Medicinal Plantation

TI: Medicinal plant raw materials for Indian drug and pharmaceutical industry. II. Problems and prospects of development of resources.

AU: Sarin-Y-K {a}
AD: {a} 21-C, Chandralok Colony, Rajpur Road, Dehra Dun, Uttaranchal, India, India
PY: 2003
AB: Proper utilization of medicinal plant resources of India requires a comprehensive approach. There are many issues concerning this area of activity. These include inventorisation, quantitative and techno-economic evaluation, standardization in terms of therapeutic efficacy and augmentation of resources through conservation, domestication and large scale cultivation. The country has been engaged in research and development in this area since long and a lot of information on different aspects is available. There is a need for retrieval and documentation of this information at national level, developing appropriate technologies and creating conditions for gainful utilization of available and developed resources. Such an exercise may go a long way for proper utilization of the resources and taking up further work to fill in the gaps.

TI: Traditional medicinal plants of Uttaranchal Himalayas.

AU: Kumar,-A.; Bisht,-P.S.; Kumar,-V.
AD: G.B.Pant University of Agri. and Tech., College of Forestry and Hill Agriculture, Hill Campus, Ranichauri - 249 199 Uttaranchal,(India)
PY: 2002

TI: Management and conservation of medicinal orchids of Kumaon and Garhwal Himalaya.

AU: Pandey-N-K {a}; Joshi-G-C {a}; Mudaiya-R-K {a}; Tewari-V-P {a}; Tewari-K-C {a}
AD: {a} (Central Council for Research in Ayurveda and Siddha) Tarikhet (Ranikhet), Indian Institute of Ayurvedic Drug Research, 263 663, Uttaranchal, India, India
PY: 2003
AB: Exploitation of medicinal plants threatened to be endangered and some on the verge of extinction, is now a matter of world wide concern on which our civilization is based and thriving at cost of their biological sources. The problem of disappearing species has hitherto been tackled mainly from the standpoint of biology and ecology with less attention to the economical factors which bring species under threat. In this paper, authors discuss some medicinal orchids of Kumaon & Garhwal Himalaya and its prospectives in order to approach conservation measures which serve pragmatic purpose of immediate value.

TI: Current status and future strategy for development of medicinal plants sector in Uttaranchal, India.

AU: Dhar-Uppeandra {a}; Manjkhola-Sumit; Joshi-Mitali; Bhatt-Arvind; Bisht-A-K; Joshi-Meena
AD: {a} G. B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora, 263 643, India; E-Mail: uddhar@nde.vsnl.net.in, India
PY: 2002
AB: As elsewhere, in the Indian Himalayan Region, ethnic communities in the state of Uttaranchal rely, to a large extent, on native plant species for sustenance of their traditional health-care system, both logistically as well as economically. However, the present scenario shows a decline in these traditional, plant-based health-
care practices. These age-old practices are conservation-oriented and have tremendous potential to uplift the state economy. The excessive extraction of medicinal plant resources for use in the pharmaceutical industry has resulted in ruthless destruction of natural populations of medicinal plants. This work attempts to assess the current status of knowledge of medicinal plant resources of the state. It also focuses on the importance of documenting traditional knowledge and practices related to conservation and sustainable utilization of medicinal plants in Uttaranchal. A collaborative work plan involving scientists, government institutions and nongovernmental organizations is suggested for preserving the traditional knowledge system and practices, conservation of medicinal plants and upliftment of the rural economy of this mountain state.

**TI: Herbalism: The next generation reproductive Biomedicine.**

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**AD:** {a} Reproductive Biology Laboratory, Department of Biotechnology, Indian Institute of Technology Roorkee, Roorkee, 247 667, Uttarakhand, India, India


**PY:** 2001

**AB:** Reproductive biomedicine covers all stages of the human lifespan from birth to death. Any kind of imbalance or abnormality in the development, growth and physiology of the reproductive and associated systems causes great physical and psychological discomfort that often results in embarrassment for the individual. Although allopathy provides immense relief and comfort to patients, the costs involved are now becoming prohibitive for the average citizen. This crisis has led us to search for alternate forms of reliable medicine. Herbalism is one form of ancient folklore medicine that has been neglected and at times brushed aside as witchcraft. However, an increasing awareness and a change of attitude has prompted a re-exploration of the potentials of this practice with a scientific bent of mind. Herbs with safer and more effective ingredients are currently being isolated and tested for use in reproductive biomedicine. The advances in information technology have also made it possible to establish databanks for various kinds of reproductive disorders and to link them with remedies offered by nature's laboratory. In this review we focus on some of the problems related to reproductive health and highlight the variety of herbs that could be used to deal with such situations effectively.

**TI: Current status and distribution of commercially exploited medicinal and aromatic plants in upper Gori valley, Kumaon Himalaya, Uttarakhand.**

**AU:** Uniyal-Sanjay-Kumar {a}; Awasthi-Anjali; Rawat-Gopal-S

**AD:** {a} Wildlife Institute of India, Chandrabani, P.O. Box No. 18, Dehradun, 248 001, India; E-Mail: suniyal@yahoo.com, India


**PY:** 2002

**AB:** Estimation of population status and biomass availability of 14 threatened medicinal and aromatic plant species (TMAPS) extracted and traded from the higher altitudes of Kumaon Himalaya was carried out. We used stratified random samples covering distinct landscape units or habitats. These TMAPS were distributed in nine different habitat types and had habitat-specific distribution. On the basis of their status and level of pressure at a local scale, we have grouped them into six categories and a conservation approach has been suggested.

**TI: Treatments to improve seed germination of Arnebia benthamii: An endangered medicinal herb of high altitude Himalaya.**

**AU:** Manjkhola-S; Dhar-U {a}; Rawal-R-S

**AD:** {a} G.B. Pant Institute of Himalayan, Environment and Development Kosi-Katarmal, Almora, Uttarakhand, 263 643, India; E-Mail: udhar@nde.vsnl.net.in, India

AB: Methods for breaking dormancy and thereby improving germination of Arnebia benthamii (Wall. ex G.Don) Johnston, an endangered medicinal herb of the high altitude Himalayas were investigated. Seeds collected from two populations (alpine and subalpine) were subjected to various treatments, viz; cold stratification (chilling and chilling+gibberellic acid), plant growth substances (gibberellic acid, 6 benzylaminopurine and alpha Naphthaleneacetic acid) and nitrogenous compounds (thiourea and KNO3). Both the populations differed significantly (p<0.001) in response to various pretreatments. In the alpine population, thiourea (50 mM) significantly (p<0.05) improved germination over that of the control (thiourea 96%; control 42%). whereas in the subalpine population chilling (14 d) resulted in a significant (p<0.05) improvement in germination over that of the control (chilling 14 d, 62%; control 13%). Reasons for variation in the responses of the two populations and among treatments are discussed.

TI: Medicinal trees of Uttaranchal State: Distribution, use pattern and prospects for conservation.

AU: Adhikari-B-S {a}; Babu-M-M {a}; Saklani-P-L {a}; Rawat-G-S {a}

AD: {a} Herbarium Section, Department of Habitat Ecology, Wildlife Institute of India, Dehra Dun, Uttarakhand, India, India


PY: 2003

AB: This paper deals with distribution and use pattern of medicinal trees in the State of Uttarakhand, India. Based on extensive literature survey, a list of 197 medicinal trees found in Uttarakhand has been appended. Their altitudinal distribution and parts used in various ailments have been given. Euphorbiaceae, Fabaceae, Moraceae and Rosaceae are the largest families having more than 10 species of medicinal trees. The medicinal trees in different ecological regions found in sub-tropical, warm temperate, cool-temperate, sub-alpine and alpine are 170, 64, 22, 10 and 4, respectively. The major parts used in various ailments are bark (118 species), leaves (78 species), fruits (65 species), root (42 species) and seed (30 species). The diseases such as dysentery, fever, diarrhoea, rheumatism, wounds, cholera, skin diseases, bronchitis, cough and asthma are the most frequent ailments. The prospects of in-situ and ex-situ conservation of medicinal trees in Uttarakhand State have been discussed.

TI: Community based conservation and management of medicinal plants in India.

AU: Jha-Mohan {a}

AD: {a} ICFRE, Dehra Dun, Uttarakhand, India, India


PY: 2003

AB: India one of the twelve centres of mega biodiversity areas of the world with two biodiversity hotspots viz, Western Ghat and Eastern Himalayas. As one amongst the top repositories of medicinal plants, India is one of the major sources of raw material for the global market. Unsustainable exploitation of medicinal plants has led to the extinction of many plants and many plants are on the verge of extinction. The local communities who are well known for their knowledge of the medicinal properties of various plants needs to be involved in conservation and management of medicinal plants. Policy makers have realised the importance of community based conservation of the medicinal plants. Successful implementation of activities related to medicinal plants conservation and their sustainable utilization needs the involvement of local communities, especially women groups and provides scope for income, employment and empowerment of primary users of medicinal plants. Some of the works by Government and non-government organization related to community based conservation is discussed in the paper. Experience of FRLHT, in five states of India, WWF work at Susala Gene Bank, Pragya project in three habitats of Himalayas and Medicinal and Aromatic Plants Program in Asia (MAPPA) are different experiences that constitute the pivotal role of community participation. The conservation and management of medicinal plant is possible through a suitably designed area specific participatory models. A community based medicinal plants...
conservation and sustainable utilisation programme, if designed appropriately, can ensure increased access to health resources to the rural poor, and create jobs and sustainable livelihoods.

**TI: Development of marketing of medicinal plants and other forest products: Can it be a path way for effective management and conservation?**

**AU:** Maikhuri-R-K {a}; Rao-K-S; Chauhan-Kusum {a}; Kandari-L-S {a}; Prasad-P {a}; Rajasekaran-C {a}

**AD:** {a} Garhwal Unit, G.B. Pant Institute of Himalayan Environment and Development, Srinagar Garhwal, Uttarakhand, India, India


**PY:** 2003

**AB:** Since times immemorial, plants have served mankind by providing food, shelter, medicine etc. In recent times the demand for Medicinal and Aromatic Plants (MAPs) has increased rapidly in the global market. Domestic sales are growing at a rate of 20% per annum, while the international market for herbal products is estimated to be growing 7% per annum. Due to rapidly increasing demand of MAPs, a number of species are known to have become rare, endangered, threatened and extinct. Every year thousands of tonnes of these plant resources are being exploited from the natural habitat either legally or illegally without fair benefits accruing to the local people. Indian Himalayan region is the storehouse for the MAPs, besides bearing the largest economic resource being tapped, but local communities get only a tiny fraction of the profits. It is historically a secretive trade and little is known about who collects, who trades, who profits and whether there is over-harvesting. It is established that the basic causes of unsustainable harvesting are ignorance, poverty and lack of alternative livelihood support systems accompanied by encroachments by outsiders. Sustainable harvest with proper buy-back guarantee will provide considerable off-farm employment opportunities to the local inhabitants. Traditional and local communities are the true resource managers with deciding roles in the conservation, management, use and development of MAPs in the Himalayan region. The conservation and management of MAPs in their natural habitat require active involvement of the local communities at every step. Therefore, effective training and capacity building focused on domestication/cultivation and conservation, improved marketing systems and processing/semi processing, bio-prospecting and value addition locally are the appropriate short and longterm solution to assure conservation and management and sustainable livelihoods to the local communities.

**TI: Medicinal plant raw materials for Indian drug and pharmaceutical industry. I. An appraisal of resources.**

**AU:** Sarin-Y-K {a}

**AD:** {a} 21-C, Chandralok Colony, Rajpur Road, Dehra Dun, Uttaranchal, India, India


**PY:** 2003

**AB:** India has a fast growing drug and pharmaceutical industry producing plant based medicines, phyto-pharmaceuticals and over-the-counter products. The country also exports a number of crude drugs and their extracts. The number of plant species yielding raw materials used by the industry on regular basis and/or in substantially large quantities is put at around 340. Among these, 145 occur wild in forests or other forms of natural vegetation, 54 grow as weed, 70 are grown as cash crop for other plant based products, 30 are cultivated as medicinal crop and around 40 are imported from other countries. There has been a tremendous increase in the production of herbal medicines and other items in recent years. This has put great pressure on the raw material resources. Natural population of many medicinal plants has declined to a great extent while a few are at the verge of extinction. A sort of scare prevails among various quarters regarding the decline in the supply of the raw materials or even its discontinuation. Though the fears expressed are quite valid there is a scope not only for damage control but also augmentation of resources assuring continued supplies in future. This paper makes an appraisal of present status of raw material resources and discusses prospects of its development.
Global trade of Medicinal Plants is worth US dollar sign60 billion and is increasing at the rate of 7% per year. This has led to scarcity of medicinal plants in natural forests. Many national and international organizations have opined that the sustainable management of medicinal plants has a potential for income generation and poverty alleviation provided that the resources are extracted sustainably. However, there is lack of information on inventory methods, safe harvest limits, regeneration status and management prescriptions, which are essential for management of this important resource in natural forests. This is attributed to traditional forest management systems, which are timber oriented. The characteristic features of medicinal plants are described and it is argued that some modifications are required in traditional forest management to make it suitable for management of medicinal plants in natural forests.

South-East Asia, Africa, Latin America and Eastern Europe provide nearly 90 per cent of raw materials for medicinal exploitation. It is revealed that there are actually 121 plants that yielded prescription drugs as a result of the study on 35,000 species of plants. About 5,000 species world over are considered to have been examined thoroughly for the active principles. Only 41 species generate commercial sales to the tune of USdollar sign 40 billion per year with non-formulation drugs as adjuncts claiming nearly USdollar sign60 billion. The Indian region endowed with nearly 20,000 species of plants highlight 75 major species of medicinal flora, out of which at least 25 were most sought after during the last decade. Nearly 3600 species of documented medicinal flora 540 find major use as herbal drugs (about 200 of these are used in bulk quantities and are of commercial potential). The families of plants such as Apocynaceae, Celastraceae, Compositae (Asteraceae), Simaroubaceae, Rutaceae, Thymelaeaceae, Magnoliaceae, Annonaceae, Boraginaceae, Leguminosae (Fabaceae), Liliaceae, Rubiaceae, Gymnosperms (Cephalotaxaceae) have anti-cancer drug yielding species. The paper provides botanical-cumphytogeographical regions of the country with specific elements of medicinal flora. The need for categorizing the rare and threatened medicinal and aromatic flora as per IUCN Red Data enlisting norms has been emphasized in the paper. Research need and priorities targeting different activities on the aspects of (i) Inventorization and Characterization, (ii) Monitoring and Assessment, (iii) Ex-situ Conservation, (iv) In-situ Conservation and (v) Utilization have been outlined in the paper.

Across the borderline of Nepal and India in the Jhulaghat region of Pithoragarh District (Uttaranchal), a total of 16 medicinal plants were documented during the present survey, which are in trade for commercial purpose. Most of these medicinal plants are being collected from the Baitedi District of Nepal and then
supplied to the India via Jhulaghat and Dharchula. Reetha (Sapindus mukorosii) was traded commercially in highest quantity (about 4,000 qtls) during 2001-2002. Six species of rare and endangered categories were also collected from Baitadi District for sale to India, inspite of the total ban on their collection for commercial purpose. Based on the survey and findings, various conservation and management steps have been discussed to protect the medicinal plants and also for future course of action.

**TI:** Breeding, improvement and germplasm conservation of medicinal and aromatic plants - A review

**AU:** Verma,-S-K [Author,-Reprint-Author]; Sharma,-S-K [Author]; Singh,-Charan [Author]; Mehta,-H [Author]

**AD:** Div Genet and Tree Propagat, Forest Res Inst, Dehra Dun, Uttar Pradesh, India

**SO:** Indian-Forester. 2004; 130(3): 291-303

**PY:** 2004

**AB:** Medicinal plants have a long history of their association with humankind since time immemorial. Indian, Chinese and the other oriental systems of medicines are dependent on medicinal plants besides the traditional use of a range of plants as medicines by tribals living in the forests as has been brought out in different ethno-botanical studies. The Asiatic flora includes tropical, sub-tropical and temperate species used in modern medicines and aroma industries. The genetic erosion rates of medicinal flora are alarming leading to shrinking biodiversity and this calls for invoking all feasible breeding methods and strategies to increase genetic variation and augment it to conservation of already existing variation. The methods of conservation could be in-situ and ex-situ. Among in-situ conservation, natural reserves, forest reserves, national parks etc. are included while in ex-situ (off site) conservation, gene banks, herbal garden, seed orchards and in-vitro methods of conservation viz, shoot culture and plant cell suspension culture are included. The advents of molecular tools have opened up new vistas of mobilizing genes across genera and taxa and plant improvement through marker assisted selection (MAS). These new techniques along with already existing time-tested methods can be useful complements for future germplasm improvement and conservation.

**TI:** Status and scope of medicinal plants in Bhagirathi valley of Garhwal, Uttarakhand - Conservation strategy

**AU:** Chandola,-S [Author,-Reprint-Author]; Singh,-S-K [Author]

**AD:** Conservator Forests, Bhagirathi Circle, Tehri Garhwal, Uttarakhand, India

**SO:** Indian-Forester. 2003; 129(8): 950-963

**PY:** 2003

**AB:** Conservation of medicinal/aromatic plants and the environment will be possible only with the precondition that our political leadership and policy makers become alive to this problem and take some really strong decisions. Since the Forest Department has to play a major role in this initiative by virtue of being the dominant custodian of the natural resource of land and forest, it should be ready for a major attitudinal change in favour of an ecosystems approach to forestry. The public of Uttarakhand are the predominant stakeholders, and will have to assert themselves against the threat of grazing, pilferage and fire. Our scientists and NGOs also have to play a very important role in this strategy of in-situ and ex-situ revival of medicinal plants. In addition to the others, the industry is expected to adopt a role that is beneficial to all stakeholders. The Bhagirathi valley is endowed with a rich wealth of medicinal and aromatic plants ranging from Sub Tropical to Alpine species. This invaluable resource is, however, under serious threat from severe depletion due to grazing, pilferage, fire and social indiscretions in utilization. Eight mega centers for the conservation of medicinal plants have been suggested which need to be protected by establishment of MPCAs. This insitu intervention needs to be closely dovetailed with ex-situ cultivation and conservation along with Eco Tourism as a major part of the strategy. In pursuance of this goal, seven medicinal plant gene repositories have been raised with over 200 important medicinal plant species. Other important issues closely related to the development of Uttarakhand as a herbal state are Research, for propagation and conservation, Standardisation of herbal produce, the need for strong regulations against unlawful removal from the forests, patenting of traditional knowledge and formulations, and, last but not the least, the
necessity to organize a transparent market. With proper planning and a concerted effort from all the stakeholders, specially the political leadership and the policy makers, Uttaranchal stands a fair chance of garnering a major share of the national and international market of medicinal and aromatic plants.

**TI: Sacred plants of district Haridwar (Uttaranchal) and their medicinal uses.**

**AU:** Dhiman,-Anil-Kumar [Author,-Reprint-Author]

**AD:** Central Library, Gurukul Kangri University, Haridwar, Uttaranchal, 249 409, India

**SO:** Advances-in-Plant-Sciences. 2003; 16(2): 377-384

**PY:** 2003

**AB:** In India, various Gods and Goddess are worshipped in Hindu religion throughout India. Various plant parts like, bark, twigs, leaves, flowers fruits and seeds are offered to Gods and Goddess, as the parts of worship. This paper discusses some of the sacred plants of district Haridwar, which are being used in traditional religious rituals and ceremonies by the local people. These plants don't only have sacred utility but also have medicinal potential and are used for curing many diseases in folk uses.

**TI:** Prioritization of medicinal plants on the basis of available knowledge, existing practices and use value status in Uttaranchal, India.

**AU:** Kala,-Chandra-Prakash [Author]; Farooquee,-Nehal-A [Author]; Dhar,-Uppeandra [Author,-Reprint-Author]

**AD:** G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora, Uttaranchal, 263 643, India

**SO:** Biodiversity-and-Conservation. 2004; 13(2): 453-469

**PY:** 2004

**AB:** In order to understand the pattern of indigenous uses of medicinal plants available in the Uttaranchal state of the Indian Himalaya, this study was undertaken through literature survey and fieldwork in various parts of the state. A list of all the major and most of the lesser categories of ailments was prepared and categorized with the help of medical practitioners. A total of 300 plant species used in curing 114 ailments prevailing in various ethnic and non-ethnic communities of Uttaranchal were documented. These 114 ailments were further grouped into 12 broad classes of diseases in order to project the indigenous uses of medicinal plants for various ailments. It was found that herbs contributed the highest number of medicinal plants (65%), followed by shrubs (19%) and trees (16%). The maximum number of plant species were used to cure generalized body aches and colic, followed by gastrointestinal and dermatological problems. Vitex negundo was the most important species, used for the treatment of more than 48 ailments. Azadirachta indica, Woodfordia fruticosa, Centella asiatica, Aegle marmelos, Cuscuta reflexa, Butea monosperma, Phyllanthus emblica, and Euphorbia hirta were among other important medicinal plants based on their high use values. The underground parts of the plant were used in the majority of cases. Of 300 medicinal plants, 35 were rare and endangered species, of which about 80% was restricted to the high altitude alpine region of Uttaranchal Himalaya. A priority list of 17 medicinal plant species was prepared on the basis of endemism, use value, mode of harvesting and rarity status. Strategies for long-term conservation of these valuable medicinal plants are discussed.

**TI:** Phenolic contents and antioxidant activity of some food and medicinal plants

**AU:** Bajpai,-Monika [Author]; Pande,-Anurag [Author]; Tewari,-S-K [Author]; Prakash,-Dhan [Author,-Reprint-Author]

**AD:** Natl Bot Res Inst, Lucknow 226001, Uttar Pradesh, India


**PY:** 2005

**AB:** To identify promising sources of antioxidants, some food and medicinal plants were studied for total phenolic contents and antioxidant activity. The leaves, bark and fruits of Terminalia arjuna, Terminalia
bellerica, Terminalia chebula and Terminalia muelleri, the leaves and fruits of Phyllanthus emblica, and the seeds of Syzygium cumini were found to have high total phenolic contents (72.0-167.2 mg/g) and high antioxidant activity (69.6-90.6%). Leaves of Eucalyptus globulus were a rich source of rutin, Moringa oleifera for kaempferol, aerial parts of Centella asiatica for quercetin, fruits of T. bellerica and T. chebula for gallic acid, and bark of T. arjuna, leaves and fruits of T. bellerica and bark, leaves and fruits of T. muelleri for ellagic acid.

**TI: Wild medicinal plants of Jaunsar-Bawar (Western Himalayas) Uttaranchal - I**

**AU:** Singh,-Dhan [Author,-Reprint-Author]; Pundir,-Y-P-S [Author]

**AD:** DBS Coll, Dept Bot, Dehra Dun, Uttar Pradesh, India

**SO:** Indian-Forester. 2004; 130(11): 1259-1271

**PY:** 2004

**AB:** The paper reports fifty wild medicinal plants used by the natives of Jaunsar-Bawar, Western Himalayas, Uttaranchal.

**TI: Determination of nutritive value and analysis of mineral elements for some medicinally valued plants from Uttaranchal**

**AU:** Indrayan,-A-K [Author,-Reprint-Author]; Sharma,-Sudeep [Author]; Durgapal,-Deepak [Author]; Kumar,-Neeraj [Author]; Kumar,-Manoj [Author]

**AD:** Gurukula Kangri Univ, Dept Chem, Nat Prod Lab, Hardwar 249404, India

**SO:** Current-Science-(Bangalore). 2005; 89(7): 1252-1255

**PY:** 2005

**AB:** Study of different medicinally valued seeds of Nelumbo nucifera, Embelia ribes, Eugenia jambolana and leaves of Artocarpus heterophyllus showed Cr, K, Ca, Cu, Zn and Mn to be sufficient in seeds of N. nucifera which also have good nutritive value and are quite rich in carbohydrates accompanied by enough protein, but are low in fat. E. ribes seeds have even a higher nutritive value with high carbohydrate, enough mineral elements but low protein. Rich in Mg and moderate in protein, the E. jambolana seeds have a moderate nutritive value. A. heterophyllus leaves are not rich in desired mineral elements except Na, and have a low nutrition value. However, on a dry matter basis they too have a high nutritive value and are used as fodder for livestock.

**TI: Organogenesis, embryogenesis, and synthetic seed production in Arnebia euchroma - A critically endangered medicinal plant of the Himalaya**

**AU:** Manjkhola,-Sumit [Author]; Dhar,-Uppeandra [Author,-Reprint-Author]; Joshi,-Meena [Author]

**AD:** GB Pant Inst Himalayan Environm and Dev, Almora 263643, Uttaranchal, India

**SO:** In-Vitro-Cellular-and-Developmental-Biology-Plant. 2005; 41(3): 244-248

**PY:** 2005

**AB:** This is the first report of simultaneous organogenesis and somatic embryogenesis in Arnebia euchroma, a highly valued, critically endangered medicinal plant of the Himalaya. Root-derived callus showed only rhizogenesis, whereas leaf-derived callus showed simultaneous organogenesis and somatic embryogenesis. Organogenesis was optimal (12.2 shoots per culture) in 1 mu M indole-3-butyric acid combined with 2.5 mu M 6-benzyladenine and induction of somatic embryogenesis (16.3 embryos per culture) occurred in 2.5 mu M indole-3-butyric acid combined with 2.5 mu M 6-benzyladenine. Shoots rooted (100%) best in half-strength Murashige and Skoog (MS) medium supplemented with 2.0 mu M indole-3-butyric acid. Early cotyledonary-stage embryos encapsulated with 3% sodium alginate and calcium nitrate (100 mM for 25 min) showed 60.6% germination in MS medium. Rooted shoots transferred to a mixture of sterile soil, sand, and peat (1:1:1 by volume) showed 72% survival ex vitro. Application of these protocols would be helpful in reducing pressure in natural populations, in genetic transformation studies, and in long-term storage of elite genotypes through synthetic seed production.
TI: Does the outreach programme make an impact? A case study of medicinal and aromatic plant cultivation in Uttaranchal

AU: Maikhuri,-R-K [Author,-Reprint-Author]; Rao,-K-S [Author]; Kandari,-L-S [Author]; Joshi,-R [Author]; Dhyani,-Deepak [Author]
AD: GB Pant Inst Himalayan Environm and Dev, Garhwal Unit, Srinagar 246174, Jammu and Kashmir, India
PY: 2005
AB: Farmers-to-farmers training programme (FFTP) is a tool to build and strengthen capabilities of farmers, extension workers associated with NGOs and government department in selecting potential species and enhancing the area under medicinal and aromatic plant (MAP) cultivation in the Himalaya. The programme has helped participants change their attitudes considerably towards the role and values of medicinal plant in current changing scenario at the local, regional, national and global level. These programmes are conducted in the farmers' field itself, and this enables the participants to have a better understanding of the problems faced by the farmers and how they overcome them. During these programmes, a holistic understanding of domestication (nursery raising) and cultivation and conservation of medicinal plants and exchange of indigenous knowledge are facilitated among participants. Scientific assessment and impact analyses carried out by researchers identified the need for further research and sustained government programme interventions to strengthen the infrastructure and extension inputs. Furthermore, the programme has shown that there is a need to adopt appropriate policy, which must integrate the cultivation of MAPs with local people's socio-economic development and also develop location-specific technologies so as to maximize the use of local resources and reduce the use of external inputs.

TI: Medicinal status of some common weeds of Shivalik Garhwal Himalaya

AU: Negi,-Surendra-Singh [Author,-Reprint-Author]; Negi,-Shalini [Author]; Negi,-K-S [Author]
AD: Govt PG Coll, Dept Bot, Kotdwara 246149, Uttaranchal, India
PY: 2004
AB: Garhwal Himalaya of Uttaranchal occupies a significant position in the phytogeography of India, as it is the hub of flora of therapeutic value. Along with rich biodiversity, the weed flora constitutes a significant portion of the vegetation. From an extensive survey programme, some common weeds of potential medicinal value were screened out and medicinal uses of these screened weed species have been given alphabetically in the enumeration along with coloured plates.

TI: Indigenous uses, population density, and conservation of threatened medicinal plants in protected areas of the Indian Himalayas

AU: Kala,-Chandra-Prakash [Author,-Reprint-Author]
AD: GB Pant Inst Himalayan Environm and Dev, Kosi Katarmal, Almora Uttaranchal, 263643, India
PY: 2005
AB: For 10 years I monitored the population density of threatened medicinal plant species in seven protected areas in the Indian Himalayas. I also documented the indigenous uses of threatened medicinal plants through interviews with 138 herbal healers (83 Tibetan healers and 55 Ayurvedic healers) residing in the buffer zone villages of these protected areas. To assess the population status of threatened medicinal plant species, I sampled the 10 major habitat types in the protected areas. In all, I found 60 threatened medicinal plant species during the study period, of which 54 species occurred in the sampling plots. Twenty-two percent of threatened medicinal plant species were critically endangered, 16% were endangered, and 27% were vulnerable. Thirty-two threatened medicinal plant species were endemic to the Himalayan region.
The density of threatened medicinal plant species varied with protected areas. The Valley of Flowers protected area had the highest number of threatened medicinal plant species. The "moist" habitat type was richest in these species among all 10 habitat types sampled. Arnebia euchroma (Royle ex Benth.) Johnston and Ephedra gerardiana Wall. ex Stapf. were the most common threatened medicinal plant species. The indigenous groups of healers used these threatened species in curing about 45 different ailments. Based on my findings, I believe that to ensure the long-term sustainability of threatened medicinal plants, medicinal-plant conservation areas should be established.

**TI: Current research on medicinal plants: Five lesser known but valuable aspects**

**AU:** Dhyani,-Pitamber-Prasad [Author,-Reprint-Author]; Kala,-Chandra-Prakash [Author]
**AD:** GB Pant Inst Himalayan Environm and Dev, Almora, 263643, India
**SO:** Current-Science-(Bangalore). 2005; 88(3): 335
**PY:** 2005

**TI: Developing propagation techniques for conservation of Heracleum candicans - an endangered medicinal plant of the Himalayan region**

**AU:** Joshi,-Meena [Author]; Manjkhola,-Sumit [Author]; Dhar,-Uppeandra [Author,-Reprint-Author]
**AD:** GB Pant Inst Himalayan Environm and Dev, Almora, Uttaranchal, 263643, India
**PY:** 2004
**AB:** Heracleum candicans, an endangered medicinal plant of commercial value, is subject to heavy exploitation in the wild. This paper presents findings on the effect of the growing medium (or substrate) on seedling performance, propagation from rhizome cuttings and in vitro propagation protocols. Seedlings were obtained from 14 d prechilled seeds. Seedling growth was best in a mixture of sand and soil (1:1 by volume). Cuttings taken from the terminal growing part of rhizomes resulted in 67% rooting, following treatment with 100 mg I-1 indole-3-butyric acid (IBA). Cotyledonary leaf explants responded better (29 shoots/explant) than cotyledonary node explants for organogenesis using MS medium supplemented with 10 muM 6-benzyladenine. Of the harvested shoots 74 % rooted in MS medium supplemented with 4 muM IBA. Rooted shoots transferred to 120 g sterile soil; sand and peat mixture (1:1:1 by volume) showed 70% survival ex vitro.

**TI: Developing propagation techniques for conservation of Heracleum candicans - an endangered medicinal plant of the Himalayan region.**

**AU:** Meena-Joshi; Sumit-Manjkhola; Uppeandra-Dhar
**AD:** G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora - 263 643 (Uttaranchal), India.
**PY:** 2004
**AB:** H. candicans, an endangered medicinal plant of commercial value, is subject to heavy exploitation in the wild. This paper presents findings on the effect of the growing medium (or substrate) on seedling performance, propagation from rhizome cuttings and in vitro propagation protocols. Seedlings were obtained from 14-day prechilled seeds. Seedling growth was best in a mixture of sand and soil (1:1 by volume). Cuttings taken from the terminal growing part of rhizomes resulted in 67% rooting, following treatment with 100 mg IBA/litre. Cotyledonary leaf explants responded better (29 shoots/explant) than cotyledonary node explants for organogenesis using MS medium supplemented with 10 micro M 6-benzyladenine. Of the harvested shoots, 74% rooted in MS medium supplemented with 4 micro M IBA. Rooted shoots transferred to 120 g sterile soil, sand and peat mixture (1:1:1 by volume) showed 70% survival ex vitro.
TI: Agro-techniques of medicinal plants.

AU: Ravindra-Sharma
AD: Green Foundation, Dehradun (Uttaranchal), India.
SO: Agro-techniques-of-medicinal-plants. 2004; xiv + 264
PY: 2004
AB: This book consists of 11 chapters covering different aspects related to the cultivation and utilization of medicinal plants, i.e. nursery technology, biofertilizers and biological pest control, organic farming, agrotechniques, harvesting technology and value-addition, adulteration and substitution, market potential (export/import), standardization and quality control, legislation and policy, sustainable conservation and development strategies. This book may serve as a ready manual and information database for policy makers, administrators, academe, exporters, extension workers, manufacturers, growers and general readers interested in medicinal plants.

TI: Cultivating a healthy enterprise - developing a sustainable medicinal plant chain in Uttaranchal - India.

AU: Belt,-J; Lengkeek,-A; Zant,-J-van-der
AD: Royal Tropical Institute (KIT), PO Box 95001, 1090 HA Amsterdam, Netherlands.
PY: 2003
AB: This book presents an overview of the major issues in developing the supply chain for medicinal plants in Uttaranchal, India. Chapter 2 discusses the importance of medicinal plants in relation to agricultural diversification, income generation, and biodiversity conservation. Chapter 3 describes the current status of medicinal plants in the state of Uttaranchal, largely based on secondary data. Chapter 4 presents the findings of field research in Chamoli district. It is concluded that Uttaranchal has the potential to become a major supplier of medicinal plants. The central question is how this opportunity can be transformed into reality. Recommendations are made in chapter 5 regarding policy reforms, stakeholder dialogue, the promotion of cultivation and removal of market uncertainties.

TI: Conservation of some Himalayan medicinal plants using biotechnological approaches.

AU: Anil-Kumar; Nandi,-S-K; Bhuwan-Chandra; Mohinder-Pal
AD: G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora (Uttaranchal), India.
PY: 2004
AB: The Indian Himalayan Region harbours a large number of economically important plants, which include several species of medicinal value. The ever increasing demand, particularly in view of world-wide shift for the drugs of herbal origin over synthetic counterparts, has led to overexploitation of medicinal plants. In addition, the lack of organized cultivation has resulted in many of these plants finding place in the list of vulnerable, endangered or threatened categories. Thus, there is an immediate need for mass multiplication of many of these species to make available the planting material for taking up organized cultivation. This article reviews the work on in-vitro multiplication of Taxus baccata subsp. wallichiana, Podophyllum hexandrum, Aconitum balfourii and Picrorhiza kurroa, with particular reference to work carried out in the laboratory. The importance of selecting elite planting materials (in relation to active ingredient content) from natural populations and the application of molecular markers to characterize the genetic diversity within and among different populations are discussed. Moreover, alternative methods of obtaining active principle(s) through callus, suspension and hairy root cultures for these medicinal plants are highlighted. These aspects have been dealt with keeping in focus the dual objectives of conservation and meeting the commercial demands through cultivation.
**TI:** Indigenous uses and ethnobotany of Cannabis sativa L. (hemp) in Uttaranchal (India).

**AU:** Shah, N-C
**AD:** CIMAP, CSIR, Lucknow, India.
**SO:** Journal of Industrial Hemp. 2004; 9(1): 69-77
**PY:** 2004
**AB:** C. sativa is one of the oldest food, fibre, medicinal, psychoactive and oil plants known. It has been used by innumerable ethnic societies in Asia. Uttaranchal (India) is an ethnic region where the plant is a part of the local culture. In this paper, the indigenous uses and ethnobotany of its seed, seed oil, stems, fibre, leaves, inflorescences and resin along with various recipes of seeds are described. A theory of its introduction to Uttaranchal by ethnic races is also given. It is concluded that in the light of the present commercial and industrial uses of Cannabis its cultivation should be promoted in Uttaranchal and other parts of the Himalayan regions of India, where it grows naturally and is cultivated for folk uses.

**TI:** Prioritization of medicinal plants on the basis of available knowledge, existing practices and use value status in Uttaranchal, India.

**AU:** Kala, C-P; Farooquee, N-A; Uppeandra-Dhar
**AD:** G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora, Uttaranchal 263 643, India.
**SO:** Biodiversity and Conservation. 2004; 13(2): 453-469
**PY:** 2004
**AB:** In order to understand the pattern of indigenous uses of medicinal plants available in the Uttaranchal state of the Indian Himalaya, this study was undertaken through literature survey and fieldwork in various parts of the state. A list of all the major and most of the lesser categories of ailments was prepared and categorized with the help of medical practitioners. A total of 300 plant species used in curing 114 ailments prevailing in various ethnic and non-ethnic communities of Uttaranchal were documented. These 114 ailments were further grouped into 12 broad classes of diseases in order to project the indigenous uses of medicinal plants for various ailments. It was found that herbs contributed the highest number of medicinal plants (65%), followed by shrubs (19%) and trees (16%). The maximum number of plant species were used to cure generalized body aches and colic, followed by gastrointestinal and dermatological problems. Vitex negundo was the most important species, used for the treatment of more than 48 ailments. Azadirachta indica, Woodfordia fruticosa, Centella asiatica, Aegle marmelos, Cuscuta reflexa, Butea monosperma, Phyllanthus emblica, and Euphorbia hirta were among other important medicinal plants based on their high use values. The underground parts of the plant were used in the majority of cases. Of 300 medicinal plants, 35 were rare and endangered species, of which about 80% was restricted to the high altitude alpine region of Uttaranchal Himalaya. A priority list of 17 medicinal plant species was prepared on the basis of endemism, use value, mode of harvesting and rarity status. Strategies for long-term conservation of these valuable medicinal plants are discussed.

**TI:** Sustainable cultivation of medicinal plants - community participation in Uttaranchal.

**AU:** Umesh-Tripathy; Dilbagh-Kaur; Rameshchandra-Maheswari
**PY:** 2003
**AB:** This study, conducted in 12 villages in the Chamba region of Uttaranchal, India, establishes that the declining farming livelihoods in the area can be revived through state-supported cultivation of medicinal plants. Infrastructural and institutional constraints to medicinal plant cultivation are identified, and possible strategies are presented, including the emphasis on community participation.
TI: Some rare and imperfectly known medicinal plant species of Uttaranchal.

AU: Chandola, S
AD: Wildlife Warden, Uttaranchal, Dehra Dun (Uttaranchal), India.
SO: Indian Forester. 2005; 131(3): 341-345
PY: 2005
AB: Valuable species have been removed for so long and so intensively from the wild that they have come to the brink of extinction. The market forces, however have been so strong that substitutes have emerged to satisfy the demand, and over time the substitute has assumed the importance of the original drug. The present paper deals with correct identity of Akarkara (Anacyclus pyrethrum), Chirayta (Swertia chirata), Kuth (Saussurea costus), Salam Mishri (Eulophia dabia). Gentiana kurroo has been rediscovered after a lapse of 50 years. It is time now to educate ourselves and to adopt the latest benefits of modern science to retrieve the true herbs species from final annihilation. Serious Species Recovery Programmes need to be initiated for the highly threatened plants.

TI: Problems of medicinal plant wealth upon the phytogeography of Uttaranchal.

AU: Dhiman, A-K
AD: Gurukul Kangri University, Hardwar - 249 404 (U.A.), India.
PY: 2005
AB: Uttaranchal is a newly established Indian state that possesses a rich potential in medicinal plant cultivation and utilization. However, exploitation of such plants led to the decline in vegetations supporting the growth of medicinal plants. This paper discusses the dynamics of such vegetations, identifies the main reasons for their decline, and suggests probable strategies to overcome problems related to overexploitation of medicinal plants. A list of endangered medicinal plants in Uttaranchal is also given.

TI: Success stories in water harvesting from Bajeena and Naila Villages, Almora District, Uttaranchal.

AU: Bikash Sharma; Asim Mirza; Rakesh Prasad
AD: International Centre for Integrated Mountain Development (ICIMOD), 4/80 Jawalakhel, G.P.O. Box 3226, Kathmandu, Nepal.
SO: ICIMOD,-Newsletter-of-the-International-Centre-for-Integrated-Mountain-Development. 2006; (49): 19-20
PY: 2006
AB: Water scarcity is a growing problem for mountain communities and causes hardship to women and girls, who must spend may hours each day collecting water from distant sources. This paper focuses on two successful water harvesting experiments in Bajeena and Naila villages in Almora district, Uttaranchal, India, which had a positive impact on the livelihoods of the women in these villages.

TI: Organogenesis, embryogenesis, and synthetic seed production in Arnebia euchroma - a critically endangered medicinal plant of the Himalaya.

AU: Sumit Manjkhola; Uppeandra Dhar; Meena Joshi
SO: In-Vitro-Cellular-and-Developmental-Biology-Plant. 2005; 41(3): 244-248
PY: 2005
AB: This is the first report of simultaneous organogenesis and somatic embryogenesis in Arnebia euchroma, a highly valued, critically endangered medicinal plant of the Himalaya. Root-derived callus showed only rhizogenesis, whereas leaf-derived callus showed simultaneous organogenesis and somatic embryogenesis.
Organogenesis was optimal (12.2 shoots per culture) in 1 micro M indole-3-butyric acid combined with 2.5 micro M 6-benzyladenine and induction of somatic embryogenesis (16.3 embryos per culture) occurred in 2.5 micro M indole-3-butyric acid combined with 2.5 micro M 6-benzyladenine. Shoots rooted (100%) best in half-strength Murashige and Skoog (MS) medium supplemented with 2.0 micro M indole-3-butyric acid. Early cotyledonary-stage embryos encapsulated with 3% sodium alginate and calcium nitrate (100 mM for 25 min) showed 60.6% germination in MS medium. Rooted shoots transferred to a mixture of sterile soil, sand, and peat (1:1:1 by volume) showed 72% survival ex vitro. Application of these protocols would be helpful in reducing pressure in natural populations, in genetic transformation studies, and in long-term storage of elite genotypes through synthetic seed production.

**TI:** Ecological features of a critically rare medicinal plant, Swertia chirayita, in Himalaya.

**AU:** Arvind-Bhatt; Rawal,-R-S; Uppeandra-Dhar

**AD:** Conservation of Biological Diversity Core, G. B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263 643 (UA), India.

**SO:** Plant-Species-Biology. 2006; 21(1): 49-52

**PY:** 2006

**AB:** An experiment was conducted during May and June 2001 in Kanchula (KN), Kalaseer (KL) and Duggalbitha (DG) in Uttarakhand, India, and Pullag (PL) and Dora (DR) in Himachal Pradesh, to provide quantitative details of Swertia chirayita [Swertia chirata] through: (i) assessment of the distribution patterns and quantum of availability; and (ii) analysis of variations in biomass among natural populations. Almost all populations of Swertia chirayita examined grew under the canopy of Acer and Quercus mixed forests, mostly on a southeast aspect. Anaphalis triplinervis, Anemone obtusiloba, Stachys sericea [Stachys emodi] and Polygonum amplexicaule were the common associates of Swertia chirayita. The density of Swertia chirayita was low in all populations and ranged between 1.65 and 2.35 individuals per m². The frequency of occurrence was high (90-95%) in all populations and either matched or exceeded the frequency of the other dormant species in the plot. Patterns of abundance:frequency ratio revealed random distributions in KN, PL and DR populations and regular distributions in DG and KL populations. The maximum value of aboveground biomass was observed in the flowering stage when comparing biomass during the different stages. There was significantly higher aboveground biomass observed in the KN population. The maximum value of below ground biomass was, however, obtained in the senescence stage. The variation in mean below ground biomass of the flowering and senescence stages was significant in all populations. In all cases (except DR), total biomass was greater at the flowering stage. However, total biomass of the flowering and senescence stages did not show significant variation except in the KN population.

**TI:** Recent advances in research on seed technology of medicinal plants - Indian scenario.

**AU:** Manisha-Thapliyal; Thapliyal,-R-C

**AD:** Forest Tree Seed Laboratory, Silviculture Division, Forest Research Institute, Dehra Dun 248 006, Uttarakhand, India.


**PY:** 2005

**AB:** Plants are the source of raw materials for medicines manufactured under various systems of pharmacology. There has been tremendous pressure on the natural populations of medicinal plants because of their extensive use as raw materials for the drug industry. WHO estimated that 80% of the population of developing countries rely on traditional medicines, especially plant drugs, for their primary health care needs. Demands for medicinal plants is ever increasing in both developing as well as developed countries. The main reasons for the growing recognition of natural products include their being non-narcotic, having no reported side effects, availability at affordable prices and sometimes being the only option of health care available to the poor. Medicinal plants as a group comprises of approximately 8000 species (being used by people in India) and account for 50% of all the higher flowering plant species in India. Though India is rich in biodiversity, the demand for medicinal plants is increasing and as a result, the existence of some of them
is being threatened in their natural habitat. Many of the valuable species may be lost forever. One of the best techniques to conserve threatened medicinal plant species is through ex-situ cultivation. Development of cultivation packages includes optimizing their seed germination and development of nursery raising techniques. Very little research effort has been made on medicinal plant seeds e.g. precise time of seed collection, processing, germination, viability and vigour, storage physiology, etc. which are prerequisite for undertaking any cultivation and conservation program. In this article, recent developments on medicinal plant seed technology research in India during the last few years has been reviewed so that the gaps in our understanding and knowledge in this field may be brought out and the need to undertake programs for conservation of medicinal plants of commercial interest can be highlighted to ensure their adequate availability for future generations.

**TI:** Traditional knowledge on medicinal plants among rural women of the Garhwal Himalaya, Uttarakhand.

**AU:** Bhagwati-Uniyal; Vandana-Shiva

**AD:** Type IV/11 (Residential Complex) Wildlife Institute of India, Post Box No 18, Chandrabani, Dehradun 248 001, India.

**SO:** Indian-Journal-of-Traditional-Knowledge. 2005; 4(3): 259-266

**PY:** 2005

**AB:** The present paper deals with traditional knowledge of medicinal plants among rural women of Garhwal, Uttarakhand, India. Seventy women of 11 villages were interviewed on the basis of their traditional knowledge on the various uses of medicinal plants found in the adjoining forest and agricultural areas. A total of 113 medicinal plant species were recorded during the intensive surveys and discussions held with the rural women.

**TI:** Phenology and biology of Arnebia benthamii: a critically endangered medicinal plant of the Himalaya.

**AU:** Sumit-Manjkhola; Uppeandra-Dhar; Rawal, R-S

**AD:** Core Group - Conservation of Biological Diversity, G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora - 263 643 (Uttaranchal), India.


**PY:** 2005

**AB:** A. benthamii, a critically endangered high-value medicinal herb, is endemic to Himalaya. The species is subject to heavy anthropogenic pressure, both due to indigenous uses and extraction for pharmaceutical preparations. In field surveys conducted in India during 1999-2003, A. benthamii, which was found to be distributed towards subalpine and alpine areas (3000-3650 m), is a monocarpic perennial plant that flowers on the fourth year after establishment. The species is heterostylos and self-incompatible with pin (flowers with long styles and short stamens) and thrum (flowers with short style and long stamen) type of individuals.

The maintenance of 1:1 pin-thrum ratio is desirable for species persistence. On account of increased interest in global warming, ozone layer depletion and related issues, phenology can serve as an indicator of vegetation change by comparing past phenological responses of seasonal changes with current ones. The study provides important clues for the development strategies for the conservation of the species.

**TI:** Effect of various presowing treatments on seed germination of Heracleum candicans Wall. ex DC.: a high value medicinal plant.

**AU:** Joshi, M; Dhar, U

**AD:** G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora - 263 643 (Uttaranchal), India.

**SO:** Seed-Science-and-Technology. 2003; 31(3): 737-743
The paper describes the effect of presowing treatments to improve percentage germination and reduce mean germination time (MGT) of *H. candicans*. Of the various pretreatments tried, 14 days chilling at 4 degrees C significantly (P<0.05) improved percentage germination (88.89%). Upon reducing the chilling duration (7 days) the improvement in germination was accompanied by increase in MGT. The lowest MGT was achieved through KNO3 treatment. Germination response varied significantly (P<0.05) between populations. Possible reasons for such variation is discussed.

**TI: Morphological and chemotypic comparison of certain Indian species of Swertia.**

**AU:** Ashwani-Bhatia; Maninder-Karan; Karan-Vasisht

**AD:** University Institute of Pharmaceutical Sciences, Panjab University, Chandigarh 160 014, India.


**AB:** Comparative morphological and chemical analyses were conducted for *S. angustifolia*, *S. lurida* and *S. nervosa* collected from Mussoorie, Uttar Pradesh, and *S. alternifolia* and *S. cuneata* collected from Kedarnath and Hemkund Sahib, Uttaranchal, India. *S. alternifolia* had round and hollow stems, while the other species had quadrangular stems. The stem was purple in *S. angustifolia*, reddish-purple in *S. cuneata*, and green and distinctly winged in *S. nervosa*. The leaves were opposite in all species except *S. alternifolia*, in which the leaves were alternate with a sheathing leaf base. The flower characteristics were the more distinguishing features of each species. *S. alternifolia* and *S. cuneata* had pentamerous flowers with a pair of hairy glands at the base of each petal. The other species were tetramerous. *S. alternifolia* had greenish-yellow flowers with greenish glands on each petal. The flowers of *S. cuneata* were purple-bluish or violet. *S. lurida* had small reddish-pink flowers with two green glands at the base of each petal. The other species had a single gland on each petal. *S. angustifolia* had white flowers with bluish-purple dots, and a yellowish-green non-hairy orbicular gland on each petal. *S. nervosa* had yellowish-white, purple-streaked flowers with a leaf calyx and hairy gland. Thin layer chromatography analysis of plant extracts revealed that amarogentin and amaroswerin were present only in *S. lurida*. However, other secoiridoids were detected in all the species at varying levels. The presence of xanthones in the hexane and chloroform extracts of the species was confirmed.

**TI: Effect of SADH and PP333 on growth and flowering attributes in Calendula officinalis.**

**AU:** Singh,-A-K

**AD:** Department of Horticulture, G. B. Pant University of Agriculture and Technology, Pantnagar - 263 145, Uttarakhand, India.


**AB:** The effects of growth retardants on the growth and flowering of *C. officinalis* were studied in Pantnagar, Uttaranchal, India in 2001/2002. SADH [daminozide] at 500, 1000 or 1500 ppm was applied at 30 and 60 days after transplanting (DAT), whereas paclobutrazol at 5, 10 or 15 mg per plant was applied at 30 DAT. Paclobutrazol at 10 mg per plant resulted in the highest number of branches (7.11) and leaves (203.78) per plant, leaf fresh weight (0.49 g), leaf area (355.50 cm2), and flower number (49.33) and weight (170.94 g) per plant. SADH at 1000 ppm was the second most effective in the enhancement of growth parameters and flower production. Flower bud initiation and flowering were delayed with the application of both growth retardants. SADH and paclobutrazol did not significantly affect leaf dry weight and flower diameter.
TI: Medicinal plant raw materials for Indian drug and pharmaceutical industry. II. Problems and prospects of development of resources.

AU: Sarin,Y-K
AD: 21-C, Chandralok Colony, Rajpur Road, Dehra Dun (Uttaranchal), India.
SO: Indian-Forester. 2003; 129(2): 143-153
PY: 2003
AB: Problems and prospects in the wide-scale utilization of medicinal plants for the Indian pharmaceutical industry are discussed, with emphasis on the issues related to resource inventory, qualitative and quantitative analyses of crude drugs, agronomic and economic evaluation of the geographical source of raw materials, availability of raw materials from natural sources, standardization of procedures for the evaluation of raw material quality, postharvest processing of raw materials, and resource augmentation through conservation, domestication and wide-scale cultivation.

TI: Medicinal trees of Uttaranchal State: distribution, use pattern and prospects for conservation.

AU: Adhikari,B-S; Babu,M-M; Saklani,P-L; Rawat,G-S
AD: Herbarium Section, Department of Habitat Ecology, Wildlife Institute of India, Dehra Dun (Uttaranchal), India.
SO: Indian-Forester. 2003; 129(2): 243-267
PY: 2003
AB: This paper presents an update on the distribution, use patterns and potential for conservation of medicinal trees in Uttaranchal, India. A total of 197 tree species belonging to 59 families were identified as medicinally important in the state. Euphorbiaceae, Fabaceae, Moraceae and Rosaceae are the largest families having more than 10 species of medicinal trees. The medicinal trees in different ecological regions found in sub-tropical, warm-temperate, cool-temperate, sub-alpine and alpine were 170, 64, 22, 10 and 4, respectively. The major plant parts used in various ailments are bark (118 species), leaves (78 species), fruits (65 species), root (42 species) and seed (30 species). The prospects of in situ and ex situ conservation of medicinal trees in Uttaranchal State are also discussed. An appendix provides detailed information on the medicinal use of trees, altitudinal range, parts used and uses for different ailments.

TI: Integrated nutrient management in rose scented geranium (Pelargonium graveolens) under tarai condition of Uttaranchal.

AU: Ram,P; Patra,N-K; Birendra-Kumar; Verma,R-S; Neeraj-Srivastava
AD: Central Institute of Medicinal and Aromatic Plants, Field Station, Panntagar - 263 149, U.S. Nagar, India.
PY: 2003
AB: A field experiment was conducted in Pantnagar, Uttaranchal, India during 2001-02 to determine the effects of organic and inorganic fertilizers on the essential oil production of geranium (P. graveolens) cv. Bourbon. Treatments comprised 150:60:40 kg NPK/ha (T1), 20 t farmyard manure (FYM)/ha (T2), 5 t vermicompost/ha (T3), 5 t Celrich/ha (T4), 1.5 l Multiplex/ha + 75:30:20 kg NPK/ha (T5), 10 t FYM/ha + 75:30:20 kg NPK/ha (T6), 2.5 t vermicompost/ha + 75:30:20 kg NPK/ha (T7) and 2.5 t Celrich/ha + 75:30:20 kg NPK/ha (T8). T1 resulted in the highest plant height (127 cm), number of leaves per plant (2650), leaf: stem ratio (1.75), and herb (393 q/ha) and oil (79.4 kg/ha) yield. Differences in the oil content due to the treatments were not significant.

TI: Medicinal plants based forest management: problems and prospects.

AU: Bhojvaid,P-P
AD: NWFP Division, Forest Research Institute, Dehra Dun (Uttaranchal), India.
AB: Global trade of medicinal plants is worth US$ 60 billion and is increasing at the rate of 7% per year. This has led to scarcity of medicinal plants in natural forests. Many national and international organizations have opined that the sustainable management of medicinal plants has a potential for income generation and poverty alleviation provided that the resources are extracted sustainably. However, there is lack of information on inventory methods, safe harvest limits, regeneration status and management prescriptions, which are essential for management of this important resource in natural forests. This is attributed to traditional forest management systems, which are timber oriented. The characteristic features of medicinal plants are described and it is argued that some modifications are required in traditional forest management to make it suitable for management of medicinal plants in natural forests.

**TI**: Commercial exploitation and conservation status of high value medicinal plants across the borderline of India and Nepal in Pithoragarh.

**AU**: Kala, C-P
**SO**: Indian-Forester. 2003; 129(1): 80-84
**PY**: 2003

AB: Field experiments were carried out between September and October 2002 across the borderline between India and Nepal in Pithoragarh District of Uttaran chal, India, to study and analyse the trade of medicinal plants, especially those of high economic and conservation importance. The current policy issues and their implications in sustainable management and utilization of medicinal plants are also studied in one of the remote regions of Uttaran chal Himalayas. Across the borderline of Nepal and India in the Jhulaghat region of Pithoragarh District, a total of 16 medicinal plants were documented, which are in trade for commercial purpose. Most of these plants are being collected from the Baitadi District of Nepal and then supplied to India via Jhulaghat and Dharchula. Reetha (Sapindus mukorossi) was traded commercially in the highest quantity (~4000 qtls) during 2002. Six species of rare and endangered categories were also collected from Baitadi District for sale to India, in spite of the total ban on their collection for commercial purpose. Based on the survey and findings, various conservation and management steps are discussed to protect the medicinal plants and also for future course of action.

**TI**: Rare and threatened medicinal orchids of Asthavarga group in Uttaran chal - Microstylis wallichii (Jeevak) and Microstylis muscifera (Rishabak).

**AU**: Dobriyal, M-J
**AD**: Non-Wood Forest Products Division, Forest Research Institute (ICFRE), Dehra Dun, India.
**SO**: MFP-News. 2003; 13(1): 3-4
**PY**: 2003

AB: Information on the morphology, phenology, habitat, geographical distribution, and medicinal properties of M. wallichii and M. muscifera, some of the threatened medicinal orchids inhabiting hills in Uttaran chal, India, is presented.

**TI**: Conserving forests in Uttarakhand: people's initiative.

**AU**: Rakesh-Agrawal
**SO**: Economic-and-Political-Weekly. 2002; 37(38): 3881-3883
**PY**: 2002

AB: Results are given of an in-depth study on the conservation of biodiversity in forests in Uttarakhand, Uttar Pradesh, India, Extensive discussions with the villagers and in-depth interviews with individuals were
conducted followed by comprehensive scientific studies to judge the extent of biodiversity in the area. The role of the women of Chakdalar, Uttarakhand in the conservation of forests is discussed.

**TI: Current status and future strategy for development of medicinal plants sector in Uttaranchal, India.**

**AU:** Uppeandra-Dhar; Sumit-Manjkhola; Mitali-Joshi; Arvind-Bhatt; Bisht,-A-K; Meena-Joshi  
**AD:** G. B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263 643, India.  
**SO:** Current-Science. 2002; 83(8): 956-964  
**PY:** 2002  
**AB:** This paper discusses the medicinal plant resources in Uttaranchal, India; the potential and role of medicinal plants in the state economy; the value of documenting conservation and sustainable utilization of medicinal plants by traditional communities; the effect of changing values and customs of tribal communities on the traditional health care system and surrounding biodiversity of medicinal plants; the current state of knowledge; and future strategies for developing the medicinal plants sector in Uttaranchal.

**TI: Conservation and utilization of Arnebia benthamii (Wall. ex G. Don) Johnston - a high value Himalayan medicinal plant.**

**AU:** Sumit-Manjkhola; Uppeandra-Dhar  
**AD:** G.B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora 263 643, India.  
**SO:** Current-Science. 2002; 83(4): 484-488  
**PY:** 2002  
**AB:** This paper presents the results of a study conducted during 1999-2000 in Uttaranchal Himalaya, India, aiming to develop strategy for optimum utilization of A. benthamii. The study attempted to identify optimum stage of the collection of propagules, improve the rooting of root cuttings, and identify optimum conditions for seedling survival. Based on the results, it is recommended that (i) individuals should be harvested only after seed set, (ii) terminal growing point should be utilized for vegetative propagation; the basal part of the root, flowering stalk and leaves can be utilized for consumption and trade, (iii) chilling pretreatment is recommended for enhancing rooting percentage of root cuttings, (iv) cultivation of A. benthamii can be practiced in high-altitude villages, (v) nursery centres can be created at low altitude for providing planting material to the rural inhabitants at high altitude, and (vi) individuals raised at high-altitude villages can be utilized for revegetating the wild population, consumption and trade.

**TI: Indigenous knowledge and conservation of medicinal plants used by the Bhotia tribes in Kumaun Himalaya, India.**

**AU:** Satyal,-G-S; Samant,-S-S; Kumar,-K  
**AD:** G. B. Pant Institute of Himalayan Environment and Development, Kosi-Katarmal, Almora (Uttaranchal) 263 643, India.  
**PY:** 2002  
**AB:** The present study deals with indigenous knowledge on 34 medicinal plants of Kumaun Higher Himalaya used by the Bhotia tribes. Most of the species are native to the Himalayan region. Angelica glauca and Allium stracheyi are narrow range endemic and Allium stracheyi, Picrorhiza kurroa, and Nardostachys grandiflora have been recorded in the Red Data Book of Indian Plants. Apart from indigenous uses, the majority of the species are used in the pharmaceutical industry and a few are among the major sources of income generation. The annual production of medicinal plants is comparable with the annual production of traditional crops. Hence, development of proper agro-techniques for cultivation, harvesting in the proper season and in situ conservation of these species is envisaged.
**TI: Use of medicinal plants by certain tribal people in North India.**

AU: Anand-Prakash; Singh,-K-K
AD: National Botanical Research Institute, Lucknow, U.P. - 226 001, India.
PY: 2001
AB: A survey was conducted [date not given] to gather indigenous knowledge about medicinal plants used by the tribal people in North India (Uttaranchal and Uttar Pradesh). A list of useful and potential ethnomedicinal plant species as claimed and practised by the tribals is presented under different disease groups for which they are used, giving information on local names, locality, tribal names, method of preparations and mode of administration. Included in the list were Berberis lycium, Cajanus cajan, Triticum aestivum and Celastrus paniculatus.

**TI: Ranisahiba - a variety with impressive flower and essential oil yield of Kannauj-damask rose.**

AU: Patra,-N-K; Sushil-Kumar; Khanuja,-S-P-S; Shasany,-A-K; Darokar,-M-P; Alok-Kalra; Ram,-P; Singh,-H-B; Singh,-H-P; Singh,-V-R; Birendra-Kumar; Hassan-Tanveer; Mengi,-N; Rajput,-D-K; Negi,-M-S; Tyagi,-N-K; Singh,-V-P; Anand-Singh; Singh,-J-P; Naqvi,-A-A
AD: Central Institute of Medicinal and Aromatic Plants Field Station, Pantnagar, US Nagar, Uttaranchal, India.
PY: 2001
AB: Ranisahiba, a new cultivar of Rosa damascena var. bifera (the damask rose commercially grown in Kannauj areas of Uttar Pradesh, India) with impressive flower and essential oil yield, is described. It is the result of introgression of dominant genes at the intraspecific level; selected female parents were emasculated and allowed to outcross with unknown male parents in an original gene pool of 500 plants. Six half-sib progenies were selected, the best of which segregated for an elite variant with robust growth habit and high flower and essential oil yields. This variant was named Ranisahiba. Ranisahiba has a large number of flowers per plant (200-250 compared to 100-150 in Noorjahan), and high per se oil content (0.08% compared to 0.04% in Noorjahan) and citronellol concentration (31.4% compared to 6.7% in Kannauj rose). Flower and essential oil yields in the main flowering season (March-May) were 40 quintals/ha and 3.2 kg/ha, respectively.

**TI: Chirharit - a high yielding lemongrass variety with frost resistance, stay-green habit and new chromosomal ploidy status.**

AU: Patra,-N-K; Sushil-Kumar; Khanuja,-S-P-S; Shasany,-A-K; Darokar,-M-P; Alok-Kalra; Ram,-P; Singh,-H-B; Singh,-H-P; Singh,-V-R; Birendra-Kumar; Hassan-Tanveer; Mengi,-N; Rajput,-D-K; Negi,-M-S; Tyagi,-N-K; Singh,-V-P; Singh,-J-P; Naqvi,-A-A
AD: Central Institute of Medicinal and Aromatic Plants, Field Station, Pantnagar, US Nagar, Uttaranchal, India.
PY: 2001
AB: Chirharit, a new high-yielding lemongrass (Cymbopogon flexuosus) cultivar with frost resistance, stay-green habit and new chromosomal ploidy status, is presented. It is an outcome of strategic selections for the desirable variant(s) (spontaneous recombinants) in a large open-pollinated seed progeny population of the otherwise high-yielding cultivar, Cauvery, clonal multiplications of the desirable variant(s) and their comparative evaluation for morpho-physiological fitnesses leading to the identification and establishment among them, of the most ideal genotype. In yield assessment trials, Chirharit significantly out-performed all the 3 standard cultivars, namely Cauvery, Pragati and CKP-25. Gas liquid chromatography analysis of the essential oil of Chirharit and Cauvery, revealed that the oil quality of Chirharit (having 80% citral) could be

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*Note: The text is a composite of information from different sections and may contain fragments from various sources. The natural text is a representation of the information as if read naturally.*
considered quite consistent with that of the mother cultivar with 81% citral in the essential oil. Other characteristics of Chirharit are provided, as well as the result of chromosomal analysis, and its availability.

**TI: Medicinal plant resources in Nanda Devi Biosphere reserve in the central Himalayas.**

**AU:** Nautiyal,-S; Maikhuri,-R-K; Rao,-K-S; Saxena,-K-G

**AD:** G. B. Pant Institute of Himalayan Environment and Development, Garhwal Unit, Post Box 92, Srinagar, Garhwal 246 174, India.


**PY:** 2001

**AB:** The traditional uses, cultivation practices and economic contribution of medicinal plants to the rural economy of the Nanda Devi Biosphere Reserve in the district of Chamoli, Uttar Pradesh, India were studied. A survey of 200 randomly selected households were conducted during 1995-96 to gather information. Samplings were done on 16 species of plants stored and used by all the households within the sample areas: Aconitum heterophyllum, Allium humile, Allium stracheyi, Angelica glauca, Betula utilis, Carum carvi, Cedrus deodara, Dactylorhiza hatagirea, Juniperus indica [J. pseudosabina], Megacarpaea polyandra, Nardostachys grandiflora, Picrorhiza kurroa, Pleurosporum angelicoides, Rheum australe, Saussurea costus and Taxus baccata. A total of eight species were cultivated on 4% of the private farm land, evolving as an indigenous practice in response to restrictions on traditional rights to collect in the wild and attempts to meet the increasing demand for medical products in the market place. Allium humile and Allium stracheyi accounted for 70% of the total land area in medicinal plant cultivation. All cultivated species except for Allium stracheyi were naturally regenerating in the forests and grazing lands. Among the cultivated species, Carum carvi yielded the highest economic returns, followed by Allium humile. Products from medicinal plant under cultivation and from species collected in the wild accounted for 3.67 and 6.45% of the total income, respectively, of an average household.

**TI: Micropropagation of Pittosporum napaulensis (DC.) Rehder & Wilson - a rare, endemic Himalayan medicinal tree.**

**AU:** Uppeandra-Dhar; Jyoti-Upreti; Bhatt,-I-D

**AD:** G. B. Pant Institute of Himalayan Environment & Development, Kosi-Katarmal, Almora 263643 (Uttaranchal), India.

**SO:** Plant-Cell,-Tissue-and-Organ-Culture. 2000 publ 2001; 63(3): 231-235

**PY:** 2000; publ. 2001

**AB:** An in vitro propagation protocol has been developed from mature trees of Pittosporum napaulensis. The best bud proliferation (83.1%), shoot number (21 axillary shoots per explant) and shoot length (5.5 cm) were achieved in Murashige and Skoog (MS) medium supplemented with 5.0 micro M N-6 benzyladenine and 0.1 micro M alpha - naphthalene acetic acid (NAA). Of the three cytokinins tested (N-6 benzyladenine, kinetin and thidiazuron), N-6 benzyladenine proved to be the best for shoot induction. Shoot regeneration potential varied among genotypes. Regenerated shoots rooted after 48-h treatment on half-strength MS liquid medium supplemented with 20 micro M indole-3-butyric acid. Rooted shoots transferred to 120 g (w/v) soilrite + sand + soil (1:1:1) mixture showed 70% survival. Twenty-one plantlets were grown in green house conditions.

**TI: Promoting the cultivation of medicinal plants in Uttaranchal, India.**

**AU:** Ghayur-Alam; Kop,-P-van-de

**AD:** Centre for Sustainable Development (CSD), 186/4 Rajpur Road, Dehradun, Uttaranchal 248 009, India.

**SO:** Medicinal-Plant-Conservation. 2005; 11: 15-19

**PY:** 2005

**AB:** This paper emphasizes the need for conservation of medicinal plants in Uttaranchal, India. The factors responsible for the failure of the policies aiming to promote the cultivation of medicinal plants on a large
scale are discussed, including lack of reliable and profitable markets and technical difficulties. The need for interventions to provide the farmers with technical and marketing support so that the risk of cultivating these species is reduced and farmers' income is increased is highlighted. One example of such intervention in Uttarakhand is given, dealing with the cultivation of Kutki (Picrorhiza kurroa) for export to a European firm based in The Netherlands.

**TI: Conservation aspects of Aconitum species in the Himalayas with special reference to Uttarakhand (India).**

**AU:** Shah, N-C
**AD:** MS-78 ‘D’, Aliganj, Lucknow - 226 024, U.P., India.
**SO:** Medicinal-Plant-Conservation. 2005; 11: 9-15
**PY:** 2005

**AB:** A brief profile is presented of the medicinal aconites, which are used in the traditional system of medicine and in folk medicines in the Great Himalayas or the Asian Himalayas, focusing on the non-poisonous and poisonous aconites, their uses, vernacular names, chemical composition, detoxification or mitigation and trade, with special reference to the aconites of Uttarakhand and the efforts and measures so far taken for their conservation.

**TI: Marketing and demand of commercially important medicinal plants in vogue and future strategy.**

**AU:** Shiva, A

**AD:** Centre of Minor Forest Products (COMFORPTS) (for Rural Development & Environmental Conservation), HIG-2, No. 8 B, Indirapuram, GMS Road, P.O. Majra, Dehra Dun - 248 171, (Uttaranchal), India.
**PY:** 2005

**AB:** This book provides information on the marketing, trade, origin and sources of raw materials, pricing, policy implementations, and utilization of economically important medicinal plants in India. Tabulated data are also presented on the: worldwide sales figures of herbal remedies; major medicinal plant species under large scale cultivation; utilization of medicinal plants in different system of medicine; top 20 medicinal plants traded in India; part-wise representation of medicinal plants in trade; average marketing margins for 3 species imported from Nepal; variation of prices of medicinal plants in raw drug shops in Kerala; most important medicinal plants in Uttarakhand; medicinal plants prioritized for conservation and cultivation in Uttarakhand; sale price of medicinal plants in Dehradun during 2002-2005; purchase price of some important medicinal plants/plant parts at different pharmacies in Haridwar during 2004; most versatile representative of medicinal plant species in the Uttarakhand market; sales price of medicinal plant parts in Tanakpur and Ramnagar at different seasons during 2003-2004; marketing channels of 7 medicinal plants; and name and addresses of herbal traders in Uttarakhand.

**TI: Allelopathic effects of medicinal plants on food crops in Garhwal, Himalaya.**

**AU:** Rohan-Basotra; Shashi-Chauhan; Todaria, N-P
**AD:** Department of Forestry, Post-Box-59, H. N. B. Garhwal University, Srinagar, Garhwal - 246 174, Uttarakhand, India.
**PY:** 2005

**AB:** An aqueous leaf and root/tuber extracts of three important medicinal plant species (e.g., Bergenia ciliata, Hedychium spicatum and Potentilla fulgens) were tested for their allelopathic effects on germination, radicle and plumule elongation of Amaranthus caudatus, Eleusine coracana, Fagopyrum esculantum, Phaseolus mungoo, Phaseolus vulgaris and Triticum aestivum. The results revealed that: the allelopathic
effects increased with increasing concentration of leachats from 2%, 5% to 10%. The susceptible crops were Amaranthus caudatus and Phaseolus mungoo whose germination, radicle and plumule growth were reduced significantly under aqueous extracts of all three medicinal species. The results suggested that all the three species can be grown satisfactorily under traditional agriculture systems of subtropical-sub temperate region if whole plants of these medicinal species are harvested from the agricultural fields and nothing is left in the fields for allelopathic influence. Domesticated cultivation of medicinal plants is clearly a sustainable alternative in order to preserve this wild wealth and increase the farm income of local farmers.

**TI: Chemical constituents of the volatile oil of Murraya koenigii leaves.**

**AU:** Rana, V-S; Juyal, J-P; Rashmi, Blazquez, M-A  
**AD:** Medicinal Plant Research Institute, 7 R.K. Puram, Lower Adhoiwala, Dehra Dun - 248 001, Uttarakhand, India.  
**PY:** 2004  
**AB:** The chemical composition of the volatile oil of the fresh leaves of Murraya koenigii growing wild in Dehra Dun was analyzed by gas chromatography–mass spectrometry. Thirty-four compounds consisting of 97.4% of the oil were identified. The major constituents identified were alpha-pinene (51.7%), sabinene (10.5%), beta-pinene (9.8%), beta-caryophyllene (5.5%), limonene (5.4%), bornyl acetate (1.8%), terpinen-4-ol (1.3%), gamma-terpinene (1.2%) and alpha-humulene (1.2%)..

**TI: Creating livelihoods and enhancing biodiversity-rich production systems based on medicinal and aromatic plants: preliminary lessons from South Asia.**

**AU:** Karki, M; Tiwari, B-K; Badoni, A; Bhattarai, N  
**AD:** MAPs Program in Asia (MAPPA), IDRC, Canada.  
**SO:** Acta-Horticulturae. 2005; (678): 37-43  
**PY:** 2005  
**AB:** The Sustainable Livelihoods Framework (SLF) (a) builds on the strengths of people, their resources and knowledge systems, (b) strengthens local institutional capacity, (c) attempts to remove conditions causing poverty rather than poverty itself, and (d) gives priority to improving policies, processes and institutions in developing and implementing programmes. Medicinal and aromatic plants (MAP)-based livelihood systems are often mediated by market forces and/or related directly to employment and income of poor people. Based on research work carried out in South Asia, this paper shows that MAP- and other biodiversity-based livelihoods can not only become poverty reducing but can also be made socially equitable and gender balanced. However, the interventions have to be carefully designed to enhance and diversify livelihood strategies with a focus on strengthening existing biodiversity-based livelihoods by considering the following points: (a) both non-monetary and monetary benefits from biodiversity-based livelihoods; (b) improving linkages and synergies with and among other components of biodiversity; and (c) landscape-scale management practices that protect or enhance biodiversity (organic farming, mixed farming, community forest management, water management to enhance aquatic resources, opposition to enclosure of the commons, etc.). MAP-based livelihoods can be easily mainstreamed with other components to enhance human welfare, especially among the poor and marginalized communities. Case studies are presented of Aconitum heterophyllum and Cinnamomum tamala cultivation in Uttarakhand and Meghalaya (India), respectively.

**TI: Essential oil composition of Entodon plicatus.**

**AU:** Joshi, P-K; Pant, A-K; Mathela, C-S  
**AD:** Department of Chemistry, Kumaon University, Nainital - 263 002, Uttarakhand, India.  
**PY:** 2004
A study was conducted to investigate the essential oil components of E. plicatus, collected from Uttar Pradesh, India. A total of 37 compounds were obtained by GC. Out of these, 19 compounds constituted 85% of the total oil. The major constituent was acorenone (30.8%). Results showed that ketones comprised 48.9% of the total oil composition.

**Leaf and twig oil constituents of Juniperus indica growing in the alpine slopes of Bhojwasa (Uttranchal), India.**

**AB:** Bagchi, G-D; Divya-Srivastava; Haider, F; Dwivedi, P-D; Singh, S-C; Naqvi, A-A

**AD:** Central Institute of Medicinal & Aromatic Plants, P.O. CIMAP, Lucknow - 226 015, India.


**PY:** 2004

Leaves and twigs of Juniperus indica [Juniperus pseudosabina] growing in the alpine slopes of the Bhojwasa area in Uttranchal, India, were hydrodistilled to obtain essential oils and were subjected to GC and GC/MS analysis. The oil yield was 2.8 and 0.9% from the leaves and twigs, respectively. A total of 27 compounds were identified (90.8% from the leaf and 71.5% from the twig oils). In the leaf oil, sabinene was the major compound followed by terpinen-4-ol and alpha-pinene (34.9, 10.8 and 8.9%, respectively), while in the twig oil, biformene was the major compound followed by terpinen-4-ol and beta-elemene (12.0, 11.1 and 10.2%, respectively).

**Productivity and quality assessment of different chemotypes of geranium under tarai of Uttarakhand.**

**AB:** Ram, P; Birendra-Kumar; Neeraj-Srivastava; Verma, R-S; Sashidhara, K-V; Patra, N-K

**AD:** Central Institute of Medicinal and Aromatic Plants, (CIMAP) Field Station, Pantnagar, P.O.- Dairy Farm Nagla, U.S. Nagar, Uttarakhand - 263 149, India.


**PY:** 2004

A field experiment was conducted in Pantnagar, Uttaranchal, India, during the 2001/02 and 2002/03 rabi seasons to study the comparative performance of rose geranium cultivars Bourbon, CIM-Pawan, Kelkar, Algerian and Egyptian under tarai conditions. CIM-Pawan was superior in herbage and oil yields followed by Bourbon. The percentage of increase in oil yield in CIM-Pawan over Bourbon was 26%, while Egyptian, Algerian and Kelkar recorded 21, 36 and 73% less oil than Bourbon, respectively. The quality profile showed that the oil of Bourbon was richer in citronellol and geraniol. CIM-Pawan had a citronellol to geraniol ratio of 2:1. Linalool and isomenthone were also present in significant amounts.

**Studies on productivity of Viola serpens Wall.: a medicinal herb under spruce and silver fir forests in the Western Himalayas.**

**AB:** Bahar, N

**AD:** Forest Tree Seed Lab., Silviculture Division, Forest Research Institute, Dehra Dun (Uttaranchal), India.

**SO:** Indian-Forester. 2004; 130(9): 1078-1080

**PY:** 2004

A study was conducted to determine the productivity of Viola serpens, a medicinal plant used in indigenous medicine for diaphoretic and in biliousness and lung trouble, under spruce (Picea smithiana) and silver fir (Abies pindrow) forests in Himachal Pradesh, India. Maximum productivity of V. serpens was recorded under spruce compared to silver fir forests based on observations on the morphological characteristics of the medicinal herb, viz., collar diameter, height, basal area, density and biomass.

**Medicinal status of some common weeds of Shivalik Garhwal Himalaya.**

**AB:** Negi, S-S; Shalini-Negi; Negi, K-S

**AD:** Department of Botany, Govt. P.G. College, Kotdwara - 246 149 (Uttaranchal), India.


**PY:** 2004
AB: Garhwal Himalaya of Uttaranchal occupies a significant position in the phytogeography of India, as it is the hub of flora of therapeutic value. Along with rich biodiversity, the weed flora constitutes a significant portion of the vegetation. From an extensive survey programme, some common weeds of potential medicinal value were screened out and medicinal uses of these screened weed species have been given alphabetically in the enumeration along with coloured plates.

TI: Current status of medicinal plants used by traditional Vaidyas in Uttaranchal state of India.

AU: Kala,-C-P
PY: 2005
AB: The current status of medicinal plants used by traditional Vaidyas was studied in Uttaranchal state of India. Information was gathered using semi-structured questionnaires among 60 traditional Vaidyas. They were questioned about the types of ailments treated with plants and the preparation of herbal medical formulations. A total of 243 herbal medical formulations prepared by Vaidyas treating 73 different ailments were documented. Plants were the major ingredients in these medical formulations. A total of 156 medicinal plant species were documented during the survey. Of these, 55% were cultivated and 45% were wild species. Of the cultivated species, 80% were found growing in the kitchen gardens and 20% in the agricultural fields. The frequency of use of kitchen garden species was highest in preparing the medical formulations as in 243 formulations the relative frequency of use of such species was 87%. The relative frequency of use of the medicinal plants growing in the wild was 55% in preparing herbal medical formulations. There was a sharp decline in the number of traditional Vaidyas through generations. The loss of knowledge on preparing medicine was due to several reasons including the number of Vaidyas coming forward to adopt this traditional healing practice professionally.

TI: Current status, distribution and conservation of rare and endangered medicinal plants of Kedarnath Wildlife Sanctuary, Central Himalayas, India.

AU: Semwal,-D-P; Saradhi,-P-P; Nautiyal,-B-P; Bhatt,-A-B
AD: Department of Environmental Biology, University of Delhi, Delhi 110 007, India.
SO: Current-Science. 2007; 92(12): 1733-1738
PY: 2007
AB: Assessment of population structure on the basis of density, distribution and diversity-dominance pattern was carried out in Kedarnath Wildlife Sanctuary, Uttarakhand, India. Besides, distribution pattern, population structure and conservation status of rare and endangered medicinal plants were also evaluated. Different habitat types for these species were identified and sampled using vertical belt transects. Out of ten habitats identified, distribution of most of the species was found to be restricted in 2-3 habitats. However, Picrorhiza kurrooa showed wide distribution in six habitats, while Swertia chirayita was restricted to a single habitat. On the basis of density, occurrence in different habitats and level of pressure, we have grouped them into two broad categories: (i) restricted distribution and high pressure, and (ii) well distributed and low pressure. Accordingly, implication of conservation and management strategies, has been suggested.

TI: Effect of different NPK doses on the plant growth and rhizome yield in Curcuma zedoria (Christm.) Rosc. (Karchoor): a less known medicinal plant introduced in Uttaranchal.

AU: Sharma,-A-K; Negi,-K-S; Shukla,-H-Y; Pareek,-S-K
AD: National Bureau of Plant Genetic Resources, Regional Station, Niglat, Bhowali (Distt. Nainital) (U.A.), India.
SO: Indian-Forester. 2006; 132(4): 509-513
PY: 2006
AB: An experiment was conducted in Uttaranchal, India, during 2001 to study the effect of NPK fertilizers (100:80:40, 100:80:60, 100:80:80, 125:80:40, 125:80:60, 125:80:80, 150:80:40, 150:80:60 and 150:80:80 kg NPK/ha) on the growth and rhizome yield of Curcuma zedoria [Curcuma zedoaria]. Data were recorded for plant height and plant spread at 60, 90, 120 and 150 days after planting, fresh weight of herbage per plant, fresh weight of herbage per plot, dry weight of herbage per plant, dry weight of herbage per plot, rhizome yield per plant and rhizome yield per plot. NPK at 125:80:80 kg/ha was the best treatment for C. zedoria to obtain the maximum rhizome yield per plant, fresh and dry weight of herbage per plant and per plot, and plant height at different intervals.

TI: Prospects of medicinal plants in Uttaranchal, India.

AU: Dimri, A-K
AD: Indira Gandhi National Open University, Regional Centre, Aliganj, Lucknow - 226 024, India.
PY: 2005

AB: Several experiments were conducted to analyse the problem and prospects of medicinal plants in Uttaranchal, India; to identify the main opportunities and constraints; suggest policy measures and plan of action to support the sector; and to enhance the capacity of collaborating institutions through joint research. In addition, the following were also studied: perceptions of the cultivators with regards to the cost economics of select crops; traders viewpoints on the prospects and problems of medicinal plant cultivation; synopsis on the perceptions of surveyed individuals; and suggestions on policy measures for development of the medicinal plant sector in the State. The results are presented.

TI: Conservation of threatened medicinal and folklore plants through cultivation in Uttaranchal state.

AU: Arya, K-R; Agarwal, S-C
AD: Botany Division, Central Drug Research Institute, Lucknow - 226 001, India.
SO: Ethnobotany-. 2006; 18(1/2): 77-86
PY: 2006

AB: Uttaranchal, northwestern part of India, comprises two hilly regions, Garhwal and Kumaon Himalayas, including the tarai belts of Udham Singh Nagar, Haridwar and Dehradun. The state has international boundaries with Tibet in the north and Nepal in the east. In recent past, indiscriminate removal of medicinal plants, deforestation and rapid urbanization have caused continuous depletion of medicinal plant diversity. The present communication provides a list of 48 threatened plants of Uttaranchal and 34 important folklore therapeutic plants of commercial value. Mention is also made of government organizations, NGOs and local farmers engaged in cultivation of these plant species.

TI: Allelopathic behaviour of three medicinal plant species on traditional agriculture crops of Garhwal Himalaya, India.

AU: Tahir-Nazir; Uniyal, A-K; Todaria, N-P
AD: Department of Forestry, H.N.B. Garhwal University, P.O. Box-59, Srinagar (Garhwal) 246 174 Uttaranchal, India.
PY: 2007

AB: The allelopathic behaviour of three medicinal herbs, viz., Rheum emodi, Saussurea lappa and Potentilla fulgens [Potentilla siemersiana], on some traditional food crops (i.e., Amaranthus caudatus, Phaseolus mungo [Vigna mungo], Phaseolus vulgaris, Eleusine coracana, Triticum aestivum and Fagopyrum esculentum) was examined in Uttar Pradesh, India. Germination of all the traditional food crops was reduced significantly under aqueous extracts of S. lappa and Pontentilla fulgens but radicle and plumule growth of A. caudatus and E. coracana was reduced significantly under aqueous extracts of all three medicinal species.
For marginal farmers sole medicinal plants cultivation is not possible, therefore, medicinal plants based agroforestry is being propagated.

**TI:** Medicinal plants of the high altitude cold desert in India: diversity, distribution and traditional uses.

**AU:** Kala,-C-P
**AD:** GB Pant Institute of Himalayan Environment & Development, Kosi-Katarmal, Almora, Uttaranchal - 263 643, India.
**PY:** 2006
**AB:** Distribution patterns and traditional uses of medicinal plant species were studied in the high-altitude cold desert of India (Indian trans-Himalaya), with the help of indigenous medical practitioners (locally called amchis). Unstructured and semi-structured questionnaire surveys were conducted with 83 amchis living in Ladakh and Lahaul-Spiti. To study the distribution pattern of medicinal plants, 70 sub-localities were surveyed and grouped into 8 broad localities. A total of 335 medicinal plant species were recorded, of which 45 were rare and endangered. The main plant part used in preparing medicine was the leaf, followed by the flower, root, shoot, seed and fruit. The distribution pattern of the medicinal plants was, generally, localized because most (27%) were restricted to marshy and moist areas, followed by dry scrub (13%), rocks (12%), boulders (10%) and undulating land or alpine meadows (9%). Within the study area, the highest numbers of rare and medicinal plants were found in the Pin valley, followed by the Zanskar valley and the Leh valley. Factors related to conservation and management of medicinal plants in the cold desert of India are also discussed.

**TI:** Medicinal plants: potential for economic development in the state of Uttaranchal, India.

**AU:** Kala,-C-P
**AD:** National Medicinal Plants Board, Ministry of Health & Family Welfare, Government of India, Chandralok Building, 36-Janpath, New Delhi 110 001, India.
**PY:** 2006
**AB:** The present study deals with the medicinal plant wealth of Uttaranchal state in northern India. A total of 964 medicinal plant species were documented with the help of a literature survey and fieldwork undertaken in the various parts of the state. These medicinal plants were used in curing 135 ailments, with the highest numbers of species being used for treatment of cuts and wounds, followed by fever and diarrhoea. Among the various life forms, herbs were dominant (64%), followed by 20% shrubs and 16% tree species. Taxonomically, Asteraceae was the dominant family, having 87 species of medicinal plants, followed by Fabaceae (58 species), Lamiaceae (49 species), Rosaceae (30 species), Liliaceae (29 species), Apiaceae (28 species), Euphorbiaceae (26 species), Ranunculaceae (26 species) and Orchidaceae (23 species). Such a rich resource base indicates the huge potential for economic development of the state through herb-based industries.

**TI:** Propagation and conservation of Picrorhiza kurrooa Royle ex Benth.: an endangered himalayan medicinal herb of high commercial value.

**AU:** Bhuwan-Chandra; Palni,-L-M-S; Nandi,-S-K
**AD:** G. B. Pant Institute of Himalayan Environment & Development, Kosi-Katarmal, Almora, 263 643, Uttaranchal, India.
**SO:** Biodiversity-and-Conservation. 2006; 15(7): 2325-2338
**PY:** 2006
**AB:** Picrorhiza kurrooa Royle ex Benth., a high value medicinal herb of alpine Himalaya and a source of hepatoprotective picrosides, is listed as 'endangered' due to heavy collection from its natural habitat. The
present report deals with successful propagation of this species using both conventional and in vitro techniques. Vegetative propagation was achieved by rooting runner cuttings with indole-3-butyric acid (IBA) or alpha-naphtheleneacetic acid (NAA) treatment before planting. Nearly 87% rooting success was achieved by treatment of cuttings with 50.0 micro M IBA. Seeds were given a presoaking treatment with gibberellic acid (GA3), 6-benzylaminopurine (BAP) or a combination of both to influence germination. More than 11-fold improvement in germination was recorded in seeds treated with 250.0 micro M GA3. In vitro shoot multiplication was achieved through sprouting of axillary buds using nodal segment. Multiple shoots were formed following culture for 3 weeks on Murashige and Skoog (MS; 1962. Physiologia Plantarum 15: 473-497) medium containing 1.0 micro M BAP. Cent percent rooting success, without basal callus formation, was observed when individual microshoots were placed in MS medium supplemented with IBA. The plantlets raised using conventional as well as tissue culture methods were hardened and successfully established in the experimental field located at 2450 m elevation. In addition, strategies have been discussed to encourage cultivation and in situ conservation of this highly valued medicinal herb so as to reduce pressure on its natural populations.