



Ethnobotanical Uses of Plants among the Bhotiya Tribal Communities of Niti Valley in Central Himalaya, India

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Research

Abstract

A study of the medicinal plants and knowledge of diseases was conducted in Bhotiya tribal communities in the Niti valley of Alaknanda catchment in Central Himalaya. Indigenous knowledge of local traditional healers about plants used for medicinal purposes was collected through questionnaire and interviews. Eighty-six plant species were identified as being used for treatment of 37 common ailments. The methods and application of uses of these plants varies and was based on the nature of disease.

Introduction

There are over 53 million tribal people in India belonging to 550 communities of 227 ethnic groups (Maikhuri & Gangwar 1993, Nautiyal *et al.* 2000). These tribal communities draw their sustenance largely from forests for food, medicine and other requirements. Forests represent a whole way of life for tribal peoples and as such their life and economy are, therefore, intimately interwoven with the forests and forest wealth (Gangwar & Ramakrishnan 1990). The mountainous region of the Himalaya is inhabited by diverse tribal communities, and among these the Bhotiyas mainly inhabit the high altitude areas of Uttarakhand state in India and practice transhumance pastoralism (Farooquee 1994, Kala 2005, Maikhuri *et al.* 1998).

The Bhotiya tribal communities have a wealth of knowledge on the use of medicinal plants in their locality. Collection of medicinal plants from the wild is has long been conducted while grazing livestock in the forests and alpine pastures. Several medicinal plants have been listed as endangered, vulnerable and threatened due to over exploitation or unskillful harvesting in the forest and alpine meadows (Farooquee & Saxena 1996, Kala 1998, Kala 2002, Maikhuri *et al.* 1998, 2000, Nautiyal *et al.* 2000) and also due to commercial exploitation by a number of individuals and agencies.

Therefore, the present study is an attempt:

1. to identify the plants being used for medicinal purposes by the Bhotiya tribal communities in order to better characterize their pharmacopoeia.
2. to better understand Bhotiya knowledge about their health care system for treating different diseases in order to understand the basis for their interactions with the forests.

Study Area and methods

The River Alaknanda originates in the Satopanth and Bhagirath kharak glacier, which rise from the eastern slope of Chaukamba peak (7138m.) of Rudraprayag district of Uttarakhand state. In its course of 141.5 km it drains approximately 11000 km² area. The catchment area of Alaknanda river extends between 29° 58' 34" to

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31° 04' 20" N and 78° 34' 31" to 80° 17' 54" E. It narrows down towards the west and tapers off at Devprayag to a confluence with the river Bhagirathi forming the holy Ganga. It covers a wide range of climatic conditions under an altitudinal variation of 642-7817 meter altitude above sea level (m.a.s.l.). The Alaknanda catchment area stretches

into four districts of Garhwal region of Uttarakhand state in India viz., Chamoli, Rudraprayag, Pauri and Tehri.

The present study was carried out in 15 villages inhabited by Tolchha and Marcha sub-communities of the Bhotiya community in the Niti valley of Alaknanda catchment in Central Himalaya, Uttarakhand state of India (Figure 1).



Figure 1. Fifteen study villages inhabited by Tolchha and Marcha sub-communities of the Bhotiya community in the Niti valley of Alaknanda catchment in Central Himalaya, Chamoli District, Uttarakhand State, India.

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The 15 Bhotiya villages (Bampa, Dronagiri, Farki, Garpak, Ghamshali Jhuma, Kaga, Kaileshpur, Lata, Malari, Niti, Phagti, Reni, Surathota, Tolma) mainly occupy the forested regions and have a total population of 6378 with an average family size of 5-6 persons. All primary rural settlements except for Lata, Phagti, Reni, Surathota and Tolma are located below 2000 m.a.s.l. All households of Jhuma, Garpak, Kaga, Dronagiri, Malari, Kaileshpur, Farki, Bampa, Ghamshali and Niti villages, have two permanent dwellings; one in the high altitude between 2000 to 3500 m.a.s.l., and other in the low altitude between 800 to 1500 m.a.s.l. and all of them practice transhumance every year between summer and winter settlements. The Bhotiya have their own culture, tradition and religious beliefs. Their major occupations have been sheep rearing and agriculture, with agriculture taking precedence over pastoralism at present. Almost all of the households are involved in agricultural activities by way of subsistence farming.

Three basic approaches were adopted to study the uses of plants by Bhotiya communities in the region.

1. An interview based approach in which questions related to the uses of plants for different purposes (i.e., medicine, food, fuel, fodder etc.) was recorded with the help of an informant while making visits to the forests for identifications.
2. An inventory based approach involving collection of plant specimens and subsequent interviews with informants requesting names and uses of the plants collected.
3. An interactive discussions approach through workshops/meetings and discussions held with various

stakeholders. Traditional herbal healers (**vaidyas**), scientists, medical doctors, forest officers, environmentalists, school teachers, social workers and local people were invited to hold discussions about the different uses of plants, methods and periods of collection, their conservation strategies and the fate of traditional knowledge systems, etc. Questionnaires were filled by participants to understand the utilization pattern of plant species used for treating different ailments.

Information related to composition of medicines prepared for treating different ailments for a particular period of time was obtained from traditional herbal healers of the studied community. Cross-checking of collected information was done during field visits.

The collected plant specimens were identified with the help of regional floras (Gaur 1999, Naithani 1985) and taxonomists. Specimens of each species identified were brought to the G.B. Pant Institute (Garhwal Unit) herbarium for scientific identification where they were subsequently deposited. This study was carried out between December 2006 to December 2008.

Results

Eighty-six plant species distributed in 43 families were documented (Table 1) that were used in treating 37 ailments (Table 2) in the high altitude areas occupied by the Bhotiya tribal communities. Twenty-five species were used for treating more than one disease. Fourteen species were mostly used in the treatment of skin diseases.

Table 1. Plants documented as used medicinally among the Bhotiya communities of Niti valley in Central Himalaya, India.

Scientific name	Vernacular name	Source/Locality	Habit
<i>Achyranthes aspera</i> L. (Amaranthaceae)	Latjiri, Apamarg	Road side	Herb
<i>Aconitum balfourii</i> Stapf (Ranunculaceae)	Mithabish	Alpine forest	Herb
<i>Aconitum heterophyllum</i> Wall. ex Royle (Ranunculaceae)	Atis	Sub-alpine forest	Herb
<i>Aesculus indica</i> (Wall. ex Cambess.) Hook. (Sapindaceae)	Pangar	Montane forest	Tree
<i>Allium cepa</i> L. (Amaryllidaceae)	Pyaz	Kitchen garden	Herb
<i>Allium humile</i> Kunth (Amaryllidaceae)	Jambu Faran	Kitchen garden	Herb
<i>Allium sativum</i> L. (Amaryllidaceae)	Lashun	Kitchen garden	Herb
<i>Angelica glauca</i> Edgew. (Apiaceae)	Choru	Sub-alpine forest	Herb
<i>Arisaema tortuosum</i> (Wall.) Schott (Araceae)	Bag-Mungri	Road sides, near forest	Herb
<i>Arnebia benthamii</i> (Wall. ex G. Don) I.M. Johnst. (Boraginaceae)	Balchari	Sub-alpine forest	Herb
<i>Asparagus racemosus</i> Willd. (Liliaceae)	Sataver, Jhirna	Submontane to montane forest	Shrub
<i>Berberis aristata</i> DC. (Berberidaceae)	Chotru	Montane forest	Shrub
<i>Berberis lycium</i> Royle (Berberidaceae)	Kirmor	Middle hill forest	Shrub
<i>Bergenia ciliata</i> Sternb. (Saxifragaceae)	Silphori	Sub-alpine forest	Herb

Scientific name	Vernacular name	Source/Locality	Habit
<i>Betula alnoides</i> Buch.-Ham. ex D. Don (Betulaceae)	Saur	Sub montane to montane forest	Tree
<i>Betula utilis</i> D. Don (Betulaceae)	Bhojpatra	Montane forest	Tree
<i>Brassica campestris</i> L. (Brassicaceae)	Sarsoo	Crop field	Herb
<i>Brassica juncea</i> (L.) Czern. (Brassicaceae)	Rai	Kitchen garden	Herb
<i>Cannabis sativa</i> L. (Cannabaceae)	Bhang	Road sides	Herb
<i>Capsicum annuum</i> L. (Solanaceae)	Mirch	Kitchen garden	Herb
<i>Carum carvi</i> L. (Apiaceae)	Kalajeera	Kitchen garden	Herb
<i>Cedrus deodara</i> (Roxb. ex D. Don) G. Don (Pinaceae)	Devdar	Montane forest	Tree
<i>Centella asiatica</i> (L.) Urb. (Apiaceae)	Brahmi	Roadside	Herb
<i>Cicerbita macrorhiza</i> (Royle) Beauverd (Asteraceae)	Karatu	Montane forest	Herb
<i>Cirsium verutum</i> (D. Don) Spreng. (Asteraceae)	Biskanara	Montane forest	Herb
<i>Corydalis cornuta</i> Royle (Fumariaceae)	Chitra jhar	Montane forest	Herb
<i>Cucumis sativus</i> L. (Cucurbitaceae)	Kakree	Kichen garden	Herb
<i>Curcuma longa</i> L. (Zingiberaceae)	Haldi	Kitchen garden	Herb
<i>Cuscuta reflexa</i> Roxb. (Convolvulaceae)	Akash bel	Road side	Herb
<i>Cymbopogon martini</i> (Roxb.) Will. Watson (Poaceae)	Mirchya ghass	Roadside	Herb
<i>Cynodon dactylon</i> (L.) Pers. (Poaceae)	Dubla	Waste places	Herb
<i>Dactylorhiza hatagirea</i> (D. Don) Soó (Orchidaceae)	Hatajari	Sub-alpine forest	Herb
<i>Datura stramonium</i> L. (Solanaceae)	Dhatura	Waste places, Road sides	Herb
<i>Delphinium denudatum</i> Wall. ex Hook. f. & Thomson (Ranunculaceae)	Nirbishi	Middle hills forest	Herb
<i>Echinochloa frumentacea</i> Link (Poaceae)	Jhangora	Crop field	Herb
<i>Excoecaria acerifolia</i> Didr. (Euphorbiaceae)	Dudhlu	Montane forest	Herb
<i>Ficus semicordata</i> Buch.-Ham. ex Sm. (Moraceae)	Khaina	Road side	Tree
<i>Galium aparine</i> L. (Rubiaceae)	Lesskuri	Road side	Herb
<i>Glycine max</i> (L.) Merr. (Fabaceae)	Kala bhatt	Crop field	Herb
<i>Hibiscus rosa-sinensis</i> L. (Malvaceae)	Gudhal	Kitchen garden	Shrub
<i>Hippophae rhamnoides</i> L. (Elaeagnaceae)	Amesh	Montane forest	Shrub
<i>Hordeum vulgare</i> L. (Poaceae)	Jau	Crop field	Herb
<i>Juglans regia</i> L. (Juglandaceae)	Jangli akhrot	Submontane to montane forest	Tree
<i>Lyonia ovalifolia</i> (Wall.) Drude (Ericaceae)	Anyar	Monate forest	Tree
<i>Macrotyloma uniflorum</i> (Lam.) Verdc. (Fabaceae)	Gaheth	Crop Field	Herb
<i>Megacarpaea polyandra</i> Benth. ex Madden (Brassicaceae)	Barmoa	Sub-alpine forest	Herb
<i>Mentha arvensis</i> L. (Lamiaceae)	Podina	Kitchen garden	Herb
<i>Maianthemum purpureum</i> (Wall.) La Frankie (Asparagaceae)	Puyanu	Sub-alpine forest	Herb
<i>Morina longifolia</i> Wall. (Dipsacaceae)	Biskandru	Sub-alpine forest	Herb
<i>Nardostachys grandiflora</i> DC. (Valerianaceae)	Jatamansi	Sub-alpine forest	Herb
<i>Nepeta discolor</i> Royle ex Benth. (Lamiaceae)	Khirku	Montane forest	Herb
<i>Paeonia emodi</i> Wall. ex Royle (Paeoniaceae)	Chandra	Near forest	Herb
<i>Panicum miliaceum</i> L. (Poaceae)	Cheena	Crop field	Herb
<i>Picrorhiza kurrooa</i> Royle ex Benth. (Plantaginaceae)	Kutaki	Alpine forest	Herb

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Scientific name	Vernacular name	Source/Locality	Habit
<i>Pinus wallichiana</i> A.B. Jacks. (Pinaceae)	Kail	Montane forest	Tree
<i>Pleurospermum angelicoides</i> (Wall. ex DC.) Benth. ex C.B. Clarke (Apiaceae)	Chippi	Sub-alpine forest	Herb
<i>Podophyllum hexandrum</i> Royle (Podophyllaceae)	Bankakri	Alpine forest	Herb
<i>Polygonatum verticillatum</i> (L.) All. (Liliaceae)	Salam misri	Sub-alpine forest	Herb
<i>Potentilla lineata</i> Trevir. (Rosaceae)	Bjradanti	Montane forest	Herb
<i>Quercus leucotrichophora</i> A. Camus (Fagaceae)	Banj	Sub-montane to montane forest	Tree
<i>Raphanus sativus</i> L. (Brassicaceae)	Muli	Kitchen garden	Herb
<i>Rheum australe</i> D. Don (Polygonaceae)	Dolu	Alpine forest	Herb
<i>Rheum webbianum</i> Royle (Polygonaceae)	Tatri	Montane forest	Herb
<i>Rhododendron anthopogon</i> D. Don (Ericaceae)	Awon	Montane forest	Tree
<i>Rhododendron arboreum</i> Sm. (Ericaceae)	Burans	Montane forest	Tree
<i>Sapindus saponaria</i> L. (Sapindaceae)	Reetha	Forest, Nearby Village	Tree
<i>Saussurea costus</i> (Falc.) Lipsch. (Asteraceae)	Kuth	Agriculture field	Herb
<i>Saussurea obvallata</i> (DC.) Edgew. (Asteraceae)	Brahm kamal	Sub-alpine forest	Herb
<i>Swertia chirata</i> (Wall.) C. B. Clarke (Gentianaceae)	Cheraita	Sub-alpine forest	Herb
<i>Taxus baccata</i> L. (Taxaceae)	Thuner	Sub-alpine forest	Tree
<i>Terminalia arjuna</i> (Roxb. ex DC.) Wight & Arn. (Combretaceae)	Arjuna	Near forest	Tree
<i>Thalictrum javanicum</i> Blume (Ranunculaceae)	Mamiri	Sub-alpine	Herb
<i>Urtica dioica</i> L. (Urticaceae)	Kandali	Roadside	Shrub
<i>Vigna mungo</i> (L.) Hepper (Fabaceae)	Kali dal	Crop field	Herb
<i>Zanthoxylum armatum</i> DC. (Rutaceae)	Timru	Road side	Shrub
<i>Zingiber officinale</i> Roscoe (Zingiberaceae)	Adrak	Kitchen garden	Herb

Table 2. Ailments treated with medicinal plants, preparation methods, and dosing from Bhotiya communities of the Niti valley in Central Himalaya, India. Standard dosing: (qd) once a day; (bid) twice a day; (tid) three times a day; (x1d) continuous for 1 day; (x3d) continuous for 3 days; (x7d) continuous for 7 days, (cm) continuous for 1 month; (pqa) continuous for 3 months; (psa) (x7d)(x7d) continuous 6 month; (pa) continuous for 1 year; (cst) continue same treatment for more than 1 year.

Ailments	Plant used	Method of Preparation	Doses
Fever	Cheraita (<i>Swertia chirata</i>)	Fresh leaves and stems are milled and made into a juice to drink with water.	1 glassful (bid) (x3d)
	Chippi (<i>Pleurospermum angelicoides</i>)	50gm root of chippi , 10gm of cumin (<i>Cuminum cyminum</i> L.) seed and 7-8 grains of black pepper (<i>Piper nigrum</i> L.) are milled together and boiled with 200ml water on moderate flame for up to 5-10 minutes and kept for cooling. The liquid is drunk to treat fever.	4 spoonfuls (tid) (x3d)
	Kutki (<i>Picrorhiza kurrooa</i>)	50gm dried roots is milled along with 2 spoonfuls of sugar and drunk with water.	1 cupful (bid) (x3d)
Headache	Atis (<i>Aconitum heterophyllum</i>)	Root paste applied on the forehead to treat headache.	5gm (bid) (x1d)
	Awon (<i>Rhododendron anthopogon</i>)	100gm powder of dried leaves is mixed with 1 spoonful of sugar and 200ml water added and boiled for a few minutes. After cooling, juice is drunk to treat headache.	20ml (bid)(x1d)

Ailments	Plant used	Method of Preparation	Doses
Headache	Karatu (<i>Cicerbita macrorrhiza</i>)	Juice of fresh leaves is drunk and root paste rubbed on the forehead to treat headaches.	6-7 drops (tid) (x1d)
Cold and cough	Amesh (<i>Hippophae rhamnoides</i>)	100ml decoction of fruit juice is mixed with 1 spoonful of sugar and 30-40gm of finger millet (<i>Eleusine coracana</i> (L.) Gaertn.) and eaten to treat cold and cough.	20gm (bid) (x3d)
	Bhojpatra (<i>Betula utilis</i>)	50gm resin of bhojpatra is boiled with 250ml water on moderate flame for 10-15 minutes and mixed with 2 spoonfuls of ghee and ½ spoonful of salt and drunk to treat cold and cough.	50ml (bid) (x3d)
	Choru (<i>Angelica glauca</i>)	1gm root powder is mixed with 1gm leaf powder of basil (<i>Ocimum basilicum</i> L.) in 1 cup tea and drunk to treat a common cold.	1 cupful (tid) (x3d)
Wounds, Cuts and Boils	Biskandru (<i>Morina longifolia</i>)	Juice of fresh leaves is mixed with 3-4 drops of mustard oil and applied externally on the infected portion to treat boils and wounds.	20ml (bid) (x3d)
	Brahm kamal (<i>Saussurea obvallata</i>)	100ml decoction of dried leaves is mixed with ½ spoonful of salt and a few drops of this is applied in the infected portion to treat boils, cuts and wounds.	20ml (bid) (x3d)
	Haldi (<i>Curcuma longa</i>)	Rhizome paste is applied to treat boils.	5gm (bid) (x3d)
	Hatajari (<i>Dactylorhiza hatagirea</i>)	Root paste is applied to treat cuts.	5gm (bid) (x3d)
	Tatri (<i>Rheum webbianum</i>)	100gm of dried leaf powder is mixed with <i>Rumex hastatus</i> D. Don leaf powder and 2 spoonfuls of mustard oil and applied externally to treat boils and wounds.	20gm (qd) (x3d)
Diarrhea	Podina (<i>Mentha arvensis</i>)	Fresh leaves are milled with lashun to make a chatni . This is eaten to treat diarrhea.	5gm (tid) (x3d)
	Pyaz (<i>Allium cepa</i>)	1 bulb milled and mixed with 5gm salt and drunk with water.	½ glassful (bid) (x3d)
Goiter	Dolu (<i>Rheum australe</i>)	5gm dry root milled with 5ml water and made into a paste	1gm (qd) (x7d)
	Jambu faran (<i>Allium humile</i>)	5gm dry leaves are fried in 50ml mustered oil and rubbed in the infected part, and leaves used with pulse.	5ml (qd) (x7d)
Rheumatism	Biskanara (<i>Cirsium verutum</i>)	100gm root boiled with 500ml water is prepared as a 50ml decoction which is further mixed with 1-2 spoonfuls of devdar oil and applied externally on joints to treat rheumatism.	4-5 drops (pqa)
	Dhatura (<i>Datura stramonium</i>)	Seed paste is rubbed on to treat rheumatism.	5gm (bid) (pqa)
	Jatamansi (<i>Nardostachys grandiflora</i>)	10gm root paste mixed with 50gm ghee (purified semi-liquid butter), mildly heated for 5 minutes and soon after, rubbed on the joints to treat rheumatism.	10gm (tid) (pqa)
High blood pressure	Thuner (<i>Taxus baccata</i>)	1gm dry powder of bark is mixed with 1gm salt, 1 spoonful ghee and 1 cupful of water to make a namkeen tea.	1cupful (bid) (cst)

Ailments	Plant used	Method of Preparation	Doses
Asthma	Barmoa (<i>Megacarpaea polyandra</i>)	100ml root decoction of barmoa is mixed with 1 spoonful sugar and 4-5 drops of apricot (<i>P. armeniaca</i>) oil and drunk to treat asthma.	20ml (tid) (cst)
	Bhojpatra (<i>Betula utilis</i>)	50gm resin of bhojpatra is milled with 20gm leaf powder of chandra and fried in 2 spoonfuls apricot (<i>Prunus armeniaca</i> L.) oil and drunk to treat asthma.	25ml (tid) (cst)
	Pharan (<i>Allium humile</i>)	5gm dried leaves of pharan and 10gm root powder of kuth are fried in 2 spoonfuls of ghee and eaten to treat asthma.	10gm (tid) (cst)
Paralysis	Adrak (<i>Zingiber officinale</i>)	10gm ginger rhizome is mixed with 10ml honey and eaten.	5gm (bid) (cst)
	Lashun (<i>Allium sativum</i>)	5-bulbs are fried in 50ml mustard oil and filtered. The oil is then rubbed on the infected part before sleeping.	10ml (qd) (cst)
	Silphori (<i>Bergenia ciliata</i>)	Leaves are boiled in water, dried in sun light, and made into a tea powder. The tea is used without sugar and milk and drunk with goor (4gm goor with half cup tea).	½ cup (bid) (psa)
Leprosy	Chitra jhar (<i>Corydalis cornuta</i>)	Root paste is applied.	1gm (qd) (pqa)
	Mithabish (<i>Aconitum balfourii</i>)	Root paste is applied.	1gm (qd) (pqa)
Rabies	Kandali (<i>Urtica dioica</i>)	5 fresh leaves milled and mixed with 1gm chili powder and made into a paste without water.	1gm (qd) (x7d)
	Mirch (<i>Capsicum annuum</i>)	2 fruit milled and made into a powder.	2gm (qd) (x7d)
	Mirchya ghass (<i>Cymbopogon martinii</i>)	Fresh leaves are milled and made into a paste.	1gm (qd) (x7d)
Snake bite/ Scorpion sting	Banj (<i>Quercus leucotrichophora</i>)	Seed paste is prepared and applied.	1gm (bid) (x3d)
	Kuth (<i>Saussurea costus</i>)	Root paste is applied.	1gm (bid) (x3d)
	Mirch (<i>Capsicum annuum</i>)	Fruit milled and made into a powder to apply.	1gm (qd) (x3d)
	Nirbishi (<i>Delphinium denudatum</i>)	Root paste is applied.	1gm (bid) (x3d)
	Pyaz (<i>Allium cepa</i>)	30ml juice of onion bulb is mixed with 30ml mustard oil and made into a paste.	1gm (bid) (x3d)
	Reetha (<i>Sapindus saponaria</i>)	Seed mass milled and drunk with water.	1 spoonful (bid) (x3d)
Bone fracture	Arjuna (<i>Terminalia arjuna</i>)	Bark is milled and made into a paste that is used to plaster on fractured part then covered with bark for 28-35 days.	100gm (qd) (cm)
	Kail (<i>Pinus wallichiana</i>)	Resin is mildly heated and used to plaster on fracture part, which is immediately covered by <i>B. utilis</i> bark, which reduces the pain and treats sprain and fracture.	20ml (qd) (cm)
	Kali dal (<i>Vigna mungo</i>)	250gm seeds are mixed with 250ml water and made into a paste that is used to plaster the fractured part. This is then covered with bhojpatra/timru bark for 28-35 days.	100gm (qd) (cm)

Ailments	Plant used	Method of Preparation	Doses
Bone fracture	Thuner (<i>Taxus baccata</i>)	Yolk of fresh egg is mixed with thuner bark and made into a paste that is used to plaster on fractured part then covered with bark for 28-35 days.	100gm (qd) (cm)
Kidney stone	Gaheth (<i>Macrotyloma uniflorum</i>)	250gm of seeds are boiled with 1 liter of water and seeds used in pulse continuously for 7 days.	200ml (bid) (cst)
	Kala bhatt (<i>Glycine max</i>)	Seeds boiled in water to make a hot liquid soup that is drunk to treat kidney stones.	1 bowlful (qd) (cst)
	Silphori (<i>Bergenia ciliata</i>)	1gm of root powder is used with 1 glass of water. Dry leaf powder is used in tea.	½ glassful (qd) morning (cst)
Jaundice	Jhangora (<i>Echinochloa frumentacea</i>)	Make a chaval (bhat) and consume it.	4-5 spoonfuls (bid) (x7d)
	Kuth (<i>Saussurea costus</i>)	100ml of root decoction of kuth is mixed with 2 spoonfuls of honey and 50ml milk and drunk to treat jaundice.	50ml (tid) (x7d)
	Kutki (<i>Picrorhiza kurrooa</i>)	50gm dried root and 3 spoonfuls sugar are dipped in 200ml of water and left for one night. The next day it is drunk to treat jaundice.	50ml (tid) (x7d)
	Muli (<i>Raphanus sativus</i>)	Used as a salad.	1 root (tid) (cm)
Cancer	Amesh (<i>Hippophae rhamnoides</i>)	Make a juice of mature fruit with 250gm of sugar used in 1 liter juice.	2 spoonfuls (qd) before sleeping (pqa)
	Bankakri (<i>Podophyllum hexandrum</i>)	Root is prepared as a paste to be applied.	1gm (qd) (psa)
	Thuner (<i>Taxus baccata</i>)	1gm dry of bark powder is mixed with 1gm of salt and 1 spoonful of ghee for 1 cup water and makes a namkeen tea.	1cup (bid) (pa)
Diabetes	Cheraita (<i>Swertia chirata</i>)	5gm of leaves and stem are milled, steeped in 250ml of water over night, then filter and drunk.	1 glass (qd) morning (psa)
	Kirmor (<i>Berberis lycium</i>)	5gm of root is milled, steeped in 250ml of water over night, then filter and drunk.	1 glassfuls (qd) Morning (psa)
	Kutaki (<i>Picrorhiza kurrooa</i>)	5gm of root is milled, steeped in a copper pot with 250ml of water over night, then filter and drunk.	1 glassfuls (qd) morning (psa)
	Mamiri (<i>Thalictrum javanicum</i>)	5gm of root is boiled with 250ml of water and made into a decoction.	1 spoonfuls (qd) (cst)
Baldness	Anyar (<i>Lyonia ovalifolia</i>)	10gm of buds are milled with 5gm of jangli akhrot bark, mixed with 10ml mustard oil, and made into a paste.	10gm (qd) (cm)
	Balchari (<i>Arnebia benthamii</i>)	5gm of root is milled, mixed with 50ml mustard oil, and rubbed in hair.	2ml (qd) (cst)
	Khaina (<i>Ficus semicordata</i>)	Milky latex is collected to apply.	1 drop (qd) (cm)
Toothache	Bjradanti (<i>Potentilla lineata</i>)	A paste is prepared from the roots and used as an ointment around the infected teeth.	5gm (qd) (x7d)
	Dhatura (<i>Datura stramonium</i>)	A paste is prepared from the seeds that may be applied.	5gm (qd) (x7d)
	Kuth (<i>Saussurea costus</i>)	100ml of kuth tuber decoction is mixed with 4-5 drops of apricot oil (<i>P. armeniaca</i>) and ½ spoonful of salt. A few small drops of this product are placed on infected teeth to treat toothache.	1 spoonfuls (bid) (x3d)

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Ailments	Plant used	Method of Preparation	Doses
Toothache	Timru (<i>Zanthoxylum armatum</i>)	A paste is prepared from the bark to be applied.	5gm (bid) (cst)
Eye disease	Chotru (<i>Berberis aristata</i>)	100ml root decoction is made from 100gm of roots with 250ml of water. Applied to treat eye infection.	2-3 drops (tid) (x7d)
	Saur (<i>Betula alnoides</i>)	100gm of bark ash is mixed with 2 spoonfuls of ghee to form a paste that is applied on the eye lid to treat eye disease/eye infection.	5gm (tid) (x7d)
Ear disease	Akash bel (<i>Cuscuta reflexa</i>)	The whole plant is ground, filtered, and drops of the resulting liquid applied.	1 drop (qd) before sleeping (x7d)
	Jau (<i>Hordeum vulgare</i>)	Fresh leaves are milled then filtered with the resulting drops being applied.	1 drop (qd) before sleeping (x7d)
	Mirchya ghass (<i>Cymbopogon martini</i>)	Fresh leaves are milled and filtered with the resulting drops being applied	1 drop (qd) before sleeping
Dyspepsia	Atis (<i>Aconitum heterophyllum</i>)	50gm of tuber is boiled with 400ml of water to prepare a decoction of 100ml after which 2 spoonfuls of sugar are added.	20ml (bid) (x3d)
	Chandra (<i>Paeonia emodi</i>)	50gm of dried chandra leaves are milled with 10gm dried barmoa root.	20gm (tid) (x3d)
	Chippi (<i>Pleurospermum angelicoides</i>)	50gm of root paste of chippi is mixed with 20gm of dried leaves of <i>Allium</i> spp. and fried with 3 spoonfuls of ghee .	20gm (bid) (x3d)
	Kutki (<i>Picrorhiza kurrooa</i>)	50gm of dried root is milled with 2 spoonfuls of sugar and 5gm of dried <i>Acorus calamus</i> L. roots.	20gm (bid) (x3d)
	Puyanu (<i>Maianthemum purpureum</i>)	50gm dried leaves is fried in 4-5 spoonfuls of <i>P. persica</i> oil.	20gm (tid) (x3d)
Stomach-ache	Atis (<i>Aconitum heterophyllum</i>)	5gm of root powder is mixed with 1 cup of water.	1 cupful (bid) (x3d)
	Barmoa (<i>Megacarpaea polyandra</i>)	100gm of dried barmoa leaves are mixed with 10gm of thuner bark powder and fried in 2-3 spoonfuls of ghee .	20gm (tid) (x3d)
	Kalajeera (<i>Carum carvi</i>)	20gm of kalajeera seeds are mixed with 5gm of <i>Plantago ovata</i> Forssk. and milled with 5gm Sindhi salt and 10gm of kuth root.	10gm (bid) (x3d)
	Kutki (<i>Picrorhiza kurrooa</i>)	50gm of root is dipped in 200ml water for 2-3 hours and afterwards 2 spoonfuls of honey is added in.	3 spoonfuls (qd) (x3d)
Stomach worm	Brahmi (<i>Centella asiatica</i>)	The whole plant is ground into a powder. 5gm of powder is used in 1 cup of water.	1 cupful (qd) morning (pqa)
	Devdar (<i>Cedrus deodara</i>)	Oil is prepared for application.	½ spoonful (qd) (cm)
	Dudhlu (<i>Excoecaria acerifolia</i>)	Paste is prepared from roots for external application.	2gm (qd) (cm)
Dysentery	Chandra (<i>Paeonia emodi</i>)	Leaves are milled and made into a juice.	1 spoonful (tid) (x7d)
	Dubla (<i>Cynodon dactylon</i>)	100gm of root powder is mixed with 5gm of <i>Valeriana jatamansi</i> Jones powder and 5gm of sugar which is drunk with 1 glass of water.	1 glassful (bid) (x7d)

Ailments	Plant used	Method of Preparation	Doses
Anemia	Rai (<i>Brassica juncea</i>)	Vegetable is applied.	1 bowl (qd) (cst)
	Kandali (<i>Urtica dioica</i>)	Vegetable is applied.	1 bowl (qd) (cst)
Abortion	Gudhal (<i>Hibiscus rosa-sinensis</i>)	One mature flower is fried with 10ml of ghee .	5gm (bid) (x7d)
Leucorrhoea	Brahmi (<i>Centella asiatica</i>)	10gm of fresh brahmi leaves are mixed with 5gm of kuth root powder and 5gm of atis root powder and made into a juice to drink with water.	3 spoonfuls (bid) (x3d)
	Salam misri (<i>Polygonatum verticillatum</i>)	1gm of root powder is mixed with one glassful of water.	1 glassful (bid) (x3d)
Pregnancy	Bhojpatra (<i>Betula utilis</i>)	100gm of bhojpatra resin and 50gm of kirol (<i>Prunus persica</i> (L.) Batsch) seed kernels are ground into a paste and then mixed with 2 spoonfuls of honey. This is eaten by women during their period of pregnancy to provide internal strength and also to control miscarriage.	100gm (tid) (psa)
	Jangli akhrot (<i>Juglans regia</i>)	Oil extracted from the seed kernels is mildly heated and rubbed on swollen legs of pregnant women.	20ml (tid) (psa)
Urinary disorder	Kakree (<i>Cucumis sativus</i>)	Seeds are ground and mixed with water.	1 glassful (bid) (x7d)
Tuberculosis	Biskandru (<i>Cirsium verutum</i>)	100gm of dried biskandru root is milled with 20gm of kuth root and 20gm of dried chandra leaves. This mixture is dipped into 500ml of water for 2-3 hour and then eaten.	50ml (tid) (cst)
	Khirku (<i>Nepeta discolor</i>)	150ml decoction of dried leaves is mixed with 2-3 spoonfuls of honey.	100ml (tid) (cst)
Cardiac disorders	Brahm kamal (<i>Saussurea obvallata</i>)	A 200ml decoction of roots or leaves is mixed with 2-3 spoonfuls of devdar oil and applied externally to treat the heart.	100ml (qd) (psa)
	Burans (<i>Rhododendron arboreum</i>)	Flower juice is prepared and applied.	1 cupful (bid) (psa)
Piles	Bag (<i>Arisaema tortuosum</i>)	Fruit paste is prepared for application.	1gm (qd) (x7d)
	Bhang (<i>Cannabis sativa</i>)	Leaf paste is prepared for application.	1gm (qd) (x7d)
	Kinmor (<i>Berberis lycium</i>)	50gm of root powder is mixed with 50ml of water for preparation of a tablet.	1 tablet (bid) (x7d)
	Silphori (<i>Bergenia ciliata</i>)	Root is chewed.	1gm (bid) (x7d)
Epilepsy	Adrak (<i>Zingiber officinale</i>)	Rhizomes are milled and mixed with cow ghee .	5gm (qd) (cst)
	Brahmi (<i>Centella asiatica</i>)	Leaf powder is mixed with cow ghee .	5gm (qd) (psa)
	Sataver, Jhirna (<i>Asparagus racemosus</i>)	Root powder is mixed with cow ghee .	2gm (qd) (psa)
Mental disorder	Brahm kamal (<i>Saussurea obvallata</i>)	Seeds are milled into a powder. The powder is steeped in water overnight then filtered.	1 cupful (qd) (psa)
	Brahmi (<i>Centella asiatica</i>)	Leaf paste is prepared for application.	5gm (qd) (psa)
Skin diseases			
Measles	Cheena (<i>Panicum miliaceum</i>)	Make a chaval (bhat) for consumption.	100gm (qd) (x7d)
	Sarsoo (<i>Brassica campestris</i>)	Oil is prepared for application.	5ml (qd) (x7d)

Ailments	Plant used	Method of Preparation	Doses
Itching	Akash matri (<i>Cuscuta reflexa</i>)	The whole plant is ground and mixed with <i>Rumex dentatus</i> L. leaf powder and mustard oil to make a paste.	5gm (qd) (x3d)
	Anyar (<i>Lyonia ovalifolia</i>)	5gm of new plant buds are ground and mixed with 5ml of mustard oil. This is rubbed in the affected part.	5ml (qd) before sleeping (x7d)
	Devdar (<i>Cedrus deodara</i>)	Bark oil is prepared for application.	5ml (qd) (x3d)
	Kuth (<i>Saussurea costus</i>)	Root paste is prepared for application.	5gm (qd) (x3d)
Ring worm	Mirchya ghass (<i>Cymbopogon martini</i>)	Leaf powder is mixed with mustard oil and rubbed in infected part.	5gm (qd) (x3d)
	Awon (<i>Rhododendron anthopogon</i>)	Leaf powder is mixed with mustard oil and rubbed in infected part.	5gm (qd) (x7d)
	Latjiri, Apamarg (<i>Achyranthes aspera</i>)	Root paste is prepared for application.	5gm (qd) (x7d)
Carbuncles	Lasun (<i>Allium sativum</i>)	5 bulbs are ground and mixed with 1gm of salt and made into a paste.	5gm (qd) (x7d)
	Lesskuri (<i>Galium aparine</i>)	Leaf paste is prepared for application.	5gm (qd) (x7d)
Dermatitis	Devdar (<i>Cedrus deodara</i>)	Oil is mixed with <i>Rubus paniculatus</i> Sm. leaf powder and used externally.	5ml (qd) (x3d)
	Mirchya ghass (<i>Cymbopogon martini</i>)	Leaf powder is mixed with mustard oil and rubbed in affected part.	5gm (qd) (x3d)
	Pangar (<i>Aesculus indica</i>)	Mature fruit coat is milled and made into a paste.	5gm (qd) (x7d)

Discussion

In the Bhotiya communities, traditional healers who prepare remedies also serve as diagnosticians, identifying causes of illness before prescribing treatment. The dose given to the patient depends on age, physical status and health conditions of the patient. The method of use of plants varies according to nature of disease. In the majority of the cases, a decoction of various parts of plants used is administered for treating a disease or diseases. Most of the decoctions are made just by crushing the plant parts but some are made by boiling plant parts in water, decanting of the liquid and drinking after cooling. Paste of some plants is plastered to set dislocated or fractured bones or muscular pain.

Conclusions

Traditional knowledge of plants in many communities is changing because of rapid socioeconomic and cultural changes that are taking place. This is particularly true in these tribal communities. Documentation of this knowledge is valuable both for the communities and their future generations and for scientific consideration of wider uses of the knowledge.

The indigenous knowledge and rights of the Bhotiya communities and local people regarding uses of plants needs

to be secured. Appropriate mechanisms for effective benefits sharing of potential value of this knowledge need to be developed.

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