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Herbal Based Traditional Practices Used by the *Bhotias* and *Gangwals* of the Central Himalayan Region, Uttarakhand, India

P.S. Mehta, K.S. Negi, S.N. Ojha, Anupam Rayal and S. K. Verma

National Bureau of Plant Genetic Resources, Regional Station Bhowali, Nainital, Uttarakhand..

Abstract

Indigenous Traditional Knowledge (ITK) on herbal medicines is gaining importance continuously, due to their efficiency, rare chances of side effects in the treatment, good faith of society on herbal medicines and their products. The present study was carried out on the tribal communities i.e., the Bhotias and Gangwals. A non-participant observation method was used to extract the knowledge from local medicine men. Ethno-medicinal uses of local plants by the natives the Bhotias and Gangwal tribes were documented.In this paper a total of 78 plants belonging to 39 families and 61 genera were recorded, which were used for the treatment of 68 diseases. Out of 78 plants, roots and rhizomes of 26 are used for medicine preparation followed by leaves (20), fruits (03), whole plant/ aerial parts (10/04), seeds (07), bark (07), flowers (07), stem (01), aerial bulbs (01), latex (02), resin (01). About 07 species were commonly used for treating wounds/ sores followed by 05 species for treating fever and 05 species for headache, 04 species each for pregnancy problems, sprains, urine problem and cold and cough. Twenty one species were found using for curing more than one ailments while 57 species were reported for single therapeutic application. Twelve species are also used as dyes, spices, condiments, flavouring agent and food items and play a significant role is rural economy of the region.

Now, due to change of socio-economy and culture, the traditional knowledge of these communities is also diminishing. It needs to be preserved before the onslaught of modernization. There is also an urgent needof conservation and resource augmentation of these medicinal plants in their natural habitat as well as their plantation in suitable agro-climatic conditions. Thus, it was concluded that the tribes Bhotias and Gangwals possess a good knowledge of herbal based medicinal practice.

Keywords : *Indigenous Traditional Knowledge, Herbal Medicines, The Bhotias and Gangawals, Central Himalayan Region.*

1. INTRODUCTION

The whole Himalayan region is well known for its biodiversity in both kinds; flora and fauna. Among the flora, a large number of plant species are used for sustaining human life. As an intelligent creature mankind has identified the plant species to fulfill his various needs such as shelter, food, fiber, .fuel, medicine, fodder for his pets etc. Right from ancient to present era, a lot of development took place in order to improve the livelihood of mankind and societies. In the development process of society, the natural resources around its environs played an important role.

The development of civilization, societies and their socio- economic and cultural development were took place around these natural recourses. The indigenes people of the world have learnt to live in

P.S. Mehta
E-mail: mehta.puran@yahoo.com

most hostile environmental condition in this universe. The interesting feature concerning with these ethnic and tribal people is that, they live in localities which are immensely rich in biodiversity. India has one of the largest concentrations of tribal communities in the world accounting for about 68 million tribal people belonging to 227 ethnic groups and 573 tribal communities living in different geographic locations in the country[1]. In the context of India, tribal means a group with traditional territory specific name common language, strong kin relations, association with clan structure tribal authority and rigid inclination to the religion and belief [2]. The Indian Himalayan region (IHR) represents nearly 18.5 % of total tribal populationof India. More than 175 of total 573 scheduled tribes of India in-habit the IHR.

The central Himalayan region (CHR) is known for its Hindu dominant culture; 3.54% of the total population of the region are scheduled tribes belong to 5 tribes i.e. the Bhotias, the Jaunsaries, the Tharus, the Buxas and *Raj*is or Van-Rawat, which is primitive tribe 3. The Bhotias a transhuman community of Mangoloid origin in-habit on high *altitud*e reg*ion of Cen*tral *Himalay*a at I*ndo-T*ibet*an and* Indo*-Nepal bo*rders. Etymologically th[e] wordB*hotia i*s blended to have originated from the term bhot or more correctly bod, which means Tibet. The major Bhotia groups are the Johari, Jeethora, Darmi, Chaudas,i Byansi, Marchaa, Tolcha and Jad and are scattered over e*ight* main river valleys *kn*own as Johar, Darma, Byans, Cha*udas i*n district Pitho*ragarh, Mana, Niti, in district Chamoli and Nilang and Jau***n**sari *in* district Uttarkashi of Uttarakhand. Each of the sub group is further divided into several clans and lineages, which regulate marriage alliances and indicate ancestry 4. Similarly a tribal community in-habits in the Gangi region of the Bhilangana valley of district of Tehri Garhwal of Uttarakhand state. Gangi is last in-habitat village on wa to Khatling glacier. The community is isolated because of natural barriers and inaccessibility of other means. They are of Mangolid origin and fulfill their substence requirement from natural resources, Agriculture and pasturalism are the major activities of the Gangwal community. The relationship of *Bhotia* and *Gangwal*tribes are very close with surrounding nature and natural resources for their survival. They have strong and strenuous knowledge about the natural resources and their uses.

This knowledge has helped them to evolve , tools, technologies and practices for subsistence of the production systems of these communities in balance with their social heritage, economic condition and ecological specificities[5]. These tools technologies, practices associated indigenous knowledge, which is essential for their survival in the difficult hill terrains. This indigenous knowledge governs almost all productive resource sectors, such as agriculture, fishery, animal husbandry and handicrafts. The traditional knowledge of the tribal community serves as a cultural and natural capital, which has a historical continuity of living in harmony with nature, mutual dependence on primary natural resources and possess a sound knowledge base of the behavior of the complex ecological system [6-7].

The role of indigenous knowledge is pivotal in the life of tribal people for their food, medicine, housing, clothing etc. For sustaining life in these difficult areas of hills the indigenous knowledge is the only tool to provide the way of living. In the era of modernization, the tribal communities living in the high lands of the Himalayas are still surviving on natural resources and indigenous knowledge. They have acquired this knowledge from their ancestors after a long experimentation and experience. In the present study, the investigators have designed the investigation to explore the indigenous medicines and plant material, they use for their primary health care. The aim of the study was to identify plant species, parts of plant used as medicine, diseases which are cured by them locally and conservation of the traditional knowledge, which they possess. The documentation of their knowledge in respect of primary health care and medicinal plants used by them were thoroughly investigated.

2. MATERIALS AND METHOD

In order to explore the indigenous knowledge in respect of medicinal practices used by the *Bhotia* and *Gangwal* communities, the investigators have surveyed the region with the help of a planned and unstructured interview schedule. The survey was conducted in the five villages of the *Bhotia* dominated valleys Johar, Chaudas, Darma and Byans in Pithoragarh district and village Gangi in district Tehri Garhwal, Uttarakhand during the year 2008-10. In each village one or two elderly people are used to prepare the medicines for the whole village people. A few numbers of elder women also possess the knowledge of medicinal practices. During the survey we identified the persons who practice as medicine men/healer in each sampled village with the help of villagers. We approached them for the purposed. The elderly people in the village are known as *Lama* or *Pujari* who performs all the religious rituals also. He is also a respected person of the village society. We discussed with them our aim and objectives. The *Lamas* of each sampled village were thoroughly investigated in respect of uses of medicinal practices. The statements and responses of them were carefully recorded in the interview schedule. The village society believes that the medicinal herbs/ plants collected and medicinal prepared in the auspicious hours by the *Lama* is effective, that's why they collect it from him. Many of the villagers also have the knowledge in respect of the plants, but they do not use them their own. After carefully recording of the vernacular name of plants, the team has identified the plants with their scientific / botanical name. The plants and preparation methods were also noted. The knowledge provided by them were also authenticated with the help of other elderly knowledgeable persons of the village or surrounding villages. Thus the investigators have identified a total of 78 plants used by them.

3. RESULTS

The investigation conducted in the studyarea for extraction of indigenous technical knowledge in respect of health care system of the *Bhotia* and *Gangwal* tribes revealed a vast wealth of traditional knowledge. There are 78 plants/herbs belong to 39 families and 61 genera, which are used for treatment of different ailments (Table 1). For collection of plants of medicinal purpose, they follow the certain regulations such as avoiding plants those are infested by insects, pests, and other diseases , plant affected by toxicity ,sunstroke, hailstorms, high velocity winds, fire, flood etc. . After a long experimentation by the method of trial and error, they have acquired a good and authentic knowledge about the parts of the plants, which are useful for treatment of diseases/ailments. The methods of preparation of medicine and application were also standardized by them.

For treatment of diseases and ailments they use many plant species, which are used for more than one ailment. The maximum among them are 07 plant species are found used for treatment of wounds/sores followed by 05 each for fever and headache, 04each for cold cough, pregnancy, sprain and urine disorder, 03 each for bone fraction, rheumatism, tumours and jaundice, 02 each for abdominal pain, asthma, burn, cancer, cataract, colic pain, diarrhea, dysentery, epilepsy, eye treatment snake and scorpian, stung, toothache, vomiting and whooping cough. A part from these 01 plant species each for 51 aliments is used by the Bhotia and Gangwals (Table 2). Vis-avis there aresome plant species, which are used to treat more than one ailment.

Some important among them are Berberis ***chitria*** for 05 ailments, ***Aconitum heterophyllum***, ***Rheum emodi, Syringa emodi*** and ***Taxus bacata,*** each for 04 diseases ***Picrorhiza kurroa, Picrorhiza scrophalariflora, Rheum moorcroftianum,*** **and** ***Zanthoxylum armatum*** each for 03***, Acorus calamus , Angelica glauca., Bergibia stracheyii , Dactylorrhiza hatagirea , Paeonia emodi., Podophyllum hexandrum , Polygonum nepalense , Saussurea costus , Saussurea obvallata, Swertiachiraita , Valeriana jatamansi*** each for

02 diseases (Table 3).

The knowledge of plants and their parts which contain the essential medicinal properties for treatment of diseases is also very important. The *Bhotias* and *Gangwal* possess a very sound knowledge in respect of plant parts for utilization. For preparation of medicine the rhizomes and roots of 26, leaves of 20, whole plant of 10, flowers, seeds and bark 07 of each, aerial parts of 04, fruits of 03, latex of 02 , stem, and resin of 01 each plant species is used (Table 4).

A part from the importance of different plant species as medicine, many of them are also used as dye, spices, condiments, flavoring agents and other food items are also play a significant role in their economy by selling them in the local markets (Table 5).

It is also observed that the market value of these goods and products are very high in terms of monitory return. It is also revealed that the social bonds among the *Bhotia* tribes are very strong and hierarchical. They respect the elders particularly the *Lama* who is considered their spiritual leader. His consent is obtained before taking any decision or starting any new task. The date and time of collection of plants/ herbs for preparation of medicine is prescribed by him. Generally he used to collect and prepare the medicine for the whole village society in spite of knowledge herbs people collect the medicine from him because of social importance and hierarchical order.

4. DISCUSSION

The region, where tribes inhabit are generally very far from the road transport, communication market economy, education centers, modern healthcare facilities etc. Although, the *Bhotia* tribe is considered as tracking people, but the pattern of their trade is operated in a traditional way. They used to collect the forest and natural products from the surrounding environs and trade them to the mainland societies. The products and harvest they carry for trading are pure in original form and valuable in terms of properties and market prices. Due to inaccessibility of the region, they are compelled to operate the healthcare practices in the remote areas by their own efforts. Every village in the region has its own traditional healthcare practioner. In the process of healthcare healing they have identified a large number of plant species for treatment of different ailments. According to an study conducted in Uttarakhand state, about 300 plant species are used in the treatment of 114 ailments [8]. In the present study, the Bhotia community uses a total of 78 plant species alone by collecting from the natural stand. In addition of wild plant species, some of the cultivated crop plants are also used as medicine in the higher reaches of Uttarakhand hills [9]. Evolving over a long period of time based on necessities and experiences, indigenous medicinal system is an important component of indigenous knowledge of *Bhotia* and *Gangwal* communities.

It is an important natural resource that facilitates the development process in cost effective, participatory and sustainable ways and plays an important role in resource conservation [10]. The herbal medicines is not being used in Indian system of medicines only, but also found in the healthcare systems of several other countries of the world. In Kenya, most of the people use herbal medicine originate from indigenous plant sources [11]. In UK phyto-medicine is used with 40% increase [12]. Considering the importance of medicinal plants, these resources are being exploited with a great pace. In the recent past, multifarious human activities like increasing urbanization illicit cutting of forests, extension of cultivation in the forest land, migration of local people for employment have led serious threat to the folk traditions and also have increased the possibilities of extinction of important ethnic diversity along with their traditional wealth of associated knowledge in future [13].

The over exploitation, deforestation, poor regeneration, forest fire, over grazing, land slide, habitat loss, use of plants as fodder, fuel and

timber were observed as major factors of threat to medicinal herbs in the entire Himalayan zone where these tribes inhabit [14]. In past, the local *Vaidyas* and old folks of the society were used to collect the medicinal plants for their own use and as a gift to their kith and kins, but at present, due to legal and illegal collection of herbs, a large number of herbs are facing danger of extinction in differe nt pockets of the Himalayan region[15-16]. Continuous and unwanted exploitation of plants of economic value from their natural habitats has posed a serious threat to their conservation. It also caused a serious threat to the traditional knowledge of centuries old, which was very important for survival of the people in the remote areas. Indiscriminate collection of rare and endangeredplants i.e., *Picrorhiza scrophalariflora, Aconitum, heterophyllum, Orchis latifolia, Podophyllum hexandrum, Swertia chiraita* etc. from their natural stand has drastically decreased their population. The knowledge system, which is very important for the survival of *Bhotia* and *Gangwal* tribes is how disappearing because of transforming of societies into modernization and extinction of plants species by over exploitation and illegal trading in the international markets. In order to document and conservation of traditional knowledge and these important plants species, the local inhabitants government and non-government agencies should come forward to generate the awareness campaign together. The law enforcing agencies must imposed the strict regulations on illegal collection and exploitation. The conservation of natural bio-resources and traditional knowledge is an important task to pave the way for sustainable development in future. The resources are also essential inputs for researchers and scholars working in this field. Thus these resource must be preserved before the awnslaught of modernization.

Table 1. Plant species used by Bhotia and Gangwal tribes for treatment of various ailments.

S. No.	Plant species	Vernacular/ local name	Family
1	*Achyranthus aspera* L.	Latjeera	Acanthaceae
2	*Aconitum atrox* Bruhl.	*Mitha bish, Patis*	Ranunnculaceae
3	*Aconitum heterophyllum* Wall ex.Royle	*Atis*	Ranunnculaceae
4	*Aconogonum tortuosum* D. Don	*Bakrolya, Bakranda*	Polygoneaceae
5	*Acorus calamus* L.	*Gurbach, Bach*	Araceae
6	*Adiantum sp.*	*Sunkiya*	Adiantaceae
7	*Allium auriculatum* Kunth.	*Pharan, Jambu*	Alliaceae
8	*Allium carolinianum DC.*	*Ladam, Duna*	Alliaceae
9	*Allium humile* Kunth.	*Knaya, Pargoni*	Alliaceae
10	*Allium sativum L.*	*Lahsun*	Alliaceae
11	*Allium wallichina* Huntn	*Gobka, Lainka*	Alliaceae
12	*Angelica glauca* Edgew.	*Chhipa*	Apiaceae
13	*Arisaemia sp.*	*Yalab*	Araceae
14	*Arisaemia tortuasm* Wall.schott.	*Bankh*	Araceae
15	*Arnebia benthamii* DC ex. Jhonston	*Balchar*	Boraginaceae
16	*Artemisia nilgerica* CL.	*Kunjaa*	Asteraceae
17	*Astragalus chlorostachys* Lindl.	*Rudrvanti*	Fabaceae
18	*Berberis aristata* DC	*Kilmora, Daruhaldi*	Berberdiaceae
19	*Berberis chitria* Edwards	*Kirmolo, Phacharge, sirkuti*	Berberidaceae
20	*Bergibia stracheyi H.* Hb. & Th	*Silphra*	Saxiferagaceae
21	*Betula utilis* D. Don	*Bhojpatra*	Betulaceae
22	*Butea fronsdosa* Koen ex Roxb	*Dhan*	Fabaceae
23	*Calotropis procera* Ait. R. Br.	*Aak*	Asclepiadaceae
24	*Cinnamomum tamala* Buch. Ham	*Tejpat*	Lauraceae
25	*Clematis montana* (Buch. Ham) ex DC	*Bulbuli*	Ranunnculaceae
26	*Dactylorrhiza hatagirea* D. Don	*Salampanja, Grurpanja*	Orachidaceae
27	*Delphinium denusatum* Wall.	*Nirbishi*	Ranunnculaceae
28	*Delphinium vestiatum* Wall ex royle	*Nirbishi*	Ranunnculaceae
29	*Delphinium brunonianum* Royle	*Jadwar*	Ranunnculaceae
30	*Dioscorea bulbifera* Linn.	*Gethi*	Dioscoreaceae
31	*Hyocyamus niger* L.	*Khursani ajuwain, langtang*	Solnaceae
32	*Iris kumaonensis* D. Don	*Bakhari*	Iridaceae
33	*Juglans regia* L.	*Akhrot*	Juglandeaceae
34	*Jurinea dolomoaea* Boiss	*Dhoop*	Asteraceae
35	*Megacapaea polyandra* Benth	*Rooki*	Brassicaceae
36	*Maharanga emodi* (Wall) DC	*Sankhuli*	Boraginaceae
37	*Meconopsis robusta* Hook. B. & Thoms	*Thans, Kailharee*	Papaveraceae
38	*Myrica esculenta Buch.* Ham ex D.Don	*Kaphal*	Tomariaceae
39	*Myristi fragrans* Houtt	*Jaiphal*	Myristicaceae
40	*Nardostachys grandiflora DC*	*Jatamasi*	Valerianaceae

41	*Orchis habenarioids* King.	*Salam Mishri*	Orchadeaceae
42	*Oxyria digyna* L.	*Hill Kailash*	polygoneaceae
43	*Paeonia emodi* Wall. Ex. Royle	*Tonkanya*	ranunnculaceae
44	*Picrorhiza kurroa* Royle & Benth.	*Kutki*	Scrophulariaceae
45	*Picrorhiza scrophalariflora* Pennell	*Kutki*	Scrophulariaceae
46	*Pinus wallichiana* A. B. Jacks	*Kail*	Pianaceae
47	*Plantago erosai* ex Roxb	*Chitrak*	Plantaginaceae
48	*Podophyllum hexandrum* Royle	*Bankakri*	Podophyllaceae
49	*Polygonum nepalense* Meissin	*Bhotia chai*	Polygoneaceae
50	*Polygonum tortuosum* D.Don.	*Sirjuum*	Polygoneaceae
51	*Potentiala fulgens* Hook.	*Bajratanth*	Rosaceae
52	*Portulaca oleracea* L.	*Jark, Jarag*	Protulaceae
53	*Psidium guajava* L.	*Amrood*	Onagraceae
54	*Punica granatum* L.	*Anar*	Punicaceae
55	*Ranunculus hirtellus* Royle	*valakseen*	Ranunnculaceae
56	*Ranunculus pulchellus* C.A. Mey.	*Nataka*	Ranunnculaceae
57	*Rheum australe* D. Don.	*Dolue*	Polygoneaceae
58	*Rheum emodi* Wall. Ex meissn	*Dolu*	Polygoneaceae
59	*Rheum moorcroftianum* Royle	*Dolu*	Polygoneaceae
60	*Rosa sericea* Lindal	*Rangel, Saipali, Dhurkurja*	Rosaceae
61	*Rubia cordifolia* Linn.	*Manjistha*	Rubiaceae
62	*Saussurea costus* L.	*Koot*	Asteraceae
63	*Saussurea gossypiphlora* D. Don.	*Gaiphool*	Asteraceae
64	*Saussurea obvallata* DC. Edgew	*Brahmkamal*	Asteraceae
65	*Scopolia stramonifolia* Wallich.	*Langtang*	Solanaceae
66	*Sedum ewersii* Ledeb.	*Pusyanano phool*	Crassuleaceae
67	*Selinum wallichianum* DC.	*Bhutkeshi*	Apiaceae
68	*Stephania elegans* Hook. F. Lithoms	*Gangeri*	merispermaceae
69	*Swertia chiraita* D. Don.	*Chiraita*	Gentiaceae
70	*Syringa emodi* Ex. Royle	*Ghiya*	Oleaceae
71	*Tanacetum nubigenum* Wall ex DC	*Guggal*	Asteraceae
72	*Taraxaum officinalis* Noochi	*Kanphuliya, karatu*	Asteraceae
73	*Taxus bacata (Zucc)* Pilger	*Thuner*	Taxaceae
74	*Thymus linearis* Benth.	*Dharajawan, Van ajawayn*	Lamiaceae
75	*Ulmus wallichiana* Planch	*Chamnermewa*	Ulmaceae
76	*Valeriana jatamansi* Jones	*MasiDhoop, Sampo*	Valerianaceae
77	*Viola biflora L.*	*Banpasa*	Valerianaceae
78	*Zanthoxylum armatum* DC	*Timoor*	Rutaceae

Table 2. Different body ailments, problems and plant species used for their treatment

S. No	Diseases	Plant species
1	Abdominal pain	*Angelica glauca* Edgew., *Saussurea costus* L.
2	Acclimatization in cold conditions	*Arisaemia sp.*
3	Allergy	*Ocyria digyna* L.
4	Antidote of posioning	*Berberis chitria* Edwards
5	Aphonia	*Berberis chitria* Edwards
6	Arthritis	*Maharanga emodi* (Wall) DC
7	Asthma	*Arnebia benthamii* DC ex. Jhonston, *Picrorhiza kurroa* Royle & Benth.
8	Blister of mouth	*Psidium guajava* L.
9	Blood purification	*Delphinium denudatum* Wall.
10	Bone facture	*Pinus wallichiana* A. B. Jacks, *Rheum australe* D. Don., *Ulnus wallichiana* Planch
11	Breath problem	*Saussurea gossypiphlora* D. Don.
12	Burn	*Adiantum sp., Delphinium brunonianum* Royle
13	Cancer problem	*Podophyllum hexandrum* Royle, *Taxus bacata* (Zucc) Pilger
14	Catarrh	*Syringa emodi* Ex. Royle, *Taxus bacata* (Zucc) Pilger
15	Cholera	*Picrorhiza scrophalariflora* Pennell
16	Cold	*Allium auriculatum* Kunth., *Allium carolinianum* DC.
17	Cold and cough	*Viola biflora L.*
18	Colic pain	*Syringa emodi* Ex. Royle, *Taxus bacata* (Zucc) Pilger, *Thymus linearis* Benth.
19	Constipation	*Swertia chiraita* D. Don.
20	Contusion	*Acorus calamus L., Allium wallichina* Huntn, *Rheum moorcroftianum* Royle, *Valeriana jatamansi* Jones
21	Cough	*Myristi fragrans*
22	Dentifrice	*Potentiala fulgens* Hook.
23	Diarrhoea	*Iris kumaonesis* D. Don, *Plantago erosai*
24	diuretic	*Aconogonum tortuosum* D. Don
25	dropsy	*Picrorhiza scrophalariflora Pennell*
26	Dysentery	*Rheum emodi* Wall. Ex meissn, *Zanthoxylum armatum* DC
27	Ear pain	*Allium sativum* L.
28	Eczema	*Achyranthus aspera* L.
29	Epilepsy	*Nardostachys grandiflora DC, Punica granatum* L.
30	Eye treatment	*Berberis aristata* DC, *Berberis chitria* Edwards
31	Faster hair growth	*Arnebia benthamii DC* ex. Jhonston
32	Fever	*Aconitum heterophyllum* Wall ex Royle, *Megacapaea polyandra* Benth, *Picrorhiza kurroa* Royle & Benth., *Picrorhiza scrophalariflora Pennell, Saussurea costus L., Swertia chiraita* D. Don.
33	Food poisoning	*Aconitum heterophyllum* Wall ex Royle
34	Gastric	*Zanthoxylum armatum* DC
35	Headache	*Cinnamomum tamala* Buch. Ham, *Myrica esculenta* Buch. Ham ex D. Don, *Rheum emodi* Wall. Ex meissn, *Saussurea obvallata DC.* Edgew, *Sedum ewersii* Ledeb.
36	Hysteria	*Punica granatum L*
37	Indigestion	*Angelica glauca* Edgew.
38	Intestinal worms	*Aconitum heterophyllum* Wall ex Royle, *Hyocyamus niger* L.
39	Intoxciciation	Scopolia stramonifolia Wallich.
40	Jaundice	*Berberis chitria* Edwards, *Portulaca oleracea L., Taraxcum officinalis* Noochi
41	Kidney stone	Bergibia stracheyi H. Hb. & Th

42	Loose motion	Iris kumaonesis D. Don
43	Lung diseases	*Stephania elegans* Hook. F. Lithoms
44	Migrain pain	*Calotropis procera* Ait. R. Br.
45	Mouth sores	*Hyocyamus niger L.*
46	Narcotics habitual	*Meconopsis robusta* Hook. B. & Thoms
47	Nose running	*Ranunculus pulchellus* C.A. Mey.
48	Opthalmia	*Rosa sericea* Lindal
49	Pimples	*Delphinium brunonianum* Royle
50	Pregnancy	*Betula utilis* D. Don, *Juglans regia L., Orchis habenarioids* King., *Polygonum nepalense* Meissin
51	Psycomedicine	*Aconitum atrox* Bruhl.
52	Rheumatism/ Rheumatic pain	*Allium humile* Kunth., *Arnebia benthamii* DC ex. Jhonston, Syringa emodi Ex. Royle
53	Skin care	*Rubia cordifolia* Linn.
54	Skin diseases	*Berberis chitria* Edwards
55	Snake and Scorpion stung	*Arisaemia tortuosum* Wall.schott., *Arnebia benthamii* DC ex. Jhonston
56	Sprain	*Acorus calamus L., Allium wallichina Huntn, Rheum moorcroftianum Royle, Valeriana jatamansi* Jones
57	Stmoache pain	*Picrorhiza kurroa* Royle & Benth.
58	swelling	*Taxus bacata* (Zucc) Pilger
59	Thrist quenching	*Polygonum tortuosum* D.Don.
60	Throat pain	*Polygonum nepalense* Meissin
61	Toothache	*Hyocyamus niger* L., *Zanthoxylum armatum* DC
62	Tumours	*Dactylorrhiza hatagirea* D. Don, *Rheum emodi* Wall. Ex meissn, *Rheum moorcroftianum* Royle
63	Urine problem	*Bergibia stracheyi* H. Hb. & Th, *Butea fronsdosa* Koen ex Roxb, *Jurinea dolomiaea* Boiss, *Saussurea obvallata DC.* Edgew
64	Urticaria dyspepsia	*Podophyllum hexandrum* Royle
65	Vomoting	*Aconitum heterophyllum* Wall ex Royle, *Paeonia emodi Wall.* Ex. Royle
66	Whooping cough	*Hyocyamus niger* L., *Paeonia emodi* Wall. Ex. Royle
67	Worm	*Artemisia nilgerica* CL.
68	Wounds/ sores	*Clematis montana* (Buch. Ham) ex DC, *Dactylorrhiza hatagirea* D. Don, *Delphinium vestiatum* Wall ex Royle, *Potentiala fulgens* Hook., *Ranunculus hirtellus* Royle, *Rheum emodi* Wall. Ex meissn, *Syringa emodi* Ex. Royle

Table 3. Plant species and their several medicinal and other uses.

S. No.	Plant species	Diseases/Other uses
1	*Achyranthus aspera* L.	Eczema
2	*Aconitum atrox* Bruhl.	Psycomedicine
3	*Aconitum heterophyllum* Wall ex Royle	Fever, Food poisoning, Intestinal worms, Vomoting
4	*Aconogonum tortuosum* D. Don	diuretic
5	*Acorus calamus* L.	Contusion, Sprain
6	*Adiantum* sp.	burn
7	*Allium auriculatum* Kunth.	Cold
8	*Allium carolinianum* DC.	Cold
9	*Allium humile* Kunth.	Rheumatism/ Rheumatic pain
10	*Allium sativum L.*	Ear pain
11	*Allium wallichina* Huntn	Contusion, Sprain
12	*Angelica glauca* Edgew.	abdominal pain, Indigestion
13	*Arisaemia sp.*	Acclimatization in cold condition
14	*Arisaemia tortuosum* Wall.schott.	Snake and Scorpion stung
15	*Arnebia benthamii* DC ex. Jhonston	Asthma, Faster hair growth, Rheumatism/ Rheumatic pain, Snake and Scorpion stung
16	*Artemisia nilgerica* CL.	Worm
17	*Astragalus chlorostachys* Lindl.	Life longevity and Strength
18	*Berberis aristata* DC	Eye treatment
19	*Berberis chitria* Edwards	Antidote of poisoning, Aphonia, Eye treatment, Jaundice, Skin diseases
20	*Bergibia stracheyi* H. Hb. & Th	Kidney stone, Urine problem
21	*Betula utilis* D. Don	Pregnancy
22	*Butea fronsdosa Koen* ex Roxb	Urine problem
23	*Calotropis procera* Ait. R. Br.	Migrain pain
24	*Cinnamomum tamala* Buch. Ham	Headache
25	*Clematis montana* (Buch. Ham) ex DC	Wound/ sores
26	*Dactylorrhiza hatagirea* D. Don	Tumours, Wounds/ sores
27	*Delphanium denusatum* Wall.	Blood purification
28	*Delphanium vestiatum Wall ex* Royle	Wound/ sores
29	*Delphinium brunonianum* Royle	Burn, Pimples
30	*Discorea bulbifera* Linn.	Cough
31	*Hyocyamus niger* L.	Intestinal worms, Mouth sores, Toothache, Whooping cough
32	*Iris kumaonesis* D. Don	Diarrhea, Loose motion
33	*Juglans regia* L.	Pregnancy
34	*Jurinea dolomiaea* Boiss	Urine problem
35	*Megacapaea polyandra* Benth	Fever
36	*Maharanga emodi* (Wall) DC	Arthritis
37	*Meconopsis robusta* Hook. B. & Thoms	Narcotics habitual
38	*Myrica esculenta Buch.* Ham ex D. Don	Headache
39	*Myristi fragrans*	Cough
40	*Nardostachys grandiflora* DC	Epilepsy

41	*Orchis habenarioids* King.	Pregnancy
42	*Oxyria digyna* L.	Allergy
43	*Paeonia emodi* Wall. Ex. Royle	Vomoting, Whooping cough
44	*Picrorhiza kurroa Royle* & Benth.	Asthma, Fever, Stmoache pain
45	*Picrorhiza scrophalariflora* Pennell	Cholera, dropsy, Fever
46	*Pinus wallichiana* A. B. Jacks	Bone fracture
47	*Plantago erosai*	Diarrhoea
48	*Podophyllum hexandrum* Royle	Cancer problem, Urticaria dyspepsia
49	*Polygonum nepalense* Meissin	Pregnancy, Throat pain
50	*Polygonum tortuosum* D.Don.	Thirst quenching
51	*Potentiala fulgens* Hook.	Dentifrice, Wounds/ sores
52	*Protulaca oleracea* L.	Jaundice
53	*Psidium guajava* L.	Blister of mouth
54	*Punica granatum* L.	Epilepsy, Hysteria
55	*Ranunculus hirtellus* Royle	Wound/ sores
56	*Ranunculus pulchellus* C.A. Mey.	Nose running
57	*Rheum australe* D. Don.	Bone fracture
58	*Rheum emodi* Wall. Ex meissn	Dysentery, Headach, Tumours, Wounds/ sores
59	*Rheum moorcroftianum* Royle	Contusion, Sprain, Tumours
60	*Rosa sericea* Lindal	Opthalmia
61	*Rubia cordifolia* Linn.	Skin care
62	*Saussurea costus* L.	abdominal pain, Fever
63	*Saussurea gossypiphlora* D. Don.	Breath problem
64	*Saussurea obvallata* DC. Edgew	Headach, Urine problem
65	*Scopolia stramonifolia* Wallich.	Intoxciciation
66	*Sedum ewersii* Ledeb.	Headach
67	*Selinum wallichianum* DC.	Hair treatment
68	*Stephania elegams* Hook. F. Lithoms	Lung diseases
69	*Swertia chiraita* D. Don.	Constipation, Fever
70	*Syringa emodi Ex. Royle*	Colic pain, Catarrh, Rheumatism/ Rheumatic pain, Wound/ sores
71	*Tanacetum nubigenus* Wall ex DC	Insense
72	*Taraxaum officinalis* Noochi	Jaundice
73	*Taxus bacata* (Zucc) Pilger	Cancer problem, Colic pain, Catarrh, swelling
74	*Thymus linearis* Benth.	Colic pain
75	*Ulnus wallichiana* Planch	Bone facture
76	*Valeriana jatamansi* Jones	Contusion, Sprain
77	*Viola biflora* L.	Cold and cough
78	*Zanthoxylum armatum* DC	Dysentery, Gastric, Toothache

Table 4. Plant parts used as medicine by Bhotia and Gangwal tribes

Plants Parts	Name of plant species
Roots and Rhizomes	*Aconitum heterophyllum* Wall ex Royle, *Acorus calamus* L., *Angelica glauca* Edgew., *Arisaemia* sp., *Arnebia benthamii* DC ex. Jhonston, *Astragalus chlorostachys* Lindl., *Berberis aristata* DC, *Berberis chitria* Edwards, *Bergibia stracheyi* H. Hb. & Th, *Dactylorrhiza hatagirea* D. Don, *Delphinium vestiatum* Wall ex royle, *Iris kumaonensis* D. Don, *Jurinea dolomiaea* Boiss, *Megacapaea polyandra* Benth., *Nardostachys grandiflora* DC., *Orchis habenarioids* King., *Picrorhiza kurroa* Royle & Benth., *Picrorhiza scrophalariflora* Pennell, *Podophyllum hexandrum* Royle, *Paeonia emodi* Wall. Ex. Royle, *Rheum moorcroftianum* Royle., *Rheum emodi* Wall. Ex meissn, *Saussurea costus* L., *Stephania elegans* Hook. F. Lithoms, *Valeriana jatamansi* Jones
Leaves	*Aconogonum tortuosum* D. Don, *Adiantum sp., artemisia nilgerica* CL., *Cinnamomum tamala* Buch. *Ham, Delphanium denusatum* Wall., *Hyocyamus niger* L., *Iris kumaonensis* D. Don, *Megacapaea polyandra* Benth, *plantago erosa* Wall, *Polygonum nepalense* Meissin, *Polygonum tortuosum* D.Don., *Protulaca oleracea* L., *Psidium guajava L., Punica granatum L.,Scorpolia stramonifolia* Wallich, *Selinum wallichianum* DC., *Syringa emodi* Ex. Royle, *Taxus bacata* (Zucc) Pilger, *Thymus linearis* Benth., *Viola biflora* L.
Whole Plant	*Aconitum atrox* Bruhl., *Allium sativum* L., *Allium auriculatum* Kunth., *Allium carolinianum* DC., *Allium humile Kunth., Allium wallichina Huntn, Maharanga emodi* (Wall) DC, *Oxyria digyna* L., *Potentiala fulgens* Hook., *Swertia chiraita* D. Don.
Aerial parts	*Achyranthus aspera L., Rubia cordifolia* Linn., *Tanacetum nubigenum* Wall ex DC, *Taraxaum officinalis* Noochi
Flowers	*Ranunculus pulchellus* C.A. *Mey., Rosa sericea* Lindal, *Saussurea gossypiphlora* D. Don, *Saussurea obvallata* DC. *Edgew, Sedum ewersii* Ledeb., *Thymus linearis.,* Benth.*Viola biflora* L.
Stems	*Picrorhiza kurroa* Royle & Benth.
Fruits	*Myristi fragrans., Podophyllum hexandrum* Royle., *Taxus bacata (Zucc) Pilger*
Seeds	*Hyocyamus niger* L., *Meconopsis robusta* Hook. B. & Thoms., *Plantago erosa* Wall., *Paeonia emodi* Wall. Ex. Royle.,*Saussurea obvallata* DC. Edgew., *Syringa emodi Ex. Royle., Zanthoxylum armatum* DC emodi Ex. Royle
Aerial bulbs	*Discorea bulbifera* Linn.
Resin	*Pinus wallichiana* A. B. Jacks
Latex	*Calotropis procera* Ait. R. Br., *Clematis montana* (Buch. Ham) ex DC

Table 5: Medicinal and aromatic plants species used for others economic purposes by Bhotia and Gangwal tribes

S. No	Plant Spices	Uses
1	*Allium auriculatum* Kunth.	Spice and flavouring agent
2	*Allium carolinianum DC.*	Spice and flavouring agent
3	*Arnebia benthamii* DC ex. Jhonston	Dye
4	*Astragalus chlorostachys* Lindl.	Tonic
5	*Berberis chitria* Edwards	Dye
6	*Cinnamomum tamala* Buch. Ham	Spice
7	*Dactylorrhiza hatagirea* D. Don	Tonic
8	*Rheum emodi* Wall. Ex Meissn	Dye
9	*Rheum moorcroftianum* Royle	Dye
10	*Rubia cordifolia* Linn.	Dye
11	*Selinum wallichianum* DC.	Flavouring agent
12	*Tanacetum nubigenum* Wall ex DC	Flavour and inscense

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