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## **Wild Edible Plants of Uttarakhand Himalaya: A Potential Nutraceutical Source**

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### **ABSTRACT**

Nutraceuticals have received considerable interest because of their presumed safety and potential nutritional and therapeutic effects. Pharmaceutical and nutritional companies are aware of the monetary success taking advantage of the more health-seeking consumers and the changing trends resulting in a proliferation of these value-added products aimed at heart health to cancer. Majority of the nutraceuticals are claimed to possess multiple therapeutic benefits though substantial evidence is lacking for the benefits as well as unwanted effects. The present review has been devoted towards better understanding of the nutraceuticals based on their disease specific indications.

**Key words:** Medicinal plants, ethnomedicinal plants, kumaun region, garhwal region, edible plants

### **INTRODUCTION**

Uttarakhand State is characterized by a rich diversity of ethnomedicinal plants as well as a rich heritage of wild edible plants system. The present study reveals the status of ethno-medicinal flora and their importance preserved by the local population in Kumaun and Garhwal region. During the study it was observed that 102 species of ethno-medicinal plants belonging to 48 families are being used in the folk-medicine system by the indigenous people of this region. For the present study, an intensive and extensive survey was made for four selected districts of Uttarakhand, viz. Almora, Champawat, Bageshwar and Pithoragarh. The neighboring villages of the study areas were also visited for identification of plant species and to explore the traditional knowledge about the use of indigenous medicinal plants. Therefore, the ethnobiological knowledge of people and listing of plants of particular region are important tools that may help in understanding human environment interactions (Gangwar *et al.*, 2010).

### **WILD EDIBLE PLANTS WITH NUTRACEUTICAL ACTIVITY**

Wild edible plants have traditionally occupied an important position in the socio-cultural, spiritual and health arena of rural and tribal lives of India. India has one of the oldest, richest and most diverse cultural traditions associated with the use of medicinal plants in the form of traditional systems of medicine (Government of India, 2000). Plants are the invaluable, incredible and traditional sources for the curability of various diseases in the form of medicines (Guerra *et al.*, 2003). Plants secondary metabolites have been implicated for most plants

therapeutic activities (Timothy *et al.*, 2008). Accordingly plant and its products are safe and as a result there is continuous use of plant product as a drug is found to be an alternative way to cure the patients and this approach is in practice from the ancient times (Archana *et al.*, 2011). Traditional treatments may provide valuable clues for the development of new oral hypoglycemic agents and simple dietary adjuncts. As one of important plant *Urtica dioica* has been used for centuries for food and medical purposes (Mehri *et al.*, 2011). Some plants have been shown to have protective antioxidant effects and are therefore hepatoprotective. Such plants are *Parkia clappertoniana* and *Xylopi aethiopica* (Patrick-Iwuanyanwu *et al.*, 2010). There are following wild edible plants which play a critical role in nutraceuticals.

**Wild edible plant species used by the indigenous people of Uttarakhand Himalaya:** It has been reported that Uttarakhand is a huge herb of flora and fauna. In India most rural inhabitants depend on the wild edible plants to meet their additional food requirements. Sometimes the nutritional value of traditional wild plants is higher than several known common vegetables and fruits (Nodeide *et al.*, 1996; Sundriyal and Sundriyal, 2001; Orech *et al.*, 2007).

Arora and Anjula (1996) have given a detailed account of wild edible plant species occurring in India. If we are talking about edible plant species of Uttarakhand, it is 97 in numbers including Cereals and pseudocereals (08 crops), Millets and minor millets (06 crops), Pulses (15 crops), Oil seeds (11 crops), vegetables (28 crops), spices and condiments (10 crops) and fruits (19 crops). Whereas in case of wild edible plant species, there are total number of 94 plant species including wild edible fruits (67) and wild edible vegetables (27), respectively.

#### **WILD EDIBLE PLANTS SPECIES ARE AS FOLLOWS**

***Agave Americana* Linn. (Rambans) V. (Agavaceae):** It belongs to family Agavaceae. It is commonly known as *Rambans*.

**Distribution:** Tropical America-cultivated in India.

**The plant:** The plant is extensively grown in Mexico for the sake of the juice of the stalk from which a fermented intoxicating drink is made. The plant leaves are heated and split and applied in rheumatism to relieve pain. An infusion of the cut-up leaves is used as a purgative.

**Properties and uses:** It is a shrub whose sap is antiseptic, diaphoretic, diuretic and laxative and used internally for the treatment of diarrhea and dysentery (Chevallier, 1996). An infusion of the chopped leaf is purgative and the juice of the leaves is applied to bruises (Duke and Ayensu, 1985).

The expressed juice of the leaves is administered by American doctors as a resolvent and alterative, especially in syphilis, scrofula and even cancers. It is considered to be laxative, diuretic and emmenagogue. The fresh juice is applied to bruises and contusions. The gum found exuding from the leaves and the lower part of the stem is used in Mexico as a cure for toothache. The core is used medicinally in Cambodia. It is given internally as a febrifuge in malaria and various other fevers; externally it is applied to wounds as an antiseptic and tonic (Kiritikar and Basu, 1994).

***Angelica glauca* Edgew. (Choru/Hanw) V. (Apiaceae):** It belongs to family Apiaceae. It is commonly known as Choru/Hanw.

**Distribution:** Throughout cultivated in India.

**The plant:** It is a herb and used as a vegetable in daily life.

**Properties and uses:** Roots are used as condiment. Root powder (10 g) is given to livestock to cure toxic effects (Tiwari *et al.*, 2010a). It is an herb and used in treatment of cordial, stimulant, in dyspepsia and in constipation. Dry roots yield 1.3% essential oil (Chopra *et al.*, 2002).

***Arisaema speciosum mart. (Bankh) V. (Araceae):*** It belongs to family Araceae. It is commonly known as Bankh.

**Distribution:** Temperate Himalaya from Kumaon to Sikkim and Bhutan.

**The plant:** Rootstock oblique, or shortly creeping and rooting; often 12.5 cm. diam. Leaf solitary; petiole very stout, green, smooth, often marbled with brown or purple; leaflets 40-48 cm., edged with red or purple, all petiolutate, acuminate, lateral dimindiate, cordate, median ovate, cumeate or rounded at the base; nerves broadly reticulate; petiolule 1.3-5 cm. Peduncle much shorter than the petiole. Limb of spathe ovate- lanceolate, incurved, caudate- acuminate, 5-15 cm long, banded white and purple; appendage cylindric or fusiform at the often inflated base, narrowed into a very long filiform tail, base usually ovoid, not truncate or disciform; tube of spathe 5-10 cm, striped with purple. Spadix pink or yellowish, tail 30-45 cm., dark purple; anther-cells 4-5; ovaries ovoid, stigma sessile, pulvinate. Very variable in size and colouring (Kiritikar and Basu, 1994).

**Properties and uses:** In Hazara, the root is stated to be poisonous; in Chumba, it is applied pounded to snake-bites. In Kulu, where the tuber is given to sheep for colic, the fruit is said to have deleterious effects on the mouth when eaten by children. The root is an antidote to snake-venom (Mhaskar and Caius, 1931).

***Asparagus filicinus Buch.-Ham ex Roxb. (Kairua) V. (Liliaceae):*** It belongs to family Liliaceae. It is commonly known as Kairua.

**Distribution:** Temperate and tropical Himalaya, from Kashmir to Bhutan, Khasia Hills, Assam, Burma-China.

**The plant:** A moderate- sized evergreen tree. Bark brown, wood moderately soft, grayish- brown. Leaves rigidly sub-coriaceous, 2-lobed, not deeply cleft.

**Properties and uses:** The root is considered tonic and astringent. In Kanawar, a sprig of this is put in the hands of small-pox patients as a curative measure. The root is considered vermifuge and taeniafuge in Assam. It is given in cholera and acts as a powerful diuretic. It is also used as a cure for rheumatism due to dampness (Kiritikar and Basu, 1994). Tubers are given, twice a day for 1-3 weeks in leucorrhoea. The roots of herb are used to cure diarrhea, dysentery and diabetes (Dhiman, 2005; Tiwari *et al.*, 2010b).

***Bauhinia purpurea L. (Khairwal) (Caesalpinioideae):*** It belongs to family Caesalpinioideae. It is commonly known as Khairwal.

**Distribution:** Lower slopes of the Himalayas.

**The plant:** A moderate-sized ornamental evergreen tree. Bark brown, 1.3 cm thick. Wood moderately soft, grayish-brown. Leaves rigidly sub-coriaceous, 2-lobed, not deeply cleft. Flowers pink, appearing with leaves in terminal panicles. Calyx-limb irregularly 3-5 cleft. Fertile stamens 3 or 4. Pods long, narrow, flat, firm, dehiscent. Seeds 12-15.

Flowers in Sep-Dec and fruits in winter and summer.

**Properties and uses:** Flowers: laxative; buds (dried): anthelmintic, useful in piles and blood dysentery; bark: in diarrhea; root-bark: mixed with curd found efficacious in haemorrhoids while its paste with dried ginger applied internally in the treatment of goiter; root: carminative.

Flowers contain quercetin, astragalin, isoquercitrin, kaempferol -3- glucoside, pelargonidin -3- glucoside and 3-triglucoside. Isolation of 3-4-dihydroxychalcone -4-O-beta-L-arabinopyranosyl- O-beta-D-galactopyranoside and butein -4-O-beta-L-arabinopyranosyl-O-beta-D-galactoside and phytohaemagglutinin, a trypsin inhibitor and presence of amino-acids and alkaloids have been reported from the seeds. Anthocyanin, rutin, apigenin-7-O-glucoside also occur in the plant (Ramchandra and Joshi, 1967).

***Bauhinia variegata* Linn. (Kwairal) V. (Caesalpiniaceae):** It belongs to family Caesalpiniaceae. It is commonly known as Kwairal.

**Distribution:** Throughout India, in areas upto 1,800 m elevation.

**The plant:** A moderate sized deciduous tree with vertically cracked grey bark, wood moderately hard, greyish brown with irregular darker patches; leaves of 2 leaflets, connate for about 2-3rd up, leaflets ovate, rounded at apex, 10-15 cm long, pubescent beneath when young, coriaceous, flowers white or pink, the uppermost petal darker and variegated, usually appearing before the leaves in short axillary or terminal racemes, stamens 5, staminodes absent, fruits flat dehiscent pods, seeds 10-15.

**Properties and uses:** The roots and bark are useful in vitiated conditions of pitta and kapha, diarrhoea, dysentery, skin- diseases, leprosy, intestinal worms, tumours, wounds, ulcers, inflammations, scrofula, proctoptosis, haemorrhoids, haemoptysis, cough, menorrhagia and diabetes (Longman, 1994a). Young flowers are cooked as vegetable. Roots are carminative, decoction prevent obesity. Bark is anathematic and used in scrofula and coetaneous troubles (Sharma *et al.*, 2006) Bark, roots, buds and gum are alterative, tonic and astringent, carminative and laxative. It is useful in haematuria and menorrhagia. Decoction of the roots prevent obesity. Bark preparations used in scrofulous tumours (Nair, 1998).

***Berberis asiatica* D.C (Kilmora) V. (Berberidaceae):** It belongs to family Berberidaceae. It is commonly known as Kilmora.

**Distribution:** Commonly occurring in the Himalayas from Himachal Pradesh at 600-2,700 m eastwards to Bhutan and Assam at 1,500-1,800 m and on Parasnath hills in Bihar, Pachmarhi in Madhya Pradesh and Mount Abu in Rajasthan.

**The plant:** It is a pretty shrub 1.8 to 2.4 m in height, armed with trifid spines, oblong-ovate or obovate, acute, mucronate, long-petioled leaves with aristato-dentate margin, yellow flowers in umbellate racemes and oblong-ovoid edible berries. It is also grown in hedges. The alkaloids present in the plant are: Berberine and Palmatine are present as chlorides (Wealth of India, 1988).

**Properties and uses:** The fresh roots are used for curing diabetes and jaundice (Uniyal *et al.*, 2006). The total alkaloid content in the roots is four percent and in the stems, 1.95%, of which berberine forms 2.09 and 1.29%, respectively. The stems are recommended in rheumatism. The roots are reported to possess anti-cancer activity. The berries are mildly laxative and are given to children (Bhakuni *et al.*, 1969, 1968).

***Ceiba pentandra* Linn. (Semal) (Bambacaceae):** It belongs to family Bambacaceae. It is commonly known as Semal.

**Distribution:** Planted mainly in south India in areas upto 450 m elevation.

These are fruity trees. Tap root used in gonorrhoea and dysentery. Gum used in impotence and bowel complaints (Nair, 1998).

**The plant:** A medium sized to tall deciduous tree, trunk prickly when young and smooth when old, branches green, horizontal usually in whorls of three; leaves digitately compound, glabrous, petioles 10-15 cm long, leaflets lanceolate, entire; flowers white or yellowish appearing at the ends of the branches along with the leaves, petals twice the length of the calyx, woolly outside; fruits oblong or fusiform capsules, lined with long silky white hairs, seeds black, glabrous, enveloped in silky wool.

**Parts used:** Root, bark.

**Properties and uses:** The roots are diuretic, aphrodisiac, antipyretic and tonic and are useful in gonorrhoea, dysuria, intermittent fevers and vitiated conditions of pitta. The bark is acrid, bitter, thermogenic, diuretic, febrifuge, emetic, purgative and tonic and is useful in hepatopathy, splenopathy, abdominal complaints, tumours, constipation, strangury, flatulence, lochiorrhoea, colic and vitiated conditions of vata and kapha. The leaves are used as an emollient and the decoction of the flowers as a laxative (Longman, 1994b).

***Chaerophyllum villosum* Wall. ex DC. (Ganziadi) (Apiaceae):** It belongs to family Apiaceae. It is commonly known as jangli gazar or Ganziadi.

**Distribution:** It is found in Kashmir to Sikkim, Arunachal Pradesh and Meghalaya, at 1200-4,000 m.

**The plant:** Plant yield essential oil 0.98% and sitosterol (Desai *et al.*, 1976).

***Chenopodium album* Linn. chenopodiaceae (Bathua):** It belongs to family Chenopodiaceae. It is commonly known as Bathua. Leaves are used as pot-vegetable (Tiwari *et al.*, 2010a).

**Distribution:** Throughout India, in areas upto 4,200 m elevation, wild as well as cultivated.

**The plant:** A small odourless herb upto 3.5 m in height, erect or ascending, stems often striped; leaves simple, very variable, upto 15 cm long, oblong, deltoid or lanceolate, obtuse or acute, entire, toothed or irregularly lobulate; flowers in clusters in spikes; fruits membranous utricle, enclosed in the perianth, seeds smooth, shiny, compressed.

**Properties and uses:** The plant is sweet, acrid, oleaginous, digestive, carminative, laxative, anthelmintic, diuretic, aphrodisiac and tonic and is useful in vitiated conditions of pitta, peptic ulcer, helminthiasis, dyspepsia, flatulence, strangury, seminal weakness, pharyngopathy, splenopathy, haemorrhoids, ophthalmopathy, cardiac disorders and general debility (Longman, 1994a).

***Colocasia esculenta* Linn. Schott (Gadpaper) (Araceae):** It belongs to family Araceae. It is commonly known as Gadpaper/Arbi. Leaves, stem and tubers are used as vegetable.

**Distribution:** Cultivated throughout the hotter parts of India.

**The plant:** A tuberous perennial with a group of underground farinaceous corms consisting of a central large one and surrounding ones of varying sizes; leaves with sheathing leaf base and erect petiole upto 1.2 m long bearing a thinly coriaceous peltate-ovate, cordate lamina; spadix shorter than the petiole and much shorter than the spathe, appendix much shorter than the inflorescence.

**Parts used:** Leaves, corms.

**Properties and uses:** The leaf juice is styptic, stimulant and rubefacient and is useful in internal haemorrhages, otalgia, otorrhoea, adenitis and buboes. The juice of the corm is laxative, demulcent and anodyne and useful in somatalgia, alopecia areata, haemorrhoids and congestion of the portal system (Longman, 1994b).

The pressed juice of the petioles is styptic and may be used to arrest arterial haemorrhage. It is sometimes used in earache and also as an external stimulant and rubefacient. The juice expressed from the leaf stalks is used with salt as an absorbent in cases of infamed glands and buboes. The juice of the corm is used in cases of alopecia. Internally, it acts as a laxative and is used in cases of piles and congestion of the portal system, also an antidote to the strings of wasps and other insects (Govil, 1998).

Good source of provitamin A and Vit. C (leaves, petioles); carotene, VitB<sub>1</sub>, Vit C; hemicelluloses and mucilage- both yielding d- galactose and l- arabinose; 2 $\alpha$ - amylase inhibitor sterols, trypsin inhibitor (tubers); 3,4- diglucosidic benzaldehyde isolated from the plant (Sumathi and Pattabiraman, 1979).

***Dioscorea bulbifera* Linn. (Genthi) (Dioscoraceae):** It belongs to family Dioscoraceae. It is commonly known as Genthi. Tubers are cooked as vegetable.

**Distribution:** It is common throughout India ascending upto 1828 m in the Himalayas. Out of which 25 species have been estimated in India.

**The plant:** It is a twinning herb with glabrous stem. The leaves are alternate, ovate- triangular to suborbicular with a deeply cordate base, basal lobes rounded, simple and glabrous and 10-20 cm 8-15 cm.

**Properties and uses:** The tubers contain furanoid norditerpenoids. The tubers are used in piles, dysentery and syphilis and are also applied to ulcers after being dried and powdered. The rhizomes are considered anorexiant and ethyl alcohol (50%) extract of its aerial parts is used as diuretic (Asolkar *et al.*, 1992).

***Diplazium esculentum* Retz. (Lingura) (Dryopteridaceae):** It belongs to family Dryopteridaceae. It is commonly known as Lingura.

**Distribution:** Thorough out Uttarakhand himalayan

**The plant:** Boiled fronds are cut and fried in cooking oil with spices such as seeds of *Cleome viscosa* L. The rhizomes are kept in the granaries to check them from insect and pests. Young fronds are used as green vegetables and also used as salad or cooked as vegetables (Upreti *et al.*, 2009).

***Fagopyrum cymosum* Trev. (Jhangar) (Polygonaceae):** It belongs to family Polygonaceae. It is commonly known as Jhangar.

**Distribution:** Temperate Himalayas, 5000-11,000 ft. Khasia Hills, 4,000-5,000 ft.

**The plant:** The seeds of plant are used as a vegetable.

**Properties and uses:** The grains are recommended as a diet in colic, choleraic diarrhea, fluxes and abdominal obstructions. Hot MeOH (90%) extraction, washing with  $\text{CHCl}_3$  and recrystallization from  $\text{H}_2\text{O}$  gives rutin 4 to 8.5% (Chopra *et al.*, 2002). Rhizome used in treatment of pulmonary abscess; active principle 5,7,3',4'-tetra-OH-flavan-3-ol (Asolkar *et al.*, 2000).

***Ficus auriculata* Lour. (Timul) (Moraceae):** It belongs to family Moraceae. It is commonly known as Timul. Fruits are eaten raw and cooked as vegetable (Tiwari *et al.*, 2010b).

**The plant:** A low spreading tree, 10-30 ft. high with large ovate or ovate-rotund leaves and conspicuous bunches of large-sized (2 1/2 in diam.) fruits borne on the trunk and leafless branches. The fruits which are gusset brown or purplish in colour, are borne in great profusion and are edible, though somewhat insipid.

**Properties and uses:** They are made into curries or jam. The bark yields a coarse fibre. The leaves of the tree are lopped for fodder in Assam, Bengal and U.P. (Burkill, 1935).

***Ficus palmata* Forssk (Bedu) (Moraceae):** It belongs to family Moraceae. It is commonly known as Bedu.

**Distribution:** North-West India, from the Indus eastwards to Oudh, ascending to 3,000 ft., in the Himalayas, Mt. Abu.

**Properties and uses:** The fruits are demulcent, laxative, used as diet in cases of constipation and in diseases of the lungs and bladder (Chopra *et al.*, 2002). Fruits are edible (Tiwari *et al.*, 2010a).



***Indigofera pulchella* Roxb. (Sakina) (Leguminosae):** It belongs to family Leguminosae. It is commonly known as Sakina.

**Distribution:** Throughout the hills of India.

**The plant:** A large shrub, 4-6 ft. high, found growing gregariously in moist evergreen forests throughout the Himalayan tract and on hills up to 5,000 ft. leaves short-petioled. The flowers of the plant are sometimes eaten in central india and Chota Nagpur.

**Properties and uses:** A decoction of the root is given by Santals for cough and its powder is applied externally for chest pains (Chopra *et al.*, 2002). The leaves and roots are used for swelling of the stomach.

***Lepidium sativum* Linn. (Halang) (Cruciferae):** It belongs to family Cruciferae. It is commonly known as Halang.

**Distribution:** Cultivated throughout India as a culinary vegetable.

**The plant:** An erect herbaceous glabrous annual upto 45 cm in height; leaves entire or variously lobed or pinnatisect, the lower petiolate, the upper sessile; flowers white, small, in long racemes; fruits obovate, small pods, notched at the apex with two seeds per pod.

Seeds elongate, with tapering ends, brownish red in color, testa smooth shiny, cotyledons fleshy, white and elongate with abundance of mucilage.

**Properties and uses:** The roots are bitter and acrid and are useful in secondary syphilis and tenesmus. The leaves are stimulant, diuretic and antibacterial and are useful in scorbutic diseases and hepatopathy. The seeds are bitter, thermogenic, depurative, rubefacient, galactagogue, emmenagogue, tonic, aphrodisiac, ophthalmic and diuretic. They are useful as poultices for sprains and in leprosy, skin diseases, dysentery, diarrhea, splenomegaly, dyspepsia, lumbago, ophthalmopathy, leucorrhoea, scurvy, seminal weakness, asthma, cough, hiccup, haemorrhoids and vitiated conditions of vata. It can be administered to cause abortion (Longman, 1994a).

***Moringa oleifera* Lam. (Sonjal) (Moringaceae):** It belongs to family Moringaceae. It is commonly known as Sonjal.

**Distribution:** Throughout India, also cultivated.

**The plant:** An unarmed middle sized graceful tree with corky grey bark and easily breakable branches; leaves usually tripinnate, rachis slender, thickened and articulated at the base, leaflets elliptic or obovate, rounded at the apex, nerves obscure; flowers white in large puberulous axillary panicles; fruits pods, upto 45 cm long, pendulous, greenish, triangular, 9-ribbed, seeds trigonous, the angles winged.

**Properties and uses:** The roots are bitter, acrid, thermogenic, digestive, carminative, anthelmintic, constipating, anodyne, anti-inflammatory, emmenagogue, sudorific, diuretic,

ophthalmic, rubefacient, expectorant, haematinic, antilithic, alexipharmic, stimulant and vesicant. They are useful in vitiated conditions of vata and kapha, dyspepsia, anorexia, verminosis, diarrhea, colic, flatulence, otalgia, paralysis, inflammations, amenorrhoea, dysmenorrhoea, fever, strangury, vesical and renal calculi, ascites, ophthalmopathy, cough, asthma, bronchitis, pectoral diseases, splenomegaly, epilepsy, hysteria, cardiopathy, abscess and pharyngodynia.

The bark is acrid, bitter, thermogenic, abortifacient, antifungal and cardiac and circulatory stimulant. It is useful in ascites, vitiated conditions of vata and kapha and ringworm. The leaves are anti-inflammatory, anodyne, anthelmintic, ophthalmic and rich in Vitamin A and C. They are useful in scurvy, vitiated conditions of kapha and vata, wounds, tumours, inflammations and helminthiasis. The seeds are acrid, bitter, anodyne, anti-inflammatory, purgative, antipyretic and ophthalmic (Longman, 1994b).

***Nasturtium officinale* R.Br. (Machhai/Padya) (Cruciferae):** It belongs to family Cruciferae. It is commonly known as Macchai/Padya.

**Distribution:** Throughout India, wild, also cultivated.

**The plant:** A perennial much-branched, aquatic herb with creeping or floating stem, native of Europe, N.Africa and W.Asia; it is naturalized in many countries, including India and is commonly found in ditches, pools and margins of shallow streams upto an altitude of 2,100 m. Leaves pinnate: leaflets 7-11, sessile, ovate-oblong or sinuately lobed, obtuse; flowers white, in short racemes; fruit a siliqua, shortly cylindric; seeds minute, ovoid, muriculate.

**Properties and uses:** It is consumed raw as salad; sometimes boiled and cooked as vegetable. Chopped leaves are incorporate in fruit and vegetable juice cocktails, soups and biscuits (Bhargava, 1959). It possesses antiscorbutic and stimulant properties and is eaten to improve appetite. A decoction of the plant is given as a blood purifier, vermifuge and diuretic. Water cress is consumed raw as salad; it is used also as garnish for various dishes. It is sometimes boiled and cooked as vegetable. Chopped leaves are incorporated in fruit and vegetable juice cocktails, soups and biscuits (Bhargava, 1959).

It possesses antiscorbutic and stimulant properties and is eaten to improve appetite. It is a good source of vitamins and minerals. Analysis of India water cress gave the following values: moisture 89.2; protein 2.9; fat 0.2; carbohydrate 5.5; mineral matter 2.2%: Calcium 290, phosphorous 140, iron 4.6 mg/100 g (Minati and Ganguli, 1961).

It is a rich source of Vitamin A and E and also of ascorbic acid. It contains: Vitamin A, 4720 I.U.; thiamine, 0.08; riboflavin, 0.16; niacin, 0.8 and ascorbic acid, 77 mg/100 g; biotin, 0.5  $\mu$ /100 g. It has been used therapeutically correcting vitamin deficiency (Watt and Merrill, 1963).

Water cress is reported to be useful in strangury and goiter; the juice is used as a cure for polypus of the nose. It possesses antibacterial properties and is used for dry throat and cold in the head, asthma and tuberculosis. A decoction of the plant is given as a blood purifier, vermifuge and diuretic (Bushnell *et al.*, 1950).

***Paspalum scrobiculatum* Linn. (Koda) (Poaceae):** It belongs to family Poaceae. It is commonly known as Koda.

**Distribution:** Throughout India, wild, also cultivated.

**The plant:** An annual grass, culms upto 90 cm in height, tufted on a very short rhizome, leafy from the base upwards; leaves 2-ranked, 15-45 cm long, glabrous or sometimes softly hairy, ligule short, membranous, spikelets. Suborbicular, normally 2-ranked, glumes glabrous, upper lemma and palea crustaceous, palea with wide membraneous auricles at the base; grain biconvex, shining, deep purple with a conspicuous ridge along the margin, tightly enclosed in the hardened lemma and palea.

**Properties and uses:** The grains are sweet, bitter, astringent, cooling, constipating, diuretic, sedative, alexeteric, styptic and tonic. They are useful in ulcers, flatulence, strangury, diarrhea, hallucination, inflammation, hepatopathy, haemorrhages, vitiated conditions of pitta, burning sensation and general debility. The stem is useful for corneal opacity (Longman, 1994b).

***Phytolacca acinosa* Roxb. (Jarag) (Phytolaccaceae):** It belongs to family Phytolaccaceae. It is commonly known as Jarag.

**Distribution:** Temperate Himalayas, wild or cultivated, from Hazara and Kashmir to Bhutan, 5000-9,000 ft.

**Properties and uses:** The plant is narcotic in nature. The oil extracted from the roots is used for pain in joints. It has a bitter toxic substance phytolacca toxin (Chopra *et al.*, 2002).

***Pueraria tuberosa* DC. (Birau/Bilikand) (Fabaceae):** It belongs to family Fabaceae. It is commonly known as Birau/ Bilikand.

**Distribution:** Throughout India, upto 1,200 m.

**The plant:** A large perennial climber with very large tuberous roots, distributed nearly throughout india, except in very humid or very arid regions and ascending up to 1,200 m. The roots are used in medicine as a demulcent and refrigerant in fevers as cataplasm for swellings of joints and as lactagogue (Kiritikar and Basu, 1994).

A large spreading tuberous herbaceous twiner with very large tuberous roots; leaves 3-foliolate, leaflets broadly ovate or rhomboid, sub-coriaceous, glabrescent above and silky beneath; flowers blue or purplish blue in leafless racemes; fruits membranous, flat, jointed pods clothed with long silky bristly brown hairs. The plant contain: dry matter 85.1; total carbohydrates 64.6; crude fibre 28.4; crude protein 10.9 and ether extraction 0.5%. Beta-sitosterol, sucrose, glucose and fructose have been identified.

**Properties and uses:** The roots are sweet, refrigerant, emollient, laxative, aphrodisiac, galactagogue, diuretic, rejuvenating, emetic, cardiogenic, alterant, expectorant, febrifuge and tonic. They are useful in vitiated conditions of pitta and vata, arthritis, burning sensation, constipation, agalactia, strangury, emaciation, cardiac debility, intermittent fevers, pharyngitis, leprosy, dyspepsia, tuberculosis, hepatosplenomegaly, cough, spermatorrhoea and general debility (Longman, 1994a).

***Rhododendron arboreum* Smith. (Burash) (Ericaceae):** It belongs to family Ericaceae. It is commonly known as Burash.

**Distribution:** Temperate Himalayas from Kashmir to Bhutan, 4,000-11,000 ft., Khasia Hills, 4,000-6,000 ft., Nilgiris Pulneys, Travancore, above 5,000 ft. An evergreen, much-branched tree, up to 14 m in height and 2.4 m in girth, found in the Himalayas from Kashmir to Bhutan and in the hills of Assam and Manipur at altitudes of 1,200-4,000 m.

**The plant:** Green leaves are reported to contain a glucoside, ericolin (arbutin, C<sub>12</sub>H<sub>16</sub>O<sub>7</sub>). Flowers, sourish-sweet in taste, are eaten; the sub-acidic jelly or preserve is made from the petals. They are also used in diarrhea and dysentery. The pigments present in the flowers are cyaniding-3-galactoside and cyaniding-3-arabinoside (Harborne, 1962).

*R. arboreum* thrives best on moist loam without lime but can also grow on rocky ground, provided there is sufficient soil-moisture. It is common in the Western Himalayas. The capsules open and shed their seeds chiefly during Jan-March in Western Himalayas (Chadha, 1995).

**Properties and uses:** An evergreen, much-branched tree, upto 14 m. in height and 2.4 m. in girth. Flowers are eaten raw or made into juice; to cure stomach diseases (Uniyal *et al.*, 2006; Tiwari *et al.*, 2010b). Young leaves are poisonous; applied to forehead for headache.

***Urtica ardens* Link. (Bichchhu ghas) (Urticaceae):** It belongs to family Urticaceae. It is commonly known as Bichchhu ghas.

**Distribution:** It occurs in temperate Himalaya's upto 5940 m.

**The plant:** Leaves, flowers and fruits are cooked as vegetables. A small or medium-sized tree, about 10 m high, found wild in the sub-Himalayan tract, from Chenab east wards to Sarda and cultivated all over the plains of India. The root of the young tree and also root bark are rubefacient and vesicant.

**Properties and uses:** The leaves are used to cure uterine hemorrhages, bleeding from nose and blood vomiting (Dhiman, 2005; Gangwar and Joshi, 2008) regulate menstrual period (Matin *et al.*, 2001). The leaves are rich in vitamin A and C and are considered useful in scurvy and catarrhal affections; they are also used as emetic. The flowers are used as tonic, diuretic and cholagogue. The seeds are considered antipyretic, acrid and bitter. The seed oil is applied in rheumatism and gout (Chopra *et al.*, 2002; Kiritikar and Basu, 1994).

## SIGNIFICANCE

Himalayan herbal medicine and their traditional knowledge is a good illustration of poor communities living in the remote areas, fighting even incurable diseases through the traditional methods and even for their livestock, through these traditional herbal medicines. Medicinal plants are natural resources for new drugs. Plants parts are directly used as medicines by a majority of community in all over world and have no side effect like allopathic medicines. Most of the modern medicines are produced indirectly from medicinal plants.

## CONCLUSIONS

In this review, we have focused on 48 wild edible plants family in Uttarakhand Himalaya for their nutraceutical importance, which have been rarely reviewed. Nutraceuticals are currently receiving recognition as being beneficial in coronary heart disease, obesity, diabetes, cancer, osteoporosis and other chronic and degenerative diseases such as Parkinson's and Alzheimer's diseases (Singh, 2011a). Evidences indicate that the mechanistic actions of natural compounds involve a wide array of biological processes, including activation of antioxidant defenses, signal transduction pathways, cell survival-associated gene expression, cell proliferation and differentiation and preservation of mitochondrial integrity. It appears that these properties play a crucial role in the protection against the pathologies of numerous age-related or chronic diseases (Mandel *et al.*, 2005; Singh, 2011b; Shanker *et al.*, 2009).

It is very imperative that the nutrients found in many foods, fruits and vegetables are responsible for the well-documented health benefits. For example, lutein and zeaxanthin prevent cataracts and macular degeneration; beta-carotene and lycopene protect the skin from ultraviolet radiation damage; lutein and lycopene may benefit cardiovascular health and lycopene may help to prevent prostate cancer. Because of these and other marked health benefits of these, it must be taken regularly and to reduce the risk factors like high cholesterol, high blood pressure and diabetes. Some of the most popular nutraceutical products marketed today are botanicals such as St. John's wort, echinacea, ginkgo biloba, saw palmetto and ginseng.

Many industries manufacture and market the nutraceuticals, where the side effects (especially consumed in large quantities) of these nutraceuticals not reported or often unproven. In order to have scientific knowledge about the nutraceuticals, publics should be educated, where recommended daily doses of these nutraceuticals should be known by each consumer.

With the rapidly increasing interest in the nutraceutical revolution, we need to establish a vibrant nutraceutical research community which is absolutely necessary to convert the majority of potential nutraceuticals to established ones thereby truly delivering their enormous benefits to all of us. The list of nutraceuticals being studied is changing continually and reflects ongoing research, market developments and consumer interest.

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