

Ethno-medicinal Uses of Various Plants Species among the Jaad Bhotiya Community of Uttarakhand, Western Himalaya

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ABSTRACT The Jaad Bhotiya tribal community of Bhagirathi valley is known for their transhumance practices in Uttarakhand. The present paper is the result of a preliminary investigation, which was conducted to understand the traditional healthcare practices and use of plant species in various remedies by the Jaad people. A total 39 plant species are documented to be used in traditional medicine which revealed that the indigenous knowledge system still serves effectively for the well-being of the Jaad community. However, the knowledge was limited to older generation while the younger ones remain deprived of such knowledge. It was also found that various medicinal plants species are less abundant than earlier in the region which is believed due to the ever-increasing anthropogenic drivers and impacts of climate change. The current utilization pattern and limited transfer of knowledge are disparaging to the sustainability of plant resource in the region and indigenous system for human well-being.

INTRODUCTION

Traditional Knowledge System (TKS) is unique among the indigenous communities across the globe. Use of flora and fauna in traditional medicine has been much fascinating among all these knowledge systems, as are distinct in different ethnic communities (Uniyal and Shiva 2005). As per the World Health Organization (WHO 2002), about eighty percent of the world population depends on indigenous medicine. The population in rural and remote hilly terrains are more dependent than others on traditional medicine systems especially based on plant resources (Dhar et al. 2002), used for prevention, diagnosis, and treatment of various physical and mental ailments. However, these practices are much prevalent among tribal communities, especially in India where over 53 million tribal people belong to about 550 communities of 227 ethnic groups (Nautiyal et al. 2000; Phondani et al. 2009). The Indian Himalayan Region (IHR) is inhabited by more than 175 schedule tribes with about 18.5 percent of the total tribal population of India (Negi and Kandari 2017).

The tribal communities of Uttarakhand such as Bhotiya, Jaunsari, Tharu, Raji, Buxas, and others, having unique socio-cultural heritage, lan-

guages, and TKS of life and livelihood, play an important role in their survival (Samal and Dhyani 2010; Negi and Kandari 2017; Nautiyal 2017). These communities largely depend on forests and other natural resources based TKS for their sustenance including food, fodder, medicine and other livelihood options (Maikhuri et al. 2000; Kala 2005; Bhatt et al. 2013). However, traditional healthcare practices based on plant and animal resources have enriched their indigenous identity. Over the time, inadequate documentation of indigenous knowledge system and limited transfer or handing it over to the younger generations has drawn the attention of scientist and policymakers toward its preservation (Samal and Dhyani 2010). Thus, documentation of ethnobotanical and ethno-zoological knowledge on medicinal plants is utmost important to preserve the ancient knowledge system (Kala 2005; Sharma and Lal 2005; Rana and Samant 2011; Bhatt et al. 2013; Negi and Kandari 2017) and to initiate the conservation and management planning for these valuable biological resources (Dhar et al. 2002; Muthu et al. 2006)

The present study was conducted on the Jaad Bhotiya tribe of Uttarkashi district, known for their transhumance practices between Terai, Shivalik and higher Himalaya of Uttarakhand state. The Jaad community holds a diverse wealth of knowledge especially on the use of locally available plant species, however, poorly documented in comparison to the other tribes of Ut-

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tarakhand Himalaya. This paper is a contribution to available knowledge on TKS of tribal communities of Uttarakhand and information to conserve plant resources of ethno-medicinal significance in the Indian Himalayan Region.

Objectives

The investigation was carried out to understand the existing status of medicinal plant usability in traditional healthcare practices by Jaad Bhotiya and the trends in the transfer of traditional knowledge to younger generations.

METHODOLOGY

Study Area and Community Profile

The present study was conducted in two villages namely Bagori (Bhatwari block) and Beerpur (Dunda block) of Uttarkashi district of Uttarakhand state (Fig.1). As per the Census 2011, these two villages are inhabited by 2579 individuals (1272 male and 1307 female) with a total of 619 households including the Jaad community. The area is characterized by cold to moderate temperature in winter (-4°C - 27°C) and summer (10°C - 35°C), and rainfall between 1650 mm to 2400 mm. Bagori is summer village of Jaad Bhotiya while Beerpur is known for the winter residence of this pastoralist community. The Jaad Bhotiyas belong to *Jaad Ganga*, a tributary of river Bhagirathi which flows through joins Nelong valley in Gangotri National Park and joined with Bhagirathi near Bhairav Ghati. Jaads perform pastoral lifestyle and collect various plants from the forest and alpine pastures during summer grazing for use in healthcare remedies, food, spices, beverage, as well as in food preservation. The major occupation of the pastoralist community is rearing of cattle (*Bos indicus*), sheep (*Ovis aries*), goat (*Capra aggeagrus*), horses (*Equus caballus*), mules (*Equus asinus x Equus caballus*) and dogs (*Canis lupus familiaris*) and livestock based income generation activities including their trade. Agriculture is limited to the growing of seasonal vegetables such as cabbage (*Brassica oleracea*), potato (*Solanum tuberosum*), beans (*Phaseolus vulgaris*), Amaranth (*Amaranthus spp*), buckwheat (*Fagopyrum esculentum*) and some other species.

Survey Method and Data Collection

Data was collected during September 2016 to August 2017, through a structured questionnaire developed and provided as Common Methodology Framework (CMF) under the National Mission on Sustaining Himalayan Ecosystem (NMSHE). The information was gathered through direct interaction with the randomly selected 41 respondents including 23 (56 %) and 18 (44%) males and females respectively. In terms of age group, 51.2 percent respondents were below 40 years and 48.8 percent were above 40 years (Table 1). The selected respondents were firstly interviewed by asking questions about common diseases and their knowledge of curing these through home based remedies. Secondly, they were asked to provide information on plant species they collect from their surroundings and their uses. The interviews also included questions on local name of plants, the source of collection or collection sites, part used in a particular ailment, method of use and preference of plants for a particular disease. Information on the availability of medicinal plant in the meadows and forest was also gathered especially from the shepherd respondents.

The plant species were identified through the samples available with the households and some were through field observations. As the household shares similar traditional and cultural system, thus, a total of 41 respondents were randomly interviewed for this preliminary study (Table 1), including male and female of different age groups and educational status. Respondents of different age group were considered for this investigation for better understanding the transfer of TKS among new generations.

Table 1: Background characteristics of interviewed respondents

Variables	Sub-category	Count	Percentage (%)
Sex	Male	23	56.00
	Female	18	44.00
Age	18-40	21	51.20
	41-65	14	34.15
	>66 years	6	14.63
Educational Status	Illiterate	13	31.70
	Primary	11	26.82
	High School	6	14.63
	Intermediate	5	12.20
Marital Status	Graduate	6	14.63
	Married	19	46.34
	Unmarried	22	53.66

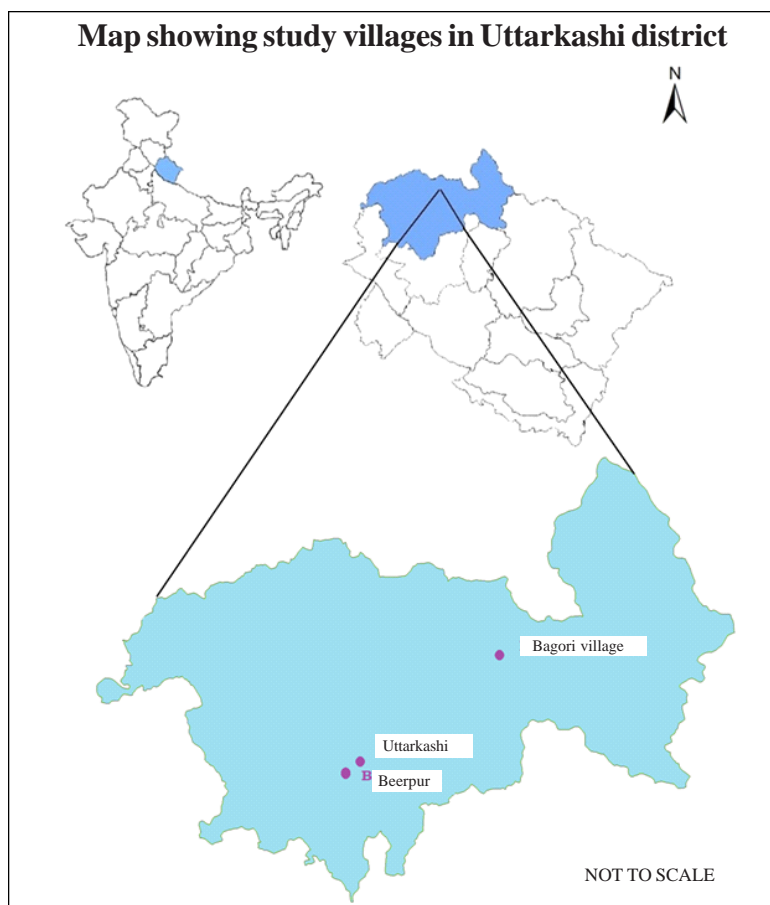


Fig. 1. Study area showing Bagori and Beerpur villages

RESULTS

The Jaad bhotiya community largely depends on traditional healthcare practices for their well-being. A total of 39 plant species belonging to 29 families were documented to be used by the Jaad community in various healthcare remedies. Maximum species belong to family *Liliaceae*, *Ranunculaceae* and *Pinaceae* (3 species each), followed by family *Rosaceae* and *Berberidaceae*, *Apiaceae* and *Amaryllidaceae* (2 species each), while remaining 22 families were represented by one species in each. In terms of collection, 87.18 percent of documented species are collected from forest and meadows in the region while only 12.82 percent species are collected from the agricultural field, kitchen garden and other locations within the village. Out of 39

species, fifty-nine percent (23 species) were reported declining by the community, as these species show less availability in the high altitude forests and meadows. However, thirty-six percent of documented medicinal plants are in the stable stage and are easily available in the region. Two species namely *Allium cepa* and *Cannabis sativa* are considered to be increasing in the area by the community. The impact of climate change and over-exploitation of these plant species were reported as major reasons behind the decline of species abundance in the region.

The community uses underground parts such as roots, rhizome, and tuber of about 53.85 percent of documented species. In terms of above-ground parts, the community uses leaves including twigs (30.77% species), flower (5.13%),

Table 2: Medicinal plants used in the treatment of different ailments

Botanical name	Local name	Family	Collected from	Status	Part used	Used in diseases
<i>Acacia catechu</i> (L.f) Willd.	Khair	Fabaceae	Shivalik forests	Declining	Bark	Bark extract is used in Indigestion and Fatigue
<i>Allium cepa</i> Linn.	Pyaj	Amaryllidaceae	Kitchen garden	Increasing	Bulb	Onion paste with Pinus resin is applied over the wound and is given in dehydration
<i>Aconitum heterophyllum</i> Wall. ex Royle	Atis	Ranunculaceae	forest, meadows	Declining	Tuber	The paste of tuber is given with warm water in fever and body ache
<i>Aconitum balfourii</i> (Bruhl) Muk.	Mitha Vish	Ranunculaceae	forest, meadows	Declining	Tuber	The paste is applied on the skin for treatment of Rheumatism, Musculoskeletal disorder
<i>Ajuga bracteosa</i> Wall. ex. Benth	Neelkanthi	Lamiaceae	forest, meadows	Declining	Leaf	Leaves paste is given in Acidity, Indigestion
<i>Allium humile</i> Kunth	Jhimu, Pharan	Amaryllidaceae	meadows	Stable	Leaf, bulb	Dried leaves and bulbs are used as spices and treatment of asthma and pectoral complaints
<i>Angelica glauca</i> Edgew.	Chora	Apiaceae	Forest	Declining	Roots	Powder of roots is given with tea, vegetables and warm water for treatment of cold, cough and stomach pain
<i>Arisaema tortuosum</i> (Wall.) Schott.	Nagdaman	Araceae	Forest	Stable	Tuber	Tuber powder is used in rheumatism and breathing disorders
<i>Arnebia benthamii</i> Wall.ex.GDon	Balchhadi, Khami	Boraginaceae	meadows	Declining	Roots, twigs	Roots and twigs are stored in mustard oil and used in dandruff and hair fall
<i>Berberis aristata</i> DC	Kingod	Berberidaceae	Forest	Stable	Roots, fruits	Extract of roots and fruit is given in indigestion and tiredness
<i>Berginia ligulata</i> (Wall.) Engl.	Botiya Chai	Saxifragaceae	rocky areas near forest, meadows	Stable	Leaves, seeds	Dried leaves are used in tea making which helps in the treatment of cough, cold, indigestion, urinary disorders and tiredness
<i>Betula utilis</i> D.Don	Bhojyuda, Bhojpatra	Betulaceae	Forest	Declining	Bark, stem	Body pain and wound filling
<i>Cannabis sativa</i> Linn.	Bhang	Cannabaceae	Nearby village	Increasing	Seed, leaf	Used in preparation of <i>Chhang</i> , a traditional beverage, which helps in indigestion and tiredness
<i>Cedrus deodara</i> (Lamb.) G.Don	Devdar	Pinaceae	Forest	Stable	Fruit, seed, hard wood	The essential oil is used in Joint pain, Dandruff and also used on wound filling of livestock
<i>Dactyloctenium aegyptium</i> L.	Panja,	Orchidaceae	Meadows	Declining	Tuber	Tuber paste is used on external wounds and diabetes
<i>Delphinium denudatum</i> Wall.	Nirbisi	Ranunculaceae	Meadows	Declining	Leaf, tuber	The extract is used in Intestinal pain, poisoning
<i>Equisetum</i> spp.	Chasma	Equisetaceae	Riverine areas	Stable	Leaf	Leaves are used in the treatment of Jaundice

Table 2: Contd...

Botanical name	Local name	Family	Collected from	Status	Part used	Used in diseases
<i>Gentiana kurroo</i> (Royle) D.Don	Kaudi	Gentianaceae	Forest	Declining	Rhizome	The paste is given with warm water in indigestion, stomach Pain
<i>Hippophae salicifolia</i> D.Don Servettaz	Amil	Elaeagnaceae	Forest	Stable	Fruit	Fruit juice or extract is given in diarrhoea and dehydration
<i>Juglans regia</i> Linn.	Akhor	Juglandaceae	Forest	Declining	Dry fruit, leaf, bark	Leaves are used in pyorrhoea, bark and fruit cover is used in natural dyes
<i>Juniper spp.</i>	Thelu	Cupressaceae	Forest, meadows	Declining	Leaves	Used in the making of Chhang and given in Indigestion
<i>Morina longifolia</i> Linn.	Bishkandaru	Dipsacaceae	Nearby village	Stable	Roots and stem	Roots paste is used wound filling
<i>Nardostachys jatamansi</i> DC.	Masi	Valerianaceae	Forest	Declining	Roots, leaves	Used in internal pain
<i>Paris polyphylla</i> Smith.	Satuwa	Liliaceae	Forest	Declining	Tuber, roots	Tuber paste or powder is given with warm water in fever, headache, poisoning and wound filling
<i>Picrorhiza kurooa</i> Royle ex. Benth	Kaduwa	Scrophulariaceae	Forest, meadows	Declining	Roots	The paste is given in fever, jaundice, pain, and dysentery
<i>Podophyllum hexandrum</i> Royle	Ban Kakdi	Berberidaceae	Forest	Declining	Tuber, fruit	The paste is applied on the skin for treatment of skin disease and wounds filling
<i>Pinus roxburghii</i> Sarg	Chir	Pinaceae	Forest	Stable	Resin	Applied on wound and cuts with onion paste
<i>Pinus wallichiana</i> A.B Jacks.	Kail	Pinaceae	Forest	Increasing	Resin	Applied on wound and cuts with onion paste
<i>Polygonatum verticillatum</i> (Linn) All.	Salam Mishri	Liliaceae	Forest	Declining	Tuber, leaf	Extract or paste is given in weakness
<i>Prunus armeniaca</i> Linn.	Chulu	Rosaceae	Nearby agricultural Forest	Stable	Fruit, seed	Fruit paste or Chutney with salt is given in dehydration and abdominal pain
<i>Rheum emodi</i> Wall.	Archu	Polygonaceae	Forest	Declining	Tuber, root	The paste is applied on the skin in the treatment of skin disease, wound, pain and swelling
<i>Rhododendron arboreum</i> Smith.	Buransh	Ericaceae	Forest	Stable	Flower	Flower paste or extract is given in fever
<i>Rosa moschata</i> Herrm.	Kujin	Rosaceae	Forest	Stable	Fruit	Paste or chutney is used for curing gastrointestinal disorders, indigestion
<i>Saussurea obvallata</i> (DC.) Edgew.	Brahmkamal	Asteraceae	Meadows	Declining	Flower	The flower is used in religious offering and smoke is used in mental disorders
<i>Selinum vaginatum</i> C.B Clarke.	Bhukesh Thuner	Apiaceae	Forest, meadows	Declining	Root	Skin disease, swelling muscles
<i>Taxus wallichiana</i> Zucc.		Taxaceae	Forest	Declining	Bark, seed	Bark and seed extract is given in the treatment of Ulcer and diabetes
<i>Trillidium govenianum</i> (Wall ex. D.Don) Kunth	Chhota Satuwa	Liliaceae	Forest	Declining	Tuber	Tuber paste or powder is given with water in the treatment of rheumatism and fever
<i>Zanthoxylum armatum</i> DC.	Timru	Rutaceae	Forest	Stable	Leaf, twigs	Leaves and twigs are used in tooth ache
<i>Zingiber officinale</i> Roscoe	Adrak	Zingiberaceae	Kitchen garden/market	Stable	Tuber	The extract is used in cold and cough

bark including stem outgrowth (15.38%), seeds (12.82%), fruits (17.95%) and essential oil in different herbal preparations (Table 2). These remedies are given to the patient in the treatment of various ailments through oral (71.8%), dermal (30.77%) and nasal routes (2.56%). A single plant is used in the preparation of more than one remedies and treatment of many ailments. In terms of plant species used for a particular ailment, maximum eleven recorded species are used in pain including body ache, joint pain, abdominal pain and headache followed by seven species used in cuts and wounds, and indigestion respectively. Two species are used in diabetes, three in cold and cough, two in dysentery and diarrhea, four species in fever and two species in jaundice (Table 3). In terms of traditional knowledge on medicinal plant use among different age group, the elderly respondents have more information in comparison to the younger generation. Moreover, the respondent having limited education (up to primary) or illiterate are on top in comparison to the individual having higher education and also married respondents hold more knowledge in comparison to the unmarried individuals.

Table 3: Use of different plants based remedies in the treatment of common ailments

<i>Ailments</i>	<i>Number of plants used</i>
Cold and cough	3
Cut and wounds	7
Diabetes	2
Dysentery and diarrhea	2
Fever	4
Indigestion	7
Jaundice	2
Pain (body ache, joint pain, etc.)	11

DISCUSSION

Use of plants as medicines in traditional healthcare formulations plays a vital role in human life and its documentation is important for the sustainability of such knowledge system. However, it has always remained difficult to obtain traditional knowledge or the professional secret (Maikhuri et al. 2000), on these formulations from the best information sources (community and practitioners) on medicinal plants (Zeraburk and Yirga 2012). This paper documents the use of medicinal plants among the Jaad and revealed that the community still depends on

the traditional healthcare practices, and are always inclined towards home based remedies before yielding modern medical consultation. Documentation of 39 medicinal plant species is an important contribution to existing knowledge on locally available plants used by the tribal communities of Uttarakhand. However, many more species might be in use as traditional medicine by the community as it largely depends on natural resources. Moreover, the indigenous knowledge system is an important component of Bhotiya tribal community which has evolved over a long period of time with necessities and experiences (Samal et al. 2010). In a previous study, more than 150 medicinal plants are used as more than 150 combinations in the treatment of various ailments by the Bhotiyas of the Central Himalayas Region (Maikhuri et al. 2000). Other studies conducted on Bhotiyas in the Central Himalayan Region have reported use of about 40 plants species in more than 50 indigenous medicine/treatment (Samal et al. 2010), 86 plant species in treatment of 37 ailments by the Tolcha and Marcha sub-communities of Bhotiya tribal community (Phondani et al. 2010) and 50 plant species in various ailments by the Bhotiya people of Dhauri Ganga valley (Kandari et al. 2012). However, only 29 medicinal plants species were reported to be used in traditional healthcare by the Jaad tribal community of the Bhagirathi valley (Maikhuri et al. 2000).

In terms of collection, most of the species are collected (roots and leaves) from wild including the forests and meadows in different seasons for substantial use in herbal preparations. Summer and monsoon are considered best harvesting season to collect the wild medicinal plants by the community. It is widely known that uses of roots and leaves are prevalent in traditional medicine systems (Kala et al. 2002; Kala 2005; Uniyal and Shiva 2005). However, these parts are important for regeneration of new plants and unscientific extraction from the wild poses serious effects on survival of mother plants (Dhar et al. 2002). Moreover, collection in summer affects the flowering and fruiting of the plant while monsoon affects the habitat as soil erosion is prevalent in the vertical slopes. Over the time, people in the region became familiar with the economic importance of medicinal plants and collecting resources for selling purposes and when the subsistence is replaced by economic benefits, sustainability always gets ne-

glected. The declining status of 23 commonly used rare and endangered medicinal plants species can be an indicator of unsustainable utilization or over-exploitation practices and an issue of concern. Most of these species (80%) were found to be restricted to the alpine region of Uttarakhand Himalaya. Many researchers have reported many of these species (such as *Aconitum balfourii*, *Aconitum heterophyllum*, *Angelica glauca*, *Arnebia benthamii*, *Berginia ligulata*, *Dactylorhiza hatagirea*, *Nardostachys jatamansi*, *Paris polyphylla*, *Picrorhiza kurrooa*, *Podophyllum hexandrum*, *Saussurea obvallata* and *Trillidium govenianum*) as declining, depleting and on the verge of extinction in previous studies (Maikhuri et al. 2000; Uniyal et al. 2002; Kala 2005; Silori and Badola 2005; Sundriyal 2005; Uniyal et al. 2005; Phondani et al. 2009; Bhatt et al. 2013; Kaur and Balodi 2016; Negi et al. 2017; Nautiyal 2017; Caplins and Halvorson 2017). In addition, anthropogenic activities like unregulated grazing and irresponsible tourism practices including the traditional religious practices based on these medicinal plants and climate change consequences are considered other reasons behind depleting the valuable biological resource in the Himalayan region (Kala 2006; Kaur and Balodi 2016). As a consequence of these issues, several medicinal plant species of ethno-botanical and economic significance have been listed in various categories of International Union for Conservation of Nature (IUCN) Red Data Book (Pandey and Das 2006).

TKS have incessantly been transferred from generations to generations over hundreds of years. However, the current developmental regime has changed the lifestyle of people over time and indigenous communities including Jaads have also not been left unaffected by modernization. The paper reveals that with the increasing education and modern healthcare facilities, the transfer of traditional knowledge system to the new generation is limited and insignificant. In fact, the older individuals are keen to share or transfer the TKS on the medicinal plant to the newer generation, however, younger ones show limited interest to acquire the knowledge of traditional life and livelihood. As a result, the transfers of TKS between generations have been neglected or not practiced, which may pace eradication of rich and diverse culture in the Himalayan region (Nautiyal 2017). Such loss of knowl-

edge is a serious issue of concern and has serious implications on the development of various pharmaceutical formulations (Raut et al. 2012; Malik et al. 2015; Nautiyal 2017). Thus, appropriate initiatives are needed to be taken as earliest as possible in order to conserve the exceptional knowledge system and rich heritage.

CONCLUSION

Indigenous knowledge system is acquired as a result of profound experience which the community utilizes for their survival. A number of plant species are used by Jaad Bhotiya tribal community in home-based remedies which have been evolved as a result of necessities and experiences over the period of time. The modern socio-economic development has led to over-exploitation of these valuable resources and has also restricted the transfer of knowledge to the younger generation. It has prevalent impact on resources availability, associated knowledge as well as the rich cultural heritage over the years. Thus, the present documentation would be beneficial to retain the traditional knowledge of medicinal plants and understanding the need of its conservation for the well-being of indigenous community.

RECOMMENDATIONS

A comprehensive documentation of traditional knowledge system among the Jaad tribal community would be helpful to understand more about the existing knowledge. An integrated approach including documentation, training on sustainable utilization, cultivation, providing resources for knowledge transfer and building awareness on medicinal plants would be crucial towards balancing subsistence and ecosystem services. Indigenous communities must be involved in any conservation and management planning in the region for the long-term conservation of these valuable resources and associated heritage.

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