

Diversity of traditional medicinal plants in silvipastoral land use systems of Indian North Western Himalaya

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The Indian Himalayan Region (IHR) is one of the world's mega biodiversity hotspots with diverse landscapes. The IHR harbour diverse agro-ecological conditions known for its silvipastoral land use systems for conservation and management of biodiversity. The present study highlights the diversity of ethno-medicinal plants in silvipastoral land use systems of Himachal Pradesh, North Western Himalaya along with their indigenous medicinal uses. The study was conducted using semi-structured interviews with locals and Vaidya's through participatory rural appraisal exercises, in 12 districts of study region spanning across 4 agroclimatic zones. The study identified 201 species belonging to 73 families and 170 genera. Fabaceae followed by Lamiaceae, Rosaceae, Poaceae were the dominant families. The study identified utilization of 197 angiosperm species, 3 gymnosperms and 2 pteridophyte species. The species diversity showed maximum distribution of herbs (83), followed by trees (58) and shrubs (48). Leaves and root were the most frequently used part followed by fruits, whole plant, tuber and seeds. Powder followed by paste, juice, decoction, and extracts were the frequently utilized preparation methods for ethnomedicinal preparation for treatment of various ailments. Further the study attempts to address threat categories and suggests conservation and management strategies for potential ethnomedicinal plants.

Keywords: Agroforestry system, Ethnobotany, Himachal Pradesh, Medicinal plants, Silvipastoral system

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Biodiversity is important for the survival of human being. Plants play significant role in the lives of rural and tribal communities of the world by providing many livelihood and ecosystem services. Nearly 4,22,000 plant species are found throughout the world of which 52,750 have medicinal values¹. Since ages, forests are major source of medicines, and plant-based medicines are playing important role in primary health care of 80% of world's population². In India, the foundation of the traditional medicine system was laid through the establishment of Ayurveda, Unani, and Siddha. Since the Vedic period, human beings have been exploring plants for various uses such as fodder, food, medicine, fuel-wood, timber etc³⁻⁸. About 40-70% plant species of any ecosystem are in use by the human for himself and in veterinary medicine⁹. Primarily due to high cultural acceptability, low cost, better compatibility with the body, few side effect, easy application as well as

easily available medical facilities the demand of medicinal plants is continuously increasing all over the world and the trade of herbal medicines is about Rs. 27 billion per year in global market¹⁰. Thus, there has been increasing dependence of rural communities on medicinal plants to meet their cash demands through collection and processing of medicinal plant products. Since ages these have been the main source of the folk or ethno-medicine¹¹. About 25% of modern medicines are developed from these plant sources used traditionally and research on traditional medicinal herbal plants leads to discovery of 75% of herbal drugs¹².

The Indian Himalayan Region (IHR) is one of the richest reservoirs of biological diversity in the world due to its diverse climatic conditions, altitudinal range and habitat. As one of the mega biodiversity hot spots it supports 18, 440 species of plants of which 1748 are medicinal³. In the remote and rural areas, the inhabitants largely depend on these medicinal plants for curing various ailments³. Local inhabitants generally collect

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these plants from kitchen garden, agricultural fields' bunds, and nearby forests for curing various diseases, and medicinal plants contribute 15-30% to the total income¹³. Huge demand of medicinal plants in traditional systems of medicine and plant-based drug industries is causing heavy pressure on natural populations due to over exploitation¹⁴ and faced with numerous threats¹⁵. Besides, habitat degradation, the population of most of the native and economically important species is declining fast^{16,17}. Estimates indicate that at least 90% of medicinal plant species are extracted from the wild¹⁸ and 69% of the material is collected through destructive harvesting which shows that medicinal plants are significantly threatened¹⁹. Such anthropogenic pressure will not only lead to loss of genetic diversity of the medicinal plants but also affect the livelihood opportunities of indigenous communities of IHR²⁰.

The practice of agroforestry in Himachal Pradesh is as old as the agriculture itself and in all agro-climatic zones, farmers traditionally cultivate food crops and purposely combine fodder, such as grasses and herbs with shrubs and trees on farm lands, grazing grounds, community land, ghasani, field bunds, on farm house, as home gardens and as windbreaks and shelterbelts etc., for animal nutrition and other complementary uses. Thus, species composition in their silvipastoral land uses systems varies depending upon landholding and basic requirement of the farmers. The medicinal plants diversity and their ethno-medicinal knowledge in IHR has been reported by many workers^{21,5,22-31} but diversity of ethno-medicinal plants in silvipastoral land use systems and their indigenous use has not been studied yet although IHR being one of the most diverse agroforestry land use systems and stores large number of wild medicinal plants. Therefore, keeping in view the role of agroforestry in conservation of medicinal plants, present study was conducted for the documentation of ethno-medicinal plants in silvipastoral land use systems of Himachal Pradesh along with their indigenous uses.

Methodology

Study area

Himachal Pradesh is a North-western Himalayan state of India with geographical area of 55,673 sq. km², which constitutes 10.5% area of the IHR. Based on topography, rainfall and altitude, the state is divided into 4 agro-climatic zones, namely (i) Sub-mountainous low hills-subtropical (350- 914 m amsl) (ii) Mid hill sub

humid (915-1523 m amsl) (iii) High hill temperate wet (1524-2472 m amsl) (iv) High hill temperate day (>2472 m amsl). Due to wide variation in topography, geological structure, and climatic conditions the state harbours rich floral diversity including huge number of medicinal plants. The present study was carried out in traditional silvipastoral land use systems of Himachal Pradesh which cover approximately 16.4% of the total geographic area of the state (Fig. 1).

Informants' selection and data collection

The study was carried out in traditional silvipastoral land use systems of Himachal Pradesh. The sampling plots were randomly laid in 12 villages representing all four agro-climatic zones (Zone I: Jogipanga (Una), Shiun Khas (Kangra), Masiyana (Hamirpur), Bhakra (Bilaspur); Zone II: Naun (Mandi), Keela Kalanj (Sirmour), Banalgi (Solan); Zone III: Ghiaghi (Kullu), Jarashi (Shimla), Kundi (Chamba) and Zone IV: Roghi (Kinnaur) and Muling (Lahaul-Spiti) were surveyed in different seasons for three years (2018-2021) (Fig. 1). Participatory Rural Appraisal (PRA) was followed for information generation on medicinal plants. Also, local knowledgeable persons including *Vaidyas* were interviewed by a semi-structured questionnaire. Information was generated on the indigenous uses. Among the knowledgeable persons, one person was hired to collect medicinal plants from the natural habitat(s). The specimens of each species were collected and identified with the help of floras and research papers. Information on locality, altitudinal range, life form, habitat, method of preparation, mode of administration and other morphological characters was collected for each species. Based on questionnaire survey and reviewing relevant literature, the analysis of medicinal plants nativity and endemism, scarcity levels, and threat status (as per reports like Conservation Assessment and Management Plan (CAMP) and International Union for the Conservation of Nature (IUCN).

Assessment of ethnobotanically important floristic diversity for nativity and endemism

Nativity of the species at global level was accessed following Index Kewensis Plantarum Phanerogamarum³². Nativity of the species indicates first record/origin of the species. The nativity of the species has been identified following several authors^{32,33}. The species having their origin from Himalayan region have been considered as natives. Endemism of the species has

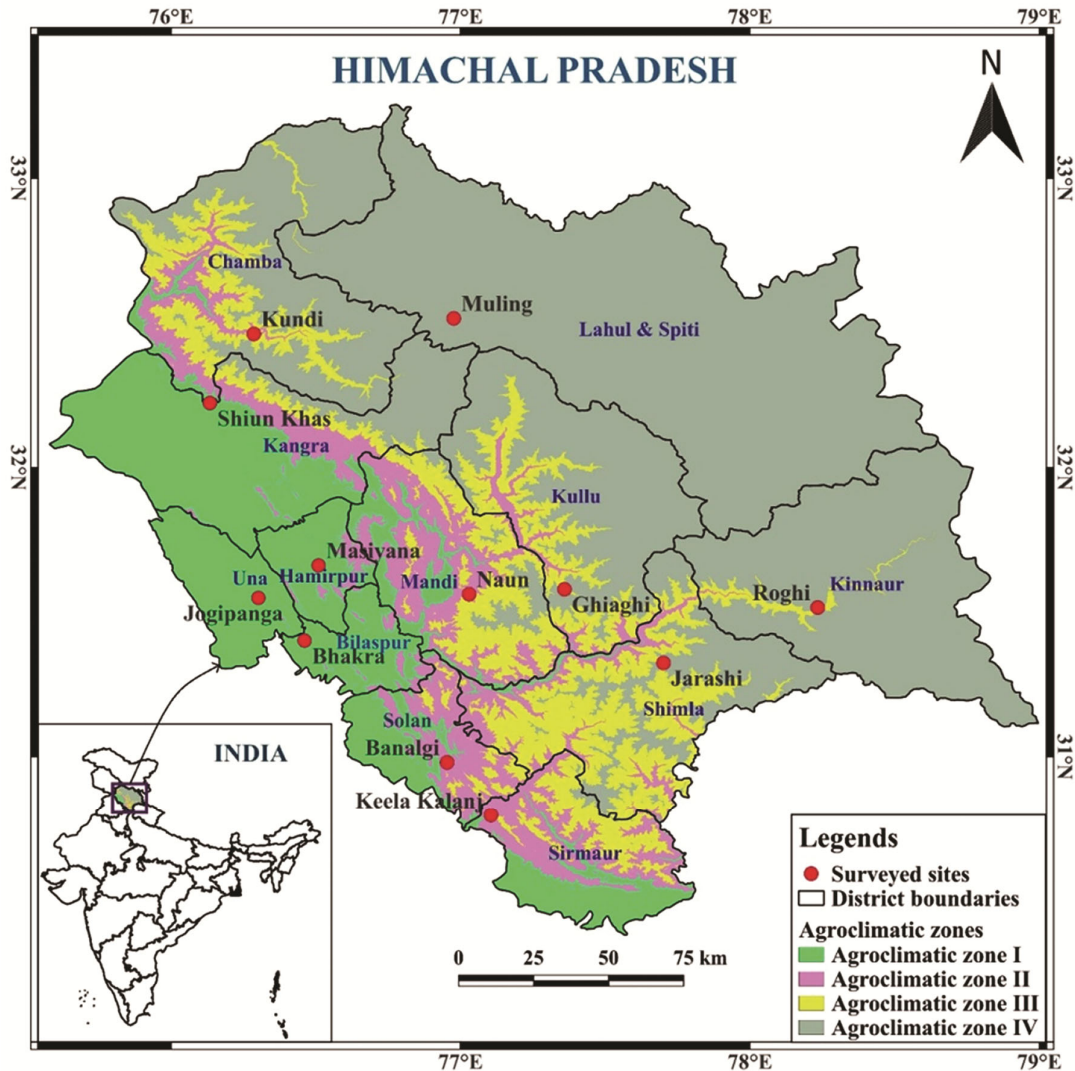


Fig. 1 — Map of the study area (Source: Authors)

been identified based on distribution of the species^{5,33}. The species restricted to the IHR have been considered as endemic whereas those with extended distribution to neighboring countries/states considered as near endemic³⁴.

Assessment of floristic diversity for threat categories

In view of the ongoing threats, it is important to identify and prioritize the biodiversity elements at local, regional, and global levels. Using different attributes of rarity *i.e.*, habitat preference, population size, distribution range, anthropogenic pressure, use values, nativity, endemism, etc. only a few studies have been carried out. Therefore, the present study attempts to assess the floristic diversity of the area for threat categories; and suggest strategies for the conservation and management. The threat categorization of the

species has been done based on the cumulative values of habitat preference, population size, distribution range, anthropogenic pressures including use values and extraction trends, nativity, and endemism^{5,24,35}.

Results and Discussion

Floristic diversity of medicinal plants

A total of 201 plant species of medicinally importance belonging to 73 families and 170 genera were documented from the study site. The highest number of ethnomedicinal plants were recorded from family Fabaceae (23 species) followed by Lamiaceae (14 species), Rosaceae (10 species), Poaceae (9 species) and Rubiaceae, Lauraceae, Rhamnaceae, Verbenaceae and Ranunculaceae contributed to one plant species each (Fig. 2). The dominant genera was

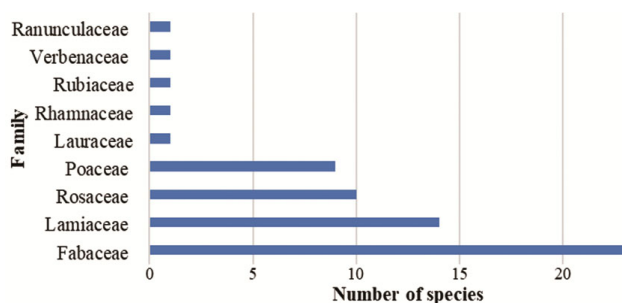


Fig. 2 — Dominant families recorded in the study area

Ficus (4 species), followed by *Berberis*, *Euphorbia*, *Albizia*, *Viola* and *Trifolium* contributed three plant species each. There are 197 angiosperms species, 3 gymnosperms and 2 pteridophytes species. The maximum number of herbs (83 species), followed by trees (58 species) and shrubs (48 species) are present in the study site. Among the various plant parts used, the leaves and root were the most frequently used part followed by fruits, whole plant, tuber, seeds, or rhizome detailed information is given in Table 1.

Table 1 — Ethnobotanical diversity of the silvipastoral land use system in north western Himalaya

Family/Species	Local name	Habit	Part used	Ailments cured	Agro-climatic zones	Method of Preparation	Mode of Administration	Nativity and Endemism	Threat Status as per IUCN red list
Acanthaceae									
<i>Achyranthes aspera</i> L.	Latzira, Kutri	Herb	Fruits, Root, Leaves	Tonic, dysentery, dog bite, insect bite, ring worm, eye problem, hydrophobia, toothache, skin diseases,	Zone-I,II,III	Paste, Decoction, Extract	Oral, Topical	Geront Trop	LC
<i>Dicliptera bupleuroides</i> Nees	Kathmal, Banbuti	Herb	Whole plant	Tonic, stomach problems	Zone-I,II,III,IV	Paste, Extract	Topical	Reg Himalya	-
<i>Justicia adhatoda</i> L.	Basuti	Shrub	Whole plant	Jaundice, asthma, headache, respiratory problems, cold, cough, skin disease	Zone-I,II,III	Paste	Topical	As Trop	LC
Adiantaceae									
<i>Cheilanthes farinosa</i> (Forssk.) Kaulf.	Hansraj	Herb	Leaves	Tuberculosis	Zone-III	Decoction	Oral	India	LC
Agavaceae									
<i>Agave americana</i> L.	Ramban, Banskeora	Shrub	Leaves	Burns, cuts, skin problems, insects bite	Zone-I,II,III	Decoction, extract	Oral	South Am	LC
Amaranthaceae									
<i>Chenopodium album</i> L.	Bathu	Herb	Leaves	Urinary and skin problems	Zone-III	Paste	Topical	Reg Temp	LC
Anacardiaceae									
<i>Mangifera indica</i> L.	Aam	Tree	Fruits, Seeds	Gastric, dysentery, jaundice, urinary problems, toothache	Zone-I, II	Decoction	Oral	Ind Or Malaya	LC
<i>Holarrhena pubescens</i> Wall. ex G. Don	Kurchi	Tree	Seeds	Dysentery, diarrhoea	Zone-I,II	Decoction, Powder	Oral	Ind	LC

(Contd.)

Table 1 — Ethnobotanical diversity of the silvipastoral land use system in north western Himalaya (Contd.)

Family/Species	Local name	Habit	Part used	Ailments cured	Agro-climatic zones	Method of Preparation	Mode of Administration	Nativity and Endemism	Threat Status as per IUCN red list
<i>Lannea coromandelica</i> (Houtt.) Merr.	Jhingan	Tree	Fruit, Leaves, Bark	Body pains, toothache, stomach ache		Juice, Decoction	Oral, Topical	Indian Subcontinent to China	LC
<i>Pistacia chinensis</i> subsp. <i>Integerrima</i> (J. L. Stewart ex Brandis) Rech. f.	Kakar-Singi	Tree	Galls	Asthma, dysentery	Zone-I,II,III	Extract	Topical, Oral	China	LC
Apiaceae									
<i>Angelica glauca</i> Edgew.	Chora	Herb	Roots	Gastric problem	Zone-III,IV	Powder	Oral	Reg Himalya	EN
<i>Bunium persicum</i> B. Fedtsch.	Kala Zeera	Herb	Seeds	Swelling, indigestion, urinary problems, leucorrhoea	Zone-III,IV	Powder	Oral	Central Asia and W Himal	
<i>Carum carvi</i> L.	Mako zira, Shingu zira	Herb	Seeds, Leaves	Swelling, indigestion, urinary problems, leucorrhoea	Zone-IV	Powder, Paste, Decoction	Oral	Europ Oriens As bor	LC
<i>Heracleum candicans</i> L.	Padiyala, Poryal	Herb	Leaves	Leukoderma, tonic for cattle's	Zone-III,IV	Paste	Topical	Reg Himal	LC
Apocynaceae									
<i>Barleria cristata</i> L.	Tadrelu	Shrub	Roots, Leaves	Swelling, cough	Zone-II	Powder, Decoction	Oral	Ind Or Burma	LC
<i>Carissa carandas</i> L.	Krunda	Shrub	Fruits	Indigestion, urinary problems, diabetes	Zone-III	Decoction	Oral	Ind	LC
<i>Carissa spinarum</i> L.	Garna, Garnu	Shrub	Fruits, Seeds, Roots	Cough, dysentery, asthma, jaundice	Zone-I,II,III	Paste	Topical	West Austr	LC
Arecaceae									
<i>Phoenix sylvestris</i> (L.) Roxb.	Khajur	Tree	Fruits	Throat infection, skin problems, urinary problem	Zone-I,II	Powder	Oral	Ind or Nepal	LC
Asclepiadaceae									
<i>Calotropis procera</i> (Aiton) Dryand.	Aak, Arka, Waak	Shrub	Roots, Flowers	Toothache, leprosy, dysentery, skin problems, fever, cold, cough, asthma	Zone-I, II, III	Latex Extract	Topical	Afg	LC
Asperagaceae									
<i>Artemisia dracuncululus</i> L.	Kyangkya	Shrub	Leaves	Jaundice, stomach ache, fever	Zone-IV	Decoction	Oral	Temp Northern Hemisphere	LC
<i>Artemisia vestita</i> Wall.	Rangbyur	Shrub	Leaves	Body odour, antifungal	Zone-IV	Paste	Topical	Pak or China	LC

(Contd.)

Table 1 — Ethnobotanical diversity of the silvipastoral land use system in north western Himalaya (*Contd.*)

Family/Species	Local name	Habit	Part used	Ailments cured	Agro-climatic zones	Method of Preparation	Mode of Administration	Nativity and Endemism	Threat Status as per IUCN red list
<i>Asparagus adscendens</i> Roxb.	Sataveri	Shrub	Roots	Dysentery	Zone-I, II	Powder	Oral	Ind or Pak	LC
<i>Asparagus racemosus</i> Willd.	Sansarpali	Shrub	Roots	Scorpion bite, swelling, toothache, hydrophobia, gastric problem	Zone-I, II	Powder	Oral	Ind or Afr	VU
<i>Seriphidium maritimum</i> (L.) Poljakov	Byur	Shrub	Leaves	Insecticide	Zone-IV	Powder, Paste	Topical	N W Europe	LC
Asteraceae									
<i>Ageratum conyzoides</i> (L.) L.	Okalbuti	Herb	Leaves	Scabies, ringworm	Zone-I, II	Paste, Decoction	Oral, Topical	Reg Trop	LC
<i>Blumea wightiana</i> DC.	Jungli tambaku	Herb	Leaves	Urinary problems, stomach ache	Zone-III	Juice	Oral	Geront trop	LC
<i>Eclipta prostrata</i> (L.) L.	Bangra, Bhrihraj	Herb	Whole plant	Skin problems	Zone-III	Decoction	Oral	Temp & Sub Trop Am	NT
<i>Lactuca serriola</i> L.		Herb	Leaves	Insomnia, anxiety	Zone-III	Paste, Extract, Decoction	Oral, Topical	Afr Trop	LC
<i>Senecio laetus</i> Edgew.	--	Herb	Whole plant	Swelling, sore throat	Zone-III	Powder, Extract	Oral, Topical	Afghanistan to S Central China	LC
<i>Tagetes minuta</i> L.	Chota genda	Herb	Leaves	Cracked feet	Zone-III, IV	Powder, Extract, Decoction, Paste	Oral, Topical	Am Trop	LC
<i>Taraxacum officinale</i> F.H. Wigg.	Dudhli, Pili jari	Herb	Flowers, Leaves	Loss of appetite, urinary problems of cattle	Zone-III, IV	Paste, Latex, Extract	Oral, Topical	Reg Temp Bor et Austr	LC
Bignoniaceae									
<i>Oroxylum indicum</i> (L.) Benth. ex Kurz	Tat Patanga	Tree	Bark	Dysentery, indigestion	Zone-I, II	Decoction	Oral	S China to Trop As	LC
Berberidaceae									
<i>Berberis lycium</i> Royle	Kashmal	Shrub	Roots	Eye problem, dysentery, jaundice, cough, cold, skin problems	Zone-III, IV	Decoction	Oral	Reg Himal	NT
<i>Berberis aristata</i> DC.	Kashmal	Shrub	Roots	Laxative, diarrhoea, fever	Zone -II	Powder, Decoction	Oral	Ind Or	LC

(Contd.)

Table 1 — Ethnobotanical diversity of the silvipastoral land use system in north western Himalaya (Contd.)

Family/Species	Local name	Habit	Part used	Ailments cured	Agro-climatic zones	Method of Preparation	Mode of Administration	Nativity and Endemism	Threat Status as per IUCN red list
<i>Berberis asiatica</i> Roxb. ex DC. Bombaceae	Kashmal	Shrub	Roots	Skin problems	Zone-III	Decoction	Oral	Reg Himal	LC
<i>Bombax ceiba</i> L. Boraginaceae	Semhal	Tree	Fruits, Bark	Dysentery, asthma, piles, gonorrhoea, menorrhoea	Zone-I,II	Decoction	Oral	Am Austr	LC
<i>Trichodesma indicum</i> (L.) Lehm. Trichodesma zeylanicum (Burm.f.) R.Br.	Chotikulfi Jalasira	Herb	Whole plant	Dysentery, swelling, joint pain Burns	Zone-I,II Zone-I,II	Juice, Extract Paste	Topical oraO Topical	Afg or Thai As et Austr Trop	LC LC
<i>Lepidium sativum</i> L. -- Brassicaceae	--	Herb	Leaves	Asthma, bronchitis, cough	Zone-III	Paste, Extract	Oral, Topical	Ind Or	VU
<i>Sarcococca saligna</i> (D.Don) Müll.Arg. Buxaceae	Anchhu	Shrub	Roots, Leaves	Burning sensation, fever	Zone-III	Decoction	Oral	Pak Or	VU
<i>Opuntia dillenii</i> (Ker Gawl.) Haw. Nagfani Cactaceae	Hathoria, Nagfani	Shrub	Fruits	Whooping cough	Zone-I,II,III	Juice, Extract	Oral	Reg Himal	NT
<i>Cannabis sativa</i> L. Cannabaceae	Bhang	Herb	Leaves, Seeds	Constipation, cold, cough, skin eruption, narcotic, wound, sores, arthritis	Zone-I, II, III, IV	Paste, Decoction	Oral, Topical	As Centr Himal Bor Occ	LC
<i>Valeriana jatamansi</i> Jones ex Roxb. Caprifoliaceae	Mushkbala	Herb	Roots	Itching	Zone-III	Decoction	Oral	Reg Himal	VU
<i>Chenopodium album</i> L. Chenopodiaceae	Bathu	Herb	Leaves	Urinary problems	Zone-I, II, III, IV	Juice	Oral	Reg Temp et Trop	LC
<i>Anogeissus latifolia</i> (Roxb. ex DC.) Wall. ex Bedd. Combretaceae	Dhawa, Chhal, Dahu	Tree	Bark	Diabetes, wound infection, epilepsy, urinary tract infection, skin problems	Zone-I, II	Decoction	Oral	Ind Or	LC

(Contd.)

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Family/Species	Local name	Habit	Part used	Ailments cured	Agro-climatic zones	Method of Preparation	Mode of Administration	Nativity and Endemism	Threat Status as per IUCN red list
<i>Terminalia arjuna</i> (Roxb.) Wight & Arn.	Arjun	Tree	Bark	Tonic, anti-dysenteric		Powder	Oral	Ind Or	VU
<i>Terminalia bellirica</i> (Gaertn.) Roxb.	Behra, Bedda	Tree	Fruits	Piles, constipation, asthma, skin diseases, anaemia, leukoderma	Zone-I, II	Powder, Paste	Oral, Topical	Ind Or Malaya	LC
<i>Terminalia chebula</i> Retz.	Herda, Harrar	Tree		Piles, constipation, asthma, skin diseases	Zone-I, II	Juice	Oral	As Trop	LC
Coriariaceae									
<i>Coriaria nepalensis</i> Wall.	Gangara	Shrub	Leaves	Toothache	Zone-III	Powder, Paste	Oral	Chinna	LC
Convolvulaceae									
<i>Cuscuta reflexa</i> Roxb.	Amer bel, Aakash bel	Climber	Whole plant	Bone fractures, liver problems, itching, intestinal worms, hair growth	Zone-I, II, III, IV	Decoction	Oral	Ind Or	LC
<i>Ipomoea carnea</i> Jacq.	Basuti	Shrub		Asthma	Zone-I, II	Paste, Decoction	Oral, Topical	Caribbean	LC
Cucurbitaceae									
<i>Coccinia grandis</i> (L.) Voigt	Kundur	Climber	Fruits	Constipation, diabetes	Zone-I, II	Paste, Decoction	Oral	Trop Afr	LC
<i>Diplocyclos palmatus</i> (L.) C. Jeffrey	--	Climber	Fruits	Stomach ache	Zone-III	Decoction, Extract	Oral	Trop & Subtrop As	LC
<i>Solena heterophylla</i> Lour.	Barakdi	Climber	Fruits	Piles	Zone-III	Paste, Extract	Oral	NE Afg	LC
Cyperaceae									
<i>Cyperus rotundus</i> L.	Motha	Herb	Roots	Wounds, cuts, burns	Zone-I, II	Decoction, Powder	Oral, Topical	Tropical & Subtropical	LC
Dioscoreaceae									
<i>Dioscorea bulbifera</i> L.	Bhirvolikan da	Climber	Roots	Skin diseases, leprosy, diabetes, asthma, piles, dysentery	Zone-I, II	Decoction	Oral	Pantropical, India	LC
<i>Dioscorea deltoidea</i> Wall. ex Kunth	Shingli-mingli,	Climber	Roots	Dysentery, piles, indigestion, sore throat	Zone-I, II, III, IV	Extract	Oral	Ind Or	VU

(Contd.)

Table 1 — Ethnobotanical diversity of the silvipastoral land use system in north western Himalaya (Contd.)

Family/Species	Local name	Habit	Part used	Ailments cured	Agro-climatic zones	Method of Preparation	Mode of Administration	Nativity and Endemism	Threat Status as per IUCN red list
Ebenaceae									
<i>Diospyros chloroxylon</i> Roxb.	Kendu	Tree	Seeds	Urinary infection	Zone-I	Juice	Oral	Ind. or	LC
Ericaceae									
<i>Rhododendron arboreum</i> Sm.	Buransh	Tree	Flowers	Dysentery, diarrhoea, fever, headache, nose bleeding	Zone-III, IV	Extract, Powder	Smoke	Ind Or Reg Himal	NT
<i>Lyonia ovalifolia</i> (Wall.) Drude	Yatta	Tree	Leaves	Insecticide	Zone-III	Decoction, Paste, Powder	Topical, Oral	Cuba (Caribbean, Southern America)	LC
Euphorbiaceae									
<i>Euphorbia helioscopia</i> L.	--	Herb	Leaves	Skin eruptions	Zone-IV	Juice	Oral	Europ et As bor	LC
<i>Euphorbia hirta</i> L.	Dudhli	Herb	Latex	Cut, wounds	Zone-III, IV	Extract, Powder	Topical	Amphig Trop	LC
<i>Euphorbia royleana</i> Boiss.	Chhoin, Churo	Shrub	Leaves, Latex	Bleeding wounds, skin problems, body pain	Zone-I, II, III	Paste, Extract	Oral	Reg Himal	LC
<i>Jatropha curcas</i> L.	Jabblota	Shrub	Seeds, Twigs	Paralysis, leucorrhoea	Zone-I, II	Powder	Oral	Trop Am	LC
<i>Mallotus philippensis</i> (Lam.) Müll.Arg.	Kamla	Tree	Seeds, Roots	Constipation, tonic pregnant woman, intestinal worms, skin problems	Zone-I, II	Paste	Topical	Trop & Subtrop Asia to N & E Australia	LC
<i>Ricinus communis</i> L.	Arandi, Tung	Shrub	Seeds	Constipation, burns, swelling, joint pain, stomach ache, skin problems, abortion	Zone-I, II	Decoction, Extract	Topical, Oral	NE Trop Afr	LC
<i>Falconeria insignis</i> Royle	--	Tree	Bark, Latex	Intestinal worms of cattle's, fungal infection	Zone-II, III	Powder, Decoction	Oral	S. India to China	LC
Fabaceae									
<i>Abrus precatorius</i> L.	Rati, Gunchi	Climber	Seeds	Cattle poisoning	Zone-I, II	Decoction	Oral	Reg trop	LC
<i>Acacia catechu</i> (L.f.) Willd.	Khair	Tree	Bark	Cough, diarrhoea, piles, bronchial infection	Zone-I, II	Decoction	Oral	Ind Or	LC
<i>Albizia lebbek</i> (L.) Benth.	Sirin	Tree	Bark, Seed	Night blindness, piles, boils, asthma, cough, cold	Zone-I, II	Decoction	Oral	Indian Subcontinent to Myanmar	LC
<i>Acacia nilotica</i> (L.) Delile	Babul	Tree	Bark	Asthma, urinary problems, infections of gums, eye problem	Zone-I, II	Paste, Extract	Topical, Oral	Afr	LC

(Contd.)

Table 1 — Ethnobotanical diversity of the silvipastoral land use system in north western Himalaya (*Contd.*)

Family/Species	Local name	Habit	Part used	Ailments cured	Agro-climatic zones	Method of Preparation	Mode of Administration	Nativity and Endemism	Threat Status as per IUCN red list
<i>Albizia odoratissima</i> (L.f.) Benth.	Kala Siris	Tree	Bark	Cough, diabetes, leprosy, skin diseases, burning sensation	Zone-I, II, III	Paste, Extract	Topical, Oral	Ind Or	LC
<i>Albizia procera</i> (Roxb.) Benth.	Safed Siris	Tree	Bark	Asthma	Zone-II	Juice	Oral	As Trop Austr	LC
<i>Bauhinia vahlii</i> Wight & Arn.	Tour	Climber	Flowers and Seed	Vermifuge	Zone-I, II	Decoction	Oral	Ind Or	LC
<i>Bauhinia variegata</i> L.	Kachnar, Kariyala	Tree	Flowers	Indigestion, dysentery, loss of appetite, obesity, dental care, headache	Zone-I, II, III	Decoction, Paste	Oral, Topical	Ind Or Burma China	NT
<i>Butea monosperma</i> (Lam.) Taub.	Dhak, Palah	Tree	Seeds, Bark	Diarrhoea, piles, snake bite, dysentery, diarrhoea	Zone-I, II, III	Decoction, Paste	Topical., Oral	Indian Subcontinent to China	LC
<i>Cassia fistula</i> L.	Amaltas, Alis	Tree	Flowers, Seeds, Bark	Constipation, blood purifier, pimples, epilepsy, jaundice, indigestion problems of cattle's, laxative, ringworm, cough	Zone-I, II	Paste	Topical	As. trop	LC
<i>Cicer microphyllum</i> Royle ex Benth.	Balmo, Rudarvanti, Jungli chana	Herb	Leaves	Acidity, gastric problem	Zone-IV	Paste	Topical	Ind Or Afghan	LC
<i>Dalbergia sissoo</i> DC.	Tahli	Tree	Seeds, Bark	Leprosy, burning sensation	Zone-I, II	Decoction	Oral	Ind Or Afghan	LC
<i>Erythrina suberosa</i> Roxb.	Parirara	Tree	Bark	Joint pain	Zone-I, II, III	Decoction	Oral	Ind Or	LC
<i>Indigofera cassioides</i> DC.	Kathie	Shrub	Roots	Cough	Zone-I, II	Powder, Paste	Topical, Oral	India	LC
<i>Lotus corniculatus</i> L.	Shangser	Herb	Whole plant	Constipation, skin inflammations	Zone-IV	Extract	Oral	Europe	LC
<i>Mimosa pudica</i> L.	Chuie-muie	Shrub	Whole Plant	Headache, boils, piles	Zone-I, II	Powder, Paste	Topical	Mexico to Tropical Amer	LC
<i>Mucuna pruriens</i> (L.) DC.	Goncha, Kaunch, Daryagal	Climber	Roots, Seeds	Joint pain, snake bite, urinary problems	Zone-I, II	Powder, Paste, Juice	Oral, Topical	Amphig trop	LC

(Contd.)

Table 1 — Ethnobotanical diversity of the silvopastoral land use system in north western Himalaya (Contd.)

Family/Species	Local name	Habit	Part used	Ailments cured	Agro-climatic zones	Method of Preparation	Mode of Administration	Nativity and Endemism	Threat Status as per IUCN red list
<i>Ototropis elegans</i> (DC.) H. Ohashi & K. Ohashi	Mooti	Shrub	Stem	Dental care	Zone-II, III	Decoction	Oral	Afg to Central China	LC
<i>Desmodium oojeinense</i> (Roxb.) H. Ohashi	Sanan	Tree	Flowers	Diarrhoea, dysentery	Zone-I, II	Decoction	Oral	Reg Himal	LC
<i>Pueraria tuberosa</i> (Willd.) DC.	Slod	Climber	Roots	Throat infection, constipation	Zone-I, II	Extract, Paste	Oral, Topical	Reg Himal	LC
<i>Trifolium pratense</i> L. --	--	Herb	Leaves	Skin problems	Zone-IV			Europ As Temp	LC
<i>Trifolium repense</i> L. --	--	Herb	Leaves	Skin problems	Zone-IV	Decoction, Extract	Oral, Topical	Europ As Temp	LC
<i>Uraria picta</i> (Jacq.) DC.	Dbra	Herb	Whole plant	Cough, cold	Zone-I, II	Decoction	Oral	Geront Trop	LC
Gentianaceae									
<i>Halenia elliptica</i> D. Don	--	Herb	Leaves	Headache, cough, cold	Zone-IV	Paste	Topical	Reg Himal	LC
Geraniaceae									
<i>Geranium nepalense</i> Sweet	Laljari	Herb	Roots	Kidney problems, body ache	Zone-II, IV	Powder	Decoction	Ind Or China	
<i>Geranium wallichianum</i> D. Don ex Sweet	--	Herb	Leaves	Toothache	Zone-III	Extract, Powder	Oral	Reg Himal	NT
Hippocastanaceae									
<i>Aesculus indica</i> (Wall. ex Cambess.) Hook.	Khanor	Tree	Fruit, Bark	Tonic, stomach problems, Joint pain	Zone-III			Reg Himal	NT
Hypericaceae									
<i>Hypericum elodeoides</i> Choisy	--	Herb	Leaves	Depression, anxiety, sleep disorders	Zone-III	Powder, Decoction	Oral, Decoction	Reg Himal Burma	LC
Juglandaceae									
<i>Juglans regia</i> L.	Ka, Akhrot, Khrot	Tree	Seeds, Bark, Leaves, Roots	Dental care, Intestinal worms	Zone-III, IV	Extract, Decoction	Oral	As Occ Reg	VU
Lamiaceae									
<i>Ajuga integrifolia</i> Buch.-Ham.	Neelkanthi, Ratpacha	Herb	Leaves	Boils, gonorrhoea, piles	Zone-I, II	Paste	Topical	Nepal	LC
<i>Clerodendrum serratum</i> Moon	Barangi	Shrub	Leaves	Eye problems	Zone-I, II	Extract, Powder	Topical	Ind Or Burma	LC
<i>Colebrookea oppositifolia</i> Sm.	Gadush, Doos, Binda	Shrub	Leaves	Hysteria, toothache, epilepsy	Zone-I, II, III	Powder, Extract	Oral, Topical	Ind Or Burma	LC
<i>Isodon rugosus</i> (Wall.) Codd	Thator	Shrub	Leaves	Stomach problems, bronchial disorder, diarrhoea	Zone-IV	Powder, Extract	Topical, Oral	Reg Himal	LC

(Contd.)

Table 1 — Ethnobotanical diversity of the silvipastoral land use system in north western Himalaya (*Contd.*)

Family/Species	Local name	Habit	Part used	Ailments cured	Agro-climatic zones	Method of Preparation	Mode of Administration	Nativity and Endemism	Threat Status as per IUCN red list
<i>Leucas lanata</i> Benth.	Gathmal	Herb	Leaves, Flowers	Skin diseases, dysentery, cough, cold	Zone-III	Juice, Paste	Oral, Topical	Ind Or China	LC
<i>Mentha longifolia</i> (L.) L.	Kusma	Herb	Leaves	Stomach problems, vomiting, carminative	Zone-III, IV	Extract, Powder	Topical	Europ As Bor	LC
<i>Micromeria biflora</i> (Buch.-Ham. ex D.Don) Benth.	--	Herb	Leaves	Wounds of cattle	Zone-III	Juice, Extract	Oral	Ind Or Arab Afr Trop	LC
<i>Nicandra physalodes</i> (L.) Gaertn.	Ban Tambaco	Herb	Leaves	Fever, toothache	Zone-III	Decoction	Oral	Peru to NW Argentina	LC
<i>Origanum vulgare</i> L.	Ban Tulsi	Herb	Leaves, Flowers	Cut, wounds, boils	Zone-III, IV	Paste	Topical	Europ As et Afr Bor	LC
<i>Pogostemon plectranthoides</i> Desf.	Kali Basuti	Shrub	Flowers, Leaves	Cold, fever, wound healing	Zone-III	Paste	Topical	India to Bangladesh	LC
<i>Prunella vulgaris</i> L.	Austak	Herb	Flowers	Fever, cough	Zone-IV			Reg Himal	LC
<i>Roylea cinerea</i> (D.Don) Baill.	Kadvi Dhargu	Shrub	Leaves	Diabetes, body ache, swelling, jaundice, skin disease	Zone- II, III	Paste, Decoction	Topical, Oral	Reg Himal	VU
<i>Salvia lanata</i> Salisb.	--	Herb	Flowers	Reduce body heat	Zone-II			Reg Himal	VU
<i>Thymus linearis</i> Benth.	Ban Ajwain	Herb	Leaves	Carminative, respiratory problems, digestive disorder	Zone-III, IV	Paste, Decoction	Oral	Europ As et Afr Bor	NT
Lauraceae									
<i>Cinnamomum tamala</i> T. Nees & Eberm.	Tejpatta	Shrub	Leaves	Diarrhoea	Zone-I,II	Decoction	Oral	Reg Himal	LC
Linaceae						Paste, Powder	Oral, Topical		
<i>Reinwardtia indica</i> Dumort.	Basanti	Shrub	Stem, Leaves	Wounds infected with maggots, paralysis	Zone-III	Paste, Decoction	Oral, Topical	Indian Subcontinent to S China	LC
Lythraceae									
<i>Punica granatum</i> L.	Dadu	Shrub	Seeds	Throat infection, anaemia, asthma, dysentery, diarrhoea, cold, blood pressure, urinary infection. vomiting, loss of appetite, intestinal worms	Zone-I, II, III	Decoction	Oral	Europ Austr	LC

(Contd.)

Table 1 — Ethnobotanical diversity of the silvipastoral land use system in north western Himalaya (Contd.)

Family/Species	Local name	Habit	Part used	Ailments cured	Agro-climatic zones	Method of Preparation	Mode of Administration	Nativity and Endemism	Threat Status as per IUCN red list
<i>Woodfordia fruticosa</i> Kurz	Dhawi, Dhatki	Shrub	Flowers, Bark	Skin diseases, dysentery, leprosy	Zone-I, II, III, IV	Decoction	Oral	E Tanzania, Comoros, Madagascar, Trop	LC
Malvaceae <i>Abutilon indicum</i> (L.) Sweet	--	Herb	Whole plant	Astringent	Zone-II	Paste, Powder, Decoction,	Oral, Topical	Trop & Sub Trop As	LC
<i>Bombax ceiba</i> L.	Simbal, Shembal	Tree	Flowers, Fruits	Piles, diarrhoea, dysentery	Zone-I, II, III,	-	-		
<i>Malva verticillata</i> L.	Beoli	Herb	Roots	Ease delivery of cow	Zone-III	Decoction	Oral	Europ As et Afr Bor	LC
<i>Sida cordifolia</i> L.	--	Herb	Fruits	Cough	Zone-II	Decoction	Oral	Trop & Sub Trop	
<i>Sida rhombifolia</i> L.	--	Herb	Roots, Leaves	Burning sensation	Zone-III	Powder	Oral, Topical	Trop & Sub Trop	
Meliaceae <i>Azadirachta indica</i> A. Juss.	Neem	Tree	Leaves, Bark	Fever, insecticide, skin problems, hair fall, anthelmintic	Zone-I, II	Paste, Decoction	Oral, Topical	Trop As	LC
<i>Melia azedarach</i> L.	Drek		Leaves, Bark	Skin disease, indigestion, wounds	Zone-I, II, III	Paste, Extract	Oral, Topical	Reg Himal	NT
<i>Cedrela toona</i> Roxb. ex Rottler	Tun, Mahaneem	Tree	Flowers	Dysentery	Zone-II, III	Extract, Decoction	Oral	Trop As	LC
<i>Toona ciliata</i> M.Roem.	Tuni	Tree	Bark	Dysentery, gastric	Zone-I, II, III	Powder	Oral	Trop As	LC
Menispermaceae <i>Tinospora cordifolia</i> (Willd.) Miers	Giloy, Guij-Gleo, Guduchi	Climber	Stem	Fever, jaundice, leucorrhoea, jaundice, seminal weakness, fever, urinary disease	Zone-I, II	Extract, Powder	Oral	Ind Or	LC
<i>Cissampelos pareira</i> L.	Bhatindu	Climber	Leaves	Cough, dry skin	Zone-I, II, III	Extract	Oral	Am	LC
<i>Stephania glabra</i> (Roxb.) Miers	--	Climber	Roots	Asthma	Zone-I, II, III	Extract, Powder	Oral	Indian Subcontinent to S Tibet and Indo-China	LC
Moraceae <i>Ficus benghalensis</i> L.	Barh	Tree	Roots	Headache, respiratory problems, snake bite, toothache, diabetes	Zone-I, II	Powder, Decoction	Oral, Topical	Ind Or Afr Trop	LC

(Contd.)

Table 1 — Ethnobotanical diversity of the silvipastoral land use system in north western Himalaya (*Contd.*)

Family/Species	Local name	Habit	Part used	Ailments cured	Agro-climatic zones	Method of Preparation	Mode of Administration	Nativity and Endemism	Threat Status as per IUCN red list
<i>Ficus palmata</i> Forssk.	Dagla, Fegda, Bedu, Anjiri	Tree	Latex	Warts, toothache, indigestion problem of cattle's	Zone-I, II, III, IV			Afr Trop Arab Ind Or	LC
<i>Ficus racemosa</i> L.	Gulliar, Gular, Umar	Tree	Fruits, Latex	Piles, diabetes, skin problems, diarrhoea	Zone-I, II	Paste, Decoction, Powder	Oral, Topical	Pakistan to N Queensland	LC
<i>Ficus religiosa</i> L.	Peepal, Pipal, Pipli	Tree	Leaves, Bark	Headache, cough, cold, skin diseases, asthma	Zone-I, II, III	Raw, Cooked	Oral	Ind Or	LC
<i>Morus alba</i> L.	Chitta toot	Tree	Fruits	Jaundice	Zone-I, II	Juice, Powder	Oral	Central China	LC
Moringaceae									
<i>Moringa pterygosperma</i> Gaertn.	Sahjan	Tree	Bark	Swelling in body	Zone-I, II	Powder, Decoction	Oral	Ind Bor Occ	LC
Myricaceae									
<i>Myrica esculenta</i> Buch.-Ham. ex D. Don	Kaphal	Tree	Fruits	Dysentery, cough, asthma	Zone-III	Decoction	Oral	As Trop Sub Trop	LC
Myrtaceae									
<i>Syzygium cumini</i> (L.) Skeels	Jamu, Jamun	Tree	Fruits	Diabetes, anaemia, indigestion, piles, jaundice, diabetes, laxative	Zone-I, II	Paste	Oral	As Trop Sub Trop	LC
<i>Eucalyptus camaldulensis</i> Dehnh.	Safeda	Tree	Leaves	Dysentery	Zone-I, II	Extract	Topical	Austr	NT
Oxalidaceae									
<i>Oxalis corniculata</i> L.	Amrul, Malori, Khatti-mithi	Herb	Leaves	Skin problems, dysentery	Zone-I, II, III, IV	Powder, Juice	Oral	Amphig Temp et Trop	LC
Papaveraceae									
<i>Argemone mexicana</i> L.	Bharband, Kateli, Shialkant	Herb	Leaves	Itchy skin rash	Zone-I, II, III	Extract	Oral	Mexico, West Indies	LC
Phyllanthaceae									
<i>Phyllanthus emblica</i> L.	Amla	Tree	Fruits	Tonic, indigestion, hair fall, jaundice, diabetes, skin problems, asthma, constipation, leucorrhoea	Zone-I, II	Extract, Powder	Oral	As Trop	LC
Pinaceae									

(Contd.)

Table 1 — Ethnobotanical diversity of the silvipastoral land use system in north western Himalaya (Contd.)

Family/Species	Local name	Habit	Part used	Ailments cured	Agro-climatic zones	Method of Preparation	Mode of Administration	Nativity and Endemism	Threat Status as per IUCN red list
<i>Cedrus deodara</i> (Royle ex D. Don) G. Don	Dyar, Devdar, Kyalbang	Tree	Resin	Skin disease, swelling	Zone- III, IV	Paste	Topical	Reg Himal	LC
<i>Pinus roxburghii</i> Sarg.	Chil	Tree	Seeds	Skin problems	Zone-I, II, III	Paste	Topical	Reg Himal	LC
<i>Pinus gerardiana</i> Wall. ex D. Don	Ree, Neoza	Tree	Resin, Seeds	Cracked feet, physical weakness, cough, cold, body pain, eye problem, wounds, ulcers	Zone-IV	Paste, Extract	Topical	Reg Himal	NT
Polygonaceae									
<i>Rumax hastatus</i> D. Don	Malora, Katambal	Herb	Leaves	Indigestion	Zone-I, II, III, IV	Extract, Decoction	Oral	Reg Himal	LC
<i>Rumex nepalensis</i> Spreng.	Khatti-mithi, Ambi, Churi	Herb	Leaves, Root	Swelling, warts, skin problems	Zone-I, II, III, IV	-	-	As Occ Ind Or Malaya Afr	LC
<i>Oxyria digyna</i> (L.) Hill.	Chucha, Lamanchu	Herb	Leaves	Stomach problems	Zone-IV	Extract, Paste	Oral, Topical	Reg Himal	LC
<i>Persicaria capitata</i> (Buch.-Ham. ex D. Don) H. Gross	--	Herb	Leaves	Urinary problems	Zone-III			Reg Himal	LC
<i>Bistorta amplexicaulis</i> (D. Don) Greene	Kukurmakri	Herb	Whole plant	Blood circulation, indigestion	Zone-III, IV	Powder, Decoction	Oral, Topical	E Afghanistan to Central China	LC
Plantaginaceae									
<i>Plantago lanceolata</i> L.	--	Herb	Leaves	Constipation	Zone-III	Decoction, Extract	Oral	Europ As Bor	LC
Plumbaginaceae									
<i>Plumbago zeylanica</i> L.	Chitra	Herb	Root	Skin diseases, stomach troubles	Zone-I, II	Juice	Oral	Geront Trop	LC
Poaceae									
<i>Arundo donax</i> L.	Rajal, Baranal	Shrub	Roots	Headache	Zone-I, II, III, IV	Extract, Paste, extract, Powder	Tropical Oral, Topical	Temp & Subtropical	LC
<i>Bambusa bambos</i> (L.) Voss	Magar	Shrub	Roots, Stem	Shivering of cattle's	Zone-I, II	Decoction	Oral	Indian Subcontinent	
<i>Cynodon dactylon</i> (L.) Pers.	Dub	Herb	Whole plant	Dysentery, menstrual problems, acidity, constipation	Zone-I, II	Decoction, Paste, Extract	Oral, Topical	Temp & Subtropical	LC

(Contd.)

Table 1 — Ethnobotanical diversity of the silvipastoral land use system in north western Himalaya (*Contd.*)

Family/Species	Local name	Habit	Part used	Ailments cured	Agro-climatic zones	Method of Preparation	Mode of Administration	Nativity and Endemism	Threat Status as per IUCN red list
<i>Dendrocalamus strictus</i> (Roxb.) Nees	Banj	Shrub	Leaves	Cough	Zone-I, II	Juice, Decoction	Oral	Ind Or	LC
<i>Heteropogon contortus</i> (L.) P.Beauv. ex Roem. & Schult.	Sariala	Herb	Roots	Wounds, burns	Zone- I, II	Paste, Decoction	Oral, Topical	Tropics & Subtropics to S. Central Europe	LC
<i>Imperata cylindrica</i> (L.) Raeusch.	Siru	Herb	Roots	Burns	Zone- I, II			Afr and Afg	LC
<i>Paspalidium flavidum</i> (Retz.) A. Camus	Dhanera	Herb	Roots	Wounds	Zone- I, II	Paste, Juice, Extract	Topical	W Indian Ocean	LC
<i>Phalaris minor</i> Retz.	Canary	Herb	Whole plant	Antifertility	Zone- I, II			Himalaya	LC
<i>Sorghum halepense</i> (L.) Pers.	Jwar gha	Herb	Roots	Urinary problems	Zone- I, II	Decoction	Oral	Reg Calid	LC
Primulaceae									
<i>Androsace rotundifolia</i> Hardw.	Nirodhak buti, Golpatti phool	Herb	Leaves	Menstrual problem	Zone-III	Paste	Topical	Reg Himal China	LC
Pteridaceae						Paste, Decoction	Topical, Oral		
<i>Adiantum incisum</i> Forssk.	--	Herb	Whole Plant	Throat problem, fever	Zone-I, II, III	-	-	Peru, Galápagos	LC
<i>Diplazium esculentum</i> (Retz) Sw.	Lingad	Herb	Leaves	Tonic, headache, dysentery	Zone-III, IV	Paste, Extract	Oral, Topical	Trop & Sub Trop Asia	LC
Ranunculaceae									
<i>Anemone rivularis</i> Buch.-Ham. ex DC.	--	Herb	Flowers	Wounds	Zone-IV	Paste, Extract	Topical, Oral	Ind Or	LC
<i>Delphinium denudatum</i> Wall. ex Hook.f. & Thomson	Nirbisi	Herb	Root	Tonic, lice killing, hair growth	Zone-III	Extract, Decoction	Oral	Reg Himal	VU
<i>Ranunculus laetus</i> Wall. ex Hook. F. & J.W. Thomson	--	Herb	Leaves	Wounds of cattle	Zone-III	Extract	Oral	Afg to CAsia and China	LC
Rhamnaceae									
<i>Ziziphus mauritiana</i> Lam.	Ber	Tree	Fruits	Blood purifier, cough, digestive problems, hair fall, headache	Zone- I, II	Extract	Oral, Topical	Ind Or	LC
Rosaceae									
<i>Fragaria nubicola</i> Lindl. ex Lacaita	Bumbra, shoch	Herb	Fruits	Skin problems, wounds	Zone- III, IV	Extract	Oral	Ind Or (Sikkim)	LC
<i>Prinsepia utilis</i> Royle	Behkal, Bekhli	Shrub	Seeds	Wounds, arthritis	Zone- I, II, III, IV	Decoction	Oral	Reg Himal	LC

(Contd.)

Table 1 — Ethnobotanical diversity of the silvipastoral land use system in north western Himalaya (Contd.)

Family/Species	Local name	Habit	Part used	Ailments cured	Agro-climatic zones	Method of Preparation	Mode of Administration	Nativity and Endemism	Threat Status as per IUCN red list
<i>Prunus armeniaca</i> L.	Chul, Chuli	Tree	Seeds, Fruits	Body pain, skin problems, tonic, ear problems, Jaundice, piles, constipation, Joint pain	Zone-III, IV	Juice, Powder	Oral, Topical	Reg Caucas	DD
<i>Prunus cerasoides</i> D.Don	Paja	Tree	Twigs	Dental care	Zone-III, IV	Raw	Oral	S China Taiwan	LC
<i>Prunus mira</i> Koehne	Bemi, Reg	Tree	Seeds, Fruits	Body pain, skin problems, tonic, eye and ear problems, jaundice, piles, constipation, joint pain	Zone-III, IV	Juice	Oral	China (Szechuan)	LC
<i>Pyrus pashia</i> Buch.-Ham. ex D.Don	Kainth	Tree	Fruits	Vomiting, Nausea, Rectal prolapse of cattle's	Zone-III, IV	Raw	Oral	Reg Himal	LC
<i>Rubus ellipticus</i> Sm.	Aakhe, Accha, Cho Soch	Shrub	Fruits, Roots	Diarrhoea, stomach ache, dysentery, throat problem	Zone- I, II, III, IV	Decoction	Oral	Ind Or	LC
<i>Rubus niveus</i> Thunb.	Gunacha, Cho Soch	Shrub	Fruits	blood purifier	Zone-III, IV	Extract, Decoction	Oral, Topical	Ind Or As	LC
<i>Rubus fruticosus</i> L.	Cho Soch	Shrub	Fruits	Throat infection	Zone-IV	Juice, Powder	Oral, Topical	Europe	LC
<i>Spiraea canescens</i> D. Don.	Khangser	Shrub	Flowers	Sores, wounds	Zone-IV	Paste, Extract	Oral, Topical	Reg Himal	LC
Rubiaceae									
<i>Rubia cordifolia</i> L.	Jamithi	Climber	Root	Skin problems	Zone-III, IV	Powder, Extract	Oral, Topical	As Trop et Temp Afr Trop	LC
Rutaceae									
<i>Aegle marmelos</i> (L.) Correa	Beel, Belpatra, Shriphala, Bilwa	Tree	Fruits	Piles, dysentery, vomiting, constipation, jaundice, gastric problem, gangrene	Zone- I, II, III	Extract, Paste	Topical	Ind Or	NT
<i>Murraya koenigii</i> (L.) Spreng.	Gandhela	Shrub	Leaves	Dysentery, dental care, stomach ache, child birth pain	Zone- I, II	Extract	Topical	Ind Or	LC
<i>Naringi crenulata</i> (Roxb.) Nicolson	Bili, Bil	Tree	Fruits	Diarrhoea	Zone- I, II			W Central Himalaya to India Sri Lanka	LC
<i>Zanthoxylum armatum</i> DC.	Timir, Timber	Shrub	Twigs, Fruits	Cough, cold, toothache, piles, mouth freshener, dental care, fever	Zone- I, II, III, IV	Powder, Decoction, Juice	Oral, Topical	Reg Himal China	VU
Salicaceae									

(Contd.)

Table 1 — Ethnobotanical diversity of the silvipastoral land use system in north western Himalaya (*Contd.*)

Family/Species	Local name	Habit	Part used	Ailments cured	Agro-climatic zones	Method of Preparation	Mode of Administration	Nativity and Endemism	Threat Status as per IUCN red list
<i>Flacourtia indica</i> (Burm.f.) Merr. Sapindaceae	Kangu	Tree	Roots	Skin diseases	Zone- I, II	Juice	Oral	Ethiopia to S Afr	LC
<i>Dodonaea viscosa</i> Jacq.	Mendu, Mehander	Shrub	Leaves	Ulcer, diarrhoea	Zone-III			Jamaica (Caribbean, Southern America)	LC
<i>Sapindus mukorossi</i> Gaertn. Saxifragaceae	Reetha	Tree	Seeds	Hair fall, skin diseases	Zone- I, II	Juice, Extract	Oral, Topical	As Trop	LC
<i>Bergenia ciliata</i> (Haw.) Sternb. Scrophulariaceae	Pashanbed, Pattar Chat	Herb	Root, Leaves	Kidney and bladder stone, swelling of joints	Zone- III, IV	Extract, Decoction	Oral	Reg Himal	VU
<i>Buddleja asiatica</i> Lour. Tiliaceae	--	Shrub	Leaves	Inflammation, skin disease.	Zone-III			As Trop Malaya	LC
<i>Verbascum thapsus</i> L. Solanaceae	Fochu Kanang, Budi Kalogar	Herb	Leaves	Stomach problems, expulsion of placenta in cattle's	Zone- I, II, III, IV	Decoction, Extract	Oral	Reg Himal Europ	LC
<i>Solanum nigrum</i> L.	Makoi	Herb	Whole plant	Skin diseases	Zone- I, II, III	Extract, Paste	Topical	Amphig	LC
<i>Datura stramonium</i> L.	Datura	Herb	Seeds	Joint problem, toothache, dandruff	Zone-I, II,	Extract, Paste, Decoction	Oral, Topical	Cosmp Trop et Temp	LC
<i>Solanum indicum</i> Burm.	Kanderi, Nar, Piuli	Herb	Leaves	Cold, cough	Zone- I, II, III	Juice	Oral	Geront Trop Ind Or	LC
<i>Solanum virginianum</i> L. Tiliaceae	--	Herb	Seeds	Asthma, cough	Zone-II	Extract	Oral	Am Bor	
<i>Grewia optiva</i> J.R.Drumm. ex Burret Urticaceae	Biul	Tree	Seeds	Pain during child birth	Zone- I, II, III	Paste. Extract	Oral, Topical	Reg Himal	LC
<i>Boehmeria rugulosa</i> Wedd. Daphneaceae	Bemol	Shrub	Leaves	Diabetes	Zone-III	Decoction	Oral	Nepal	
<i>Daphne papyracea</i> Wall. ex G.Don	Bursha	Shrub	Stem	Dental care	Zone- III	Extract, Juice	Oral	China	LC
<i>Girardinia diversifolia</i> (Link.) Fries.	Jarahn, Bichhubuti, Kugus	Herb	Leaves	Menstrual problems	Zone- III, IV			Ind Or Malaya	LC
<i>Pilea umbrosa</i> Blume	--	Herb	Leaves	Skin diseases		Decoction	Oral	Reg Himal	LC
<i>Urtica dioica</i> L. Valerianaceae	Bichu buti, Choya, Aan	Herb	Leaves	Jaundice, hair problem, dysentery, blood problem, skin problem	Zone-I, II, III, IV	Decoction, Paste	Oral, Topical	Europ	

(Contd.)

Table 1 — Ethnobotanical diversity of the silvopastoral land use system in north western Himalaya (Contd.)

Family/Species	Local name	Habit	Part used	Ailments cured	Agro-climatic zones	Method of Preparation	Mode of Administration	Nativity and Endemism	Threat Status as per IUCN red list
<i>Valeriana jatamansi</i> Jones ex Roxb.	Nihanu	Herb	Root	Stomach ache	Zone- III	Decoction, Extract	Oral	Reg Himal	VU
Verbenaceae						Powder	Oral		
<i>Vitex negundo</i> L.	Bana	Shrub	Leaves	Asthma, cough, cold, headache, indigestion, skin diseases, joint pain, bone fractures, paralysis, swelling	Zone-I, II, III	Powder	Oral	As Trop et sub Trop	LC
Violaceae									
<i>Viola canescens</i> Wall.	Banaksha	Herb	Whole plant	Fever, cold, asthma, tonsils, fever, skin problems	Zone- III, IV	Powder	Oral	Reg Himal	LC
<i>Viola odorata</i> L.	Banaksha	Herb	Whole plant	Fever, cold, asthma	Zone- III	Powder	Oral	Europ Afr et As Bor	LC
<i>Viola pilosa</i> Blume	Banaksha	Herb	Whole plant	Fever, cold, asthma	Zone- II, III	Powder	Oral	E Afg to China	LC
Zingiberaceae									
<i>Hedychium spicatum</i> Sm.	Banhaldi	Herb	Roots	Skin diseases	Zone- II, III	Powder	Oral	Reg Himal	VU
<i>Zingiber chrysanthum</i> Roscoe	Jangli adrak	Herb	Roots	Piles, joint pain, body pain	Zone-III	Powder	Oral	Reg Himal	LC

Abbreviations used: As=Asia; Trop=Tropical; Malaya=Malaysia; Am=America; Amphig=Amphigaea; Reg Himal=Regional Himalaya; Ind=India; Europ=Europe; DD=Data Deficient= LC=Least Concern; VU=Vulnerable; EN=Endangered; NT=Near Threatened; Afr=Africa; Bor=Borealis; Austr=Australia; Afg=Afghanistan; Cosmop=Cosmopolitan; Malaya=Peninsular Malaysia; Ind Or=Indian Oriental; Occ=Occidentalis; Geront= Gerontia; m=meter; amsl=above mean sea level

Parts used, mode of administration and method of preparation

The different parts, such as bark, leaves, fruit, roots, seeds, and the whole plant of medicinal plants, are used by local people in various modes of preparation, such as powder, paste, juice, decoction, and extracts, as part of local ethnomedicine. The percentage distribution of different plant parts used for the preparation of ethnomedicine is represented in (Fig. 3). Use of above ground plant parts (77.6%; considering whole plant in this category) was higher than that of below ground plant parts (22.4%). Leaves from 73 plant species were used to prepare medicine, followed by root (34 species), fruit (29 species), seeds (26 species), whole plant (19) and bark (5 species) (Fig. 4). Decoction (85 species), Extract (68 species), Paste (66 species), were found to be most popular way to prepare medicine . Maximum

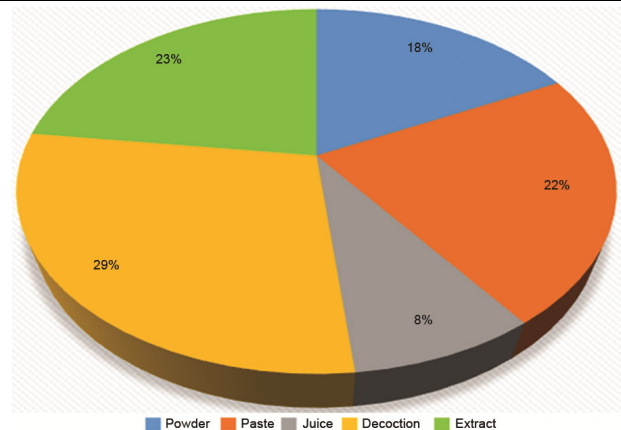


Fig. 3 — Different mode of preparation of the medicinal plants by the locals

medication was oral (64 %), followed by topical (8 %). In some cases, some species were used both orally and topically (28 %) (Table 1).

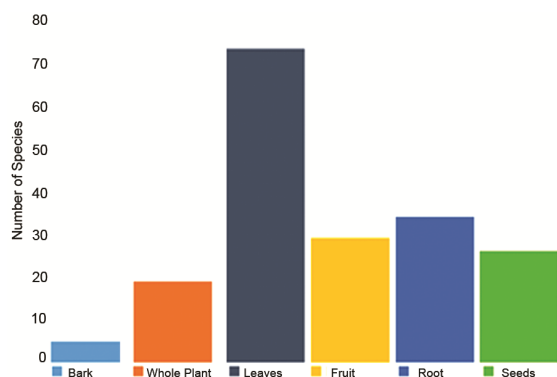


Fig. 4 — Different parts of the medicinal plants used by the locals

Nativity, endemism and threat status

Eighty-one species were native to IHR and 121 were non-native to the Indian north western Himalaya. Three species i.e., *Angelica glauca*, *Pimpinella acuminata* and *Habenaria edgeworthii* were reported endemic and 66 species as near endemic to IHR. Out of total recorded medicinal plants, *Angelica glauca* and *Prunus armeniaca* was found endangered (EN) and Data deficient (DD), respectively, whereas 164 species were found least concern (LC), 14 species Vulnerable (VU), and 12 species were also recorded as near threatened (NT) locally (Table 1).

Silvipastoral diversity in NW Himalaya

In the North Western Himalayan region, the Himalayan Mountains exhibit distinct differences in climate, terrain, vegetation, ecology, and land use patterns³⁶. Within this region, the most employed horticultural-based agroforestry systems are agri-horticulture, silvi-horticulture, and silvipastoral system³⁷. These systems involve various components that interact on both ecological and economic levels³⁸. As a traditional land use system and resource management practice, agroforestry contributes to enhancing lives by providing valuable ecosystem services such as food, fruits, fodder, and firewood³⁹. It offers one alternative to address land use challenges and combat CO₂-induced global warming by integrating more trees into farming, like agroforestry practices⁴⁰. The Himalayan challenge encompasses sustainable development and conservation efforts in the region, presenting a complex scenario due to deep interconnections between social, economic, and environmental problems. Impoverished families, limited land resources, heavily depend on agroforestry to meet their daily needs, including food, fruits, fodder, and firewood⁴¹.

Conservation and management options

Monitoring the populations and habitats of overexploited plants on a regular basis is critical for understanding vegetation dynamics. Quantum extraction of these plants is necessary to assess species-level pressures and propose mitigating strategies. Mass multiplication of these species should be done through the development of conventional and *in-vitro* propagation techniques. A cooperative work plan involving many stakeholders, including scientists, technocrats, government agencies, non-governmental organizations, and farmers, must be created. This plan must implement the guidelines outlined in Section 8 of the Biodiversity Act 2002, which include the preservation of biological diversity, the sustainable use of its components, the fair and equitable distribution of benefits resulting from the use of biological resources and knowledge to satisfy market demands, and the preservation of threatened and economically significant plant biodiversity.

Conclusion

Traditionally medicinal and aromatic plants occupied an important position in the socio cultural, spiritual, and medicinal arena of rural and tribal lives in the Himalayan states. Currently, traditional knowledge on usage of medicinal plants is depleting drastically all over the world due to modernization, urbanization, lack of interest in following traditional practices, easy availability of allopathic drugs and lack of written documents and state of Himachal Pradesh also not untouched from this. In addition, natural habitats of medicinal plants are under severe threat due to continuously changing climate and land use changes. Therefore, traditional medical knowledge of medicinal plants and their use by indigenous culture are not only useful for conservation of cultural traditions and biodiversity but also for community health care and drug development.

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Conflict of Interests

No conflicts of interest have been disclosed by the authors. All authors declare that they do not have any

financial and personal relationships with other people or organizations that could inappropriately influence (bias) their work.

Author Contributions

Overall coordination, draft manuscript writing and final editing was done by SL. Preparation of figures and editing of the draft manuscript was done by TB. Formal analysis was done by N. Maps were prepared by RS.

Prior Informed Consent

Prior Informed Consent was sought from every respondent.

Data Availability

The data that support the findings of this study are available from the corresponding author upon reasonable request.

References

- Schippmann U, Leaman D J & Cunningham A B, Impact of cultivation and gathering of medicinal plants on biodiversity: global trends and issues, In: *Biodiversity and the Ecosystem Approach in Agriculture, Forestry and Fisheries*, Ninth Regular Session of the Commission on Genetic Resources for Food and Agriculture, (FAO, Rome, Italy), (2002) 1-21.
- Gupta S K, *Pharmacology and Therapeutics in the New Millennium*, (Narosa Publishing House, New Delhi), (2001).
- Samant S S, Dhar U & Palni L M S, *Medicinal Plants of Indian Himalaya*, (Gyanodaya Prakashan, Dehradun), (1998).
- Bargali S S, Shrivastava S K, Dixit V K & Bargali K, Some less known ethnomedicinal plants of Jagdalpur District of Chhattisgarh State, *The Botanica*, 53 (2003) 192-197.
- Bargali S, Singh S & Pandya K, Effects of *Acacia nilotica* on gram crop in a traditional agroforestry system of Chhattisgarh plains, *Int J Ecol Environ Sci*, 30 (4) (2004) 363-368.
- Bargali S S, Bargali K, Singh L, Ghosh L & Lakhera M L, *Acacia nilotica* based traditional agroforestry system: Effect on paddy crop and management, *Curr Sci*, 96 (4) (2009) 581-587.
- Kittur B H & Bargali S S, Perspectives of agroforestry: Present and future facets, *J Progrs Agri*, 4 (2) (2013) 91-94.
- Kittur B H, Swamy S L, Bargali S S & Jhariya M K, Wildland fires and moist deciduous forests of Chhattisgarh, India: Divergent Component assessment, *J For Res*, 25 (2014) 857-866.
- Shanker D, Conserving the medicinal plants of India: the need for the bio-cultural perspective, *J Altern Complement Med*, 2 (3) (1966) 349-358.
- Kala C P, Dhyani P P & Sajwan B S, Developing the medicinal plants sector in Northern India: challenges and opportunities, *J Ethnobiol Ethnomed*, 2 (2006) 32.
- Bargali S S & Shrivastava S K, Exploration of valuable medicinal vegetal wealth from the tribal belt of Bastar district in Chhattisgarh, *Botanica*, 52 (2002), 75-82
- World Health Organization (WHO), The world health report 2002: reducing risks, promoting healthy life, World Health Organization, 2002.
- Hamilton A C, Medicinal plants, conservation and livelihoods, *Biodivers Conserv*, 13 (2004) 1477-1517.
- Nautiyal S, Rao K S, Maikhuri R K, Negi K S, & Kala C P, Status of medicinal plants on way to Vashuki Tal in Mandakini Valley, Garhwal, Uttaranchal, *J Non-Timber Forest Prod*, 9 (3&4) (2002) 124-131.
- Uniyal S K, Kumar A, Lal B & Singh R D, Quantitative assessment and traditional uses of high value medicinal plants in Chhota Bangal area of Himachal Pradesh, Western Himalaya, *Curr Sci*, 91 (9) (2006) 1238-1241.
- Samant S S, Pant S, Singh M, Lal M, Singh A, *et al.*, Diversity, distribution pattern, indigenous uses and conservation prioritization of medicinal plants of Himachal Pradesh, India, *Int J Biodivers Sci Ecosyst Serv Manag*, 3 (4) (2007) 234-251.
- Singh A, Lal M & Samant S S, Diversity, indigenous uses and conservation prioritization of medicinal plants in Lahaul valley, proposed Cold Desert Biosphere Reserve, India, *Int J Biodivers Sci Manag*, 5 (3) (2009) 132-154.
- Anonymous, Conservation assessment and management plan workshop process, WWF, India, 1997.
- Dhar U, Manjkhola S, Joshi M, Bhatt A, Bisht A K, *et al.*, Current status and future strategy for development of medicinal plants sector in Uttaranchal, India, *Curr Sci*, 83 (8) (2002) 956-964.
- Rao M R, Palada M C & Becker B N, Medicinal and aromatic plants in agroforestry systems, In: *New Vistas in Agroforestry: A Compendium for 1st World Congress of Agroforestry*, (Springer, Netherlands), (2004) 107-122.
- Jain S K, *Dictionary of Indian folk medicine and ethnobotany*, (Deep Publications, New Delhi), 1991.
- Chauhan N S, Important medicinal and aromatic plants of Himachal Pradesh, *Indian For*, 129 (8) (2003) 979-998.
- Joshi B & Pant S C, Ethnobotanical study of some common plants used among the tribal communities of Kashipur, Uttarakhand, *Indian J Nat Prod Resour*, 3 (2) (2012) 262-266.
- Samant S S & Pal M, Diversity and conservation status of medicinal plants in Uttaranchal State, *Indian For*, 129 (9) (2003) 1090-1108.
- Singh S K, Ethno-medicinal plants of Kullu valley, Himachal Pradesh, *J Non-Timber Forest Prod*, 11 (2004) 74-79.
- Kala C P, Medicinal plants of the high-altitude cold desert in India: diversity, distribution and traditional uses, *Int J Biodivers Sci Ecosyst Serv Manag*, 2 (1) (2006) 43-56.
- Rawat R S, Vaneeet J & Kapoor K S, Medicinal and aromatic plant diversity of Himalayan cold desert with reference to Spiti valley of North-West Himalayas, *Indian For*, 135 (7) (2009) 891-904.
- Arti S, Kumar S V, Pooja S & Sangeeta C, Studies on traditional knowledge of ethnomedicinal plants in Jawalamukhi Himachal Pradesh, India, *Int Res J Biol Sci*, 3 (10) (2014) 6-12.
- Lata S, Negi P S, Samant S S, Seth M K & Shrama S, Documentation of traditional alcoholic beverages and their indigenous utilization pattern by Kinnaura tribes of Himachal

- Pradesh, North Western Himalaya, *Indian J Tradit Know*, 20 (4) (2021) 1002-1013.
- 30 Rana D, Bhatt A, Lal B, Parkash O, Kumar A, *et al.*, Use of medicinal plants for treating different ailments by the indigenous people of Churah subdivision of district Chamba, Himachal Pradesh, India, *Environ Dev Sustain*, 23 (2) (2021) 1162-1241.
- 31 Raghuvanshi D, Dhalaria R, Sharma A, Kumar D, Kumar H, *et al.*, Ethnomedicinal plants traditionally used for the treatment of Jaundice (Icterus) in Himachal Pradesh in Western Himalaya - A review, *Plants*, 10 (2) (2021) 232.
- 32 Anonymous, *Index Kewensis Plantarum Phanerogamarum*, Vol. 1-2 (1883-1885) and 15 *Suppl.* (1886-1970), (Clarendon Press, Oxford).
- 33 Samant S S & Dhar U, Diversity, endemism and economic potential of wild edible plants of Indian Himalaya, *Int J Sustain Dev World Ecol*, 4 (3) (1997) 179-191.
- 34 Samant S S, Dhar U & Palni M S, *Himalayan Medicinal Plants: Potential and Prospects*, (Gyanodaya Prakashan, Dehradun), 2001.
- 35 Rana M S & Samant S S, Threat categorization and conservation prioritization of floristic diversity in the Indian Himalayan region: A state of art approach from Manali Wildlife Sanctuary, *J Nat Conserv*, 18 (3) (2010) 159-168.
- 36 Radotra S, Dev I, Ahmad S & Kannan A, Pasture and Forages in North Western Himalayan Region: Current Status and Future Strategies, In: *Current status and future prospects of animal production system in North western Himalayan Region*, IVRI Palampur (HP), (2015) 49-57.
- 37 Yadav R P, Bisht J K, Mondal T & Pattanayak A, Forage production in peach based hortipastoral system in Indian Himalaya, In: *XXIII International Grassland Congress IGC 2015*, New Delhi, India (Range Management Society of India, Jhansi), (2015) 1375.
- 38 Peri P L, Dube F & Varella A C, Silvopastoral systems in the subtropical and temperate zones of South America: An overview, *Silvopastoral Systems in Southern South America*, (2016), 1-8.
- 39 Pandey D N, Multifunctional agroforestry systems in India, *Curr Sci*, 92 (4) (2007) 445-663.
- 40 Albrecht A & Kandji S T, Carbon sequestration in tropical agroforestry systems, *Agric Ecosyst Environ*, 99 (1-3) (2003) 15-27.
- 41 Chisanga K, Bhardwaj D R, Pala N A & Thakur C L, Biomass production and carbon stock inventory of high-altitude dry temperate land use systems in North Western Himalaya, *Ecol Process*, 7 (1) (2018) 22.