An overview and economical importance of few selected endangered medicinal plants grown in Jammu and Kashmir region of India

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Abstract

Medicinal plants as a group comprise approximately 8000 species and account for around 50% of all the higher flowering plant species of India. Millions of rural households use medicinal plants in a self-help mode. Over one and a half million practitioners of the Indian System of Medicine in the oral and codified streams use medicinal plants in preventive, promotive and curative applications. In recent years, the growing demand for herbal product has led to a quantum jump in volume of plant materials traded within and across the countries. Further, in view of the side effects of synthetic drugs coupled with their high cost of production, medicinal plants have become major sectors of trade and commerce and are significantly contributing to the socio-economic developments of certain developed and developing countries. Though India has a rich biodiversity, the growing demand is putting a heavy strain on the existing resources. Among various States of India, Jammu and Kashmir State has a rich diversity of medicinal plants because it provides a diverse type of habitats for their growth. Kashmir valley represents the temperate region, Jammu area represents sub-tropical and tropical and Ladakh as cold desert region. More than 50% of plant based medicines prescribed in British Pharmacopoeia are growing in Jammu and Kashmir State.


Key words: Medicinal plants, bioprospection, traditional system of medicine

1. Introduction

Medicinal plants are living resource, exhaustible if over used and sustainable if used with care and wisdom. At present, 95% collection of medicinal plant is from wild. Current practices of harvesting are unsustainable and many studies have highlighted depletion of resource base. Medicinal plants based industries although old and vast are still being managed on traditional ethos and practices and lack a proactive and socially responsible image. As many medical dogmas and beliefs are beginning to fall into disfavour, the benefits of natural health care are enjoying renaissance. With an increase in apprehensions regarding the toxicity and safety of modern drugs, people are once again shifting to traditional system of medicine (Subramonium, 2016). The increasing resistance of some disease producing micro-organisms against synthetic drugs and the interest in herbal remedies shown by the people all over the world has made the policy makers even in developed countries to incorporate herbal medicines in their health care programmes. Medicinal plants play a central role not only as traditional medicines but also as trade commodities, meeting the demand of distant markets (Nayanabhirama, 2016). In USA, as many as one quarter of all medications and pharmaceuticals are derived from plant materials, however, in Germany, the proportion is half as large. In Russia, more than 100 plant species have been approved by the Ministry of Health for prescription use. More than 5000 medicinal plants have been catalogued in China and 1700 of these are in common use. As per the WHO report, 70-80 % of rural population in developing countries depend on traditional health remedies. In India traditional medicine is wide spread. Ayurveda being the oldest one, followed by Siddha, Homeopathy, Naturopathy and Unani System of Medicine. These systems are mostly plant based. Total trade in ISMaH sector in India, is well over Rs 5000 Crores (Shawl, et al. 2004). The main market outlets for medicinal plants are traditional medicine, OTC (Over the Counter) prescription drugs, phyto-pharmaceuticals and functional foods (Shawl, et al., 2004).

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India is having a large plant and animal life, owing to diverse climatic conditions, ranging from the cold desert of Ladakh and Spiti to the hot desert of Thar, the temperate forests of the Himalayas to the tropical rain forests of low lands (Manoharachary and Nagaraju, 2016). The State of Jammu and Kashmir occupies a most strategic position in the entire Himalayan region with a wide range of topographic and climatic conditions from tropical/sub-tropical to sub-alpine/alpine in Jammu and Kashmir to that of cold desert of Ladakh region. In fact, due to physical and climatic conditions, many areas of Jammu and Kashmir State have no surface communication with outside world for about 3-6 months a year and the people of these places have been largely relying on plants growing around for the basic necessities of life, be it food, fodder, fuel or medicine.

The diversity of vegetation of the State of Jammu and Kashmir is evident from the presence of diverse type of habitats. Although, the accurate figures about the number of medicinal plants is not available, however, the studies made by different workers from time to time reveal that about 570 plant species are claimed to be of medicinal importance. More than 50% of plant based medicines prescribed in British Pharmacopoeia grow in Jammu and Kashmir State. Most of the areas under the present study fall under the great Himalayan range constitute the Kashmir Himalayas (Kozgar and Khan, 2010).

2. Materials and Methods

The plant material and the information on medicinal uses were collected during ethnobotanical explorations conducted for a period of time to time. Most of the survey was conducted in far-flung/tribal areas of the study area. The information on each plant was recorded in the field through interviews with the persons having knowledge of medicinal plants or practicing as local medicine men. The information on the medicinal use of plants collected from one locality was cross checked with another locality so that the claim can be confirmed. For each plant species, information was collected on common name of the plant, medicinal use, part(s) used, whether used singly or in combination, mode of application and dosage. A review of literature for general information, bioprospection (folk use, part used, traditional use, main phytochemical constituents and bioactivity, etc.) for the plants included in the paper was carried out thoroughly. The plant species so collected were properly identified and are being maintained in the plant gene bank of CSIR-Indian Institute of Integrative Medicine, Srinagar and its field stations at Bonera (Pulwama), Yarikah (Tangmarg) , etc.

1. Name of plant: Artemisia absinthium L.

   Family: Asteraceae

   Local name: Tethwen/Afsantin/Worm wood.

   Local distribution: Throughout Kashmir Valley, usually in open mountainous slopes. Mostly distributed in Tangmarg, Ferozpur Nallah, Verinagh towards Banihal and outskirts of Srinagar.

   Taxonomic note: An erect shrubby herb, 3-4 ft. tall, much branched. Flower heads small, 3-4 mm, globular, pale yellow in colour. Leaves small, pale green to grayish.

   Bioprospection folk use: The decoction of leaves is used as vermifuge. The leaves are also used as insecticide.

   Part used: Aerial part

   Use in TSM: Used in epilepsy, hemiplegia, facial palsy, melancholic, antispasmodic and as antiseptic. In Unani system of medicine, the drug is extensively used for fevers, swellings and inflammation of viscera.

   Phytochemical constituents: The plant contains a volatile oil known as absinthe or wormwood oil (0.12-0.51 %). The oil contains thujyl alcohol, cadinone, phellandrene, α pinene, 5-guaiiazulene, 3,6-dihydrochamazulene and 5,6 - dihydrochamazulene. In the oil of leaves and flowers, more than 90 compounds have been identified (Nin et al., 1995). The essential oil is also rich in β-thuzone and (z) epoxyocimene, chrysanthyl acetate (Tucker et al., 1993; Juteau et al., 2003). A bitter glucoside absinthin, a bitter substance anabsinthin, a crystalline compound artemetin and artesin. Polycyathylenes like dihydromatricaria ester, C14-trans spiro ketolen ether and tetra hydrafuro lignans of sesamiu type were isolated from aerial parts (Kelsey and Shafizadeh, 1979; Gregor, 1978; Gregor and Hofer, 1980; Kasimov et al., 1987). A guainolide olide, absinholide; a new sesquieterpene lactone, artenolide, parshin C and parshin B isolated from above ground part of the plant (Beauhaine et al., 1984; Ovezduriev et al., 1987). Ethanolic extracts yielded 24-zeta-ethyl cholesta-7, 22-dien-3β-ol (Ikram et al., 1987). Two new diatereomeric homoditerpene peroxydes have also been isolated from the aerial part (Rucker et al., 1992).

   Bioactivity: Steriod sharing of Artemisia absinthium has shown significant effect in crolm’s disease (Omer et al. 2007). Essential oil is reported to have antimicrobial activity (Juteau, et al., 2003). Crude extract of the plant species exhibited hepato protective action partly through microsomal drug metabolizing enzymes and validates the traditional use of plant in hepatic damage (Anwar and Khalid, 1995). 24-ethylcholesta-7, 22-diene-3β-ol exhibited antipyretic activity (Ikram et al., 1987). Two new diatereomeric homoditerpene peroxydes have also been isolated from the aerial part (Rucker et al., 1992).

   Propagation/cultivation: It can be propagated through seeds. However, vegetative propagation through stem and root cuttings is preferable.

2. Name of plant: Achillea millefolium L.

   Family: Asteraceae

   Local name: Pehl-ghasa, Panjoli/ Biranjasif/Yarrow

   Local distribution: Commonly found throughout Kashmir Valley, Kishwar (towards Symthan Pass), waste lands and in open mountainous slopes, etc.

   Taxonomic note: A perennial herb, about 2-3 ft. tall. Flowers borne on dense terminals, flat topped spikes, off white. Leaves desiccated.

   Bioprospection folk use: Flowering spikes are used to cure tooth ache, head ache and as an antipyretic

   Part used: Flowering tops
Use in Traditional System of Medicine (TSM): Flowers laxative, diuretic, anthelmintic, analgesic, abortifacient and antiarthritic. Plant extract is also used as nasal drops in nasal congestion.

Phytochemical constituents: The aerial part of Aconitum millefolium growing in Kashmir have essential oil (0.014 %). 86 compounds are identified by GC and GC Mass analysis. Major constituents are camphor (28%), 1,8-cineole (12%), germacrene-D (12%) and cis-chrysanthenyl acetate (8%) (Shawl, et al. 2002). Many sesquiterpene lactones, viz., 8-acetoxyartabsin, acetylbalchanolide, achillicin, achillin, 8-angeloyxyastabsin, austrirein, millefin are present besides usual mono and sesquiterpenes. Many alkaloids and quaternary bases have also been isolated (Chandler et al., 1982). Aerial part yields a new sesquiterpene lactone - achililolin (Uhebelen et al., 1990). Aerial part yielded desacetylmatricarin, 8-acetyl egelolide and 8-angeloyl egelolidé (Ochir et al., 1991). A glycosyl-neolignan dihydroadenocidoniferyl alcohol 9-O-β-d-glucopyranoside was isolated and characterized; and six flavone derivatives, apigenin, apigenin -7-O-β-d-glucopyranoside, luteolin, luteolin -7-O-β-d-glucopyranoside, luteolin-4'-O-β-d-glucopyranoside, rutin, and two caffeic acid derivatives. 3, 5-dicaffeoylquinic acid and chlorogenic acid also isolated (Innocente et al., 2007).

Bioactivity: Essential oil and methanolic extract has shown antioxidant and antimicrobial activity (Ferda et al., 2003). Antihepatoprotective, antispasmodic and calcium antagonistic activity was reported in the aerial methanolic extract of Aconitum millefolium (Yaesh et al., 2006). The plant has shown antiulcer efficacy after chronic treatment in winter rats (Cavalcanti et al., 2006). Antiprotozoal activity has been reported in the essential oil on Trypanosoma cruzi (Giani et al., 2007).

Propagation/cultivation: The plant can be raised through seeds which germinate in 3-4 weeks at 18-25°C. Vegetatively, it can be propagated by dividing the clumps.

3. Name of plant: Asplenium adiantum-nigrum L.

Family: Polypodiceae

Local name: Dade/Spleenwort

Local distribution: It is found in the temperate/sub-alpine areas of Jammu and Kashmir mainly in Kishan ganga, Jeelum, Lolab and Lidder Valleys and Pir panchal.

Taxonomic note: A perennial herb with tufted stipes about 1-1½ ft. in height. Fronds bi-tri-pinnate, usually lanceolate coriaceous, sori cupious.

Bioprospection folk use: It is used to treat diarrhea, jaundice and as diuretic. Young plant claimed as health/medicinal food and used as vegetable.

Part used: Whole plant

Use in TSM: Although the plant is not documented in the Unani Pharmacopoeia but widely used by Unani physicians for the diseases of spleen, ophthalmology and in various Unani formulations.

Phytochemical constituents: Flavonoids like 2, 4-di-C-glucosides, 1-hydroxyl - 3, 6, 7-trimethoxyxanthone 2, 4-di-C-glucoside and two of its O-rhamnosides, have been found in the aerial parts of the fern (Filippo, 1991). 3, 7, 8-trihydroxyxanthone-1-O-β-lamina-ribioside (Filippo, 1980). A new hydroxycinnamic acid-1-caffeylaminaribioside; 3, 7, 8-trihydroxyxanthone-1-O-β-cellobioside also reported (Rastogi and Mehrotra, 1980).

Bioactivity: The plant is used as expectorant, laxative, purgative and diuretic, antijaundice and as anticonstipative (Vasudeva, 1999).

Propagation/cultivation: Although it can be raised sexually through spores but is very hectic, cumbersome and needs extra care. The best method to propagate the plant is by rhizome cuttings

4. Name of plant: Aconitum heterophyllum wall-ex Royle

Family: Ranunculaceae

Local name: Patris, Patis, Atis, Atvika


Taxonomic note: An erect perennial herb. Leaves broad, ovate, orbicular, toothed, upper amplexicaule. Racemes many flowered. Flowers 2-3cm long, blue, veined.

Bioprospection folk use: The root is eaten raw to relieve abdominal pain and also used antihelminthic.

Part used: Root

Use in TSM: Antiperiodic, aphrodisiac, astringent, tonic, dyspepsia and cough.

Phytochemical constituents: Molecular and crystal structure of hetisine determined (Rastogi and Mehrotra, 1990). Heterophylline, heterophyllisine. heterophyllidene and the strong base fraction of the roots yielded besides atisine two new alkaloïds, atidine and dihydroatidine (Pelletier et al., 1968).

Bioactivity: Preparation of Aconitum sp. showed marked influence on the development of inflammation (Pashinskii et al., 2006). Plant extract inhibited the spinach mosaic virus (SMV) (Zaidi et al., 1988). The plant showed immunomo-dulatory activity (Aral et al., 1986) and antihypertensive activity (Raymond, 1954).

Propagation/cultivation: It can be propagated through seeds as well as vegetatively dividing tuberous roots. The vegetative propagation is better because the seeds often show dormancy. In vitro regeneration protocol has been standardi/ed and detailed chemoprocessing has been done based on marker compounds (Jabeen et al., 2006).

5. Name of plant: Berberis lycium Royle

Family: Berberidaceae

Local name: Kaw duck/ Zirishk/Indian, lycium/Berberry
Local distribution: Usually found on dry stony slopes of Kishwar, Mirpur, Ramban-Reasi, Marwa, Dacchan, Dara, Dacchigham, Sindhi Valley, Pir panchal.

Taxonomic note: A stout shrub about 5-9 ft. tall. Stems spiny, branched, more or less white. Flowers dull-yellow.

Bioprospection folk use: Fruit anticoagulant. Decoction of bark and root used for eye infections and boils.

Part used: Root

Use in TSM: Fruits astringent, sedative and antipyretic. Roots are used as resolvent lithotryptic, diuretic, antirheumatic, antiparalytic and in hemicaria.

Phytochemical constituents: Berberine (Zhongguo et al., 1993), Tertiary dihydroproto-berberine (Gulam, 1973) and Barbamine (Khan et al., 1969).

Bioactivity: The plant collected from western himalayas showed pesticidal effect (Tewary et al., 2005). Berberine produced antagonistic effect on ventricular arrhythmia following myocardial ischemia (Zhongguo et al., 1993). Berberine (1.0 and 2.0 mg/kg) prevented barium chloride induced ventricular arrhythmia in wister rats. It also increased the required doses of aconitine and ouabain for induction of ventricular premature beats, ventricular tachycardia, ventricular fibrillation and cardiac arrest (Zhangguo et al., 1990). Hypotensive action of barbamine, an alkaloid isolated from Berberis lucium has also been reported (Khan et al., 1969).

Propagation/cultivation: It can be raised through seeds as well as vegetatively. Seeds stratified for 2-3 weeks should be sown before winter. Vegetatively it can be raised through leafy cuttings or sometimes by layering.

6. Name of plant: Cydonia oblonga Miller.
   Family: Rosaceae
   Local name: Bum Chuntu/ Behi/Beh dana/ Safarjal dana/ Amrit phala
   Local distribution: Cultivated
   Bioprospection folk use: Fruits are eaten raw and cooked as vegetables also. The jam of fruits is taken particularly during winters to prevent cold and chest complaints. Seed is applied to hair by women for getting silky texture.
   Part used: Fruit and seed
   Use in TSM: Used as cardiac stimulant, tachycardia, anti-anxiety and in flatulence and liver complaints. Seeds with milk have laxative and cooling effects.
   Phytochemical constituents: A homo-monoterpenic compound trans-9-amo-8-hydroxyl-2, 7-dimethylona-2, 4-dienoic acid glucopyranosyl ester isolated (Sousa et al., 2007). Phenolic profile composed of 3-O-caffeoylquinic, 4-O-caffeoylquinic and 3, 5-dicaffeoylquinic acids, lucenin-2, vicenin-2, steallarin-2. isoschaftoside, schaftoside, 6-C-panosyl-8-C-glucosyl chrysosierol and 6-C-glucosyl-8-C-panosyl chrysosierol (Silva et al., 2005). Ionone glycosides; 9-O-beta-D-glucopyranoside of (6R)-3-oxy-4-hydroxy-7, 8-dihydro alpha ionol; a o xo-5, 6-epoxy beta-ionol (Roder et al., 2002). Martnelolactone A & B from fruits of Cydonia oblonga. (2R, 4S)-2, 7 dimethyl-4-hydroxy-5-E, 7 -octadienoic acid lactone (Rastogi and Mehrotra, 1980).
   Bioactivity: Cydonia peel extract was the most active for inhibiting bacteria growth with minimum inhibitory and bactericidal concentrations in the range of 102.5 x 103 microg polyphenol/ml (Fattouch et al., 2007). The plant showed anti-oxidant, anti-influenza and antiulcerative activity (Hamzuza et al., 2005, 2006).
   Propagation/cultivation: Although it can be raised through seeds but vegetative propagation is economical. Root cuttings should be taken in late autumn and stored at low temperature during winter. In spring they can be lined-out horizontally in nursery rows. Leafy cuttings of mature plant can also be used for vegetative propagation.

7. Name of plant: Delphinium denudatum Wall. ex. H&T
   Family: Ranunculaceae
   Local name: Jadwar, Nirbisi/Nirvishi
   Local distribution: Found in Kashmir Himalayas on open and stony mountainous slopes. Usually found in Jhelum and Kishen-Ganga Valley, also towards Tragabal and some parts of Kangan-Naranag area.
   Taxonomic note: A perennial branched erect herb. Leaves orbicular, segments cuneate to obviate, pinatifid. Flowers in racemes, bluish in colour.
   Bioprospection folk use: The roots are chewed to cure tooth ache and the grounded roots are made into paste and applied as an antiseptic.
   Part used: Root
   Use in TSM: Stimulant, tonic, alterative, antiepileptic and also in hemiplegia
   Phytochemical constituents: A new diterpenoid alkaloid, 8-acetylheterophyllisine. In addition to the known alkaloids vilmorrianone, panicutine, denudatine, isotalatizidine, condelphine, and 3-hydroxyl-2methyl-4H-pyran-4-one isolated (Rahman et al., 1997).
   Bioactivity: Ethanolic extract of Delphinium denudatum showed protective effect in a rat model of Parkinson’s disease (Ahmad et al., 2006). The plant shows anticonvulsant, anti-anxiety and memory enhancing activity (Nizami et al., 2005). The aqueous extract of roots showed a significant effect against morphine (10 mg/kg) induced tolerance and dependence in mice (Zafar et al., 2002). Anticonvulsant activity as effective as world renowned antiepileptic drug phenytoin (Raza et al., 2001). Root extract has shown antifungal activity against a number of human pathogenic fungi (Rahman et al., 1997).
**Propagation/cultivation:** It can be propagated through seeds but the rate of germination is very low as the germination is very sensitive to temperature. Seeds fail to germinate at the temperature above 12-15°C. The better method of propagation is by dividing clumps.

8. **Name of plant:** *Prunella vulgaris* L.

**Family:** Lamiaceae

**Local name:** Kalveot/uste-e-kudus/Self heal

**Local distribution:** Commonly found in Kashmir Valley and Drass.

**Taxonomic note:** A small perennial herb, stem ascending, 4-8 inches in height. Whorls in dense heads, terminal. Flower violet. Leaves elliptic or lanceolate, upper sessile.

**Bioprospection folk use:** Flower decoction vapours inhaled for relieving pain in the joints and body. Orally taken decoction of whole plant is used to cure upper respiratory ailments, also used as an antipyreic.

**Part used:** Whole plant

**Use in TSM:** It is used in the upper respiratory tract infections and the disease produced by accumulation of Phlegm. The decoction is also used in hepatitis and in ascites. Externally it is applied on painful joints to reduce inflammation

**Phytochemical constituents:** A prunellin (Tabba et al., 1989).

**Bioactivity:** Aquous extract of *Prunella vulgaris* showed a high antiviral activity against Herpes Simplex Virus-1, 2 and Acyclovir (resistant) strain of HSV (Nolkemper et al., 2006). P-374 herbal therapy for endometriosis of *Prunella vulgaris* (Self heal) reduces the size and number of endometriotic xenograft in immune deficient RAG-2/gamma (C) knockout mice (Collins et al., 2006). *Prunella vulgaris* extract demonstrated a concentration-dependent photoprotection against UVA-induced oxidative stress and may be beneficial as a supplement in photoprotective dermatological preparations (Psotova et al., 2006). Polysaccharides isolated from *Prunella vulgaris* exhibited both immune stimulatory and anti-inflammatory effects against microbial invasion (Fang et al., 2005). Prunellin showed anti HIV activity (Tabba et al., 1989).

**Propagation/cultivation:** The plants can be raised through seeds as well as vegetatively. Seeds take 4-5 weeks to germinate.

9. **Name of plant:** *Podophyllum hexandrum* Royle

**Family:** Podophyllaceae

**Local name:** Bun Wangun/ Papra/ Drenmokshu/Indian May apple

**Local distribution:** Found throughout temperate/ sub-alpine regions of Kashmir, Sonamarg, Gulmarg, Khellenmarg, Naranag- towards Gangabal Sym than Pass, Lolab, Handwara-Gurez region.

**Taxonomic note:** A small herb about 8-16 inches in height. Stem more or less reddish in colour. Leaves usually two, three or four lobed, blade rounded in outline. Flower cup-shaped, solitary, large, white to pinkish in colour. Fruit branjal shaped, purple in colour.

**Bioprospection folk use:** Fruits eaten raw to prevent chest congestion particularly in Ladakh region. Powdered rhizomes are used to cure stomach upsets.

**Part used:** Fruit and root

**Use in TSM:** Powered rhizomes are used for stomach upsets.

**Phytochemical constituents:** Podophyllotoxin-4-O-(D)-6-acetyl-glucopyranoside identified from high-altitude Podophyllum hexandrum (Puri et al., 2006). 4-O-dimethyldehydrodopodophyllotoxin and picropodop-hyllone (Atta-u-Rehman et al., 1995). Ten atyltetralin lignans, viz., podophyllotoxin, 4'-demethylpodophyllotoxin, α - peltatin, β-peltatin, desoxypodophyllotoxin, podophyllotoxone, isopicro podophyllone, 4'-demethyldesoxypodophyllotoxin, 4'-demethylpodop-hyllotoxone and 4'-demethylisopicro podophyllone (David et al., 1984).

**Bioactivity:** The plant species modulates gamma radiation induced immune-suppression in babl/ mice implications in radioprotction (Goel et al., 2007). A fraction (REC-2001) isolated from the rhizome of *P. hexandrum* exhibited cytoxic and radioprotective properties (Shukla et al., 2006). The plant offers radioprotection by modulating free radical flux, role of atyltetralin lignans (Chawla et al., 2006). 4-O-dimethyl-dehydrodopodophyllotoxin and picropodophyllone showed strong antifungal activity against epidermophytoflocosum (Atta-u-Rehman et al., 1995). Podophyllotoxin is a pharmacologically important compound for its anticancer activities. It is used as a precursor for the chemical synthesis of the anticancer drugs etoposide, teniposide and etopophos (Farkya et al., 2004).

**Propagation/cultivation:** The plant can be propagated through seeds as well as by rhizome cuttings. Seeds should be sown before winter to produce better yield. In vitro protocol developed and cultivation technology standardized based on marker compounds (Sultan et al., 2006).

10. **Name of Plant:** *Picrorhiza kurroa* Royle. ex. Benth.

**Family:** Scrophulariaceae

**Local name:** Kode/Kutki/Gentian/ Kudu
Local distribution: The plant is found in sub-alpine/alpine areas of Kashmir Himalayas, usually found in alpine meadows of Mahadev, Zojila range from upper reaches of Thajwas, Gumri onwards, Vishansar to Gangabal, Razdhani top, Symthan pass. Endemic to western Himalayas, present rate of utilization is very high and is in the red list.

Taxonomic note: A low perennial herb, more or less hairy. Leaves basal, narrow elliptic, sometimes round tipped and shoot petioled. Flowering scape ascending, stout. Flower bracteate, pale-purplish blue in colour.

Bioprospection folk use: Powdered roots with water or milk are taken orally as a tonic. Roots used as antipyretic and stomachic.

Part used: Root

Use in TSM: Used in epilepsy, cough, swollen piles, leucoderma, ascites. It is also antiflatulent, tranquilizer and abortificient.

Phytochemical constituents: Extract of the seeds of Picrorhiza kurroa yielded a new triterpenoid, 2α, 3β, 19β, 23-tetrahydroxyolean-12-en-28-O-β-D-glucoside, along with live known triterpenoids. 2α, 3β, 19β, 23-tetrahydroxyolean-12-en-28-oic acid. 2α, 3β, 23-trihydroxyolean-12-en-28-O-β-D-glucoside, 2α, 3β, 23-trihydroxyolean-12-en-28-oic acid. 2α, 3β, 19β, 23-hydroxyolean-12-en-28-oic acid, and 2α, 3β, 6β, 23 -tetrahydroxyolean-12-en-28-oic acid (Zhang et al., 2005).

Extract of roots and rhizome of Picrorhiza kurroa, picroliv yielded picroside I, picroside III, picroside IV, kutkoside, 6-feruloyl catalpol (Jia et al., 1999).

Bioactivity: Hypolipemic effect of water extract of the plant improves the immune system and might be regarded as a biological response modifier (Gupta et al., 2006). The apocyanin (4'-hydroxy-3'-methoxy-acetophenone) a non-toxic compound proved to be effective in the experimental treatments of several inflammatory diseases such as arthritis, colitis and atherosclerosis (Worm et al., 2001). The methanolic extract of Picrorhiza kurroa exhibited antistress, immunomodulatory, anti-inflammatory and antiaging effects. (Rossou et al., 2001). Picroliv, the iridoid glycoside mixture from rhizome of Picrorhiza kurroa exhibited anhepatoxic action in adult male albino rats (Ansari et al., 1991).

Propagation/cultivation: The plant is difficult to propagate through seeds. Therefore, the best method is to raise the plants vegetatively by splitting roots. In vitro regeneration protocol and chemoprofiling based on the Picroside I to IV standardized (Jan et al., 2005).

11. Name of plant: Salix caprea L.

Family: Salicaceae

Local name: Beid/ Bred Mushk/Goat willow

Local distribution: Cultivated

Taxonomic note: A tree like shrub about 20-25 ft. tall. Leaves elliptic, oblong, obviolate, crenate, dark green above, margins often recurved, base cuneate or cordate. Catkins sub-sessile, densely silky, male very stout, sweet scented, 1 inch; female 2-3 inches. Flowering is before leaves emerge.

Bioprospection folk use: The decocition of the flowers is used to core chest congestion and other respiratory ailments and also against fevers.

Part used: Flower

Use in TSM: In TSM apart from flowers, leaves and stem bark are also used as stimulant, refreshing, cardiac and brain tonic, sedative, laxative, in jaundice, in enlargement of spleen and anti pyretic.

Phytochemical constituents: 1, 4-dimethoxybenzene (a floral scent compound) (Dorterl et al., 2005). 12-O-tetradecanoyl-13-phorbol acetate isolated (TPA) (Sultana et al., 2004). Salix caprea stemwood and knots were found to contain the phenolic compounds, viz., vanillic acid, 3-p-coumaryl alcohol, coniferyl alcohol, sinapylaldehyde, dihydrokaemerol, catechin, naringenin, gallocatechin, dihydromyrcetin and taxifolin (Pohjamo et al., 2003).

Bioactivity: The plant has shown significant antioxidant and hepatoprotective activity (Alam et al., 2006). The floral scent compound (1, 4-dimethoxybenzene) of the plant has shown attracting effect of an oligoleptic bee (Dorterl et al., 2005). The plant inhibits skin carcinogenesis in marine skin, inhibition of oxidative stress, ornithine decarboxylase activity in DNA synthesis (Sultana et al., 2004).

Propagation/cultivation: It is difficult to propagate by seeds. The seeds retain their viability for 1-2 months even under most unfavourable conditions. The best method is to raise the plant by stem and root cuttings.

12. Name of Plant: Taraxacum officinale Webber.

Family: Asteraceae

Local name: Hundh /Dudhi/ Bathur/ Dandelion

Local distribution: Commonly found throughout Himalayas, grass lands, shady and moist conditions.

Taxonomic note: A glabrous perennial herb. Leaves all radical, sessile, oblongate or narrowly oblong toothed. Flowering heads solitary on leafless scape about 3-8 inches in height. Flowers yellow in colour.
**Bioprospection folk use:** The leaves are cooked as vegetable and given to the women during and after pregnancy as general and as uterine tonic. Also used as anti-inflammatory.

**Part used:** Aerial part

**Use in TSM:** Used in ascites, jaundice, cholecystitis and as liver and spleen tonic, resolvent, debloater. Seeds are used in tachycardia and enlargement of spleen. The decoction of root is used as blood purifier.

**Phytochemical constituents:** Lutein epoxide isolated from petals of dandelion *Taraxacum officinale* (Martinez et al., 2006). Luteolin and luteolin 7-O-glucoside (Hu et al., 2004). Five germacran and guaiane type sesquiterpene lactones including two taraxinic acid derivatives, isolated from the roots of *Taraxacum officinale*, together with benzyl glucoside, dihydroconiferin, syringin and dihydroxyringin. The other lactones isolated and identified are 11 β-dihydrolactucin, ixerin D and ainslioside (Kisiel et al., 2000). Taraxalsin-a serine proteinase isolated from latex of roots of *Taraxacum officinale* (Rudenskaya et al., 1998). Three flavonoid glycosides: luteolin 7-glucoside and two luteolin 7-diglucosides isolated from dandelion flowers and leaves together with free luteolin and chrysoeriol in the flower tissue. The hydroxycinnamic acids, chioric acid, monoaflowertaric acid and chlorogenic acid found throughout the plant and the coumarins. ciehoriin and ascesuln identified in the leaf extracts of *Taraxacum officinale* (Williams et al., 1996).

**Bioactivity:** The dandelion flower extract possesses marked antioxidant in both biological and chemical models (Hu and Kitts, 2005). Luteolin and luteolin 7-O-glucoside from the plants suppresses the iNOS and COX-2 in RAW 264.7 cells (Hu and Kitts, 2004). The ethanol extract for antidiabetis herbal preparation of which *Taraxacum* is one of the component, has been found significantly to decrease the glucose and fructose amine levels in alloxan induced non obese diabetic mice (Petlevski et al., 2001). Hot water extract of the plant shows correlation with antitumor activity and administration timing (Baba et al., 1981). *Taraxacum officinale* increases nitric oxide production and synthesis from recombinant interferon-α (rIFN-α) primed mouse peritoneal macrophages. The synergy between rIFN-γ and *Taraxacum officinale* is mainly dependent on *T. officinale* induced tumor necrosis factor-α (TNF-α) secretion (Kim et al., 1999).

**Propagation/cultivation:** It can be propagated through both vegetative and seeds. However, seed propagation is more common. Seeds are sown in autumn to produce crop in late spring or early summer.

13. **Name of plant:** *Viola odorata* L.

**Family:** Violaceae

**Local name:** Nun-u-Posh/ Bunafsha/Garden violet

**Local distribution:** Throughout Jammu and Kashmir in shrubberies, forest clearings, rocky and shady areas. Bandipora - Tragbal, Kangan, Sindh valley, Baltal, Lidderwatt and Kishtwar.

**Taxonomic note:** A perennial herb with stout creeping root-stock. Leaves all radical, petiolate, heart shaped. Flowers purplish blue with long pedicels.

**Bioprospection folk use:** Flowers are taken internally to cure bronchitis and other upper respiratory ailments.

**Part used:** Whole plant

**Use in TSM:** Antipyretic, resolvent, laxative, emollient and demulcent. Also used in eczema and to cure certain eye-diseases and bronchitis.

**Phytochemical constituents:** Linear cyclotide, violacin A (Ireland et al., 2006). Two polypeptides-Vodo M and Vodo N isolated from *Viola odorata* (Svangard et al., 2003).

**Bioactivity:** Plant extract exhibited 100% repellency effects against aedes aegypti, Anopheles stephensi, and Culex quinquefasciatus (Amer et al., 2006). The chemical and biological stability of cyclotides of *Viola odorata* have the potential, as pharmacological tools and antitumor agents (Lindholm et al., 2002). Significant oral antipyretic activity in rabbits was exhibited by hexane. Chloroform and water soluble extracts of *Viola odorata*, comparable to aspirin. Antipyretic activity was more prominent in the hexane-soluble portion (Khattak et al., 1985).

**Propagation/cultivation:** Propagation through seeds is not common. Vegetative propagation is the best and productive method to raise the plants. It grows by rhizome like stems that can be separated from others on the crown and taken as cuttings with some roots present. These cuttings should be planted in autumn.

3. **Results and Discussion**

India’s centuries old heritage of traditional medical systems have been utilized for preventive as well as curative aspects of health care. The Jammu and Kashmir State’s contributing part to this treasure is also rich in ethnic folklore, culture and heritage. Because of the fact of its typical agroclimatic conditions, the vegetation is not only diverse but even the targeted plant species contain important secondary metabolites in large concentrations than growing in other parts of the country. The authors have collected a large number of folk claims during ethnopharmacological explorations but only 13 plants, which seem to have better prospects for commercial production have been discussed in the paper. It is well known that the modern system of medicine has been continuously attracting the attention of the people of Jammu and Kashmir State. However, still there is a large population who prefer to use natural herbs in primary-health care. These plants are used by locals in crude form besides being easily available and have successfully cured their ailments for generations (Lone and Bhardwaj, 2013).

A perusal of literature indicates that the use of many medicinal plants, viz., Artemisia absinthium, Achillea millefolium, Berberis lyticum, Cydonia oblonga and Viola odorata, etc., have already been reported in literature. However, the modes of application in many
cases are different as far as the part of plant used, method of preparation of drugs and modes of administration are concerned. This suggests that folk medicinal therapies developed through personal experiences in tribal and other folk communities are mostly endemic in nature. Similarly the different names given to the plants in different areas also makes the ethnomedical study important. *viz*, *Achillea millefolium* is known as “Pahl Ghasa” in the southern and eastern parts of the State, while as the same plant is known by the name of “Panjoli” in northern part of State. Same is the case with *Podophyllum hexandrum* which is known as Drenmokshu in Suru Valley (Ladakh), Papa in the upper reaches of the Narang and Bun-wangun in the other parts of the State. *Viola odorata* is usually known by its Unani name, Bunafsha yet there are many places where it is called as Nun-u-posh. Another interesting observation about *Prunella vulgaris* locally known as Kalvoet is also known as Uste-kudas, particularly in the local herbal market. However, Uste-kudas is the Unani name given to *Lavandula stoechas* in Unani literature. Probably the name Uste-kudas to *Prunella vulgaris* was given by the medicine men from Central Asia who came to Kashmir during Mongol invasions and used it as a substitute of the Uste-kudas. More than one name given to the same plant, strongly suggests the preparation of comprehensive dictionary of local names of the plants to avoid confusions.

Unani system of medicine owns its origin to Greece. In India, Arabs introduced Unani system of medicine and had the State patronage up to 17th century. But during the British rule it suffered a set back due to withdrawal of Governmental support. Hakim Ajmal Khan championed the cause of this system in early twenties and had the vision of bioactive molecules present in various plant species. He is to be credited to integrate this system with modern system of medicine where mostly single drug molecules operate. In Unani system of medicine, single drug or their combinations in raw form are preferred over compound formulations. Moreover, substantial importance is attached to the temperament of the individual. The system offers time tested and excellent remedies for various diseases where modern medicine fails. However, the weaknesses/ shortcomings in traditional medicines involving plant based products is inadequate process of standardization and quality control. There is no proper finger printing of the ingredients in herbal medicines. Therefore, the methods need to be developed particularly to standardize polyherbal preparations (Gupta et al., 2013). The present biological investigations of the plants showed promising activities that coincides with the folk claims already presented in materials and methods. It reveals that it is the traditional use that gives an impetus towards the modern biological activities and lays the foundation of reverse pharmacology. There is a need to undertake detailed phyto-chemical and pharmacological studies for the plants used locally. Since chemical investigation of plants have already yielded many new compounds of therapeutic value in recent years (Cotton, 1996; Buckingham, 1999), such detailed investigations may lead to the discovery of new bioactive molecules for the treatment of specific ailments for which there is no satisfactory cure in modern system of medicine.

The conservation and bioprospection of these medicinal plants is of utmost importance. What is the need of the hour is the integration of new molecular biological assays into the screening of extracts and plant constituents to evaluate detailed pharmacological profile. These methods should elucidate the synergistic effects of various constituents of an extract and herbal drug preparation and gain a better understanding of the mechanism.

Conservation of these plant species should be done involving both conventional as well as biotechnological approaches. Further, identification, isolation of novel genes and development of transgenics for designer plants will be quite fruitful for these listed plants. Domestication of certain high altitude plant species like *Picrorhiza kurroa* and *Podophyllum hexandrum* is a challenge. At CSIR-IIIM-Srinagar propagation through rhizomes and tissue culture in case of *Picrorhiza kurroa* and *Podophyllum hexandrum* has been completed. Identification of genes responsible for cold stress and the relation of this stress with glucosides content in *Picrorhiza kurroa* is underway. Cultivation protocols of elite accessions of *Podophyllum hexandrum* based on marker compounds has been successfully achieved by the Institute. The strategy for the development of medicinal plants will, thus include in situ and ex situ cultivation in near to nature conditions. Keeping in pace with the present international intellectual property rights (IPR), it is important to maintain authentic profiles of these important plant genetic resources through chemo and DNA profiling.

**Conflict of interest**

We declare that we have no conflict of interest.

**References**


