Cross-cultural ethnomedicinal study of the wild species of the genus *Berberis* used by the ethnic communities living along both sides of the Indo-Pak border in Kashmir

Hammad Ahmad Jan, Tawseef Ahmad Mir, Rainer W. Bussmann, Muatasim Jan, Uzma Hanif and Sher Wali

Correspondence

Hammad Ahmad Jan[1*], Tawseef Ahmad Mir[2,3], Rainer W. Bussmann[4,5], Muatasim Jan[2,3], Uzma Hanif[6] and Sher Wali[7]

[1]Department of Botany, University of Buner, Swari-19290, Pakistan
[2]School of Life and Allied Sciences, BFIT Group of Institutions, Dehradun, 248007 Uttarakhand, India
[3]Centre of Research in Ethnobotany, Government Model Science College, Gwalior, 474009 India
[4]Department of Botany, State Museum of Natural History Karlsruhe, 76133 Karlsruhe, Germany
[5]Department of Ethnobotany, Institute of Botany, Ilia State University, 0105 Tbilisi, Georgia
[6]Department of Botany, Government College University Lahore, Pakistan
[7]Department of Botany, Islamia College Peshawar, Pakistan

[*]Corresponding Author: hammadjan@ubuner.edu.pk

Ethnobotany Research and Applications 26:3 (2023) - http://dx.doi.org/10.32859/era.26.3.1-14
Manuscript received: 24/08/2022 – Revised manuscript received: 08/01/2023 - Published: 18/01/2023

Research

Abstract

Background: Plants have been the basis of human medical systems for thousands of years in Pakistan and India. This study was conducted to compare the traditional medicinal knowledge and species diversity of the genus *Berberis* that are widely distributed in the study area.

Methods: The data was collected through group discussion and face-to-face interviews from 2,368 participants during 2020–2022, using a semi-structured questionnaire.

Results: We collected a total of five species of the genus *Berberis*. Four species (*Berberis aristata*, *Berberis lycium*, *Berberis pseudumbellata*, and *Berberis vulgaris*) were documented from Kashmir Pakistan and four species (*Berberis aristata*, *Berberis kashmirana*, *Berberis lycium*, and *Berberis pseudumbellata*) from Kashmir India. The most commonly reported species in both areas was *Berberis lycium*. The most common group of diseases treated in Kashmir, India, was digestive diseases, and in Kashmir, Pakistan, liver and endocrine system diseases. The root was found to be the most used plant part in both regions (33% of all uses). The decoction was found to be used predominantly for the preparation of herbal remedies (26%).

Conclusion: The results of this study clearly show that ethnomedicinal knowledge is still alive in the study area, but due to political restrictions, the local people cannot share the knowledge easily.

Keywords: Ethnomedicine; Genus *Berberis*; Cross-cultural study; Kashmir Pakistan; Kashmir India

Background

An ancient custom of human development is the indigenous knowledge of utilizing medicinal plants to heal a variety of ailments (Gertsh, 2009; Jan *et al.* 2022a). Plants are the main source of healthcare for up to 85% of the world's population (Calixto, 2005; Mir *et al.* 2021a; Khoja *et al.* 2022), and plants are often harvested from the wild. Traditional medicine is essential for the healthcare, especially for those living in rural regions (Sen and Chakraborty, 2016). It is customary for local communities to orally pass on their traditional knowledge of how to utilize medicinal herbs from one generation to the next (Pieroni and Quave, 2005; Mir *et al.* 2021b). In nations like Pakistan and India, nearly 75% of the population still relies on traditional indigenous medicine to cure common diseases (Jan *et al.* 2022b). But as cultures modernize and rapidly adapt to new ways of life, this priceless wisdom is being lost (Jan *et al.* 2017).

Medicines have traditionally been prepared from medicinal plants (Nwachukwu *et al.* 2010). Still, around 25% of the ingredients in prescription drugs are based on medicinal plants (Sher *et al.* 2003; Nwachukwu *et al.* 2010). The majority of these medicines include plant extracts and their active ingredients, and the compounds in many allopathic medications are still isolated from natural medicinal herbs (Khalil *et al.* 2013).

Berberis is a large dicotyledonous genus that belongs to the family Berberidaceae. Seventeen genera and 650 species of Berberidaceae have been reported in recent publications (Khan *et al.* 2014). *Berberis* is characterized by its prickly, woody, deciduous, or evergreen shrubs and small trees with distinctive yellow flowers and wood. Throughout the world, the genus is widely distributed, although it is mostly found in India, Pakistan, Japan, China, Central and West Asia, South-East Asia, Europe, East Africa, South America, and North America (Rao *et al.* 1998). Species from this genus are prevalent in Pakistan's hilly areas (1400 m to 3500 m above sea level), and they are essential components of both traditional and contemporary remedies (Shinwari *et al.* 2006; Khan *et al.* 2014). These plants are divided into three groups based on their habitat: the Rocky Mountain group, which contains *B. aquifolium* Pursh, the Asiatic group, which includes *B. aristata*, and the European group, which includes *B. vulgaris* (Shinwari *et al.* 2000). Some of the species are also utilized as sources of natural dyes in addition to being used medicinally (Haji, 2010; Srivastava *et al.* 2015).

In India, Pakistan, Iran, and other countries, *B. vulgaris, B. orthobotrys, B. khorasanica, B. integerrima, B. crataegina, B. lycium, and B. aristata* are used commonly in traditional medicine (Rajasekaran *et al.* 2009; Bhardwaj and Kaushik, 2012; Mir *et al.* 2022). This study work was designed to document the traditional medicinal uses of the members of genus *Berberis* by the ethnic communities living along both sides of the Indo-Pak border in Kashmir and to discuss the cross-regional consensus on the uses of this medicinal plant. In addition to providing a foundation for the investigation of novel phytochemicals, this study would guarantee the preservation of important ethnomedicinal information related to the *Berberis* species in the study area.

Materials and Methods

Study region

For this cross-regional ethnomedicinal study, data was collected from Kupwara, Baramulla, Bandipora, Budgam, Anantnag, Kulgam, Pulwama, Shopian, and Ganderbal regions of Kashmir, I ndia and Bagh, Bana Valley, Bangoin, Barali Kass, Bheri, Dawarian, Devi Gali, Dhirkot, Goi, Harighal, Kel Village, Kotli, Lawat Village, Leepa valley, Machyara National Park, Maradori Valley, Neelum Valley, Nikyal, Pearl Valley, Pir Nasoora National Park, Poonch, Rawalakot, Samahni, Sharda, Sudhan Gali, Sudhnoti, and Toli Pir National Park parts of the Kashmir, Pakistan (Fig. 1). Both the study areas are geographically isolated and have a rich diversity of ethnic tribes throughout.

The native language of Kashmir-India is Kashmiri and is mostly spoken in the valley, certain areas of Jammu, and some areas of Azad Kashmir. The other three languages that are most extensively spoken in Jammu, Ladakh, and Azad Kashmir are Dogri, Ladakhi, and Pahari. The sole language spoken throughout the whole bio-geographic region is Urdu (Kashmir, Ladakh, Jammu, and Azad Kashmir). In Kashmir, Islam and Sikhism have traditionally been the two most popular faiths. In Jammu, Hinduism predominates, but Buddhism is practiced by the Ladakhi people.

Geographically, Jammu and Kashmir are made up of mountains and desolate slopes (Shafiq *et al.* 2019). The northeastern side of the valley is bounded by the main Himalayan range. The Kashmir valley is generally 1850 meters above sea level (masl). Different language groups including the Gujjar, Bakerwal, Kashmiri, and Pahadi are living in Kashmir-India. The area is endowed with a wide variety of plants and has tremendous economic potential. Some significant medicinal plants that the

native people gather for their livelihood include *Fritillaria cirrhosa, Trillium govanianum, Aconitum heterophyllum, Podohyllum hexandrum, Rheum webbianum,* and *Bergenia ciliata*.

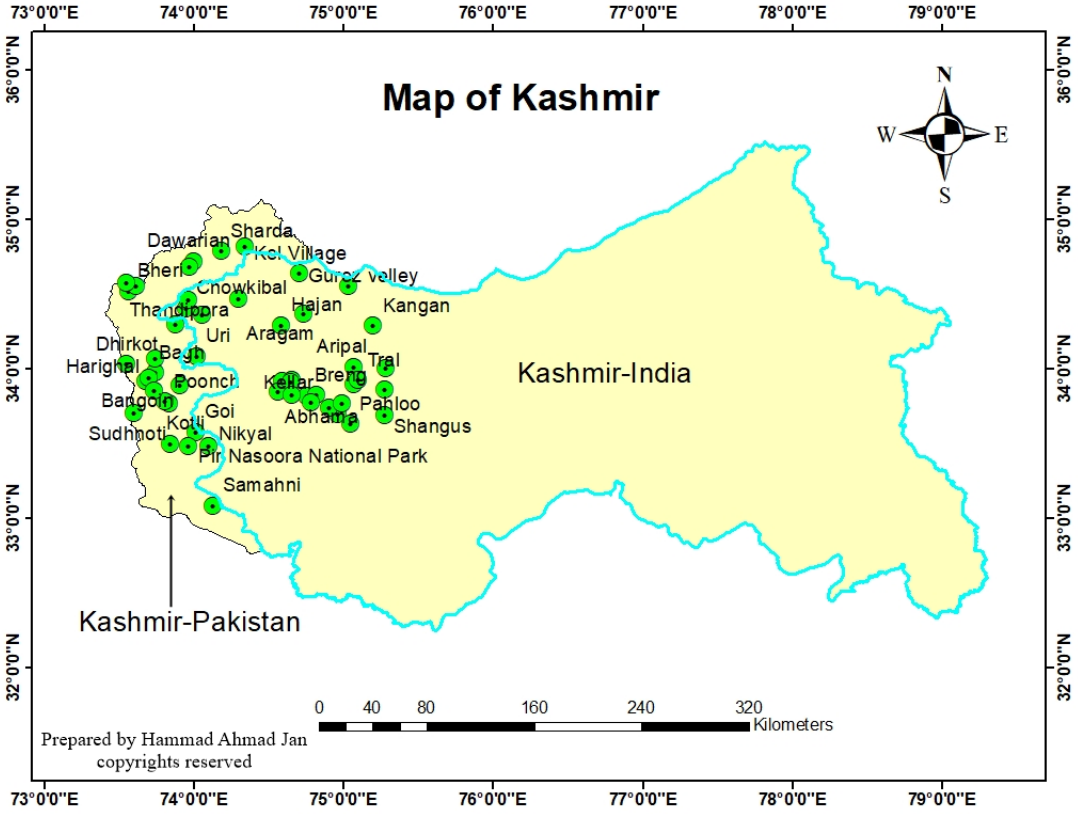

Figure 1. Map of the study area with the data collection sites

With a total size of 13,297 km^2, the Kashmir-Pakistan is situated in the Himalayan foothills between 73-75'1º1 East longitude and 33-35º1' North latitude. South to north, the elevation above sea level varies from 360 meters to 6325 meters. The region is blessed with abundant natural beauty, including a variety of ecosystems such as lakes, rivers, streams, springs, meadows, steep mountain slopes and roads, farmed fields, wastelands, etc. Although the winters in Kashmir Valley are quite cold, the summers are rather mild. Jhelum, Neelum, and Poonch rivers are the principal water sources. The majority of the Southern districts, such as Kotli, Mirpur, and Bhimber, are comparatively plan and rolling whereas the Northern districts, such as Muzaffarabad, Bagh, Poonch, and Sudhanoti, are often hilly **(**Rashid *et al.* 2015**).** Jamgarh Peak, which rises to a height of 4734 masl, is located in the lower Himalayas in the northern section of AJK. With valleys and patches of plains, the geography of the region is mostly hilly and mountainous. A typical annual rainfall of 1300 mm characterizes the subtropical highland climate (Bano *et al.* 2013).

Data collection

Field surveys were carried out from 2020 to 2022 to document the ethnomedicinal knowledge. The data was collected through face-to-face interviews, group discussions, and field observations using a semi-structured questionnaire. The local participants were asked about the human diseases treated, local names of plants used, parts used, methods of preparation, and routes of application. Objectives of the study were explained to the informants before the study in their local language. Translators were consulted to clearly explain the objectives and procedures in the local language to informants, and oral prior informed consent was taken from all participants (Mir *et al.* 2021c; Jan *et al.* 2021a). Interview questionnaires were prepared in English and then translated into local languages according to the need of the different study regions. Local knowledgeable persons were consulted to select the informants from the different parts of the study areas. The unauthentic information was excluded as much as possible by cross-checking the information through informal methods of confirmation (Quinlan, 2005). The timing of the informants' responses to the questions was left up to them. We used two different approaches for the survey. The first approach was specimen presentation, where fresh plant material was displayed to informants to acquire medicinal information and the same plant was shown to additional informants to ensure the

correctness of data for a given plant. In the second method of survey, field walks (Maundu, 1995) were conducted with local knowledgeable participants to get the most accurate information regarding the identification and use of *Berberis* species during a guided field trip to the forest area. Each informant was interviewed more than once to ensure the accuracy and coherence of the information.

Plant collection preservation and taxonomic confirmation

To gather, dry, mount, prepare, and preserve voucher specimens, standard herbarium procedures were used (Jain, 1964). The Flora of Jammu and Kashmir and the Flora of Pakistan were used to identify the voucher specimen. The botanical nomenclature of the plants was verified using various online platforms (IPNI, Tropicos, and The World Flora Online).

Results and Discussion

Demographic status of informants

The plant resources are known to play an important role in the holistic development of indigenous communities living in the Indo-Pak Kashmir region by taking care of their dietary, medical, and socio-cultural provisions. The Indo-Pak Kashmir is located in the bosom of the Himalayas with rich ethnic culture and ecological diversity. Most people are inhabitants in rural areas hence the dependency on plants is common. Born out of necessity due to poverty, disputation, medicinal plant usage has slowly established itself in this territory, becoming a part of confined socioeconomic and religious cultures. A total of 2368 informants with ages ranging from 25 to 93 were chosen to collect the relevant information on the ethnomedicinal usage of the genus *Berberis* (Table 1). Most of the informants belonged to the age group of 34-55 (44.13%). Most of the participants were illiterate, and the least number were having secondary education, and few were job holders. This might be because the areas selected for the current research included remote and rural villages with negligible modern healthcare facilities. The majority of the informants were men (1762) with fewer women (706). Due to cultural norms, access is mostly restricted to rituals for elderly women (Ullah *et al.* 2021). The result of this study clearly shows that the younger generations in both Kashmir-Pakistan and Kashmir-India have less knowledge of ethnomedicines. This may be due to the modernity of lifestyle, which encourages younger generations to choose allopathic over natural remedies (Sargin, 2015). A declining tendency in the ethnomedicinal knowledge of informants with a rising literacy rate was observed. This may be because educated individuals prefer Western healthcare systems over traditional ones (Jan *et al.* 2022).

Table 1. Demographic status of informants of Kashmir, Indo-Pak

Demographic features	**Kashmir-India**	**Kashmir-Pakistan**
Respondents	1030	1338
Male	811	951
Female	319	387
Age group (Years)		
Young (25-33)	112	73
Middle (34-55)	527	518
Old (56-93)	391	360
Farmers	237	284
Shepherds	278	135
Herbalists	71	63
Shopkeepers	157	151
Job Holders	123	176
Housewives	164	142

Ethno-floral diversity

During the study, a total of 5 species of *Berberis* were found to be used for the treatment of a wide range of ailments in both Kashmir-Pakistan and Kashmir-India. *Berberis lycium, Berberis aristata, Berberis vulgaris,* and *Berberis pseudumbellata* were used in Kashmir-Pakistan (Table 2) and *Berberis lycium, Berberis aristata, Berberis kashmirana* and *Berberis pseudumbellata* (Table 3) were used for the treatment of a wide range of ailments in Kashmir-India. Considering the comparison of species utilization, *Berberis kashmirana* was exclusively found in Kashmir-India, and *Berberis vulgaris* was exclusively found in Kashmir-Pakistan. As far as the usage pattern of the species is concerned, it was found that the reported species were widely used for the treatment of human ailments throughout the length and breadth of both the isolated geographical chunks. *Berberis lycium* was used commonly throughout both the study regions in contrast to the other reported species. The reason

behind its major use may be attributed to its good content of secondary metabolites or its wide distribution in both areas. As reported in many of the earlier studies, many species of the genus *Berberis* have been found to use in the treatment of a wide range of ailments in developing and developed nations (Rahimi-Madiseh *et al.* 2017; Jan *et al.* 2021a). Some species which were found to be used in the present study including *B. lycium, B. aristata,* and *B. kashmiriana,* have been shown to have antibacterial, antifungal, and carminative properties in previously published research (Singh *et al.* 2009; Madiseh *et al.* 2014). *B. lycium* has been reported to have wide use in traditional healthcare systems in remote areas of developing countries (Jee *et al.* 1984; Mir *et al.* 2021a; Rahimi-Madiseh *et al.* 2017).

Part(s) used, mode of preparation and administration

Roots were the dominant plant part used in both the regions with a total of 33% of all uses (22% in Kashmir-Pakistan and 12% in Kashmir-India), followed by fruits (21% - 6% in Kashmir-Pakistan, 15% in Kashmir-India), leaves (19% - 3% in Kashmir-Pakistan, 16% in Kashmir-India) and bark (19% - 3% in Kashmir-Pakistan, 16% in Kashmir-India), stem (7% - 2% in Kashmir-Pakistan, 5% in Kashmir-India) (Fig. 2). Roots have been found frequently documented in earlier studies for the preparation of herbal remedies (Singh *et al.* 2011; Malik *et al.* 2015; Singh *et al.* 2017), likely due to the presence of active ingredients (Ghorbani, 2005). The fruit was found to be the second most part used in our study similar to earlier reports (Tariq *et al.* 2015; Dogan and Ugulu, 2013). Leaves were the third most frequently used part. Apart from being rich in metabolites, leaves are easy to collect and process (Cakilcioglu and Turkoglu, 2010).

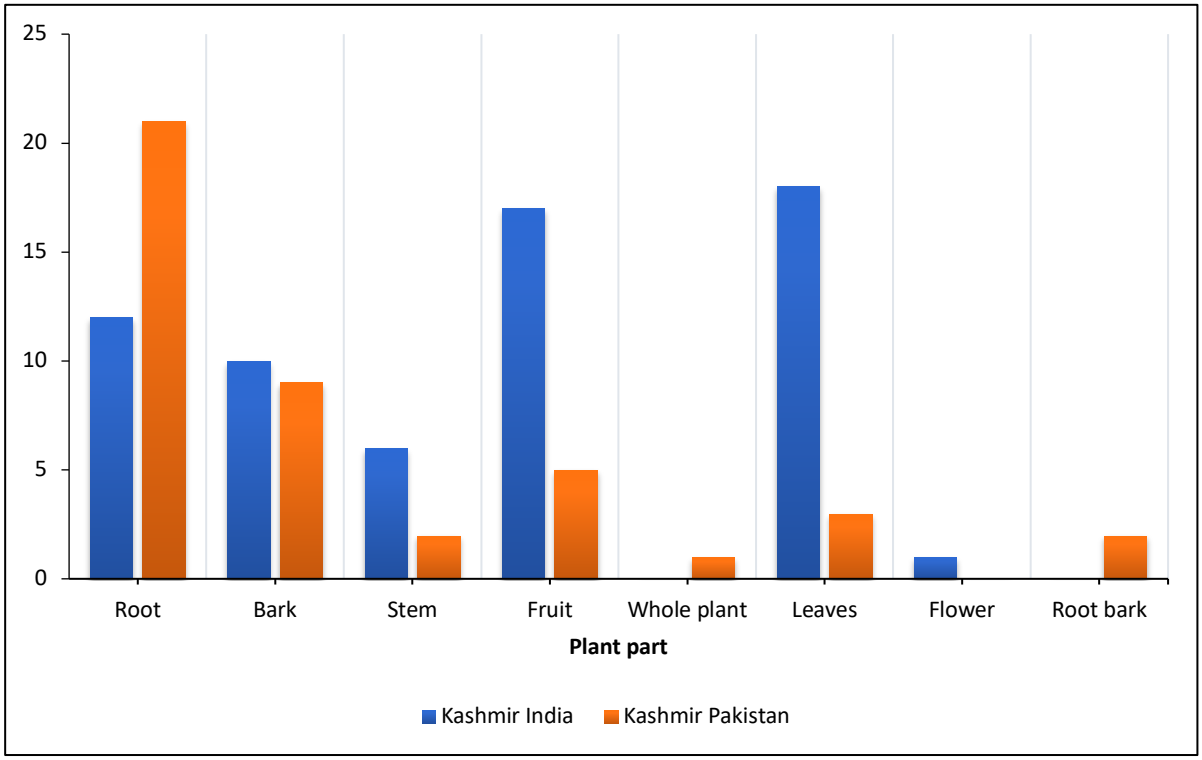

Figure 2. Comparative uses of plants parts as medicine

The decoction was used dominantly in the present study for the preparation of herbal remedies with a percentage contribution of 26% (12% in Kashmir-Pakistan, 14% in Kashmir-India), followed by powder-20% (11% in Kashmir-Pakistan, 9% in Kashmir-India), raw-17% (6% in Kashmir-Pakistan, 12% in Kashmir-Pakistan), juice-13% (1% in Kashmir-Pakistan, 12% in Kashmir-India), paste-11% (4% in Kashmir-Pakistan, 7% in Kashmir-India) and cooked-1% (1% in Kashmir-Pakistan, none in Kashmir-India) (Fig. 3). Remedies were mostly used orally; however, topical application was also followed. However, there was a potential difference in the number of doses given to treat a particular disorder. Several previous showed similar importance of decoctions (Malik *et al.* 2015; Thakur *et al.* 2016). Aqueous extracts are often less toxic than preparations made with other extraction procedures, decoctions are frequently used, which may be related to their perceived high efficiency for treating a variety of disorders (Bussmann *et al.* 2011). The preparation and use of the different remedies are based on the potency and shelf life of a particular remedy (Sonibare and Abegunde, 2012). Most often, fresh plants were used to prepare herbal remedies. These findings concur with previous reports from other areas of the world (Ignacimuthu *et al.* 2006; Bussmann and Sharon, 2006). Remedies were mostly used orally; however, topical application was also followed.

Oral application is considered one of the best ways of herbal remedy administration (Kumar *et al.* 2017). The most widely used method of therapy for conditions including skin conditions, joint pain, wounds, muscle discomfort, headaches, etc. is the topical application (Andrade-Cetto, 2009), whereas internal problems are best treated by oral means (Lee *et al.* 2008; Andrade-Cetto, 2009). However, there was a potential difference in the number of doses given to treat a particular disorder.

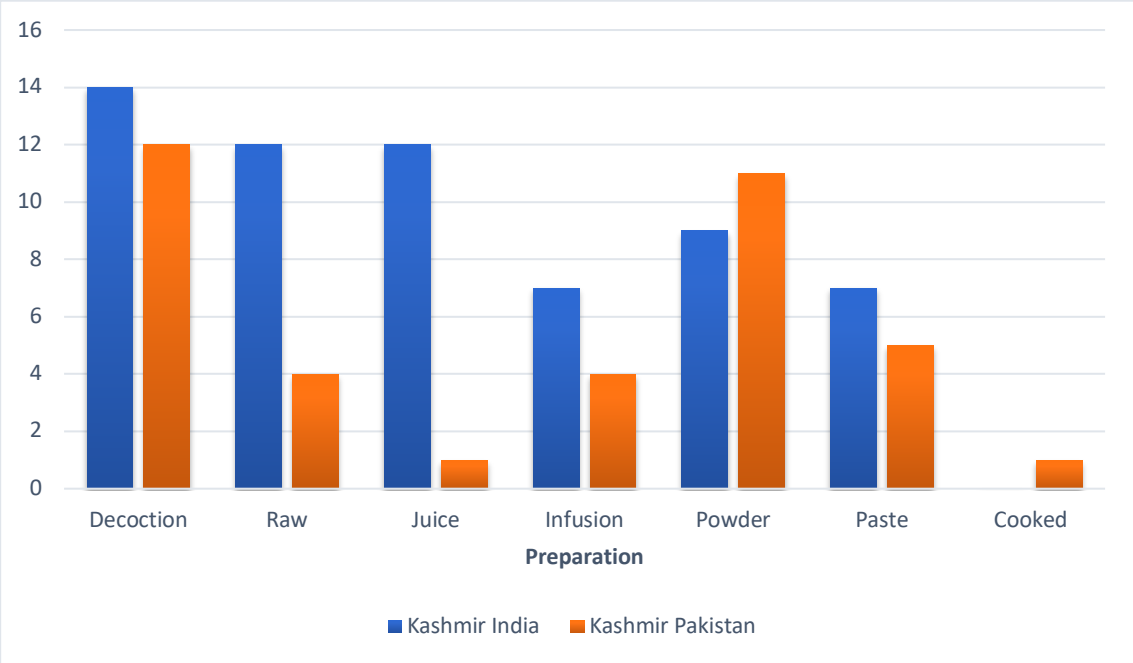

Figure 3. Comparison of mode of preparations of medicines

Comparative analysis/novelty of the study

The local people used *Berberis* for a variety of different diseases, but the most common group of diseases treated in Kashmir-India was digestive diseases followed by musculoskeletal diseases, and in Kashmir-Pakistan the most commonly treated group of diseases was liver and endocrine system diseases followed by musculoskeletal diseases (Table 4). Of the 5 different species of *Berberis*, were used in Kashmir-India (*Berberis lycium, Berberis aristata, Berberis kashmirana* and *Berberis pseudumbellata*) and four in Kashmir-Pakistan (*Berberis lycium, Berberis aristata, Berberis vulgaris,* and *Berberis pseudumbellata*). Of these 3 species (*Berberis lycium, Berberis aristata,* and *Berberis pseudumbellata*) were used in both two regions, whereas *B. kashmiriana* and *B. vulgaris* were used only in Kashmir-India and Kashmir-Pakistan, respectively.

Conclusion

This study is the first attempt to investigate the cross-regional medicinal uses of the species of *Berberis* from the selected regions of Kashmir-India and Kashmir-Pakistan. During the study, we found that people in both regions relied on the local medicinal flora for the treatment of their day-to-day ailments. Elderly people and nomadic grazers were the custodians of traditional knowledge. A total of 4 different species of the genus *Berberis* were reported as remedies throughout the study regions. The actual number of *Berberis* species could be higher, however, and there is a dire need for conservation strategies for this genus. Trained taxonomists and well-authenticated herbaria are needed for the proper identification and collection of plant species, and further phytochemical research is needed to elucidate the pharmacological activities of the genus for its proper use and preservation.

Table 2. *Berberis* species collected from Kashmir-Pakistan and their medicinal uses

Botanical name	Local name	Part Used	Administration Mode	Medicinal use	Area	Informants
Berberis aristata DC.	Sumblo	Root	Decoction	Malaria	Bangoin	27
Berberis aristata DC.	Doody	Leaves	Decoction	Backache, Tonic	Pearl Valley	29
Berberis aristata DC.	Kala Sumbal	Root	Powder	Anti-diabetic, Internal wounds, Mouth inflammation	Poonch	18
Berberis lycium Royle	Simblo	Root, Bark	Infusion	Blood purification, Anti-diabetic	Bagh	31
Berberis lycium Royle	Sumbal	Root	Decoction	Diabetes	Bana Valley	73
Berberis lycium Royle	Komal	Root, Stem	Infusion	Ophthalmia	Barali Kass	53
Berberis lycium Royle	Sunmbal	Whole plant	Decoction	Fever, Spams	Bheri	26
Berberis lycium Royle	Sumbal	Bark, Root	Paste, Cooked	Headache, Fracture bones, Internal wounds, Tonic	Dawarian	21
Berberis lycium Royle	Sumbal	Root, Fruit	Powder, Raw	Wounds, Fruits are eaten raw	Devi Gali	55
Berberis lycium Royle	Sumbal	Bark	Powder	Bleeding gums	Dhirkot	67
Berberis lycium Royle	Sumbal	Leaves	Raw	Mouth inflammation	Goi	37
Berberis lycium Royle	Sumbal	Fruit	Raw	Cough	Harighal	25
Berberis lycium Royle	Sambal	Root	Decoction	Jaundice	Kel Village	77
Berberis lycium Royle	Komal	Root, Stem Bark	Decoction	Jaundice	Kotli	81
Berberis lycium Royle	Sunmbal	Root	Powder	Bone fracture, Jaundice	Lawat Village	50
Berberis lycium Royle	Sumblu	Fruit	Paste	Stomachache, Internal injuries	Leepa valley	40
Berberis lycium Royle	Sonmal	Root, Fruit	Powder, Raw	Anti-diabetic, Internal wounds, Tonic	Machyara National Park	35
Berberis lycium Royle	Sumblu	Root	Decoction	Pimples	Maradori Valley	33
Berberis lycium Royle	Sumbal	Root, Bark	Paste	Headache	Neelum Valley	48
Berberis lycium Royle	Sumbal	Root	Infusion	Diabetes, Internal wounds	Nikyal	60
Berberis lycium Royle	Sumblu	Root	Decoction	Tonic	Pearl Valley	32
Berberis lycium Royle	Sumblu/komal	Root bark	Paste	Wounds	Pir Nasoora National Park	26
Berberis lycium Royle	Sumbal	Bark, Root	Powder	Anti-daibetic, Internal wounds, Tonic, Pustules	Poonch	53
Berberis lycium Royle	Sumbal	Root bark	Powder	Bone fracture	Rawalakot	84

Berberis lycium Royle	Sumbalo	Leaves, Bark	Juice, Decoction	Dysentery, Hypertension, Wound Healing, Jaundice, Sore throat	Samahni	33
Berberis lycium Royle	Sumbal	Bark	Powder	Carminative	Sharda	19
Berberis lycium Royle	Kala Sumbal	Root	Powder	Diabetes	Sudhan Gali	62
Berberis lycium Royle	Sumblo	Root	Decoction	Jaundice	Sudhnoti	58
Berberis lycium Royle	Sumblu	Root	Paste	Bone fracture	Toli Pir National Park	32
Berberis pseudumbellata Parker	Sumbl	Bark	Decoction	Internal injuries	Leepa valley	23
Berberis vulgaris L.	Kal	Root, Fruit	Decoction, Powder	Impotency, Kidneys Stones, Gall bladder Stones	Bheri	12
Berberis vulgaris L.	Kala Sumbal	Root	Powder	Anti-diabetic, Internal wounds	Machyara National Park	18

Table 3. *Berberis* species collected from Kashmir-India and their medicinal uses

Botanical name	Local name	Part used	Administration Mode	Medicinal use	Area	Informants
Berberis aristata DC	Pumble, Kawdach	Fruit	Raw, Juice	Tonic	Bungus valley	31
Berberis aristata DC	Kawdach	Fruit, Leaves	Juice	Tonic, Vaginal infection	Chowkibal	29
Berberis aristata DC	Kawdach	Stem, Bark	Powder, Paste	Eye sores, Joint pain	Doodpathri	17
Berberis aristata DC	Pumble	Bark	Powder	Rheumatism	Uri	22
Berberis aristata DC	Pambal	Leaves, Flower	Decoction	Joint pain, Pimples	Dadsara	28
Berberis kashmirana Ahrendt	Pambal	Leaves	Decoction	Jaundice	Lolab valley	18
Berberis lycium Royle	Kawdach	Root	Decoction	Fever, Toothache	Aragam	19
Berberis lycium Royle	Pumble	Leaves, Stem	Raw	Acidity, Fever	Bungus valley	22
Berberis lycium Royle	Pumble	Leaves	Raw, Decoction	Stomachache	Thandipora	13
Berberis lycium Royle	Kawdach	Root, Bark	Infusion	Jaundice	Chowkibal	19
Berberis lycium Royle	Chuk chen	Leaves, Root	Infusion	Jaundice, Headache	Lolab valley	22
Berberis lycium Royle	Kawdach	Stem, Fruit	Raw, Decoction	Indigestion	Doodpathri	26
Berberis lycium Royle	Kawdach, Chuk chen	Leaves, Fruit	Decoction, Infusion	Constipation, Spasms	Yusmarg valley	27
Berberis lycium Royle	Kawdach	Leaves	Juice	Constipation	Arizal	27
Berberis lycium Royle	Pambal	Fruit	Juice, Raw	Fever, Sore throat	Budnumble	37
Berberis lycium Royle	Pambal	Fruit, Leaves	Raw, Infusion	Antiseptic, Intestinal infection	Gujjar warsun	34
Berberis lycium Royle	Kawdach	Leaves, Bark, Stem	Powder, Paste	Headache, Wounds	Raithan	19
Berberis lycium Royle	Kawdach	Bark, Root	Paste	Headache	Khansahib	31
Berberis lycium Royle	Pumble	Leaves	Decoction	Diabetes, Jaundice	Oogable	15
Berberis lycium Royle	Chuk chen	Leaves, Stem	Decoction, Infusion	Eye infections, Tonic, Spasms	Gurez velley	41
Berberis lycium Royle	Kawdach	Root	Decoction	Piles, Dysentery	Uri	20
Berberis lycium Royle	Kawdach	Root, Fruit	Decoction, Juice	Fractured bones, Typhoid	Khachadari	32
Berberis lycium Royle	Kawdach/Pumble	Leaves	Decoction	Jaundice	Sangri Bala	24
Berberis lycium Royle	Pambal kul	Fruit, Root	Juice, Powder	Colic infection, Sore eyes	Tulail valley	37

Berberis lycium Royle	Kawdach	Fruit	Juice, Raw	Stomachache	Hajin	25
Berberis lycium Royle	Dhouch	Leaves	Decoction	Jaundice, Tonic	Tral	24
Berberis lycium Royle	Dhouch	Fruit, Root	Raw, Paste	Fever, Sore throat, Fractured bones	Abhama	33
Berberis lycium Royle	Kawdach, Douch	Leaves, Bark	Infusion	Acidity, Skin allergy	Imamsahib	31
Berberis lycium Royle	Bergi-sana	Leaves	Powder	Constipation	Dadsara	16
Berberis lycium Royle	Dhouch	Fruits	Juice, Raw	Piles, Constipation	Zainpora	18
Berberis lycium Royle	Bergis-sana, Douch	Root, Bark	Powder, Paste	Headache, Fractured bones, Wounds	Keller	25
Berberis lycium Royle	Kawdach, Douch	Root	Paste	Pimples	Pahalgam	24
Berberis lycium Royle	Kawdach, Douch	Fruit	Raw	Mouth ulcers	Shangus	18
Berberis lycium Royle	Chuk chen	Bark, Stem	Powder, Decoction	Snake bite, Vaginal itching	Breng	23
Berberis lycium Royle	Bergi-sana	Root	Infusion	Ear pus, Loss weight	Aripal	21
Berberis lycium Royle	Kawdouch	Bark, Fruit	Powder, Juice	Eye infections, Internal bleeding	Kangan	26
Berberis lycium Royle	Kawdouch	Fruit, Leaves	Raw	Kidney stones, Dysentery	Wakoora	27
Berberis lycium Royle	Dach	Leaves	Decoction	Asthma, Rheumatism	Pahloo	27
Berberis lycium Royle	Douch, Dach	Fruit	Juice	Toothache, Wounds, Diabetes	Behibagh	24
Berberis lycium Royle	Douch, Kahmal	Fruit, Bark, Root	Juice, Powder, Paste	Anthelminthic, Tonic, Eye sores, Joint pain	Aishmuqam	37
Berberis pseudumbellata R.Parker	Douch	Fruit	Juice, Raw	Indigestion	Yusmarg valley	21

Table 4. Diseases categories and comparative medicinal uses across the Kashmir Indo-Pak

Diseases Categories	Diseases Treated Kashmir-India	Diseases Treated Kashmir-Pakistan
Antidote	1	Nil
Digestive system diseases	16	3
Eyes and ear diseases	6	1
Fevers	4	2
Genitourinary and gynecological diseases	3	1
Heart and Circulatory system diseases	Nil	2
Liver and Endocrine system diseases	7	13
Mouth and dental diseases	3	3
Musculo-skeletal diseases	10	12
Nervous system diseases	4	2
Other	1	1
Respiratory system diseases	3	2
Skin and subcutaneous diseases	7	5
Tonic and health drinks	5	5

Declarations

Ethical approval: This study has been conducted under the provisions of the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization of the Convention on Biological Diversity. Oral Prior consent was obtained from each participant.

Participants' consent: A prior verbal consent was taken from all the participants.

Data availability: The original data is presented in the article. There is no supplementary data.

Funding: This study has no funding body.

Data and materials accessibility: The raw data without the names of informants can be provided by authors.

Author's contributions: All authors declare to have made equal, direct, and intellectual contributions and have approved the current work for publication in this journal. All authors have read and agreed to the published version of the manuscript.

Conflict of interests: No competing interests or conflicts of interest in this article.

Consent for publication: Not applicable –this manuscript has no personal data from the authors.

Acknowledgments

We are indebted to the indigenous societies of the study area for sharing their knowledge about medicinal plants with us. We are also thankful to all who helped during the study.

Literature cited

Andrade-Cetto A. 2009. Ethnobotanical study of the medicinal plants from Tlanchinol, Hidalgo, México. Journal of Ethnopharmacology 122(1):163-171.

Bano A, Ayub M, Rashid S, Sultana S, Sadia H. 2013. Ethnobotany and conservation status of floral diversity of Himalayan range of Azad Jammu and Kashmir Pakistan. Pakistan Journal of Botany 45(SI):243-251.

Bhardwaj D, Kaushik N. 2012. Phytochemical and pharmacological studies in genus Berberis. Phytochemistry Reviews 11:523-542.

Bussmann RW, Sharon D. 2006. Traditional medicinal plant use in Loja province, Southern Ecuador. Journal of Ethnobiology and Ethnomedicine 2:1-11.

Bussmann RW, Malca G, Glenn A, Sharon D, Nilsen B, Parris B, Townesmith A. 2011. Toxicity of medicinal plants used in traditional medicine in Northern Peru. Journal of Ethnopharmacology 137(1):121-140.

Cakilcioglu U, Turkoglu I. 2010. An ethnobotanical survey of medicinal plants in Sivrice (Elazığ-Turkey). Journal of Ethnopharmacology 132(1):165-175.

Calixto JB. 2005. Twenty-five years of research on medicinal plants in Latin America: a personal view. Journal of Ethnopharmacology 100(1-2):131-134.

Dogan Y, Ugulu I. 2013. Medicinal plants used for gastrointestinal disorders in some districts of Izmir province, Turkey. Studies on Ethno-Medicine 7(3):149-161.

Gertsch J. 2009. How scientific is the science in ethnopharmacology? Historical perspectives and epistemological problems. Journal of Ethnopharmacology 122(2):177-183.

Ghorbani A. 2005. Studies on pharmaceutical ethnobotany in the region of Turkmen Sahra, north of Iran: (Part 1): General results. Journal of Ethnopharmacology 102(1):58-68.

Haji AAD. 2010. Functional dyeing of wool with natural dye extracted from *Berberis vulgaris* wood and Rumex hymenosepolus root as biomordant. Iranian Journal of Chemistry and Chemical Engineering 29(3):55-60.

Ignacimuthu S, Ayyanar M, Sivaraman KS. 2006. Ethnobotanical investigations among tribes in Madurai district of Tamil Nadu (India). Journal of Ethnobiology and Ethnomedicine 2(1):1-7.

Jain SK. 1964. The role of botanist in folklore research. Folklore 5(4):145-150.

Jan HA, Abidin SZU, Bhatti MZ, Ahmad L, Alghamdi AK, Alkreathy HM. 2022. Medicinal Plants and Related Ethnomedicinal Knowledge in the Communities of Khadukhel Tehsil, Buner District, Pakistan. Sustainability 14(20):13077.

Jan HA, Wali S, Ahmad L, Jan S, Ahmad N, Ullah N. 2017. Ethnomedicinal survey of medicinal plants of Chinglai valley, Buner district, Pakistan. European Journal of Integrative Medicine 13:64-74.

Jan M, Khare RK, Mir TA. 2021. Medicinal plants used during pregnancy and childbirth in Baramulla District of Jammu and Kashmir, India. Ethnobotany Research and Applications 22:1-19.

Jan M, Mir TA, Khare RK. 2022a. Traditional use of medicinal plants among the indigenous communities in Baramulla district, Jammu and Kashmir, India. Nordic Journal of Botany 2022(6):e03387.

Jan M, Mir TA, Jan HA, Khare RK. 2022b. Medicinal plants diversity and their uses for Gynecological Disorders of District Baramulla, Jammu and Kashmir, India. Vegetos 35(2):438-452.

Jee V, Dar GH, Kachroo P, Bhat GM. 1984. Taxo-ethnobotanical studies of the rural areas in district Rajouri (Jammu). Journal of Economic and Taxonomic Botany 5(4):831-838.

Khalil AT, Khan I, Ahmad K, Khan YA, Khan M, Khan MJ. 2013. Synergistic antibacterial effect of honey and Herba Ocimi Basilici against some bacterial pathogens. Journal of Traditional Chinese Medicine 33(6):810-814.

Khalil AT, Shinwari ZK, Qaiser M, Marwat KB. 2014. Phyto-therapeutic claims about euphorbeaceous plants belonging to Pakistan; an ethnomedicinal review. Pakista Journal of Botany 46(3):1137-1144.

Khan T, Khan IA, Rehman A. 2014. A review on *Berberis* species reported from Gilgit-Baltistan and Central Karakoram National Park, Pakistan. Journal of Medicinal Plants Studies 2(6):16-20.

Khoja AA, Haq SM, Majeed M, Hassan M, Waheed M, Yaqoob U, Zaman W. 2022. Diversity, Ecological and traditional knowledge of pteridophytes in the western Himalayas. Diversity 14(8):628.

Lee S, Xiao C, Pei S. 2008. Ethnobotanical survey of medicinal plants at periodic markets of Honghe Prefecture in Yunnan Province, SW China. Journal of Ethnopharmacology 117(2):362-377.

Madiseh MR, Heidarian E, Rafieian-kopaei M. 2014. Biochemical components of Berberis lycium fruit and its effects on lipid profile in diabetic rats. Journal of Herbal Medicine and Pharmacology 3(1):15-19.

Malik ZA, Bhat JA, Ballabha R, Bussmann RW, Bhatt AB. 2015. Ethnomedicinal plants traditionally used in health care practices by inhabitants of Western Himalaya. Journal of Ethnopharmacology 172:133-144.

Maundu P. 1995. Methodology for collecting and sharing indigenous knowledge: a case study. Indigenous Knowledge and Development Monitor 3(2):3-5.

Mir TA, Jan M, Khare RK. 2021b. Ethnomedicinal application of plants in Doodhganga forest range of district Budgam, Jammu and Kashmir, India. European Journal of Integrative Medicine 46:101366.

Mir TA, Jan M, Jan HA, Bussmann RW, Sisto F, Fadlalla IMT. 2022. A Cross-Cultural Analysis of Medicinal Plant Utilization among the Four Ethnic Communities in Northern Regions of Jammu and Kashmir, India. Biology 11(11):1578.

Mir TA, Jan M, Khare RK, Dhyani S. 2021a. Ethno-survey of traditional use of plants in Lolab Valley, Kashmir Himalaya. Indian Forester 147(3):281-287.

Nwachukwu CU, Umeh CN, Kalu IG, Okere S, Nwoko MC. 2010. Identification and traditional uses of some common medicinal plants in Ezinihitte Mbaise LGA, of Imo State, Nigeria. Report and Opinion 2(6):1.

Pieroni A, Quave CL. 2005. Traditional pharmacopoeias and medicines among Albanians and Italians in southern Italy: a comparison. Journal of Ethnopharmacology 101(1-3):258-270.

Quinlan M. 2005. Considerations for collecting freelists in the field: examples from ethobotany. Field Methods 17(3):219-234.

Rahimi-Madiseh M, Lorigoini Z, Zamani-Gharaghoshi H, Rafieian-Kopaei M. 2017. Berberis vulgaris: specifications and traditional uses. Iranian Journal of Basic Medical Sciences 20(5):569.

Rao RR, Husain T, Dutt B, Garg A. 1998. Revision of the Family Berberidaceae. Rheedea 8:1.

Rashid S, Ahmad M, Zafar M, Sultana S, Ayub M, Khan MA, Yaseen G. 2015. Ethnobotanical survey of medicinally important shrubs and trees of Himalayan region of Azad Jammu and Kashmir, Pakistan. Journal of Ethnopharmacology 166:340-351.

Sargin SA. 2015. Ethnobotanical survey of medicinal plants in Bozyazı district of Mersin, Turkey. Journal of Ethnopharmacology 173:105-126.

Sen S, Chakraborty R. 2017. Revival, modernization and integration of Indian traditional herbal medicine in clinical practice: Importance, challenges and future. Journal of Traditional and Complementary Medicine 7(2):234-244.

Shafiq MU, Islam ZU, Abida AW, Bhat MS, Ahmed P. 2019. Recent trends in precipitation regime of Kashmir valley, India. Disaster Advances 12(4):1-11.

Sher H, Midrarullah G, Coll PGJ. 2003. Medicinal plants of Udigram, district Swat, Pakistan. Pakistan Journal of Forestry 53:65-74.

Shinwari ZK, Gilani SS, Kohjoma M, Nakaike T. 2000. Status of medicinal plants in Pakistani Hindukush Himalayas. Proceedings of Nepal–Japan Joint Symposium on Conservation and utilization of Himalayan Medicinal Resources 6:257-264.

Shinwari ZK, Watanabe T, Rehman M, Youshikawa T. 2006. A pictorial guide to Medicinal Plants of Pakistan. KUST. Kohat, Pakistan.

Singh A, Lal M, Samant SS. 2009. Diversity, indigenous uses and conservation prioritization of medicinal plants in Lahaul valley, proposed Cold Desert Biosphere Reserve, India. International Journal of Biodiversity Science & Management 5(3):132-154.

Singh A, Nautiyal MC, Kunwar RM, Bussmann RW. 2017. Ethnomedicinal plants used by local inhabitants of Jakholi block, Rudraprayag district, western Himalaya, India. Journal of Ethnobiology and Ethnomedicine 13:1-29.

Singh G, Rawat GS. 2011. Ethnomedicinal survey of Kedarnath wildlife sanctuary in Western Himalaya, India. Indian Journal of Fundamental and Applied Life Sciences 1(1):35-46.

Singh NP, Singh DK, Uniyal BP. 2002. Flora of Jammu & Kashmir: Pteridophytes Gymnosperms and Angiosperms. Botanical Survey of India: New Delhi, India 1:900.

Sonibare MA, Abegunde RB. 2012. Ethnobotanical study of medicinal plants used by the Laniba village people in South Western Nigeria. African Journal of Pharmacy and Pharmacology 6(24):1726-1732.

Srivastava S, Srivastava M, Misra A, Pandey G, Rawat A. 2015. A review on biological and chemical diversity in Berberis (Berberidaceae). EXCLI Journal 14:247.

Tariq A, Mussarat S, Adnan M, Abd_Allah EF, Hashem A, Alqarawi AA, Ullah R. 2015. Ethnomedicinal evaluation of medicinal plants used against gastrointestinal complaints. BioMed Research International 2015.

Thakur M, Asrani RK, Thakur S, Sharma PK, Patil RD, Lal B, Parkash O. 2016. Observations on traditional usage of ethnomedicinal plants in humans and animals of Kangra and Chamba districts of Himachal Pradesh in North-Western Himalaya, India. Journal of Ethnopharmacology 191:280-300.

Ullah N, Siraj-Ud-Din, Bussmann RW, Jan HA, Wali S. 2021. A step towards the documentation of indigenous knowledge about the medicinal plants in mollagori: A tribal war affected area of Fata, Pakistan. Pakistan Journal of Botany 53(5):1779-1789.