Journal of Plant Chemistry and Ecophysiology

Open Access

Austin Publishing Group

Research Article

Some Important Medicinal Plants of Cold Desert Regions of District Kinnaur of Himachal Pradesh State in India: Their Uses and Chemical Ingredients

Verma RK and Tewari VP*
Himalayan Forest Research Institute Conifer Campus, India

***Corresponding author:** Tewari VP, Himalayan Forest Research Institute Conifer Campus, Shimla, India

Received: May 10, 2016; **Accepted:** June 09, 2016; **Published:** June 10, 2016

Abstract

Himalayan region including cold deserts has the richest medicinal plant resource of India. More than 50% medicinal plants traditionally used in India come from the Himalayan region. During the field studies of cold deserts of Kinnaur district of Himachal Pradesh, India about 113 plants of medicinal value were documented. This article highlighted the information on habitat, plant parts used, uses and chemical ingredient of 22 most important medicinal plant species. Out of 22 plant species, 11 i.e. *Aconitum heterophyllum, Arnebia euchroma, Betula utilis, Dactylorhiza hatagirea, Ephedra gerardiana, Hippophae rhamnoides, Hyssopus officinalis, Hyoscyamus niger, Jurinea dolomiaea, Picrorhiza kurroo, Rhododendron campanulatum* fall in the category of threatened plants. The rarity in these medicinal plants is due to habitat alteration, narrow range of distribution, over grazing and over harvesting. The better conservation of natural resources can be done by inclusion of a section on the conservation of rare and endangered medicinal plants in the wild life protection act, promotion of community based conservation, *In-situ* conservation through the establishment of nature reserves, *Ex-situ* conservation through tissue culture and developing medicinal plant nurseries.

Keywords: Cold deserts; Medicinal plants; Habitat; Chemical ingredients; Himachal pradesh

Introduction

Himalayas, one of the largest and youngest mountain chains in the world, cover roughly 10% of India total land surface. The diverse climate and the varied environmental conditions of Himalayas support diverse habitat and ecosystems with equally diverse life forms. It provides an important habitat to the flora and fauna including 9,000 species of angiosperms and hence, is considered as the hot spot of biodiversity [1]. There are about 3,470 species considered exclusively endemic to the Himalayas [2].

Medicinal plants have been used as a major source of therapeutic agents by man for thousands of years. India is a one of the richest medicinal plant resources of the world. This vast wealth is widely distributed in different parts of the country having specific phytogeographical entities. In India, out of 17,000 species of flowering plants about 17% are considered to be of medicinal value [3]. As per an estimate, out of over 1600 species of medicinal plants traditionally used in India, more than 50% species come from the Himalayan region [4]. The World Health Organization has estimated that some 80% of the developing world relied on their traditional medicines and that of these 85% use plants or their extracts as the active substance [5]. Earlier, only the local people used these plants resources for their own consumption, but in recent years there has been a sudden rise in the demand of herbal products and plant based drugs across the world resulting in the heavy exploitation of medicinal plants.

The cold deserts in India have been formed primarily due to the rain shadow effect of the towering main Himalayan mountain wall and its offshoot ranges those run in an accurate shape from the Indus gap in north west to the Brahmaputra gap in the north east. In India, the cold deserts mainly occur in Ladakh region of Jammu & Kashmir, Spiti valley of Lahaul & Spiti district and Pooh sub division of Kinnaur district of Himachal Pradesh with some area falling in the state of Uttarakhand and North- east region of India with a total geographical area of about 1,26,400 km^2. The total geographical area under cold deserts in Himachal Pradesh is about 11,000 km^2, out of which 3,400 km^2 lies in Kinnaur district [2]. Human pressure on natural ecosystems is intensifying, some being incompatible with survival of certain species of plant. The assessment of medicinal plant wealth in this harsh cold arid belt may provide a key for their conservation. Keeping these facts in view attempts were made to documents the medicinal plants, their uses and chemical ingredients found in cold desert of Kinnaur district in Himachal Pradesh.

Description of study areas

Kinnaur is located in the North-Eastern part of Himachal Pradesh and it shares its Eastern boundary with Tibet. The Zanskar Mountains form the international frontier between Kinnaur and Tibet. Kinnaur is a tribal area of Himachal Pradesh in true style. It consists of very high mountains, deep valleys or gorges, glaciers and rivers. The river Satluj, which is the main river draining this district, divides it into two unequal parts. The district has a number of valleys varying in altitude from 1000 m to 5000 m [6]. Most of the areas in Kinnaur have a temperate climate due to its high elevation. The lower

Citation: Verma RK and Tewari VP. Some Important Medicinal Plants of Cold Desert Regions of District Kinnaur of Himachal Pradesh State in India: Their Uses and Chemical Ingredients. J Plant Chem and Ecophysiol. 2016; 1(2): 1009.

Table 1: Location of study areas.

S. No.	Name of the area	Altitude	Latitude	Longitude
1	Labrang	3000-5000 m	31° 40′ 46.8″ to 31° 42′ 37.5″N	78° 26 32.2″ to 78° 28′ 30.5 E
2	Lippa-Asrang	2700-5000 m	31° 39′ 30.1″ to 31° 41′ 14.9″N	78° 22′ 80.3″ to 78° 15′ 44.6″ E
3	Pooh	2700-4200 m	31° 45′ 37.6″ to 31° 46′ 53.4″ N	78°34′ 54.9″ to 78° 36′ 57.1″ E
4	Ropa-Giavung	3000-5000 m	31° 42′ 93.6″ to 31° 43′ 98.7″ N	78°31′ 72.8″ to 78° 23′ 94.1″ E
5	Namgia	3000-5000 m	31° 48′ 38.3″ to 31° 46′ 63.2″ N	78° 39′ 26.4″ to 78°40′ 68.4″ E
6	Hango	3400-5000 m	31° 49′ 35.4″ to 31° 48′ 30.2″ N	78° 31′ 99.8″ to 78° 33′ 83.0″ E

Figure 1: Map of location of study sites.

parts of the Satluj valley and the Baspa valley receive monsoon rains. The upper areas of the Kinnaur mainly Pooh sub division fall in the rain shadow area. These areas are considered to be cold desert areas and having climate similar to that of Tibet. Accordingly, study was conducted in different areas of cold deserts of Pooh sub division of district Kinnaur, Himachal Pradesh (Table 1, Figure 1).

The climate of the area is characterized by extremes in temperature coupled with excessive dryness, dry and highly evaporative wind exhausting whatever little moisture is there in the already rarefied atmosphere. During the prolonged winters, which usually starts from the end of September, area receive heavy to moderate snowfall which continues up to next May. Hence, snow remains the only form of precipitation in these areas. The bare mountains exhibit typical desert coloration of rocks due to peculiar solar weathering.

Methodology

The information on botanical name, plant families, description, habitat type, flowering and fruiting period, medicinal uses and chemical ingredient of medicinal plants found in cold desert area of Pooh sub division in district Kinnaur, Himachal Pradesh was compiled following Chopra et al. [7], Kirtikar and Basu [8] and Kala [9]. The information on plant part used, local uses was collected from the interactions with the local people during the field surveys. The information on chemical ingredients of medicinal plants has been taken from already published papers/ literature and no independent wok on determination of chemical ingredients was done.

Some Commercially Valuable Medicinal Plants of Cold Deserts of Himachal Pradesh

There are about 3500 species of higher plants have been identified in the Himachal Pradesh state flora. Besides, there are also large number of ferns, mosses, fungi and asso-lichens occurring in various parts of the state. Out of 3500 known plant species, there are around 500 medicinal, 150 aromatic and quite good number of potent alternative and substitute drug plant sources available for being harnessed at present [10]. Many of them are valued for their medicinal uses for which indigenous traditional knowledge existed since long (Table 2). Many of them are on the verge of extinction due to unscientific over exploitation.

The details of twenty-two most important and commercially valuable medicinal plants of cold deserts are given below. These plant species are commercially extracted from the region for the purpose of marketing to the various pharmaceutical industries/ traders. Out of 22 plant species selected for detailed description, 11 of them are fall in the category of threatened plants.

Aconitum heterophyllum all. ex Royle [*Ranunculaceae*]

It is a tuberous herb, up to 1 m tall (Figure 2). Stem simple or branched from the base. Lower leaves 5-10 cm long, broadly ovate, cordate, or more or less 5 lobed, teeth obtuse or acute, upper leaves lanceolate, sharply toothed. Flowers in racemes, greenish- blue with purple veins. Sepals petaloid, the upper one helmet shaped. Follicles are hairy and 5in numbers. The plant is mostly found in moist areas of the cold deserts and distributed from 3000-4000 m. The plant is used for tonic, diarrhoea, aphrodisiac and cough. The roots contain non-toxic, amorphous alkaloids, atisine (0.4%), dehydroatisine, heteratisine and hetisine. It also contains aconitic acid, tannic acid, pectin and starch. Atisine is physiologically relatively inactive substance. The drug is chiefly used in the form of pure white bitter powder. Atisine in small doses is much less toxic than the aconites and consequently the species is often regarded as non-poisonous [10].

Arnebia euchroma (Royle ex Benth) Johnston [*Boraginaceae*]

Plant is having rounded clusters of pale-purple flowers which

Table 2: Details of some of important medicinal plants of cold deserts, Himachal Pradesh.

S. No.	Plant Name	Flowering & Fruiting	Parts Used	Uses	Reference
1	*Aconitum heterophyllum*	June-September	Root	Tonic, diarrhoea, aphrodisiac, cough	Anonymous [11]
2	*Anaphalis triplinervis*	July-August	Leaf, shoot	Wounds, skin diseases	Verma and Kapoor [2]
3	*Arnebia euchroma*	June-August	Roots	Toothache, ear-ache, eye diseases, cuts, wounds, hair tonic	Chauhan [10]
4	*Arnebia guttata*	July-September	Roots	Roots yield a dye and also as a cough medicine	Verma and Kapoor [2]
5	*Berberis aristata*	May-September	Root, bark	Skin diseases, diarrhoea, jaundice, eye complaints	Kirtikar and Basu [8]
6	*Bergenia stracheyi*	June- August	Root, flower	Blisters, kidney stones, liver disorders	Chopra et al. [7]
7	*Betula utilis*	June–October	Leaf	Jaundice, Burns, Wounds	Chauhan [10]
8.	*Capparis spinosa*	May-September	Flower bud, bark	Scurvy, rheumatism, paralysis, toothache	Verma and Kapoor [2]
9	*Cassiope fastigiata*	June-August	Leaves	Fire burns, cooling effect, healing the wound	Verma and Kapoor [2]
10	*Corydalis govaniana*	July-September	Flower, leaves	Fever	Anonymous [13]
11	*Dactylorhiza hatagirea*	July-August	Tuber	Kidney complaints, aphrodisiac	Chauhan [10]
12	*Datiscca cannabina*	July-September	Roots, Shoots	Fever, Gastric complaints	Verma and Kapoor [2]
13	*Dracocephalum heterophyllum*	July-September	Flower, leaf, stem	Peptic ulcer, gastritis, hypertension, cough, headache	Verma and Kapoor [2]
14	*Ephedra gerardiana*	May-June	Aerial shoot, roots	Asthma, hay fever, rashes of allergic origin, rheumatism	Anonymous [15]
15	*Heracleum candicans*	May-October	Flowers, Leaves	Liver complaints, arthritis, toothache	Verma and Kapoor [2]
16	*Hippophae rhamnoides*	June-July	Fruits	Pulmonary complaints, tumors, preventing sunburn	Chauhan [10]
17	*Hyoscyamus niger*	July-September	Fruits	Nervous affections, toothache, asthma and whooping cough	Anonymous [16]
18	*Hyssopus officinalis*	July-September	Leaves	Nervous disorders, toothache; uterine and urinary troubles	Chauhan [10]
19	*Jasminum humile*	April-June	Leaves, Roots, Flowers	skin diseases, wounds and ulcers, eye trouble, headache	Chopra et al. [7]
20	*Juniperus communis*	June-October	Flowers, Leaves	Asthama, stomalitis, hemicarnia, chronic bronchitis, disease of the liver and spleen	Chauhan [10]
21	*Jurinea dolomiaea*	July-September	Roots	Skin eruptions, gout and rheumatism	Verma and Kapoor [2]
22	*Mentha longifolia*	July-September	Leaves	Headache, stomach complaints, rheumatism	Anonymous [20]
23	*Origanum vulgare*	June-September	Whole plant	Tonic, cold, hysteria, fever	Chauhan [10]
24	*Picrorhiza kurrooa*	June- August	Rhizomes, Stolen	Asthma, cold & cough, bile trouble, jaundice, leprosy, constipation and stomach trouble	Anonymous [17]
25	*Prunella vulgaris*	June-September	Shoot	Fever, lung complaints	Chauhan [14]
26	*Rheum australe*	June-July	Dried rhizomes and roots	Stomach problems, cuts, wounds, muscular swellings, tonsillitis and mumps	Chopra et al. [7]
27	*Rhododendron campanulatum*	May-June	Leaves and flowers	Chronic rheumatism, syphilis, sciatia, hemicranias and cold	Anonymous [18]
28	*Tagetes minuta*	May-August	Whole plant	Ranikhet diseases virus, asthmatic, aperients, diuretic and diaphoretic	Verma and Kapoor [2]
29	*Taraxacum officinale*	June-October	Roots, stems	Tonic, mouth blisters, kidney and liver disorders	Anonymous [21]
30	*Thymus linearis*	June–September	Whole plant	Whooping cough, epilepsy, suppression of urine and menstrual catarrh	Chauhan [10]

turn blackish-purple and with slender corolla-tubes usually longer than the subtending bracts and calyx (Figure 3). Corolla-tube to1.5 cm, but often shorter, lobes spreading to 12 mm. Leaves linear with conspicuous long bristly hairy stem leaves many, stalkless, mostly 5-8 cm; stem one or severally to 30 cm; rootstock stout. It is found in drier areas and distributed from 3500-4200 m. It is used in toothache, ear-ache, eye diseases, as healer of cuts, wounds, hair tonic and also the fire burns. It has been reported to be an antipyretic, anti-microbial and anti inflammatory. The purple roots are used as hair tonic by the local people and often dug out for sale. The plant contains Ac-Shikonin and 4 related compounds; alkamin- Beta-di-Me-Acrylate [10].

Berberis aristata DC. [*Berberidaceae*]

A large, thorny, deciduous shrub nearly 2-5 m tall with pale rough, furrowed bark; leaves stalked, obovate or elliptic, fascicled in the axils of simple or branched spines, leathery, often with sharply toothed margin. Flowers yellow, in compound racemes with stout pedicles; racemes are longer than the leaves. Fruits 1.8 cm x 0.6 cm, ovoid, grey white when young, bluish when ripe. The habitat of the plant is dry slopes and mostly found at 2700-3500 m elevation. The wood, root bark and extract have been used in medicines from a very remote period. Used in skin diseases, menorrhagia, diarrhoea, jaundice and in affections of the eye. A decoction of the rot bark is used as a wash for unhealthy ulcers and is said to improve their

Figure 2: *Aconitum heterophyllum.*

Figure 3: *Arnebia euchroma.*

Figure 4: *Bergenia stracheyi.*

approach and promotes cicatrization. Ripe fruits are edible and are also given as a mild laxative to children. Berberine in the form of its salts as Berberine hydrochloride and berbein sulphate is used in dyspepsia, diarrhoea, malarial affections, amenorrhoea, enlargement of the spleen, anorexia, vomiting of pregnancy and intestinal catarrh. Infusion of berberis has bactericidal power [8]. Berberine is the principal alkaloid and also contains oxycanthine and umbellatine, fat, resin and tannin. The fruits contain malic acid, citric acid and tannins. The root bark is rich in alkaloid contents. The principal alkaloid (berberine), can be easily obtained from the roots in the form of its salts i.e. hydrochloride 2.23% and sulphate 3% [11].

Bergenia stracheyi (HooK.f. & Thoms.) Engl. [*Saxifragaceae*]

It is erect, fleshy, perennial herb with stout creeping root stock

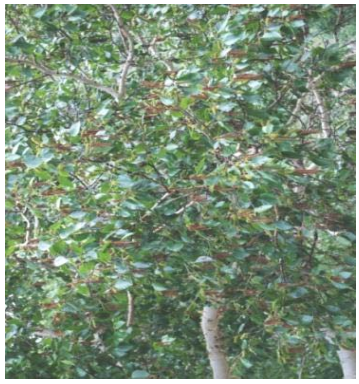

Figure 5: *Betula utilis.*

Figure 6: *Corydalis govaniana.*

(Figure 4). Leaves obovate to oblong-obovate, base cuneate, apex rounded, margins crenate to dentate, ciliate, glabrous or puberulous, scape usually 10-20 cm long, pink tinged. Flowers are white or liliac, in terminal loose corymbs. The plant is mostly found in glacial moraines, moist rocky slopes at an elevation from 3000-4500 m. Rhizomes and roots are bitter, astringent, diuretic aphrodisiac, also used in fever and applied to boils and opthalmia [12]. Bark is antiseptic, carminative, and is used to heal up the wounds [7]. Rhizomes contain gallic acid, tannic acid, glucoside, mucilage, wax, starch, calcium oxalate and mineral salts.

Betula utilis D. Don. [*Betulaceae*]

It is small tree upto 10 m tall. Bark is papery, white, brownish or reddish-white (Figure 5). Young shoots pubescent, older glabrescent. Leaves are ovate, base rounded, subcordate or cuneate, margins doubly serrate to subserrate. Male flowers are in catkins. Fruiting scales woody. Nuts elliptic-ovate. It is found in rocky area at an elevation from 3000-4000 m. In Ayurveda, the bark is acrid, pungent, heating, tonic, alexiteric; useful in convulsions, bronchitis, diseases of the blood and the ear, leprosy etc. In Yunani system, the bark is good for ear-ache. The decoction of the bark is used as a wash in otorrhoea and poisoned wounds. It is also antiseptic carminative given in anaemia, cough, obesity, urinogenital diseases, bysteria, toxemia and various infections. Internally, it is given for hidden injuries and is also a good veterinary medicine. The plant contains betulin, lupeol, olenolic acid and acetyle olenolic acid in addition to leucocyanadin in the outer bark and polymeric anthocyanidins in the inner bark.

Figure 7: *Dactylorhiza hatagirea.*

Figure 8: *Ephedra gerardiana.*

Corydalis govaniana Wall. [*Fumariaceae*]

It is erect or tufted, perennial herb, 20-30 cm high (Figure 6). Radical leaves few to many, 2 -pinnate with petiole as long as or longer than lamina; cauline leaves usually 2, opposite or sub opposite, simple dentate. Racemes 10-30 flowered, 5-10 cm long, exceeding the radical leaves. Bracts dissected. Flowers yellow. Capsule is oblong. It is found mostly in marshy areas and glacial moraines at an elevation of 2700-3200 m. The root is considered tonic, diuretic, alterative and antiperiodic. It is prescribed in syphilitic, scrofulous and cutaneous affections. The yellow juice is employed in eye diseases [8]. An alkaloids derived from the plant is isoquinoline which contain protopine and stylopine. The plant also contains l-Adlumine, berberine, l-canadine, l-corypalmine, cryptocavine, alpha-allocryptopine, ophiocarpine and protopine [13].

Dactylorhiza hatagirea (D. Don) Soo [*Orchidaceae*]

It is glabrous, terrestrial, robust herb, 20-25 cm (Figure 7). Tubers palmately divided into 2 or 5 like processes. Leaves are voblong or oblong-lanceolate. Flowers are pink or purple, in dense flowered spikes. It is found in moist places in grassy meadows at an altitude of 4000-4500 m. The roots are used as a farinaceous food, nervine tonic and aphrodisiac. Mucilage jelly is nutritious and useful in diarrhoea, dysentery and chronic fever. A decoction of salep with sugar and flavoured with species is a useful drink for the sick. In Unani system of medicine, it is used in seminal debility, chronic diarrhoea and general weakness in debilitated women after delivery. It is also considered as demulcent, nutritive, astringent and is given in paralytic affections [14]. The roots contain starch, fairly large quantity of mucilage, sugar, alumen, a trace of a volatile oil and ash consisting chiefly of potassium and lime. The starch is obtained by grinding the root under water and straining. Salep powder is whitish or yellowish in colour and as specified in Russian Pharmacopoeia, not yield more than 14 per cent moisture and 3 per cent ash [10].

Ephedra gerardiana Wall ex Stapf. [*Gnetaceae*]

A low growing rigid tufted plant 30-60 cm, with numerous densely clustered erect slender smooth green jointed branches, arising from a branched woody base (Figure 8). Branches are with scales at the joints. Male cones ovate 6-8 mm, solitary or 2.3; with 4-8 flowers each with 5-8 anthers with fused filaments, and rounded fused bracts. Female cones are usually solitary. Fruit are ovoid 7-10 mm, with fleshy red succulent bracts enclosing the 1-2 seeds. It is found in drier regions of the cold deserts at an altitude ranging from 2700 to 4500 m. Dried twigs used for asthma, hay fever and rashes of allergic origin. Decoction of stems and roots is used as remedy for rheumatism. Nasal spray prepared from the drug is used in asthmatic attacks and inflammation of mucous membrane. Alkaoids present in plant is ephedrine and pseudo-ephedrine. Total alkaloid content in Indian ephedra varies from 0.28% to 2.79%. The rainfall has adverse effect on the alkaloid content which decreases from May-August and thereafter gradually increases to maximum value in October-November. Ephedrine is the principal alkaloid and in pharmacological action is similar to adrenaline. The alkaloid content increases with the age of the plant and best period to collect the green twig is, when the plants are 4 years old and are in blossom [15].

Hippophae rhamnoides Linn. [*Elaeagnaceae*]

It is usually dwarf much-branched very thorny shrubs, with scaly young twigs and with a silvery-waxy covering to the older shoots; distinguished from Hippophae salicifolia by the leaves which are smaller and narrower and clothed beneath with silvery or rusty scales (not star-shaped hairs). Leaves are variable, oblong blunt to 4 cm by 2-4 mm broad, green above or silvery-scaly on both sides. Fruits are 6 mm long, orange or red. It is found in riversides of the cold desert areas at an altitude ranging from 2700-3200 m. Fruits are used for preparation of jelly, syrup and used against pulmonary complaints, tumors, in sunburn preventing preparation. As emollient it is also used in prevention of eye region skin wrinkles and in other cosmetic preparations. Alkaloids derived from the plant are harmol and Harman. Polyphenols, quercetin and isorhamnetin have also been found. Berries yielded isorhamnitol, while the leaves contain flavones. Serotonin has been extracted from its bark. Plant contains steroids, terpenoids, alkaloids and sugars. Fruits are rich in Vitamin-C. Seeds yield fatty oil [10].

Hyoscyamus niger Linn. [*Cannabaceae*]

It is erect, pubescent or hairy, viscid, tall herb (Figure 9). Basal leaves oblong-ovate, coarsely sinuate toothed, petioled; cauline leaves ovate, irregularly pinnatifid or lobed, sessile. Flowers lurid-green with purple veins, lower ones in the forks of the branches, upper solitary in the axils of leaf-like bracts, forming one sided long spikes. It is mostly found in open area and also along the road sides at an elevation of 3000-3600 m. Hyoscyamus has anodyne, narcotic and mydriatic properties. It is principally employed as a sedative in

Figure 9: *Hyoscyamus niger*.

Figure 10: *Jurinea dolomiaea*.

nervous affections, toothache and irritable conditions, such as asthma and whooping cough and is substituted for opium in case where the latter is inadmissible. The plant is used in indigenous medicine, along with other ingredients, for diabetes. The total alkaloids present in the various parts of the plant are: roots: 0.16% leaves: 0.045-0.08%; flowering tops: 0.07-0.010 % and seeds: 0.06-0.10%. The principal alkaloids present in the various parts of plant are hyoscyamine and hyoscine or scopolamine. The traces of tropine and scopoline are also present. Atropine occurs only in the roots of biennial plants at the end of the vegetative period. Mature leaves are richer in byoscyamine than gyoscine; tender leaves are relatively richer in hyoscine. The seeds are more or less odourless and are slightly bitter to taste. They contain an amber-coloured oil (25-30%) with the palmitic, 6.5%; stearic, 1.6%; oleic, 35.2%; and linoleic, 56.4% [16].

Hyssopus officinalis Linn. [*Lamiaceae*]

It is erect or decumbent, aromatic, woody herb, and 30-60 cm in height. Stems much branched from the base. Leaves are sessile, oblong - linear or lanceolate, obtuse, entire. Spikes are axillary or terminal. Whorls many flowered, calyx funnel-shaped. Corolla is blue to blush purple. It is found mostly in dry slopes at an elevation of 3000-3600 m. Plant is considered stimulant, carminative and used in medicines. An infusion of the tea, prepared from the plant is said to be effective in nervous disorders, toothache; in pulmonary, digestive, uterine and urinary troubles. The leaf juice is employed for the expulsion of the round worms. The crushed herb is applied as a resolvent and vulnerary. Steeped in hot water, it is used as fomentation for wounds, sprains and sprains; muscular rheumatism and for clearing blackness due to the blows. It is recommended for use as a gargle in throat inflammations and hoarseness and internally for chronic bronchitis and bronchial asthma. Hyssop oil is used as a flavouring agent in bitters and tonics and also used to some extent in perfumes with a spicy odour. The herb yielded 1 per cent essestial oil. The volatile oil consists of the betone 1-pinocamphene, Beta-pinene, L-pinene, camphene, 1-pinocampheol, and aldehyde, bicyclic sesquiterpenes and sesquiterpene alcohols of the carinen type and small amounts of primary and secondary alcohols. Besides the volatile oil, the herb contains fat, sugar, choline, tannis, carotin and xanthophylls. The tops contain ursolic acid and flavonoid glunosides-hesperidin, diosmen, besides the bitter principle marubion, resin, sugar and gums.

Juniperus communis Linn. [*Cupressaceae*]

Shrub, more or less procumbent having leaves in 3 whorls, linear or boat shaped, sharply pointed, spreading nearly at right angles from the branchlets. Flowers are dioecious, axillary. Fruit is subglobose, blue-black, glaucous. Seeds are 1-3 in number. It is found in drier areas at an elevation of 3000-4000 m. Juniper is aphrodisiac, styptic useful in asthama, stomatitis, hemicrania, chronic bronchitis, disease of the liver and spleen. Juniper oil possesses carminative, stimulant and different forms of dropsies, either administered alone, or in combination with other diuretics. They have also been used in mucous discharge such as gonorrhea, leucorrhoea and in some cutaneous disease. Indian juniper yield as low as 0.25 % of essential oil. It also contains resin (about 10%), a bitter substance, juniperine and organic acids. Oil of Juniper berries is colourless or pale-greenish yellow, but on exposure thickens rapidly, turns yellow and ultimately to reddish brown simultaneously acquiring an acid reaction. The fruits contain, besides the volatile oil, fermentable sugars (33%), resin (8%), juniperin (a mixture of tannin and sugars, 0.36%), fixed oil, protides, wax, gum, pectins, organic acids (formic, acetic, malic, oxalic and glycolic) and potassium salts. They are a good source of ascorbic acid (35 mg/100g.). The oil contains d-a-pinene as the major constituent together with smaller amounts of camphence, cadinene, juniper camphor, Junene and terpinenol [16].

Jurinea dolomiaea Boiss [*Asteraceae*]

A quite prostrate perennial herb with a dense central domed cluster to 10 cm across, of rather large purple flower-heads, and a rosette of longer spreading lobed leaves often with purple mid-veins (Figure 10). Flower-heads to 4 cm long, very shortly stalked, in an umbel like head, involucre with outer bracts lanceolate, hairy, the inner narrower long-pointed, dark red, papery. Leaves are oblong blunt in outline, pinnately lobed, the lobes toothed or shallowly lobed, white wooly beneath, stalked, arising from a stout taproot and radiating to 30 cm. It is found in open alpine slopes or pastures at an elevation of 4000-5000 m. The aromatic roots are used as a chief ingredient of dhoop industries. The roots are considered stimulant and given in fever after childbirth. The bruised roots are applied to skin eruptions. Aromatic oil from roots is useful in gout and rheumatism. It contains aromatic resin.

Mentha longifolia (L.) Hudson [*Lamiaceae*]

It is erect or diffuse, strongly aromatic, hoary-tomentose herb, 30-90 cm high (Figure 11). Leaves are shortly petioled, 3-8 cm long, lanceolate or ovate to oblong, acute, sharly toothed, rounded or cordate at the base, pubescent or haory-tomentose above, haory-

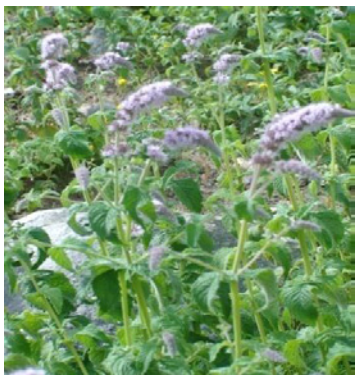

Figure 11: *Mentha longifolia.*

Figure 12: *Picrorhiza kurrooa.*

tomentose beneath. Spikes 2-5-8-0 cm long, slender, hoary. Flowers shortly pedicelled; pedicels hoary, whorls usually continuous but occasionally interrupted. Corolla is liliac, hairy outside. It is found in moist places of the cold deserts region at an elevation of 2700-4000 m. The plant is considered to be carminative, antiseptic and stimulant. The leaves are astringent and are used for rheumatic pains. A decoction of the plant is used in fever, headache and heat apoplexy. The plant is used as a substitute for imported peppermint oil for flavouring confectionery. The oil is used in U.S.A. for flavouring powder and is used as a snuff to remove headache. A politice is placed over the lumber and renal region acts as a good diuretic and emollient. As a liniment, it is applied in. Essential oil obtained from the plant contains piperitone oxide, disophenol, pipertenone, piperitinone oxide and diosplhenolene.

Origanum vulgare Linn. [*Lamiaceae*]

It is erect branched, hairy herb, 30-60 cm high. Leaves are petioled, broadly ovate, and sparsely hairy. Cymes are corymbose, sometimes forming panicles. Bracts are large, imbricating, green or purplish. Flowers are polygamous, larger ones bisexual, smaller ones pistillate. Calyx is bell-shaped, enlarged in fruit. Corolla is pink or white. It is found in moist slopes of cold desert region at an elevation of 2700-4000 m. The plant oil possesses carminative, stomachic, diuretic, diaphoretic and emmenagogue properties. It is also given as a stimulant and tonic in diarrhoea, colic and is applied in chronic rheumatism; toothache and earache. Also used in cough and bronchitis. In homoeopathy, it is used for hysteric conditions. The oil is used in baths, healing wounds and stimulates the growth of hair and has been extensively used in the cosmetic and soap industry. The paste of the leaves is applied in fireburns, eczematous skin, boils, cuts and wounds. The herb contains a volatile oil containing 50 per cent thymol. It has also been reported to yield tannin and a bitter principle.

Picrorhiza kurrooa Royle ex Benth [*Scrophulariaceae*]

It is small herb having pale or purplish blue flowers are and corolla much smaller, 8 mm, 5-lobed to the middle and with very much longer stamens (Figure 12). Leaves 5-15 cm, almost all basal, spathulate to narrow elliptic, coarsely saw toothed, narrowed to a winged stalk, flowering stamens usually longer than leaves. It is mostly found in alpine and rocky slopes at an elevation of 4000-4500 m. The plant is considered to be anthematic, appetizer, blood purifier, blood pressure reducer, cardiac expectorant, febrifuge and useful in asthma, cold and cough, bile trouble, jaundice, leprosy, constipation and stomach trouble. A brown resinous glucoside, picorhizin and its aglycone, picorhizetin have been reported from the rhizome. A glycosidal bitter principle kutkin, a non bitter substance kurrin, vanilic acid, kutkiol occurring as acetate and kutkisterol also isolated from the drug. Kutkin, apocynin alkanol alkane and Beta-sitosterol have also been reported from the rhizomes [17].

Prunella vulgaris Linn. [*Lamiaceae*]

It is erect or ascending, hairy to glabrous herb, 10-30 cm high. Stems are often creeping and rooting at the base. Leaves are petiolate, ovate or oblong, entire or toothed. Flowers dimorphic; larger ones bisexual; smaller female, six in a whorl, crowded in erect, cylindric, terminal spikes. Caylx tinged with purple. Corolla is violet to purplish-violet. It is mostly found in moist shady slopes at an elevation of 3500-4000 m. The herb is antiseptic, expectorant, anti-rheumatic, alterative, tonic, astringent, carminative, anti-spasmodic, stimulant and is used in fever and coughs. It is also used in haemorrhages, diarrhoea, relaxed throat and ulcerated mouth in the form of an infusion and is useful for the treatment of internal bleeding piles. It can be used as syrup for the internal wounds and for curing the headaches. The herb yields a bitter principles and essential oil. The oil mainly consists of d-camphor and d-fenchone and traces of penchyl alcohol [14].

Rheum australe D. Don [*Polygonaceae*]

It is perennial herb having stem stout, streaked green and brown, with rounded leaves and with dense branched clusters of small dark reddish-purple flowers borne in an inflorescence 20-30 cm long, which enlarges greatly in fruit. Leaves with a very stout leaf stalk and with rounded to broadly ovate blade with a heart shaped base, hairy beneath. Nutlets purple with narrow wings and with a rounded heart shaped base and notched apex. It is mostly occurred in open slopes of the cold deserts regions at an elevation of 3000-4000 m. Rhizomes/roots are purgative, astringent, tonic, stomachic and aperients. Powdered roots are used for cleaning teeth and are sprinkled over ulcers for quick healing. Root is used as a local home remedies and for stomach problems, cuts, wounds and muscular swellings, tonsillitis and mumps. It has been found as potent anti-inflammatory drug. Chrysophanic acid, emodin, starch, rhein, anthraquinone derivatives, essential oil, calcium oxalate and a resinous substance have been obtained from the roots. Leaves contain oxalic acid. The total oxalic acid contents of the leaves and stems are reported to be 0.65 and 0.81 per cent, respectively. Rutin (0.32%) is present in the leaves and

Figure 13: *Rhododendron campanulatum.*

flowers [7].

Rhododendron campanulatum Linn. [*Ericaceae*]

It is a small shrub, leaves10-15 cm long, ovate- oblong or elliptic, entire glabrous above, red beneath (Figure 13). Flowers are 2-3 cm long, pinkish- purple, in lax terminal cluster. Calyx is 1-2 mm long, teeth ovate, Obtuse glabrous. Corolla 2-3 cm long, bell-shaped; lobes 5, notched. Stamens are 10 in numbers. Ovary is densely hairy. Capsules are 1.5-3 cm long. Cylindrical, curved, longitudinally furrowed. It is found in rocky slopes and forest areas at an elevation of 3000-4500 m. Leaves are used in chronic rheumatism, syphilis, sciatia, hemicranias and cold. Flowers yield pungent aromatic oil. Leaves contain a toxic substance which is closely resembled andromedotoxin in its chemical and pharmacological properties. Besides, they are also reported to contain ericolin, ursolic acid, a-amyrin, friedelin, epifriedelinol, campanulin, quercetin, a bitter yellowish brown resin. They also contain the pigments myricetin and quercetin [18].

Tagetes minuta Linn. [*Asteraceae*]

This plant is highly aromatic annual, 1-2 m tall (Figure 14). Leaves are 7-15 cm long, piunatisect and the segments are 11-19; 4 cm or more long, linear or lanceolate. Flowers heads are pale yellow, narrow, tubular, in corymbose clusters and the achenes are black. It is found near waste places and on dry embankments at an elevation of 2700-3500 m. The oil obtained from the herb has synergistic activity and shows positive juvenile hormone activity. The ethanolic extracts of the entire herb show anti-viral activity against Ranikhet diseases virus. The roots show nematicidial activity. The flowers are used as asthmatic, aperients, diuretic and diaphoretic. They contain a volatile oil which exhibits tranquilizing, hypotensive, spasmolytic, bronchodilatory and anti- inflammatory properties. Aromadendrenem tagetone, phenylethyl alcohol, ocimens, salicyladehuyde, phenylacetaldehyde, eudesmil, linalyacetate, limonene, linalool and an un-identified carbonyl compound have been isolated from the plant.

Figure 14: *Tagetes minuta.*

Taraxacum officinale Wigg. [*Asteraceae*]

It is perennial herb with stout rootstock. Leaves are all radical, sessile, oblanceolate or linear, entire to lyrate pinnatifid; lobes often pointing downwards, rarely oblanceolate and entire. Heads yellow, 1.0-3.0 cm across, solitary, on long flowering scapes. Pappus is hairy white. It is found in marshy/ moist areas at an elevation of 2700-3700 m. Root is diuretic, tonic laxative, anti-rheumatic and aperients. The plant has slight insulin content and is used as a bitter for loss of appetite and stomach upsets. The drug promotes the secretion of gall and is a useful remedy for chronic disorders of kidney and liver. It has been in use for gallstones, cholecystits, jaundice, atonic dyspepsia with constipation, muscular rheumatism and obligurea. The drug contains a bitter crystalline principle, taraxacin and a crystalline substance, taraxacerine; the phytosterols-taraxasterol and homotaraxasterol besides saponin. The milky sap contains ceryyalcohol-lacutuce-roltaraxacin, and choline. The root yields inulin, tannin and some ethereal oil; the leaves contains vitamin C and the flowers, xanthophylls. Plant is also reported to contain pectose, enzyme, fatty acids including melissic and p-hydroxyphenylacetic acids, stigmaterol, sampnin, Potassium and Vitamin.

Thymus linearis Benth. [*Lamiaceae*]

It is prostrate, much branched, hairy, aromatic herb (Figure 15), which is 10-25 cm long with woody rootstock. Leaves are subsessile, oblong-ovate or lanceolate, conspicuously gland-dotted on both surfaces. Flowers are polygamous, in compact capitate spikes. Male flowers are large. Calyx is hairy outside and at the mouth within, gland-dotted. Corolla is purple or white. It is found in rocky areas of the clod deserts regions at an elevation of 3000-4500 m. The herb possesses anti- spasmodic, antiseptic, expectorant, carminative, anthelmintic and stimulating properties. The leaves and floral shoots are employed for the treatment of whooping cough, epilepsy, suppression of urine and menstrual catarrh. An infusion of the leaves is used in the treatment of itch and skin eruptions. The leaves are used in billousness and their juice is considered emetic. The seeds are considered antifebrile and antheminitic. It is a popular remedy in the hills for stomach complaints, cough and colds. The leaves and

Figure 15: *Thymus linearis.*

floral tops yield a volatile oil known as oil of wild thyme 0.27 per cent from fresh and 0.60 per cent from dried plants. The oil contains chiefly thymol. Three flavonoides, i.e. scutellarin heteroisede, luteolin 7-glucoside, and apigenin have been isolated from the plant. The floral tops and leaves are reported to yield 0.75 per cent of urisolic acid. Its nectar is rich in ascorbic acid.

Conclusion

Out of 22 medicinal plant species recorded from the area, 11 species i.e. *Aconitum heterophyllum, Arnebia euchroma, Betula utilis, Dactylorhiza hatagirea, Ephedra gerardiana, Hippophae rhamnoides, Hyssopus officinalis, Hyoscyamus niger, Jurinea dolomiaea, Picrorhiza kurroo, Rhododendron campanulatum* fall in the category of threatened plants [19]. The rarity in these medicinal plants is due to habitat alteration, narrow range of distribution, over grazing and over harvesting. A major threat is for the species those are uprooted and their underground parts such as rhizomes, tubers, bulbs and roots are used in medicine. *Aconitum heterophyllum* and *Dactylorhiza hatagirea* have become endangered throughout the Himalayas due to over collection. The proper cultivation technology for many of these rare plant species is essentially required to be developed right now so that the cultivation can be done at a large scale for fulfilling the requirements of local people and industries. Moreover, pharmaceutical companies and local people both prefer to use the wild resources as it is believed that the effectiveness in cultivated varieties of medicinal plants is lesser than its wild relatives.

The habitat of most of the plant species have shrunk including in cold desert areas of the Himalayan region mainly due to expansion of human population and environmental degradation primarily because of heavy live stock grazing, unregulated tourism and construction of dam and roads etc. For the better conservation of natural resources following improvement can be done: inclusion of a section on the plant conservation especially of rare and endangered medicinal plants in the wild life protection act; promotion of community based conservation; In-situ conservation through the establishment of nature reserves; *Ex-situ* conservation through tissue culture and developing medicinal plant nurseries; conducting regular training on the procedure of medicinal plants collection, processing among the local people, traders and real stake holders. There is also an urgent need to educate the local people about sustainable harvesting techniques so that the present pressures on medicinal plants especially of rare and endangered categories can be minimized. Collection should only be done in areas where plants grow adequately. Plant parts should be collected during autumn after the vegetative processes are ceased. Meanwhile, proper cultivation technology needs to be developed, established and promoted at large scale among the people.

References

1. Verma RK, Kapoor KS. Kalatop Khajjiar Wild Life Sanctuary, Chamba, Himachal Pradesh: An Appraisal to its Plant Diversity. 2011; 34: 124.
2. Verma RK, Kapoor KS. Plant Wealth in Cold Deserts: Kinnaur, Himachal Pradesh. 2009; 31: 95.
3. Jain SK. Medicinal plants. National Book Trust, India. 1968; 216.
4. Uniyal SK, Awasthi A, Rawat GS. Current status and distribution of commercially exploited medicinal and aromatic plants in upper Gori Valley, Kumaon Himalaya, Uttaranchal. Current Science. 2002; 82: 1246-1252.
5. Sheldon JW, Balick M, Laird S. Is using medicinal plants compatible with conservation? Plant Talk, April. 1998; 98: 29-31.
6. Negi SS. Cold Deserts of India. Indus Publishing Company, New Delhi. 1995; 240.
7. Chopra RN, Nayar SL, Chopra IC. Glossary of Indian Medicinal Plants. CSIR, New Delhi. 1956; 330.
8. Kirtikar KR, Basu BD. Indian Medicinal Plants. International Book Distributors, Rajpur Road, Dehradun. 1987; 1-4: 2791.
9. Kala CP. Medicinal plants of Indian trans-Himalaya. Bisen Singh Mehendra Pal Singh, New Connaught Place, Dehradun (India). 2002; 200.
10. Chauhan NS. Medicinal and Aromatic Plants of Himachal Pradesh. 2nd Edn. Indus Publishing Company, New Delhi. 2006; 632.
11. Anonymous. The Wealth of India, Raw Materials. Publications and Information Directorate (CSIR), New Delhi. 1988a; 1: 253.
12. Manadhar NP. Medicinal Plants of Nepal Himalaya. Ratna Pustak Bhandar, Kathmandu, Nepal. 1980.
13. Anonymous. The Wealth of India, Raw Materials. Publications and Information Directorate (CSIR), New Delhi. 1988b; 2: 427.
14. Chauhan NS. Medicinal Wealth of Pabbar Valley in Himachal Pradesh. M.Sc. Thesis, HPKVV, Palampur, India. 1984.
15. Anonymous. The Wealth of India, Raw Materials. Publications and Information Directorate (CSIR), New Delhi. 1989; 3: 236.
16. Anonymous. The Wealth of India, Raw Materials. Publications and Information Directorate (CSIR), New Delhi. 1959; 5: 332.
17. Anonymous. The Wealth of India, Raw Materials. Publications and Information Directorate (CSIR), New Delhi. 1979; 3: 394.
18. Anonymous. The Wealth of India, Raw Materials. Publications and Information Directorate (CSIR), New Delhi. 1980; 9: 472.
19. Ved DK, Kinhal GA, Ravikumar K, Prabhakaran V, Ghate U, Sankar RV, et al. Conservation Assessment and Management Prioritisation for the Medicinal Plants of J & K, H. P. and Uttaranchal. Workshop held at HFRI, Shimla 22-25 August, 2003. FRLHT, Bangalore, India. 2003; 206.
20. Anonymous. The Wealth of India, Raw Materials. Publications and Information Directorate (CSIR), New Delhi. 1962; 6: 483.
21. Anonymous. The Wealth of India, Raw Materials. Publications and Information Directorate (CSIR), New Delhi. 1976; 10: 591.

Citation: Verma RK and Tewari VP. Some Important Medicinal Plants of Cold Desert Regions of District Kinnaur of Himachal Pradesh State in India: Their Uses and Chemical Ingredients. J Plant Chem and Ecophysiol. 2016; 1(2): 1009.