

# **THREATENED MEDICINAL PLANT BIODIVERSITY OF WESTERN HIMALAYA AND ITS CONSERVATION**

**H. K. Pandey, Deendayal and S.C. Das**

Ministry of Defence

Defence Research & Development Organization

Defence Agricultural Research Laboratory

Pithoragarh, Uttaranchal-262 501

## **INTRODUCTION**

Since time immemorial Himalaya is famous for its rich medicinal and aromatic plant biodiversity. The varying soil, topography and occurrence of different climatic and micro-climatic zones of the region provide very congenial conditions to grow a number of therapeutically important medicinal plant species. Nowadays due to increasing awareness towards herbal products there is tremendous pressure on Himalayan medicinal plants. In this region no serious attempts are made for commercial scale cultivation of these important plants, especially medicinal and aromatic plants of high altitude areas. The unscientific, over and irregular exploitation of medicinal plants from its natural habitat has resulted in very fast depletion as well as extinction of some important medicinal plant species. So development of agro-technology of highly demanded medicinal plants and their commercial scale cultivation are the need of the hour. The threat of extinction can be reduced by developing their agro-technology, adopting scientific methods of collection, *in-situ* and *ex-situ* conservation, etc.

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The total geographical area of Indian Himalaya is about 5,94,427 sq. km., which is about 18% of the total area of the country. Length of Indian Himalaya is about 2,400 km and width is around 240 – 320 km. The major geographic divisions of Himalaya are:

- (i) **Eastern Himalaya** (Assam, Darjeeling, Sikkim Himalaya)
- (ii) **Central Himalaya** (Nepal Himalaya)
- (iii) **Western Himalaya** (Kashmir, Himachal Pradesh, Kumaon-Garhwal Himalaya)

The total geographical area of Western Himalaya is about 3,29,032 sq. km<sup>1</sup>., lying in the west of Nepal. 67.5% of this total area lies in Kashmir and about 17% area lies in Himachal Pradesh, while hilly districts of Uttaranchal state, i.e., Kumaon and Garhwal region cover a total area of approximately 51,125 sq. km. According to climatic zones of Western Himalaya, it can be further divided into the following classes (Table 1)

**Table 1: Climatic Zones of Himalaya**

S.No.	Climatic Zone	Altitude (in meters)
1.	Tropical	Up to 1,000
2.	Warm temperate	1,000 – 2,000
3.	Cold temperate	2,000 – 3,000
4.	Alpine temperate	3,000 – 4,000
5.	Glacial temperate	4,000 – 5,000

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Western Himalaya has a very rich heritage of medicinal and aromatic plants. About 2,500 plant species are being utilized in different Indian system of medicines; more than 1,750 herbal species are native of Indian Himalayan region, in which western Himalaya has a share of about 1,000 species which are still in use. The natural environment of this region has been affected to a great extent due to overgrazing, cultivation in slopes, sub marginal lands, ruination of forest change in weather pattern and unplanned developmental activities like construction of tourist resorts, roads, buildings, etc. Indiscriminate and over-exploitation have severely disturbed the ecological balance.

In Western Himalaya great efforts were made for compilation of flora of this region; some important compilations are **Forest Flora of Kumaon, Flora Nainitalensis, Herbaceous Flora of Dehradun, Flora of Mussoorie, Forest Flora of Chakrata, Dehradun and Saharanpur, Flora of Chamoli Vol., I & II**, etc. A large Number of research papers and articles are also published on the flora of this region. Above compilation work concludes that at least 5,942 genera and 17,381 taxa of plants are represented by Western Himalayan region<sup>2, 3</sup> (Table – 2). The dominant families and genera of this region<sup>3</sup> are cited in (Table 3).

**Table 2: Plant Biodiversity of Himalayas**

S. No.	Plant Group	Genera	Taxa
1.	Angiosperms	3,200	8,000
2.	Gymnosperms	7	44
3.	Pteridophytes	150	600
4.	Bryophytes	565	1,737
5.	Lichens	130	1,159

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6.	Fungi	1,890	6,900
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Source : Dhar (1996)

**Table 3: Major Families and Genera of Angiosperms in Western Himalaya**

S. No.	Dominant Family	No. of Taxa	Dominant Genera	No. of Taxa
1.	Compositae	540	<i>Astragalus</i>	90
2.	Poaceae	439	<i>Carex</i>	86
3.	Leguminosae	362	<i>Taraxacum</i>	80
4.	Orchidaceae	255	<i>Potentilla</i>	48
5.	Cyperaceae	205	<i>Berberis</i>	48
6.	Rosaceae	172	<i>Saussurea</i>	46
7.	Scrophulariaceae	150	<i>Artemisia</i>	40
8.	Brassicaceae	145	<i>Gentiana</i>	39
9.	Ranunculaceae	126	<i>Saxifraga</i>	39

Source : B.P. Nautiyal *et al.*, (2000)

**Factors responsible for the depletion of medicinal plant bio-diversity**

- Increasing Demand of herbal products, i.e., medicine as well as cosmetic has resulted very high demand of raw plant parts causing tremendous pressure on their natural habitat.

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- Shrinking of natural habitat of medicinal plants due to population pressure and other developmental activities.
- Indiscriminate and over exploitation from natural sources.
- Lack of agro-technology of highly demanded medicinal plants.
- No serious efforts for commercial scale cultivation.
- Forest fire plays a very devastating role in the destruction of small medicinal plants.
- Illegal trading of banned high value medicinal plants.
- Excessive grazing by domestic as well as wild animals.
- Cutting of medicinal trees for fuel, timber, etc., and lopping of leaves for fodder and cattle bedding.
- Change in climate and weather pattern.
- Lack of awareness towards this valuable heritage.

The flora of Western and Central Himalaya were also explored by Strachey and Winterbottom from 1846 to 1849, and they have identified an over all flora of these regions under 137 orders, 983 genera and 2,672 species of flowering plants and 101 genera, 371 species of cryptogams. In Flora Nainitalensis, Dr. R.K. Gupta has reported 457 genera and 869 species of herbs of Nainital district. E.T. Atkinson has reported more than 200 species of medicinal plants in his book Economic Botany of Himalayas.

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In 1975 an international level organization 'Conservation on International Trade in Endangered Species of Wild Fauna and Flora (CITES) was established, about 155 countries are its members. This organization checks the trade of endangered plants and animal species with the help of IUCN and SSC group. For the export of endangered flora and fauna a permit is needed from CITES. India became its 25th member after joining it in 18th October 1976.

In Red Data Book of IUCN 215 threatened taxa native to India are mentioned. About 121 plant species of Himalayan region have also been recorded in it. Similarly Red data book published by BSI identified that about 214 species of flowering plants are endangered in Himalayan region out of which 29 species have been listed under rare category and some of them are at the verge of extinction. On 1st April 1998 a ban was imposed on 29 plant species by Director General of Foreign Trade, Govt. of India, in this list 15 medicinal species, viz., *Aconitum sp.*, *Aquilaria malaccensis*, *Coptis teeta*, *Gentiana kurooa*, *Nardostachys grandiflora*, *Podophyllum hexandrum*, *Swertia chirayata*, *Panax pseudoginseng*, *Picrorhiza kurroa*, *Dactylorhiza hatagirea*, *Saussurea costus*, *Dioscorea deltoidea*, orchid sp., *Taxus wallichiana* and *Rauwolfia serpentina* of the Himalayan region were also included. Using Red Data book criteria of International Union of Conservation of Nature and Natural Resources (IUCN) the threatened medicinal plant species have also been categorized as vulnerable, critically rare and endangered<sup>4</sup>, under Biodiversity Conservation Prioritization Project (BCPP). Categorization of some threatened medicinal plants is being given in Table 4.

**Table 4: Categorization of Some Threatened Medicinal Plants Using IUCN Criteria**

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<b>Critically Rare</b>	<b>Endangered</b>	<b>Vulnerable</b>
<i>Aconitum balfourii</i>	<i>Berberis aristata</i>	<i>Bergenia ligulata</i>
<i>A. deinorrhizum</i>	<i>B. lycium</i>	<i>Clerodendrum colebrookeanum</i>
<i>A. falconeri</i>	<i>Bunium persicum</i>	<i>C. serratum</i>
<i>A. ferox</i>	<i>Gloriosa superba</i>	<i>Curculigo orchiodes</i>
<i>A. heterophyllum</i>	<i>Hedychium coronarium</i>	<i>Curcuma angustifolia</i>
<i>A. violaceum</i>	<i>Heracleum candicans</i>	<i>Gymnema sylvestre</i>
<i>Acorus calamus</i>	<i>Lavatera cashmiriana</i>	<i>Hedychium spicatum</i>
<i>Angelica glauca</i>	<i>Panax pseudoginseng</i>	<i>Paeonia emodi</i>
<i>Aquilaria malaccensis</i>	<i>Picrorhiza kurrooa</i>	<i>Rheum australe</i>
<i>Arnebia benthamii</i>	<i>Polygonatum verticillatum</i>	<i>Rhododendron anthopogon</i>
<i>Atropa belladonna</i>	<i>Rauwolfia serpentina</i>	<i>Rhus semialata</i>
<i>Berberis kashmiriana</i>	<i>Rheum nobile</i>	<i>Thalictrum foliolosum</i>
<i>Coptis teeta</i>	<i>Saussurea gossypiphora</i>	<i>Tylophora indica</i>
<i>Dactylorhiza hatagirea</i>	<i>S. obvallata</i>	<i>Urginia indica</i>
<i>Delphinium denudatum</i>	<i>S. simsoniana</i>	
<i>Dioscorea deltoidea</i>	<i>Swertia angustifolia</i>	
<i>Fritillaria roylei</i>		
<i>Gentiana kurrooa</i>		
<i>Inula racemosa</i>		
<i>Meconopsis aculeata</i>		
<i>Nardostachys grandiflora</i>		
<i>Nepenthes khasiana</i>		
<i>Podophyllum</i>		

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<b>Critically Rare</b>	<b>Endangered</b>	<b>Vulnerable</b>
<i>hexandrum</i>		
<i>Saussurea costus</i>		
<i>Swertia chirayita</i>		
<i>Taxus baccata</i> sub sp. <i>wallichiana</i>		
<i>Valeriana</i> <i>wallichii</i>		

As the awareness is increasing towards medicinal herbs, some progressive farmers are also taking interest in the cultivation of these highly demanded herbs in Pithoragarh district. The farmers of remote villages of Munshyari tehsil like Uttam Singh Sayana (Vill – Millam), Darban Singh (Vill – Lillam), Himalay Singh (Vill – Madkot), Prahlad Singh (Vill – Matwalvada), Durga Singh (Vill – Walla), Jashwant Singh, Ratan Singh (Vill – Nigalpani), etc., and 50 – 60 other farmers are also engaged in the cultivation of endangered medicinal herbs of high altitude like Kutiki, Jamboo, Gandhrayan, Atish, Salam punja, Salam mishri, Dolu, Kuth, Kala Jeera, etc. They have successfully proved that, cultivation of these highly demanded herbs could become a good source of income for the inhabitants of remote high altitude areas.

Apart from identified plants there are many other valuable plants which are still unidentified and unexplored, but they are traditionally being used by tribal people. Many of these are under endangered stage; hence there is a need of their proper identification, conservation and development of methods of commercial cultivation.



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In Western Himalayan region forest corporation is responsible for the collection of raw herbal drugs from their natural habitat. The collection of herbal plants has been done generally by unskilled and unqualified laborers. But due to lack of knowledge on their proper methods of collection, unscientific and irregular exploitation of these herbs from its natural resources, many important and highly demanded medicinal herbs are at the verge of extinction. In (Table – 5) some threatened medicinal plants<sup>6</sup> with their habitat and medicinal uses<sup>7,8</sup> are mentioned, most of these plants are highly demanded by herbal pharmaceutical. Therefore, there is an urgent need to develop cultivation practices, simultaneously large-scale cultivation to meet out growing demand of entrepreneurs.

Table 5 : Some Important Threatened Medicinal Plants of Western Himalaya

	Common Hindi name	Scientific Name	Habitat	Plant part used	Medicinal uses
1.	Manjistha	<i>Rubia cordifolia</i> Linn	Lower Himalayas	Whole plant	In Eye- Ear disorder, Leprosy, Stomach disorders, in Swelling
2.	Chirayata	<i>Swertia chirata</i> Buch. Ham.	-do-	-do-	In Stomach disorders
3.	Daruhaldi	<i>Berberis asiatica</i> DC.	-do-	Roots	In Fever, Jaundice, Dysentery
4.	Maida	<i>Polygonatum cirifolium</i>	-do-	-do-	In Blood disorders, Cough, Tuberculosis and as Spermaturia.
5.	Dioscoria	<i>Dioscorea deltoidea</i> Wall.	-do-	-do-	Fish poison, source Steroidal hormones.
6.	Lahasuniya	<i>Microstylis wallichii</i>	-do-	-do-	In Tuberculosis, Asthma, Tonic, in Asthwarga.
7.	Patthar long	<i>Didymocarpus pedicellata</i> R.Br.	-do-	Leaves	In Renal calculi, Perfumery value.
8.	Kalihari	<i>Gloriosa superba</i>	-do-	Roots	Purgative, Antihelmintic, in Leprosy, Snakebite.
9.	Pashan bedh	<i>Bergenia ligulata</i>	Lower/ Higher Himalayas	Rhizomes	In Fever, Stomach disorders, Pulmonary disorder and in Renal stones.
10.	Maha maida	<i>Polygonatum verticilatum</i>	-do-	Roots	In leucorrhoea, blood purifier, in Asthawarga.
11.	Kuth	<i>Saussurea lappa</i> C.B. Clarke	Higher Himalayas	Roots	In Cough, Ant asthmatic.
12.	Talish patra	<i>Taxus baccata</i> Linn.	-do-	Bark/ leaves	Anticancerous, Germicidal.
13.	Ban kakri	<i>Podophyllum hexandrum</i> Royle.	Higher Himalayas	Roots	Anticancerous, Hepatic stimulant





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	Common Hindi name	Scientific Name	Habitat	Plant part used	Medicinal uses
14.	Kutiki	<i>Picrorhiza kurroa</i>	-do-	-do-	In Jaundice, Fever, Stomach- disorders
15.	Atish	<i>Aconitum heterophyllum</i> Wall.	-do-	Tubers	In cough, Aphrodisiac, ant- periodic
16.	Salam Punja	<i>Orchis latifolia</i> Linn.	-do-	Roots	Ant diabetic, Tonic, wound healer
17.	Salam Mishri	<i>Orchis laxiflora</i> Lam.	-do-	-do-	Spermaturia, Blood purifier, for enhancement of sexual power
18.	Salam	<i>Ephedra gerardiana</i> Wall.	-do-	Whole plant	Tonic, Appetizer, in Headache
19.	Dolu	<i>Rheum emodi</i> Wall.	-do-	Roots	For Healing internal wounds, in Sprain and Fractures.
20.	Jatamansi	<i>Nardostachys jatamansi</i> D.C.	-do-	Whole plant	In Nervous disorders, Heart tonic in Piles.
21.	Gandhrayan	<i>Achillea glauca</i>	-do-	Roots	Appetizer, Gastric troubles and Stomach-disorders.
22.	Meetha/Banwa	<i>Aconitum balfourii</i> Stapd.	-do-	Tubers	In Leprosy, Arthritic pains
23.	Guggal dhoop	<i>Jurinea macrocephala</i> Benth.	-do-	Whole plant	In stomachache, Boils, Perfumery value.
24.	Jamboo	<i>Allium strachey</i>	-do-	<b>Leaves</b>	Carminative, Gastric- disorders, as Condiments.
25.	Kanda	<i>Meconopsis aculeata</i> Royle.	-do-	Roots	Narcotic properties

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## CONSERVATION MEASURES

-  A thorough survey on threatened medicinal plants should be carried out and detailed information about their natural habitat, climate, soil, adaptability, growing season, flowering time, seed setting stage, etc., should be generated. Accordingly conservation measures should be developed.
-  Standard methods of cultivation, i.e., agro-technology should be developed for endangered and highly demanded medicinal herbs. Farmers should be motivated for commercial scale cultivation of these plants to meet out growing demand of herbal pharmaceuticals.
-  Ban on endangered medicinal plants should be strictly materialized by district administrations, since due to improper attention of administration one can easily see banned medicinal plants in the market. After a gap of few years, when these plant species will multiply in sufficient quantity in their natural habitat, permission of scientific collection should be allowed one by one in each district of Western Himalaya.
-  Training should be provided regularly to the persons engaged in the collection of crude herbal plants from natural resources. They should be trained for proper and scientific methods of collection, right time of collection of medicinally important plant parts without damaging whole plant. For the collection of different plant parts the following should be taken into consideration:

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- (i) Seeds : Should be collected after attaining full maturity,
- (ii) Leaves : After flowering stage,
- (iii) Stems : After leaf fall or fruiting stage,
- (iv) Flowers : During full flowering stage,
- (v) Fruits : After full ripening,
- (vi) Bark : After raining season,
- (vii) Roots : After attaining full growth.



Collection of medicinal plants should be carried out scientifically, for example, if in a particular place there are 50 plants of desired species, collection should be made from 35 to 40 plants only, the rest should be kept intact for their further natural multiplication, otherwise, the species will disappear from that particular area. Often irregular and unscientific exploitation by illiterate and unskilled persons is the major cause of depletion of these valuable herbal heritage.







Collection of folklore information on medicinal plants from tribal and elderly people and its proper documentation are very important, otherwise this valuable information will vanish with them and coming generation will be deprived of it. This information may be beneficial for future research.



Endemic species of different phyto-geographical zones should be preserved in their natural environment as biosphere reserve.

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-  Hot spots of medicinal species should be protected from fire and other hazards.
-  Necessary research work should be carried out for optimum extraction of active ingredients from economically important and valuable herbal species.
-  In Western Himalayan region a research institute working on medicinal plants should be established, it should be engaged in the development of cultivation techniques on endangered and highly demanded medicinal plants through germplasm collection, tissue culture, breeding, diseases and pest control, etc.
-  By using different advertising medias people should be motivated to take immense pride in their natural heritage and actively participate in medicinal plants conservation programme.

### **REFERENCES**

1. Joshi, S.C. 1987. Western Himalaya, Vol. I, Gyanodaya Prakashan, Nainital, U.A., pp. 1 – 2.
2. Dhar, U. 1996. Changing Perspectives of Biodiversity Status in the Himalaya British Council Division, British High Commission, New Delhi.
3. Nautiyal, B.P., Pandey, N. and Bhatt A.B. 2000. Shikhar : *Salutations to the Himalaya* (eds. C.M. Agrawal) Indian publishers' Distributors, Delhi, pp. 229 – 244.

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4. Samant, S.S., Dhar, U., Palni L.M.S. 1998. *Medicinal Plants of Indian Himalaya*, Gyanodaya Prakashan, Nainital, pp.18 – 20.
5. Shah, U.C. 1988. Uttarakhand, Uttarakhand Sodh Sansthan, Almora, **2** : 82-92.
6. Pant, A.K. 1994. Aaj Ka Pahad., PAHAL, Pithoragarh, pp. 1, 11 – 14.
7. Chopra, R.N., Nayar S.L. and Chopra. I.C. 1996. *Glossary of Indian Medicinal Plants NISCOM*, New Delhi. pp. 36, 125, 215, 222, 237.
8. Asolkar, L.V., Kakkar, K.K. and Chakre O.J. 1992. Second Supplement to *Glossary of Indian Medicinal Plants With Active Principle PID*, CSIR, New Delhi, pp. 17, 270, 275, 294.