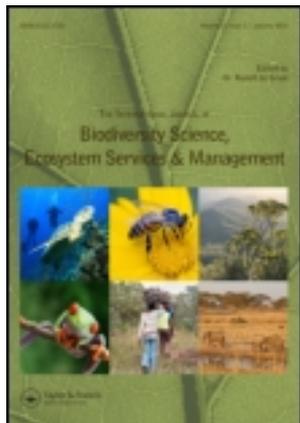


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SHORT RESEARCH PAPER

Traditional and indigenous uses of medicinal plants by local residents in Himachal Pradesh, North Western Himalaya, India

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In the hilly areas of Indian Himalaya, the inhabitants largely depend on plants for curing various diseases. The indigenous knowledge and traditional practices of medicinal plants are vanishing fast. Therefore, we aimed to document indigenous uses of some important medicinal plants of Kullu district; analyze distribution pattern, nativity and endemism of these medicinal plants; and suggest conservation strategies. We recorded information on 75 species of medicinal plants. The recorded species represent trees (12 spp.), shrubs (15), herbs (47), and fungi (1). Of these, 29 medicinal plants were native, 1 endemic, 11 near-endemic, and 46 non-native. Of all species, various plant parts such as leaves (32 spp.), roots (29), tubers (2), seeds (8), fruits (10), flowers (8), fruiting body (1), bark (8), stem (3), and wood (2) were used in curing various diseases. We recommend further studies on habitat ecology of the species, mass multiplication of commercially viable species through conventional and *in vitro* methods, and their establishment in the *in situ* and *ex situ* conditions. Furthermore, it is important to develop farming techniques of commercially viable species and disseminate knowledge among stakeholders through education and awareness raising.

Keywords: indigenous use; endemism; medicinal plants; conservation; Himachal Pradesh; North Western Himalaya

Introduction

Herbal medicine plays an important role in rural areas, and various locally produced drugs are still being used as household remedies for different ailments (Qureshi & Ghufraan 2005). The increasing use of traditional therapies demands more scientifically sound evidence for the principles behind therapies and for effectiveness of medicines (Patwardhan et al. 2005). Herbal medicine is still the mainstay of about 75–80% of the world population, mainly in the developing countries, for primary health care because of better cultural acceptability, better compatibility with the human body, and lesser side effects (Kamraj 2000). Also, traditional knowledge is the most affordable and accessible method available for the treatment of various diseases. Forests represent an important resource for local inhabitants who gather and sell medicinal plants as part of their livelihood (Seth 2003; Adnan & Holscher 2011). Local healers have information and understanding on a wide range of medicinal plants that are useful to cure the common ailments. In particular, they highlight cure pertinent for skin diseases, stomach disorders, respiratory infections, fever, piles, rheumatism, etc. among others. The Indian Himalayan Region (IHR) is one of the richest reservoirs of biological diversity in the world and is considered as a 'store house' of the valuable medicinal plant species. The inhabitants of the IHR utilize the biodiversity in various forms, i.e., medicine, food, fuel, fodder, timber, making agricultural tools, fiber, religious, and various other purposes (Samant & Dhar 1997; Samant et al. 1998).

As one of the top repositories of medicinal herbs, the state of Himachal Pradesh in Himalaya is one of the major sources of raw materials to the global market (Badola & Pal 2003). Kullu, one of the 12 districts of Himachal Pradesh, is perhaps the most important ones. Its valley, which is also an important tourist attraction, is situated between 31° 25'–32° 35' N and 76° 09'–77° 09' E, covering an area of 5503 km² and an elevation range from 850–6000 m above mean sea level (a.m.s.l.). In the north and north-east, it neighbors the Lahaul–Spiti and Kangra districts, in the east and south-east, the Shimla and Kinnaur districts (Figure 1). Medicinal plants have played a vital role in the healing of diseases. The native people of this district have been using these resources for various ailments in their daily life since time immemorial. The preservation of indigenous knowledge has become an urgent need for the society. In the IHR, a number of studies have been carried out on the documentation of medicinal plants diversity (e.g., Jain 1991; Maikhuri et al. 1998; Samant et al. 1998; Chauhan 1999; Joshi et al. 1999; Sood et al. 2001; Dhar et al. 2002; Samant & Pal 2003; Seth & Jaswal 2004; Rawat 2005; Rawat & Garg 2005; Kala 2006; Samant & Pant 2006; Uniyal et al. 2006; Samant et al. 2007, 2011; Rawat et al. 2009; Singh et al. 2009; Semwal et al. 2010). In general, studies on medicinal plants in the Kullu district have been carried out on diversity, distribution pattern, and indigenous uses (Singh 2004; Boktapa & Sharma 2010; Rana & Samant 2011a, etc.), conventional propagation (Butola & Badola 2004, 2006; Butola & Samant

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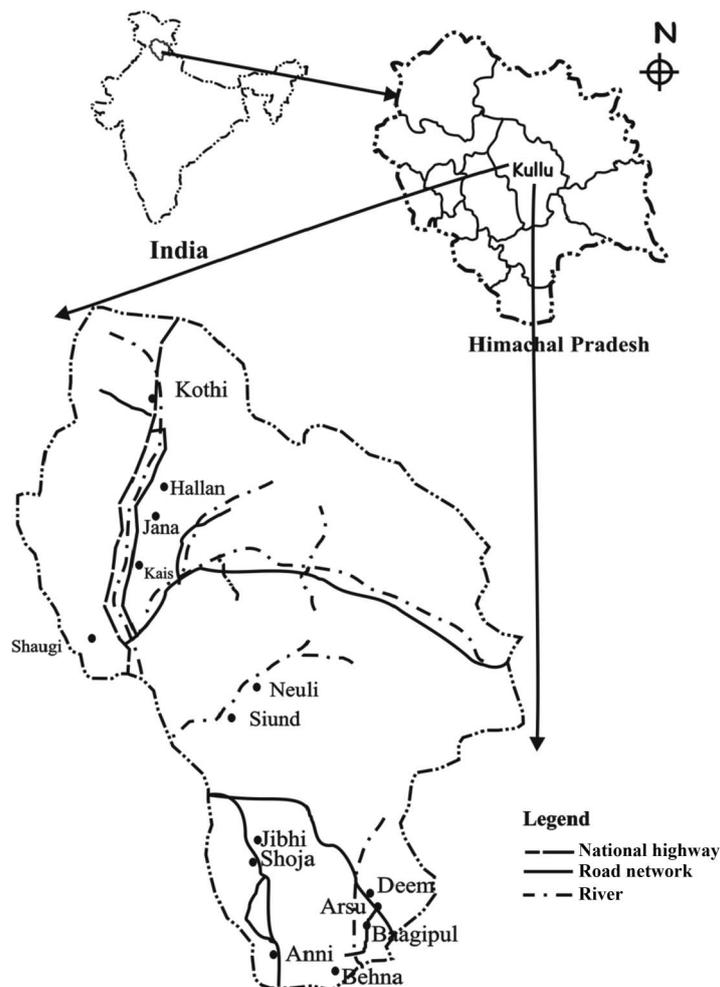


Figure 1. Map of the study area.

2006; Butola et al. 2010, etc.); threatened plants (Butola & Badola 2008; Pant & Samant 2008; Rana & Samant 2011b, etc.) and agro-techniques (Samant et al. 2008, etc.). Although these studies also include information on medicinal uses, actual mode of utilization/traditional practices of these medicinal plants have not been documented so far. Therefore, we aimed to document the indigenous uses as well as actual utilization and traditional practices of some important medicinal plants of Kullu district, Himachal Pradesh.

Methodology

The present study was based on the extensive field surveys made to different villages of the district during different seasons of the years from 2008–2011. During the surveys, participatory interview tools including group discussions, informal meetings, questionnaire surveys, and field observations were used for primary data collection. Surveys were done in 14 villages, Kothi, Hallan, Kais, Jana, Neuli, Shaugi, Siund, Jibhi, Shoja, Anni, Behna, Bagipul, Arsu, and Deem. From each village, knowledgeable persons were interviewed (Table 1). The informants included men, women, youths, and elders between the

ages of 28 and 65 years. Most of them were dependent on agriculture and horticulture for their livelihood. Prior consent for the documentation of information provided by informants was obtained verbally from each of them before the interview was taken. These local knowledgeable persons were interviewed through semi-structured questionnaires on indigenous uses of the medicinal plants (Figure 2). In the beginning, an inventory interview was done where the villagers and the local healers were shown the plant specimens in order to elicit information on the plant's therapeutic uses. Thereafter, the detailed information on these plants was taken. During the interactive meeting, questions on medicinal plants, their parts used, and mode of utilization were asked to the villagers. The participants provided information on the medicinal plants, their parts used, indigenous uses, and traditional practices. The information was documented and analyzed for various parameters. Collection of fresh samples was done and identified with the help of sources on local flora (Collett 1902; Aswal & Mehrotra 1994; Dhaliwal & Sharma 1999; Singh & Rawat 2000). The species were authenticated by the second author, who is an expert of the Himalayan flora, and has been working on Biodiversity Conservation and Management for the last 27 years. Information regarding

Table 1. Profile of the informants of Kullu district in Himachal Pradesh.

S. No.	Name	Age	Sex	Education	Profession	Village
1	Jabhe Ram	41	M	12th	Farmer	Kothi
2	Penu Ram	65	M	8th	Farmer	Jana
3	Dile Ram	55	M	5th	Farmer	Jana
4	Puran Chand	39	M	12th	Farmer	Jana
5	Balwant Kumar	34	M	12th	Farmer	Neuli
6	Bhag Chand	47	M	8th	Farmer	Neuli
7	Nimi Devi	40	F	5th	Farmer	Neuli
8	Mangat Ram	48	M	10th	Farmer	Siund
9	Prem Lata	35	F	10th	Farmer	Siund
10	Surat Ram	46	M	8th	Farmer	Jibhi
11	Koshlaya Devi	28	F	12th	Farmer	Jibhi
12	Bhagat Ram	49	M	8th	Farmer	Shojha
13	Hirdu Ram	52	M	5th	Farmer	Shojha
14	Tuli Devi	43	F	5th	Farmer	Shojha
15	Pritam Singh	43	M	8th	Farmer	Anni
16	Suman Kumari	32	F	12th	Farmer	Anni
17	Purkh Chand	50	M	5th	Farmer	Hallan
18	Dola Singh	48	M	8th	Farmer	Hallan
19	Krishna Thakur	34	F	12th	Farmer	Hallan
20	Roshan Lal	37	M	12th	Farmer	Bagipul
21	Paras Ram	41	M	10th	Farmer	Bagipul
22	Kanta Devi	36	F	10th	Farmer	Bagipul
23	Shyam Lal	42	M	8th	Farmer	Kais
24	Ram Krishan	28	M	12th	Farmer	Kais
25	Kamla Devi	38	F	5th	Farmer	Kais
26	Bhola Ram	50	M	5th	Farmer	Arsu
27	Sohan Lal	40	M	8th	Farmer	Arsu
28	Nanak Chand	52	M	5th	Farmer	Shaugi
29	Hira Mani	42	F	5th	Farmer	Shaugi
30	Dahram Dass	46	M	8th	Farmer	Behna
31	Lal chand	55	M	5th	Farmer	Behna
32	Ram Kali	45	F	5th	Farmer	Behna
33	Jagar Nath	56	M	8th	Farmer	Deem
34	Prakash Chand	46	M	10th	Farmer	Deem
35	Saneh Lata	29	F	12th	Farmer	Deem



Figure 2. Pictures of an oral interview with a local Vaidya (A) and local inhabitants (B).

indigenous uses of medicinal plants was collected from locals and Vaidyas (Ayurveda practitioners) of the villages. However, some information was also validated with the help of secondary information (Jain 1991). An anonymous source (1883–1970) and Samant et al. (1998) were also consulted for determining the nomenclature and nativity. Endemism of the species was identified based

on bio-geographical distribution; species restricted to the IHR were identified as endemic, while those species also found in adjacent Himalayan countries (Himalayan region of Afghanistan, Pakistan, Tibet, Nepal, Bhutan, and adjacent states of the IHR) were identified as near-endemic (Dhar & Samant 1993; Samant et al. 1998; Singh et al. 2009).

Results

Diversity

The present study obtained information on traditional practices of 75 medicinal plants of Kullu district. The species fall under 70 genera and 51 families and represent diverse life forms, i.e., trees (12 spp.), shrubs (15 spp.), herbs (47 spp.), and fungi (1 sp.). Different plant part(s), such as leaves, roots, tubers, seeds, fruits, flowers, fruiting body, bark, stems, and wood were used by the native communities for the treatment of ailments (Figure 3).

Distribution pattern

Along an altitudinal gradient, maximum medicinal plants were distributed in the sub-tropical zone (<1800 m), followed by temperate zone (1801–2800 m) (Figure 4) and Table 2. The diversity of medicinal plants decreased with the increasing altitude. This may be due to the relatively

less species richness and accessibility in the sub-alpine and alpine zones. The diversity and indigenous uses of the medicinal plants are presented in Table 2.

Nativity and endemism

Twenty nine medicinal plants were native to the Himalayan region, while 46 were non-natives and represent Arabia, Oriental India, Europe, China, Malaya, Japan, and other biogeographic provinces, etc. One species (i.e., *Angelica glauca*) was endemic, whereas 11 species were identified as near-endemics (Figure 5) and Table 2).

Discussion and conclusion

The inhabitants of the rural areas are largely dependent on medicinal plants for curing various ailments (Samant et al. 1998; Kala 2006; Samant et al. 2007). But, due to overexploitation and habitat degradation, the population of most

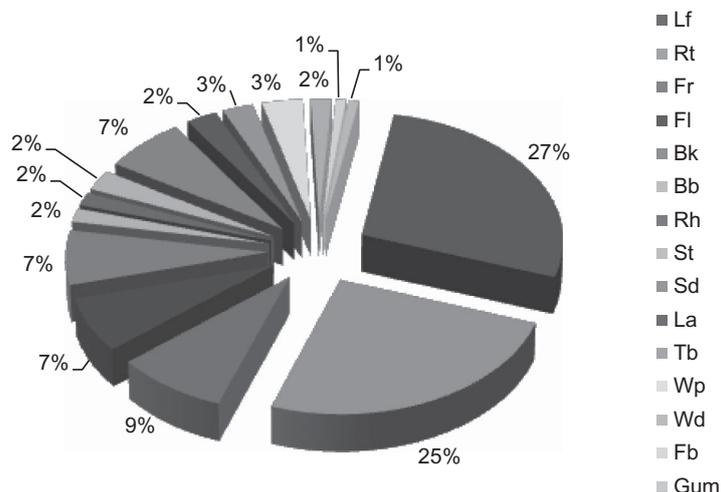


Figure 3. Part(s) of the medicinal plants used by inhabitants. Note: Abbreviations: Lf = Leaf; Rt = Root; Fr = Fruit; Fl = Flower; Bk = Bark; Bb = Bulb; Rh = Rhizome; St = Stem; Sd = Seed; La = Latex; Tb = Tubers; Wp = Whole parts; Wd = Wood; and Fb = Fruiting body.

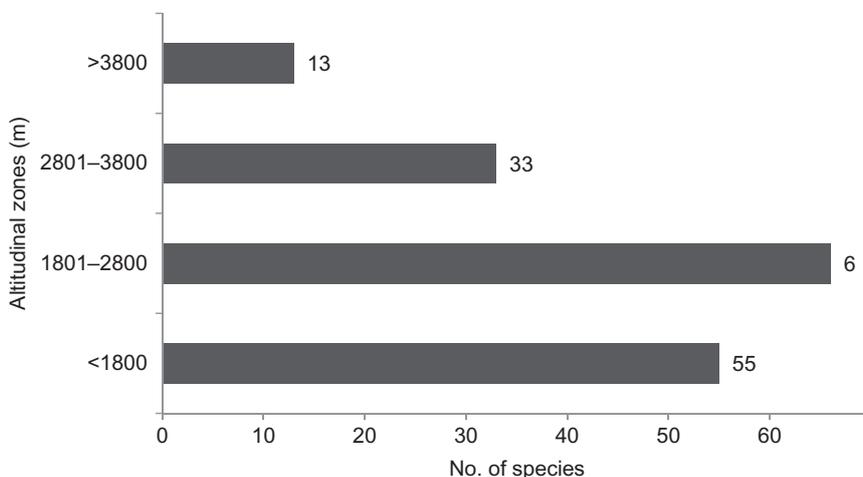


Figure 4. Altitudinal distribution of medicinal plants diversity.

Table 2. Diversity, altitudinal distribution, nativity, endemism, indigenous uses, and traditional practices of some important medicinal plants of Kullu district, Himachal Pradesh.

Taxa	Family	Local name	LF	Altitudinal range (m)	Nativity	Part(s) used	Indigenous uses and traditional practices
<i>Achyranthes aspera</i> L.	Achyranthaceae	Latjeera	H	1200–2200	As trop	Rt, Lf	The roots are dried and its paste is applied for ring worm and pimples twice a day. Juice of the leaves is used to reduce the effect of poisonous insects and snake bite
<i>Aconitum heterophyllum</i> Wall. ex Royle*	Ranunculaceae	Patish	H	3200–4000	Reg Himal	Rt	The dry root is powdered and taken orally with lukewarm water twice a day for 3–4 days. Decoction of its root is also helpful for stomach disorders, fever, nausea, vomiting, and piles
<i>Aconitum violaceum</i> Jacq. ex Stapf.*	Ranunculaceae	Atish	H	3200–3600	Reg Himal	Rt	The dry root is powdered and taken orally with lukewarm water once a day for gastrointestinal complaints
<i>Acorus calamus</i> L.	Araceae	Bach	H	1100–1500	Reg Bor Temp	Rt	The dry root is powdered and taken orally with lukewarm water once a day for stomach ache. Also, a thick paste is applied on the cuts and wounds and cold is cured by applying its paste on nose. Fresh rhizome is inhaled in common cold as anti-allergic and small pieces if chewed on an empty stomach helps in curing asthma
<i>Justicia adhatoda</i> L.	Acanthaceae	Basuti	Sh	850–1700	As trop	Rt, Fl, Fr, Lf	The leaves are ground with the flowers of <i>Hibiscus rosa-sinensis</i> and taken orally to treat asthma
<i>Aesculus indica</i> Leb. ex Camb.*	Hippocastanaceae	Khanor	T	1500–2700	Reg Himal	Fr, Bk	The fruits are dried and beaten into flour, washed several times in water to remove the bitter taste, dried and kept for use as tonic for ladies and stomach problems. The bark is applied in the form of a paste in dislocated joints for 10–15 days
<i>Allium cepa</i> L.	Alliaceae	Payaz	H	850–2200	Persia Beluchistan	Bb	Paste mixed with oil applied topically to cure fever, cuts, pimples, aches, and sores

(Continued)

Table 2. (Continued).

Taxa	Family	Local name	LF	Altitudinal range (m)	Nativity	Part(s) used	Indigenous uses and traditional practices
<i>Allium sativum</i> L.	Alliaceae	Lahsun	H	850–2000	Europe	Bb, Lf	Juice mixed with honey taken orally cures coughs, asthma, and abdominal pain
<i>Angelica glauca</i> Edgew.**	Apiaceae	Chora	H	2000–3800	Reg Himal	Rt	Roots are powdered and taken orally with water twice a day for stomachache. It increases appetite and combined with tonics; it is given in typhoid conditions and bronchitis
<i>Arisaema flavum</i> (Forsk.) Schott.	Araceae	—	H	2000–3400	Arabia	Rh	Rhizome juice is applied on earache, skin diseases, toothache, stomachache, and chest infection
<i>Berberis lysium</i> Royle	Berberidaceae	Kshambal	Sh	1200–3000	Reg Himal	Rt, St	Roots are boiled in water and this decoction mixed with honey is taken orally in jaundice, cough, and cold. Extract of stem is used for skin diseases, sores, and leprosy
<i>Bergenia ciliata</i> Stemb.	Saxifragaceae	Pashanbhed	H	1500–2800	Reg Himal	Lf, Rt	The dry root is powdered and taken orally with lukewarm water for dissolving kidney and bladder stones, fever, and swollen joints. Leaves are kept on head under the cap for relieving from fever
<i>Betula utilis</i> D. Don	Betulaceae	Bhojpattar	T	2900–4000	Reg Himal Japan	Bk	The dried bark is powdered and taken with milk for healing the injuries and swelling. Gout is cured by tying its bark
<i>Boerhaavia diffusa</i> L.	Nyctaginaceae	Punarnava	H	900–2000	Cosmop Trop	Lf, Rt	Decoction of its leaves cures kidney diseases. Paste of its root with honey is applied on the redness of eyes. It is also used to cure leprosy and jaundice
<i>Bombax ceiba</i> L.	Bombacaceae	Simul	T	1200–1600	Am Austr	Fl, Lf	Flowers and fruits are used in snake bite. Paste of flowers and leaves is applied in cutaneous troubles
<i>Butea monosperma</i> Lam.	Fabaceae	Palah	T	700–1200	Ind Or Burma	Gum	The gum mixed with curd and small amount of salt cures diarrhea

<i>Carum carvi</i> L.*	Apiaceae	Singhu Jira	H	2700 – 3650	Europe Oriens As Bor	Fr, Sd	Fruits are used against swelling of breast and testicles. Plant fruit juice is used for muscular swellings and raw fruits are stomachic and carminative. Seeds are used for uterine complaints
<i>Cannabis sativa</i> L.	Cannabinaceae	Bhang	H	1200 – 2500	As Centr Reg Himal Bor Occ	Lf, Sd	The leaves are dried and its paste is used as dressing for wounds and sores. Leaf juice removes lice and dandruff. Seed oil is warmed and massaged on the parts affected with arthritis once a day
<i>Cedrus deodara</i> (Royle ex D. Don) G. Don*	Pinaceae	Diyar	T	1600 – 3000	Reg Himal	Wd	The wood is dried and its paste is applied to swelling. The tar is used for chronic skin diseases, in large doses; it is used for curing leprosy and also applied externally to ulcers
<i>Centella asiatica</i> (L.) Urb.	Apiaceae	Brahmi	H	1200 – 1500	Reg Trop et Sub Trop	Lf	The dried leaves are powdered and given with milk in small doses in mental weakness. Fresh juice of leaves mixed with milk is used in treatment of fever and jaundice. The leaves or entire plant parts are boiled in water and this decoction is given for the treatment of leprosy
<i>Curcuma domestica</i> Valel.	Zingiberaceae	Haldi	H	800 – 1500	Java	Rt	Root paste with water cures breast diseases. Root powder mixed with milk provides relief from cough. By applying mixture of haldi powder with mustard oil on gums cure pyorrhea
<i>Cuscuta reflexa</i> Roxb.	Cuscutaceae	Amarbel	H	800 – 2500	Ind Or	Wp	Its paste with sesame oil is used to strengthen hairs. Tying amarbel with cotton thread on children's neck and hand cures many diseases. Its paste is used to cure itch

(Continued)

Table 2. (Continued).

Taxa	Family	Local name	LF	Altitudinal range (m)	Nativity	Part(s) used	Indigenous uses and traditional practices
<i>Cynodon dactylon</i> Pers.	Poaceae	Drub	H	1200–1600	Cosmop	Lf	The dried leaves are powdered and its paste with water is tied with cloth on eye lid to get relief from eye pain. Its paste with milk is used to cure urinary inflammation
<i>Dactyloctenium aegyptium</i> L.	Asteraceae	Hath panja	H	3000–3800	Reg Himal	Tb	The rhizome is powdered. The powder is taken orally with lukewarm water twice a day for chronic fever, cold, cough, and stomach diseases. Its thick paste is made with water and applied to cuts and wounds
<i>Dactyloctenium aegyptium</i> L.	Asteraceae	Banbuti	H	1500–2500	Ind Or	Lf	Juice of its leaves is given to children suffering from fever and stomach troubles
<i>Dioscorea deltoidea</i> Wall. ex Kunth	Dioscoreaceae	Sigli Mingli	H	1000–2800 m	Ind Or	Tb	Tubers are boiled and used for dysentery and piles
<i>Euphorbia hirta</i> L.	Euphorbiaceae	Dudhali	H	800–1800	Amphig Trop	La	Plant latex is applied for cuts and juice is applied in asthma, diarrhea, boils, cuts, and wounds
<i>Ficus palmata</i> Forsk.	Moraceae	Phegda	T	1000–1500	Ind Or	St, Fr, La	Few drops of latex are applied on aching teeth and gums. Its fruit is used as vegetable for digestion. Its latex is used to pick out thorn (<i>kanta</i>) from the body
<i>Ficus religiosa</i> L.	Moraceae	Peepal	T	850–1400	Ind Or	Lf, Bk	The bark is powdered and taken with water for curing asthma. Taking decoction of its leaves cure skin diseases
<i>Fragaria mubicola</i> Lindl.	Rosaceae	Bumbra	H	1300–3400	Reg Temp	Fr, Rt	Fruit paste heals skin diseases, wounds, and used as astringent and diuretic. Plant juice is useful for inflammation of the nerves and lungs. Root juice is taken for fever
<i>Girardinia diversifolia</i> (Link.) Fries.	Urticaceae	Jarahn, bichhubuti	H	1200–2800	Ind Or-Malaya	Rt, Fr	The dry root is powdered and mixed with water. A thin paste is applied to boils to enhance suppuration. Ground-up fruits are used in the treatment of menorrhoea

<i>Heracleum candicans</i> L.	Apiaceae	Padiyala	H	1800 – 2800	Reg Himal	Rt	The dry root is powdered and mixed with water. A thin paste is applied on the parts affected with leucoderma and psoriasis
<i>Jasminum officinale</i> L.	Oleaceae	SunnaJuhī	Sh	1200 – 2800	Ind Bor Occ	Lf, Fl	The leaf paste is applied in skin disease. Leaves are chewed in toothache. Paste of flowers is used for headache. Juice of its leaves is used in the treatment of diabetes. Drops of its juice in ear provide relief from ear pus
<i>Juglans regia</i> L.*	Juglandaceae	Akhrot	T	1000 – 3300	As Occ Reg Himal	Lf, Sd	The kernel is given for intestinal worms. Decoction is taken for stopping mammary secretion. It is also used to check diarrhea and gargling in sore throat
<i>Juniperus indica</i> Bertol.	Cupressaceae	Bethar	Sh	3500 – 4500	Reg Himal	Wd	The smoke from the green wood is useful for vomiting
<i>Melia azedarach</i> L.	Meliaceae	Jek, darek	T	1100 – 2200	Reg Himal	Bk, Sd	The paste of fresh bark with water twice a day destroys the worms in stomach. The paste of seeds mixed with mustard oil is useful for joint pains
<i>Melothria heterophylla</i> (Lour.) Cogn.	Cucurbitaceae	Barakdi	H	1200 – 2500	As Trop et Sub Trop	Rt	The roots are dried and paste with water is useful for piles
<i>Mentha longifolia</i> (L.) Huds.	Lamiaceae	Kusma	H	1200 – 3500	Europe As Bor	Lf	Decoction of its leaves is useful for stomach pain, acidity, and rheumatic pains
<i>Mentha piperata</i> L.	Lamiaceae	Pudina	H	850 – 3000	Europe As et Afr Bor	Lf	Decoction of its leaves is useful for stomach pain, acidity, and rheumatic pains
<i>Mimosa pudica</i> L.	Mimosaceae	Chui mui	H	850 – 1900	Brazil	Lf, Rt	The dried roots are powdered and paste is made with water and is used for gall bladder stones. The leaves are ground and juice is prepared which is useful for goiter
<i>Morchella esculenta</i> (L.) Pers.	Helvellaceae	Guchhi	F	2200 – 3200	—	Fb	The fruiting body is boiled in water and decoction is prepared. It is given for 2–3 days for cold and cough. The paste of the mushroom is applied to cure chronic boils

(Continued)

Table 2. (Continued).

Taxa	Family	Local name	LF	Altitudinal range (m)	Nativity	Part(s) used	Indigenous uses and traditional practices
<i>Myrica esculenta</i> Buch.-Ham. ex D. Don	Myricaceae	Kaphal	T	1400–2000	As Trop et Sub Trop	Fr, Bk	Fruits are used in dysentery and bark is useful for cough, asthma, sinusitis and chronic bronchitis, diarrhea, and dysentery
<i>Ocimum sanctum</i> L.	Lamiaceae	Tulsi	H	850–1800	Geront Trop	Lf, Rt	Decoction of the root is given in malarial fever. Fresh juice of its leaves is given for fever, cold, and dysentery. Taking 2–3 leaves with water enhances mental power of children
<i>Origanum vulgare</i> L.	Lamiaceae	Ban Tulsi	H	1100–3500	Europe As	Lf, Fl, Rt	The paste of the leaves is applied in cuts, wounds, burns, and boils. The root is powdered and taken for curing tuberculosis. Its oil is given in diarrhea, cough, and bronchitis
<i>Oxalis corniculata</i> L.	Oxalidaceae	Malori	H	1100–2000	Amphig Temp et Trop	Lf	Fresh juice of its leaves is useful for gum problems and dysentery. Paste of its leaves is applied in the treatment of pimples and boils
<i>Parnassia nubicola</i> Hk. f.	Parnassiaceae	—	H	1900–3400	Reg Himal	Rt	Root paste is applied for eye inflammation and useful for wounds, bodyache, headache, and eye problems and showed anti-inflammatory effect
<i>Papaver somniferum</i> L.	Papaveraceae	Afim	H	850–2000	Oriens	Sd	The seeds are dried and powdered. Thin paste with equal amount of clove is used for curing headache. The mixture of its seeds with milk is used to eradicate dandruff
<i>Picrorhiza kurrooa</i> Royle ex Benth.	Scrophulariaceae	Karru	H	3000–4000	Reg Himal	Rt, Lf	The root is dried, powdered, and boiled in water with sugar and decoction is prepared. It is taken orally for jaundice and stomach disorder. Decoction of dry leaves is taken orally once a day for cold and cough
<i>Pistacia integerrima</i> L.	Anacardiaceae	Kakrasingi	T	800–2200	Egypt Persia, Reg Himal	Fr	Galls are used in asthma, phthisis, and other diseases of the respiratory tract and in dysentery. The oil, found in the galls, is used as a carminative

<i>Peurosperrum brunonis</i> Benth. ex Cl.	Apiaceae	Losar	H	3000–4000	Reg Himal	Fl, Lf	A decoction of dried leaves and flowers is taken orally once a day to warm up body during cold. The paste is applied externally on the parts affected with small pox. The dry roots are powdered and taken orally with lukewarm water once a day for stomachache.
<i>Podophyllum hexandrum</i> Royle	Podophyllaceae	Bankakri	H	2200–4000	Reg Himal	Rt	The warm seed oil is massaged on the parts affected with arthritis. Powder of its root is used in the treatment of menorrhagia.
<i>Prinsepia utilis</i> Royle	Rosaceae	Bekhli	Sh	1800–2500	Reg Himal	Sd,Rt	Juice of its seeds controls vomiting. Bark is used to expel tapeworms.
<i>Punica granatum</i> L.	Punicaceae	Dadu	T	1100–2300	Europe Austr	Sd, Bk, Fl	Fresh juice is prepared from its leaves and given against malarial fever for 3 days.
<i>Rhamnus virgatus</i> Roxb.	Rhamnaceae	Chaunsh	Sh	1500–2000	Reg Himal	Lf	The dry root is powdered and mixed with water. A thick paste is applied externally on muscle sprains and for cleaning teeth and are sprinkled over the ulcers for quick healing.
<i>Rheum australe</i> D. Don*	Polygonaceae	Chuchi	H	3300–5200	Reg Himal	Rt	Fresh leaves are crushed to make a paste along with mustard oil and cow's urine. A thick paste is applied externally during small pox and itching.
<i>Rhododendron campanulatum</i> D. Don*	Ericaceae	Shergal	Sh	3000–4000	Reg Himal	Lf	The dry root is powdered and mixed with water. A thick paste is taken for removing swelling and stomach fat.
<i>Ricinus communis</i> L.	Euphorbiaceae	Arandi	Sh	1300–2000	Reg Trop	Rt, Lf	Fresh juice of leaves cure stomach pain and diabetes.
<i>Roylea cinerea</i> (D. Don) Bail.*	Lamiaceae	Kadu	Sh	1100–2000	Reg Himal	Lf	The dry root is powdered and mixed with water. A thick paste is used in the treatment of boils, ulcers, and skin troubles.
<i>Rubia cordifolia</i> L.*	Rubiaceae	Jamithi	H	1800–3000	As Trop et Trop	Rt	Fresh juice of the leaves is applied to control bleeding from cuts and helps in healing. Fruits are useful for proper digestion.
<i>Rubus ellipticus</i> Sm.	Rosaceae	Accha	Sh	1200–1800	Ind Or	Fr, Lf	

(Continued)

Table 2. (Continued).

Taxa	Family	Local name	LF	Altitudinal range (m)	Nativity	Part(s) used	Indigenous uses and traditional practices
<i>Rumex nepalensis</i> Spreng.	Polygonaceae	Curi	H	1200–3500	Ind Or	Rt	The dry root is powdered and mixed with water. A thick paste is useful for removing warts and other skin diseases
<i>Sapium insigne</i> (Royle) Benth. ex.Hk. f.	Euphorbiaceae	—	H	700–2000	Ind Or	La, Bk	Milky latex is used as a skin irritant and sprayed as fish poison in stream and tributaries. Bark latex is used to dispel worms and germs of livestock
<i>Senecio rufinervis</i> DC.	Asteraceae	Dhuda	H	1800–3500	Reg Himal	Wp	Its decoction is used to cure fever. Essential oil obtained from the plant is used as a perfumery material
<i>Smilax aspera</i> Wall.	Smilacaceae	—	Sh	1200–2700	Europe Oriens Ind Or	Rt	Root decoction is used for venereal disease. Root extract cures scabies and purifies blood
<i>Solanum indicum</i> Burm.	Solanaceae	Kanderi	H	1000–1500	Trop Geront	Rt, Fr, Lf	The dry root is powdered and mixed with lemon juice. A thick paste is useful for eye diseases. Decoction of its leaves is helpful for cough and cold
<i>Tagetes minuta</i> L.	Asteraceae	Genda	H	1200–2000	Amer Trop	Lf	Fresh juice of leaves is useful in healing the cracks on feet
<i>Taraxacum officinale</i> Web.	Asteraceae	Dudhli	H	800–4500	Temp Bor Reg Austr	Rt, Lf	The tender leaves are used as 'salad' when harvested in spring and has slight inulin content and is used as a bitter for loss of appetite and stomach upsets
<i>Urtica dioica</i> Jacq. ex Wedd.	Urticaceae	Aan	H	2000–3000	Reg Bor Temp	Lf	The young leaves are used as blood purifier and cure skin diseases
<i>Valeriana jatamansi</i> Jones	Valerianaceae	Nihanu	H	1500–3600	Reg Himal	Rt	The root is dried, powdered, and boiled in water and decoction is prepared. It is taken orally as kaadu (decoction) for stomach disorder
<i>Verbascum thapsus</i> L.	Scrophulariaceae	Budi kalogar	H	1000–4000	Europe Afr Reg Himal	Lf	The decoction of leaves along with onion is useful for stomach problems. Crushed leaves are warmed in mustard oil and used as massage for curing inflammation of the body

<i>Viola canescens</i> Wall.	Violaceae	Banksha	H	900—2000	Ind Or	Fl, Lf	Decoction of its flowers and leaves is used in the treatment of cough and cold. It is also used in tonsil, asthma, bleeding piles, cancer of throat, constipation, fever, headache, and skin diseases. Its syrup is given in infantile disorders
<i>Vitex negundo</i> L.	Verbenaceae	Banna	Sh	700—1600	As Trop et Subtrop	Wp	The fresh leaves are boiled in water and vapors are inhaled twice a day to get relief from headache, fever, cold, and cough
<i>Withania somnifera</i> Dunal	Solanaceae	Ashvagandha	Sh	700—1500	Med Reg Ori	Wp	The leaves are chewed to reduce the obesity, diabetes, and are alterative aphrodisiac, tonic, diuretic, narcotic, hypnotic, sedative, restorative, rheumatism, cough, debility, and abortifacient
<i>Woodfordia fruticosa</i> (L.) Kurtz.	Lythraceae	Dhatki	Sh	1400—1800	As et Afr-Trop	Fl	The dry flower is powdered and is used in the treatment of diarrhea and dysentery. Powder is mixed with rose water and paste is prepared and applied on burnt areas
<i>Zanthoxylum armatum</i> DC.	Rutaceae	Timbar	Sh	1300—2000	Reg Himal China	Sd, St, Bk	The dried seeds are ground and used as tooth powder and mouth freshener. Teeth and gums become healthy by brushing with twig. Bark and seeds are used as an aromatic tonic in fever and cholera

Note: Abbreviations: LF = Life form; H = Herb; Sh = Shrub; T = Tree; Rt = Root; Rh = Rhizome; Tb = Tuber; Bk = Bark; Lf = Leaf; Fr = Fruit; Fl = Flower; La = Latex; Sd = Seed; St = Stem; Wp = Whole plant; Wd = Wood; Fb = Fruiting body; Cosmop = Cosmopolitan; Reg Himal = Himalayan region; Ind Or = Indian Oriental; Bor = Boreal; Occ = Occidental; As = Asia; Amer = America; Trop = Tropical; Afr = Africa; Maurit = Mauritius; Austr = Australia; Temp = Temperate; Geront = Gerontia; Amphig = Amphigaea; Orient = Oriental; Centr = Central; * = Endemic and ** = Near-endemic.

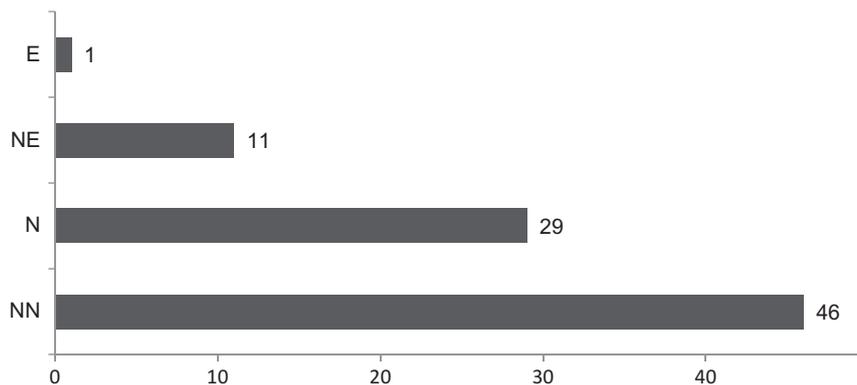


Figure 5. Species numbers of endemic (E), near-endemic (NE), native (N), and non-native (NN) medicinal plants.



Figure 6. Pictures of dried roots of *Angelica glauca* (A), *Picrorhiza kurrooa* (B), and *Acorus calamus* (C).

of the economically important species is decreasing fast (Samant et al. 2007; Singh et al. 2009; Rana & Samant 2011a). Also due to modernization, the traditional knowledge of medicinal plants is vanishing fast. While comparing the studies on medicinal plants carried out in Jammu and Kashmir (Srivastava & Gupta 1982; Kapur & Sarin 1984; Kapur 1991, etc.), Himachal Pradesh (Chauhan 1999; Seth & Jaswal 2004; Kala 2006; Samant et al. 2007; Rana & Samant 2011a; etc.), Uttarakhand (Nautiyal 1981; Maikhuri et al. 1998; Joshi et al. 1999; Samant & Pal 2003, etc.), Sikkim and Darjeeling Hills (Rai & Sharma 1994, etc.), and North Eastern States (Pandey et al. 1990; Rawat et al. 1995; Sajem et al. 2008, etc.), it was found that most of these studies only provide information on indigenous uses, but do not provide detailed information on mode of utilization/traditional practices of medicinal plants. The present study provides the detailed information on the indigenous uses and traditional practices of medicinal plants. Our study indicates that the inhabitants still rely on plants for curing various diseases. Furthermore, plants growing in this region are of immense use in herbal as well as pharmaceutical industries (Samant et al. 2007). The recorded medicinal plants are highly valuable for various medicinal uses namely stomach disorders, fever, nausea, vomiting, piles, cancer, arthritis, diabetes, dysentery, diarrhea, skin diseases, cuts and wounds, asthma, typhoid, bronchitis, jaundice, kidney and bladder stones, leprosy, and various other diseases. Apart from this, this paper also shows the proper mode of application and dosage for the treatment. This medicinal plant wealth plays an imperative role in the livelihood of the native people of the region. But, due to overexploitation, habitat degradation, and changes in environment conditions, the populations of high-value

medicinal plants are depleting fast. Over exploitation of roots, tubers, seeds, fruits, flowers, and barks of most of the species may lead to their early extinction (Figure 6A–C). Also, over exploitation of 29 native, 1 endemic, and 11 near-endemic species clearly indicates that these species may become extinct from the area if their over exploitation continues. These species are well adapted to the local environmental conditions, and are likely to be resistant to pests and diseases. Therefore, they may play a vital role in tracing the evolution of the species in the region (Samant et al. 1998).

In view of the high value of these medicinal plants for the inhabitants, studies on habitat ecology of the species using quadrat methods are essentially required. In addition, mass multiplication of commercially viable medicinal plants through conventional (seeds and cuttings) and *in vitro* methods (tissue culture) and establishment and maintenance of plantlets and seedlings in *in situ* (natural habitats) and *ex situ* (in cultivation, herbal gardens, botanical gardens, etc.) conditions (*ex situ*) is also essentially required for ensuring the conservation and their availability for the posterity. Agro-techniques of the commercially viable medicinal plants need to be developed and disseminated among the stakeholders. Further, education and awareness among the native communities for the conservation and sustainable utilization of high value commercially viable medicinal plants in the region need to be created. Establishment and maintenance of these species under cultivation would not only help to meet their requirement for curing diseases, but also become as an income-generating source as most of these are traded. Replication of such studies across the IHR would help in developing database on indigenous uses and traditional

practices and this database would help in developing proper management plan for conservation.

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