



## Himalayan Ecology

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### Inside the issue ...

International Biodiversity Day Celebration

.....Page 1-2

IBD Celebration at Chaudas Valley,  
Pithoragarh, Uttarakhand

.....Page 3

Revitalizing and Therapeutics Potentials  
of Home Garden Medicinal and Aromatic  
Plants

.....Page 4

Influence of the Nutrition and Health  
Information

.....Page 5

Wild Edibles as the Herbal Medicines

.....Page 6

Food: A Source of Nutraceuticals

.....Page 7

Chemical Pesticides and Nutraceuticals

.....Page 8

Role of Spices in Our Food and Health

.....Page 9

Biodiversity and their Impact on Climate  
Change

.....Page 10

Wild Edibles as an Option of Livelihood in  
the Indian Himalyan Region

.....Page 11

ENVIS Activities (April-June-2019)

.....Page 12

Important Environmental Days

.....Page 12

### International Biodiversity Day Celebration (Our Biodiversity, Our Food, Our Health)



The G.B. Pant National Institute of Himalayan Environment and Sustainable Development (GBPNIHESD) celebrated the International Day for Biological Diversity (IDB) under the theme, "Our Biodiversity, Our Food, Our Health" at various localities across the Indian Himalayan region through its HQs at Kosi-Katarmal, Almora and the four regional Centers (Garhwal Regional Center, Srinagar; Himachal Regional Center, Kullu; Sikkim Regional Center, Pangthang, and Northeast Regional Center, Itanagar Arunachal Pradesh). In addition the Institute also participated and showcased the R&D accomplishments in biodiversity conservation through posters and videos based on the R&D work highlighting the importance of mountain biodiversity in the national level event organized by National Biodiversity Authority (NBA) and Ministry of Environment, Forest and Climate Change (MoEFCC) at Kalaivanar Arangam, Chepauk, Chennai. This event was inaugurated by Shri. M. Venkaiah Naidu, Hon'ble Vice President of India inaugurated the function. In his address Hon'ble Vice President said that Biodiversity is fundamental to the survival of the human race and human being must re-establish the link with nature like our ancestors. Shri. Anil Kumar Jain, Additional Secretary - MoEFCC & Chairman, NBA welcomed the audience and provided the importance of biodiversity in India. The Additional Chief Secretary, Govt. of Tamil Nadu, Shri H. R. Verma, the Principal Secretary, Govt. of Tamil Nadu, Shri S. Kallollikar, the Secretary, National Biodiversity Authority, Dr. P. Ramachandran and other dignitaries were present on the occasion. The GBPNIHESD stall organized during this event was visited by over 400 visitors.

At the Institute HQs one day programme at Nature Interpretation and Learning Centre (NILC) was organized by Centre for Biodiversity Conservation and Management (CBCM) of the institute wherein 32 students (12 boys and 20 girls) and 6 teachers from six different schools of Almora district, Uttarakhand participated. The programme began with an address by Dr. R.S. Rawal, Director GBPNIHESD and the Chief Guest of the function Dr. B.S. Kalakoti explaining why the engagement of young students is important for biodiversity conservation and management. Field based demonstrations and presentations of modules related to biodiversity value i.e. importance of traditional food, nutritional composition of traditional and modern (fast) food, wild edibles and livelihood, herbal spices, role of traditional agro-diversity, importance of medicinal plants, organic farming etc, were made. An exhibition by students was also made on this occasion. At the Institute of Biotechnology, G.B. Pant University of Agriculture & Technology, Patwadangar (Distt. Nainital) two day (22-23 May 2019) event was organized for 25 officials of Research Wing of the State Forest Deptt., Uttarakhand and reserchers of the regional Universities with a focus on Long- Term Ecological Monitoring (LTEM) of forest diversity vis-a-vis climate change. Inaugurating the Workshop, Chief Guest Shri Sanjiv Chaturvedi (Conservator of Forest, Research, Govt. of Uttarakhand) emphasized on The importance of LTEM of forests for biodiversity conservation.



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Lectures and hands-on practical exercises on related topics were delivered by subject experts and Institute faculty. Dr. Narendra Singh, Aryabhata Research Institute of Observational Science, Nainital, Prof. Jeet Ram, Head, Dept. of Forestry & Environmental Sciences, Kumaun University, Prof. Uma Melkania, G. B. Pant University of Agriculture and Technology, Pantnagar, and Dr. G.C. Joshi, former Incharge Scientist of C.C.R.A.S., Tarikhet (Distt. Almora) were the main resource persons. IBD was celebrated at another R&D field sites of the Institute at Sri Narayan Ashram, Chaudas (Pithoragarh) and at the Institute of Biotechnology, G.B. Pant University of Agriculture & Technology, Patwadangar (Distt. Nainital). At the Sri Narayan Ashram 60 local farmers, 41 students and 2 teachers of Chaudas valley participated in the event. The main focus was given on the wild edibles and medicinal and aromatic herbs diversity of the area and their cultivation practices. At the Himachal Regional Center, Kullu, IBD was jointly celebrated with Himachal Pradesh State Biodiversity Board (HPSBB), Shimla. The Chief Guest of the function Shri Akshay Sood, Additional District Magistrate, Kullu while addressing the participants requested representatives of various panchayats to play active role in biodiversity conservation by formation of People's Biodiversity Registers (PBR). In addition, various lead lectures on the different aspects of biodiversity were given by eminent persons including Prof. P.L. Gautam, Former Chairman, National Biodiversity Authority; Dr. J.R. Thakur, Former Associate Director, YSPUHF; Dr. K.C. Sharma, KVK, CSKHPKV, Bajaura; Dr. M.L. Thakur, HPSSB, Shimla, etc. At this occasion a brain storming session was organized to discuss on the mountain biodiversity and its role in livelihood and health in which 135 participants representing various stakeholder groups participated. At the Sikkim Regional Center, Pangthang the IBD was celebrated in the form of an exposure visit and biodiversity knowledge interpretation competition for students and plantation drive. The day was linked with the three days nature camp (May 22-24, 2019) where students were introduced to diverse aspects of biodiversity. At the Garhwal Regional Center, Srinagar an awareness program and brain storming session for the 30 students and 15 teachers of local schools was organized in which biodiversity conservation and food security was focused to sensitize the students. At the Northeast Regional Center, Itanagar events were organized for the students of Donyi Polo Vidya Bhawan School, Itanagar at the Rural Technology Centre (RTC) of the Institute. In this event Institute scientists shared valuable information with the participants on forest biodiversity, agricultural diversity; its importance and conservation practices. After technical discussions, a drawing competition was organized among the school students on the theme Biodiversity of Arunachal Pradesh.



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# IBD Celebration at Chaudas Valley, Pithoragarh, Uttarakhand



Himalaya is the youngest mountain chain and globally important biodiversity hotspot. Among the Himalayan mountain chains, Indian Himalayan Region (IHR) is designated as one of the biodiversity hotspots and has been recognized as a rich repository of unique biodiversity, which supports 18,440 plant species, including 1,748 medicinal plants, of which 25.3% are endemic to Himalaya. The different topography, micro and macroclimatic conditions, and habitats show variation among the life forms. The flora and fauna of the Himalaya vary with climate, rainfall, altitude and soils. The climate ranges from tropical at the base of the mountains to permanent ice and snow at the highest elevations. The amount of yearly rainfall increases from west to east along the southern front of the range. This diversity of altitude, rainfall and soil conditions combined with the very high snow line supports a variety of distinct plant and animal communities. The Himalaya represents a vast mountain system and globally valued for its significant role in regulation of global as well as regional climate that has direct impact on biodiversity and ecosystem services crucial for sustenance of millions people in Himalaya and adjoining areas. The Chaudas valley is inhabited by an ethnic community known as Bhotia or Shauka located in inhabits Dharchula area of Kumaon Himalayas in Pithoragarh district, Uttarakhand in North India. This biodiversity rich area is culturally connected to Nepal and Tibet and supports plant species used in India, Chinese and Tibetan systems of medicines. These communities utilize their agriculture land in cultivating specialized crops such as buckwheat (*Fagopyrum esculentum*), sweet buckwheat (*Fagopyrum tataricum*), and barley, potato and other vegetables to meet the nutritional and food security of these communities. In 2019, Centre for Biodiversity Conservation and Management of GBPNIEHSD Kosi-Katarmal, Almora celebrated International Biodiversity Day (IBD) under theme "Our Biodiversity, Our Food, Our Health" at Sri Narayan Ashram, Chaudas area, Pithoragarh district by organizing a series of events with diverse stakeholders under the support of National Mission on Himalayan Studies (NMHS). The major stakeholders i.e., local farmers, school students and teachers of the area actively participated in the IBD celebration. Total 31 students and 2 teachers represented Government Inter College, Pangu and Government Inter College Makhm Kailash and rest stakeholders representing different villages i.e., Jaykot, Pangu, Sosa, Niyang, Pasti, Chalmachilanso, Dharpangu etc., of Chaudas area. The aim of the programme was to create awareness among villagers, farmers and students towards mountain biodiversity and its value for support of our life, food value, health and highlighted major threats of biodiversity due to over-exploration, deforestation and to create interest among the participants towards conservation of the forest resources, promotion of their cultivation and conservation. The stakeholder of region know about rich biodiversity of forest used as fodder species (i.e., *Quercus glauca*, *Quercus leucotrichophora*), wild edible fruit species (i.e., *Myrica esculenta*, *Rhododendron arboreum*, *Prunus cerasoides*, *Pyracantha crenulata*, *Berberis asiatica*), and a number of medicinal and aromatic plants. The wild edible fruit species were major sources of vitamins, minerals, amino acids, carbohydrates, proteins, natural antioxidants and other health promoting substances and their regular consumption in diets (fresh or raw products) useful for reducing several degenerative and neurodegenerative diseases. Their sustainable utilization and formulation of products such as juice, jam, sauce, jelly, etc also plays a significant role in upliftment of economic condition of local inhabitants. This event provides an opportunity to local farmers, students to discuss on conservation and cultivation of high value medicinal plants, establishment of seed banks and linking these practices with their livelihood opportunity. The various techniques of propagation (i.e., seed germination, vegetative propagation), land



preparation, agro-techniques, demand of herbal products, organic farming, and conservation of genetic diversity, gene bank, improvement of quality material, cultivation technique/approaches were also discussed. For promotion and conservation of threatened plant species at high altitude institute developed *ex-situ* conservation demonstration model and polyhouse at Sri Narayan Ashram, Dharchula. The several high value medicinal plant species such as *Hedychium spicatum* (Van haldi), *Valeriana jatamansi* (Samyo), *Allium stracheyi* (Faran), *Picrorhiza kurrooa* (Kutki), *Saussurea costus* (Kuth), *Angelica glauca* (Gandrayan) etc were grown. The stakeholders knew that how these plant species can be conserved through various cultivation approaches, which will reduce pressure on its wild population and domestication of these will be provide *ex-situ* conservation of these species and also make an alternative source of income generation to the local farmers. Total 11 farmers of the region started cultivation of *Hedychium spicatum* (Van haldi), *Valeriana jatamansi* (Samyo), *Allium stracheyi* (Faran) on their fields and institute also provided technical support on their cultivation, post harvesting techniques and marketing. This module was to create awareness and sensitize local inhabitants of the region for the mass cultivation and conservation of medicinal plants and develop linkages between human and nature. This kind of participatory approaches will be helpful for conservation of the species, fulfil market demand, cultivate quality of plant material and also helpful for reducing migration of local inhabitants from high altitude region.



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# Revitalizing and Therapeutics Potentials of Home Garden Medicinal and Aromatic Plants

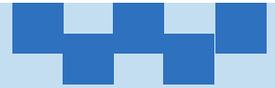
The medicinal and aromatic plants (MAPs) are one of the major ecosystem services having direct implication in human well-being. The World Health Organization (WHO) estimates approx. about 80% of the human population's dependence on plant based medicines despite the heavy flow and demand of synthetic drugs in the market. In view of this, the medicinal plants have always been in limelight of local medical practitioners, pharmaceutical industry and plant explorers since time immemorial. The growing recognition comes in view of its products with least side effects and single raw material source for modern therapeutics. Dwindling ecological status, over exploitation, illegal trade, habitat fragmentation etc., are some of the reasons highlighting the importance of conserving genetic resources has received increasing attention among conservationists, and ecologists. In view of these home gardens play a key

role not only in cultivation but also aids in conservation efforts and step up of field germplasm banks. Land use pattern of home gardens are one of the oldest, representing reservoirs of cultivated food crops and potentially useful MAPs, thus providing an array of direct or indirect ecosystem services from it. Ruling out the importance of home gardens and the ecosystem services provided, the theme of this year of "International Biodiversity Day" was "Our Biodiversity Our Food and Our Health" under which the school children's were sensitize towards the necessities of home gardens medicinal plants. Along with the commonly grown and used medicinal plants, knowledge disseminations on their available market products and their therapeutics values were highlighted (Table 1).

**Table 1.** Services provided by home gardens and knowledge dissemination

Species	Common names	Ethnobotanical uses	Therapeutic uses
<i>Ocimum tenuiflorum</i>	Basil (tulsi)	Common colds, Headaches	Diabetes, Emetic syndrome
<i>Aloe barbadensis</i>	Aloe vera	Headaches, dizziness, cold and flu, antifungal	Arthritis, rheumatism
<i>Terminalia chebula</i>	Harad (haritaki)	Ulcer, skin allergies and constipation	Weight loss, anti-dandruff, diabetes
<i>Thymus vulgaris</i>	Thyme	Respiratory disorders, acne treatment, antibacterial	Promotes hair growth, muscle cramps
<i>Salvia rosmarinus</i>	Rosemary	Facilitates digestion, improves memory, helps with migraine, improves menstrual cramps	Anti-aging, cancer prevention, anti-depressant
<i>Trigonella foenum-graecum</i>	Fenugreek (methi)	Helps in digestion, good for lactating mothers and menstrual discomfort	Good for diabetics, improves kidney health
<i>Mentha piperita</i>	Peppermint (pudina)	Heartburn, indigestion and headaches	Bad breath, mosquito repellent
<i>Citrus limon</i>	Lemon	Antioxidant, digestive issues, detoxifier	Disinfectant, muscle aches
<i>Curcuma longa</i>	Turmeric (haldi)	Pain reliever, reduces inflammation, treats indigestion, skin problems, wound healing	Boost immunity, cancer prevention, arthritis and diabetes
<i>Phyllanthus emblica</i>	Indian gooseberry (amla)	Hair growth, lice and dandruff prevention, improves eyesight	Anti-aging, skin nourishment, diabetes, heart disease, migraine,
<i>Zingiber officinale</i>	Ginger	Inflammation, cold and flu, analgesic, menstrual cramps	Prevents Alzheimer's disease, control high cholesterol
<i>Allium sativum</i>	Garlic	Antioxidant, toothache, diabetes, acne treatment, cold and sore throats	Lowers cholesterol, inhibits leukemia, increases insulin production and blood sugar level regulation
<i>Cymbopogon citratus</i>	Lemongrass	Natural bug repellent, detoxifier, improves blood circulation, good for itchy scalp and dandruff, headache relief	Antibacterial and antifungal, treats urinary tract infection and Athlete's foot
<i>Sesamum indicum</i>	Sesame	Boosts metabolic functions, facilitates hair and skin health and aids aging	Reduces hypertension, prevents damage from radiations, relief from pain associated with gout and arthritis
<i>Murraya koenigii</i>	Curry leaves	Beneficial for eyesight and cures gastrointestinal issues and diarrhoea	Lowers cholesterol levels, fights diabetes and helps in weight loss
<i>Syzygium aromaticum</i>	Clove	Toothache, cold, nausea and headaches, antimicrobial, improves digestion	Arthritis, controls diabetes, skin care
<i>Coriandrum sativum</i>	Coriander	Treats diarrhoea, good for oral hygiene and ulcers	Prevents anaemia, good for bones, reduces cholesterol levels

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# Influence of the Nutrition and Health Information

## Nutrition Value of Traditional Food of Uttarakhand

The International Day of Biological Diversity (IBD), an initiative of United Nations, which is celebrated on May 22<sup>nd</sup> of every year for raising awareness, understanding the biodiversity and its conservation. Firstly on 29 December 1993, date of the Convention on Biological Diversity (CBD) was designated as the International Day for Biological Diversity by the second committee of the UN General Assembly. But due to the number of holidays in many countries during the designated month and day, UN General Assembly adopted 22<sup>nd</sup> May as IDB from 2000 onwards. Theme of IBD this year (2019) was “Our biodiversity, our food, our health” means biodiversity is the foundation of our food and health, which works as key catalyst to transforming food systems and improving human well-being. According to the UN Secretary-General, António Guterres- “From individual species through entire ecosystems, biological diversity is vital for human health and well-being. The quality of the water we drink, the food we eat and the air we breathe all depend on keeping the natural world in good health.” According to the Executive Secretary of the United Nations Convention on Biological Diversity, Dr. Cristiana Paşca Palmer- “Biodiversity is the food we eat, the water we drink, and it is also the air we breathe. More than that, biodiversity is part of us, as we humans are part of nature.” The main aim of the above mentioned theme was to disseminate the knowledge and spread awareness about importance of biodiversity for our food, nutrition, health and healthy ecosystem. Nowadays, we are using different kinds of food for our survival but we have forgotten the traditional foods which were used by our ancestors. This is a undesirable practice for us and our next generation also. More than 90% crop varieties have disappeared from farmers' fields in last 100 years. Our indigenous, traditional and local knowledge is going to extinct which is a severe threat for our food production systems. The loss of traditional food production system is directly related with diseases or health risk factors, which is a serious threat to human beings. Many studies shows that the leafy and green vegetables are the main source for Vitamins and Iron, which is a good indicator of healthy food as well as healthy survival. Functional Diversity (FD) metric is the essential ecological concept for knowing the linkages between biodiversity composition and nutrition. 70% of the world's poor live in rural areas and depend directly on biodiversity for their survival and wellbeing. The average abundance of species is declining - 40% loss between 1970 and 2000. Unsustainable consumption continues as demand for resources worldwide exceeds the biological capacity of the Earth by about 20%. Hence, urgent and decisive action is needed to conserve and maintain biodiversity in different ecosystems, with a view of sustainable management and use of biological resources.

खाद्य	मात्रा (ग्राम)	प्रोटीन (ग्राम)	चर्बी (ग्राम)	कार्बोहाइड्रेट (ग्राम)
मिठित दाल	100	1.8	0.2	1.0
मिठित सब्जी	100	1.2	0.1	0.5
...	...	...	...	...

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## Our Biodiversity Our Food Our Health

Life is unique to our planet. The extraordinary richness of life that surrounds us is called biodiversity, and is the basis of our civilization. Biodiversity also has immense aesthetic, cultural, and spiritual value. India, like almost all other places in the world, has unique biodiversity. The richer the biodiversity, the more organized and balanced our environment will be. Different types of flora and fauna also contribute to make the earth habitable. Each region of India is very diverse in its food habits. The Himalayan region has its unique identity in the world. It supports rich flora and fauna across its diverse habitats. Himalaya is one of the global biodiversity hotspot that harbours nearly 8000 species of flowering plants including 25-30% endemic ones (Singh *et al.*, 1996; Samant *et al.*, 1998). The occurrence of 1748 medicinal plant species, 675 wild edibles; 279 species of fodder; 118 species of essential oil yielding medicinal plants and 155 species of sacred plants justifies the diversity and uniqueness of Indian Himalaya region (Samant *et al.*, 1997; Samant *et al.*, 2000). Phyto-diversity of Indian Himalaya region are used for variety purposes, i.e. fodder, fuel wood, timber, in making agriculture implements, fibre, medicine, spices, dyes, etc. (Pant *et al.*, 2009). Presently, the conservation of biodiversity occupies a very important place in the agenda of all conscious nations because the possibility of life on earth can remain as long as the innumerable biodiversity living in it can be saved. There are many species of flora, fauna, sand-soil, rivers-ocean, plateau-mountains and island-oceans on earth which play their important role in maintaining the balance of our environment in one way or the other. The theme aims to enhance knowledge and spread awareness of the dependency of our food, nutrition and health on our biodiversity. Biodiversity plays a crucial role in human nutrition through its influence on world food production. Human health depends upon ecosystem services and products. Good nutrition depends on healthy food and healthy food directly or indirectly depends on biodiversity. Healthy diet requires a balance between vegetables, fruits, pulses and grains; hence its basis is biodiversity. Biological diversity especially phyto-diversity is the backbone of Uttarakhand. Biodiversity and food are connected in many ways. Biodiversity is an important resource for humanity. Plants and plant based products have been used both by humans and animals since ancient times. A large population in developed countries depends on the products derived from plants for curing human diseases and livestock ailments. Production of food such as fruits, nuts, vegetables, meat and condiments are sourced from agriculture, forests, uncultivated fields, water bodies, etc. Food provides necessary nutrients and leads to production of energy (calories) which is a combination of protein, fat, carbohydrates, minerals, etc. More than 6000 plant species have been cultivated for food. Biodiversity, food and health interact on a number of key issues. It contributes directly to food security, nutrition and well-being. Biodiversity, food and nutrition (health) leads to a healthy planet. Loss in biodiversity may limit the discovery of treatments for many diseases and health problems of human and livestock. If biodiversity disappears we will lose the food wealth on our plates not only this but we will also lose nature and the knowledge that links it to food and nutrition. We need to create a mandate for the biodiversity-rich foods that have served generations before us, and we need to protect the environment where these plants grow. So that we can connect our lives with food, nutrition and nature and can celebrate the joy of living.

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# Wild Edibles as the Herbal Medicines

The term “wild” refers to those plants grow without being cultivated and found in different environment / ecosystems. Wild edible plants could be weeds growing in urban areas to native plants growing in deep wilderness. Wild edible plants played an important role in human life since time immemorial. They provide easy, inexpensive way to sustain our physical and mental health. The Himalayan region has a repository of wild edible plants and over 675 are represented in the region. Diversity of wild edible plants (WEPs) has traditionally played a great role in meeting significant part of the nutritional and mineral requirements of indigenous communities all across the globe. Human health depends on the quality of the environment. People are getting aware for the healthy lifestyle and are seeking added health benefits from their dietary intake. WEPs and medicinal herbs are widely used as dietary supplements, in daily foods with the aim of promoting health. WEPs are selected for food application because of their pleasant taste and aroma, and positive pharmacological effects as these are abundant source of dietary fiber, vitamins, minerals and phytochemicals. They are frequently associated with biological properties such as antioxidant, anti-inflammatory, neuro-protective and cardio-protective (Brown *et al.*, 2010). These plants have medicinal, functional food, nutraceutical, pharmaceutical, cosmoceuticals and many health benefits.

## Wild edibles as herbal medicine

The use of herbal medicines and phytonutrients or nutraceuticals continues to expand rapidly across the world with many people now resorting to these products for treatment of various health challenges in different national healthcare and as an important component towards alternative medicine. Wild edible plants play significant role in herbal medicine system. These plants are important for nutritional, flavoring, beverages, dyeing, cosmetics and many industrial uses. Extracts of wild edible fruits from various blackberry, raspberry, and gooseberry cultivars act effectively as free radical inhibitors (Wang *et al.*, 2000) because it provide significant health benefits because of their high levels of polyphenols, antioxidants, vitamins, minerals, fiber and used as herbal remedies. Herbal medicine is well documented for treating several diseases in traditional system of medicine. The leaves of *Pyracantha crenulata* are used to make herbal tea which has antioxidant, immunomodulatory, anti-inflammatory activities and leaves of *Pyracantha* (Fig. 1C) and Ginkgo used as nerving tonic and also used in tea formulation. Fruits and roots of *Myrica esculenta* (Fig. 1A) used to prepare ayurvedic formulations such as Chwayanprash and Brahmarasayan to enhance digestion, memory, intelligence, concentration and physical strength. According to Schroeder *et al.*, (1995), sea buckthorn berries are among the most nutritious and vitamin-rich fruits found in the plant kingdom. Dietary flavanoids and high antioxidant activity are found in *Rubus ellipticus* (Fig. 1D) and it prevents coronary heart disease. *Prinsepia utilis* (Fig. 1B) used in skin disease and seed oil are equal to like olive oil and *Berberis aristata* extensively used in ayurvedic system for many skin diseases and diabetics (Table 1). Some edible plants such as cinnamon, mint are used to heal wounds and boils. Research is in progress to validate the traditional uses of the wild edibles, positive pharmacological effects of edible plants included in a pharmacopeia is one of probably safe and effective way for development of functional products with new beneficial effects.

## Conclusion and future direction

The use of wild edibles as the herbal medicines offers their sustainable utilization for several health benefits. The demand for herbal/value added extracts of medicinal/ wild plants is gradually increasing in many countries, especially in European and other developed countries because of less toxicity and side effects of the medicines. It is more important in the present scenario when global community is looking towards the source of natural antioxidant and health promoting substitute and therefore, wild edibles could be a natural choice of the consumers. There has been a tremendous upsurge in the demand for phytopharmaceutical

raw medicinal herbs of Indian origin from the Western nations. The demand for traditional herbal drugs is also increasing rapidly mainly because of the harmful effects of synthetic chemical drugs and also because of an expansion of pharmacies manufacturing natural drug formulations. Our country is the proud possessor of an impressive medical heritage which encompasses various systems of medicine, viz., Ayurveda, Siddha, Unani and grandma medicine. India has an invaluable treasure trove of various scriptures on diverse medical systems. India is endowed with incredible natural plant resources of pharmaceutical and nutraceutical value and can become a potential supplier of phytopharmaceutical, alkaloids and raw medicinal herbs for the emerging world market.



Fig. 1. Wild edibles fruits (A) *Myrica esculenta* (B) *Prinsepia utilis* (C) *Pyracantha crenulata* (D) *Rubus ellipticus*

Table 1. List of few nutraceutical food products

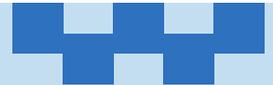
Name of wild edible	Common name	Herbal product description	Used
<i>Berberis aristata</i>	Kimor	Berberine HCl 900mg 180 Caps	Depression, Cholesterol and Heart health
<i>Hippophae rhamnoides</i>	Sea	Sea buckthorn powder	Helps to fight against cell damage
<i>Juglans Regia</i>	Akhor	Juglans Regia dietary supplement 125 ml	support pancreatic health
<i>Morus Alba</i>	Keemu	Geneceuticals white mulberry extract, 1000 mg	High dietary fiber and promote weight loss
<i>Myrica esculenta</i>	Kaphal	Kaphal powder	Fever, cold and asthma
<i>Prinsepia utilis</i>	Bhainkal	Prinsepia utilis royle oil	Used in skin diseases and cosmetics
<i>Pyracantha crenulata</i>	Ghingaru	Hridayamrit	Used for heart diseases
<i>Rhododendron arboreum</i>	Burans	Burans juice	Anti diabetic, heart and liver protective
<i>Bauhinia variegata</i>	Kanchnar	Kanchnar Capsules	Used as herbal supplement

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# Food: A Source of Nutraceuticals



Nutraceuticals is defined as the products prepared using edible ingredients but sold in medicinal forms of either, a capsule, tablet, powder, or solution, and believed to have demonstrated physiological benefits along with protection against chronic diseases (ElSohaimy 2012). In 1989 Dr. Stephen DeFelice, introduced the term “nutraceutical” a syncretic neologism of the words “nutrient” and “pharmaceutical” and defined it as “food or part of a food that provides medical or health benefits, including the prevention and/or treatment of a disease” (Chaturvedi 2011). Nutraceuticals being a diverse product category have various synonyms such as “Functional foods,” “nutraceuticals,” “pharmaconutrients,” and “dietary integrators” (Palthur *et al.*, 2010). Nutraceuticals include isolated nutrients in the form of dietary supplements, herbal formulations, processed products of cereals, soups and beverages which have the potential to provide bioactive constituents which can be helpful for maintaining health (ElSohaimy 2012). The principle, “*Let food be thy medicine, and medicine be thy food*”, advocated by Hippocrates (460–377 BC), the well-recognized father of modern medicine, and the concept of “*Medicine and food are isogonics*” emphasize the association between nutrition and human health, and conceptualized the relationship between the use of appropriate foods

for health and their therapeutic benefits This concept of using food as medicine is receiving a lot of interest today as food scientists and consumers realize many health benefits of certain foods. These foods contain ingredients that aid specific body function and improve our health and well-being (Palthur *et al.*, 2010, Gul *et al.*, 2016). The demand for food with a positive impact on human health and wellness has exploded globally over the past two decades. Modern food preferences and progress made in the food industry have led to a completely new definition of nutrition and health through eating food which can even help to reduce the risk of endemic to modern society from the diseases such as, obesity, osteoporosis, cancer, diabetes, allergies, and dental problems, which can occur at an early age and could be related to eating habits and preferences (Cencic *et al.*, 2010). The “vital nutrients” that are needed to prevent particular diseases have been a major focus of human nutritional research over decade. The Indians, Egyptians, Chinese and Sumerians are among few civilizations that have provided evidences suggesting that, foods can be effectively used as medicine and can be helpful to treat and prevent disease (Parasuram *et al.*, 2011 and El Sohaimy, 2012).

Table 1. List of few nutraceutical food products

Product	Category	Ingredients	Manufacturer
Kellogg's Cornflakes, Oats	Nutritional Supplement	Corn* (88%), sugar, salt, barley malt extract, vitamins (vitamin C, vitamin E, niacin, riboflavin, thiamin, folate), minerals (iron, zinc oxide)	Kellogg Battle Creek, Michigan, U.S
GRD	Nutritional Supplement	Sugar, skimmed milk powder*, whey protein concentrate, thickener (ins 466), preservative (ins211), minerals & vitamins	Zydu Cadila Ltd. Ahmedabad, India
Patanjali Choco Flakes, Corn Flakes, Oats, Power Vita	Nutritional Supplement	Wheat Flour* (62.29%), Sugar (32.15%), Cocoa Powder (4.69%), Salt (0.62%), Ashwagandha, Shatavari, Brahmi, Shankpushpi, Soya, Gram, Coco powder, Guar gum, Sugar, Milk, Samudri lavan, Sajjkhari, Moti pisti, Praval pisti, Liquid malt, Chocolate, Chocolate b	Patanjali Ayurved Limited, Haridwar, India.
Yakult: Probiotic Drinks	Vitamin Supplement	Water, skimmed milk*, glucose-fructose syrup, sucrose, citrus aroma, and live Lactobacillus paracasei Shirota bacteria	Yakult Honsha, Japan and Groupe Danone of France
Coral Calcium	Calcium Supplement	Acacia gum*, dibasic calcium phosphate, gelatin (capsule) and magnesium stearate	Nature's answer, Hauppauge, NY, USA
Chyawanprash	Immune booster	Ashwagandha ( <i>Winter cherry</i> ), asparagus, amla*, <i>bamboo manna</i> , blue Egyptian water lily (Makhana), cardamom, chebulic myrobalan, cinnamon, clove etc.	Dabur India ltd.
Pediasure	Nutritional Supplement	Corn Maltodextrin*, Sugar, Blend of Vegetable Oils (Canola, Corn), Milk Protein Concentrate, and Soy Protein Isolate, Nonfat Milk. Less than 0.5% of: Natural & Artificial Flavor, Cellulose Gel, Tuna Oil, Lecithin, Cellulose Gum, Salt, Carrageenan, Stevia Leaf Extract, Monk Fruit Extract	Abbot Nutrition, India.
Omega woman	Immune Supplement	Omega 3- fish oil**, phytochemicals (e.g. Lycopene and resveratrol)	Wassen, Surrey, U.K.
Amiriprash (Gold)	Good Immuno modulator	Chyawanprash Avaleha, Swarna bhasma and Ras Sindur	Uap Pharma Pvt. Ltd.
Nestle ActiPlus Dahi, Ceregrow, MILO, Baby & Me	Nutritional Supplement	Milk solids* (28%), Wheat flour* (21.5%), Sugar, wheat pomegranate puff (6%), Pomegranate juice concentrate (0.9%), Maltodextrin, Starch, Antioxidant (307), Oat flour* (5.7%), Rice flour (5.3%), Soyabean oil, Apple juice concentrate (4%), Cereal corn mix flakes, Corn flour (3.5%), Malt extract, Sodium chloride, Antioxidant(307), Orange juice concentrate(2.9%), wheat mango puff (2.9%), Mango pulp (0.4%), Mango powder (0.2%), Maltodextrin, Starch, Antioxidant(307), Wheat blackcurrant puffs(2.4%), Blackcurrant juice concentrate(0.4%), Maltodextrin, Starch, Antioxidant(307), Beetroot rice* flakes, Minerals and Vitamins	Nestle, Vevey, Vaud, Switzerland
Amway Nutrition and Energy Drink	Nutritional Supplement	Acacia gum*, microcrystalline cellulose, alfalfa, corn starch, spinach*, acerola cherry, parsley, carrot*,	Amway, Ada Township, Michigan, United States

Source: (Sarin *et al.*, 2012), \* Ingredients consumed directly in the form of food, \*\* Fish oil is obtained from fish

# Chemical Pesticides and Nutraceuticals



## Harmful Effect of Chemical Pesticides on Human Health

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The medicinal importance of foods is being explored for thousands of years. Nutraceuticals and functional food industry has grown together with the expansion and exploration of modern technology (Cencic *et al.*, 2010). Example of such advancement in the food industry can be understood through Table 1. Today nutraceuticals market consists of both traditional as well as non-traditional foods. Traditional foods are simply natural, whole foods with new information about their potential health qualities making no change to the actual foods. Example, include lycopene in tomatoes, omega-3 fatty acid in salmon, curcumin in turmeric, piperine in black pepper, cymene in cumin, coumarin in fenugreek and eugenol in clove. These bioactive compounds having high nutritional properties can be used in value addition of food items. Non traditional nutraceuticals, are foods resulting from agricultural breeding or added nutrients and/or ingredients, to boost their nutritional value. Examples include  $\beta$ -carotene-enriched rice, and soybeans, orange juice fortified with calcium, cereals with added vitamins and minerals (Nema *et al.*, 2018). Now days various products are being launched globally focusing on both nutritional as well as therapeutic effects. These products are of keen interest to the people as they are interested in the health benefits of foods and have begun to look beyond the basic nutritional benefits of food to the disease prevention and health enhancing compounds contained in many foods. Thus direct food consumption can be considered as a good source of nutraceutical which can provide all the essential substances required for day to day life to human.

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The industrialization of the agricultural sector has increased, due to chemical burden on natural ecosystems. Pesticides products (insecticides, rodenticides, herbicides, fungicides, fumigants etc.) are also used to destroy unwanted forms of life. However exposure of pesticides through farmer field during treatment of crops, plants and grain stores. There are more than 1000 pesticides used around the world to increase the productivity of the crop. Each pesticide has different properties and toxicological effects on human health. Many of the older, cheaper pesticides, such as dichlorodiphenyltrichloroethane commonly known as (DDT) and lindane, can remain for years in soil and water ecosystem. These chemicals have been banned by countries who signed the 2001 Stockholm Convention – an international treaty that “*aims to eliminate or restrict the production and use of persistent organic pollutants*”. The toxicity of a pesticide depends on its function and other factors. For example, insecticides tend to be more toxic to humans than herbicides. In this observation WHO has two objectives in relation to pesticides: (i) To ban pesticides that are most toxic to humans, as well as pesticides that remain for the longest time in the environment. (ii) To protect public health by setting maximum limits for pesticide residues in food and water.

In this view of above ENVIS Centre of GBPNIHESD participated IBD programme under the theme '*Our Biodiversity, Our Food, Our health*' organized by Centre for Biodiversity Conservation & Management (CBCM) of the Host Institute held on 22 May 2019. The Programme was started with an introductory talk by Dr. R.S Rawal, Director GBPNIHESD at NILC Centre of the institute. ENVIS team delivered a lecture to 200 children of 5 different school on “*Harmful Effect of Chemical Pesticides on Human Health*”. team talk about how Pesticides are poisons and, unfortunately, they can harm more than just the “pests” at which they are targeted. During the lecture team also aware about toxicity, and exposure to pesticides that can cause a number of health effects. Team linked to a range of serious illnesses and diseases from respiratory problems to cancer. Nevertheless, is already known that long-term contact to pesticides can harm human life and can disturb the function of different organs in the body, including nervous, endocrine, immune, reproductive, renal, cardiovascular, respiratory systems, and chronic diseases, including different types of cancer, Parkinson, Alzheimer, multiple sclerosis, diabetes etc.



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# Role of Spices in Our Food and Health

Food is the basic need of life and India is well-known for its spicy and tasty food which is extremely nutritious and healthy as well. One such ingredient which makes food healthy and nutritious is Spices and Condiments. According to the International Organization for Standardization, the term "spices and condiments" applies to natural vegetable products that are used for flavoring, seasoning, and imparting aroma to foods. They refer to the dried part of a plant that contain volatile oils or aromatic flavors such as, buds (cloves), bark (cinnamon), root (ginger), berries (black pepper), seeds (cumin, coriander). The variety of spices that give flavor and color to food comes from different family of plants. The most popular ones are Apiaceae, Fabaceae, Lamiaceae, Lauraceae, Piperaceae and Solanaceae etc. Right from the kitchen and medicinal uses in homes, spices have an important role to play in different places. The volatile oils from spices give the aroma and the oleoresins impart the taste. They stimulate appetite by increasing the flow of gastric juice and possess antimicrobial, antibacterial, anti-inflammatory properties (Table 1). The consumption of garlic has the potential to reduce arterial plaque and possess antioxidant properties on skin cancer, ginger led to reduction in blood cholesterol and also served as a potential anti-inflammatory and antithrombotic agent. Pepper is used to treat cardiovascular diseases, diabetes and respiratory diseases etc. This year's celebrations of the International Day for Biological Diversity, on 22 May 2019, focused on biodiversity as the foundation for our food and health and a key catalyst to transforming food systems

**Table 1. Some common spices with health benefits**

Common name	Botanical name/ Family	Part used	Active constituents	Therapeutic properties	Common uses
Turmeric	<i>Curcuma longa</i> Linn. (Zingiberaceae)	Rhizome	Curcumin, bisabolane, $\alpha$ - and $\beta$ -turmerone	Anti-inflammatory, anti-oxidant, chemopreventive, antiproliferative, anti-parasitic and antimalarial	Cold and cough, wound healing, immunity booster
Bay Leaf	<i>Cinnamomum tamala</i> (Lauraceae)	Dried leaves	A-pinene, camphene, eugenol, limonene	Antioxidant, anti-inflammatory, antidiabetic, antimicrobial, anticancer	Stomach ache, skin, migraine, tooth ache, cold and cough, activities against neurological disorders, such as Parkinson's and Alzheimer's diseases
Cumin	<i>Cuminum cyminum</i> L. (Apiaceae)	Fruit and Seed	Cuminaldehyde, limonene, $\alpha$ - and $\beta$ -pinene, 1,8-cineole, o- and p-cymene, $\alpha$ - and $\gamma$ -terpinene, safranal and linalool	antimicrobial, antidiabetic, anticarcinogenic/ antimutagenic, antistress, antiulcerogenic	Used in treatment of mild digestive disorders, diarrhea, flatulence, morning sickness, colic, dyspeptic headache
Coriander	<i>Coriandrum sativum</i> Linn. (Apiaceae)	Seeds and leaves	Coriandrol, monoterpenoid-linalool, borneol	Antioxidant, antidiabetic, antilithogenic and anti-inflammatory	Beneficial for cough and cold, indigestion, menstrual problems, rheumatism and pain in the joints, relief of anxiety and insomnia
Clove	<i>Eugenia caryophyllus</i> (Myrtaceae)	Buds	Eugenol, acetyleugenol, sesquiterpenes ( $\alpha$ - and $\beta$ -caryophyllenes) and small quantities of esters, ketones & alcohol	anti-oxidant, anti-bacterial, anti-pyretic, local anesthetic, and aphrodisiac	Used in dentistry, oral and pharyngeal treatments. It is widely used as an aromatic stimulant, antispasmodic and carminative spice
Ginger	<i>Zingiber officinale</i> Linn. (Zingiberaceae)	Rhizome	Gingerol, shogaols, Zingiberene	Antioxidant, anti-inflammatory and antitumor	Common cold, heartburn, nausea, diarrhea, headaches, minor body aches and even some cases of arthritis
Black Pepper	<i>Piper nigrum</i> L. (Piperaceae)	Fruit	Piperine, limonene	Immunomodulatory, anti-oxidant, anti-asthmatic, anti-carcinogenic, anti-inflammatory, anti-ulcer, and anti-amoebic	Reduces blood pressure and contains iron. Increases appetite, helps in weight loss, prevents gastric problem and depression

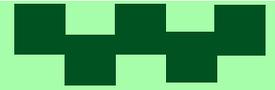
and improving human health. In order to spread awareness among school children regarding the role of biodiversity in our food system, nutrition, and health, a one day event was organized at GBPNIHESD, Kosi-Katarmal, Almora. Our group focused on role of spices in our food and health. Although the school children's were able to recognize the common spices but most surprisingly they have not seen or aware about the plants from where these spices originates. With the help of charts (containing packets of spices and photographs of plant species) and our live demonstration site "Surya-Kunj" (an *ex-situ* conservation site) students were exposed to different plants species of spices along with their general uses and the properties they possess.



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# Biodiversity and their Impact on Climate Change



## Biodiversity in Indian Himalayan Region

Mountains cover nearly a quarter of the Earth's land surface, and home to about a tenth of the global population. The global importance of mountains are reflected, as (i) provider of goods and services to at least half of humankind, (ii) provider of 70-80% of all freshwater resources for our planet, and (iii) half of the world's biodiversity hotspots are concentrated in mountains and support approximately one-quarter of terrestrial biological diversity. Himalaya characterized by high degree of ecological and geological fragility, and contains the largest deposit of snow and ice outside the poles. This mountain range has great ecological and economic relevance for its enshrined values as; a climate regulator, source of major rivers, rich repository of biodiversity, culturally & ethnically rich diversity, spiritual & recreational values, and rich source of traditional/indigenous knowledge base. The Indian Himalayan region constitutes a large portion of the Himalayan Biodiversity Hotspot and, therefore, contributes greatly to richness and representativeness of its biodiversity components at all level i.e. genes, species and ecosystems. The flora of the region consists of 8000 Angiosperms, 44 Gymnosperms, 600 Pteridophytes, 1737 Bryophytes, 1159 species of Lichens and 6900 Fungi (Samant *et al.*, 1998). The flora of the region also includes 1748 plant species of medicinal importance, 675 plants that are being used as wild edibles and 335 Agricultural crops, that forms a major component of traditional health care system, nutritional supplements and food. The faunal diversity of the region is also vast. Altogether, 30,377 species/subspecies of both Protozoa and Animalia have been recorded from the region of which 372 are Protozoans and 30,005 comes under Animalia group, that represents more than 30% of the fauna of India (Chandra *et al.*, 2018). Among the various regions within the IHR, Central Himalaya has the highest faunal diversity (14,183 species/subspecies) followed by West Himalaya (12,022), North West Himalaya (8,731), East Himalaya (5,542), Ladakh Mountains (1,561), Tibetan Plateau (1,320), and Trans Himalaya-Sikkim (1,112). The region has 280 species of mammals, >940 species of birds, 316 species of fishes, 200 species of reptiles, and 80 species of amphibians that accounts about 27.6% of the total vertebrate diversity of the country (Chandra *et al.*, 2018). The region is bestowed with some of the majestic faunas of the world i.e. Snow Leopard, Himalayan Monal, Satyr Tragopan, Himalayan Quail, Red Panda, etc.. The region is home to more than 940 species of birds, of which 15 are endemic to Himalaya and four big cats i.e. Snow Leopard, Bengal Tiger, Clouded Leopard and Indian Leopard.

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## Training Workshop During IBD on Impact of Climate Change

On the occasion of International Day for Biodiversity, a two days Training Workshop (22-23 May 2019) on "Long Term Ecological Monitoring of Forests" was organised at Institute of Biotechnology, G.B. Pant University, Patwadangar (Distt. Nainital) for the training and skill building of forest officials and research scholars of research wing of Forest Department, Govt. of Uttarakhand. In the inaugural session, after the introduction of participants and resource persons, co-ordinator of this Training Workshop, Dr. G.C.S. Negi, Scientist & Head, CBCM, GBPNIHESD after introducing theme of the IBD - 2019 (Our Biodiversity-Our Food-Our Health) presented the frame work of the training workshop designed for the Research Wing of the Forest Department and emphasized that MoEF&CC has published a manual on Long-term ecological observations (LTEO) to monitor the impact of climate change on the forests. As a follow-up GBPNIHESD has established four LTEM sites in four different forest sites of Gaula catchment (Kumaun Himalaya) along an altitudinal gradient of 500- 2000 m asl. He told that the main



objective behind the workshop is to enhance the capacity of Research Wing of Forest Deptt. on this LTEM protocol for further follow-up. In his inaugural address the chief guest, Shri Sanjiv Chaturvedi (Conservator of Forest, Research, Govt. of Uttarakhand) mentioned about the importance of biodiversity conservation and briefly explained about the ongoing research projects and activities of their department

for the conservation of endangered flora and fauna species. In technical session-I, Dr. Narendra Singh, Scientist of Aryabhata Research Institute of Observational Science, Nainital delivered a talk on climate change in Uttarakhand. Prof. Jeet Ram, Head, Dept. of Forestry & Environmental Sciences, Kumaun University, Nainital explained about structure and function of forests of Uttarakhand. Prof. Uma Melkania, G. B. Pant University of Agriculture and Technology, Pantnagar explained about the man-forest relationships and ecosystem services of forests. Dr. G.C. Joshi, former Incharge Scientist of C.C.R.A.S., Tarikhet (Ranikhet) delivered a lecture on the ethnobotany and uses of medicinal plants. In the next day of the workshop, Dr. Shruti Shah and Dr. Amit Mittal of Kumaun University, Nainital

explained to participants about water relations of forest trees with the help of instruments. After that a field visit was conducted to LTEM sites established in mixed-broadleaf forest wherein participants were taught on various aspects of LTEM (such as phenology,



measurement of leaf area, estimation of biomass and productivity, soil sampling, data retrieval from AWS etc.) by research scholars of the Institute to understand the impact of climate change on forests. This exercise was repeated at the LTEM site established at Sal forest of Bhujighat by the participants. At last the closing ceremony was completed at Forest Training Institute, Haldwani where certificates were distributed to the participants by Shri Sanjiv Chaturvedi, CF (Research). In the conclusion session of the workshop some participants shared their experiences and feedbacks about the workshop. They wished that more such training workshops need to be organized by GBPNIHESD, and they were particularly interested in the instrumentation work.

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# Wild Edibles as an Option of Livelihood in the Indian Himalayan Region

Forest based resources, since time immemorial, has been associated with human civilization and serving a large number of human populations throughout the world in sustaining the livelihood, food and health needs. Forest products constitute an important source of livelihood for millions of people from forest fringe communities across the world. Forests provide a wide range of products that are crucial for day-to-day needs of people dependent on them. These products include: timber products and non-timber forest products (NTFPs). Timber products include timber and fuelwood, whereas, NTFPs include resin, wild edibles, medicinal plants, etc. Wild edible fruits are one of the precious groups of non-timber forest products that played a prominent role in uplifting the socio-economy of human beings, particularly in tribal and rural areas for thousands of years. They are rich source of protein, carbohydrates, fats, vitamin, antioxidants (Bhatt *et al.*, 2017) and minerals, and thus are known to play important role in fulfilling the dietary needs of indigenous communities. They are not only a source of nutritional value but also a source of income generation for mountain peoples (Negi *et al.*, 2011). Indian Himalayan region (IHR), is one among the 34 biodiversity hot-spots of the globe. The rich plant diversity of the IHR is utilized by the native communities in various forms as medicine, edible/food, fodder, fuel, timber, agricultural tools, etc. Majority of tribal population in the IHR live close to or inside the forests, and has higher dependence on wild products and biomass for food and energy need. Among these, wild edible plants form an important source as a supplement/substitute food in times of scarcity and traditional medicine for native communities, and also play an important role in tribal and rural livelihoods throughout the IHR (Maikhuri *et al.*, 2004). In many parts of the IHR, these resources are critical, especially for the poor, in securing subsistence needs in times of hardship and emergencies when quick cash is required or when casual food stores run out (Maikhuri *et al.*, 2004). Dwindling forest resources, low agricultural productivity, lack of required infrastructure facilities and growing number of rural and traditional societies to move to semi-urban and plain areas has necessitated, the role of wild edibles in our daily lives. Uses of non cultivated foods, of which wild fruits form a part, as a diet supplement, and as coping mechanisms at times of food shortage, seasonally as gap filler, or in times of emergency provides an important fallback option or safety net for rural poor world over. The recent increase in interest in potential wild bioresources has been a consequence of a number of shifts in development focus. With the growing concerns for hill area development and poverty alleviation led to explore hitherto untapped and underutilized wild bioresources are being explored that may contribute to household's food, nutrition and livelihood security (Maikhuri *et al.*, 2004; Negi *et al.*, 2011). Among others, a number of wild edibles i.e. *Hippophae salicifolia*, *Rhododendron arboreum*, *Embelica officinalis*, *Myrica esculenta*, *Spondias axillaris*, *Berberis asiatica* and many more have begun to draw attention as being one of the income generating option through value added products such as squash, juice, sauce, jam by the rural and tribal population in the region. Although these wild plants for food and other valuable means are not consumed and utilized in large quantity but their role in local communities cannot be ignored. Most of these species are not only known for their nutritional value but also for their preventive properties against various diseases. Thus playing a vital role in traditional system of health care in the Himalaya. Commercial opportunities for wild edibles are emerging throughout the world as economic liberalisation is opening new markets and

decentralisation and democratisation is enabling communities to have a greater role in the management of forest resources. The recent increase in consumer interest on the wild edibles has been accompanied by attention from conservation and developmental agencies. However, access to information about management, sustainable harvest, use and marketing of wild edibles is an important part of raising awareness and can help to ensure a long term future for both wild produce and the people who depend upon them.



Fig. 1. Some important wild edible plants from Indian Himalayan Region

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# ENVIS Activities (April-June-2019)

## National Review Meet (NRM) of ENVIS Centres- 2019



## Celebration of IBD and World Environment Day- 2019



## Mass Plantation and Cleanliness Drive at Nanda Van, Almora, Uttarakhand -2019



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World Wetland Day	2 February
National Science Day	28 February
World Forestry Day	21 March
World Water Day	22 March
World Meteorological Day	23 March
World Health Day	07 April
World Heritage Day	18 April
Earth Day	22 April
World Environment Day	05 June
World Ocean Day	08 June
World Nature Conservation Day	28 July
World Ozone Day	16 September
World Tourism Day	27 September
World Habitat Day	03 October
World Wildlife Week	1-7 October
World Animal Welfare Day	04 October
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International Mountain Day	11 December
Kisan Divas (Farmer's Day)	23 December

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