

Medicinal plants of North-Western Himalayas: Initiatives and Achievements of HFRI



HIMALAYAN FOREST RESEARCH INSTITUTE (HFRI)

(Indian Council of Forestry Research & Education)

Conifer Campus, Panthaghati

SHIMLA - 171 009 (H.P.)

Medicinal plants of North-Western Himalayas: Initiatives and Achievements of HFRI

North-western Himalayan region with its wide range of altitudes, topography and climatic conditions, is a rich repository of medicinal wealth, which occupies an important place in Vedic treatise. More than 800 no. valuable medicinal species found in this part of India is extensively used by the locals since time immemorial for curing various diseases of humankind. It is now a well known fact that medicinal plants sector possesses great potential to uplift the economy of this part of India. However, various developmental and anthropogenic pressures on the forests, unscrupulous/unscientific exploitation of medicinal plants in the wake of their increasing national and a global trade, inadequacy of management inputs and lack of enabling legislation have caused severe depletion of the medicinal plants resource base thereby affecting the health and livelihood options of the people. The situation may further aggravate if some corrective measures are not put in place. Moreover, the trade in medicinal plants in the region is largely un-regulated, secretive and exploitative and takes place in the form of raw material. Even the post harvest handling of the raw material does not generally conform to the well laid down norms resulting in low remuneration to the poor rural people for their efforts to collect/cultivate medicinal plants, who have very small land holding and dependant on such activities for additional income.

Encouraging commercial cultivation is vital for the success of medicinal plants sector to meet out the ever growing demand for temperate medicinal plants as this wealth has been depleting continuously since last two decades in their natural habitat. Biodiversity Conservation and Sustainable development of medicinal plants sector require active participation of local communities and people friendly policies. For obtaining common man's support in medicinal plants sector, it must be linked with economic viability.

Himalayan Forest Research Institute (HFRI), Shimla being one of the regional institute of Indian Council of Forestry Research and Education (ICFRE), Dehradun also started its focussed attention towards research and developmental activities in the Medicinal Plants Sector in North-Western Himalayas since last decade. Accordingly, in its concerted efforts the institute was able to generate following knowledge in this direction:

1. Survey in Some Important and Fragile Eco-Systems:

With an intention to augment the earlier literature, the institute undertook survey in different ecologically sensitive and fragile zones in the state of Himachal Pradesh. Accordingly, a list of information on the medicinal plants as per their status has been prepared which is as below;

1.1. Cold Deserts- The Ecologically Fragile Areas:

The institute conducted survey in different areas of cold deserts in Pooh sub division of district Kinnaur, Himachal Pradesh revealed the presence of 114 medicinal plant species from the area. Out of



these medicinal plants, 24 species i.e. *Aconitum heterophyllum*, *Aconitum violaceum*, *Arnebia euchroma*, *Bergenia stracheyi*, *Betula utilis*, *Dactylorhiza hatagirea*, *Datisca cannabina*, *Ephedra gerardiana*, *Ferula jaeschkeana*, *Hippophae rhamnoides*, *Hyssopus officinalis*, *Hyoscyamus niger*, *Juniperus polycarpus*, *Jurinea dolomiaea*, *Meconopsis aculeata*, *Picrorhiza kurrooa*, *Polygonatum verticillatum*, *Rheum webbianum*, *Rheum moorcroftianum*, *Rhodiola heterodonta*, *Rhododendron anthopogon*, *Rhododendron campanulatum*, *Saussurea gossypiphora*, *Saussurea obvallata* fall in different categories of threatened plants.

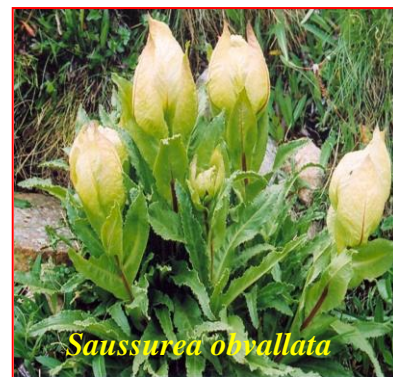


The similar exercise for documentation of Medicinal plants in Miyar Valley of the district Lahaul & Spiti of the state showed the presence of 50 most promising medicinal plants and some of them are; *Podophyllum hexandrum*, *Meconopsis aculeata*, *Viola biflora*, *Geranium wallichianum*, *Rosa webbiana*, *Bergenia stracheyi*, *Potentilla atrisanguinea*, *Angelica glauca*, *Bunium persicum*, *Ferula jaeschkeana*, *Pleurospermum brunonis*, *Inula racemosa*, *Arnebia euchroma*, *Picrorhiza kurrooa*, *Rheum australe*, *Polygonatum verticillatum*, *Trillium govanianum* etc.

1.2. Wild-life Sanctuaries: The Area of Interest

These Protected Areas are another important area of interest and provides uniqueness to the thought process of the stakeholders in general and the specialist in particular. Findings of some of the prioritized sanctuaries revealed as below;

The survey in Rakchham-Chitkul Wildlife Sanctuary, district Kinnaur (Himachal Pradesh) included the presence of 98 plant species of medicinal importance. Twenty two plant species of threatened categories were recorded from the sanctuary, out of which 3 were critically endangered, 11 endangered and 13 vulnerable. **Critically Endangered** species include *Aconitum heterophyllum*, *Dactylorhiza hatagirea* and *Saussurea obvallata* where as *Acer caesium*, *Angelica glauca*, *Betula utilis*, *Dioscorea deltoidea*, *Jurinea dolomiaea*, *Meconopsis aculeata*, *Picrorhiza kurrooa*, *Podophyllum hexandrum*, *Polygonatum cirrihifolium*,



Rheum australe and *Taxus wallichiana* fall in **Endangered** category and **Vulnerable** species include *Aconitum violaceum*, *Bergenia stracheyi*, *Heracleum lanatum*, *Hippophae rhamnoides*, *Ferula jaeschkeana*, *Polygonatum verticillatum*, *Polygonatum multiflorum*, *Rheum webbianum*, *Rhodiola heterodonata*, *Rhododendron anthopogon*, *R.campanulatum* and *R. lepidotum*.

Renuka and Simbalwara Wildlife Sanctuaries have the presence of 95 plants of medicinal value. Some of the medicinal plants recorded are; *Acorus calamus*, *Aegle marmelos*, *Asparagus racemosus*, *Celastrus paniculata*, *Chonemorpha fragrans*, *Gloriosa superba*, *Hedychium spicatum*, *Nelumbo nucifera*, *Nervilia prainiana*, *Oroxylum indicum*, *Pistacia chinensis*, *Smilax aspera*, *Zanthoxylum armatum* etc.

Out of 100 medicinal plant species recorded in Kalatop- Khajjiar Wildlife Sanctuary, 7 species viz; *Cinnamomum tamala*, *Dioscorea deltoidea*, *Paris polyphylla*, *Podophyllum hexandrum*, *Polygonatum verticillatum*, *Taxus wallichiana*, *Zanthoxylum armatum* fall in the category of threatened plants. Recording of new floral elements including those of medicinal plants in Churdhar Wildlife Sanctuary had also paved the way for additional thrust on such areas of interest.

2. Establishment of Germplasm bank and Propagation Techniques:

The Institute has established the Germplasm bank of 30 species of medicinal plants of temperate Himalayas in Brundhar nursery (Manali); 20 species at Shilly nursery, Solan and 10 species each at Shillaru Nursery (Shimla) and Model Nursery (Shimla) for demonstration purpose to different stakeholders. Studies were conducted for improvement in the nursery techniques of economically important medicinal plant species e.g. *Picrorhiza kurrooa* (Kutki), *Aconitum heterophyllum* (Patish), *Valeriana jatamansi* (Mushkbala), *Angelica glauca* (Chora) etc. Developed macro-proliferation technique for mass multiplication of Kutki and Mushakbala as explained below:

2.1. Macro-proliferation technique for Kutki multiplication

Picrorhiza kurrooa, Royle ex Benth. commonly known as Kutki is an important temperate medicinal plant species found in western Himalayas. It possesses great potential for commercial cultivation in higher temperate regions. It possesses inherent proliferation capacity and offset planting capabilities to reproduce it. The well grown mature plant of Kutki can be utilized for vegetative multiplication by exploiting such characters of the species. Keeping this clue in mind, macro-proliferation technique was developed for vegetative multiplication of this important medicinal plant species. The technique ensures that each propagules possesses some parts of shoot along with rhizome parts and few roots at the time of separation from mature healthy plant. By the application of this technique a healthy mature plant of Kutki can be multiplied 6 to 10 times successfully. In addition to multiplication >50% yield of rhizomes and roots can be recovered for marketing or various other uses. Time of separation, portion of shoot/root/rhizome to be retained in each propagule and providing appropriate growing conditions for plantation of separated propagules are found to be critical factors for achieving success through this technique. In general it is always better to go for this technique during rainy season and plantation of propagules in poly-house or sand trays.



Mature plant of Kutki



Macro-proliferated propagules

2.2. Macro-proliferation technique for Mushakbala multiplication

Valeriana jatamansi, Jones commonly known as Mushakbala is an important temperate medicinal plant species found in western Himalayas and possesses great potential for commercial cultivation. The species can be easily grown through seeds but the vegetative propagation has scientific advantage over sexual propagation. The well grown mature plant of Mushakbala can be utilized for vegetative multiplication by exploiting such characters of the species. Keeping this the above in mind, macro-proliferation technique has been developed for vegetative multiplication of this important medicinal plant species. This technique ensures that each propagule possesses some parts of shoot along with rhizome parts and roots at the time of separation from mature healthy plants. By the application of this technique a healthy mature plant of Mushakbala can be multiplied 10 to 12 times successfully. In addition to multiplication >50% yield of rhizomes and roots can be recovered for marketing or various other uses. Time of separation, portion of shoot/root/rhizome to be retained in each propagule and providing appropriate growing conditions for plantation of separated propagules are found critical factors for achieving success through this technique. In general it is always better to go for this technique during rainy season.



Mature Plant of Mushakbala



Macro-proliferated propagule

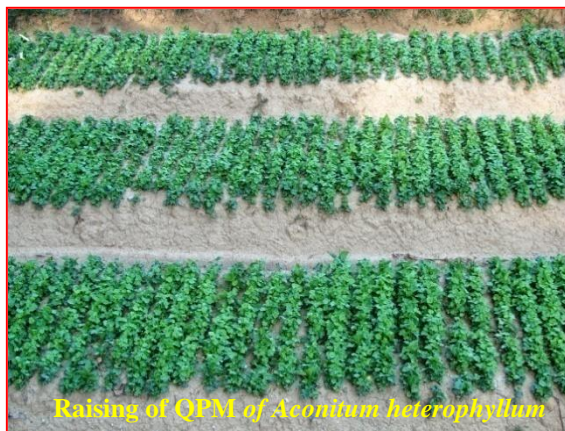
2.3. Fabrication of Equipments:

A ‘Multiple Nursery Planting Bar’ has been designed and developed for maintaining desired spacing at field or commercial level. The equipment not only marks the surface of nursery bed/field for precision planting but also creating cavities or planting holes for inserting propagules of Medicinal plants. It is dual purpose equipment as it maintains desired spacing as well as creates cavities for inserting propagules. Its operation results into 9 no. bed marks at 30cm x 30cm spacing with around 10cm deep cavity/planting hole at each mark.

3. Production of quality planting material of selected medicinal plant species:

Around 8.0 lacs quality planting material of *Picrorhiza kurroa* Royle Ex. Benth, *Valeriana jatamansi* Jones, *Aconitum heterophyllum* Wall. ex Royle & *Angelica glauca* Edgew were produced under NMPB sponsored projects during last five years, of which around 7.0 lakhs planting stocks were distributed to various end users for cultivation and further multiplication.

Various extension activities were also carried out by organising training and demonstration programmes, village open meetings and publication of extension materials in simple vernacular language for the benefit of various end users.



4. Development of suitable model for intercropping for commercially important medicinal plants with horticultural plantations in temperate regions of Himachal Pradesh

Himachal Pradesh basically a horticultural state accordingly temperate fruit growing is the main activity of mid and higher hill farmers. Till recently growing of temperate fruits was lucrative business but continuous failure of these fruit crops due to erratic rainfall accompanied with very less snow fall, increased incidence of various insect pest and diseases attacks, overall rising temperature and decreasing forest areas of the region, shortened chilling hours required by the apple trees during winter for optimum flowering and fruit setting thereby resulting in low yields and lower qualities have forced the farmers/ horticulturist to look for some other alternatives to supplement their income through diversification. The Institute worked on these lines and through scientific inputs was able to develop the model of intercropping



that could be viable and will help farmers to augment their income besides helping in productivity enhancement per unit area of land and in mitigating the poverty in rural areas.

4.1. Intercropping model of *Aconitum heterophyllum* (Patish):

The species is suitable for intercropping with horticultural plantations of Apple (*Malus domestica* Borkh.) and Cherry (*Prunus avium* Linn.) in high hill temperate zone. Seedlings should be planted in the spacing of 30x20 cm² in the field beds. Irrigation after weekly interval is recommended during hot summer season for optimum growth and yield. Apple orchard of age between 16 to 20 years have been found to be best for optimum yield of the *Aconitum heterophyllum*. After harvesting roots have to be thoroughly washed with clean water and dried under shade and packed. Root parts contain active ingredient called Atisine (0.4%), which is of commercial importance. After two and half years the average yield was found to be 202 Kg/ ha. The market rate may vary from ₹1300 to ₹2200/- per Kg. *Aconitum heterophyllum* (Patish) may fetch a net return of ₹1,52,000/- to ₹3,30,000/- per ha.



4.2. Intercropping of *Valeriana jatamansi* (Muskbala)

Seedlings should be planted in the spacing of 30x40 cm² in the field beds. Irrigation after day's interval is recommended during hot summer season for optimum growth and yield. Apple orchard of age 30 years has been found to be best for optimum yield. After harvesting roots have to be thoroughly washed with clean water and dried under shade and packed. Root parts contain active ingredient called Valepotriate and Volatile essential oil (0.5%) which is of commercial importance. After two and half years the average yield was 12 quintal/ ha. The market rate may vary from ₹120 to ₹150/- per Kg. *Valeriana jatamansi* (Muskbala) may fetch a net return of ₹40,000/- to ₹80,000/- per ha.



4.3. Intercropping of *Picrorhiza kurrooa* (Kutki):

In the interspaces of horticultural plantations field beds should be prepared during the month of February-March. Seedlings should be planted in the spacing of 30x40 cm² in the field beds. Irrigation after weekly interval is recommended during hot summer season for optimum growth and yield. Apple orchard of age between 26 to 36 years has been found to be best for optimum yield. After harvesting roots have to be thoroughly washed with clean water and dried under shade and packed. Root parts contain active ingredient called Picroside-I and Picroside-II which is of commercial



importance. After two and half years the average yield was 07 quintal/ ha. The market rate may vary from ₹200/- to ₹225/- per Kg. *Picrorhiza Kurooa* (Kutki) may fetch a net return of ₹40,000/- to ₹57,000/- per ha.

4.4 Intercropping *Angelica glauca* (Chora) with horticultural plantations:

The species is suitable for intercropping with horticultural plantations of Apple (*Malus domestica* Borkh.) and Cherry (*Prunus avium* Linn.) in high temperate zone. Seedlings should be planted in the spacing of 45x75 cm² in the field beds. Irrigation after weekly interval is recommended during hot summer season for optimum growth and yield. Apple orchard of age between 26 to 30 years has been found to be best for optimum yield. After harvesting roots have to be thoroughly washed with clean water and dried under shade and packed. Root parts contain Glycosides which is of commercial importance. After two and half years the average yield was 23 quintal/ ha. The market rate may vary from ₹60/- to ₹100/- per Kg. *Angelica glauca* (Chora) may fetch a net return of ₹38,000/- to ₹1,30,000/- per ha*.



* The market rate for medicinal and aromatic plants is fluctuating, hence the economics may vary.

5. **Under the project "Promotion of Medicinal Plants Cultivation among Rural Communities for Sustainable Income Generation"** funded by Himachal Pradesh Forestry Sector Reform Project (HPSFRP) of Himachal Pradesh Forest Department under Big Good Idea Fund (GIF) in theme: Mountain Based Farming System; the Institute had established demonstration plots (3 no's) of important medicinal plants in different altitudinal zones (Lower, Mid and High zones) of Sirmour district, Himachal Pradesh. Besides, organized training and demonstration programmes (8 nos.) to different target groups on medicinal plants cultivation and also developed user friendly extension materials.

6. *Berberis aristata* (Daruhaldi)

The Institute in collaboration with Forest Research Institute, Dehradun has identified seven



provenances of *Berberis aristata* in Himachal Pradesh and identified high berberine (2.81%) yielding plant populations under the project titled "**Studies on population status and berberine content in different provenances of *Berberis aristata* DC. in Himachal Pradesh and standardization of its propagation techniques**" sponsored by Department of Biotechnology, Government of India. Propagation techniques were also standardized for the species.

7. Medicinal plants in Sacred Groves of Kullu Valley

Medicinal plants in Sacred groves of Kullu Valley, Himachal Pradesh was documented under the project on "**Inventorization, documentation of plant diversity and to evolve site-specific management strategies for conservation of various sacred groves in Kullu Valley of Himachal Pradesh**" sponsored by the GB Pant Institute of Himalayan Environment & Development, Almora under Integrated Eco-development Research Programme.



A sacred grove in Nashala village, Kullu Valley, Himachal Pradesh

8. **Standardized the methodologies for Seed Collection, Seed Handling, Storage and Breaking Seed Dormancy in *Juniperus polycarpus* C.Koch and *Fraxinus xanthoxyloides* (Wall. ex G. Don) DC"** the Institute has successfully conducted trials on seed collection, processing, storage and pre-sowing treatments in *Juniperus polycarpus* and *Fraxinus xanthoxyloides*. The extension material for the benefit of various end users is being developed and mass production of nursery stock of these species is under process.



***Juniperus polycarpus* seedlings raised at Model Nursery, Shimla**

9. Survey, Biology and Control of Insect-Pests of Important Medicinal Plants in Himachal Pradesh”

During the survey 37 insect species belonging to 5 insect orders viz. Lepidoptera, Coleoptera, Hemiptera, Orthoptera, Hymenoptera and 24 families, Class Arachnida, were found to be associated with medicinal plants in the nurseries. *Plusia orichalcea* is one of the important insect-pests associated with medicinal plants. Biopesticides viz. Neem cake @ 500 gm / m², Grownim @ 5.0 % and summer oil @ 5.0 % is proved to be effective to keep the population of *Plusia orichalcea* Fabr. (Lepidoptera ; Noctuidae) below Economic Threshold Level in medicinal crop like *Saussurea costus*, *Acronitum heterophyllum*, *Picrorhiza kurrooa*, *Heracleum candicans*, *Angelica glauca* and *Valeriana jatamansi*.



Apple Mite infested plants of *Valeriana jatamansi* Moth of Cabbage semilooper in Kuth

10. Identification of Superior Genetic Stock of *Podophyllum hexandrum* (Bankakdi) from from H.P. and J & K:

The Institute has carried out extensive surveys to identify the superior genetic stock of *Podophyllum hexandrum* in different geographical locations (25 No.) of Himachal Pradesh and Ladakh (J & K) and collected genetic material from the same. Trials are being conducted to develop user friendly propagation methods of the species. On the basis of high active ingredient content identified the superior chemo-types and has established the Field Gene Bank (FGB) of the same.



11. Network project on Population assessment and identification of superior genetic stock of *Picrorhiza kurrooa* Royle ex Benth and *Valeriana jatamansi* Jones by screening different populations from North-Western Himalayas (H.P. and Uttarakhand)

Population assessment, characterization of micro habitat and identification of Superior Genetic Stock of *Picrorhiza kurrooa* Royle ex Benth and *Valeriana jatamansi* Jones from different geographical location of Himachal Pradesh and Uttarakhand has been carried out. In case of *P. kurrooa*, out of total 24 sources studied throughout Himachal Pradesh and Uttarakhand, about 17 sources (14 from H.P. and 3 from Uttarakhand) have been found to contain more than 7% total

Picroside (PI & PII). As far as *V. jatamansi* is concerned 4 sources from Himachal Pradesh have been found to possess >4% Valepotriate content.

12. Assessment of Optimum harvest limits of *Picrorhiza kurrooa* and *Valeriana jatamansi* in Himachal Pradesh

The institute is currently assessing the optimum harvest limits of *Picrorhiza kurrooa* and *Valeriana jatamansi* in different natural habitats of Himachal Pradesh. Different harvesting levels are being simulated in the experiments.



Establishing experiment in Lahaul



Collection of data on *Valeriana jatamansi* in Chail

13. Extension activities on medicinal plants:

Extension is an integral component of institute's activity. New technologies in forestry sector are regularly being developed along with improvement in existing technologies. The gains realized through the advancement of technologies in forestry sector would be of limited significance without the effective transfer of these technologies to user's group. Therefore, a separate budget is allotted every year for the Institute to carry out effective extension of technologies developed/ improved among various stakeholders. Training programmes are planned well in advance and information circulated to various stakeholders for active participation in those programmes. More and more emphasis is now a day's given to publication of literature in simple vernacular languages and institute has already published no. of pamphlets and booklets in simple Hindi on medicinal plants for the benefit of end users.

- Number of training and demonstration programmes on medicinal plants cultivation have been conducted by the Institute for the benefit of local communities and field functionaries of Himachal Pradesh State Forest Department. Besides, Scientists and researchers are also acted as resource person in no. of training programmes organized by other organizations.
- The institute has organized a number of exposure visits for the farmers of Himachal Pradesh and Jammu & Kashmir on medicinal plants and Agroforestry awareness.



Training and Demonstration Programme on Medicinal Plants

14. Workshop on medicinal plants

The Institute has organized a workshop on **“Challenges and Opportunities for Growth of Medicinal Plants in North-West Himalayas”** at Himalayan Forest Research Institute, Shimla on 18-19th March, 2010. The purpose of workshop was to review the present status of Himalayan medicinal plants and the gaps in this sector and provide an opportunity to various stakeholders, researchers from various forestry fields such as ICFRE, Regional Research Centers, Universities, Industries, Managers from Forest Department, Non-Governmental Organizations and Village Level Institutions and local bodies including Panchayati Raj Institutions and Agriculture extension workers and even progressive farmers to deliberate on the issues regarding Temperate Medicinal Plants and come out suitable recommendations for the growth of medicinal plant sector in North-West Himalayan region. The important recommendations emerged after thorough discussions in the plenary session included:



- All Himalayan states should evolve uniform medicinal plants specific Policy. State policies need to be strictly in consonance with the central policy. The policy and related rules and regulations should be dynamic and people centric.
- Genetic and chemical characterization, development of agro-techniques, regeneration pattern and entomo-pathological problems of prioritized commercially important medicinal plant species needs to be studied.
- There is a strong need for generating awareness regarding the conservation, collection procedure, sustainable harvesting, cultivation technology, initial and post harvest handling and marketing through well defined awareness strategy at state level involving Panchayats and local communities.

15. Issues in development of medicinal plant sector in Himachal Pradesh

Some of the points/ activities those are required to be considered for the development of medicinal plants sector in the state and can be explained on the following lines:

i. Authentication of Quality Raw Material on the Basis of Taxonomic Identification and Chemical Standardization:

The job is to be accomplished through a plant taxonomist and an ecologist. The issue will revolve around exact identification and assessment of chemical standardization through collection of the same material from different agro-climatic zones within the state.

ii. Identification of Certification Agency for Source authentication of Medicinal Plants (Cultivation and not from wild):

This is another important issue and can be accomplished through recruiting trained staff for their posting in different agro-climatic zones for source authentication of medicinal plants being grown by the farmers/ cultivators, Registration of the farmers/ cultivators is required so as to give sustenance to the medicinal plants related activities and Identification and Registration of clearing houses in consultation with National and State Medicinal Plant Boards.

iii. Technical Know-how Pertaining to Cultivation, Post-harvest and Value Addition:

The institute at this stage is in a position to impart necessary trainings on cultivation techniques on the species like *Picrorhiza kurroa*, *Aconitum heterophyllum*, *Angelica glauca*, *Valeriana jatamansi* etc. Extension of cultivation technologies to the farmers pertaining to other species can be taken up. However, it is pertinent to add over here that zone specific technologies for each of the species can be standardized at later date and imparted to the end users subsequently.

As far as techniques related to post-harvest and value additions are concerned, there is an urgent need of collaboration amongst various institution like University of Horticulture and Forestry Solan, IHBT, Palampur etc. The infrastructure and expertise available with the

institute will certainly be made use while developing these working/ academic relationships for the cause of medicinal plant sector.

iv. Creation of Linkages with Marketing Agencies/ Industries for Assurance of Buyback Arrangements:

Thrust for developing linkages with marketing agencies / industries is required to be given boost and at the same time attempts are required to be made for certification of origin and quality of the medicinal plants growing in this part of Himalayas. These efforts will be followed subsequently by devising strategies for assured market of the product because in the present scenario authenticity of the material is essentially required.

v. Promotion of Global Marketing System:

There is an imperative need for development of Farmers Cooperatives for easy acceptability of their products. Nodal agencies – mainly government departments – need to be designated for smoothening the work. The farmers are required to be made aware on the issues regarding organic certification of the material and they can also be taught about the good agricultural/ production practices since, it is essentially required in marketing in present scenario. Site specific mechanism is required to be developed for sustained supply of the raw material to the industry for at least 8-10 years thereby, making the whole system self-sufficient, self-regulating and sustainable.



Complied by:
Sandeep Sharma, Jagdish Singh & A. Rajasekaran

For further details please contact:

Director

**Himalayan Forest Research Institute
Conifer Campus, Panthaghathi
SHIMLA-171 009 (H.P.)**

Telephone: 0177 – 2626778

FAX: 0177 - 2626779

Email: dir_hfri@icfre.org

Website: <http://hfri.icfre.gov.in>