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Traditional Medicinal Practices and Consensus of Inhabitants for Health Care Systems in Himalayas

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ABSTRACT The present study was carried out in the Dhasoli block of district Chamoli, in Garhwal Himalaya of Uttarakhand. The aim of the study was to document the cultural and indigenous knowledge of plant resources for health care management practices among the inhabitants of remote areas of Himalaya. Questionnaire and field visits were used for data collection on different plant species with ethnomedicinal importance. The informants' consensus factor value ranged from 0.36 to 0.67 with the highest value of 0.67 for a liver disorder. Most dominant plant parts used were roots. Gastrointestinal disorder was treated by the highest number of species (21) followed by (17) species for dermatological disorders and respiratory disorders (17). There is a need for future research for different parts of plants for precise information about the curable ailments of a particular part of the plant which will open further path for pharmacological evaluation of traditional herbal medicine.

INTRODUCTION

The exploration and utilization of ethnobotanical resources and their conservation is essential for rebuilding the traditional knowledge (Reddy 2012; Payyappallimana and Fadeeva 2013; Biswakarma et al. 2017; Raj et al. 2018; Pala et al. 2019). Plant species used in traditional medicines globally is around 5300 species (Hamilton 2004). As estimated by World Health Organization, about seventy to ninety five percent of people in developing countries rely on the traditional knowledge of plants for health care (World Health Organization 2011). India harbors about 17,000 plant species, of which 7500 are known as medicinal plants (Nayar 2011). About sixty five percent of the Indian population depends on the traditional system of medicine (Timmermans 2003). Ethnobotanical research is important by documenting the traditional knowledge for the conservation and utilization of bio resources (Muthu et al. 2006). Therefore, the establishment of local knowledge of plant species has significant benefits (Baðcý 2000) and this traditional knowledge is kept secret by traditional healers and is only passed to their own generations (Panghal et al. 2010).

This part of north-western Himalaya which lies in the state of Uttarakhand is known for dense vegetation with a wide species of medicinal plants and the majority of the medicinal plants have been recorded from this state (Singh et al. 2005; Kala 2004), followed by Sikkim and North Bengal (Samant et al. 1998). The majority of the people from this area are mainly dependent on traditional healers *(Vaidyas)* for treating diseases (Kala 2000). Indian Himalayan region has been explored by several researchers for use of medicinal plants (Gaur and Sharma 2011; Singh and Rawat 2011; Kumar et al. 2011; Bhat et al. 2013; Malik et al. 2015). Ethnomedicinal knowledge of plant resources has been constantly diminishing due to the influence of global commercialization and socio-economic transformation (Kunwar and Adhikari 2005). Therefore, there is an urgent need to record this traditional knowledge of plants for its medicinal values and it is also important for future drug discovery and development. In the view of above background, the

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present research work was carried out with the following two objectives.

Objectives

- To document the traditional use and ethnobotanical knowledge of the medicinal plants used by local communities.
- To document the various cultural indices of these utilized medicinal plant species in the study area.

MATERIAL AND METHODS

Study Area

The present study was carried out in three villages namely Khalla, Bandawara and Mandal of Block Dhasoli of district Chamoli, in Uttarakhand (Table 1). These villages are largely covered by forests of Banj oak (*Quercus leucotrichophora*) and Utis (*Alnus nepalensis*). The mean annual maximum and minimum temperature was recorded as 16.41 ± 3.60 °C and 6.14 ± 1.98 °C respectively. The study area is represented by three main seasons; the cool and relatively dry winter (November to March); the warm and dry summer (mid-April to June); the warm and wet period (July to mid-September) the monsoon. The brief depiction of studied villages was given in Table 1.

Methodology

Structured and pretested questionnaires were used and approximately more than thirty percent of the total households in each village (75 households in 3 villages) were interviewed. For the survey, a door-to-door approach was used. The information was gathered for plants with medicinal uses from the family heads. The other members of the family including women and elderly people also participated in the interviews which typically lasted 20-25 minutes at each household. During the interview process, the questionnaires were used to gather information on medicinal plants, including the local name of the plant, plant part used for curing and the diseases for which a particular plant is used etc. The questions were composed in English and then translated into Hindi and local dialect Garhwali based on the preference of the respondent. Interviews were documented in English. At the beginning of the interview, respondents were informed that their participation in the survey is completely voluntary and information provided would be helpful in future designing management practices.

The medicinal uses of the plants were classified into different categories following the standard chart developed by Heinrich et al. (1998). To test the homogeneity of knowledge on the use of plants in the illness categories between the populations, the researchers used the informant consensus factor (Heinrich et al. 1998):

ICF= Nur-Nt / (Nur-1),

Where, Nur refers to the number of use reports for a particular use category and Nt refers to the number of taxa used for a particular use category by all informants.

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.

Table1: Description of study villages

Description of villages	*Mandal*	*Khalla*	*Bandwara*
Location	*30°27"N, and 79°16"E*	*30°26"N, and 79°16"E*	*30°31"N, and 79°17"E*
Altitude (masl.)	1400	1420	1442
Total households	101	70	45
Sampled households	35	25	15
Total population	630	500	325
General caste	540	350	275
Schedule caste	90	150	50
Van panchayat Area (ha.)	48.80	64.41	65.20
Annual fodder consumption (tonnes)	4381.63	4152.34	2764.91
Annual fuel-wood consumption (tonnes)	293.61	165.27	136.27

The information collected in the present study was also validated with earlier available secondary literature. Literature searches in published peer-reviewed journal sources were performed using electronic databases, namely, Elsevier, Springer, and Wiley and Blackwell and other journals. The literature survey was intended to be as inclusive as possible. The search parameters were limited to papers whose title, abstract, or keywords referred to ethnobotanical, traditional knowledge, medicinal plants, Himalayas, and indigenous knowledge.

RESULTS AND DISCUSSION

Ethnomedicinal Plants and Their Extent of Use

The plants used as ethnomedical by the indigenous local communities of the study area are given in Table 2. It was observed that the local villagers had knowledge of about 54 ethnomedicinal species used for the treatment of various ailments. These species were distributed across 37 families, of which 2 species are gymnosperms and remaining plant species are angiosperms. The study recorded that herbs are represented by 28 species and are found to be more prominent growth forms for treatment of various ailments followed by trees (11 species), shrubs (9 species) and climbers (6 species). In terms of a number of medicinal plants species, Rosaceae, and Euphorbacieae (4 species each) were dominant families, followed by Solanaceae (3 species) and Asteraceae, Rubiaceae, Ranunculaceae, Polygonaceae, Liliaceae, Gentianaceae, Saxifragaceae and Zingiberaceae with 2 species each. The local people recognized the plant species by various vernacular names (Table 2) for curing different ailments. The highest extent of use was calculated for *Arocus calamus, Solanum nigrum, Zanthoxylum armatum, Oxalis corniculata, Phyllanthus amarus* (10.64%). It was followed by *Achyranthes aspera, Bauhinia variegata, Phyllanthus urinaria, Perilla frutescens, Rubia manjith, Smilex aspera* (8.51%). The lowest use extent value (2.13%) was recorded for *Berbaris asiatica, Aesculus indica, Juglans regia, Myrica esculenta, Plantago erosa, Symplocus racemosa, Thalictrum foliolosum, Pyrus pashia, Rosa macrofolia, Astilbe rivularis, Taxus wallianchiana* and *Roscoea alpina* (Table 2).

Plant Part Used and Curable Ailments

Plant parts used for ethnomedicinal preparations were both below ground and above ground such as fruit, flower, resin, rhizome, stem, bark, seed, leaf, root and the whole plant. The use of below ground parts was higher than the above ground parts. Of the plant parts, the most frequently utilized plant parts were roots (35%), whole plant (18%), leaves (11%), fruit (9%), seed (6%), bark (6%), and rhizome (5%). Roots were found most frequently utilized plant part in other studies (Malik et al. 2015; Bhat et al. 2013; Kunwar et al. 2006; Kunwar et al. 2010; Singh and Rawat 2011). Similarly, in present study most common plant parts used were roots (35%), whole plant (18%), leaves (11%), fruit (9%), seed (6%), bark (6%), rhizome (5%) etc. The high importance of the underground part was attributed to its having a high concentration of bioactive compounds (Moore 1994). The plant species used by the local villagers are used to treat different ailments such as dysentery, cough, fever, joint pain, cold, body pain, eye problems, respiratory problems, insect bites, jaundice, skin problems etc. (Table 3). It was also documented that a particular species may be used for the treatment of various ailments (Table 3). *Bergenia ciliata* is used for the treatment of constipation, dysentery, kidney stones, gall bladder stones, painful and small urination, wormicide, boils, wounds, burn, piles, urinary trouble, asthma, and fever. Allopathic medicines may cure a wide range of diseases; however, their high prices and side-effects are causing many people to return to herbal medicines which have fewer side effects (Kala 2005). However, the instant rising demand of plant-based drugs is, unfortunately, creating heavy pressure on some selected high-value medicinal plant populations in the wild due to over-harvesting. Several of these medicinal plant species have slow growth rates, low population densities and narrow geographic ranges (Kala 1998); therefore, they are more prone to extinction (Jablonski 2004). *Zanthoxylum armatum* is used for the treatment of anesthetic, pyorrhea, cough cold, fever, toothache, abdominal trouble, leucoderma, eye, and ear trouble. *Oxalis corniculata* is used for the treatment of cuts, wounds, swelling, insect stings, snake bite, scorpion sting, appetite, corns, dysentery, fe-

Table 2: Indigenous knowledge of plants and the extent of use

Species name	*Local name*	*Family*	*Habitat*	*Extent of use (%)*
Acharanthus aspera	Lat jeera	Amaranthaceae	H	8.51
Arocus calamus L	Boja	Araceae	H	10.64
Artemisia nilagirica	Kunja	Asteraceae	H	6.38
Siegsbeckia orientalis	Lichkuru	Asteraceae	H	4.26
Berbaris asiatica	Kilmora	Berberidaceae	S	2.13
Berbaris aristata	Kilmora	Berberidaceae	S	4.26
Drymaria diandas	Mendi	Caryophyllaceae	H	4.26
Bauhinia variegate	Kwiral	Ceasalpinanacea	T	8.51
Melothria heterophylla	Gwalkakhari	Cucurbitaceae	C	4.26
Dioscorrea belophylla	Tarur	Dioscoraceae	C	4.26
Rhodendron arboreum	Burans	Ericaceae	T	6.38
Phyllanthus amarus	Bhumiamlaki	Euphorbiaceae	H	10.64
Phyllanthus urinaria	Tamaravalli	Euphorbiaceae	H	8.51
Ricinus cummunis	Arand	Euphorbiaceae	S	4.26
Euphorbia pilosa	Dhudya	Euphorbiaceae	H	4.26
Swertia chirayita	Chiratay	Gentianceae	H	4.26
Geranium wallichianum	Khapla	Gerenaceae	H	4.26
Aesculus indica	Pangar	Hippocastanaceae	T	2.13
Juglans regia	Akhrot	Juglandaceae	T	2.13
Perilla frutescens	Bhanjerra	Lamiaceae	H	8.51
Cinnamomum tamala	Dalchini	Lauraceae	T	4.26
Asparagus curilus	Jharana	Liliaceae	S	6.38
Polygonatium cirrhfolium	Meds	Liliaceae	H	6.38
Stephania glabra	Ginjaru	Menispermaceae	C	6.38
Ficus palmata	Bedu	Moraceae	T	4.26
Myrica esculenta	Kaphal	Myricaceae	T	2.13
Symplocus racemose	Lodhra	Myrsinaceae	T	2.13
Oxalis corniculata	Chalmori	Oxalidaceae	H	10.64
Pinus roxburghii	Chir	Pinaceae	T	4.26
Plantago erosa	Lahuriya	Plantaginaceae	H	2.13
Rumex histatus	Almoda	Polygonaceae	H	4.26
Rheum austral	Dolu	Polygonaceae	H	6.38
Thalictrum foliolosum	Panglajari	Ranunculaceae	H	4.26
Prinsepia utilis	Bhenkal	Rosaceae	S	4.26
Prunus cerasiodes	Payan	Rosaceae	T	4.26
Pyrus pashia	Mehal	Rosaceae	T	2.13
Rosa macrofolia	Kinj	Rosaceae	H	2.13
Galium aparine	Less Kora	Rubiaceae	C	6.38
Rubia manjith	Manjishtha	Rubiaceae	C	8.51
Zanthoxylum armatum	Timru	Rutaceae	S	10.64
Bergenia ciliata	Shilphure	Saxifragaceae	H	6.38
Astilbe rivularis		Saxifragranaceae	H	2.13
Verbascum Thapsus	Akuluber	Scrophulariaceae	H	6.38
Smilex aspera	Kukardara	Smilaceae	C	8.51
Datura metel	Dhatura	Solanaceae	H	4.26
Solanum viarum	Bari kantkari	Solanaceae	H	4.26
Solanum nigrum	Giwoen	Solanaceae	H	10.64
Taxus wallianchiana	Thuner	Taxaceae	T	2.13
Urtica dioica	Dhunkanali	Utricaceae	H	4.26
Valeriana hardwickii	Shameus	Valerianaceae	H	6.38
Viola canescens.	Dudibirali	Violaceae	H	6.38
Hedychium spicatum	Garoor	Zingiberaceae	H	6.38
Roscoea alpina Royle	Panja	Zingiberaceae	H	2.13

H=Herb; S= Shrub; T=Tree; C=Climber

ver, jaundice, rickets, and stomachache. *Bauhinia variegate* is used for skin problems, ulcers, tuberculosis of bone or lymph gland, dysentery, diarrhea, colic, indigestion, snake bite

Table 3: Present study and previous reports of plant parts used and their curable ailments

Species name	*Part used*	*Curable ailments*	*Source*
Achyranthes aspera	W P	Skin disorders malarial fever, toothpaste	Present study;
	R, L	Body pain, toothache, cut wounds, easy delivery, inflammation, headache, malaria, and snake bites	Mathur and Joshi 2013; Chandra et al. 2013.
Arocus calamus	RH	Fever, jaundice, kill licks	Present study;
	RH	Cut, wounds, skin diseases, bone fracture	Kala 2005;
	R, RH	Warm Killer, menstrual disorders, improve lost voice, inflammation, neck pain, asthma, cough, cold, rheumatism, gout, stomach trouble	Agrawal 2001; Singh and Rawat 2011; Chandra et al. 2013.
Artemisia nilagirica	L, R	Intestinal worms, sores.	Present study;
	L	Cough, headache, sores	Kala 2005;
	L, WP	Cuts, wounds, Ulcer, as antiseptic, ear trouble, abscess, analgesic, asthma, ear troubles, epilepsy	Agrawal 2001; Singh and Rawat 2011; Chandra et al. 2013.
Siegsbeckia orientalis	L	Diarrhea and bowl complaints	Present study
Berberis asiatica	W P	Eye troubles	Present study;
	B, L, R	Stomach trouble, eye trouble, snakebite, ear trouble, piles	Agrawal 2001; Singh and Rawat 2011;
	F,B, R	Ulcers, Jaundice, Fever	Malik et al. 2015.
	R	Gastric diseases, diabetes and eye infection	
Berbaris aristata	B, ST, R	Medicinal alkoides, ophthalmic	Present study;
	ST, R	Eye diseases	Kala et al. 2006;
	B, R	Cold, fever, conjunctivitis, malaria, typhoid, leucorrhoea, hemorrhoids, jaundice, snakebite, boils, anticancer, blood pressure	Agrawal 2001; Malik et al. 2015;
		Rheumatism, fever, eye diseases	Singh and Rawat 2011.
	F, B, R		
Drymaria diandas	W P	Laxative, bile complaints	Present study
Bauhinia variegata	B, F, L	Skin diseases, menstrual disorders,	Present study;
	B, R	Skin problems, ulcers, tuberculosis of bone or lymph gland, dysentery, diarrhea, colic, indigestion, snake bite and piles	Mathur and Joshi 2013;
		Biliousness, ulcers and tuberculosis	Singh and Rawat 2011.
	FL		
Melothria heterophylla	R, S	Diabetes and digestive trouble	Present study;
	R, L, F	Antifertility, cuts, diabetes, fever, stomach ache	Agrawal 2001.
Dioscorea belophylla	T	Burns and wounds	Present study;
	T	Aphrodisiac	Gaur and Sharma 2011.
Rhodendron arboreum	F, B	Digestive, respiratory problems	Present study;
	FL	Dysentery, diarrhea, headache, nose bleeding,	Kharwal and Rawat 2013; Agrawal 2001; Malik et al. 2015.
Phyllanthus amarus	W P	Astringent, stomachic problem, antibacterial	Present study;
	W P	Jaundice, aphrodisiac, dysentery	Kala et al. 2006.
Phyllanthus urinary	W P	Diuretic, jaundice, liver complaints,	Present study;

and piles. *Juglans regia* is used for the treatment of herpes, eczema, scrophula, syphilis, tooth diseases, pyorrhea and toe sores. Earlier studies have reported extra medicinal properties of some plants which were gathered in the present study. The present study was compared with various earlier reports for plant part used and their curable ailments (Table 3). The different researchers have revealed the different parts of plants for medicinal use. It was also found that curable treatments for particular species are not common among the local informants in different areas of Himalayas. Several researchers like Singh and Rawat (2011), Malik et al. (2015) also reported that a single plant may be used for curing more than one ailment. Therefore, it is very vital to recognize which part of the plant and at which developmental stage; the preferred product can be obtained. It is critically important that the target plant species or its parts be collected completely separated from any other species or parts thereof. Furthermore, species reported for treatment for various ailments should be explored for the recognition of the active ingredients. It would be beneficial to conduct pharmacologic studies on such plants. Such studies may make a contribution to indigenous ethnobotanical knowledge as well as suggest sourcing of raw materials for the development of commercial pharmaceuticals (Cakilcioglu et al. 2011). The precious indigenous knowledge when supplemented and validated by the latest scientific insights, can offer new holistic models of sustainable development that are economically viable, environmentally benign and socially acceptable (Shinwari and Gilani 2003).

Category of Ailments and Their Informant Consensus Factor (ICF)

These ethnomedicinal plant species were used in curing about 24 different ailments which are grouped into major 11 categories of diseases and disorders (Table 4). These include liver disorders, bone disorders, jaundice, insect bite, dermatological disorder, respiratory, fever, urological problem, gastrointestinal disorder, body pains and general health. A maximum number of species (21) are used for the treatment of gastrointestinal disorder followed by dermatological and respiratory problems disorders (17 species each) and body pains (13 species). The highest informant consensus factor (ICF) value was 0.67 for liver disorder, followed by bone disorder (0.64), jaundice (0.63), insect bite (0.50), dermatological disorder (0.48), respiratory problems (0.41) categories which indicated moderate consistency of informant knowledge in the use of these medicinal plant species while the low ICF value of fever (0.40), urological (0.40), gastrointestinal disorder (0.38), body pain (0.37) and general health (0.36) indicates the less consistency of the informants knowledge in the plant used for treatment (Table 4). In the present study, the ICF value ranged between 0.36-0.76 which is higher than other studies. Singh et al. (2014) (0.23-0.55) and Namsa et al. (2011) (0.17 to 0.56) indicated a high level of consensus. In this region high ICV indicates that use of these species is widely known in the study area, and most of the respondents concurred regarding the particular usage. This paper takes the position that informant consensus is a reliable method of se-

Table 4: Category of ailments and their informant consensus factor (ICF)

Category (Disease and disorders)	*Plant species*	*Use reports*	*ICF*
Liver problems	3	7	0.67
Bone disorders	5	12	0.64
Jaundice	4	9	0.63
Insect bite	5	9	0.50
Dermatological disorder (cuts, wounds, burns)	17	32	0.48
Respiratory (bronchitis, cold, cough, asthma) problems	17	28	0.41
Fever	10	16	0.40
Urological problem (kidney stone, diuretic)	7	11	0.40
Gastro-intestinal disorder (cholera, digestion, dysentery, stomach ache, constipation, vomiting)	21	33	0.38
Body pains (a toothache, ear, eye diseases, swelling)	13	20	0.37
General health (tonic, blood purification, ulcer, energetic)	8	12	0.36

lecting a medicinal plant for pharmacological evaluation (Etuk and Mohammed 2009).

Rare and Threatened Medicinal Plants

Among the 54 plant species recorded, some plant species are under the serious threat of extinction and are listed in various local and red data list (RET). *Bergenia ciliata (Haw.) Sternb.* (Vulnerable), *Cinnamomum tamala* (Near Threatened), *Geranium wallichianum* (Rare), *Hedychium spicatum Buch. - Ham. Ex Smith*. (Vulnerable), *Thalictrum foliolosum DC.* (Vulnerable), *Taxus baccata L.* (Critically Endangered), *Zanthoxylum armatum* (Vulnerable), *Artemisia nilagirica* (Cl.) *Pamp* (Vulnerable), *Swertia chirayita* (Vulnerable), *Roscoea alpina Royle (Rare)*, *Asparagus curilius Buch. - Ham. Ex Roxb* (Vulnerable). Species like *Drymaria diandra*, *Rosa macrophylla*, *Siegsbeckia orientalis* and *Solanum viarum* were not found in the reported literature from this region.

CONCLUSION

Considering the fact that 54 species were documented from only three villages reflects the potential of the entire area in terms of ethnomedicinal diversity. The present study concludes that people still prefer the plant based medicines in the area and have enogh traditional knowledge to take it to commercial level. The utilisation of these plant resources for treatment of some important diseases like liver, gastro-intestinal, jaunidence reflects the potentioal of available resources for livlihood improvement on sustainable basis. Even some of the reported species from the present study have been reported under RET categories and needs further management and conservation strategies.

RECOMENDATIONS

The potential of these documented species to cure the prevailing diseases among the communitties shows the interdependency of the people with these resources. The highest informant consensus factor (ICF) value reported for liver disorder, bone disorder, jaundice, insect bite suggests the availability and utilization of these species and opportunities for livelihood. These species if utilized sustainably can be practised at commercial scale and to produce cash income. Processing of these ethnomedicinal plant resources can be fruitful by reducing wastage and marketing prospects through value addition. Bio-chemical analysis of these plant resources can be useful for providing nutrition and suitable food materials for dependent and under privileged communities.

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