

Traditional knowledge on ethnobotanical uses of plant biodiversity: a detailed study from the Indian western Himalaya

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Abstract: The present article is based on the findings of ethnobotanical surveys conducted in the entire Lahaul-Spiti region of Indian western Himalaya to highlight the traditional use of medicinal plants by the native people. Results revealed that tribal communities of both Lahaul and Spiti valleys (Lahaulas in Lahaul and Bhotias in Spiti) have a great respect for and faith in Amchi system of medicine practiced in the entire region. Information collected on the traditional use of plants in the local health care system by the tribal communities of Lahaul-Spiti revealed the use of 86 plant species belonging to 69 genera and 34 families to cure about 70 different ailments. Maximum number of plant species used in herbal formulations belonged to families Asteraceae, Apiaceae, Gentianaceae, and Polygonaceae. Both single herbal preparations and polyherbal formulations are prescribed and administered by local healers known as Larje in Lahaul and Amchis in Spiti. Most of the medicines are prescribed in a powder form, some as juice and decoctions. Among plant parts, leaves were recorded to be used to a large extent as a remedy, followed by flowers. Results of the present study show that the highest number of plants was used to cure stomach disorders, while the highest extent of phytotherapeutic use among all the species had *Hippophae rhamnoides* (17.14%). The obtained data also revealed the information on new or less known medicinal uses of various plant species that are new addition to the traditional knowledge from western Himalaya. Modes of preparation, administration and dosage are discussed along with the family and local names of plants and plant parts used.

Key words: medicinal plants, ethnobotany, Indian Himalaya, Lahaul-Spiti

1. Introduction

The art of herbal healing has very deep roots in tribal culture and folklore. Even today, most of the tribal communities are dependent upon local traditional healing systems for their primary health care. Lahaul-Spiti is one of the exceptional locations in the Indian western Himalaya which offers immense scope for ethnobotanical studies. Because of the unique geographical location, Lahaul-Spiti harbours distinct ethnic and biological diversity. This is one of the regions in Indian Himalaya, where traditional healing system is still popular among the local people (Singh 2008).

Lahaul-Spiti is inhabited by two major ethnic groups, namely, Lahaulas in Lahaul and Bodhs (Bhotias) in Spiti. Besides distinctions in socio-economic and cultural conditions, peoples of both communities have

firm belief in indigenous medicines. In Spiti, the local practitioners who prescribe medicines are called Amchis, whereas in Lahaul, they are regarded as Larje. The traditional system of medicine followed by these healers is known as Amchi System of Medicine. The Amchi System of Medicine is one amongst the indigenous systems of medicine which are still practiced throughout Indian trans-Himalaya.

Due to the on-going developmental activities, the traditional wisdom, developed over centuries, is vanishing rapidly. Modernization has also affected living standards of the inhabitants of Lahaul-Spiti (Singh & Brijlal 2008). Changing lifestyle has also jeopardized the ages-old practice of herbal use. Therefore, documentation of valuable information known to the native people has become imperative to discover potential sources of new herbal medicines. On the other hand,

it also aims to preserve ages-old traditional knowledge which is mostly transferred by the word of mouth from one generation to another without any permanent record. Therefore, the present study was designed to provide comprehensive and novel information on traditional phytotherapy curing various ailments prevailing in Lahaul-Spiti region of Indian western Himalaya.

2. Materials and methods

2.1. Study area and topography

Study is confined to district Lahaul-Spiti of Himachal Pradesh in western Himalaya. Lahaul-Spiti, situated between $31^{\circ}44'57''$ - $32^{\circ}59'57''$ N latitudes and $76^{\circ}46'29''$ - $78^{\circ}41'34''$ E longitudes, is an ideal landscape, encompassing most of the diverse ecosystems widely spread between temperate to cold desert zones. The district headquarter is located at Keylong (3350 m). Among the 12 districts in the state, it is the largest district with a total area of 13,835 sq km and accounts for 24.85 percent of the total geographical area of Himachal Pradesh. Lahaul-Spiti comprises two different mountainous tracts (sub-divisions). The first one is known as Lahaul and the other as Spiti (Fig. 1). These two sub-divisions are totally distinct from each other in several aspects. Lahaul sub-division, the western part of the district, is physically more accessible, whereas Spiti, the eastern part of the district, is difficult to access. The Kunjum Pass (4591 m) keeps these two sub-divisions

isolated from each other for more than six months in a year due to heavy snowfalls.

Lahaul-Spiti is thinly populated. It is inhabited by 31,294 persons with a population density of 2 persons per sq km, representing 0.6 percent of the total population of the State. The Lahaul valley is physically a closed unit surrounded by the main Himalayan ranges on the North, the mid-Himalayan range or Pir Panjal on the South, the Kunjum range which separates Lahaul from Spiti on the East, and the off-shoot of the Pir Panjal range on the West. The Rohtang Pass (3981 m), the gateway to Lahaul-Spiti region, connects Lahaul to Kullu district of the State. Higher mountain ranges and narrow river valleys are the most important features of Lahaul. The lowest elevation point (2400 m) in the valley is at the exit of the Chenab River in Chamba. Waters of the Great Himalayan ranges enclosed within the Lahaul is drained by two rivers, namely the Chandra and the Bhaga, which originate in the mountain ranges of Baralacha Pass situated at the northern extremities of the valley.

The Spiti valley with its headquarter at Kaza (3450 m), is situated beyond the Kunjum Pass and lies in adjoining part of the central Himalaya behind the rain shadow of the Great Himalayan ranges. It is bounded by Tibet in the North-East, Kinnaur and Kullu districts in South-East and West, and Ladakh (Jammu and Kashmir) in the North, with average elevation of 4000 m. Minimum altitude of Spiti valley is 3050 m at the entrance (Sumdo) to the valley from the South-East border with Kinnaur. The only other point of entry is from the



Fig. 1. Map of the study area (Lahaul-Spiti) showing major localities

North-West at Kunjum Pass. The predominant feature of Spiti cold desert is the broad and completely rugged valley with perennial flowing water of the Spiti River. A natural glacial lake (4575 m) at Mane, Spiti River, and Pin River originating from Bhava Pass (4700 m) are the main sources of water. The Spiti valley is famous for lakes and monasteries. Gete (4270 m) and Kibber (4205 m) are amongst the villages in this region linked with a road, which are located at the highest elevations in the world (Census of India 2003).

2.2. Native people

The inhabitants of Lahaul-Spiti are overwhelmingly Buddhists and the dialect spoken by the inhabitants is known as Bhoti, which is near to Tibetan language. Before the start of the modern communication system, the main occupation of the people was agriculture and animal husbandry. Male folks mainly used to spend their time playing with their mules, apart from helping the ladies in agricultural operations. Kuth (*Saussurea costus*) was cultivated largely and was the main source of trade in Lahaul valley. Due to gradual socio-cultural changes and modern facilities, people are now engaged in government jobs, road construction and other activities. Besides cultivating traditional cultivars of mustard, buckwheat, barley and wheat, people are now concentrating on cash crops like seed potato, green peas and hops. However, introduction and production of high quality apple from Lahaul-Spiti indeed have revolutionized the economy of the tribal people.

2.3. Ethnobotanical surveys and documentation of traditional knowledge

In order to explore plants used as ethnomedicines by the tribal communities of Lahaul-Spiti, 3-4 field surveys every year, from 2002-2008 were conducted in the entire study area. Surveys were organized periodically during the flowering period of most of the higher plants. It helped the informants to identify the plants by their local names and quality specimens of the plants used traditionally by the people were available for the herbarium purpose.

Since there is a common belief among the indigenous people that if any secret regarding therapeutic value is revealed to anyone outside their own clan, the efficacy of plant will vanish, in order to win their confidence, close contacts were developed with local people particularly traditional healers and elders before gathering information on traditional medicinal uses of plants.

Information on traditional phytotherapy to cure various ailments was collected through oral discussions and documented on well-structured questionnaires following Jain (1987), Martin (1995) and Cotton (1996). Data were verified in different villages among the interviewers showing the same plant sample, and

even with the same informants on different occasions. The information regarding the traditional knowledge on the local uses of plants, their local names, part(s) used, ailments cured and mode of preparation and administration have been given in the results. Besides, plant family and scientific name with voucher specimen number of each plant used in traditional phytotherapy have also been provided. The extent of use of each plant species curing various diseases was computed as follows:

Extent of use (%) = (total number of ailments cured with the use of a plant / total number of ailments prevailing in the area) × 100

2.4. Collection and identification of plant specimens and preservation

From each sampling site, the voucher specimens of plant species observed in the quadrats were collected and identified with the help of local and regional floras (Polunin & Stainton 1984; Aswal & Mehrotra 1994). Herbarium of Botanical Survey of India (BSD), Dehradun was also consulted for the identification and authentication of the plant species. Specimens collected during the surveys were processed in the herbarium laboratory following Jain and Rao (1976). These were pressed, dried in blotting sheets and poisoning with formaldehyde or mercuric chloride solution (0.5%) was done to protect against insect and fungal attack before mounting on the herbarium sheets.

The plant specimens having unique voucher number were deposited in the herbarium of the Institute of Himalayan Bioresource Technology (PLP), Palampur, Himachal Pradesh and one set of these specimens was also deposited in the herbarium of BSI, Dehradun for future reference.

3. Results

3.1. Alphabetical arrangement of families showing number of species and genera of medicinal plants used in traditional phytotherapy in Lahaul-Spiti

A p i a c e a e

Angelica glauca Edgew. (PLP 6443), Churra – about 3 gram powder of dried roots is taken orally with warm water to cure gastric troubles. Crushed root parts are mixed with ghee (clarified butter) in 2:1 ratio, then warmed and applied externally on swollen parts of the body especially leg joints and feet to cure swelling and pain.

Bupleurum falcatum L.L. (PLP 4275), Thonpu – whole plant is collected, dried under shade and powdered. The powder is taken orally with lukewarm water to cure stomach pain.

Carum carvi L. (PLP 4695), Mathui, Gronae – mature seeds are fried in ghee and crushed into powder.

Ghee is added to prepare paste and applied on swollen testis to reduce inflammation twice a day for one week. Seeds can be ground and roasted in ghee to be applied on skin for a week to cure a skin infection locally called 'yiring'. It is also used to cure toothache. Half spoon of powder, mixed with equal proportion of flower powder of *Thymus linearis*, is taken with water after meal to improve digestion. It also cures stomach pain and gastric troubles. Seeds of plant are also ground in equal proportion with floral parts of kuth (*Saussurea costus*) and mixed with ghee. These ingredients are concentrated at low temperature so that a thick paste can be prepared. This paste is applied externally for 2-3 days twice a day to cure ear ache.

Chaerophyllum villosum Wall. ex DC. (PLP 4278), Shigu zera – seeds and leaves are directly consumed as vegetable to cure cold and cough. It is also reported to cure stomach pain caused by cold.

Ferula jaeschkeana Vatke (PLP 4300), Thunak – powder prepared from dried parts is consumed daily with water to cure chest pain.

Heracleum lanatum Michx. (PLP 6436), Roa, Swarsh, Tukhar – leaf powder is taken with water to cure gastric trouble. About 500 grams of roots are crushed and boiled in 1 liter of cow urine to prepare a decoction. The decoction obtained is applied externally to cure joint pains.

Pleurospermum stylosum Benth. ex Cl. (PLP 4310), Yumo-dijen – all parts, including roots, are dried under shade and powdered. Small tablets (about 2-5 grams) prepared from the powder are given to pregnant women to reduce pain during childbirth.

Asteraceae

Artemisia biennis Willd. (PLP 6418), Phurmong nakpo, Ciski – leaves are boiled in water to prepare decoction. About ¼ glass of this decoction is taken orally to cure gastric trouble and stomach pain. Powder prepared from leaves and flowers is roasted at low temperature in earthen pot and is further mixed with black pepper locally known as 'temar' in the ratio of 2:1. Half spoon of this mixture is taken orally with one glass of water with empty stomach to kill the worms. Smoke of above ground parts is used as insect repellent.

Artemisia maritima L. (PLP 1560), Shoma, Atong – juice of fresh roots is applied externally on skin to cure boils due to burning. Also, can be taken orally to cure stomach pain. Seeds are ground to prepare powder. About ½ spoon of powder is taken twice daily to cure joint pains.

Artemisia scoparia Waldst. & Kit (PLP 4334), Phur-Mang – dried leaves and seeds are crushed and boiled in water at low temperature until it becomes a paste. The concentrate thus obtained is mixed with mustard oil and is applied to cure ear and toothache.

Cousinia thomsonii C.B. Clarke (PLP 4208), Tulse – about 2-2.5 grams of root powder is taken regularly to cure swellings and joint pains. Powder of leaves is stored in paper in the shape of cigarette. It is then burned and is touched with the body parts for 2-3 times for 5-6 days to cure body pains.

Crepis flexuosa (DC.) Benth. (PLP 1534), Homa Sili – fresh juice of a plant, mixed with equal amount of water, is taken regularly once a day to cure jaundice, until cured.

Erigeron multiradiatus Benth. (PLP 4247), Luk-Mik – juice of fresh leaves is taken with equal quantity of water to get relief from burning sensation in the stomach.

Erigeron borealis (Vierch.) Simmons (PLP 4342), Mathok-Lugmik – leaves are dried under shade and ground to prepare powder. Powder along with other ingredient is taken as an antidote to cure food poisoning.

Hieracium crocatum Fries (PLP 4269), Khala – leaves are ground to prepare powder. Half spoon is taken with one glass of cold water to cure gastric troubles.

Inula racemosa Hook.f. (PLP 6457), Manuruta, Manu, Manukuth – dry roots are crushed and boiled either in mustard or in apricot oil at a very low temperature so that all the content (alkaloids) from the roots get dissolved in oil. It can be noticed, when colour of oil starts changing and gives an appearance of brownish red. This decoction is again concentrated at low temperature. It is applied on head once a day for 2-3 months to check hair fall. Paste prepared from the powder when mixed with desi ghee is also applied on skin, twice a day for 7 days to cure boils/ blisters and skin eruptions. One spoon of decoction prepared from roots is given to cure boils every day, until cured.

Lactuca dolichophylla Kitam. (PLP 6492), Tharnu – roots are dipped in cow urine for purification before drying in shade. Powder is prepared, which is mixed with the powder of ripened fruits of Jamalghotta (*Jatropha*). One gram of powder is taken with water for only one day to cure constipation.

Lactuca macrorhiza Hook.f. (PLP 4292), Gonpu – powder of whole plant is used as an ingredient to cure stomach ache.

Lactuca rapunculoides (DC.) Clarke (PLP 4315), Gonpu – juice of young leaves mixed with equal quantity of water is taken to cure severe stomach pain and cramps for immediate relief.

Saussurea costus (Falc.) Lipschitz (PLP 6458), Kuth, Shahruta – about 100 grams of roots are ground to prepare the paste with water. This paste is applied on skin to cure boils and blisters. It is also applied to cure leprosy locally called as 'kod/ jai' for 7-8 days. Floral parts of kuth and seeds of *Carum carvi* are ground in equal proportion and mixed with desi ghee (butter). These ingredients are warmed to concentrate at low

temperature so that a thick paste can be prepared. This paste is applied on external parts of the ears twice a day for 2-3 days to cure ear ache. Oil extracted from the dried roots is applied on joints to cure pain. It is also very effective to cure paralysis. Furthermore, it is applied on forehead and chest to cure cold and cough.

Saussurea glanduligera Sch.-Bip. ex Hook.f. (PLP 4309), Pang-Poy – fresh juice of leaves and flowers along with other ingredients is taken as an antidote against food poisoning. The dried powder is also consumed as cooling agent.

Scorzonera divaricata Turcz. (PLP 4203), Thunpu – decoction of leaves and shoots prepared at low temperature is prescribed orally to cure jaundice and dysentery.

Tanacetum falconeri Hook.f. (PLP 4284), Khanpa – whole plant is dried under shade and powdered. It is taken along with other ingredients to cure joint pains. It is also prescribed for blood purification.

Taraxacum officinale Wigg. (PLP 4013), Sarchen-Metok, Sirsim, Koadi – powder of aerial parts is taken with milk or water to cure joint pains and kidney problems. About 100 grams of flowers/inflorescences is boiled in one liter of water for two hours. It forms a decoction of yellow colour. It is mixed with water in equal proportion to make one glass volume and is taken regularly for two days to cure mouth ulcers. It also cures boils and blisters. Roots are crushed to prepare paste by mixing with milk of either cow or sheep. It is applied on burnt parts of human body due to hot water for immediate healing and to reduce pain. About one gram of powder prepared from leaves and flowers is taken with half glass of water to cure diabetes and liver trouble locally called 'peet'.

Tragopogon pratense L. (PLP 6495), Thunbu – one gram of root powder is taken orally with water once a day to cure constipation.

Berberidaceae

Berberis pseudumbellata Parker (PLP 6449), Kimli – roots are cut into small pieces. About one quintal (100 kg) of this material is boiled in a big pot with 15 l of water for one day. It is concentrated and then filtered. Half of one drop of this decoction is applied to eyes to reduce eye irritation and pain. It is also applied on forehead and chest to cure cold, cough and fever.

Betulaceae

Betula utilis D. Don (PLP 6455), Bhujpatra – stem bark of the tree is dried and burned. Smoke is inhaled through nose for 1 minute for 2 days to cure cold and cough. It helps to stop bleeding from nose.

Boraginaceae

Arnebia euchroma (Royle) T.M. Johnston (PLP 4205), Khamed, Dimok – fresh roots are crushed and

ground to prepare powder. It is then filtered by using muslin cloth and stored. Powder is prescribed to cure cough and dryness in the throat. It is also given by 'Amchis' for blood purification.

Lindelofia longiflora (Royle ex Benth.) Bail. (PLP 4256), Showarag, Showara – leaves are burned to prepare ash which is applied on cuts and wounds to control bleeding and for quick healing. Dry leaves are crushed and then boiled in water. One glass of decoction is taken once for two days to cure food poisoning and control vomiting.

Brassicaceae

Aphragmus oxycarpus (Hook.f. & Th.) Jafri (PLP 1520), Chhuruk – powder of dried above ground parts of a plant is used along with other ingredients to regulate urine flow.

Lepidium latifolium L. (PLP 4226), Chulti – powder of dried leaves and flowers is taken daily with water to cure joint pains.

Capparidaceae

Capparis spinosa L. (PLP 4330), Martokpa, Rutoka – green shoots are cut and dried in shade and powdered. The powder is taken orally twice a day to cure liver pain (preliminary stage of jaundice). It also cures irregular urination. About 4-5 ripened fruits are consumed daily as aphrodisiac and cures impotency.

Chenopodiaceae

Chenopodium botrys L. (PLP 4301), Sha – vegetable prepared from tender shoots and leaves is found effective to cure severe headache.

Crassulaceae

Sedum tibeticum Hook.f. & Th. (PLP 4262), Sholo – juice of fresh above ground plant parts is used as an ingredient in the medicine which cures trouble (pain) in heart and lungs.

Cupressaceae

Juniperus communis L. (PLP 6451), Bethda – the heartwood is cut into small pieces and stored in earthen pot. It is warmed at high temperature, which results in oozing of oil from wood chips. The oil obtained is applied externally on male genital organs to cure impotency. Regular massage with this oil cures skin itching, infection and boils.

Elaeagnaceae

Hippophae rhamnoides L. (PLP 4268), Cherma, Shuaag, Tarbu – the juice extracted from fruit pulp is mixed with double proportion of water and taken for a week to cure impotency. The juice extracted from 5 kg of fruit pulp is boiled at low temperature with half liter of water till it gets solidified. Tablets are made and 2 tablets are

given to women with milk to cure excessive bleeding and pain during menstruation cycle. It helps in blood purification and improves lungs. It also cures jaundice, cold, cough and kidney disorders. Dried berries are used to prepare herbal tea, which is quite effective to cure tuberculosis. Fresh vegetative twigs are used as local toothbrushes to control bleeding and infection in gums.

Hippophae tibetana Schlecht. (PLP 4348), Chha-Tuan – dried berries are crushed and boiled in water and the decoction obtained is taken as tea to cure cough, congestion, jaundice and also for blood purification. The dried fruit powder is mixed with the root powder of *Valeriana jatamansi* in 1:2 ratio. A small quantity of powder is taken daily with cold water to regulate menstruation cycle. Dried fruits are crushed and boiled in water to prepare a decoction. Berries are also taken directly to manage excess weight problems. Seeds are powdered and mixed with cardamon and kakarsinghi (*Pistacia integrima*) in equal proportion and with half quantity of multhi (*Glacyrihiza glabra*). One spoon of this powder is taken with one glass of warm water with empty stomach twice a day for 2-3 days to cure cold and cough.

Ephederaceae

Ephedra gerardiana Wall. ex Stapf. (PLP 4232), Tse – whole plant is ground and boiled in water. 2-3 drops of decoction are applied to eyes for 7-8 days to improve eye sight. Extract of young and fresh shoots is used to cure joint pains.

Ephedra regeliana Florin. (PLP 4333), Thak-Tse – Juice extracted from fresh leaves and berries is used to cure joint pains. Also consumed as a tonic for general weakness.

Fabaceae

Astragalus thomsonianus Benth. (PLP 4210), Satkar – powder of dried plant parts is used for treating gastric troubles due to cold. It also cures swelling and joint pains.

Medicago falcata L. (PLP 6450), Kathoama – above ground plant parts are ground to prepare paste with water which is applied on wounds and injuries for healing purpose.

Oxytropis lapponica (Wahl.) Gay. (PLP 1840), Chhushin Darm – entire plant is boiled in water and the decoction prepared is applied externally to treat joint pain.

Thermopsis inflata Camb. (PLP 4213), Tapa – seed powder is consumed to cure joint pains. Also taken orally with milk or water as a general tonic to improve health.

Trigonella emodi Benth. (PLP 4298), Rebuksu – flowers and leaves are dried and ground to prepare powder. One spoon of powder is taken twice a day for one week to cure jaundice.

Fumariaceae

Corydalis moorcroftiana Wall. ex Hook.f. & Th. (PLP 4263), Tongre-sewa – fresh leaves and flowers are collected, dried in shade and ground. Powder is consumed with water to cure pain and swelling in the bones.

Gentianaceae

Gentiana moorcroftiana Wall. ex G. Don (PLP 4218), Santik – fresh plant parts are crushed and the juice obtained is taken in empty stomach to cure jaundice and for blood purification.

Gentiana tubiflora (G. Don) Griseb. (PLP 1514), Chatik – juice of the whole plant is mixed with equal quantity of water and about ½ glass is taken orally during morning hours with empty stomach to cure jaundice.

Gentianopsis detonsa (Rottb.) Ma. (PLP 1844), Chatik – fresh leaves and flowers are crushed to extract the juice. The juice is taken orally to cure jaundice and also for purification of blood.

Gentianopsis paludosa (Hook.f.) Ma. (PLP 6489), Khilchenakpo, Khilche – flowers and leaves are air dried and are ground to prepare powder, which further is mixed with powder prepared from the flowers of *Jaeschkea oligosperma* and root powder of both *Aconitum heterophyllum* and *Picrorhiza kurroo* in the same proportion. About ½ spoon of this mixture is prescribed with water for a week to cure fever and liver troubles (pain).

Jaeschkea oligosperma (Griseb.) Knobl. (PLP 6481), Chaktik – powder of above ground plant parts is mixed with dry powder of *Picrorhiza kurroo* and *Aconitum heterophyllum* in the ratio of 2:1:1. About ½ spoon of this mixture is served to adults, whereas ¼ spoon is prescribed for children to cure headache and fever.

Swertia cordata (G. Don) Clarke (PLP 6439), Khilche – leaves and flowers are boiled in one liter of water and concentrated to retain half liter of total volume. Decoction is taken orally to cure gastric trouble. Powder of above ground parts (about 3-5 gram) is taken with warm water twice a day to cure fever. Half of this dose is recommended for children.

Geraniaceae

Geranium pratense L. (PLP 4285), Podh-Lo, Tapan – about one spoon of plant powder is taken orally with water to cure cough, cold, jaundice and stomach disorders (gastric trouble).

Geranium collinum M. Bieb (PLP 6480), Pour – fresh flowers are crushed; juice is extracted and directly applied on grey hair as hair tonic. It is also considered effective to reduce the headache.

Iridaceae

Iris ensata Thunb. (PLP 4336), Thema – about 10 grams of seed powder is consumed orally to kill worms in the stomach, which cause burning sensation.

Lamiaceae

Dracocephalum heterophyllum Benth. (PLP 4201), Shim-thingli – juice of fresh leaves and flowers is filtered and used in treating eye diseases like irritation, burning sensation and pain.

Hyssopus officinalis L. (PLP 4271), Tiyanku – powder of dried parts is taken directly with water to cure cough and cold. It is also used as an ingredient in the medicine to purify blood. Above ground parts are also boiled in water to prepare decoction and about 300 ml of such remedy is recommended daily for 2-3 days to cure fever. Flowers and leaves are crushed and applied on boils. It also cures skin eruptions.

Phlomis bracteosa Royle ex Benth. (PLP 6453), Ga-hand-Shang – above ground plant parts are air dried and ground to prepare powder, which is further mixed with powder of *Mentha longifolia*, *Heracleum thomsonii*, *Thymus linearis* and *Angelica glauca* in equal ratio. About ½-1 spoon is taken with a glass of warm water to cure stomach disorder particularly gastric trouble.

Thymus linearis Benth. (PLP 6441), Mashi – flowers and leaves are dried, ground and applied on teeth to kill the worms and infection in the tooth gums. Dried flowers mixed with the equal ratio of seeds of *Carum carvi* and powdered. Half spoon of the powder is taken with water after meal to improve digestion. It also cures stomach pain and gastric troubles.

Liliaceae

Allium carolinianum DC. (PLP 4207), Lahud – Paste of fresh parts is taken orally with water to cure stomach pain. Vegetable prepared from leaves and rhizome is consumed to cure stomach disorders.

Malvaceae

Malva verticillata L. (PLP 6478), Sukchil, Champa – Mature seeds are ground to prepare powder. It is mixed as an ingredient along with the powder of dried roots of *Aconitum heterophyllum* and *Withania somnifera* in equal proportion. About 3 grams of this mixture is taken with water during morning, with empty stomach, per day to cure swelling and pain in kidney due to cold.

Oleaceae

Fraxinus xanthoxyloides Wall. ex DC. (PLP 6416), Thum – about ½ kg of stem bark is boiled in one liter of water. This decoction is filtered and concentrated at low temperature so that about ½ liter of decoction should retain. Half glass of this decoction is recommended every day to cure internal wounds/injuries for a week.

Orchidaceae

Dactylorhiza hatagirea (D. Don) Soo (PLP 4217), Wangpo-lakpa, Thebrang – about 1 kg powder of rhizomes is boiled in 2 liter of milk at low temperature

until it gets concentrated. The concentrate obtained is mixed with refined butter and taken about 1-2 grams with one glass of milk in empty stomach to increase semen concentration and sperm count. Simple powder mixed with equal quantity of honey is taken once a day for 20-40 days to cure impotency. Vaginal discharge (leucorrhoea), in case of women, is cured if powder is taken for seven days. It is also given to the patients having pain in the kidney. Paste prepared by grinding the roots is applied on wounds twice a day for 2-3 days for healing purpose.

Pinaceae

Cedrus deodara (Roxb. ex D. Don) G. Don (PLP 6497), Devdar – regular massage of oil extracted from the heartwood chips is prescribed to cure skin itching and boils.

Plantaginaceae

Plantago major L. (PLP 6438), Caratta, Tharma – mustard oil is applied on leaves. These leaves are applied on a boil overnight to burst it out. They reduce both swelling and pain. The cleaned and roasted seeds are taken with water in constipation. About 5 grams of seeds for children and 10 grams for adults are recommended to consume with lukewarm water for 2-3 days to cure constipation. One spoonful of seed powder is also taken once a day with cold water to cure dysentery.

Podophyllaceae

Podophyllum hexandrum Royle (PLP 6444), Omo-Chhe – about 100 grams of roots are boiled in 1 liter of water to prepare decoction. It is further concentrated at low temperature. After filtration, half glass of the decoction is taken once a day for a week to cure constipation. It is also prescribed to asthma patients.

Polygonaceae

Polygonum polystachyum Wall. (PLP 6459), Khabin – above ground vegetative part is crushed and consumed during morning with empty stomach to cure mouth ulcer caused by excessive heat in the stomach. It acts as cooling agent.

Polygonum tortuosum D. Don (PLP 4215), Nayalo – powder obtained from aerial parts is consumed orally with water to cure jaundice and stomach pain.

Polygonum viviparum L. (PLP 6446), Yahee, Rat-mungli, Naram – seeds are roasted at low temperature and ground to prepare powder. About one spoon of this powder is taken with water to cure blood dysentery. About 100 grams of roots are boiled in 1 liter of water. When this decoction reduces to a half liter of the total volume, it is given to patients to reduce blood pressure. It also cures internal injuries and wounds and helps to reduce the pain.

Rheum emodi Wall. ex Meissn. (PLP 4313), Tukshu, Lichu, Artho, Chucha – juice of young leaves and roots is consumed with water to cure stomach pain due to internal injury. Roots are washed and boiled in water to prepare decoction, which is applied with ghee (butter) or with oil to cure boils, skin eruptions and wounds twice a day for 2-3 days.

Rumex nepalensis Spreng. (PLP 6487), Chuomsa, Shomang, Nabchalli – floral parts are ground to prepare powder. Half spoon of the powder is taken once a day to cure joint pains. It also cures body ache. Roots are ground to prepare powder. As per the requirement, powder is taken and paste is prepared by adding cow urine to apply on burned body parts to avoid infection and for immediate healing.

Rumex orientalis Bernh. ex Schult. (PLP 4293), Shomang – sap of fresh leaves is applied directly to cure burned skin due to hot water.

Ranunculaceae

Aconitum heterophyllum Wall. ex Royle (PLP 6460), Bhonga, Bhonkhur – roots are dried in shade and are ground to prepare powder. About 0.5 gram of this powder is recommended to consume orally with honey for children and 1 gram for adults to cure tuberculosis, cough, typhoid fever and gastric trouble. One spoon of leaf powder is taken orally with warm water, honey or milk to cure gastric trouble. Sugar is added because of its bitter taste.

Aconitum rotundifolium Kar. & Kir. (PLP 4264), Bonkar, Pongtha, Vashi – juice extracted by crushing whole plant is taken orally with equal volume of water to cure jaundice. About 4-5 grams of root powder is taken with one glass of water once a day to cure fever and joint pains. It is also prescribed for blood purification.

Aquilegia fragrans Benth. (PLP 4363), Lande, kumuk – flowers and leaves are ground to prepare paste. It is applied on boils to cure them. It is also applied in case of snake bite. Flower powder is mixed with ghee and is warmed gently. It is then used to massage the body to cure body pains once a day for 10-15 days.

Rosaceae

Potentilla multifida L. (PLP 4351), Pangcha – dried leaves, flowers and roots are used as ingredients to make herbal tea which is considered a healthy drink and is also prescribed due to its anti-aging potential.

Rosa webbiana Wall. ex Royle (PLP 4233), T-siya, Seva, Shanab, Susli – ripened fruits locally called as 'shuli' are ground to extract juice. Add small quantity of water to this juice to make one glass of volume. It is consumed daily to cure impotency and jaundice. It is also considered a good health drink.

Rubiaceae

Galium aparine L. (PLP 6494), Zangchi – above ground plant parts are dried in shade and ground to

prepare powder. This powder is applied on fresh wounds directly to stop bleeding and for quick healing.

Rubia tibetica Hook.f. (PLP 1893), Thak-Thokpa – ripened fruits are dried and powdered. The powder along with other ingredients is used for blood purification.

Saxifragaceae

Bergenia stracheyi (Hook.f. & Th.) Engl. (PLP 2728), Gatikpa – paste prepared from roots is applied to cure ulcers and blisters in mouth.

Scrophulariaceae

Pedicularis pectinata Wall. ex Benth. (PLP 6482), Langna Marfo – powder of flowers is mixed in the same proportion with floral powder of *Pedicularis tenuirostris* (Langna Karfo). 5- 10 grams of this powder mixed with water is taken with empty stomach twice a day to cure swelling and stomach pain due to intestinal infection.

Pedicularis punctata Decne. (PLP 4245), Lungru-serpo, Lugru Marfo – powder of dried leaves and flowers is used as an ingredient to control blood pressure. Fever is also cured by taking ½ spoon of this powder. This dose is also prescribed with empty stomach twice a day with water to improve digestion.

Pedicularis tenuirostris Benth. (PLP 6483), Langna Karfo – powder prepared from the flowers of this plant is mixed with the flower powder of *Pedicularis pectinata* in equal proportion. About 5-10 gram of this mixture is consumed twice a day with water to cure stomach pain due to intestinal swelling and infection.

Verbascum thapsus L. (PLP 6493), Pungchunpuru – powder of leaves and flowers is mixed with mustard oil to prepare a thick paste. It is applied on boils to dry them. It is also applied on burned parts of the body for early healing.

Solanaceae

Hyoscyamus niger L. (PLP 4344), Thuglang, Dandur, Tham-Damkarfo – seeds are ground and applied directly on tooth gums to cure infection and bleeding. It is also helpful to reduce tooth ache. Seed smoke is also inhaled to cure toothache because it is believed to be effective in killing germs, causing pain and swelling in gums.

Tamaricaceae

Myricaria germanica (L.) Desv. (PLP 1846), Humbu – juice extracted from fresh young shoots with tender leaves is used as one of ingredients in the medicines to cure joint pains.

Urticaceae

Urtica dioica L. (PLP 6434), Achuka – about 500 grams of crushed material of roots mixed with 1 liter of cow urine is boiled to prepare decoction, which is applied externally for 2-3 weeks to cure joint pain and swelling.

3.2. Statistical analyses

Information collected on the traditional utilization of plants in local health care system by the tribal communities of Lahaul-Spiti revealed the use of 86 plant species belonging to 69 genera and 34 families. These have been found to cure around 70 ailments prevailing in the area. Maximum of the species used in herbal preparations belonged to the Asteraceae families followed by Apiaceae, Gentianaceae, and Polygonaceae etc. (Table 1).

Information regarding the traditional knowledge on the medicinal uses of plants is provided in Table 2, where scientific names are given under their families arranged alphabetically along with voucher number, local names, mode of preparation, ailments cured and administration. Observations on single herbal preparations were also recorded, besides documentation of polyherbal formulations that are prescribed and administered by local healers. Most of these formulations were prescribed in powder form, whereas juice and decoction forms were

also in use. Generally, both fresh as well as dried plant material were used to prepare medicines but the fresh material was believed to be more effective. Among the plant parts used as a remedy, leaves were recorded to be used to a large extent followed by flowers.

Results revealed the maximum use of plants to cure stomach disorders mainly gastric trouble, stomach pain, food poisoning, indigestion, burning sensation, constipation and dysentery. To cure these problems, *Aconitum heterophyllum*, *Allium carolinianum*, *Angelica glauca*, *Artemisia biennis*, *A. maritima*, *Astragalus thomsonianus*, *Bupleurum falcatum*, *Carum carvi*, *Chaerophyllum villosum*, *Erigeron multiradiatus*, *E. borealis*, *Geranium pratense*, *Heracleum lanatum*, *Hieracium crocatum*, *Iris ensata*, *Lactuca dolichophylla*, *L. macrorrhiza*, *L. rapunculoides*, *Lindelofia longiflora*, *Pedicularis pectinata*, *P. punctata*, *P. tenuirostris*, *Phlomis bracteosa*, *Plantago major*, *Podophyllum hexandrum*, *Polygonum tortuosum*, *P. viviparum*, *Saussurea glanduligera*, *Scorzonera divaricata*, *Swertia cordata*, *Thymus linearis* and *Tragopogon pratense* were commonly used.

The highest extent of use was calculated for *Hippophae rhamnoides* (17.14%) curing tuberculosis, male impotency, excessive bleeding and pain during menstruation cycle in case of women, blood purification, lung disorder, jaundice, cold, cough, kidney problems, gum bleeding and infection. It was followed by *Saussurea costus* and *Taraxacum officinale* (11.42% each), where *S. costus* was used to cure boils, blisters, leprosy, ear ache, joints pains, paralysis, cold, cough. However, the use of *T. officinale* was recorded to cure joint pains, kidney problems, mouth ulcers, boils, blisters, burned body parts, diabetes and liver troubles. The lowest use extent value (1.42%) was recorded for *Allium carolinianum*, *Aphragmus oxycarpus*, *Bupleurum falcatum*, *Chenopodium botrys*, *Crepis flexuosa*, *Erigeron multiradiatus*, *Erigeron borealis*, *Ferula jaeschkeana*, *Galium aparine*, *Gentiana tubiflora*, *Hieracium crocatum*, *Iris ensata*, *Lactuca dolichophylla*, *Lactuca macrorrhiza*, *Lepidium latifolium*, *Myricaria germanica*, *Oxytropis lapponica*, *Phlomis bracteosa*, *Pleurospermum stylosum*, *Polygonum polystachyum*, *Rubia tibetica*, *Rumex orientalis*, *Saussurea glanduligera*, *Tragopogon pratense*, *Trigonella emodi* and *Urtica dioica* (Table 2).

Table 1. Number of genera and species in individual families

Name of family	Number of genera	Number of species
Apiaceae	7	7
Asteraceae	12	18
Berberidaceae	1	1
Betulaceae	1	1
Boraginaceae	2	2
Brassicaceae	2	2
Capparidaceae	1	1
Chenopodiaceae	1	1
Crassulaceae	1	1
Cupressaceae	1	1
Eleagnaceae	1	2
Ephedraceae	1	2
Fabaceae	5	5
Fumariaceae	1	1
Gentianaceae	4	6
Geraniaceae	1	2
Iridaceae	1	1
Lamiaceae	4	4
Liliaceae	1	1
Malvaceae	1	1
Oleaceae	1	1
Orchidaceae	1	1
Pinaceae	1	1
Plantaginaceae	1	1
Podophyllaceae	1	1
Polygonaceae	3	6
Ranunculaceae	2	3
Rosaceae	2	2
Rubiaceae	2	2
Saxifragaceae	1	1
Scrophulariaceae	2	4
Solanaceae	1	1
Tamariaceae	1	1
Urticaceae	1	1

4. Discussion

The information collected on traditional use of plants to cure various ailments revealed that native people of Lahaul-Spiti have a great respect for and faith in Amchi system of medicine practiced in the area for ages. Elderly family heads of Bhot community and Amchis (local practitioners) inherit a rich traditional knowledge and people still use the herbal medicines prescribed by local healers. Despite emergence of modern medical

Table 2. Extent of use of plant species in traditional phytotherapy

Name of species	Extent of use (%)	Curable ailments
<i>Aconitum heterophyllum</i>	5.71	Cough, gastric trouble, tuberculosis, typhoid
<i>Aconitum rotundifolium</i>	5.71	Jaundice, fever, joint pains, blood purifier
<i>Allium carolinianum</i>	1.42	Stomach pain
<i>Angelica glauca</i>	2.85	Swelling, gastric troubles
<i>Aphragmus oxycarpus</i>	1.42	Urinary disorders
<i>Aquilegia fragrans</i>	4.28	Snake bite, body pains, boils
<i>Arnebia euchroma</i>	4.28	Cough, throat dryness, blood purification
<i>Artemisia biennis</i>	4.28	Gastric trouble, stomach pain, kills worms
<i>Artemisia maritima</i>	5.71	Boils, burned parts, stomach pain, joints pains
<i>Artemisia scoparia</i>	2.85	Ear and tooth ache
<i>Astragalus thomsonianus</i>	4.28	Gastric troubles, swelling and joint pains
<i>Berberis pseudumbellata</i>	7.14	Eye irritation and pain, cold, cough, fever
<i>Bergenia stracheyi</i>	2.85	Ulcers, blisters in mouth
<i>Betula utilis</i>	4.28	Cold, cough, bleeding from nose
<i>Bupleurum falcatum</i>	1.42	Stomachache
<i>Capparis spinosa</i>	4.28	Urinary troubles, liver infection, impotency
<i>Carum carvi</i>	4.28	Skin infection, toothache, testis inflammation
<i>Cedrus deodara</i>	2.85	Skin itching, boils
<i>Chaerophyllum villosum</i>	4.28	Cold, cough, stomach pain
<i>Chenopodium botrys</i>	1.42	Headache
<i>Corydalis moorcroftiana</i>	5.71	Bone pain, swelling
<i>Cousinia thomsonii</i>	4.28	Swellings, joint pains, body pains
<i>Crepis flexuosa</i>	1.42	Jaundice
<i>Dactylorhiza hatagirea</i>	7.14	Low semen concentration, impotency, leucorrhoea, kidney pain, wounds
<i>Dracocephalum heterophyllum</i>	4.28	Eye irritation, burning sensation and pain
<i>Ephedra gerardiana</i>	2.85	Eye sight, joint pains
<i>Ephedra regeliana</i>	2.85	Joint pains, health tonic (general weakness)
<i>Erigeron multiradiatus</i>	1.42	Burning sensation
<i>Erigeron borealis</i>	1.42	Food poisoning
<i>Ferula jaeschkeana</i>	1.42	Chest pain
<i>Fraxinus xanthoxyloides</i>	2.85	Internal wounds, injuries
<i>Galium aparine</i>	1.42	Wounds
<i>Gentiana moorcroftiana</i>	2.85	Jaundice, blood purification
<i>Gentiana tubiflora</i>	1.42	Jaundice
<i>Gentianopsis detonsa</i>	2.85	Jaundice, blood purification
<i>Gentianopsis paludosa</i>	2.85	Fever, liver troubles
<i>Geranium collinum</i>	2.85	Hair tonic (grey hairs), headache
<i>Geranium pratense</i>	5.71	Cough, cold, jaundice, stomach disorders
<i>Heracleum lanatum</i>	2.85	Joint pains, gastric trouble
<i>Hieracium crocatum</i>	1.42	Gastric troubles
<i>Hippophae rhamnoides</i>	17.14	Tuberculosis, impotency, excessive bleeding and pain during menstruation cycle, blood purification, lung disorder, jaundice, cold, cough, kidney problems, gum bleeding, gum infection
<i>Hippophae tibetana</i>	8.57	Chest congestion, jaundice, blood purifier, irregular menstruation periods in females, over body weight, cough
<i>Hyoscyamus niger</i>	5.71	Gum infection, bleeding, tooth ache, kill worms
<i>Hyssopus officinalis</i>	8.57	Cough, cold, blood purifier, fever, boils, skin eruptions
<i>Inula racemosa</i>	5.71	Hair fall (hair tonic), boils, blisters, skin eruptions
<i>Iris ensata</i>	1.42	Kill worms in the stomach
<i>Jaeschkea oligosperma</i>	2.85	Headache, fever
<i>Juniperus communis</i>	5.71	Impotency, skin itching, infection, boils
<i>Lactuca dolichophylla</i>	1.42	Constipation
<i>Lactuca macrorrhiza</i>	1.42	Stomachache
<i>Lactuca rapunculoides</i>	2.85	Stomach pain, cramps
<i>Lepidium latifolium</i>	1.42	Joint pains
<i>Lindelofia longiflora</i>	5.71	Cuts, wounds, food poisoning, vomiting
<i>Malva verticillata</i>	2.85	Swelling and pain in kidney
<i>Medicago falcata</i>	2.85	Wounds, injuries
<i>Myricaria germanica</i>	1.42	Joint pains
<i>Oxytropis lapponica</i>	1.42	Joint pains

<i>Pedicularis pectinata</i>	4.28	Intestinal infection, swelling, stomachache
<i>Pedicularis punctata</i>	4.28	Blood pressure, fever, digestion
<i>Pedicularis tenuirostris</i>	2.85	Intestinal swelling and pain
<i>Phlomis bracteosa</i>	1.42	Gastric trouble
<i>Plantago major</i>	4.28	Boils, constipation, dysentery
<i>Pleurospermum stylosum</i>	1.42	Child delivery pain
<i>Podophyllum hexandrum</i>	2.85	Asthma, constipation
<i>Polygonum polystachyum</i>	1.42	Mouth ulcer
<i>Polygonum tortuosum</i>	4.28	Stomach and intestinal troubles, jaundice
<i>Polygonum viviparum</i>	5.71	Blood dysentery, blood pressure, internal injuries, wounds
<i>Potentilla multifida</i>	2.85	Health drink, fatigue
<i>Rheum emodi</i>	4.28	Internal injury, skin eruptions, wounds
<i>Rosa webbiana</i>	4.28	Impotency, jaundice, general weakness
<i>Rubia tibetica</i>	1.42	Blood purifier
<i>Rumex nepalensis</i>	2.85	Joint pains, burned body parts
<i>Rumex orientalis</i>	1.42	Burned skin
<i>Saussurea costus</i>	11.42	Boils, blisters, leprosy, ear ache, joints pains, paralysis, cold, cough
<i>Saussurea glanduligera</i>	1.42	Food poisoning
<i>Scorzonera divaricata</i>	2.85	Jaundice and dysentery
<i>Sedum tibeticum</i>	2.85	Heart and lungs disorders
<i>Swertia cordata</i>	2.85	Gastric trouble, fever
<i>Tanacetum falconeri</i>	2.85	Joint pains, blood purifier
<i>Taraxacum officinale</i>	11.42	Joint pains, kidney problems, mouth ulcers, boils, blisters, burned body parts, diabetes, liver trouble
<i>Thermopsis inflata</i>	2.85	Joint pains, general tonic
<i>Thymus linearis</i>	7.14	Kill worms, gum infection, indigestion, stomach pain, gastric troubles
<i>Tragopogon pratense</i>	1.42	Constipation
<i>Trigonella emodi</i>	1.42	Jaundice
<i>Urtica dioica</i>	1.42	Joint pain
<i>Verbascum thapsus</i>	2.85	Boils, burned skin

facilities, the native people are still dependent to a large extent on locally available plant resources to cure different diseases.

The present study sheds some light on various herbal remedies using about 86 plant species (69 genera and 34 families) curing a total 70 ailments. The most common diseases recorded with maximum use of different plants to cure, were stomach disorders, skin problems, cold and cough, pains including rheumatism, liver problems, sexual disorders and fever. Among these diseases, stomach disorders, dysentery and diarrhoea (locally known as trigpa) are the major causes of death in Lahaul-Spiti (Jain 1996). The perusal of data on plants used for various ailments in Lahaul-Spiti reveals the use of maximum number of plants for digestive disorders (Sood *et al.* 2001).

It was observed that most plants were used as single herbal preparations. Most of the preparations were prescribed for oral consumption because most of the formulations were in powder, juice and decoction forms. Paste forms of plant parts and oil extracted from seeds and roots were also used to cure ailments like joint pains and swellings. Maximum use of leaves and flowers for medicinal purpose indicates either easy availability of

these plant parts or they may have strong medicinal properties. In the present discussion, relevant secondary information on traditional phytotherapy from western Himalaya was used for the authentication of the tradition knowledge recorded in the present investigation.

Against various stomach disorders, *Aconitum heterophyllum* was reported by maximum numbers of informants, to be used to cure gastric troubles. Root powder of this plant was also reported by several workers to cure diarrhoea, indigestion, dysentery, stomachache and vomiting (Sood *et al.* 2001; Sharma *et al.* 2004; Uniyal *et al.* 2006). The carminative properties of *Carum carvi* and *Thymus linearis* reported earlier from the Lahaul valley (Kapahi 1990) validate the information of the present study. Among species used against stomachache, *Allium carolinianum* was also reported to cure indigestion (Kala & Manjrekar 1999) in Spiti. Root decoction of *Podophyllum hexandrum* is consumed orally to cure constipation (Sood *et al.* 2001); however, in earlier reports, it was also suggested to cure blood diarrhoea (Kala & Manjrekar 1999; Kala 2000) and liver problems from other parts of western Himalaya (Sharma *et al.* 2004). Similar use of the roots of *Saussurea costus* was also reported against dysentery and stomachache from Spiti

area (Kala & Manjrekar 1999; Kala 2000) and *Trigonella emodi* for indigestion (Kala & Manjrekar 1999).

Among the skin diseases, boil disorder is common in Lahaul-Spiti region which may be due to high radiation and unfavourable climatic conditions in the area (Jain 1996). Of the total plants, *Cedrus deodara*, *Hyssopus officinalis*, *Inula racemosa*, *Juniperus communis*, *Rheum emodi*, *Saussurea costus* and *Taraxacum officinale* were found to be used to cure more than one skin disorder which indicates that these species are relatively more effective. Observations on the use of *Aconitum heterophyllum* against cough is in line with the observations of Jain (1991) from Lahaul. The traditional knowledge on the use of *Saussurea costus* against cough is also well documented from the trans-Himalaya (Chowdhery & Rao 2000). In case of swellings and joint pains, leaves of *Myricaria germanica*, reported earlier from the study area to cure swollen joints and pains (Kapahi 1990) and reports on *Oxytropis lapponica* as a remedy for swollen joints (Kala & Manjrekar 1999) have strengthened the observations recorded under present work. Furthermore, the use of *Aconitum rotundifolium* to cure rheumatism recorded from Garhwal Himalaya (Tewari *et al.* 1990) and the use of *Taraxacum officinale* and oil extracted from roots of *Saussurea costus* reported to cure joint pains (Kapahi 1990) also support information gathered under present investigation.

To cure liver disorders, another common ailment in Lahaul-Spiti, the therapeutic use of the juice of aerial parts of *Gentiana moorcroftiana* was found very effective and has also been described by Kala and Manjrekar (1999). The flower and leaf extract of this plant is also used for acidity (Singh & Chauhan 2005) causing liver trouble. Among the *Hippophae* species, the use of *H. rhamnoides* against liver disease has also been reported from other parts of Himalayan region (Brijljal *et al.* 2001; Zeb 2004). However, there is only a single report on the traditional use of *H. tibetana* for treating jaundice (Brijljal *et al.* 2001). Besides these, the use of *Taraxacum officinale* treating jaundice has also been reported (Kapahi 1990).

In comparison with the ailments described above, less information on plants was recorded curing sexual disorders because local people and many of the informants were found to be little hesitant to disclose sexual problems. Observations revealed maximum use of plants to cure male sexual dysfunctions. Among various species, the use of *Dactylorhiza hatagirea* to cure impotency, low sperm and semen concentration in males and leucorrhoea in females recorded from Lahaul-Spiti is in line with the observations of Brijljal *et al.* (2004) and Sharma *et al.* (2004) who reported its use in curing loss of sexual power, nerve debility and spermatorrhoea. Koelz (1979) reported the fruits of *Hippophae rhamnoides* effective as an aphrodisiac for males. However, fruit juice of *H. rhamnoides* is also

recommended to control excessive bleeding and pain during menstrual periods in case of females, besides curing male impotency in Lahaul-Spiti. In case of traditional knowledge to cure fever, relevant literature also reveals the similar use of *Aconitum heterophyllum* (Kapahi 1990) from Lahaul. Powder of whole plant of *Hyssopus officinalis* in case of fever has also been reported by Kala and Manjrekar (1998) from Spiti. However, the use of *Jaeschkea oligosperma* (Jain 1991; Sood *et al.* 2001) and *Swertia cordata* (Jain 1991) to cure fever is also available in published literature.

Traditional use of *Chenopodium botrys* and *Jaeschkea oligosperma* for headaches (Gupta *et al.* 1981), *Ferula jaeschkeana* for chest pain (Kala & Manjrekar 1999), *Aconitum rotundifolium* for blood purification (Kala & Manjrekar 1999), *Malva verticillata* (Jain 1991) and *Taraxacum officinale* for kidney disorders (Chowdhery & Rao 2000) and mouth ulcers and blisters (Uniyal & Chauhan 1973; Kala & Manjrekar 1999), the use of seeds of *Hyoscyamus niger* to cure tooth problems (Koelz 1979; Kala & Manjrekar 1999), *Thymus linearis* for gum infection and bleeding (Koelz 1979), *Bergenia stracheyi* (Kala & Manjrekar 1999) for mouth ulcers and blisters and *Dracocephalum heterophyllum* for eye disorders (Gupta *et al.* 1981; Chowdhery & Rao 2000) validates the information recorded during the present investigation. Among various plant species used in traditional phytotherapy, the highest use extent was recorded for *Hippophae rhamnoides* (17.14%) followed by *Saussurea costus* (11.42%) and *Taraxacum officinale* (11.42%) determined on the basis of curing maximum of ailments which also revealed their importance in the local health care system of tribal communities in Lahaul-Spiti.

Screening of literature relevant to plants and plant associated traditional knowledge of Lahaul-Spiti (Koelz 1979; Kapahi 1990; Aswal & Mehrotra 1994; Kala & Manjrekar 1999; Kala 2000; Sood *et al.* 2001; Brijljal *et al.* 2004; Singh & Chauhan 2005), adjoining areas, Jammu and Kashmir, Garhwal and Kumaon Himalayas (Koul 1941; Gupta *et al.* 1980, 1981; Srivastava *et al.* 1981; Shah 1982; Dar *et al.* 1984; Sand & Badola 1987; Tewari *et al.* 1990; Balodi & Singh 1997; Sharma *et al.* 2004; Zeb 2004; Sharma *et al.* 2005; Uniyal *et al.* 2006) and other relevant sources like Compendium of Indian medicinal plants (Rastogi & Mehrotra 1960-1984), Dictionary of Indian medicinal plants (Husain *et al.* 1992), Dictionary of Indian folk medicine and ethnobotany (Jain 1991), Glossary of Indian medicinal plants (Chopra *et al.* 1956), Indian materia medica (Nadkarni 1954), Reviews on Indian medicinal plants (Gupta & Tandon 2004) and Wealth of India (Anonymous 1948-1976) and plants screened from India by Gautam *et al.* (2007) revealed information on new or lesser known medicinal uses of various plant species from Lahaul-Spiti.

The medicinal use of *Artemisia biennis*, *Astragalus thomsonianus*, *Bupleurum falcatum*, *Erigeron borealis*, *Heracleum lanatum*, *Irisensata*, *Lactuca dolichophylla*, *L. rapunculoides*, *Pedicularis pectinata*, *P. punctata*, *P. tenuirostris*, *Phlomis bracteosa*, *Saussurea glanduligera*, *Scorzonera divaricata* and *Tragopogon pretense* are new additions to the ethnobotanical knowledge of curing different kinds of stomach disorders.

Medicinal uses of *Aquilegia fragrans* against boils, *Fraxinus xanthoxyloides*, *Galium aparine* and *Medicago falcata* for wounds and injuries, *Hyssopus officinalis* for boils, *Inula racemosa* for boils, skin eruptions and blisters, *Juniperus communis* for boils, skin infection and itching, and *Carum carvi* against skin infection and itching are recorded to be lesser known. Traditional uses of *Betula utilis*, *Chaerophyllum villosum*, *Geranium pretense*, *Hippophae rhamnoides* and *H. tibetana* for cold and cough, and *Aconitum rotundifolium*, *Gentianopsis paludosa* and *Pedicularis punctata* for fever are less known in the traditional knowledge of western Himalaya. Furthermore, therapeutic use of *Berberis pseudumbellata* for cold, cough and fever is also not documented elsewhere. In case of rheumatism, various herbal preparations from plants like *Angelica glauca*, *Artemisia maritima*, *Astragalus thomsonianus*, *Corydalis moorcroftiana*, *Ephedra regeliana*, *Heracleum lanatum* and *Tanacetum falconeri* seem to be new or less known from study area.

Similarly, *Aconitum rotundifolium*, *Capparis spinosa*, *Crepis flexuosa*, *Gentiana tubiflora*, *Gentianopsis detonsa*, *G. paludosa*, *Geranium pratense*, *Polygonum tortuosum*, *Scorzonera divaricata* and *Trigonella emodi* were reported for the first time for the treatment of liver disorders. Traditional formulations of *Aphragmus oxycarpus*, *Capparis spinosa*, *Hippophae tibetana*, *Juniperus communis*, *Pleurospermum stylosum* and *Rosa webbiana* to cure sexual ailments have not yet been reported and thus are new claims to the ethnobotanical knowledge. For various other ailments, the use of *Pedicularis punctata* to cure blood pressure, *Aconitum heterophyllum* for tuberculosis, *Saussurea costus* for paralysis, *Sedum tibeticum* for heart and lung disorders, *Aquilegia fragrans* to cure body pains, *Geranium collinum* for headache, *Hippophae tibetana* for blood purification, to control body weight and chest congestion, *Arnebia euchroma*, *Gentiana moorcroftiana*, *Gentianopsis detonsa*, *Hyssopus officinalis*, *Rubia tibetica* and *Tanacetum falconeri* for blood purifica-

tion, *Taraxacum officinale* for diabetes, *Dactylorhiza hatagirea* and *Hippophae rhamnoides* to cure pain due to kidney disorder, gum infection and bleeding and *Artemisia scoparia* and *Carum carvi* for ear and toothache are also not documented elsewhere. Besides, the use of *Saussurea costus* for ear ache, *Betula utilis* for nose bleeding *Polygonum polystachyum* for mouth ulcers, *Berberis pseudumbellata* for eye disorders like pain and irritation, *Ephedra gerardiana* for weak eye sight, *Podophyllum hexandrum* for asthma and *Aquilegia fragrans* against snake bite are also new to the ethnobotany of western Himalaya.

Information on *Ephedra regeliana*, *Potentilla multifida*, *Rosa webbiana* and *Thermopsis inflata* to prepare health drinks, and use of *Geranium collinum* and *Inula racemosa* as hair tonic has also been found an addition to the traditional knowledge of western Himalaya.

Therapeutic applications of the plants discussed in this article to cure various ailments in Lahaul-Spiti region, open new vistas for the researchers to carryout in-depth phytochemical and pharmacological investigations. Different lesser known or new medicinal claims which are found hitherto unknown for their ethnobotanical usefulness and medicinal properties need immediate attention for carrying out chemical and ethnopharmacological studies. Such investigations may lead to the discovery of novel bioactive molecules and may provide leads in searching of new prospective drugs. It is greatly needed to assess these plants for phytochemical analyses and ethnopharmacological screenings so as to validate the efficacy of indigenous herbal medicines.

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