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Medicinal plants used by shepherds in Trans-Himalayan Rakchham-Chitkul Wildlife Sanctuary in Baspa Valley of Kinnaur district, Himachal Pradesh, India

[Plantas medicinales utilizadas por los pastores en el Santuario de Vida Silvestre Rakchham-Chitkul Trans-Himalayan en el distrito de Baspa Valley of Kinnaur, Himachal Pradesh, India]

Radha¹, Adolfo Andrade-Cetto², Sunil Puri¹ & Ashok Pundir³

¹School of Biological and Environmental Sciences, Shoolini University of Biotechnology and Management Sciences, Solan, India

²Laboratorio de Etnofarmacología, Facultad de Ciencias, Universidad Nacional Autónoma de México, Ciudad de México, México

³School of Mechanical & Civil Engineering, Shoolini University of Biotechnology and Management Sciences, Solan, India

Reviewed by:
Alfred Maroyi
University of Fort Hare
South Africa

Jeremías Puentes
Universidad Nacional de La Plata
Argentina

Correspondence:
Adolfo ANDRADE-CETTO
aac@ciencias.unam.mx

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Abstract: The present study deals with the ethnomedicines used by migratory shepherds in an Indian Trans-Himalayan area. Shepherding depends on traditional healthcare practices. A non-probabilistic sampling technic was used for the selection of the research participants; the information was collected through 8 extensive field visits. The data was analyzed by the interpretation of the interviews since a qualitative as well as quantitative perspectives. A comparison with previous studies in the area was done based on literature research. The results of this study show that shepherds in tribal areas are highly dependent on medicinal plants, they report the use of 58 taxa to handle their main health problems. They prefer 20 taxa, to treat; coughs, asthma, colds, throat complaints, general pain, fever, dysentery, diarrhea and urinary infections, which are the main reported illnesses. Mainly they use the fresh plant juices of these taxa. Two health issues are remarkable high blood pressure and jaundice.

Keywords: Ethnobotany; Himachal Pradesh; Traditional Medicine; Ethnobiology; Medicinal plants

Resumen: El presente estudio trata sobre las etnomedicinas utilizadas por los pastores migratorios en una zona india transhimalaya. El pastoreo depende de las prácticas sanitarias tradicionales. Se utilizó una técnica de muestreo no probabilístico para la selección de los participantes de la investigación; la información se recopiló a través de 8 extensas visitas de campo. Los datos fueron analizados mediante la interpretación de las entrevistas desde una perspectiva tanto cualitativa como cuantitativa. Se realizó una comparación con estudios previos en el área basada en la investigación de la literatura. Los resultados de este estudio muestran que los pastores en áreas tribales son altamente dependientes de las plantas medicinales, informan el uso de 58 taxones para manejar sus principales problemas de salud. Prefieren 20 taxones para tratar; tos, asma, resfriados, molestias de garganta, dolor general, fiebre, disentería, diarrea e infecciones urinarias, que son las principales enfermedades reportadas. Principalmente utilizan los jugos de plantas frescas de estos taxones. Dos problemas de salud son la hipertensión arterial y la ictericia.

Palabras clave: Etnobotánica; Himachal Pradesh; Medicina tradicional; Etnobiología; Plantas medicinales.

INTRODUCTION

Indian Himalayan region has more than 18,000 varieties of plants, known as one of the biodiversity hotspots in the World (Wildlife Institute of India, 2014). The whole Himalaya is a sign of one of the newest mountain ecosystems on the Earth with a varied range of environmental conditions, this gigantic system of mountain ranges supports different fauna and flora (Singh *et al.*, 2009). A north Indian state, Himachal Pradesh (HP) is to be found in western part of the Himalayan range, the state has enormous geographical spread 55,673 km² with astonishing altitudinal variations 350 to 7,000 masl. Conservation of biodiversity is one of the most imperative concerns, and the state ranks third in the country in terms of the percentage of the whole region under protected area coverage (Negi *et al.*, 1999). The plant medications of original societies handed down by word of mouth from one generation to the next generation gradually became part of the knowledge of communities. In India, tribal communities depend mainly on native herbal resources for healing different illnesses (Chauhan, 2000; Khanna & Ramesh, 2000; Thakur *et al.*, 2014).

In HP, alpine pastures cover around 10,052 sq km i.e. 17% of the whole geographical region of the state. The alpine areas chiefly fall in the great Himalayan ranges, these are about 2400 km in length and differ from 240 to 400 km in width. These areas are characterized by comparatively low atmospheric pressure, intense insulation, low temperature, rapid and high ultraviolet radiation along with other connected special effects as chain reactions. The pastures occupy about 1.52% of the complete land area, these pastures are supposed to be the only true grasslands where the grazing density is high. Western Himalayan pastures are significantly affected by heavy grazing pressure. In the Himalayan grasslands current level of grass production is less than 25% (Verma & Kapoor, 2014).

The state is home to a sizeable tribal population like the Gaddis, Pangwals, Lahulis, Kinnauras, Bhots and Gujjars (mainly they are shepherds). Himachal Pradesh has led to tribal ways of life, adherence to myths and traditions representing an enormous and difficult terrain of scattered human settlements and sensitive ecosystems (Chowhery, 1999). Shepherds move their livestock all over the year in search of green fodder and pastures. They travel from low hills or plains to high hills and vice versa, shepherds leaving for low hills and plains with the commencement of the summer and returning to

their villages in winter. With the onset of summer each year, in the early morning, the shepherds migrate along with their livestock to upper reaches of Himalayas through different tribal migration routes (which are centuries' old), there are many sub-routes also (Suri, 2014), there is no seasonal movement as the winter's sets in. The movement of shepherds is to make maximum use of nature's bounty in the form of good grazing for their flocks. Tough environmental conditions and non-availability of fodder cause seasonal migration of shepherds. The shepherds move in a group of their own family members. The shepherds also take along with them few horses (hardy local breeds) for carrying provisions and tents (Radha *et al.*, 2018). Often few dogs also accompany the shepherds, these dogs are trained to keep the flock together. The tribal shepherds having large number of flocks are relatively well-off compared to those with fewer number. Several surveys have reported that flock size is straight connected with migration space, flock with higher size travel longer space as compared to small size flocked (Balamurugan *et al.*, 2012). The livelihood of shepherd's is dependent either getting food and fruits from the forests on the path. The wild vegetation not only use as their medicine but also for their livestock. It was observed that during their seasonal migration the nomadic shepherds are highly in need of forest products for their necessities of wild edible fruits, ethnoveterinary medicines, vegetables and medicines (Thakur & Puri, 2016).

Most of the rural peoples possess significant traditional knowledge of natural resources, which they have inherited from their forefathers. They closely depend on this knowledge for a variety of reasons related to the economy, healthcare, social order, food and shelter, etc. A few studies on ethnomedicinal plants in different districts of Himachal Pradesh were previously done by some researchers (Sharma & Lal, 2005; Singh *et al.*, 2008; Rawat & Kharwal, 2014; Dutt *et al.*, 2014; Kumar, 2014; Negi & Banyal, 2015; Singh & Batish, 2015). Medical facilities are available but are very costly, so medicinal plant species are collected by tribal communities from the surrounding areas, forests and alpine meadows are used as the main source of remedies for several diseases.

Due to the lifestyle, shepherds rely on medicinal plants to treat all kinds of illnesses in the migration period. Because the cold type of weather and unreachable surroundings there is no proper record available about ethnomedicines used by

migratory shepherds in Trans-Himalayan Rakchham-Chitkul Wildlife Sanctuary in Baspa (Sangla) Valley of Kinnaur District, therefore this study is an attempt to document the medicinal plants used by migratory shepherds which in turn could be helpful in devising strategies for better management, for this purpose we do a correlation with the use of plants as medicines. We also determine the relative importance of the identified species, to achieve this goal we use qualitative and quantitative tools; Informant consensus factor (ICf) and use reports (UR) (Andrade-Cetto, 2009; Andrade-Cetto & Heinrich, 2011).

We postulate the following research questions; A) Is there a consensus among the shepherds in this district if we study the illnesses by category? B) Do they prefer a plant or set of plants to treat their main illnesses? C) If we compare the plants of this work with previous studies in the region, can we find similar species used for the same purpose?

MATERIALS AND METHODS

Description of the studied area

The present study has been carried out in Rakchham Chitkul Wildlife Sanctuary situated in the Baspa (Sangla) valley with geo-coordinates of latitude 31° 14'22" N - 31° 28'37" N and longitudes 78° 17'31" E - 78° 31'30" E, cover a region of about 304 Km² in the northeast corner of Kinnaur District in Himachal Pradesh, India (Figure No. 1). The Baspa Valley is regarded as by mountains enclosed by snow (Deota *et al.*, 2011). The temperature ranges from -15°C to 18°C, and annual snowfall 1,130 mm. The altitude ranges from 2,800 to 5,486 masl. The environmental characteristics change very sharply in the mountains due to the steep gradient. The flora includes; Upper Western Himalayan Temperate Forest, Sub-Alpine Birch-Fir Forest and Lower Western Himalayan Temperate Forest. The sanctuary area is fed with numerous snow-fed perennial and seasonal streams (Dhanze & Dhanze, 2004; Mehta & Sharma, 2008). The Sanctuary situated at high altitude and remain cut-off from the rest of the world due to heavy snowfall during winters.

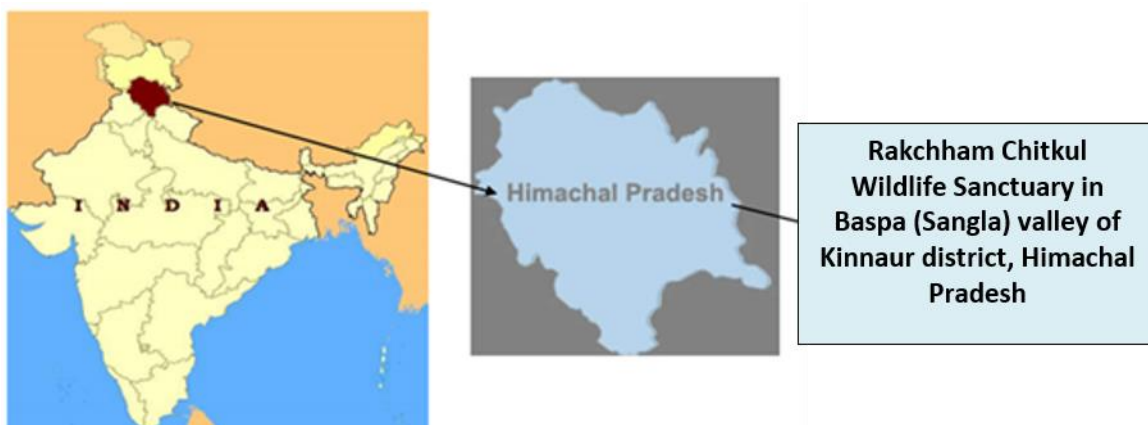


Figure No. 1
Map of India showing Rakchham-Chitkul Wildlife Sanctuary in Baspa (Sangla) valley of Kinnaur district, (H.P)

Selection of research participants

Since, male pastors are migrants, we select a non-probabilistic sampling technic; we interview all the shepherd's groups who visited the sanctuary during the study period, and who agreed with participating. In total 5 shepherd's groups (57 informants) were selected from 5 originated villages named as Chitkul Rakchham, Batsari, Sangla and Kamru and interviewed in Rakchham and Chitkul Wildlife Sanctuary of Kinnaur District. The interviewed

shepherds aged between 30 to 70 (Table No. 1).

Interviews

The information was collected through 8 extensive field visits (2017 to 2018) in study area by using; participant observation, focus groups discussions, semi-structured interviews, free listing and through direct observations (Jain, 1995), (Figure No. 2). In order to access traditional knowledge in India, is there no need for government authorizations for this reason we picked up straight from the shepherds the

Free Prior Informed Consent (PIC). Additionally, shepherds reported that they have a special permit from Himachal Pradesh forest department to use sanctuary and forest areas for their livestock, it passes from one generation to the next generation and they renewed it every year.

Shepherds are very friendly in nature and they love to talk and share their self-experience to each person, during migration, who wants to know their lifestyle and traditions. Plant specimens of

ethnobotanical medicines being used by migratory shepherds for their healthcare were collected, dried and mounted. Plants were identified with the help of a taxonomist from Botanical Survey (B.S.I.) of India, and Forest Research Institute (F.R.I.), Dehradun, Uttarakhand. Vouchers of plant specimens were placed in the herbarium of Shoolini University Solan, Himachal Pradesh, plant names were checked in international data bases; Tropicos and The Plants list.



Figure No. 2
Field survey pictures in study area

Data analysis

We present the qualitative information about the shepherds' perception of the use of plants, this was done based on the interviews, we highlight what we notice most remarkable for the interviewees, the main data are presented in tables and our interpretation is presented in the results.

With the main aim of finding the plant species greatly used for a different ailment or disease category the Factor Informant Consensus was used, to explore the results regarding the general use of plant species (Heinrich *et al.*, 1998). This factor was at first used to highlight plants species of intercultural relevance and agreement in the usage of plant

species. To use this tool, it was essential to classify the diseases into broad disease categories, as follows: 1) Gastrointestinal, 2) Respiratory, 3) Pain/Fever, 4) Dermatological, 5) Muscular/Skeletal, 6) Cardiovascular, 7) Urological and 8) Others. As a result of this analysis, it was possible to assess whether there was an agreement in the use of plants in the disease groups between the informants. The originally proposed categories were adapted for this work.

The Fic was calculated as the amount of use citations in each category (*nur*) minus the number of species used (*nt*), divided by the number of use citations in each category minus one:

$$F_{IC} = \frac{nur - nt}{nur - 1}$$

Also, we record the uses reported for each plant (Ur), number of informants which refer one plant use.

Literature research

To complement the study, we compare the here reported plants uses with previous studies in the region, we search for the terms Himachal Pradesh and Medicinal Plants or Ethnobotany or Traditional medicine in the following data bases; SCOPUS, PUBMED and Clarivate Analytics (Former web of Science), furthermore each reported taxa was individually searched.

RESULTS

Shepherds

Seasonal migration is a traditional process in the Himalayan region the present study indicated that

shepherds having a high number of flocks are comparatively well off compared to those with less number and disparity of flock size, generally is an indicator of status of farmer's livestock holding capacity (Balamurugan *et al.*, 2012; Negi & Banyal, 2015). In our survey it was found that irrespective of flock size, the shepherds travel same distance and the routes of seasonal migration are in general fixed (Figure No. 3). Shepherds reported that there is a high risk of wild animal attack at high altitude as compared to low altitude, some livestock killed due to wild animal's attacks in forest area and some are also injured and killed due to landslides, etc. The present survey shown that the livelihood of migratory shepherd's family is dependent either getting food, fruits, and vegetables from the forests on the path they transect and sell the meat from their herds.

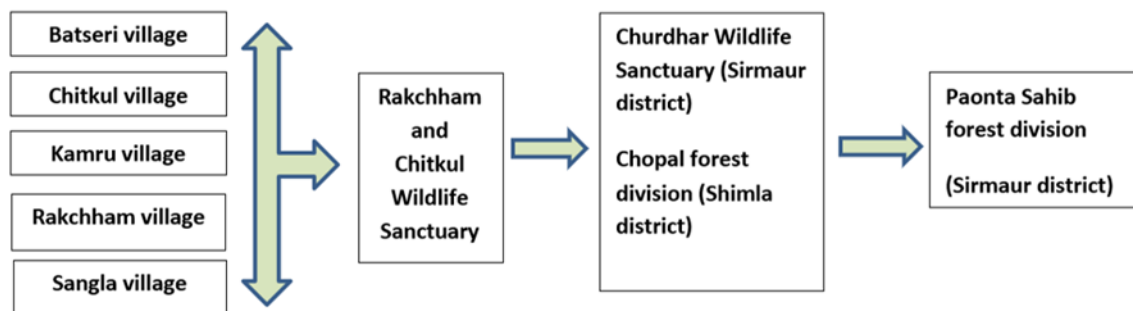


Figure No. 3

Routes followed by shepherds in Rakchham and Chitkul Wildlife Sanctuary

Socioeconomic Data

Occupation

In the present study migratory shepherds reported that their main occupation is shepherding. They reported that with the shrinkage of grazing pastures, it has become difficult task for shepherds to continue with the traditional profession of shepherding. Also, the younger generation does not want to continue this profession

Shepherds females

Shepherds reported that female are skilled craftswomen and they weave different woolen fabrics. They sort the wool fibers as per the length. The woolen are in general woven for individual requirements as well as to sustain in the harsh climatic condition. These woven cultural products are not much popular in the native market and they do not get the correct price if sold.

Language and physical features

Shepherds are short to medium stature. They have a long head and a narrow to medium nose and face. They speak Kinnauri language and Hindi.

Source of income

Chief source of income for migratory shepherds depends on different economic activities;

Livestock sale: Livestock sale provides the chief portion of income. During migration shepherds do not get enough time to go to the market. Thus, livestock are sold to the agents and traders who visit the camps. Migratory shepherds usually sell physically unhealthy goats and sheep to meet short-term cash requirements. During seasonal migration, it is necessary that livestock should be fit, capable of movement and should be able to survive on less quality fodder for a long time. It is also essential for them to discard unfit goats and sheep. Such goats and

sheep are sold in the early stage of seasonal migration. Shepherds do not sell female goats and sheep because they want to keep them for further rise in their flock size.

Sale for goats and sheep wool: Shepherds reported that generally wool is sheared twice a year. But, nowadays, they have started shearing thrice also. In view of the quality, the wool is of 2 types namely (1) Unwashed wool (ii) Washed wool. Wool after shearing is washed before it is sold. It is of high economic value.

Sale from manure: Income of livestock is a vital part, but it is in general an unrecognized percentage of the overall income during seasonal migration.

Table No. 1
Showing migratory shepherds groups details
Total = 57 People selected for interview in 5 groups

Sr. No.	Originated villages of shepherds in Kinnaur district	Shepherds selected for interview from each group	Total groups of shepherds
1.	Chitkul	15	1
2.	Rakchham	13	1
3.	Batseri	13	1
4.	Sangla	11	1
5.	Kamru	5	1

The shepherds have the perception that some taxa are the important medicines in their tribe because these medicinal plants show their effect in few minutes and hours and so they are highly effective, they informed their preference for the following medicines (suggested as Shepherd's basic pharmacopeia);

Achillea millefolium; The dried powder of the whole plant is taken orally with hot water to reduce the high blood pressure, to treat body pain and respiratory infections.

Justicia adhatoda; The juice of fresh leaves is taken orally for curing coughs, asthma and cold.

Amaranthus viridis; Leaves are mixed with hot water and taken orally to treat skin infection and fresh Roots extract is used on skin infections.

Asparagus filicinus; The juice of fresh roots is mixed with hot water and taken orally to treat dysentery, diarrhea and throat complaints.

Bauhinia variegata; The Juice of Leaves and Bark are mixed with cold water and Topical for wound healing and remove lice.

Berberis lycium; Fruits are edible and highly nutritious for health. Dried Roots decoction is given in jaundice.

Data Analysis

In the present survey 58 wild medicinal plant species used in sanctuary area by shepherds were documented, the full description of the plants as remedies is available in Table No. 2, we notice that mainly plant juices of wild plants are used, in oral or topical applications. The collection of medicinal plants and plant parts varied from plant to plant, depending upon their availability, they mainly use; Roots (18), Barks (7) Fruits (6) the Whole plant (5) and Rhizomes (4), they also use; Flowers, Seeds, a Stem, Tubers, Needle, a Bud, and a Twig.

Bergenia ciliata; Decoction of dried Rhizome powder is prescribed to cure cold and joint pain. Dried leaves and flowers taken orally for fever.

Betula utilis; Seeds are mixed with *Cynodon dactylon* and make a paste, used to plaster on fractured part then covered the bark of *Betula utilis*.

Cannabis sativa; Leaves of *Cannabis sativa* burn over flame and smoke is used for abdominal pain.

Chenopodium album; The dried Seeds are chewed and used for the treatment of urinary infections. The juice of the fresh roots is taken orally for treatment of dysentery. The juice of the stem is applied to sunburn.

Cynodon dactylon; the juice is mixed with milk and taken orally for headaches, skin allergies, cough, cold and high blood pressure.

Dioscorea deltoideia; The wounds and cuts are washed with water boiled with Tubers and Leaves.

Euphorbia hirta; The juice of the stem and leaves are given orally to increase milk quantity.

Ficus religiosa; The powder of dried bark and leaves mixed with milk and applied to cure wounds and skin allergies.

Gentiana kurroo; Fresh juice of roots, leaves and rhizomes are taken orally to treat urinary infections.

Picrorhiza kurroa; The juice of fresh leaves and rhizomes are taken orally to treat asthma, cold, cough and jaundice, rhizome dried powder is mixed with milk and used in the treatment of jaundice.

Trillium govanianum; The juice of fresh leaves and roots are taken orally to treat fever and headache.

Urtica dioica; The juice of leaves and roots are topical to heal minor wounds. Tender leaves and shoots cooked as a vegetable.

Urtica palviflora; The juice of fresh leaves and shoots are applied on a sprain of feet.

Zanthoxylum armatum; The powder of dried bark and seeds are applied on tooth pain. Fruits are chewed for tooth pain.

With the use of these 20 taxa, the shepherdess treats the main illnesses which they suffer, most of them are used fresh. If we analyze the data by categories of disease and in agreement with the reports, they use these taxa for: Dermatological conditions; skin infections and wound healing, joint pain and cuts. For respiratory ailments; coughs, asthma, cold and throat complaints. For Pain/Fever; general pain and fever. Gastrointestinal ailments; dysentery and diarrhea. Urological conditions treat urinary infections. Two main problems are remarkable “high blood pressure” and jaundice. They think jaundice comes for drink contaminated water, the skin and eyes become yellow they feel weakness and less hungriness. When they fell and increase in heart rate and difficulty in breath and anger, they assume high blood pressure.

The present study also documented that some medicinal plants used by shepherds in study area are “new” for them such as; *Argemone mexicana*, *Berberis lycium*, *Bauhinia variegata*, *Celtis tetrandra*, *Commelina benghalensis*, *Leycesteria formosa*, *Pyracantha crenulata* and *Solanum nigrum*. They have the perception that their forefathers don't know this species.

The shepherds mention that the availability of wild medicinal plants has gone down over the years, they have troubles to find; *Asparagus filcinus*, *Gentiana kurroo*, *Picrorhiza kurroa* and *Trillium govanianum*, most probably because of changing climatic conditions.

The informants report the following organoleptic properties of the plants: Sour: In Hindi is called khatta. described as; “is like a when we eat citrus fruits” a good example is *Oxalis corniculata*, the fresh juice is used to treat stomach infections.

Sweet: In Hindi Bhutkesi is like “sugarcane but not much strong like as Sugarcane” a plant with this taste is *Achillea millefolium* the dried powder of the whole plant is taken orally with hot water to reduce the high blood pressure, body pain and treat respiratory infections. Umami taste, Bhojpatra in Hindi is like “a mixed taste of little bitter, sour and sweet” *Betula alnoides* is a plant with this taste, the seeds are used as plaster on fractured parts, Bitter in Hindi called Kadua “is dirty taste” like in *Picrorhiza kurroa* traditionally the juice of fresh leaves and rhizomes are taken orally to treat asthma, cold, cough and jaundice. They do not report a preference in taste to treat a specific disease, but they use 25 taxa with a bitter taste (43%) (Table No. 2).

Hot plants mean when they eat them feeling warm body and body temperature increase sweating also comes and cold plant feelings mean, body temperature decrease and do not sweat comes from the body after using it, mainly they use cold pants to treat respiratory conditions and hot plants to treat gastrointestinal and dermatological conditions (see Table No. 2).

Factor Informant Consensus and UR

We noticed that the shepherds have a high consensus if we study the illnesses by category, they use plants to treat ailments in the following categories; Muscular/Skeletal (Fic = 0.89), Urological (Fic = 0.86), Gastrointestinal (Fic = 0.85), Respiratory (Fic = 0.85). Dermatological (Fic = 0.84), Other (Fic = 0.84), Cardiovascular (Fic = 0.81) and Pain/Fever (Fic = 0.77) The Fic have a close value, this means a high agreement in the use of plants, this fact is explained because a relative low number of taxa are used to treat all the ailments, a possible explanation can be; they collect the plants in alpine pastures and Himalayan forest with extreme climate conditions where the plant diversity is low compared to other ecosystems like rain forest. It is remarkable in this study, common chronic conditions like; diabetes, obesity or high cholesterol levels were not mentioned, neither cancer. We already remark the use of plants to treat high blood pressure and jaundice (3 taxa each), this means around 5%, of plants, special attention must be played on high blood pressure, hepatic diseases or other jaundice causes. All the plants have a high number of use reports (UR) see Table No. 2, this confirms the high knowledge of the shepherds about the taxa found in the region as medicines.

Table No. 2
Ethnomedicinal plants used by shepherds in Trans-Himalayan Rakchham-Chitkul Wildlife Sanctuary in Baspa Valley of Kinnaur district, Himachal Pradesh

Sr. No.	Botanical Name (Family)	Voucher Number	Common name	Habit	Parts used
1	<i>Abies spectabilis</i> (D.Don) Mirb. (Pinaceae)	SUBMS/BOT-901	Kolroi, Tosh, Talispatra	Tree	Leaves
2	<i>Abrus precatorius</i> L. (Fabaceae)	SUBMS/BOT-907	Ratti, Gunchi	Climber	Leaves
3	<i>Achillea millefolium</i> L. (Asteraceae)	SUBMS/BOT-905	Bhutkesi	Herb	Whole part
4	<i>Achyranthes bidentata</i> Blume (Amaranthaceae)	SUBMS/BOT-1278	Puthkanda	Herb	Leaves
5	<i>Justicia adhatoda</i> L (Acanthaceae)	SUBMS/BOT-909	Arusa, Vasaka	Herb	Leaves
6	<i>Ageratina adenophora</i> (Spreng.) R.M. King & H. Rob. (Asteraceae)	SUBMS/BOT-925	Pamakani	Shrub	Leaves
7	<i>Amaranthus viridis</i> L. (Amaranthaceae)	SUBMS/BOT-906	Jungali chaulayi	Herb	Leaves Roots
8	<i>Argemone mexicana</i> L. (Papaveraceae)	SUBMS/BOT-908	Satyanashi, Bharband	Herb	Whole part
9	<i>Asparagus filicinus</i> Buch.-Ham. ex D.Don (Asparagaceae)	SUBMS/BOT-904	Chiriyakanda, Sahasimuli, Sharanoi	Fern	Roots
10	<i>Bauhinia variegata</i> L. (Fabaceae)	SUBMS/BOT-910	Kachnar	Tree	Leaves, Bark
11	<i>Berberis aristata</i> DC. (Berberidaceae)	SUBMS/BOT-1128	Kashmal	Shrub	Leaves
12	<i>Berberis lycium</i> Royle (Berberidaceae)	SUBMS/BOT-911	Karmashal	Shrub	Fruits, Roots
13	<i>Bergenia ciliata</i> (Haw.) Sternb. (Saxifragaceae)	SUBMS/BOT-912	Pashanbhed	Herb	Rhizomes, Leaves, Flowers
14	<i>Betula alnoides</i> Buch.-Ham. ex. D. Don. (Betulaceae)	SUBMS/BOT-1234	Bhojpatra	Tree	Seeds
15	<i>Betula utilis</i> D. Don (Betulaceae)	SUBMS/BOT-913	Bhojpatra	Tree	Seeds
16	<i>Cannabis sativa</i> L. (Cannabaceae)	SUBMS/BOT-918	Bhang	Herb	Leaves
17	<i>Celtis tetrandra</i> Roxb. (Ulmaceae)	SUBMS/BOT-917	Khirk	Tree	Seeds
18	<i>Chenopodium album</i> L. (Amaranthaceae)	SUBMS/BOT-920	Bathua	Herb	Seeds, Roots, Stem

19	<i>Commelina benghalensis</i> L. (Commelinaceae)	SUBMS/BOT-915	Kana, Kankawa	Herb	Leaves, Roots, Flowers
20	<i>Cynodon dactylon</i> (L.) Pers. (Poaceae)	SUBMS/BOT-919	Doob, Durva	Grass	Whole part
21	<i>Dioscorea deltoidea</i> Wall. ex Griseb. (Dioscoreaceae)	SUBMS/BOT-922	Singli mingli	Climber	Tubers Leaves
22	<i>Ephedra gerardiana</i> Wall. ex Stapf (Ephedraceae)	SUBMS/BOT-926	Rachi, Budagur, Chhe	Shrub	Whole part
23	<i>Euphorbia hirta</i> L. (Euphorbiaceae)	SUBMS/BOT-923	Duddhi	Herb	Stem, Leaves
24	<i>Ficus religiosa</i> L. (Moraceae)	SUBMS/BOT-927	Peepal	Tree	Leaves, Bark
25	<i>Gentiana kurroo</i> Royle (Gentianaceae)	SUBMS/BOT-929	Kaur, Kutki	Herb	Roots, Leaves Rhizomes
26	<i>Hedychium spicatum</i> Sm. (Zingiberaceae)	SUBMS/BOT-932	Kapurkachri	Herb	Rhizomes
27	<i>Heracleum lanatum</i> Michx. (Apiaceae)	SUBMS/BOT-937	Patrala, Padara	Herb	Roots
28	<i>Hippophae salicifolia</i> D. Don (Elaeagnaceae)	SUBMS/BOT-941	Chuk, Chuma, Kalabis	Shrub	Bark, Fruits
29	<i>Hypericum perforatum</i> L. (Hypericaceae)	SUBMS/BOT-1357	Dhantu	Herb	Roots
30	<i>Hypericum oblongifolium</i> Choisy. (Hypericaceae)	SUBMS/BOT-930	Basant	Herb	Roots
31	<i>Juglans regia</i> L. (Juglandaceae)	SUBMS/BOT-934	Akhrot	Tree	Bark, Leaves,
32	<i>Juniperus communis</i> L. (Cupressaceae)	SUBMS/BOT-939	Bethar, Pethri	Shrub	Bark, Needles
33	<i>Jurinea dolomiaea</i> Boiss. (Asteraceae)	SUBMS/BOT-945	Jari-Dhoop	Herb	Roots
34	<i>Leyceistera formosa</i> Wall. (Caprifoliaceae)	SUBMS/BOT-949	Piralu	Shrub	Roots
35	<i>Lyonia ovalifolia</i> (Wall.) Drude (Ericaceae)	SUBMS/BOT-946	Ayar, Airan Alhan	Herb	Leaves, Buds
36	<i>Morchella esculenta</i> Fr. (Morchellaceae)	SUBMS/BOT-950	Guchhi	Fungi	Whole part
37	<i>Oxalis acetosella</i> L. (Oxalidaceae)	SUBMS/BOT-1257	Aamli	Herb	Leaves
38	<i>Oxalis corniculata</i> L. (Oxalidaceae)	SUBMS/BOT-953	Amrul	Herb	Leaves
39	<i>Phytolacca acinosa</i> Roxb. (Phytolaccaceae)	SUBMS/BOT-954	Jharka, Jalga	Herb	Leaves, Twigs

40	<i>Picrorhiza kurroa</i> Royle ex Benth. (Scrophulariaceae)	SUBMS/BOT-955	Karru, Kutki	Herb	Leaves, Rhizomes
41	<i>Pinus roxburghii</i> Sarg. (Pinaceae)	SUBMS/BOT-957	Chir	Tree	Leaves
42	<i>Prunus cerasoides</i> Buch.-Ham.ex D.Don (Rosaceae)	SUBMS/BOT-957	Pajja	Tree	Fruits
43	<i>Pyracantha crenulata</i> (Roxb. ex D. Don) M. Roem. (Rosaceae)	SUBMS/BOT-959	Bedu, Chhota seb	Shrub	Leaves, Fruits
44	<i>Rhododendron arboreum</i> Sm. (Ericaceae)	SUBMS/BOT-960	Burans	Tree	Flowers
45	<i>Rhus parviflora</i> Roxb. (Anacardiaceae)	SUBMS/BOT-964	Samakdana, Samakdan	Shrub	Bark
46	<i>Rumex hastatus</i> D. Don (Polygonaceae)	SUBMS/BOT-963	Churki, Churka	Herb	Roots, Shoots
47	<i>Saussurea obvallata</i> (DC.) Edgew. (Asteraceae)	SUBMS/BOT-968	Brahma Kamal	Herb	Roots
48	<i>Selinum vaginatum</i> C.B. Clarke. (Apiaceae)	SUBMS/BOT-965	Bhutkeshi, Mathosla	Herb	Leaves
49	<i>Solanum americanum</i> Mill. (Solanaceae)	SUBMS/BOT-967	Mokoi, Dhakh	Herb	Leaves, Roots
50	<i>Solanum surattense</i> Burm.f. (Solanaceae)	SUBMS/BOT-962	Kantkari	Herb	Fruits
51	<i>Thymus mongolicus</i> (Ronniger) Ronniger (Lamiaceae)	SUBMS/BOT-972	Banajwain	Shrub	Leaves, Seeds
52	<i>Trillium govanianum</i> Wall. ex D. Don (Trilliaceae)	SUBMS/BOT-970	Nagchatri	Herb	Leaves, Roots
53	<i>Urtica dioica</i> L. (Urticaceae)	SUBMS/BOT-974	Bichhu Booti	Herb	Leaves, Roots, Shoots
54	<i>Urtica parviflora</i> Roxb. (Urticaceae)	SUBMS/BOT-975	Kandali	Herb	Leaves, Shoots
55	<i>Valeriana jatamansi</i> Jones (Caprifoliaceae)	SUBMS/BOT-979	Muskbala	Herb	Leaves, Roots
56	<i>Verbascum thapsus</i> L. (Scrophulariaceae)	SUBMS/BOT-978	Tamaku	Herb	Roots
57	<i>Vitex negundo</i> L. (Verbenaceae)	SUBMS/BOT-977	Nirgandi	Herb	Leaves
58	<i>Zanthoxylum armatum</i> DC. (Rutaceae)	SUBMS/BOT-981	Tirmir	Shrub	Bark, Seeds, Fruits

No.	Diseases treated	Plant as Remedy	Route of admin.	Taste /Feeling after use/ Nature; Hot-Cold	Ur
1	Asthma (2), Fever (3), Bronchitis (2)	The fresh juice of crushed Leaves taken orally with hot water for treatment of asthma, fever and bronchitis.	Oral	Bitter/Relief/Cold	41
2	Wound healing (4)	The juice of fresh Leaves is mixed with oil and Topical for wound healing.	Topical	Bitter/Relief/Hot	46
3	Reduce high blood pressure (6), Body pain (3), Respiratory infection (2)	The dried powder of whole plant is taken orally with hot water to reduce the high blood pressure, body pain and respiratory infection.	Oral	Sweet/Relief/Hot	54
4	Skin cuts (4)	The powder of dried Leaves is mixed with honey and Topical cuts.	Topical	Bitter/Relief/Hot	39
5	Cough (2), Asthma (2), Cold (2)	The juice of fresh Leaves is taken orally for curing coughs, asthma and cold.	Oral	Sweet/Relief/Cold	48
6	Skin cuts (4)	The powder of dried Leaves is mixed with honey and Topical cuts.	Topical	Bitter/ Relief/Hot	45
7	Skin infection (4)	Dried Leaves are mixed with hot water and taken orally to treat skin infection and fresh Roots extract is used on skin infections.	Oral, Topical	Bitter/Relief/Hot	43
8	Malaria (8)	Tea is used to treat <u>malaria</u> . The whole plant is used and as much tea as possible is drunk until symptoms disappear.	Oral	Bitter/Relief/Hot	51
9	Dysentery (1) Diarrhea (1) Throat complaints (2)	The juice of fresh roots is mixed with hot water and taken orally to treat dysentery, diarrhea and throat complaints.	Oral	Sweet/ Relief/Cold	53
10	Wound healing (4) Remove lice (4)	The juice of Leaves and Bark are mixed with cold water and Topical for wound healing and remove lice.	Topical	Sweet/Fresh/Hot	38
11	Tonic (8), Jaundice (1)	Fruits are edible and highly nutritious for health. Dried Roots decoction is given in Jaundice.	Oral	Sweet/Relief/Hot	55
12	Tonic (8), Jaundice (1)	Fruits are edible and highly nutritious for health. Dried Roots decoction is given in Jaundice.	Oral	Sweet/Relief/Hot	55
13	Cold (2), Joint pain (5),	Decoction of dried Rhizome powder	Oral	Bitter/Relief/Cold	52

	Fever (3)	prescribed to cure cold and joint pain. Dried Leaves and Flowers taken orally for fever.			
14	Fractured part (6)	Seeds mixed with <i>Cynodon dactylon</i> and make a paste, used to plaster on fractured part.	Topical	Umami/Fresh/Hot	55
15	Fractured part (6)	Seeds mixed with <i>Cynodon dactylon</i> and make a paste, used to plaster on fractured part then covered the bark of <i>Betula utilis</i> .	Topical	Umami/Fresh/Hot	55
16	Abdominal pain (3)	Leaves of <i>Cannabis sativa</i> burn over flame and smoke is used for abdominal pain.	Inhale	Umami/Relief/Hot	50
17	Indigestion (1)	The juice from the Seeds is used orally in the treatment of indigestion.	Oral	Bitter/Fresh/Cold	39
18	Urinary infection (7), Dysentery (1), Sun burn (4)	The dried Seeds are chewed and used for the treatment of urinary infections. The juice of the fresh Roots is taken orally for treatment of dysentery. The juice of the Stem is applied to sunburn.	Chewed, Topical	Bitter/Relief/Cold	39
19	Diarrhea (1) Stomach disorder (1)	The juice of fresh Leaves, Roots and Flowers are drunk to treat diarrhea. The juice of dried roots is used orally for stomach disorder.	Oral	Sweet/Fresh/Hot	43
20	Headache (3), Skin allergy (4), Cough (2), Cold (2), High blood pressure (6)	The Juice of whole grass mixed with milk and taken orally for headache, skin allergy, cough, cold and high blood pressure.	Oral	Umami/Relief/Cold	54
21	Wounds (4), Cuts (4)	The wounds and cuts are washed with water boiled with Tubers and Leaves.	Topical	Umami/Relief/Cold	55
22	Cold (2), Cough (2), Asthma (1), Respiratory problems (1)	Tea is used for colds, coughs, asthma and respiratory problems.	Oral	Bitter/Relief/Hot	54
23	Increase milk quantity (8)	The juice of the Stem and Leaves are given orally to increase milk quantity.	Oral	Umami/Relief/Hot	51
24	Wounds (4), Skin allergy (4)	The powder of dried Bark and Leaves mixed with milk and applied to cure wounds and skin allergy.	Topical	Umami/Relief/Cold	45
25	Urinary infections (7)	Fresh juice of Roots, Leaves and Rhizomes are taken orally to treat urinary infections.	Oral	Bitter/Relief/Hot	39
26	Cough (2) Asthma (2) Headache (3) Skin infection (4) Purify the blood (8)	The fresh Rhizomes are chewed to relief cough, asthma, headache and skin infections. Grounded rhizomes	Chewed, Oral	Bitter/Relief/Cold	38

		taken orally with milk to purify the blood.			
27	Cough (2) Asthma (2), Skin allergy (4)	The juice of fresh Roots is taken internally for the treatment of coughs, asthma, and skin allergy.	Oral	Sweet/Relief/Hot	35
28	Sunburns (4)	The powder of dried Bark and Fruits are mixed with oil and applied on sunburn.	Applied on skin	Bitter/Relief/Hot	32
29	Skin allergy (4)	The juice of fresh Leaves and Roots mixed with honey and Topical allergy.	Topical	Sweet/Relief/	38
30	Skin allergy (4)	The powder of dried Roots is mixed with oil and Topical allergy.	Topical	Sweet/Relief/Cold	41
31	Tooth pain (3)	The fresh Leaves and Bark are chewed to relief toothache.	Chewed	Sweet/Relief/Cold	41
32	Asthma (2)	The fresh juice of Bark and Needles are taken orally to treat asthma.	Oral	Bitter/Relief/Cold	48
33	Fever (3) Cold (2), Cough (2)	The juice of fresh Roots is taken orally for the treatment of fever, cold and cough.	Oral	Bitter/Relief/Hot	51
34	Skin infection (4)	The juice of fresh Roots is given orally to treat skin infection.	Oral	Bitter/Relief/Cold	48
35	Fever (3), Cough (2), Cold (2)	The tea of young Leaves and Buds are used for throat infections. Leaves have insecticidal properties.	Oral	Bitter/Relief/Hot	41
36	Indigestion (1)	<i>Morchella esculenta</i> have been used as vegetable to treat indigestion.	Oral	Umami/Fresh/Cold	40
37	Stomach infection (1)	The juice of fresh Leaves is taken orally to treat stomach infection.	Oral	Sour/Fresh/Cold	43
38	Stomach infection (1)	The juice of fresh Leaves is taken orally to treat stomach infection.	Oral	Sour/Fresh/Cold	50
39	Tonic (8)	The fresh tender Leaves and Twigs are cooked as vegetable and highly nutritious for health.	Oral	Bitter/Relief/Hot	39
40	Asthma (2), Cold (2), Cough (2) Jaundice (1)	The Juice of fresh Leaves and Rhizomes are taken orally to treat asthma, cold, cough and jaundice. Rhizome dried powder is mixed with milk and used in the treatment of jaundice.	Oral, Topical	Bitter/Relief/Cold	55
41	Joint pain (6)	The juice of fresh Leaves mixed with oil and used externally in joints pain.	Topical	Sour/Relief/Cold	30
42	Tonic (8)	Fresh Fruits is taken orally and highly nutritious for health.	Oral	Sweet/Fresh/Hot	35

43	Tonic (8), Fever (3)	The dried Leaves is used in the preparation of tea. Leaves and Fruit juice are taken orally as a tonic to mind.	Oral	Sweet/Fresh/Cold	38
44	Cough (2), Cold (2), Fever (3)	The juice of dried Flowers is taken orally for cough, cold and fever.	Oral	Sweet/Relief/Cold	49
45	Forehead Pain (3)	The paste prepared from the dried Bark is used over forehead to treat pain.	Topical	Sweet/Fresh/Cold	44
46	Indigestion (1)	The juice of Shoots and Roots are taken orally for indigestion.	Oral	Sour/ Fresh/Cold	51
47	Wounds (4) Cuts (4)	The juice of fresh Roots is applied on wounds and cuts.	Topical	Bitter/Relief/Hot	49
48	Skin allergy (4)	The Juice of fresh Leaves is Topical allergy.	Topical	Umami/Relief/Hot	45
49	Foot infections (4)	The Juice of Leaves and Roots are applied on foot infections.	Topical	Sweet/Relief/Hot	40
50	Bladder stone (7)	The juice of fresh Fruits is taken orally for controlling of stone in bladder.	Oral	Sweet/Relief/Hot	43
51	Stomach problems (1), Fever (3) Cough (2)	The fresh juice of Leaves and Seeds are considered a popular remedy for stomach problems, fever and cough.	Oral	Bitter/Relief/Hot	55
52	Fever (3) Headache (3)	The Juice of fresh Leaves and Roots are taken orally to treat fever and headache.	Oral	Umami/Relief/Cold	55
53	Wounds (4)	The juice of Leaves and Roots are Topical to heal minor wounds. Tender Leaves and Shoots cooked as vegetable.	Topical, Oral use	Bitter/Relief/Cold	53
54	Sprain (5)	The Juice of fresh Leaves and Shoots are applied on sprain of foot	Topical	Bitter/Relief/Hot	51
55	Headache (3) Wounds (4)	The juice of dried Leaves and Roots mashed in water is applied on forehead to relieve the pain. The juice of dried Roots is applied in wounds for better healing.	Topical	Umami/Relief/Hot	55
56	Vomiting (1)	The juice of fresh Roots is taken orally to treat vomiting.	Oral	Umami/Fresh/Cold	55
57	Joint pain (5)	The juice of fresh Leaves is applied to heal swollen joints pain.	Topical	Bitter/ Relief/Cold	52
58	Fever (3), Tooth pain (3)	The powder of dried Bark and Seeds are applied on tooth pain. Fruits are chewed for tooth pain.	Topical, Chewed	Bitter/Relief/Hot	55

Comparison with Previous Works

In the ethnomedical work performed by (Negil *et al.*, 2011) in Chitkul, Sangla Valley, the authors report the use of 15 medicinal plants in the area, few species were documented due to hard climate conditions, the species in common with the present work are; *Bergenia stracheyi*, we found *Bergenia ciliata* with a different use, *B. stracheyi* root powder used in dissolving stones in the kidney, while *B. ciliata* root is used for cold complaints, both plants have the same vernacular name; Pashanbhed, *Heracleum candicans*, the roots of the plant have anti-inflammatory properties we found *Heracleum lanatum* used for coughs. *Hippophae rhamnoides* is reported for cholesterol, in the present work we found *Hippophae salicifolia* used to treat sunburn, *Saussurea obvallata* rhizomes are used as antiseptic and for healing cuts and bruises, in the present work the juice of fresh roots is applied on wounds and cuts. Only *Saussurea obvallata* present the same use in both regions.

In the following works, we found plants with the same use; (Thakur *et al.*, 2016) worked in Kangra and Chamba districts of Himachal Pradesh, the plants with similar uses in both works, are ; *Berginia ciliata* for fever, *Vitex negundo* for joint pain and *Zanthoxylum armatum* for tooth pain, the authors (Malik *et al.*, 2011) also report the use of *Cynodon dactylon* to treat cold in Kashmir Himalaya, , the work of (Sharma & Lal, 2005) report the use of *Valeriana jatamansi* for wound and headaches (Rani *et al.*, 2013) also mention the use of *Berberis lycium* for gum problems and *Urtica dioica* for wounds. Jaundice is a special symptom reported by the shepherds they use fresh juice of; *Berberis aristata*, *Berberis lycium* and *Picrorhiza kurroa* to treat it, those plants are described in the literature for the same purpose (Rani *et al.*, 2013). *Berberis aristata*, and *Picrorhiza kurroa* are well described, however, more phytochemical and pharmacological studies for *Berberis lycium* are needed.

DISCUSSION

Wild medicinal plants play an important role in the lives of the shepherds, because they migrate during the year the main source of medicines are plants. To treat the main illnesses which they suffer they have a preferred pharmacopeia of 20 taxa in which they trust more, they use 58 species to treat ailments in the above-mentioned categories of illness. For the 20 taxa reported as preferred, several studies mentioned them in the literature, however, the fresh juice as

used by the Shepherd's is not reported, we propose further pharmacological and phytochemical studies of the fresh juices for *Adhatoda vasica*, *Asparagus filcinus*, *Bauhinia veriegata*, *Cynodon dactylon*; *Euphorbia hirta*, *Gentiana kurroo*, *Picrorhiza kurroa*, *Trillium govanianum*, *Urtica dioica*, and *Urtica parviflora*.

The ecosystem in which they live has drastically climate conditions and the limited presence of plants, as compared with other ecosystems, for this reason, they use few taxa but with high knowledge of them and high consensus about the use of plants. Also, the taxa have high Ur values, because mainly all the interviewed people know them as well as their main use. The shepherds have an extraordinary knowledge of their environment and they can solve the day-to-day health problems with the use of plants. Chronic diseases are not reported this can be associated with the lifestyle, they walk a lot and don't have access to processed food. It is also remarkable that mainly they use plant juices in oral or topical application, this can also be correlated to the lifestyle, they use the wild plant when they need it, instead of dry it and prepare and infusion, as common in other traditional medicine systems.

The plants with a common use with previous works in the area are; *Berberis lycium* *Berginia ciliata*, *Cynodon dactylon*, *Ficus religiosa*, *Saussurea Obvallata*, *Valeriana jatamansi*, *Urtica dioica*, *Vitex negundo* and *Zanthoxylum armatum*.

B. ciliata and *Z. armatum* are important in previous works and in the present one (shepherds' perception and Ur), the uses of *B. ciliata* are reported in the literature mainly is used to treat kidney stones, but it is reported as toxic (Ahmad *et al.*, 2018), for *Z. armatum* a review of the medicinal proprieties is found in (Mukhtar & Kalsi, 2018) the anti-inflammatory and antinociceptive propriety correlates with the here reported use to treat tooth pain.

Based on the comparison between the plant uses reported in the literature and our own results, we propose for *Cynodon dactylon*, *Saussurea obvallata*, *Urtica dioica*, *Valeriana jatamansi* and *Vitex negundo* further analysis of the juices, those plants are reported in the literature but no studies about the phytochemical composition and pharmacological aspects of the juice are available.

Deforestation activities and the altering climatic conditions have made availability of medicinal plant species a scarce resource to the shepherds during

seasonal migration. It is also highlighted that necessary attention has not been put in conserving traditional medicinal plants, for this problem we propose the urgent need to adopt a plantation of medicinal plant species within the forests so that the migratory shepherds are profited.

CONCLUSION

The study revealed that most of the wild medicinal plants found on the migratory routes are widely used by the shepherds. The survey also indicated that there is a huge wealth of knowledge with the tribal people and the same needs to be documented in a scientific manner, this is important because the newer generation in the study region seems to be less attracted in the profession as point out by the respondent shepherds from each group.

It was also pointed out that the availability of wild medicinal plants has gone down over the years chiefly that of *Asparagus filcinus*, *Gentiana kurroo*, *Picrorhiza kurroa* and *Trillium govanianum* most probably because of changing climatic conditions. Market pressures are also the factor in excessive/unscientific extraction of this wealth from the wild. There thus is a need to take steps for conservation and restoration sites with wild medicinal

plants, we propose the plantation of wild medicinal plants.

Because the migratory lifestyle, the shepherds mainly use the juice of wild plants. They prefer the use of 20 taxa to treat; coughs, asthma, colds, throat complaints, general pain, fever, dysentery, diarrhea and urinary infections. As we remark special attention must be played on high blood pressure, hepatic diseases or other jaundice causes among the shepherds.

The fresh juices of *Berberis lycium*, *Cynodon dactylon*, *Saussurea obvallata*, *Valeriana jatamansi* and *Vitex negundo* needs further phytochemical and pharmacological investigations.

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