



Research article

Diversity, utilization and sacred values of Ethno-medicinal plants of Kumaun Himalaya

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Abstract: Kumaun Himalaya is characterized by a rich cultural and biological diversity as well as a rich heritage of traditional medicine system. The Himalayan people have a close association with nature. People used plants for fuel fodder medicine fruits etc. They considered some plants synonyms of god and worship because of the divine value of plant in Kumaun Himalayas. The present paper deals with ethno medicinal use and sacred value of some important plants of Kumaun region. The information was based on oral communication and interview with local people, rural persons, and *vaidyas*. During the study it was observed that 58 species of ethno-medicinal plants belonging to 38 families are being used in the folk-medicine system by the indigenous people of this region. In which 11 species were trees, 30 were herbs, 14 were shrubs and 02 were climbers. These identify the plants that need conservation and protection. A total 15 sacred plant recorded from 13 families which have high sacred value in Himalayan region and used in various ritual.

Keywords: Medicinal plants - Sacred plants - *Vaidyas* - Kumaun Himalaya.

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INTRODUCTION

The forests of India have been the source of traditional medicines from ancient time. The *Charak Samhita*, a document on herbal therapy written about 300 BC, reports on the production of 340 herbal drugs and their indigenous uses (Vedprakash 1991). The unique diversity of medicinal plants in the region is manifested by the presence of a number of native (31%), Endemic (15.5%) and Threatened elements (14%) of total Red Data Book plant species of Indian Himalaya Region (Samant *et al.* 1998). Documentation on ethno-botanical knowledge was done by Maikhuri *et al.* (2000) and Nautiyal *et al.* (2001). While a wide-ranging review has described a rich diversity and use of medicinal flora within Uttarakhand (Joshi 2002). The pharmaceutical sector is using 280 medicinal plant species, out of which 175 are from the Indian Himalayan Region (Dhar *et al.* 2002). Various plants and their products which are being used by human day to day need to use in *Havan* (burning of herbal ingredients and other religious activities like *Katha*, *Vrat*, festivals, *Pathpuja*, *Pitrashradha* ceremony).

The use of alternative medicine is growing because of its moderate costs and increasing faith in herbal medicine. According to the World Health Organization (WHO), as many as 80% of the world's people depend on traditional medicine to meet their primary health care needs (Cotton 1997). Non-sustainable collection methods and harvesting cause threat and many valuable medicinal herbs are becoming rare due to their continuous utilization (Swe & Win 2005) International agencies such as the World Wildlife Fund (WWF) and United Nations Educational, Scientific and Cultural Organization (UNESCO) as part of their people and plants initiative, are promoting research on ethno botanical knowledge and the integration of people's perceptions and practices in resource management at the local level.

MATERIAL AND METHODS

The Himalaya extend from west to east in a massive arc for about 2500 km. Covering an astounding area of 612,021 km², the vast mountain chain passes through the Indian States of Jammu and Kashmir, Himachal Pradesh, Uttarakhand, Sikkim and the Himalayan kingdom's of Nepal and Bhutan From west to east the

Himalayas are divided broadly into three mountainous regions Eastern Himalaya, Central Himalaya and Western Himalaya. The western Himalaya is one of the well-defined and better known phyto-geographic regions of the Indian subcontinent in his book sketch of the flora of British India; Hooker (1875–1897) recognized the western Himalayan botanical zone extending from Kumaun to Chitral. Kumaun in Uttarakhand hills comprises the six district of Nainital, Alomra, Bageshwar, Champawat, US Nagar and Pithoragarh. The Almora district lies between 29° 30' N to 30° 20' N latitudes and 79° 20' E to 80° 20' E longitudes. It is located in the central part of Kumaun region of Uttarakhand (India). The study area covers 3629.66 km² (Fig. 1).

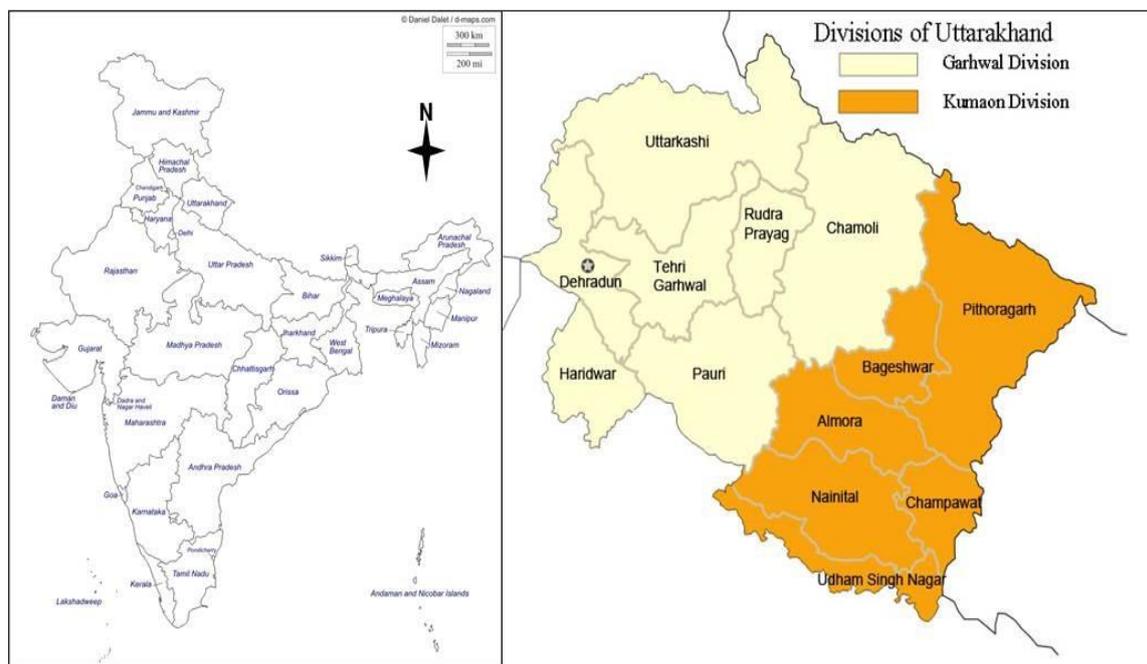


Figure 1. Map showing the study area.

The area rich in traditional knowledge and vegetation Present study is based on intensive field surveys made during 2013 the villages were visited for identification of medicinal and sacred plant species. Data on local name botanical name family medicinal and other use were collected recorded and tabulated. The collected information was re-examined by consulting important works on medicinal plants and ethno-botany and identification of plant species was made with the help of available literature (Nair & Mohanan 1998, Samant & Palni 2000, Samant *et al.* 2001, Brahmvarchaswa 2003). The status of the ethno-medicinal plants was compared with Red Data Book (IUCN 1993).

RESULTS AND DISCUSSION

Diversity and utilization pattern

The present study records 58 species of ethno-medicinal plants representing 38 families in which Solanaceae, Rutaceae, Asteraceae and Fabaceae families were showing largest number of medicinal plant species in study site (Fig. 2; Table 1). Various parts such as whole plant (25 spp.), fruits (20 spp.), roots (46 spp.), seeds (8 spp.), bark (17 spp.), leaves (11 spp.) and flowers (4 spp.) were used for the treatment of various ailments like in asthma, bronchitis, constipation, cough, diabetes, fever, intestinal complaints, leprosy, piles, respiratory disease and stomach ache (Fig. 3A). Qualitative analysis of present study reveals that a total of 58 plants used differently of which 53 % were herbs, 25 % shrubs, 20 trees and 2% climbers (Fig. 3B).

Table 1. List of medicinal plants traditionally used by villagers in the study area.

Sl.	Local name	Botanical name	Family	Status	Part use	Habitat	Ethno medicinal use
1	Lahsun	<i>Allium sativum</i> L.	Alliaceae	CU	Whole plant	Herb	Clove with the mustard oil used in joint pain.
2	Aam	<i>Mangifera indica</i> L.	Anacardiaceae	CU	Seed, fruit	Tree	Powder of seed used in diarrhoea locally people used milk and mango pulp for weight gaining.
3	Brahmi	<i>Centella asiatica</i> (L.) Urb.	Apiaceae	CO	Leaves	Herb	Leaves used as a brain tonic.
4	Patti	<i>Artemisia parviflora</i> Roxb. ex D. Don	Asteraceae	CO	Leaves	Shrub	Used in skin diseases, burns cuts, wounds and Fumes are insect repellents.

5	Kalabasa	<i>Eupatorium odoratum</i> L.	Asteraceae	CO	Leaves, Stem	Herb	Extract of plant is used to cure cuts.
6	Gha buti	<i>Ageratum conyzoides</i> (L.) L.	Asteraceae	CO	Leaves	Herb	Extract of leaf used in stop bleeding.
7	Muli	<i>Raphanus sativus</i> L.	Brassicaceae	CU	Whole plant	Herb	The roots and leaves used to cure jaundice, piles and kidney stone.
8	Sarson	<i>Brassica rapa</i> L.	Brassicaceae	CU	Whole plant	Herb	2-3drops of seed oil put in ear in sepsis and also used in toothache.
9	Kilmora	<i>Berberis asiatica</i> Roxb. ex DC.	Berberidaceae	EN	Root	Shrub	The juice of fresh roots is used for curing diabetes and jaundice. Extract of root used as eye drop in eye disease.
10	Bathua	<i>Chenopodium album</i> L.	Chenopodiaceae	CO	Leaves	Herb	Green vegetable used in bladder stone and anaemia.
11	Harar	<i>Terminalia chebula</i> Retz.	Combretaceae	CO	Fruit	Tree	Locally used in cough and throat disorder. Cure vomiting and used in formation of 'Triphla' with <i>Awala</i> and <i>Harar</i> .
12	Bhera	<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Combretaceae	CO	Fruit	Tree	Fruit is given 2-3 times a day in hyper acidity.
13	Karela	<i>Momordica charantia</i> L.	Cucurbitaceae	CO	Fruit	Climber	Continuous use of fruit juice control diabetes.
14	Burans	<i>Rhododendron arboretum</i> Cowan.	Ericaceae	CO	Flower	Tree	Flowers are eaten raw or made into juice to cure stomach diseases but Young flower and leaves are poisonous.
15	Awala	<i>Emblia Officinalis</i> Gaertn	Euphorbiaceae	CO	Fruit	Herb	Fresh fruit juice used in eye sight improving and anaemia.
16	Gahat	<i>Vigna unguiculata</i> (L.) Walp.	Fabaceae	CU	Seed	Herb	Boiled seed or <i>Dal</i> is used in kidney stone and localized abdominal tumour.
17	Methi	<i>Trigonella foenum - graecum</i> L.	Fabaceae	CU	Seed	Herb	Decoction of seed with honey is beneficial in piles.
18	Akhrot	<i>Juglans regia</i> L.	Juglandaceae	CO	Bark, Nut, Leaf	Tree	The bark is boiled in water after filtration it is used as mouthwash, very useful in loose teeth.
19	Tulsi	<i>Ocimum tenuiflorum</i> L.	Lamiaceae	CO	Whole plant	Herb	The leave used with common salt in toothache leave also used in fever and cold.
20	Piperment	<i>Mentha × piperita</i> L.	Lamiaceae	CU	Leaf	Herb	Crushed leaves are used in nausea vomiting and typhoid.
21	Pudina	<i>Mentha longifolia</i> (L.) L.	Lamiaceae	CU	Leaf	Herb	People used in the acidity, stomach pain, gastrointestinal disorders, cough, cold and chronic fever.
22	Stawar	<i>Asparagus recemosus</i> Willd.	Asparagaceae	CO	Root	Shrub	Dry root powder with milk help in cure eye disease and used as a tonic.
23	Alovvera	<i>Aloe barbadensis</i> Mill.	Liliaceae	CU	Leaf	Herb	Leaves juice used in jaundice, fiver, liver disease, piles, and skin disease.
24	Bakain	<i>Melia azedarach</i> L.	Meliaceae	R	Bark	Tree	The bark is boiled in water. After filtration it is used as mouthwash, very useful in loose teeth.
25	Guduci	<i>Tinospora sinensis</i> (Lour.) Merr.	Menispermaceae	R	Stem, Leaves	Climber	Stem and leaves juice is used in fever, body heat, burning sensation, diabetic, urinary problem and anaemia.
26	Peepal	<i>Ficus religiosa</i> L.	Moraceae	CO		Tree	The juice of its leaves extracted by holding them near the fire can be used as the ear drop. Its power bark has been used to heal the wounds. The roots are chewed to prevent gum diseases.
27	Timul	<i>Ficus auriculata</i> Lour.	Moraceae	CO	Fruit	Tree	Fruits are eaten raw and cooked as Vegetable.
28	Kafal	<i>Myrica esculenta</i> Buch.-Ham. ex D. Don	Myricaceae	CO	Bark, Fruit	Tree	Bark powder inhale is useful in headache. Fruits are edible.
29	Kela	<i>Musa balbisiana</i> Colla.	Musaceae	CU	Fruit	Herb	The fruit is given with milk to cure body weakness.
30	Til	<i>Sesamum Indicum</i> L.	Pedaliaceae	CU	Seed	Herb	It prevents hair loss and It is used for massaging patients who suffer from body pain and joint pain.
31	Devdar	<i>Cedrus deodara</i> (Roxb. ex D.Don) G.Don	Pinaceae	CO	Bark, Wood	Tree	Its fumes are used as a snake repellent.
32	Pine	<i>Pinus roxburghii</i> Sarg.	Pinaceae	CO	Wood	Tree	Resin use to heal crack. Wood and Resin. Wood used in snake bite and scorpion sting.
33	Dub	<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	CO	whole plant	Herb	The extract of plant used in cure nasal bleeding.

34	Chalmori	<i>Rumex hastatus</i> D.Don	Polygonaceae	CO	Leaves	Herb	Leaves juice is given in abdominal stomach pain.
35	Hisalu	<i>Rubus ellipticus</i> Sm.	Rosaceae	CO	Fruit	Shrub	Juice of fruits is administered orally in cholera.
36	Ghingaru	<i>Pyracantha crenulata</i> (Roxb. ex D.Don) M.Roem.	Rosaceae	CO	Fruit	Shrub	The fruit used in anaemia.
37	Pyra	<i>Prunus Cerasoides</i> Buch.-Ham. ex D.Don	Rosaceae	CO	Bark, Seed	Tree	The juice of the bark is applied externally to treat backaches. Seed are chewed in case of kidney stone.
38	Mangishta	<i>Rubia cordifolia</i> L.	Rubiaceae	R	Root	Herb	Paste of root applied externally in leucoderma.
39	Belpatri	<i>Aegle marmelos</i> (L.) Correa	Rutaceae	CO	Fruit	Tree	Local people used ripe fruit to cure the digestive disorder.
40	Timur	<i>Zanthoxylum armatum</i> DC.	Rutaceae	T	Whole plant	Shrub	It is used in curing various common ailments such as toothache, common cold, cough, and fever, as it is believed to give warmth to the body.
41	Carry Patta	<i>Murraya koenigii</i> (L.) Spreng.	Rutaceae	CO	Leaves	Shrub	Paste of leaf applies in skin disease.
42	Lemon	<i>Citrus medica</i> L.	Rutaceae	CU	Fruit	Tree	Juice of fruit is used as refrigerant drink and allaying thirst. It is beneficial in cough and throat disorder with ginger. Juice is also useful in diarrhoea and liver trouble.
43	Ber	<i>Ziziphus mauritiana</i> Lam.	Rhamnaceae	R	Whole plant	Shrub	Powdered leaf is given in pain in joint pain. Leaves chewed in scorpion sting. Root made into paste is applied to snake bite.
44	Mamiri, Pilihari	<i>Thalictrum foliolosum</i> DC.	Ranunculaceae	VU	Root	Herb	Root is used in jaundice
45	Reetha	<i>Sapindus mukorossi</i> Gaertn	Sapindaceae	CO	Fruit	Tree	Used to control external parasites, hair and skin diseases and to expel leach
46	Silfoda	<i>Bergenia ligulata</i> Engl.	Saxiferaaceae	VU	Root	Herb	The plant has been recognized for its role in dissolving kidney and bladder stone.
47	Kutki	<i>Picrorhiza kurroa</i> Royle ex Benth.	Scrophulariaceae	EN	Root	Herb	Roots used to cure digestive disorders, asthma, fever, piles, ring worm, jaundice, anaemia, heart disease, malarial fever, worms infestation in children, indigestion.
48	Ekalveer	<i>Verbascum thapsus</i> L.	Scrophulariaceae	CO	Leaf	Herb	Leaf paste is rubbed on chest to relieve pain due to cold. Leaves are useful in fever.
49	Dhatuira	<i>Datura stramonium</i> L.	Solanaceae	CO	Seed	Shrub	The seed, leaves after roasting are applied locally to relieve pain.
50	Makoi	<i>Solanum nigrum</i> L.	Solanaceae	CO	Fruit, Root	Herb	Fruits are used to treat eye diseases, dysentery and fever. Seeds and roots are used to treat liver related problems.
51	Mirchi	<i>Capsicum annum</i> L.	Solanaceae	CU	Fruit	Herb	Paste of fruit is applied on scorpion sting.
52	Ashwgandha	<i>Withania somnifera</i> (L.) Dunal	Solanaceae	CO	Leaves, Root	Herb	To improve memory and weakness in humans. The leaves are applied to tumours. The roots are regarded as useful in rheumatism.
53	Baigain	<i>Solanum melongena</i> L.	Solanaceae	CU	Stem	Herb	In dog bite wounds portion is brunt with the help of burning woody stem.
54	Swina	<i>Urtica parviflora</i> Roxb.	Urticaceae	CO	Leaf	Shrub	Flogging by leaf in bone fracture.
55	Jtamansi	<i>Valeriana wallichii</i> DC.	Valerianaceae	CR	Whole plant	Herb	The essential oil of the root and rhizome is having antibacterial property.
56	Van haldi	<i>Hedychium spicatum</i> Sm.	Zingiberaceae	VU	Rhizome	Herb	The powder of root is useful in the treatment of liver complaints, and it also used in treating fevers, vomiting, diarrhoea, inflammation, pains.
57	Haldi	<i>Curcuma longa</i> L.	Zingiberaceae	CU	Rhizome	Herb	The powder of rhizome considered as a good antiseptic, 1:10 mixture of rhizome powder with boiled water (filtered) use as eye drop in eye diseases. Juice of crushed raw <i>Haldi</i> with milk used in physical damage.
58	Punarnva	<i>Boerhavia diffusa</i> L.	Nyctaginaceae	CO	Root	Herb	Juice of fresh roots is used as eye drops. Root juice is used in urinal disorder. Watery extract of the root is given in jaundice.

Note: CR, Critically Endangered; EN, Endangered; VU, Vulnerable; R, Rare; CU, Cultivated; CO, Common.

Among the important works on Himalayan plants Osmaston's (1922) Forest Flora for Kumaun is notable but, however, more emphasis was laid on their systematic rather than their ethno-medicinal used (Gupta 1960 & 1968, Shah & Joshi 1971, Pangtey 1980). Recently Kumari *et al.* (2012) explore the diversity and ethno-medicinal significance of medicinal plant of Almora. The present attempt has been designed to explore the utilization pattern ethno-medicinal significance and sacred values of the floral habitat of this region.

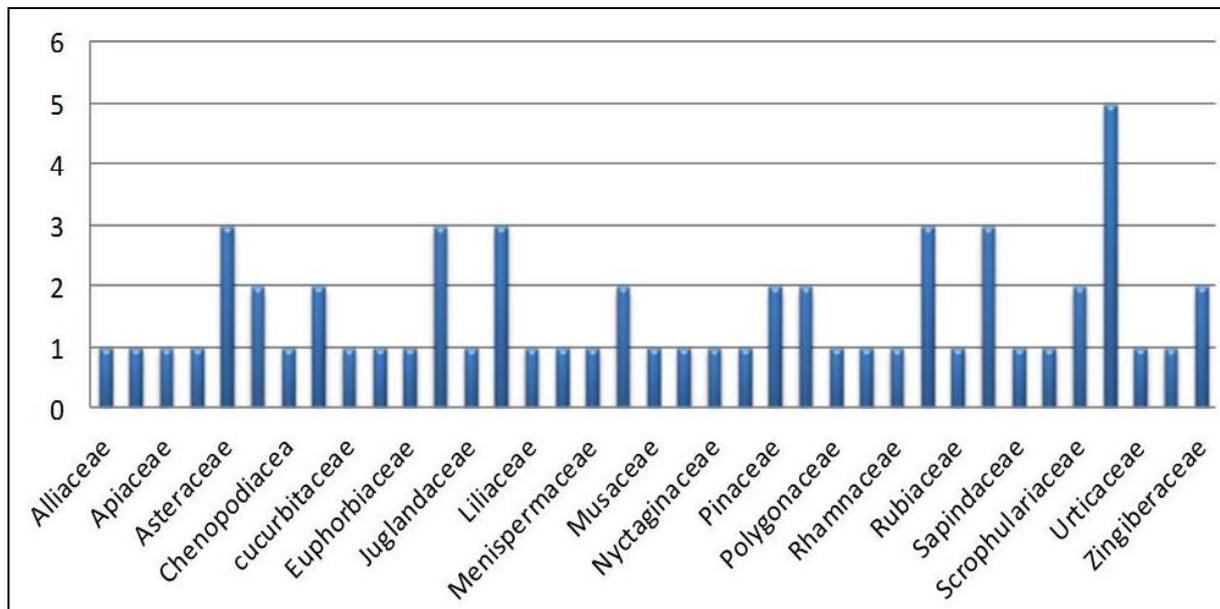


Figure 2. Ethno- medicinal plant belonging to different families.

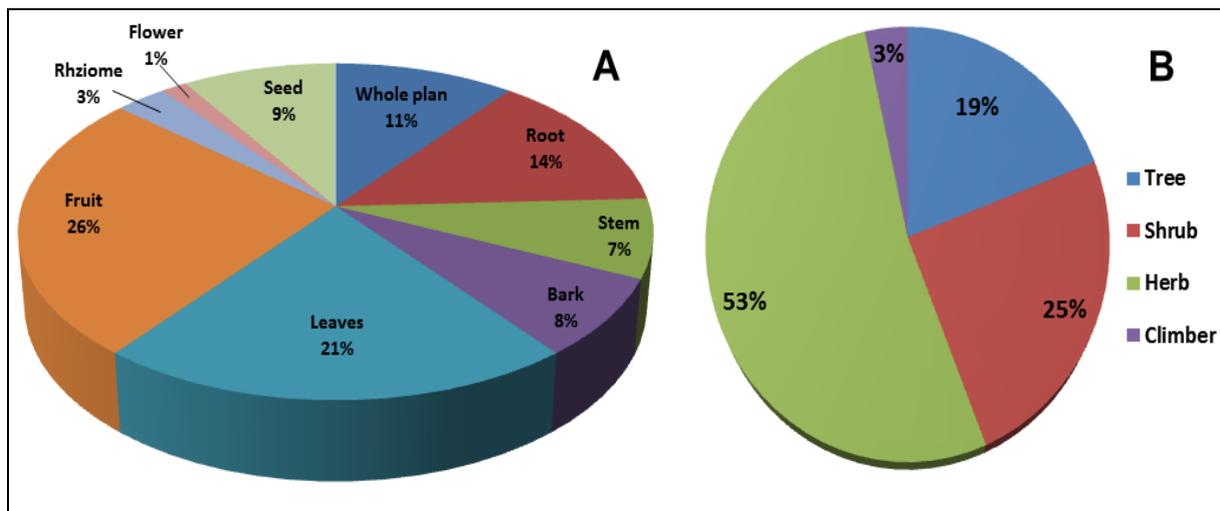


Figure 3. Ethno medicinal plants: **A**, Utilization pattern; **B**, Life form diversity.

Rarity

Using new IUCN criteria, 10 species of medicinal plants have been categorized in different categories, Critically Endangered (CR) (*Valeriana wallichii*); Endangered (EN) (*Berberis asiatica*, *Picrorhiza kurroa*); Vulnerable (VU) (*Bergenia ligulata*, *Hedychium spicatum*, *Thalictrum foliolosum*); Rare (R) (*Melia azedarach*, *Tinospora sinensis*, *Rubia cordifolia*, *Ziziphus mauritiana*) (Fig. 4).

Sacred plants and their values

A total 15 sacred plants recorded from 13 families which have high sacred value in Himalayan region these plant species used in different ceremony. These plant species are regularly used by local people. The uses of each plant are enumerated in table 2. Dhiman (2003) have discussed the sacred plants and their medicinal importance. The religious aspect of plants is less explored in western Himalaya region. This religious aspect of plants is a tool of biodiversity conservation.

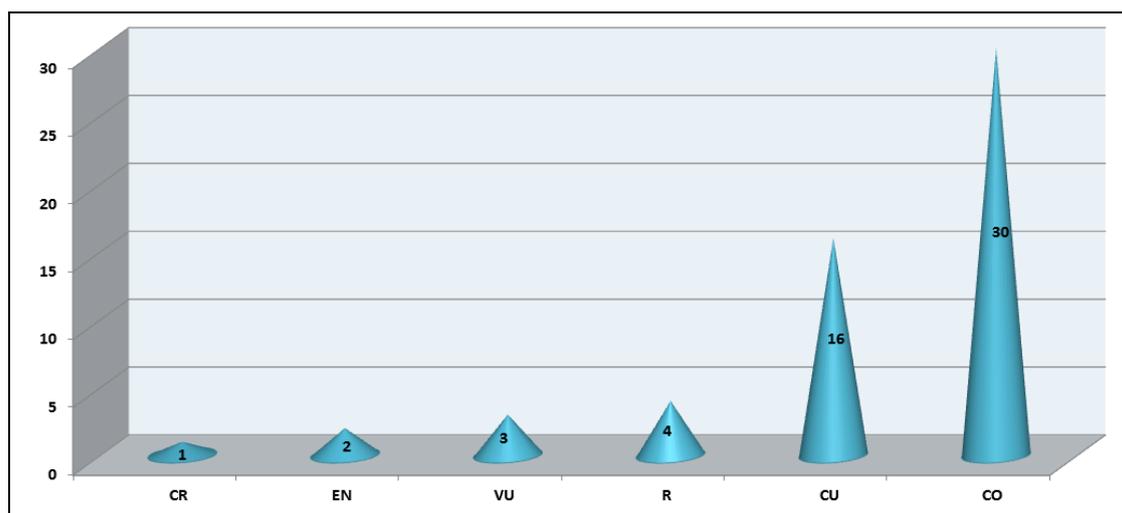


Figure 4. Number of plant species under different IUCN categories (CR, Critically Endangered; EN, Endangered; VU, Vulnerable; R, Rare; CU, Cultivated; CO, Common).

Table 2. List of sacred plants and there values.

S.N.	Local name	Botanical name	Family	Status	Habitat	Sacred value
1	Aam	<i>Mangifera indica</i> L.	Anacardiaceae	Common	Tree	Used for decoration of new homes and Havankund (a sacred place). Wood is used in worship and Hwans (scarify)
2	Patti	<i>Artemisia parviflora</i> Roxb. ex. D.Don	Asteraceae	Common	Shrub	Plants are worshipped on Sunday
3	Sarson	<i>Brassica rapa</i> L.	Brassicaceae	Cultivated	Herb	Seeds of plants are used for yielding oil and this oil is considered as pure for lighting lamp (Deepak).
4	Bhang	<i>Cannabis sativa</i> L.	Cannabaceae	Common	Shrub	Used in worship of lord Shiva.
5	Tulsi	<i>Ocimum tenuiflorum</i> L.	Lamiaceae	Common	Herb	This sacred plant worshipped because associated with Lord Vishnu.
6	Guduci	<i>Tinospora sinensis</i> (Lo ur.) Merr.	Menispermaceae	Rare	Climber	Used in Hawan or worship.
7	Timul	<i>Ficus auriculata</i> Lour.	Moraceae	Common	Tree	Leaves of tree are used in any religious activity because considered pure for the gods.
8	Kela	<i>Musa balbisiana</i> Colla	Musaceae	Common	Herb	The whole banana tree is worshipped in Katha being regarded as representation of Lord Satya Narayan.
9	Til	<i>Sesamum indicum</i> L.	Pedaliaceae	Common	Herb	The oil used in all sacred rituals Generally black color Til is used in religious work like Havan
10	Dub	<i>Cynodon dactylon</i> (L.) Pers.	Poaceae	Common	Herb	it is used in all rituals of Hindu to please lord Ganesh
11	Kush	<i>Saccharum spontaneum</i> L.	Poaceae	Common	Herb	Kush is used during Janeau and Shradha ceremony
12	Pya	<i>Prunus cerasoides</i> Buch.-Ham. ex D.Don	Rosaceae	Common	Tree	The leaves and branches of tree are worshipped during Katha, Jneu& marriage ceremony.
13	Belpatri	<i>Aegle marmelos</i> (L.) Correa	Rutaceae	Common	Tree	leaves are used in worship of Lord Shiva
14	Timur	<i>Zanthoxylum armatum</i> DC.	Rutaceae	Threatened	Shrub	Branches or sticks of plantsare worshipped in Jneusanskar considered symbolic of folk god 'Narsingh'.
15	Haldi	<i>Curcuma longa</i> L.	Zingiberaceae	Culivated	Herb	Rhizome used in various religious activities. The rhizome used in dyeing of cloths in festival.

Sacred plans and there values

A total 15 sacred plant recorded from 13 families which have high sacred value in Himalayan region these plant species used in different ceremony. These plant species are regularly used by used by local people. The uses of each plant are enumerated in table 2. Dhiman (2003) have discussed the sacred plans and their medicinal

important. The religious aspect of plant less explore in western Himalaya region. This religious aspect of plants is a tool of biodiversity conservation.

Conclusion

Religious beliefs and rituals are closely related to the management of the ecosystems the sacred value of a plant can conserve this plant. Sacred value is an important tool of biodiversity conservation. Villagers use herbal medicine because of easy access and no side effect the presents findings help in conservation of these medicinal plants. In present study a total. Medicinal plant comes in threatened category the frequent use of these plant is a point of concern since this practice may put extinction of these species. The indigenous knowledge about sacred and medicinal plant pass orally from generation to generation there is an urgent need of investigation and documentation.

REFERENCES

- Brahmverchas (2003) In: *Ayurved Ka Pran: Van ausdhi vigyan*. Shantikunj, Haridwar.
- Cotton CM (1997) *Ethnobotany, Principles and Applications*. Wiley & Sons, UK.
- Dhiman AK (2003) *Secred plan and here medicinal use*. Daya Publications, New Delhi.
- Dhar U, Manjkhola S, Joshi M, Bhatt A, Bisht AK & Joshi M (2002) Current status and future strategy for development of medicinal plants sector in Uttaranchal, India. *Currant Science* 83 (8): 956–964.
- Gupta RK (1960) Some Useful and Medicinal Plants of Nainital in Kumaun Himalaya. *Journal of Bombay Natural History Society* 68: 309–329.
- Gupta RK (1968) *Floral Nainitalensis*. NavYug Traders, New Delhi.
- IUCN (1993) Draft IUCN Red List Categories, Gland Switzerland.
- Joshi BD (2002) A brief review on the flora of medicinal importance and prospects of developing a sustainable network of small scale pharmaceutical industries in Uttaranchal. *Himalayan Journal of Environment and Zoology* 16(2): 233.
- Kumari P, Joshi GC & Tewari LM (2012) Indigenous uses of threatened Ethno-medicinal plants used to cure different diseases by Ethnic people of Almora District of Western Himalaya. *International Journal of Ayurvedic & Herbal Medicine* 2: 4.
- Maikhuri RK, Nautiyal S, Rao KS & Saxena KG (2000) Indigenous knowledge of medicinal plants and wild edibles among three tribal sub-communities of Central Himalayas, India. *Indigenous Knowledge and Development Monitor* 8(2): 7–13.
- Nair CKN & Mohanan N (1998) In: *Medicinal plants of India*. Nag Publishers, Delhi.
- Nautiyal S, Rao KS, Maikhuri RK, Semwal RL & Saxena KG (2001) Traditional knowledge related to medicinal and aromatic plants in tribal societies in a part of Himalaya. *Journal of Medicinal and Aromatic Plant Sciences* 22(4A) & 23(1A): 528–541.
- Osmaston AE (1927) *A Forest Flora of Kumaun*. Allahabad.
- Pangtey YPS (1980) Some Wild Edible Fruit Plants of Kumaun Hills In: Singh JS, Singh SP & Shastri C (eds) *Science and Rural Development in Mountains*. Gyanodaya Publication, Nainital.
- Samant SS & Palni LMS (2000) Diversity, distribution and indigenous uses of essential oil yielding medicinal plants of the Indian Himalayan Region. *Journal of Medicinal and Aromatic Plant Sciences* 22: 671–684.
- Samant SS, Dhar U & Palni LMS (1998) *Medicinal Plants of Indian Himalaya: Diversity Distribution and Potential Value*. Gyanodaya Prakashan, Nainital.
- Samant SS, Dhar U & Palni LMS (2001) *Himalayan Medicinal Plants: Potential and Prospects*, Gyanodaya Prakashan, Nainital.
- Shah NC & Joshi MC (1971) An Ethnobotanical Study of Kumaun Region of India. *Economic Botany* 25: 414–422.
- Swe T & Win S (2005) *Herbal gardens and cultivation of medicinal plants in Myanmar regional consultation on development of traditional medicine in the South East Asia region*. Department of Traditional Medicine, Ministry of Health, Myanmar, Pyongyang, DPR Korea, 22–24 June 2005, World Health Organization (Regional office for South-East Asia).
- Vedprakash (1991) In: Samant SS, Dhar U & Palni LMS (eds) *Indian Medicinal Plant: Current Status in Himalayan Medicinal Plants: Potential and Prospects*. Gramodaya Prakashan, Nainital, pp. 45–63.
- Hooker JD (1875–1897) *The flora of British India*. L. Reeve & Co., Covent Garden, UK.