to be a potent home remedy against all joint pains especially back ache. Rice prepared in water extract of roots of this plant is fed to patients for one month to control dysentery in calves and fawns (Kaul, 1997).

**Ethno medicinal use:** The stems are acidic in taste and relished as a vegetable in Kashmir Himalaya.

**Chemical constituents:** Root stock contains 16-2% tannin, 14-80% soluble non-tannins and 5% sugars. Tannins are derivatives of leucoanthocyanidins and gallic acid. The flavinoids are hyperocytide, rutin, avicularin and quercetin (Anonymouse, 1998).

*Rheum emodi* Wall. ex Meissner

**Distribution:** Himalaya, Kashmir to Skim.

**Family:** Polygonaceae; English: Indian Rhubarb, Himalayan Rhubarb; Vernicular name: Pumbachalan, Rhubarb; Part used: rhizomes, flowers and leaves; Life form: Perennial herb; Habitat: moderately moist, less shady places in or among rocks.

**Medicinal uses:** Rhizomes and roots are source of the drug which is used as laxative, tonic and purgative. It is also reported to an astringent but not used under chronic constipation, useful in dyspepsia. Its usage is prohibited for patients suffering from gout, rheumatism, epilepsy and uric acid troubles. The root powder is sprinkled on ulcers and wounds for quick healing (Chatterjee and Pakrash, 1991; Kaul, 1997).

**Ethno medicinal use:** Leaf stalks, leaves and flowers are consumed as vegetables after cooking. The root is used with madder and potash for dying fabrics red.

**Chemical constituents:** Roots contain rhein, emodin, rhizomes yield 0.05% essential oils, containing eugenol, leaves contain 1.34% oxalic acid. Indian rhubarb contains emodin and chrysophanic acid, Samples from Kashmir are reported to contain (35.28%) Nepal (30.57%) and from Punjab (39.97%) apart from a glycoside rhapoticin, gallic acid, sugar starch, pectin, lignin, calcium oxalate and various other inorganic salts (Kapoor, 2000).

*Saussurea costus* (Falc.) Lipsch.

**Family:** Asteraceae; English: costus; Vernicular name: Kuth; Part used: Rhizome; Life form: Perennial herb; Habitat: moderately-moist, open or shady slopes.

**Distribution:** Pakistan to Himachal Pradesh.

**Medicinal uses:** Root is medicinally used as tonic, carminative, stimulant and in controlling bronchial

asthma. Their use as an insect repellent and in treatment of cardiac complaints has made its commercial usage dominant. It is also used in the treatment of cough and asthma, smoked as substitute for Opium. The alcoholic extract is useful in treatment of bronchial asthma particularly of vagotonic type. In Kashmir the root oil is used to cure joint pains through external massage (Morton, 1977; Kaul, 1997; Chatterjee and Pakrash, 1991).

**Ethno medicinal use:** Root-used as incense, and to protect valuable garments from insect damage roots are reported to have considerable activity against pathogenic fungi. Dried stems used as fodder in Lahaul, Himachal Pradesh.

*Viola odorata* Linn.

**Family:** Violaceae; English name: Sweet violet; Vernicular name: Banafsha (Kashmiri); Part used: leaf and flowers; Life form: Perennial herb; Habitat: moist, shady or open loose soiled places.

**Distribution:** In the low ranges of North West Himalaya.

**Medicinal uses:** The flowers are used as demulcent and in biliousness and lung troubles. Its usage in Ayurvedic and Unani system is as: rhizomes are internally used as an infusion or as a component of herbal tea for relieving cough and bronchitis; as diuretic, emetic and externally used for the treatment of gargles. The dried petals made into syrup are used as a remedy for infantile disorders and is considered to be good for throat. The fresh flowering herb is used in homeopathy in the treatment of diseases of skin, eye and ear. It is also used as blood purifier (Singh and Johri, 1983; Chatterjee and Pakrash, 1991; Kaul, 1997).

**Ethno medicinal use:** Both above and below ground parts of the plant are given to the pregnant women's almost immediately after giving birth to the child-boiled with water what is locally known as sharbat in order to stop the flow of blood as well as stimulating the defense mechanism of the body, preventing the latter from other infections. The sharbat is also given to the other persons of any age against the chest and throat infections.

**Chemical constituents:** flowers and rhizomes contain an alkaloid violine, a glycoside violequerreitin which is identical to rutin and a saponin. Roots, leaves and blossoms contain methyl-salicylate in the form of glucoside (Kapoor, 2000).

## CONCLUSIONS

In 1950's, Jammu and Kashmir was having 66% of its total area under forest cover, while at present we are left with only 50.97%. World famous Kashmir Himalaya is known to be the rich repository of medicinal and aromatic plants apart from providing refuge to vast genetic diversity. However, this precious legacy is near the threat of extinction due to multiple factors including the reduction in the total forest area, habitat fragmentation, illicit trade, over exploitation, indiscriminate and unplanned collection for various research purposes. The study reveals that there is an urgent need for extensive survey, analysis and documentation of the natural plant resources. The studies also reveal that, the rapid changes in eco-edaphic conditions are declining the wealth of Country at an alarming rate. The main cause of threat or extinction of taxa is the habitat destruction and biotic exploitation. The over-utilization of medicinal and related plants, ultimately will lead to the alteration of the habitat in such areas due to the changes in eco-edaphic conditions over-exploitation of bioresources for medicinal purposes and collection by unauthorized hands and traders, the existence of some common wild medicinal plants of such area has been threatened. Therefore in view of the continuous extraction of medicinal herbs from the forest in this region, their conservation and systematic cultivation is essential (Farnsworth and Soejarto, 1991). The present study has revealed that the means of development of conservation of such common folk species is essential because most of these are being over-exploited for local use and might become rare in due course of time.

In addition to the above mentioned valuable medicinal herbs, many other species like, *Aconitum chasmanthum*, *Geranium* spp., *Saussurea saccara*, *Podophyllum hexandrum* and many more are used in traditional medicinal systems. Among these many folk drugs are commercially exploited by drug dealers indiscriminately and this exploitation resulted in rapid depletion of the medicinal plants and is also creating troubles to the tribal people who are dependent upon these natural resources for survival to earn their livelihood. In addition to this visitors are also by and large adding fuel to the already burning candle.

The study reveals that there is an urgent need for extensive survey, analysis and documentation of the natural plant resources of the Kashmir Himalaya. The studies also reveal that, the rapid changes in eco-edaphic conditions are declining the wealth of Country at an alarming rate. The main cause of threat or extinction of

taxa is the habitat destruction and biotic exploitation. The over-utilization of medicinal and related plants, ultimately will lead to the alteration of the habitat in such areas due to the changes in eco-edaphic conditions over-exploitation of bioresources for medicinal purposes and collection by unauthorized hands and traders, the existence of some common wild medicinal plants of such area has been threatened. Therefore in view of the continuous extraction of medicinal herbs from the forest in this region, their conservation and systematic cultivation is essential (Farnsworth and Soejarto, 1991). The present study has revealed that the means of development of conservation of such common folk species is essential because most of these are being over-exploited for local use and might become rare in due course of time.

The experience gained while surveying these areas and the information gathered from experienced and tribal people, the following suggestions if followed would help to revegate the area as whole and individual plant species in particular.

The Forest Department should take some positive steps to conserve these medicinal plants; the entry into such areas should be restricted and prohibited.

The people which are living in the vicinity of these natural plant reserves should domesticate and cultivate these medicinal plants.

There should be recognized agencies consisting of trained personals for supply of raw materials and scientific collection.

There should be recognized panel for survey to these natural habitats of medicinal plants for their maintenance.

The waste lands under the vicinity of such areas should be converted for cultivation of such species.

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