

HERBAL BIODIVERSITY AND BIORESOURCES OF HIMACHAL PRADESH

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Biodiversity forms the basis for a healthy environment and source of economic and food security for future generations. Every organism and its variation are unique and have its own role to play in a particular ecological niche. At least 40% of the world's economy and 80% of the need of the poor are dependent upon biological material. Traditional systems of medicine, which serve as a cure for about 75 to 80% of the world's population, are based upon herbal biodiversity and natural products.

Himachal Pradesh is one of the largest states of the Indian Himalayan region. It is located between 28⁰ to 33⁰ N and 75⁰ to 79⁰ E. The state encompasses extraordinary vegetation communities and floral assemblages, which could be attributed to wide altitudinal gradient coupled with local variations, such as heavy rainfall in the southern parts of the state and arid conditions in northern part of the state.

Out of the total 55,576.3 sq km area of the state approximately 14,353 sq km is under forest cover, which amounts to about 25% of the total area. It is higher than the average estimates for the country (20.64%). However, when compared to Himalayan states the forest cover in Himachal Pradesh is very low. In the north-east, as high as 87% forest cover has been reported, even the adjoining state of Uttaranchal has more than 45% forest cover.

Of the 12 district of HP, maximum forest cover is reported from Sirmaur (48%) and lowest from Lahaul and Spiti (1.3%). The state contributes 2.12% to the total forest cover of the country (FSI, 2003). The distribution of these forests has recently been mapped using remote sensing and GIS (Chandrasekhar *et al.*, 2003). A total of 20 different vegetation types have been identified in the state (Table 1).

Based on the available information, the flora of HP consists of about 180 families comprising about 1038 genera and about 3400 species (Chowdhery and Wadhwa, 1984, Chowdhery, 1999). Asteraceae with more than 328 species is the largest family followed by Poaceae and Fabaceae. *Carex* is the most dominant genera (48 species) followed by *Polygonum* (37 species) and *Poa* (33 species). These rich forests and diversity of bioresources available in the state support the livelihood of the inhabitants.

Table 1. Vegetation communities, their area and diversity

Land use types	Area	Per cent of total	Diversity H'
Alpine meadow	5346.21	9.60	5.41
Alpine scrub	2086.92	3.80	6.55
<i>Betula/Rhododendron</i>	455.09	0.80	4.34
Chilgoza	76.98	0.10	0.40
Chir pine	2005.52	3.60	5.35
Blue pine	2193.60	3.90	4.02
Deodar	2153.35	3.90	7.64
Dry deciduous	26.78	0.10	7.13
<i>Ephedra</i>	81.97	0.20	0.80
<i>Hippophae</i>	258.43	0.50	1.72
Juniper	208.41	0.40	0.73
Mixed conifer	3226.72	5.80	8.15
Moist deciduous	1573.62	2.80	6.84
Oak	879.38	1.60	5.78
Riverine	24.66	0.04	2.17
Sal	306.97	0.55	2.07
Scrub	2152.55	3.87	1.56
Temperate broadleaved	408.83	0.73	7.52
Temperate grassland	2154.36	3.87	4.32
Temperate scrub	321.64	0.58	7.25
Non forest	29731.40	53.36	NA
Total	55673.39	100.00	NA

Source: Chandrasekhar *et al.*, 2003

Table 2. Quantity of some herbs extracted from Himachal during 1995-2000

Species	Quantity (t)
<i>Aconitum heterophyllum</i>	43.6
<i>Angelica glauca</i>	73.3
<i>Berberis</i> spp.	797.1
<i>Betula utilis</i>	56.2
<i>Centella asiatica</i>	170.8
<i>Ephedra gerardiana</i>	74.7
<i>Picrorhiza kurrooa</i>	108.3
<i>Podophyllum hexandrum</i>	37.3
<i>Selinum tenuifolium</i>	30.2
<i>Valeriana</i> spp.	645.2

Nearly 61 lakh people reside in the state of HP (Nandy and Rao, 2001), majority of whom are rural (92%) (Holden and Sankhayan, 1998) and practice farming. The interior areas of the state are devoid of modern medical facilities, and hence dependency on medicinal plants is very high. As many as 500 different plants are used by the local people for curing various ailments (Chauhan, 2003).

The state contributes heavily to the trade in medicinal plants and nearly 130 species are in heavy demand (Badola and Pal, 2003). During the year 1999-2000 a total of about 1402 t of different medicinal plants and other forest produce worth Rs. 705.79 lakhs were traded (Anon., 2002). This is what has been officially documented and allowed. However, majority of the trade in medicinal plant is illegal for which information is not available.

In addition to agriculture, people in the state rear livestock. The fodder requirements of the livestock are met primarily from the surrounding forests. It has been estimated that in the Himalaya majority of the fodder is extracted from forests and only 37% is derived from agricultural system, pastures and degraded lands (Singh *et al.*, 1998). Plants not only fulfill the fodder requirements but are also used for curing various livestock diseases.

As domestication of plants and animals was the first endeavour of human being on earth, the domesticated animals have been subjected to various sufferings. With passage of time the struggle for existence taught many lessons to mankind vis-à-vis natural phenomena. Consequently, through age long trial and error, the primitive men developed various skills including treatment of their domestic animals by plants found in vicinity.

Traditional uses of medicinal plants have been continuing since Vedic period and still a large population is dependent on herbal medicines. About 152 plants have been documented in India for traditional veterinary medicines (Table 3, Srivastava *et al.*, 2000). However, owing to urbanization, the people have abandoned the idea of traditional use of plants in their day-to-day life and majority of such plants are becoming scarce owing to unplanned exploitation and prevailing biotic factors. The knowledge of taxa and their uses against particular ailment of livestock is getting limited to remote and far flung areas.

Table 3. Plant used for traditional veterinary medicines

<i>Acacia catechu</i>	<i>Acacia nilotica</i>	<i>Achillea millefolium</i>	<i>Aconitum ferox</i>
<i>Acorus calamus</i>	<i>Aegle marmelos</i>	<i>Albizia procera</i>	<i>Allium cepa</i>
<i>Allium sativum</i>	<i>Aloe barbadensis</i>	<i>Alpinia galanga</i>	<i>Alstonia scholaris</i>
<i>Andrographis paniculata</i>	<i>Annona squamosa</i>	<i>Apium graveolens</i>	<i>Asparagus racemosus</i>
<i>Atropa belladonna</i>	<i>Azadirachta indica</i>	<i>Baliospermum montanum</i>	<i>Bambusa arundinacea</i>
<i>Bambusa arundinacea</i>	<i>Bauhinia variegata</i>	<i>Berberis asiatica</i>	<i>Boerhaavia diffusa</i>
<i>Bombax ceiba</i>	<i>Bryonopsis laciniosa</i>	<i>Buchanania lanzan</i>	<i>Butea monosperma</i>
<i>Calotropis gigantea</i>	<i>Cannabis sativa</i>	<i>Capparis sepiaria</i>	<i>Carissa congesta</i>
<i>Cassia fistula</i>	<i>Cassia occidentalis</i>	<i>Cassia senna</i>	<i>Cassia tora</i>

<i>Centella asiatica</i>	<i>Cinnamomum camphora</i>	<i>Cinnamomum verum</i>	<i>Cissampelos pareira</i>
<i>Cissus quadrangularis</i>	<i>Citrullus colocynthis</i>	<i>Citrus aurantifolia</i>	<i>Claviceps purpurea</i>
<i>Cleome viscosa</i>	<i>Clerodendrum phlomidis</i>	<i>Coriandrum sativum</i>	<i>Crataeva magna</i>
<i>Croton tiglium</i>	<i>Cuminum cyminum</i>	<i>Curcuma amada</i>	<i>Curcuma domestica</i>
<i>Cynodon dactylon</i>	<i>Cyperus rotundus</i>	<i>Dalbergia sissoo</i>	<i>Datura stramonium</i>
<i>Digitalis purpurea</i>	<i>Eclipta prostrata</i>	<i>Elettaria cardamomum</i>	<i>Embelia ribes</i>
<i>Emblica officinalis</i>	<i>Ephedra gerardiana</i>	<i>Erythroxylum coca</i>	<i>Eulophia campestris</i>
<i>Euphorbia antiquorum</i>	<i>Exogonium purga</i>	<i>Ferula assafoetida</i>	<i>Ficus racemosa</i>
<i>Foeniculum vulgare</i>	<i>Gardenia gummifera</i>	<i>Gloriosa superba</i>	<i>Glycyrrhiza glabra</i>
<i>Gmelina arborea</i>	<i>Gossypium arboretum</i>	<i>Hedyotis corymbosa</i>	<i>Helianthus annuus</i>
<i>Heliotropium indicum</i>	<i>Helicteres isora</i>	<i>Hemidesmus indicus</i>	<i>Hibiscus rosa-sinensis</i>
<i>Holarrhena antidysenterica</i>	<i>Hyoscyamus niger</i>	<i>Illicium verum</i>	<i>Juniperus communis</i>
<i>Kalanchoe integra</i>	<i>Lepidium sativum</i>	<i>Leucas cephalotes</i>	<i>Linum usitatissimum</i>
<i>Madhuca indica</i>	<i>Mallotus philippensis</i>	<i>Mangifera indica</i>	<i>Maytenus senegalensis</i>
<i>Mentha piperita</i>	<i>Mimosa pudica</i>	<i>Myrica esculenta</i>	<i>Myristica fragrans</i>
<i>Nicotiana tabacum</i>	<i>Nigella sativa</i>	<i>Ocimum basilicum</i>	<i>Ocimum tenuiflorum</i>
<i>Oroxylum indicum</i>	<i>Papaver somniferum</i>	<i>Phyllanthus amarus</i>	<i>Picrorhiza kurrooa</i>
<i>Pimpinella anisum</i>	<i>Piper cubeba</i>	<i>Piper longum</i>	<i>Piper nigrum</i>
<i>Plumbago zeylanica</i>	<i>Podophyllum hexandrum</i>	<i>Pongamia pinnata</i>	<i>Premna obtusifolia</i>
<i>Punica granatum</i>	<i>Quercus infectoria</i>	<i>Rheum emodi</i>	<i>Ricinus communis</i>
<i>Santalum album</i>	<i>Saraca asoca</i>	<i>Semicarpus anacardium</i>	<i>Sesamum orientale</i>
<i>Solanum nigrum</i>	<i>Solanum surattense</i>	<i>Soymida febrifuga</i>	<i>Stereospermum chelonoides</i>
<i>Strychnos nux-vomica</i>	<i>Swertia chirayita</i>	<i>Symplocos racemosa</i>	<i>Syzygium aromaticum</i>
<i>Syzygium cumini</i>	<i>Tamarix troupii</i>	<i>Tectona grandis</i>	<i>Tephrosia purpurea</i>
<i>Terminalia arjuna</i>	<i>Terminalia bellirica</i>	<i>Terminalia chebula</i>	<i>Thymus vulgaris</i>
<i>Tinospora cordifolia</i>	<i>Trachyspermum amni</i>	<i>Trachyspermum roxburghianum</i>	<i>Tribulus terrestris</i>
<i>Trichosanthes cucumerina</i>	<i>Trigonella foenum-graecum</i>	<i>Triumfetta rhomboidea</i>	<i>Uraria lagopodioides</i>
<i>Urginea indica</i>	<i>Valeriana jatamansi</i>	<i>Vigna aconitifolia</i>	<i>Vitex negundo</i>
<i>Withania somnifera</i>	<i>Woodfordia fruticosa</i>	<i>Zingiber officinale</i>	<i>Zizyphus mauritianan</i>

Source: Srivastava *et al.*, 2000, CIMAP

In Himachal Pradesh, many workers have conducted Ethnobotanical surveys to record knowledge of treating different ailments of domestic animals by natives of different regions of the state (Table 4).

Table 4. Plants used for traditional veterinary medicines by natives of Himachal Pradesh

	Ailment	Remedial plant	Plant part used	Reference
1.	Boils	<i>Thalictrum foliolosum</i>	Root	Sharma <i>et al.</i> , 2005
2.	Conjunctivitis	<i>Pyrus pashia</i>	Cell -sap	Kanwar & Yadav, 2005
3.	Diarrhoea	<i>Cissampelos pariera</i> and <i>Buddleja crispa</i>	Leaves	Kanwar & Yadav, 2005
4.	Diarrhoea	<i>Leucas lanata</i>	Leaf infusion	Sharma <i>et al.</i> , 2005
5.	Fever	<i>Zanthoxylum armatum</i>	Seeds / leaves	Kanwar & Yadav, 2005
6.	Food poisoning	<i>Hedychium spicatum</i>	Rhizome & flowers	Brij <i>et al.</i> , 1996
7.	Foot & Mouth	<i>Tamarindus indica</i>	Fruits	Kanwar & Yadav, 2005
8.	Foot & Mouth	<i>Thalictrum foliolosum</i>	Whole plant	Sharma <i>et al.</i> , 2005
9.	Foot & Mouth	<i>Thalictrum foliolosum</i>	Roots	Brij <i>et al.</i> , 1996
10.	Foot & Mouth	<i>Valeriana jatamansi</i>	Roots	Kanwar & Yadav, 2005
11.	Foot & Mouth	<i>Thalictrum foliolosum</i>	Whole plant	Sharma <i>et al.</i> , 2005
12.	Giddiness	<i>Heracleum candicans</i>	Shoot powder	Sharma <i>et al.</i> , 2005
13.	Lice in sheep	<i>Codonopsis clematidea</i>	Extract of foliage & flowers	Singh & Chauhan, 2005
14.	Low milk production	<i>Asparagus filicinus</i>	Roots	Sharma <i>et al.</i> , 2005
15.	Rheumatic pain / deep cut	<i>Betula utilis</i>	Ash of stem bark	Sharma <i>et al.</i> , 2005
16.	Stomachache	<i>Fraxinus xanthoxyloides</i>	Extract of bark	Singh & Chauhan, 2005
17.	Stubborn placenta	<i>Leucas lanata</i>	Leaves	Sharma <i>et al.</i> , 2005
18.	Swelling due to food poisoning in goats	<i>Lantana camara</i>	Roots' paste	Brij <i>et al.</i> , 1996
19.	Ulcers/ wounds	<i>Delphinium vestitum</i>	Root powder	Sharma <i>et al.</i> , 2005

Owing to urbanization, tourism, natural calamities, and over-exploitation of plant-resources, some of these plants are already endangered (Pal and Jain, 1998) and some more may be

threatened in times to come. The most affected area is the Himalaya - the abode of many valuable plants like *Taxus baccata*, *Picrorhiza kurrooa*, *Podophyllum hexandrum*, *Saussurea lappa*, *Coptis teeta*, *Swertia* spp. etc. Concomitantly, our demand for herbs and herbal products is increasing with growing population and awareness regarding herbal therapies. Thus, sustainable use of these plant-resources through *in-situ* and/or *ex-situ* conservation becomes imperative. The present wave of awareness around environment and natural products is an opportunity for planned sustainable utilization of our valuable forest and cultivable bioresources in the Indian Himalayan zone.

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