Medicinal Plants and their Contribution in Socio-Economic Upliftment of the Household in Gurez Valley (J&K)]

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Abstract

Gurez is situated along the Kishanganga river in Kashmir valley. It is remotely located but the most beautiful valley. Owing to connectivity problems, this valley has largely remained unexplored and thereby its various features have generally gone unnoticed. This beautiful valley harbors a diversity of the medicinal plants. These medicinal plants are not only used in traditional health care system for the treatment of various diseases but also provide an edge for socio-economic upliftment for households. The socio-economic profile of the people of this remote area depicts that these people live in underprivileged conditions. The medicinal plants indigenous to Gurez, like *Bunium persicum*, *Achillea Millefolium, and Carum carvi* besides others, have high commercial value and can be utilized as a source of income. These phytochemically rich plant species can contribute to the development of various formulations of herbal therapies. However, overexploitation of these plant species has caused a decline in the frequency of these species in the past few years. Planned cultivation, proper exploitation, and the commercialization of these medicinal plants can serve as a primary source of income to the people of this downtrodden community of Gurez, particularly marginalized farmers and landless poor people. These plants have the potential to broaden livelihood opportunities of these people by framing proper policy that can give topmost priority to proper exploration of these plants.

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5.1 Introduction

Medicinal plants form the basis of traditional health care needs by the majority of people worldwide (Karunamoorthi et al. 2013). The indigenous knowledge of medicinal plants forms the backbone of the healthcare system and is likely to contribute the sustainable developments of society and its economy (Bekalo et al. 2009; Patra 2009; Rana 2011). Globally, about 60–80% of the people rely on medicinal plants for their primary health care needs (World Health Organization 2005). These plants are not only the basic pillars of health care system but also provide a valuable source of income for millions of people worldwide. According to WHO, about 70–80% of emerging Asian/African population depend on traditional medicines for their primary health care needs. Traditional herbal remedies account for 30–50% of total medicinal utilization in china. People in developing countries have strong convection and faith in traditional system of medicine, with India (80%), Bangladesh (90%), Myanmar (85%), and Nepal (75%) (Manzoor and Ali 2017). There are about 1300 medicinal plants used in Europe, of which around 90% plants are collected from wild source. In the USA around 118 of the top 150 prescription drugs are based on natural resources (Balunas and Douglas Kinghorn 2005). China and India are the countries where the highest number of medicinal plants are used (11,146 and 7500 species, respectively) followed by Columbia, South Africa, and the USA. India is the highest consumer of these medicinal plants (44%) (Hamilton 2004; Mahmoud and Rafieian-Kopaei 2012; Srujana et al. 2012).

With an ever-increasing demand for herbal medicine, natural health products and secondary metabolites, the use of medicinal plants is growing rapidly (Cole et al. 2007; Nalawade et al. 2003). The Indian Himalayan region, which is the richest source of plants, contributes about 1748 of medicinal plants (Joshi et al. 2016). The region known for its biodiversity is also bestowed with diverse ethnic communities, each with their own culture and traditional knowledge. The medicinal plant related trade in India is approximately about 1 billion $ per year (Joshi et al. 2004). However, overutilization of these plant species has resulted in their decrease, and if unchecked may ultimately lead to species extinction and loss from their natural habitats. Furthermore, the increasing push for economic development and the socio-cultural transformation, the biodiversity in the Himalayan region is going to face a very high risk of extinction (Dad and Khan 2011).

Kashmir valley, endowed with implausible beauty, is a treasure trove of herbs with high medicinal value. About 81 plants growing here have been reported for their medicinal use in traditional healthcare system (Tali et al. 2019). However, a recent study in Jammu & Kashmir territory, has documented more than 1123 plant species, with ethno-medicine use (Dad and Khan 2011). Of these Family *Asteraceae* constitutes around 151 species, *Fabaceae* 69, *Lamiaceae* 66, and *Ranunculaceae* 53.

These species are used to treat a wide range of illnesses. Due to the presence of diverse phytoconstituents, these medicinal plants gain significance and importance in formulation and development of various dosage forms for different types of ailments.

5.2 Impact of Medicinal Plants on Socio-Economic Upliftment in Gurez Valley

Gurez valley located in the high Himalayas in Kashmir valley is about 86 km from district Bandipore of Kashmir Province. Located on the banks of the river Kishenganga, Gurez valley extends between 34°30–4°41 North and 74°37–74°46 East latitudes at an average altitude of about 2370 m above sea level. One of the coldest and dangerous peaks Razdan located above 4000 m above sea level has to be crossed to reach the valley of Gurez. The valley has got very cold climate, which is too harsh in winters. It has a diverse topography with varying habitats that contribute to its rich biodiversity. Gurez houses a Shina-speaking tribe of Dards. The other tribes of Shina-speaking Dards live in Chilas, Gilgit and other adjoining areas that come under Pakistan-controlled part. Although the area has been influenced much by Kashmiri culture, still whole of Gurez has a distinct socio-cultural and linguistic identity. According to census 2011, it covers an area of above 57,842 hectares having a population roughly around 37,992 (45 km^2) (Rather and Baba 2015). The population consists of *Dard* (predominant, Shina-speaking tribe), *kashmiris*, *Gujars*, *Bakarwals,* and *Pathans* (Kapahi et al. 1993). Shina is the main language spoken in Gurez. The literacy rate and the level of education in the population is less, (26.22%) with large household size (74.76%) (India 2011). Among the sample households, the prevalence of marginal landholders is higher about 57.29% (India 2011). As per the survey done in 2018, the average family income of the household was Rs 89094.28 with medium annual income ranging between Rs 60,001 and Rs 90,000/ annum (Kapahi et al. 1993). The road leading to the Gurez generally remains closed for more than 5 months. Main occupations of these people are agriculture, livestock production, and non-timber forest products (NTFPs) collection. Besides, poor socio-economic conditions and lack of proper marketing, the area faces acute shortage of Doctors and other health care services. The NTFPs collection, processing, and utilization/selling of these forest resources must be given topmost priority. This can serve as an important strategy in reducing the poverty of the area and thereby uplifting the socio-economic status of these backward tribal people (Atta et al. 2018).

Like other Himalayan savanna, Gurez is rich in diverse medicinal plants. Around 50 medicinally important herb species have been regularly collected and used by the *Gujjar* and *Bakarwal* pastoral communities of Gurez. A large proportion (75%) of these people use these plants for treating health problems. The elderly and traditional healers of this land have a sound knowledge about the use of these plants in treating ailments in both humans and livestock. All the three ethnic tribes (especially the elders and women folk) possess as well as have maintained within their communities the knowledge of habitat distribution, life history features, regeneration, uses and

mode of use of these plants. The continued belief of these communities on these high-altitude plants (traditional medicine) and the absence/scarcity/high cost of alternative modern medicine in the area is the driving force that greatly affects their source of medicine. These plant species are used for treating common ailments like cough, cold, asthma, bronchitis, headache, fever, and stomach pain by all three ethnic tribes. Furthermore, various species are used for some specific cases, e.g., *D. hatagirea* and *A. heterophyllum*. Likewise *F. roylei* is known for the broad range of medicinal applications suggestive from its vernacular name "Sheetkar" which in Kashmiri language means that it can cure 80 diseases. In terms of their ethnomedicinal properties and uses, species like *A. heterophyllum, D. hatagirea,* and *P. kurroa* are the most important medicinal plants for these people, as these species are used to treat common ailments as bacterial infections, inflammatory conditions, and fever. Besides, these possess a high market value, which makes them species of choice with regard to collection among all Gurezian communities. Various medicinal plants are also used frequently by these people for their ethnoveterinary applications. *R. webbianum* and *P. kurroa* are notable species in this regard, as these are used to cure different diseases of the livestock. Specifically, *R. webbianum* is used to cure many animal diseases including skin and eye diseases, respiratory tract diseases like cough, gastrointestinal problems, mastitis, hoof diseases, internal and external injuries, etc., while *P. kurroa* is used by nomadic people including *Bakerwals* and *Gujjars* in conditions of gastrointestinal disorders, inflammatory conditions of tonsils, and intestinal worms of their livestock. Similarly, *P. hexandrum* and *D. hatagirea* are specifically used for healing wounds and to treat bone fractures. The purpose and pattern of collection of these plants differ within the communities. *Gujjars* and *Bakerwals* collect these plants for both household and commercial purposes, the semi-sedentary *shepherds* collect these mainly for their household use. Furthermore, the pattern of collection also differs between the communities. The women of the *Gujjars* and *Bakerwals* seasonally migrate with their men to these high-altitude grasslands, where they collect these medicinal plants. However, semi-sedentary *Chopans* (shepherds), do not have such a division, as their women folk do not migrate. Furthermore, these medicinally and economically important species have got varied distribution. Species like *P. hexandrum* have a wide distribution in different habitat types, species like *P. kurroa* and *R. webbianum* at the same time are heavily localized. Others like *F. roylei* and *D. hatagirea* have low distribution and density. The high frequency of some species like *P. hexandrum* stems and their ability to grow in varied habitat types and complete their life cycle makes them candidates for planned cultivation. In addition, the part used frequently, e.g., fruit, which does not require damaging or cutting of plant also adds to their high frequency and density. However, the other species are highly localized and prone to grazing and trampling besides the part used being that which damages the plant or necessitates its cutting or destructive harvesting (e.g. rhizomes and tubers). These factors are responsible for the low density and availability of such plants (Kunwar et al. 2013). The two important steps for the long-term sustenance of these medicinal plants are to ensure the protection of these wild plant populations, without having an adverse effect on the livelihood of local

communities and to promote cultivation of these plant species, for commercial purposes (Government of Jammu and Kashmir 2019). These plants are regarded as free commodity by these people and are collected from nature (Kunwar et al. 2013). These medicinal herbs do not merely add value to health care, but they can be a good source of income for the households. On an average, a household harvests about 5–7 kg of medicinal plants of varied nature in a year; however, the amount of extraction varies across the zones. Due to frequent snowfall, extended winter, and belief of people on the traditional medicine, these remain the only reliable curative option. Furthermore, due to the scarcity of the allopathic practitioners and medicine, these people usually depend on their own traditional system of medicine based on the herbs found in nearby areas. These plants are usually collected during the summer season and are normally prescribed by elderly people who have inherited the knowledge of medicinal value of these plants. These plants were earlier widely distributed in the alpines, but because of overgrazing and overharvesting, their distribution and abundance has thinned down. Unsustainable anthropogenic activities are also posing serious threat to these precious plant resources (Andriamparany et al. 2014).

Through traditional plant knowledge, people can cure various diseases and ailments for successful life in their local environment (Singh and Rai 2017). The income of the people of Gurez valley mainly depends on agriculture, animal husbandry, and the collection from forest resources, which is mainly the collection of medicinal plants. There is an increasing demand for the medicinal plants in the traditional system and in pharmaceutical industries. Due to restricted activity, lack of basic facilities and infrastructure, the livelihood of farmers and their economic development is severely hampered. The cultivation and commercialization of these diverse medical plants can provide new avenues for social and economic upliftment of households in this part of the world. These plants not only add immediate value to the health care, but can be a good source of income for poor to medium families. The proper exploitation, preservation, and cultivation of natural medicinal plants can lead to biodiversity conservation and livelihood enhancement in the area. Moreover, it can also suffice the social and cultural needs of the people.

Medicinal plants indigenous to Gurez include *Achillea millefolium, Bunium persicum, Aconitum chasmanthum, Carum carvi, Betula utilis, Atropa acuminata* Royle, and many others as listed in Table 5.1. However, the most widely reported and used medicinal plants are *Bunium persicum, Carum carvi, Achillea millefolium, Hyoscyamus niger, Taraxacum officinale, Viola sylyatica, Fritillaria royle, Lavatera kashmiriana, Mentha arvensis and Rheium spiciforme*. These medicinal herbs are used by locals either as a decoction, dried powder or as a cold aqueous extract.

5.2.1 *Bunium persicum*

Bunium persicum is an economically and medicinally important grassy plant belonging to family *Apiaceae*. It is commonly called as wild cumin, wild caraway, shahi-zeera, jira, kala zeera (Mandegary et al. 2012; Sofi et al. 2009). Several

Table 5.1 Indigenous Medicinal plants of Gurez valley

S. No	Medicinal Plants/ family (local names)	Uses
1.	*Aconitum heterophyllum* /Ranunculaceae (Patees)	Diarrhea, fever, and dysentery.
2	*Aconitum. Violaceum* Stapf/Ranunculacea (Bishmool)	Tooth ache.
3.	*Angelica archangelica/* Apiaceae (Chora)	Expectorant.
4.	*Arctium lappa/* Asteraceae (Cheer Kachh)	Diurectic.
5.	*Artemisia absinthium* /Asteraceae (Chhuma-Jom)	Epilepsy and fever.
6.	*Atropa acuminate* Royle /Solanaceae (Bellodona)	Sedative, diuretic, and analgesic.
7.	*Bergenia ciliata* /Saxifragaceae (Pahend/ Korasadun)	Tonic in bladder and kidney stones.
8.	*Betula utilis* /Betulaceae (Burz)	Antiseptic.
9.	*Prunella vulgaris* /Lamiaceae (Kal-veoth)	Fever and as an expectorant.
10.	*Bupleurum falcatum* /Apiaceae (Gureinala)	Liver tonic.
11.	*Cichorium intybus/* Asteraceae (Kasini)	Liver, spleen, and menstrual disorders.
12.	*Corydalis ramose/* Papaveraceae (Ralkul)	Eye diseases.
13.	*Epipactis latifolia/* Orchidaceae (Ikchha-neuli)	Heart pain.
14.	*Euphrasia officinale/*Scrophulariaceae (Pushi-kachh)	Jaundice.
15.	*Fritillaria roylei*/Liliaceae (Sheetkar)	Tuberculosis and broncho-asthma.
16.	*Hyoscyamus niger* Linn. /Solanaceae (Bazarbang)	Asthma and whooping cough.
17.	*Inula racemosa* hook. F. /Asteraceae (Poshkar).	Asthma and bronchitis.
18.	*Jurinea macrocephala/* Asteraceae (Dhup).	Colio pain.
19.	*Lavatera kashmiriana* /Malvaceae (Resha khatmi)	Rheumatic pain.
20.	*Mentha arvensis* /Lamiaceae (Pudinakachh)	Carminative.
21.	*Orchis latifolia/* Orchidaceae (Nar-Mada)	Aphrodisiac.
22.	*Origanum vulgare/* Lamiaceae (Marzanjosh).	Menstrual suppression.
23.	*Picrorhiza kurroa/* Scrophulariaceae (Kutki)	Jaundice.
24.	*Pimpinella diversifolia* /Apiaceae (Hyo-kachh)	Carminative.
25.	*Plantago lanceolata* /Plantaginaceae (Phatal Kachh)	Purgative.
26.	*Podophyllum hexandrum/* Berberidaceae (Chhamadeh)	Hepatic enlargement.
27.	*Polygonum viviparum/* Polygonaceae (Churkee)	Diarrhea and dysentery.
28.	*Rubia cordifolia/* Rubiaceae (Manjithi).	Stomach ache.
29.	*Saussurea lappa/* Asteraceae (Koth)	Rheumatism and joint pain.
30.	*Senecio jacquemontianus*/Asteraceae (Khalar)	Nervine tonic.
31.	*Taraxacum officinale* weber/Asteraceae (hand)	Hepatic stimulant.
32.	*Taxus baccata/* Taxaceae (Postul).	Asthma and bronchitis.
33.	*Thymus serpyllum/* Lamiaceae (Javen).	Menstrual disorders.
34.	*Trifolium pretense/* Fabaceae (Lalchopati).	Expectorant.
35.	*Valeriana hardwickii/* Valerianaceae (Mushk Bala)	Hysteria and epilepsy.
36.	*Viola sylvatica* / Violaceae (Banafsha)	Cough and cold.
37.	*Viscum album/* Viscaceae (Banada)	Rheumatism and joint pain.

therapeutic effects have been attributed to this plant, which include brain tonic, anticonvulsant, anti-helminthic, anti-asthma, in the treatment of urinary tract infections, jaundice, and dyspnea (Miraj and Kiani 2016). The plant has been evaluated for its anticonvulsant (Miraj and Kiani 2016), diuretic, antifertility (Thakur et al. 2009), antidiabetic (Dhandapani et al. 2002; Srinivasan 2005), immunomodulatory (Chauhan et al. 2010), anticancer (Gagandeep et al. 2003), antioxidant (Shah et al. 2018), antifungal (Gani et al. 2015), and antibacterial (Rather and Baba 2015), activities, etc. In local folklore, its decoction is used to treat various digestive ailments and to increase milk flow in breast feeding mothers (Kapoor et al. 1951; Srivastava et al. 1984). Kala zeera is rich in iron (above 600 mg in each 100 grams) and can be a nutritious additive to daily diet for lactating mothers, menstruating women, pregnant ladies, and anemic people (Metropulos 2019). 100 gm of kala zeera contain 900 mg of calcium, which contributes about 90% of daily requirements of calcium. Being rich in calcium, it can be used in osteoporosis and by lactating mothers (Metropulos 2019). On commercial basis, Gurez valley has high potential to produce quality zeera which has got a tremendous popularity, because of its fragrance and taste. The present scientific data and the historical evidence of its medicinal uses support future research as well as its use as an aromatic plant. Because of having rich phytochemical, pharmacological, aromatic, and nutritious properties, the plant has a huge potential for economic development of Gurez valley through its planned cultivation.

5.2.2 *Achillea millefolium*

Achiella millefolium commonly known as "Pahhlegasse," "Monudnu" in Kashmiri, Yarrow or Thousand leaf in English, is native to Northern hemisphere in Asia, Europe, North America, and Northern Kashmir, especially Gurez valley (Cheers 1999; Kapoor et al. 1951; Srivastava et al. 1984). The tribal people of Gurez valley use decoction of this dried herb to cure fever, cold, and liver disorders. The field surveys carried out in North Kashmir have reported that *Gujjars* and *Bakkerwals* use crushed leaves of *Achillea millefolium* with boiled water three times a day to cure cold, eye infection, headache, toothaches, inflammation of gums, kidney pain, and urinary tract burning sensation (Khan et al. 2016). The main traditional remedial properties and pharmacological profile of *Achillea millefolium* show that it is a magical herb that holds the excellent promise for its incorporation in drug industry in novel drug development for the treatment of various diseases. The plant has been evaluated for various pharmacological activities presented in Table 5.2.

5.2.3 *Hyoscyamus niger*

Hyoscyamus niger or Black henbane commonly known as Bazar bhang in Kashmiri belongs to the family *Solanaceae.* It has been used in the treatment of various ailments since previous centuries (Kaul 1997). It grows wild in Kashmir including

Table 5.2 Reported pharmacological activities of *Achillea Millefolium*

S. No	Pharmacological activity	Animal used	Type of extract	References
1.	Anti-ulcer	Rodent	Ethanol	Baggio et al. (2002)
2.	Antispermatogenic	Swiss mice	Ethanolic and hydroalcoholic	Montanari, de Carvalho, and Dolder (1998)
3.	Hepatoprotective	Wistar rats	Aqueous	Gadgoli and Mishra (2007)
4.	Analgesic	Rats	Aqueous	Noureddini and Rasta (2008)
5.	Anxiolytic activity	Mice	Hydroalcoholic	Baretta et al. (2012)
6.	Cardiovascular activity	Wistar rats	Aqueous, ethanol	Niazmand and Saberi (2010)
7.	Antinociceptive	Mice	Hydroalcoholic	Pires et al. (2009)
8.	Hypotensive, vasodilatory, and bronchodilatory activities	Rats	Aqueous, ethanol	A Khan et al (2011)

Table 5.3 Reported pharmacological activities on *Hyoscyamus niger*

S. No	Pharmacological activity	Type of extract	Animal used	References
1.	Cardiovascular activity	Crude extract	Rat	Vallabi and Elango (2016)
2.	Anti-inflammatory analgesic and antipyretic	Crude extract	Mice	Khan and Gilani (2010)
3	Anti-parkinsonian	Ether and aqueous methanol	Mice	Sengupta et al. (2011)
4	Anticonvulsant	Methanolic	Mice	Reza et al. (2009)
5	Antidepressant	Ethanolic	Mice	Patil et al. (2013)

Gurez valley and is commonly found in Fakirpur area of Gurez, at an altitude of 2425 m. Traditionally the plant is used in toothaches. Its smoke is inhaled through mouth without swallowing and expelled out after half a minute. Traditionally it has been extensively used as sedative, in mental disorders, in epileptic mania, convulsions, neuralgia, and asthma (Matsuda et al. 1991; Patil et al. 2013). Planned cultivation, collection, and extraction of this plant, which is found in abundance in Gurez valley grass lands can be beneficial in the upliftment of the socio-economic status of local community. *Hyoscyamus niger* has been evaluated for pharmacological activities presented in Table 5.3.

5.2.4 *Saussurea lappa*

Saussurea Lappa, locally known as "Kuth," is naturally found in Kashmir's upper reaches of Chenab valley, Suru valley, Kishenganga, and Gurez (Butola and Samant

2010; Kapoor et al. 1951; Srivastava et al. 1984). Kuth is a plant of great economic value. Its economic importance can be well understood by Stewart's book, "Punjab plants" (published in 1864). In this book, the author states that in the year 1873, 7000 maunds of Kuth were exported via Calcutta to China. *Saussurea* is one of the best known herbs in several indigenous systems of medicine for the treatment of various diseases, viz., urinary problems, joint pain, sole ulcers, dysentery, and fever (Khan et al. 2004; Mir 2013; Pandey et al. 2012). Traditionally the paste prepared from roots of this plant is used to cure skin diseases, arthritis, and paralysis of body parts (by messaging it over skin in sun light) (Nalawade et al. 2003). For the economic Upliftment of people of state especially Gurez valley, experts are of the opinion that the extraction and export of drug should be carried out on large scale. For the obvious reason, government has banned unauthorized possession of Kuth. Provided appropriate measures are carried out for the proper cultivation, collection, extraction, and isolation of important phytoconstituents in this regard, Gurez valley in particular can find a place in the economic map of world. The plant has been evaluated for pharmacological activities presented in Table 5.4.

5.2.5 *Fritillaria roylei*

Fritillaria roylei commonly known as "Sheetkar" belongs to family *Liliaceae.* It is distributed from Kashmir to Uttarakhand with in an altitude range of 2400 – 4000 m. In Gurez valley, it mostly grows at Paatalwan at an altitude of 3636 m(Shah et al. 2018; Singh and Rawat 2011; Srivastava et al. 1984). *Fritillaria roylei* has been reported for ethano-medicinal properties like antitumor (Ping et al. 1995), antiulcer (Muto et al. 1994), and antihypertensive (Kang et al. 2002). Traditionally it is used for the treatment of asthma, stomach problems, bronchitis, and in burns (Singh and Rawat 2011). In Jammu and Kashmir the bulb is boiled with orange peel and is used traditionally in the treatment of asthma and tuberculosis (Shaheen et al. 2012).

Table 5.4 Reported pharmacological activities of *Saussurea Lappa*

Pharmacological activity	Experimental model	Extract used	References
Hepatoprotective activity	Mice	Aqueous, methanolic extract	Yaeesh et al. (2010)
Anti-diarrheal activity	Wistar rats		Negi et al. (2013)
Cardiovascular disease	Rat	Aqueous extract	Akhtar et al. (2013)
Anti convulsant activity	Mice	Petroleum ether, alcoholic extract	Ambavade et al. (2009)
Antiinflammatory activity	Mice and rat	Water and Ethanolic	Moeslinger et al. (2000)
Anti-ulcer	Mice	Acetone	Yamahara et al. (1985)

Fritillaria roylei has been evaluated for antioxidant and antiproliferative properties (Shah et al. 2014). It is used in preparation of the Ayurvedic tonic "Chyawanprash" (Krishnamurthi 1969). The market demand of this species is increasing while supply is gradually decreasing because of overexploitation. Because of this, the plant has been categorized as endangered by International Union for Conservation of Nature (Kroemer et al. 1997; Ved 2008). Though the herb is a source of income for local inhabitants, but over exploitation of this plant from the wild has rung the alarm bell for the conservators. In situ conservation and ex situ cultivation are the remedial measures ought to be carried out in order to fulfill the ever-increasing demand for this phytochemically rich plant species having potential to boost the economy of region.

5.2.6 *Betula utilis*

Betula utilis commonly known as "Burz" family *Betulaceae* is found mostly in Afghanistan, China, Bhutan, and India. In Kashmir it is found in Gurez valley (Rajdhani pass) at an altitude of 3630 m (Bean 1980; Shah et al. 2018; Srivastava et al. 1984). The plant contains important constituents like oleanoic acid, lupeol, botulin, lupeonone, sitosterol, methyl betulate, and betulitic acid (Pal et al. 2015). In ayurvedic and Unani system of medicine, plant bark is used in the treatment of diseases like convulsions, leprosy, blood, and ear diseases. Bark infusion is used as an antiseptic (Singh et al. 2012). Owing to excessive use of the plant as fuel and medicinal purposes, the plant is considered threatened. The immense medicinal uses and its religious importance necessitate a two-prong approach of conservation and extensive research on this plant both phytochemically as well as medicinally. Well planned conservation, cultivation, and collection can be good for the economic upliftment of the region. The plant has been evaluated for various activities enlisted in Table 5.5.

5.2.7 *Mentha arvensis*

Mentha arvensis commonly known as Pudina-kachh (Kashmiri), Pudana (Unani), and Corn Mint (English) family *Lamiaceae* is commonly found in Europe, Western central Asia, and Eastern Siberia. In India, it is distributed in Kashmir parts including Markoot area of Gurez valley at an altitude of 2425 mtr (Kapoor et al. 1951; Rastogi et al. 1990). The important constituents reported in mint plant are isomenthone, menthofuran, menthylacetate, carvomenthone, cineol, pipertone, carvacrol, α-pinene, α-phellandrene, dipentene, cardinene, quercetin, vitamin K, menthoside, eugenol, and thymol (Imai et al. 2001; Nair and Chanda 2007). *Mentha arvensis* is traditionally used in stomach problems, dysentery, asthma, jaundice, arthritis, rheumatic pain, and ischemic heart diseases (Biswas et al. 2014; Farnaz Malik 2012). It is used in food, pharmaceutical, and aroma industries (Sharangi and Datta 2015). Traditionally decoction of dried leaves is used as carminative and to relieve digestive

Table 5.5 Reported pharmacological activities of *Betula utilis*

Pharmacological Activity	Active constituent Used	Mechanism of action
Anticancer activity	Botulin	In lung and liver cancer it induces apoptosis by disrupting mitochondrial functions Mishra et al. (2016)
Anti HIV activity	Botulin	Betulin inhibits protease enzyme and reverses transcriptase Kroemer et al. (1997)
Antioxidant activity	Botulin	Scavenging of free radicals Shukla et al. (2017)
Anti-inflammatory activity	Botulin	Inhibition of lipoxygenase enzyme Kumaraswamy and Satish (2008)

Table 5.6 Reported pharmacological activities of *Mentha arvensis*

Pharmacological activity	Experimental model used	Active constituent	Mechanism of Action
Antibacterial activities	H. Pylori and S. aureus E. Coli	Menthol	Bacteriostatic and Bactericidal Fatih et al. (2017)
Antioxidant activities	Rat	Eugenol, terpenes, and flavonoids	Inhibition of enzymes-glutathione-s-transferase, and glutathione Evans (2009)
Antifertility activities	Albino mice	Petroleum ether	Reduces fructose level due to which viability of spermatozoa is altered; Thawkar et al. (2016)
Anti-inflammatory and anti-allergic activity	Mice	Ethanolic and aqueous	Inhibition of histaminerelease Malik (2012)

ailments (Thawkar et al. 2016). *Mentha arvensis* has been studied for various actions presented in Table 5.6.

5.2.8 *Bergenia ciliata*

Bergenia ciliata (Haw) commonly called as "Zakhnlehayati" (Kashmiri) belongs to family *Saxifragaceae* (Kour et al. 2019). It is mostly distributed in Himalayas from Kashmir to Bhutan at an altitude of 900-3000 m (Mir et al. 2019). In Gurez valley it is located in Sheetal bagh (2425 m) (Dhandapani et al. 2002; Srivastava et al. 1984). There is a paucity of data regarding phytochemical work on this plant. The phytochemical investigation of the aerial parts (whole) and leaves have led to the isolation of hydroquinone (benzenoids) (+) afzelechin, (+) catechin, arbutin,quercetin-3-O-α-L-arabinofuranoside,quercetin-3-O-β-D-xylopyranoside, eryodictiol-7-O-β-D-

Table 5.7 Reported pharmacological activities of *Bergenia ciliata*

Pharmacological activity	Extract used	Animal Used	Mechanism
Anti-pyretic activity	Methanolic	Rats	Lowers body temperature for up to 4 h in a dose-dependent manner Sinha et al. (2001)
Anti-diabetic activity	Hydroalcoholic	Rats	Inhibition of enzymes- α-glucosidase and porcine pancreatic α-amylase Bhandari et al. (2008)
Anti-inflammatory activity	Methanolic	Rats	Inhibition of inflammatory mediator; Sinha (2001)
Anti-tussive activity	Methanolic	Mice	Inhibition of cough reflex Kakub and Gulfraz (2007)
Anti-ulcer activity	Aqueous-methanol	Rats	Cytoprotective effects conferred by enhancement of the mucosal barrier Kakub and Gulfraz (2007)
Antimalarial activity	Leaf extract	Mice	Antiplasmodial activity Walter, Bagai, and Kalia (2013)
Antioxidant activity	Methanolic	In vitro	Free radical scavenging Rajkumar et al. (2010)
Anti-antiurolithic activity	Aqueous-methanolic	Albino rats	Mimics the urinary stone formation Bashir and Gilani (2009), Saha and Verma (2011)

glucopyranoside, 6′-O-p-hydroxybenzoylar-bergenin, 4-O-galloylbergenin, 11-O-galloylbergenin, p-hydroxybenzoic acid and protocatechuic acid 6′--O-protocatechuoylarbutin, 11-O-p-hydroxybenzoylbergenin,11-O-protocatechuoylbergenin and 6′-O-phydroxybenzoyl parasorboside, (3-O-galloylepicatechin and (−)-3-O-galloylcatechin (Chandrareddy et al. 1998; Khan and Kumar 2016; Sticher et al. 1979). In Jammu and Kashmir, traditionally the plant is used in the treatment of diarrhea, asthmatic disorders and locally as an application to boils and bruises (Ishtiyak and Hussain 2017). Powdered rhizome is used as tonic and to break stones in kidney and bladder (Saha and Verma 2013). From religious point of view, plant is used as a good luck gesture in the local festival called "Phool Sangran" in Uttaranchal state of India. The plant has been evaluated for various pharmacological activities presented in Table 5.7.

5.2.9 *Lavatera kashmiriana*

Lavatera kashmiriana belonging to family *Malvaceae* is commonly known as Sazakul (full plant), sazposh (flower), Sazmool (root), and Wan sotsal (leaves) in Kashmiri language(Pimenta 2003; Vidyarthi and OP. 2010). Traditionally it is an important herb used by people of Kashmir to treat various types of ailments. Crude roots of plant are sold by herbalists for abdominal disorders, common cold, pain killer, and laxative (Dar et al. 2013a; Kaul 2010). Important compounds found in *Lavatera kashmiriana* are lavateral, lavaterone, lavateronic acid, lavaterpene, and

lavaterosterol (Parveen 2013). Other compounds isolated from *Lavatera kashmiriana* include caffeic acid, gallic acid, vanillic acid, dodecanoic acid, ferulic acid, tetradecanoic acid, rutoside, n-hexadecanoic acid, chlorogenic acids, etc. (Skalicka-Woźniak et al. 2007). The high chemical profile of this plant makes it a potential herb in the treatment of various diseases. Gallic acid, an important phytoconstituents present in *Lavatera kashmiriana* possesses a wide range of biological activities including anti-viral, antiulcer, hepatoprotective, and anti-inflammatory activity (Sajeeth et al. 2010). The plant has been evaluated for many biological activities including anticancer (Dar et al. 2004), anti- lipoxygenase, antibacterial, and protease Inhibitor activity (Rakashanda et al. 2013).

5.2.10 *Taraxacum officinale*

Taraxacum Officinale commonly known as "Hand" in Kashmiri, family *Asterceae,* thrives in a wide range of conditions (Manzoor and Ali 2017). *Taraxacum Officinale* is an essential medicinal plant used by tribal people of Gurez for joint, kidney and inflammatory ailments (Seo 2005). The plant has been used ethanomedicinally in conditions of common cold,chest infection and back pain. Decoction and infusion of plant is used as a tonic, digestive stimulant, diuretic, and mild laxative (Schütz et al. 2006). Traditionally leaves are used as salad and in the form of soup, both recommended as natural source of vitamin C. The roots are used as infusion or coffee substitute. In addition, plant contains higher amounts of β-carotene, iron, and calcium along with macro and micronutrients (Jassim et al. 2012). Phytochemistry of the plant has revealed the presence of carotenoids (Singh et al. 2008), flavonoids (Schütz et al. 2005), sterols (Trojanová et al. 2004), and polysaccharides. Extracts of *Taraxacum officinale* have been evaluated for hypoglycemic (Cho et al. 2002), anti-inflammatory, antioxidant (Hu and Kitts 2005) diuretic, hepatoprotective, and antibacterial activity. The phytochemical constituents and therapeutic effects of *Taraxacum officinale* suggest that the herb can be a valuable addition in the pharmaceutical industry for compounding of newer formulations for various diseases and its planned cultivation, collection, and extraction can be a valuable in the upliftment of socio-economic state of people of Gurez.

5.2.11 *Aconitum heterophyllum*

Aconitum commonly known as "Monkshood" or "Atish" comprises of 250–300 species of which 24 species are found in India. These species are distributed widely in Northern Temperate Zone and cold-temperate regions of the Northern Hemisphere. There are a number of species found in Kashmir Himalaya, including Gurez valley. However, there is a lack of convincing criteria for species delimitation (Dar et al. 2013b). *Aconitum heterophyllum* belongs to family *Ranunculaceae* is listed in Ayurveda (Indian system of alternative medicine) as an ingredient of many formulations. It is one of the most valued medicinal plants and is a source of many

useful drugs (Dar et al. 2007). The plant has been reported for a number of activities like antidiarrheal, expectorant, diuretic, hepatoprotective, antioxidant, alexipharmic, anodyne, antiflatulent, antiperiodic, and carminative, besides having antiphlegmatic action. The plant is also claimed to have beneficial effects in reproductive disorders (Verma et al. 2010). The plant has been used both externally and internally in conditions of rheumatism, and for relieving pain and fever (Ameri 1998). Three main alkaloids found in the aconite root, mesaconitine, aconitine, and hypaconitine, have shown analgesic activities (Evans 2009). *A. heterophyllum* root extract has been reported to have anti-viral activity (Hikino et al. 1979; Zaidi et al. 1988), whereas *A. chasmanthum* for antifungal activity (Patwardhan et al. 1990). Owing to its unique properties, it has been facing the indiscriminate and ruthless exploitation by tribals, local people, forest contractors, various drug development agencies and other anthropogenic pressures since ages, resulting in speedy decline in its natural populations in the entire northwest Himalayan range (Anwar et al. 2003). Unabated exploitation has brought some of the species nearer to extinction and are now declared as critically endangered (Krishnamurthi 1969; Mamgain et al. 1998; Pandit 2002). Earlier, the Kashmir's Himalayan Aconites used to be collected from low and sub-alpine areas, but presently, they are only found and collected from alpine areas. So, it is the need of hour to undertake the commercial cultivation of the plant in different zones of alpine region, so that the stress is reduced on wild populations on one end, and revenue for both local people and the State is generated at the same time.

5.2.12 *Arctium lappa* Linn

Arctium lappa Linn., Family: *Asteraceae*, commonly called as Burdock is considered a healthy and nutritive food. The plant is popularly used in Chinese folklore and its roots, seeds, and leaves have been investigated for medicinal benefits. Antioxidants and antidiabetic compounds have been found in the root. These compounds are said to promote blood circulation to the skin surface, improve the skin quality/texture, and cure skin diseases like eczema. Some active seed constituents possess anti-inflammatory and potent inhibitory effects on the growth of tumors such as pancreatic carcinoma. Similarly, the bioactive leaf compounds have the property of inhibiting the growth of micro-organisms in the oral cavity. Burdock has been found to be effective in chronic diseases as cancers, diabetes, and AIDS (Chan et al. 2011). Arctigenin (AR) and its glycoside, arctiin, are two major active ingredients of *Arctium lappa* L. AR, the most potent bioactive component has shown potent anti-inflammatory activity, based on the mechanism of inhibition of inducible nitric oxide synthase (iNOS) via modulation of several cytokines. Thus, AR can serve as a therapeutic compound against both acute inflammation and various chronic diseases (Gao et al. 2018). The plant is also a rich source of lignans, sesquiterpene lactones, polyynes, sulfur derivatives, caffeic acid derivatives, polysaccharides, mucilage's, triterpenes, phytosterols and their esters, tannins, and lignans. Burdock leaves, fruits, and seeds have been found to contain various

important principles like arctigenin, arctiin, trachelogenin, lappaol F, diarctigenin, terpenoids, polyphenols, beta-eudesmol, caffeic and chlorogenic acid, tannins, inulin and sterols, amino acids, metal elements, vitamins, particularly vitamin C, A, B1, and B2), crude fiber, phosphorus, carotene, sulfur-containing acetylenic compounds (Angerhofer 2002; Chan et al. 2011; Fleming 2000; Jeelani and Khuroo 2012; Kato and Watanabe 1993; Kemper 2010; Maruta et al. 1995; Matsumoto et al. 2006; Park et al. 2007; Schulte 1967; Wang and Yang 1993; Washino et al. 1986. The plant also contains a good amount of total phenolic content (Predes et al. 2011).

5.2.13 *Atropa acuminata* Royle

Atropa acuminata Royle Ex Lindl (*A. acuminata*), commonly known as maitbrand or Indian belladona, belongs to family *Solanaceae*. It is a critically endangered species, endemic to northern Pakistan, Kashmir, and India found mostly in western regions of Himalayan subcontinent, starting from Kashmir at an altitude of 1.8–3.6 kilometers (km) to the connecting hills of the Himachal Pradesh up to 2.5 km. The plant has been reported from Kashmir, Muzaffarabad, and Chakrata (Mehraj et al. 2018a, b). The plant grows abundantly in Gurez. In traditional medicine, the rhizome and aerial parts of the plant have been used over a period of time, for the relief of joint pain, muscle pain, and muscle spasms. The plant parts have also been used in the treatment of arthritis, pancreatitis, peritonitis, scarlet fever, Parkinson's disease, and neuro disorders (Kahn et al. 1991; King 1966; Matsuda et al. 1991). The ethanolic extract has shown anti-arthritic activity (Nisar et al. 2015). *Atropa acuminata* is an extremely poisonous plant valued for its richness in tropane alkaloids such as atropine, hyoscyamine, and scopolamine. These alkaloids possess anticholinergic activity and have diversified therapeutic uses in medicine in the fields of ophthalmology, cardiology, and gastroenterology (Cardillo et al. 2016; Kursinszki et al. 2005). Besides these, monoterpenes, sesquiterpenes, phenyl propanoids, flavonoids, saponins, quinine (Butt et al. 2015), highly oxygenated triterpenes (Mehmood et al. 2002) have also been isolated from the plant. DART (Direct Analysis in Real Time) and HPLC analysis of hairy root culture has revealed the presence of high amount of different alkaloids. (Fatemeh Ashtiania 2011). The average active alkaloid content of leaves has been found to be 0.4%, whereas the root alkaloidal content is around 0.96%. The alkaloid content has been found to vary with age and developmental stage of the plant. At early age, the plant contains low alkaloidal content, but the content increases at the flowering stage (Dräger and Schaal 1994). The ethanolic leaf extract has been found to contain approximately 188 micro grams of phenolic compounds per ml, which is a huge amount compared to other plants in the family (Nisar et al. 2013). Since *A. acuminata* is under tremendous threat of extinction in its natural habitat, biological conservation of the plant as well as knowledge of its active ingredients is of paramount importance. Proper planning, preservation, and cultivation of the plant may bring laurels to Gurez communities economically.

5.2.14 *Prunella vulgaris*

Prunella vulgaris L. commonly called as "heal-all" or heart of the earth belongs to *Labiatae* family of perennial plants and is widely distributed in Asia and Europe (Psotová et al. 2003; Tutin et al. 2010). The dried spikes of the plant are often utilized in Traditional Chinese Medicine. In the Chinese Pharmacopeia, *Prunella vulgaris* is recommended for treating headaches, high blood pressure, diseases of the lymphatic system, goiter, and tuberculosis. In Kashmir it is used in the conditions of inflammatory disease and forms an important ingredient of the herbal extract, used for bathing by women after delivery. In a study, Liang Feng et al. (Feng et al. 2010) extracted, separated, and purified two polysaccharides from the plant (P31 and P32). The main polysaccharide P32 was found to possess anti-lung cancer activity and could increase the thymus index and spleen index in tumor-bearing mice. The study concluded that anti-lung adenocarcinoma activity was possibly one of the mechanisms responsible for immunomodulation effect. Currently *Prunella vulgaris* is considered more compatible with other antitumor herbs in lung cancer treatment because of its bioactive principles as terpenoids, flavonoids, polyphenols (Liang et al. 2009), and polysaccharides, that have known tumor inhibitory effects. Polysaccharides from the plant have been reported for immunoregulatory (Han et al. 2009; Harput et al. 2006) anti-inflammatory (Fang et al. 2005a, b), anti-viral (Tabba et al. 1989) and antioxidant (Dehua 2006) activities.

5.2.15 *Angelica archangelica*

Angelica archangelica, commonly known as garden angelica, wild celery, or *Angelica officinalis* Moench) is a biennial plant from the family *Apiaceae*. It was originally found in Syria but now has spread to many Europe countries and western Asia. In India, it grows from Kumaon and Garhwal in Uttarakhand to Kashmir Valley including Gurez valley of J&K. The dry rootstocks of the plant yield 0.35–1% of essential oil, which contains mainly β-phellandrene. The roots contain several furocoumarins and phenols that include angelicin, bergapten, xanthotoxin, umbelliprenin. The dried roots are used mainly in food and confectionery industry, perfumery, and medicine. Cakes, candy beverages, jams, omelettes (Jelen 2011), and gin are flavored with the root essential oils. The age of the roots determines their essential oil content. They possess stimulant, expectorant, and diaphoretic properties. The activity is attributed to high levels of terpenes, including α-pinene and β-phellandrene (Burdock 2016). Out of more than eighty aroma compounds found in the plant, Cyclopentadecanolide, is particularly of interest to perfumers and aroma chemists, which although present in small quantities ($< 1\%$ in roots, and $< 0.5\%$ in seeds), is primarily responsible for the distinctive musky aroma (Jelen 2011). Both the seeds and roots contain coumarins and furocoumarins. Anjelica roots and leaves are said to stimulate the blood flow to the peripheral parts of the body, and thus are valuable in treating poor circulation. The plant is specifically used in the treatment of Buerger's disease, a condition that narrows the

arteries of the hands and feet (Culpeper 1995). An essential oil from the seeds is sometimes used as a rub to relieve rheumatic conditions (Chevallier 1996). Angelica fruit has been approved by The German Commission E Monographs (a therapeutic guide to herbal medicine) for fevers and colds, infection of the urinary tract, dyspeptic complaints, and loss of appetite. The root has been approved for dyspeptic complaints and loss of appetite. The plant is used in the form of combination product "iberogast" for stomach problems like acid reflux, stomach pain, cramping, nausea, and vomiting. It is claimed that breathing its vapors for two minutes, few times daily can reduce tobacco carvings. Taking it orally is said to reduce the frequency of nocturnal urination in men with small bladders, however, the plant does not seem to be of any use in other men. It is one of the components of a combination product cream, which, when applied directly to the skin of the penis, helps in the condition of premature ejaculation. Besides Angelica root, the cream also contains Panax ginseng root, *Cistanches deserticola*, Zanthoxyl species, torlidis seed, clove flower, asiasari root, cinnamon bark and toad venom.The herb also helps in faster healing of bed sores. The plant is currently considered to be crucially endangered due to overactivity of man and needs to be conserved for its continued existence in nature. With proper planning and conservation, the plant has the potential for upliftment of economic status of people of Gurez.

5.2.16 *Picrorhiza kurroa*

Picrorhiza kurroa Royle ex Benth commonly known as Kutki or Kutka is a small, self-propagating, perennial alpine herb, belonging to family *Scrophulariaceae*. It is prevalent at high altitudes in the Himalayan regions of China, Pakistan, India, Bhutan, and Nepal. It is an endangered medicinal plant species. Owing to its folklore and medicinal value, its requirement is ever increasing but, the supply is rather inconsistent and inadequate. The reason for inconsistant and inadequate supply is harvesting and deforestation. Phytochemically *P. kurroa* has been extensively studied and around 132 active ingredients have been found from different parts of the plant such as roots, stem, leaf, and seeds. Kutkin is the major chemical constituent of the species. The plant has been found to contain picrosides I, II, and III, kutkoside. Veronicoside, pikuroside, cucurbitacins, 4-hydroxy-3-methoxy acetophenone, phenolic compounds (Husain et al. 2014; Nisha 2012), apocyanin and drosin. Apocynin belongs to catechol group and can check neutrophil oxidative burst as well as act against inflammation. Curcubitacins are cytotoxic in nature and exhibit antitumor activity (Simons et al. 1990). Cucurbitacins extracted from *P. kurroa* include cucurbitacin B, D, and R. Different extracts and individual bioactive compounds of the plant have been found to possess a range of pharmacological effects. *P. kurroa* is extensively used by locals in Gurez valley for the treatment of diseases like high fever and stomach problems. Owing to its choleretic property, its rhizome extracts are also used in hepatic injury in livestock. In Bhutan, its rhizome extract is recommended for colds, coughs, and fever. In China the plant extract is used in jaundice, digestive disorders, diarrhea, and dysentery. In Nepal, the plant is

commonly used to treat hepatitis and jaundice. In Kathmandu, the rhizome extract is used as an antidote against scorpion bite. It is also used in the treatment of high blood pressure, eye disease, colic pain, bile disease, gastritis, and sore throat (Mulliken 2000). In India, the rhizome extract is considered as an antibiotic and is widely used in Ayurvedic and Unani medicine. It is used as a foremost ingredient in Arogyavardhini; an ayurvedic medicine to cure liver diseases. A survey of literature shows that thorough pharmacological appraisals have not been carried out on the pharmacological claims. Different extracts and bioactive compounds from *P. kurroa* have shown therapeutic potential in various in vivo and in vitro studies. The activities include antioxidant (Deshpande et al. 2015; Rajkumar et al. 2011), immunostimulatory Immunomodulatory activity of biopolymeric fraction, anti-inflammatory (Gupta et al. 2006; Kantibiswas et al. 1996; Kumar et al. 2016), antimicrobial (Laxmi and Preeti 2015; Sharma and Kumar 2012; Shubha et al. 2016), antidiabetic (Husain et al. 2009), antiasthmatic (Sehgal et al. 2013), analgesic (Shid et al. 2013), cardioprotective (Nandave et al. 2013), anticancer (Mallick et al. 2015), and hepatoprotective (Dwivedi et al. 1992; Jia et al. 2015; Kaur et al. 2012; Siddiqi et al. 2015). The plant is valued by herbalists as hepatoprotective, stomachic, antiperiodic, anti-amoebic, cholagouge, anthelmintic, antioxidant, cardio-tonic, anti-inflammatory and carminative, etc. (Gaddipati et al. 1999; Prajapati 2013; Singh et al. 1993). It is also effective in gastrointestinal and urinary disorders, scorpion sting, snake bite, leukoderma, and inflammatory affections (Dey et al. 1980).

5.2.17 *Rheum webbianum*

Rheum webbianum Royle commonly known as "Himalayan Rhubarb" in English, and "Pumbachalan" in Kashmiri belongs to family *Polygonaceae*. It is native to Asia-Temperate to Asia-Tropical, from China to India, Nepal, and Pakistan. In Jammu and Kashmir, it grows on open slopes and shrubberies in the valleys of Kashmir, Gurez, Leh, and Zansker between 3105 and 3920 m above mean sea level (Chaurasia et al. 2007; eFloras 2020). The roots, stems, leaves, and leaf-stalks of the plant are used in various conditions like constipation, indigestion, abdominal diseases, wounds, boils, and flatulence (Huang et al. 2007). The plant has been studied for the management of gastrointestinal (GI) and renal function disorders, and for the treatment of hyperlipidemia and cancer (Huang et al. 2007; Srinivas et al. 2007). As per traditional Chinese system of medicine, rhubarb is thought to improve the memory in senile patients (Tian et al. 1997). Rhubarb extract has been suggested as an adjunct to chemotherapy in tumors and has shown antiangiogenic action (Cai et al. 2008; Cui et al. 2008; Huang et al. 2007; Lin et al. 2003; Srinivas et al. 2007; Wang et al. 2007). The plant has been used GI bleed cases to eliminate extravasated blood (Dong-hai et al. 1980; Srinivas et al. 2007). It is a potential source of dietary fiber, with a lipid-lowering effect (Abe et al. 2000). The plant has also shown anti-inflammatory activity (Atta et al. 2018) and its anthraquinone derivatives have been used as antifungal and molluscicidal agents. The active constituent Rhein has demonstrated in vitro antimicrobial activity against a wide spectrum of gram-

negative and gram-positive bacteria (Agarwal et al. 2000; Huang et al. 2007; Jong-Chol et al. 1987; Liu et al. 1997; Tegos et al. 2002). An extract of rhubarb stalk has been used as a dental desensitizer. In vitro and in vivo studies in fish have proposed that the herb possesses estrogenic activity (Usui et al. 2002). Rheum emodi roots possess hepatoprotective principles that can prevent and/or treat paracetamol induced liver damage (Akhtar et al. 2009). Its roots give yellow color and are thus used to dye wool and silk fibers. The main coloring component is chrysophanic acid, which is found associated with a number of compounds. The plant has been found to contain a number of Anthraquinone derivatives, viz., rhein, emodin, aloe-emodin, physcion, and chrysophamol. Stilbene glycosides as rhaponticin and the metabolite rhapontigenin, Tannins, Sennosides, Catechins, Gallic, and cinnaminic acid (Li et al. 2000; Misiti et al. 2006; Xiao et al. 1984; Zhu et al. 2005) besides Lindleyin, having estrogenic activity (Usui et al. 2002), oxalic acid, as well as 2-methylbutanol and 4-methylhexanol (Dregus et al. 2003; Lust 1983). Human activity has been responsible for extinction of this species from lower reaches of Gurez, and is now limited to high altitudes. The importance and usefulness of the plant in traditional medicine demands the consevation and sustainable utilization of this rare species. This will not only provide raw material but also provide resource generation for economic upliftment for the local population in the cold arid high-altitude regions like Gurez.

5.3 Conclusion

This study concludes that even living in the area having a very rich diversity of NTFPs, the main communities of Gurez valley are living in underprivileged conditions in all aspects as depicted by their socio-economic profile. Today in this modern world in the era of "Digital India" movement, the people of Gurez valley are still isolated from the rest of the world because of the lack of basic amenities of life, like electricity, proper market, inaccessible roads, and absence of highspeed internet even mobiles, given the proximity to the border and the current prevailing situation. This has led to migration of people to other areas. Also acute poverty, debt, substandard quality of life, lack of awareness, and exposure, etc. contribute further to the problem. In such circumstances, forests in general and proper exploitation of medicinal herbs in particular can play a crucial role in the upliftment of socio-economic status and livelihoods of a majority of these people. The forest-based livelihoods mainly collection, processing, and utilization/selling of various medicinal herbs can prove detrimental in this regard and should be given topmost priority as important strategy of poverty reduction and socio-economic upliftment of these backward tribal people.

In recent years, there is growing awareness globally that apart from being safer, economical, and easily available, phytochemicals and herbal products can affect the course of inflammatory diseases and may provide an amalgamation of nutritional substances, which help in re-establishing and maintaining wear and tear of tissues. Medicinal plants and herbs are not only the prime and effective source of health care for the people of Gurez but also have the potential to uplift the socio-economic state

of these people. The high diversity and commercialization of these medicinal plants can provide edge for social and economic upliftment of households in Gurez. To fulfill their primary health care needs, these medicinal plants have an important role to play because these people treat their common ailments with these locally available herb-based medicines instead of allopathic drugs which are scarce in this part of the world, costly as per their living standard, and full of side effects as per their belief. Considering the geographical constrains, and connectivity problem, especially in long and harsh winters (there is no road connectivity at least for 5–6 months due to heavy snow fall), when there is scarcity of everything including medicine and food items (though they may be available, but there is restriction in movement due to heavy snow fall and below freezing temperatures), conservation of these herbs is of paramount importance in those testing times. Besides, these herbs are phytochemically much superior in constitution than the herbs found in other parts of the world and thus can form an important tool for the development of various important medicine and nutritional supplements. Thus, their planned cultivation and conservation can bring laurels to the economy of this backward area and uplift the economic status of the local tribal community. Scientific data reveals that if these herbal plants are exploited effectively and properly, Gurez valley could become a hub in the future not only for herbal medicine but also for aroma compounds. Since the faith in herbal drugs is growing day by day as, they are considered to be devoid of side effects, such an endeavor would be detrimental in socio-economic upliftment of these people. With appropriate measures Gurez valley of Jammu and Kashmir can find a place in the economic map of the world and the need of the hour is that Government should provide technical and marketing assistance to these poor farmers living in underprivileged conditions in this regard.

Conflict of Interest Authors declare no conflict of interest.

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