Ethnomedicinal use of some plant species by Gujjar and Bakerwal community in Gulmarg Mountainous Region of Kashmir Himalaya

Muatasim Jan, Tawseef Ahmad Mir, Aijaz Hassan Ganie and Rakesh Kumar Khare

Research

Abstract

Background: Plants are being used since the time immemorial to alleviate sufferings and ailments. Herbal medicine forms an essential part of the traditional primary medical system of Kashmir Himalaya. Present study attempts to report the essential ethnomedicinal plant species used against various ailments by Gujjar and Bakerwal community of Gulmarg Mountainous region of district Baramulla, Jammu and Kashmir.

Methods: Extensive surveys were conducted in the study area in different seasons during March 2019 to July 2020 for the collection of medicinally important plants and the traditional knowledge associated with them. Ethnomedicinal data was obtained through group discussions, semi-structured interviews, questionnaires and field observations. During the study a total of 54 informants (36 males and 18 females) were interviewed aged between 29-78 years. The interviews were carried out in local dialect and all the documented data was then translated into English.

Results: A total of 60 plant species belonging to 56 genera and 35 different families were reported to be used by Gujjar and Bakerwal community in order to treat various ailments. Asteraceae was recorded to be the dominant plant family in the area and leaves were the most commonly utilized plant part with decoction as the major mode of herbal recipe preparation. The highest ICF value of 0.83 was reported for dermatological disorders. Present study reported two plant species *Taraxacum officinale* and *Viola odorata* with a FL of 100% and *Achillea millefolium*, *Chenopodium album*, *Phytollaca acinosa*, *Ajuga bracteosa, Cannabis sativa, Senecio chrysanthemoides* were reported to be the most important medicinal plants according to their use value.

Correspondence

Muatasim Jan[1*], Tawseef Ahmad Mir[1], Aijaz Hassan Ganie[2] and Rakesh Kumar Khare[1]

[1]Centre of Research for Ethnobotany, Goverment Model Science College, Jiwaji University, Gwalior, India-474009
[2]Department of Botany, University of Kashmir, Kargil Campus-194105

[*]Corresponding Author: muatasimbot@gmail.com

Ethnobotany Research & Applications 21:38 (2021)

Conclusions: It was observed that herbal medicine plays a significant role in meeting primary health care needs of tribal communities living at high altitudes. Traditional knowledge of plants is passing on from one generation to another through the word of mouth only and this knowledge is on the verge of extinction. Hence there is a dire need to document these valuable medicinal plants and the traditional treasure associated with them. The species reported with high use value (UV) and fidelity level value (FL) should be employed for further phytochemical and

Manuscript received: 13/04/2021 - Revised manuscript received: 28/05/2021 - Published: 03/06/2021

http://dx.doi.org/10.32859/era.21.38.1-23

pharmacological investigation to authenticate this indigenous knowledge.

Keywords: Ethno-medicinal uses, Gulmarg mountainous region, Traditional knowledge, Documentation.

Background

Since prehistoric times, medicinal plants have played a vital role for the treatment of various diseases (Sullivan & Sheally 1997). Medicinal plants constitute the base of health-care system in many rural and tribal societies. People all over the world depend on plants and plant derived products for their primary healthcare needs either directly or indirectly (Kala 2005). Traditional herbal medicine has sustained its popularity in developing countries of the world, and its usage is rapidly spreading in the developed and industrialized countries as well (Singh & Kachroo 1994). More than 75,000 plant species have been estimated to be used by about 4,635 ethnic communities for the treatment of various aliments across India (Baba *et al*. 2012, Mir *et al.* 2018b). Besides treating human ailments, a number of medicinal plant species are used in veterinary healthcare (Dar *et al*. 2018, Khuroo *et al.* 2007). The traditional knowledge related to usage of plants and plant derived products for human survival is old age practices in Indian Himalayan region, where people by experience have learnt to identify, collect, formulate and utilize these medicines for the treatment of day to day diseases (Rajadurai *et al*. 2009). The inhabitants of the tribal areas are the reservoir of accumulated traditional knowledge related to medicinal plants, but due to the invasion of modernization, knowledge about the use of herbal medicinal wealth is vanishing at an alarming rate (Rajadurai *et al.* 2009). Medicinal information related to plants and their uses by ethnic communities is beneficial not only in the preservation of traditional cultures and biodiversity but also for primary healthcare and development of novel drugs (Farooq *et al.* 2014). Being a part of Indian Himalayan region, Kashmir valley is recognized for its economically important plant species and their products including, food, fodder, medicine, fiber etc. Because of the plant richness and its unique floral biodiversity, a large number of plant species are used as medicine in this region in one or another form (Lone *et al.* 2014, Malik *et al.* 2015). A number of ethnobotanical studies have been conducted across the Kashmir Himalaya (Ara & Naqshi 1992, Kaul 2010, Khan *et al.* 2004, Lone 2003, Navchoo & Bhat 1994, Singh 1995). This is the first elaborated ethnomedicinal study in Gulmarg Mountainous region of Baramulla. Despite good development in the rural health care facilities, the tribal people of the study area still depend on indigenous medicines to a greater extent for the treatment of various ailments such as cough, cold, skin disorders etc. But this valuable traditional information is being passed on from one generation to another on oral basis

Keeping the dependency of local populations on medicinal plants in view, we hypothesized that, (i) Due to its remoteness the traditional knowledge of the local population would differ considerably from other regions in J&K, as well as the wider Himalayas, (ii) Participants will have a high consensus, fidelity level and use value for the use of ethnomedicinal plants, (iii) New ethnomedicinal claims will be reported from the area. With these hypotheses, our research focused on (i) documentation of ethnomedicinal plants used by the local population (ii) assessment of informant consensus, fidelity level and use value of ethnomedicinal plants. By the use of various ethnobotanical indices the more useful plants of the area can be determined which can be subjected to further pharmacological and phytochemical analysis.

Materials and Methods

Study area

Current study was carried out in Gulmarg Mountainous region of district Baramulla Jammu and Kashmir (Fig. 1). Gulmarg is located across 74°.13' to 74°.42' N latitude and 34°.03' to 34°.10' E longitude at an altitude of 2100-2800 m. It is located about 52 km from capital city Srinagar and some 39 km from district headquarter Baramulla. The total area of Gulmarg is 180 sq. km, which covers the forests surrounding Gulmarg. The area is surrounded in North by Jhelum valley forest division, Forest division of Poonch and Pir-Panchal in South and Special forest division-Tangmarg in West. Gulmarg is home to various ethnic tribes mostly Gujjars and Bakerwals. During the winters the study area faces severe cold and a pleasant weather during summers. The temperature ranges between -9° C minimum in winter and up to 28° C maximum in summers (Ahmad and Qayoom 2019).

A total of 40 visits with each visit of 2 days was made to the study area to collect the plants and information from total 17 sites/villages (Wahipora, Solinda, Gogal dara, Rajpora, Kulhama, Tetran, Kralwat, Ferozpora, Wanigam, Hardu, Gulnar, Fajapora, Gonipora, Hajibal, Khaipora, Ratnipora and Gulrez) richly populated with ethnic communities, where these people are solely dependent on medicinal plants to cure a variety of diseases. Plants were collected with the help of local guides who were aware about the region. Plants with mature leaves, stem, roots and flowers were selected for collection. Agriculture (animal husbandry and crop production) is the main source of livelihood for these people in the region. In addition, collection of non-timber forest products including medicinal plants is the other source of income in this region.

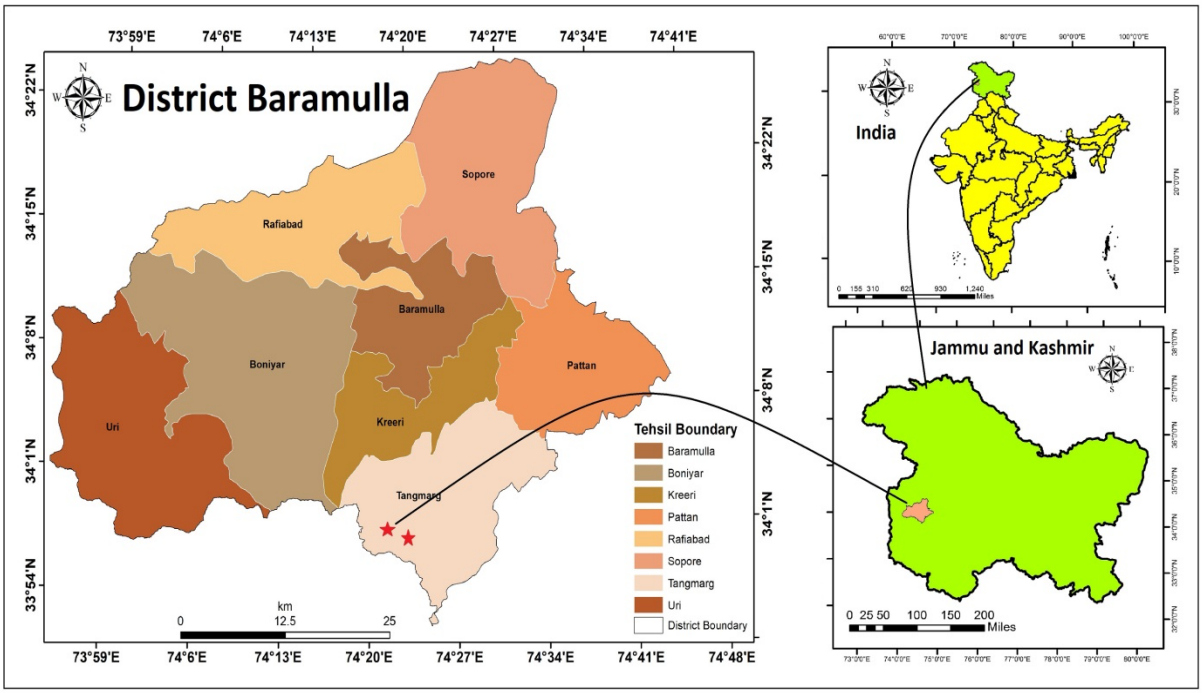

Figure 1. Map showing the study area surveyed

Demographic features of informants

To explore the traditional knowledge regarding the ethnomedicinal uses of plant species in the area, a total of 54 informants (36 males, 18 females) were interviewed aged between 29-78 years (Table 1). Among these, male informants (36 informants) were found to have more experience in terms of knowledge sharing than female informants (18 informants). Most of the selected informants were illiterate, and a small number were having education up to higher secondary level and few were job holders. All the selected informants were of one religion (Muslims), as it is the most practiced religion of the area. Gujri and Pahari are the two main languages of communication. The informants were selected on the basis of their traditional knowledge about the use of plants for treating various diseases. To ensure the validity of traditional knowledge, continuous relationship was maintained with the local population throughout the survey.

Data collection

The practice of herbal medicine to cure various ailments is a widely accepted system by the Gujjar and Bakerwal community of Gulmarg upper reaches. Extensive surveys were conducted in the study area in different seasons during March 2019 to July 2020 for the collection of medicinally important plants and the traditional knowledge associated with them. Prior to interview, brief group discussions were held with the key informants to explain the objective of the present research and a formal written consent was taken from all the informants. Ethnomedicinal data was obtained through group discussions, semi-structured interviews, questionnaires and field observations. The interviews were carried out in local dialect and all the documented data was then translated into English. Guided field walk to the forest area allowed us to collect best possible information about the identification and utilization of important medicinal plant species. The information collected included local name of the plant, habit, part(s) used, ethnomedicinal use, method of administration preparation.

Preservation and taxonomic verification of collected plants

The medicinal plant species reported by informants were collected during field trips guided by local people. The specimens were dried, pressed and mounted on herbarium sheets and good quality voucher specimens were made according to standard techniques (Jain & Rao 1997). Voucher specimens were identified with the help of Flora of Jammu and Kashmir (Singh *et al.* 2002), Flora of British India (Hooker 1879), various other available literatures (Nawchoo & Kachroo 1995, Singh & Kachroo 1994) and help was sort from taxonomists and experts of J&K. All the identified plant specimens were then verified at KASH herbarium of Department of Botany, University of Kashmir, Srinagar, Jammu and Kashmir. The preserved specimens were then deposited at the aforementioned herbarium for future reference.

Table 1. Demographic status of informants.

Variable	Total	Percentage
Gender		
Male	36	67
Female	18	33
Age groups		
29-40	6	11
41-50	9	17
51-60	13	24
61-70	15	28
71-78	11	20
Educational qualification		
Illiterate	29	54
Primary	11	20
Secondary	8	15
Above secondary	6	11
Occupation		
Males		
Shopkeepers	6	11
Farmers	24	44
Job holders	6	11
Females		
Housewives	15	28
Job holders	3	6
Religion		
Muslim	54	100

Data Analysis

The data collected through interviews with the informants was analyzed using three different quantitative indices viz. fidelity level (FL%), informant consensus factor (ICF) and use value (UV).

Fidelity level

Since a particular ailment may be treated with more than one plant species, it is interesting to figure out the most preferred plant species used for the treatment of that particular ailment (Musa *et al.* 2011), which can be determined with the help of fidelity level (FL%). Fidelity level shows the percentage of informants claiming the use of a particular plant species for the same major ailment. It is aimed to enumerate the importance of the medicinal plant species for a given ailment (Friedmen *et al.* 1986).

$$FL\ (\%) = \frac{I_p}{I_u} \times 100$$

Where, Ip is the number of informants who cite the use of a plant species for a particular ailment and Iu is the total number of informants who cite the use of plant species for any ailment. The plant species that are frequently used by the people have higher FL values and plants that are less used have lower FL values (Trotter *et al.* 1986).

Informant consensus factor

Informant consensus factor (ICF) was used to test the uniformity of knowledge about medicinal plant species (Heinrich *et al.* 1998). To develop the informant consensus factor, diseases were categorized into different ailment categories based on the information provided by the informants (Table 2).

Table 2. Disease categories based on ailments recorded.

Disease Category	Ailments
Gastrointestinal	Abdominal pain, Worms, Diarrhoea, Stomach disorders , Constipation, Vomiting, Stimulate bowel movement, Stomach cramps, Indigestion, Purgative, Dysentery, Vermifuge, Expel poisonous substances from stomach, Anthelminthic
Dermatological	Burns, Bruises, Hair fall, Rashes, Swellings, Cleansing agent, Killing lice, Allergy, Itching, Chilblain, Hair growth, Skin allergies, Insect sting, Sunburn, Cracked heals, Boils, Snake bite, Skin irritation, Fungal infections, Anti-inflammatory, Measles, Scabies
Wounds	Wounds
Nervous disorder	Headache, Depression
Respiratory	Chest congestion, Common cold, Cough, Asthma , Bronchitis, Throat infections
Gynaecological	Fertility, Post-partum haemorrhage, Lactation, Menorrhagia, Oligomenorrhea, Swelling of nipples, Dysmenorrhea, Morning sickness
Skeltomuscular	Rheumatism ,Fractured bones, Strengthening bones, Muscular pain, Arthritic pain, Swelling of joints, Poliomyelitis ,Back pain
Cardiovascular	Blood pressure, Blood purifier
Antipyretic	Fever, Malaria
Ear, Mouth, Eye (EME)	Inflamated gums, Toothache, Eye diseases, Ear-ache, Bad smell, Mumps, Ulcers, Tonsillitis
Liver and Kidney	Excessive urination, Urine infection, Jaundice, Diuretic
Body weakness	General weakness, Body tonic

Informant consensus factor was calculated as:

$$F_{ic} = \frac{N_{ur} - N_t}{N_{ur} - 1}$$

Where, Nur denotes the number of use reports for a particular disease category and Nt denotes the number of taxa used for that particular disease category by all informants.

ICF values range from 0-1, an ICF value of 0 means that there is no exchange of information regarding the usage of plant species among informants and ICF values approaches 1, when the information is exchanged between the informants (Gazzaneo *et al.* 2005). Informant's consensus within a population and between ethnic groups shows which plant species are rigorously used and hence helps in the selection of plant species for pharmacological and phytochemical analysis (Giday *et al.* 2007).

Use value

The use value (UV) demonstrates the importance of a medicinal plant species by taking into account the number of use reports mentioned by the informants. In the present study, use value was calculated by the following formula (Phillip and Gentry 1993).

$$UV = \sum \frac{Ui}{N}$$

Where Ui is the total uses reported by each informant for a given pant species and N is defines the total number of informants participating in the study.

Results and Discussion

Diversity of ethnomedicinal flora

During the present study a total of 60 medicinally important plant species belonging to 32 families and 56 genera were reported (Table 3). Each plant species is provided with botanical name, vernacular name, voucher number, family, habit, Part(s) used, mode of preparation, disease(s) treated, mode of administration, fidelity level (FL %) and use value (UV). Most of the documented medicinal plant species were herbs (72%) followed by shrubs (13%) and trees (15%) (Fig. 2). These findings are in consistent with other studies carried out in Jammu and Kashmir (Malik *et al.* 2011, Bhatia *et al.* 2014) and other parts of the world (Bolson *et al.* 2015, Hu *et al*. 2020; Kadir *et al.* 2014). As per Simbo (2010), occurrence of pharmacologically active substance in greater concentration in herbs makes them valuable for treating various ailments. Herbs have the ability to grow in diverse habitats including kitchen gardens, pavements, lawns, croplands etc. and therefore are easily accessible to the local population for use in traditional medicine.

Among 32 families representing 1-11 plant species, Asteraceae was the dominant family with 18% contribution of the total reported taxa followed by Lamiaceae (8%), Pinaceae, Solanaceae Fabaceae and Polygonaceae (5%). All other families contributed less than 5% varying from 2-3% (Table 4). Our results regarding the abundant utilization of family Asteraceae are in line with other studies carried out in different parts of Jammu & Kashmir (Tali *et al.* 2019, Lone *et al.* 2014, Mir *et al*. 2021) and other parts of the world (Abbas *et al.* 2016, Kadir *et al.* 2014, Hu *et al.* 2020). The dominance of this family can be attributed to its widespread distribution, herbaceous life form and its abundance in the area (Gazzanaeo *et al.* 2005, Mehraj *et al.* 2018). Moreover, Asteraceae has been reported to contain a large number of bioactive compounds used against different ailments (Leonti *et al.* 2003, Hamill *et al.* 2000).

Plant part(s) used

Data presented in Fig. 3, shows that the native people of the study area use 17 different plant parts in order to cure various ailments. Among these, leaves were found to be the most preferred plant part, with a percentage contribution of 34% followed by whole plant (21%) fruit and seed (8% each), root (6%), flower, rhizome, aerial part (4% each) whereas, the use of bark, stem, resin, twig, latex, tuber, bulb, wood and thorn was less than 4%.

In other studies (Hussain *et al.* 2019, Savikin *et al.* 2013, Bussmann & Glenn 2010) as well, leaves were found to be the most abundantly utilized plant part as medicine. Easy collection, effortless storage and easy preparation as medicinal product mark the dominance of leaves in traditional healthcare system (Dutt *et al.* 2015). In contrast, some other ethnomedicinal studies (Tali *et al.* 2019, Hu *et al.* 2020) reported whole plant as the most exploited plant part to treat various diseases. The utilization of specific plant part gives an indication that such parts have a strong therapeutic potential and therefore phytochemical investigation should be done to validate this indigenous knowledge. It was reported that different parts of a same plant are used for the treatment of different disorders because of the varying healing property of these plant parts against a particular disorder. These plant parts are a rich source of compounds that can be used to develop drug synthesis. The active compounds in most parts of the medicinal plants have direct or indirect therapeutic effects and are used as medicinal agents. But these compounds are not the same in all the parts of the plant. This may be the reason why different parts of a same plant are used for different purposes (Bassam 2012).

Table 3. Medicinal plants used by the Gujjar and Bakerwal community of Gulmarg mountainous region of Baramulla, Jammu and Kashmir

Botanical name (Vernacular name)/Voucher number	**Family**	**Habit**	**Part(s) used / Preparation**	**Application**	**Disease(s) treated**	**Mode of administration**	**FL (%)**	**UV**
Abies pindrow (Royle ex D. Don) Royle. (Budul) 3464-KASH	Pinaceae	Tree	LF: Paste, BR: Decoction, RS: Resin, LF: Infusion	External	Rashes (3), Rheumatism (2), **Wounds** (2), **Swellings** (1)	Leaf paste is applied as an indigenous remedy on skin rashes. Decoction of bark is used against rheumatism. Resin is directly applied to cuts and wounds for quick healing. Leaf extract is used as water bath for swellings.	37.5	0.148
Achillea millefolium L. (Pahal-gassh) 3024-KASH	Asteraceae	Herb	LF and FL: Paste, LF: Paste	External	**Inflamated gums** (11), Toothache (3), Burns (2), Bruises (2)	Leaves and flowers are crushed and used to cure inflammated gums and toothache. Leaves are made into paste and corn flour is added to and is directly applied on burns and bruises in children.	61	0.33
Adiantum capillus-veneris L. (Guetheer) 3467-KASH	Pteridaceae	Herb	LF: Paste, WP: Infusion	External	Chest congestion (6), Headache (2), **Hair fall** (2)	Leaves made into paste are applied directly to treat chest congestion and headache. Extract of whole plant is used to wash hair to treat hair fall.	60	0.19
Ajuga bracteosa Wall ex Benth. (Janiadam) 3469-KASH	Lamiaceae	Herb	LF: Decoction, LF: Decoction	Internal	Abdominal pain (12), Worms (2), Diarrhoea (2)	Decoction obtained from leaves is taken orally for the treatment of abdominal pain and in case of worms. Decoction is also taken to treat diarrhoea.	75	0.30
Allium sativum L. (Rohun) 3472-KASH	Liliaceae	Herb	BL: Roasted, BL: Paste	Internal	**Blood pressure** (7), **Fertility** (4)	Bulb is roasted and eaten empty stomach early morning for blood pressure. Paste of bulb is applied into uterus to enhance fertility.	63.63	0.20

Anagallis arvensis L. (Chari-saben) 3477-KASH	Primulaceae	Herb	WP: Rubbed, WP: Decoction	External and Internal	**Cleansing agent** (4), Killing lice (3), Allergy (3)	Fresh herb is rubbed between hands, a large quantity of leather is formed which removes dirt. Extract of plant is applied for killing lice and allergy.	44.44	0.19
Anthemis cotula L. (Fakh-gash) 3025-KASH	Asteraceae	Herb	AP: Decoction, LF: Rubbed, WP: Poultice, WP: Paste	External	Body muscular pain (6), Skin infection (3), Insect sting (2), Sunburn (2)	Extract of aerial portion is used to wash body for muscular pain and skin infections. Leaves are rubbed on insect sting as pain reliever. Plant is crushed and applied as poultice to treat piles. Paste of plant is used to treat sun burn.	46.15	0.24
Artemisia absinthium L. (Tethwan) 3027-KASH	Asteraceae	Herb	LF: Powder	Internal	Worms (13), Stomach disorders (1)	Powdered dried leaves taken with water is used to expel worms and for the treatment of stomach disorders.	93	0.26
Artemisia vulgaris L. (Nagdowna) 3029-KASH	Asteraceae	Herb	WP: Powder, WP: Infusion, WP: Powder	Internal	Malaria (6), Fever (2), **Oligomenorrhea** (2), **Headache** (2)	Whole herb is dried, powdered and taken with water to treat malaria, fever. Extract of whole plant is taken by women to treat irregular menstruation. Root is dried, powdered and taken with milk or water to get relief from headache.	50	0.22
Berberis lycium Royle (Kawdach) 3479-KASH	Berberidaceae	Shrub	FR: Paste, RT: Decoction	External	Wound healing (8), Eye diseases (5)	Paste obtained from fruits is applied externally on wounds for enhanced healing Water extract of root is used externally to treat eye diseases.	61.53	0.24
Cannabis sativa L. (Bhang) 3482-KASH	Cannabinaceae	Herb	LF: Smoked, LF: Paste, LF: Paste	Internal and External	Depression (7), Excessive urination (5), **Ear-ache** (3)	Leaves dried are smoked through pipe and called *Hukkah* to relieve depression. Powdered leaf mixed with egg yolk is given to children to treat excessive urination. Leaf essence is used to relieve earache.	46.66	0.28

Capsella bursa-pastoris (L.) Medik. (Kralmund) 3483-KASH	Brassicaceae	Herb	AP: Cooked	Internal	Postpartum haemorrhage (9), **Constipation** (1), Abdominal pain (1), Vomiting (1)	Above ground part is cooked and given to ladies after delivery to cure prolonged bleeding. It is also taken against constipation, abdominal pain and vomiting.	75	0.22
Cedrus deodara (Roxb. Ex D. Don) G.D. Don. (Deodar) 3484-KASH	Pinaceae	Tree	WD: Oil	External	Wound healing (8), Itching (2), Rheumatic pain (2)	Wood chipped into pieces and the oil obtained is applied directly on wounds and cracked heals as antiseptic. Oil extracted from wood is applied on hands against itching. Oil is also massaged to treat rheumatic pain.	67	0.22
Centauria iberica Trevir & Spreng. (Kreach) 3035-KASH	Asteraceae	Shrub	TH: Paste, FL: Powder	External	Skin rashes (10), **Wound healing** (3)	Thorns are burnt and the ash is made into paste with added ghee and applied to treat skin rashes. Dried flowers are powdered and sprinkled on wounds for quick healing and as antiseptic. Powder	77	0.24
Chenopodium album L. (Liss) 3486-KASH	Chenopodiacea e	Herb	LF: Cooked, AP: Decoction	Internal	**Stimulate bowel movement (12),** Intestinal worms (3), **Diarrhoea** (2)	Leaves are cooked as vegetable and used to stimulate bowel movement. Water extract f aerial portion is taken to expel intestinal worms and against diarrhoea.	79	0.31
Cichorium intybus L. (Kaw-Handh) 3036-KASH	Asteraceae	Herb	WP: Decoction, WP: Poultice	Internal and External	Fever (6), Diarrhoea (3), **Fractured bones** (1), **Wound healing** (1)	Whole plant is boiled in water and the extract is taken against fever and diarrhoea. Whole plant is crushed, made into paste and used as poultice on fractured bones and also for wound healing.	54.54	0.20
Conyza bonariensis (L.) Cronquist (Shashedra) 3041-KASH	Asteraceae	Herb	WP: Infusion, WP: Infusion	Internal	Dysmenorrhea (3), Diarrhoea (2), Abdominal pain(2), Anthelminthic (2), Urinary infections (2)	Extract of whole plant is taken to treat painful menstruation. Extract is taken against diarrhoea, abdominal pain, as anthelminthic and urinary infections.	33.33	0.20

Cotula anthemoides L. (Thol-Babul) 3040-KASH	Assteraceae	Herb	WP: Decoction, WP: Infusion, WP: Poultice	External and Internal	Chilblain (7), Headache (3), Fever (1), Blood purifier (1), Fractured bones (2)	Whole herb is boiled in water and the extract is used to wash feet in order to get relief from chilblain Water extract of whole plant is used to treat headache and fever and as blood purifier. Plant crushed is made into paste and used directly as poultice on fractured joints.	50	0.26
Cynodon dactylon L. (Dramun) 3040-KASH	Poaceae	Herb	WP: Decoction, WP: Paste, WP: Poultice, WP: Juice	Internal and External	Common cold (4), **Anti-inflammatory** (3), **Skin rashes** (2), Wound (1)	Decoction of whole plant is taken in case of common cold. Whole plant is made into paste and used as anti-inflammatory. Poultice of whole herb is applied to treat skin rashes. Juice of plant is extracted on wounds to stop bleeding	40	0.19
Datura stramonium L. (Datur) 3498-KASH	Solanaceae	Shrub	SD: Oil, SD: Powder	External and Internal	Hair growth (6), Wounds (3), **Cough** (4)	Oil obtained by crushing seeds is applied directly on head to enhance hair growth and to treat wounds. Seeds are dried, powdered and taken with water to treat cough	46.15	0.24
Equisetum arvense L. (Bandakey) 3505-KASH	Equisetaceae	Herb	AP: Paste, AP Infusion	External and Internal	**Skin allergies** (3), Strengthening bones(2), Hair fall (2), **Urine infection**(2), **Stomach cramps**(2), **Wound** (2)	Plant is crushed, made into paste and used for skin allergies and strengthening of bones. Paste of the aerial portion is applied on scalp for hair growth. Whole herb is dried, powdered and taken with water to cure urine infection and stomach troubles. Infusion of whole herb is used to stop bleeding from an injury.	23.07	0.24

Ficus carica L. (Anjeer) 3597-KASH	Moraceae	Tree	FR: Raw, FR: Decoction	Internal	**Lactation** (8), Cough (2), Cold (2), **Stomach disorders** (2)	Dried fruit is taken by women to increase breast milk. Decoction obtained from fruits is used to cure cough, cold and stomach disorders.	57.14	0.26
Geranium wallichianum D. Don. ex Sweet (Ratanjog) 3511-KASH	Geraniaceae	Herb	RT: Paste	Internal	Fever (5), Muscular pain (2), **General weakness** (1)	*Halwa* made by mixing root powder of plant, with corn flour and ghee is taken to treat fever, muscular pain and general body weakness.	62.25	0.15
Hypericum porforatum L. (Ring-Chai) 3514-KASH	Hypericaceae	Herb	WP: Powder, WP: Decoction	Internal	Rheumatism (5), Cough and chest infection (3), Menorrhagia (2) Abdominal pain(3)	Whole plant is dried, powdered and taken with water to treat rheumatism. Tea is made of whole plant and used against cough and chest infections and to check excessive menstrual bleeding and abdominal pain	38.46	0.24
Indigofera heterantha L. (Zand) 3516-KASH	Fabaceae	Shrub	RH: Powder, ST: Rubbed, RT: Powder	Internal and External	Abdominal pain (4), Toothache (2), Cough (2)	Powdered rhizome added with water is taken orally to treat abdominal pain. Young branches are used as brush to treat toothache. Powder of root bark is used to treat cough.	50	0.15
Juglans regia L. (Doon) 3519-KASH	Juglandaceae	Tree	BR: Rubbed, LF: Decoction	External and Internal	Toothache (10), Intestinal worms (2)	Bark of the plant is rubbed on teeth to get relief from toothache. Decoction of leaves is taken to cure intestinal worms.	83.33	0.22
Lavetera cashmeriana L. (Saz-posh) 3520-KASH	Malvaceae	Herb	FL: Decoction, FL: Powder	Internal	Skin irritation (12), Mumps (1)	Decoction of flowers is given to pregnant women to treat skin infection. Flowers are dried, crushed and given with milk to children to treat mumps.	92.30	0.24
Malva neglecta Wall. (Sochal) 3524-KASH	Malvaceae	Herb	LF: Cooked	Internal	Body tonic (6), Constipation (1), Abdominal pain (1)	Leaves are cooked as vegetable and taken with meals as body tonic, to treat constipation, and abdominal pain	75	0.15
Mentha arvensis L. (Pudneh) 3529-KASH	Lamiaceae	Herb	LF: Powder	Internal	Diarrhoea (9), **Low blood pressure** (1)	Dried leaves are powdered and mixed with curd and taken against diarrhoea and low blood pressure.	90	0.19

Mentha longifolia L. (Yen-pudneh) 3530-KASH	Lamiaceae	Herb	LF: Powder, LF: Decoction	Internal	Bad smell (4), Abdominal pain (3), Stomach cramps (3), Indigestion (1)	Crushed leaves with added salt are taken as mouth freshener. Tea made from leaves is taken to cure abdominal pain, stomach cramps and indigestion.	36.36	0.20
Nepeta cataria L. (Brair-gass) 3535-KASH	Lamiaceae	Shrub	LF: Powder, LF: Infusion	Internal	Fever (7), Worms (2), Diarrhoea (4), Vomiting (1)	Leaves are dried, powdered and used against fever, worms and diarrhoea. Extract of fresh leaves is taken to prevent vomiting.	50	0.26
Phytollaca acinosa Roxb. (Brand-hakh) 3540-KASH	Phytolaccaceae	Herb	LF: Cooked, RT: Oil	Internal and External	Stomach disorders (7), Swelling of nipples (5), Arthritic pain (5)	Young leaves cooked and taken as vegetable against stomach disorders. Oil obtained from roots is used to treat swelling of the nipple and arthritic pain.	41.17	0.31
Pinus wallichiana A. B. Jack. (Kayar) 3541-KASH	Pinaceae	Tree	RS: Resin, ST: Oil	External	Cracked heals (4), Wounds (2), Skin rashes (2), Boils (2)	Resin obtained from the tree is directly applied on cracked heals and wounds for quick healing. Stem oil is applied on skin rashes and boils.	40	0.19
Plantago lanceolata L. (Gull) 3542-KASH	Plantaginaceae	Herb	LF: Juice, LF: Decoction, SD: Powder	External and Internal	Skin infections (9), Cough (2), Cold (1), Purgative (1)	Juice of leaves is applied on skin infections. Tea obtained from leaves is taken in case of cough, cold. Seeds are taken with sugar and water as purgative.	69	0.24
Plantago major L. (Bead-gull) 3543-KASH	Plantaginaceae	Herb	LF: Poultice, SD: Decoction	External and Internal	Rheumatic pain (6), Fractured bones (2), Dysentery (4)	Leaves crushed and made into paste are used as poultice for rheumatic pain and on fractured bones. Seeds are boiled in water and the water extract is taken to treat dysentery.	50	0.22
Podophyllum hexandrum Royle (Wanwangun) 3544-KASH	Berberidaceae	Herb	RH: Decoction, RH: Paste	Internal and External	Body tonic (4), Vermifuge (3), **Snake bite** (2)	Decoction obtained from rhizome is taken orally as a good body tonic and as vermifuge. Paste of rhizome is applied on snakebite.	44.44	0.17

Polygonum aviculare L. (Dudijj) 3545-KASH	Polygonaceae	Herb	LF: Paste, LF: Poultice, WP: Cooked	External and Internal	Boils (5), Joint pain (3), Menorrhagia (3)	Paste of leaves is applied on boil to get quick relief. Dried leaves made into paste are used as poultice on joints to get relief from pain. Whole plant is cooked and taken as vegetable for excessive menstrual bleeding.	45.45	0.20
Potentilla indica (Andrews) Th. Wolf (Ringrish) 3550-KASH	Rosaceae	Herb	RH: Decoction LF: Poultice	Internal and External	Headache (5), Fever (3), General body weakness (1), Diarrhoea (2)Snake bite (3)	Dried rhizome decoction mixed with milk is taken in case of headache, fever general body weakness and diarrhoea . Poultice of leaf is applied in case of snake bite.	35.71	0.24
Prunella vulgaris L. (Kalweuth) 3551-KASH	Lamiaceae	Herb	WP: Infusion , LF: Paste, LF: Poultice, LF: Decoction	External	Muscle pain (7), Wounds (1), **Tonic** (1)	Extract of whole plant is used as water bath to treat muscle pain. Leaves crushed and made into paste are applied to wounds for enhanced healing. Leaf decoction is taken for energy.	78	0.17
Punica granatum L. (Daen) 3553-KASH	Punicaceae	Shrub	FR: Juice, FR: Juice	Internal	General body tonic (6), Diarrhoea (4), Jaundice (2)	Juice obtained from fruits is used as general body tonic and to treat diarrhoea. Juice of fruit is taken in jaundice.	50	0.22
Ranunculus arvensis L. (Dimm-gassh) 3554-KASH	Ranunculaceae	Herb	WP: Poultice, WP: Juice	External and Internal	Fungal infections (10), Diarrhoea (1)	Whole plant is crushed and used externally as poultice for fungal infections. Juice of whole plant is taken against diarrhoea.	91	0.20
Rheum emodi Wall. ex Meisn (Pumbchalan) 3558-KASH	Polygonaceae	Herb	RH: Powder	External	**Burns** (10), Ulcers (1), Wounds (1)	Rhizome is dried and made into powder; powder is sprinkled on burns, ulcers and non-healing wounds for enhanced healing.	83.33	0.22
Robinia pseudoacacia L. (Kikar) 3559-KASH	Fabaceae	Tree	LF: Decoction, LF: Decoction	External	Chilblains (6), Swelling of joints (4), Fever (1)	Hot water extract from plant leaves is obtained and is used to wash feet in case of chilblains. Extract is also used for bathing to treat swelling of joints and fever.	54.54	0.20

Rubus niveus Thunb**.** **(**Chaanch) 3461-KASH	Rosaceae	Shrub	LF: Decoction, FR: Juice, LF: Decoction	Internal	Menorrhagia (3), Fever (2), Tonsillitis (1)	Tea made from leaves is taken by women against heavy menstrual bleeding. Juice of fruit is taken to treat fever. Leave are boiled in water and used as gargle to treat tonsillitis.	50	0.11
Rumex nepalensis L. (Abijj) 3563-KASH	Polygonaceae	Herb	RT: Decoction, WP: Paste	Internal and External	Stomach pain (8), Abdominal pain (3), weakness (1),Skin diseases (2)	Root decoction is taken to treat stomach pain and abdominal pain. Whole plant is dried, powdered and made into paste to treat skin diseases.	57	0.26
Salix alba L. (Veer) 3565-KASH	Salicaceaeae	Tree	LF: Infusion, BR: Decoction, LF: Decoction	External	Joint pain (4), **Skin Infection** (2), Headache (3)	Extract obtained from leaves is used to wash joints to get relief from joint pain. Bark is kept in water for some time and this water is used to bath new born babies in order to prevent them from infection. Extract of leaves is used to cure headache.	44.44	0.17
Sambucus wightiana Wall. (Gundula) 3567-KASH	Caprifoliaceae	Shrub	FR: Juice, RT: Decoction, RT: Decoction	Internal	Expel poisonous substances from stomach (6), **Poliomyelitis** (4), **Diuretic** (4)	Fruit juice is given orally to stimulate vomiting to expel poisonous substances from stomach. Extract of root is used to treat poliomyelitis in children. Also used as diuretic.	42.85	0.26
Senecio chrysanthemoides DC. (Bagghu) 3047-KASH	Asteraceae	Herb	FL: Poultice LF: Paste	External	**Wounds** (6), **Asthma** (4), **Bronchitis** (5)	Flowers are crushed and applied directly on wounds to prevent infection and for rapid healing. Leaf paste is applied to chest to get relief from asthma and bronchitis.	40	0.28
Sisymbrium irio L. (Tilgogul-gash) 3568-KASH	Brassicaceae	Herb	SD: Paste, LF: Cooked	External and Internal	Fever (4), **Headache** (2), **Measles** (2), **Throat and chest infections** (3)	Seeds are crushed and made into paste and applied in case of fever, headache and measles. Leaves are cooked and taken to treat throat and chest infections.	36.36	0.20

Solanum nigrum L. (Kambai) 3571-KASH	Solanaceae	Herb	LF: Paste, FR: Paste, FR: Raw	External and Internal	Burns (5), Skin disorders (2), Anti-inflammatory (2), Weakness (1)	Leaves made into paste are directly applied on burns and skin disorders. Also used as anti-inflammatory. Fruit is take as energiser for general body weakness	50	0.19
Solanum tuberosum L. (Alua) 3572-KASH	Solanaceae	Herb	TB: Paste	External	Burn (3), Bruises (2), Wound healing (2),	Paste obtained from tuber is applied directly on burn and bruises and for wound healing.	42.85	0.13
Sonchus arvensis L. (Dudijj-kand) 3049-KASH	Asteraceae	Herb	LF: Poultice, LT: Paste	External	Swelling (6), Boils (2), Wounds (2)	Leaves are crushed and used as poultice on swelling. Latex obtained from plant is applied externally on boils and wounds for quick healing.	60	0.19
Stellaria media (L.) Vill. (Nikhakh) 3574-KASH	Caryophyllaceae	Herb	WP: Cooked, SD: Powder, WP: Paste	Internal and External	**Stomach pain** (4), **Bone fracture** (3), Skin infections (3), **Swelling** (2)	Whole plant is taken as a vegetable to treat stomach pain. Seeds are crushed, made into powder and given with milk to children to treat skin infections. Whole plant is made into paste and applied on affected part to treat bone fracture and swelling.	33	0.22
Taraxacum officinale L. (Handh) 3051-KASH	Asteraceae	Herb	LF: Cooked	Internal	Post-partum haemorrhage (9)	Dried leaves are cooked and taken by women after delivery to prevent excessive blood loss.	100	0.17
Trigonella foenum graecum L. (Meth) 3576-KASH	Fabaceae	Herb	SD: Decoction, SD: Decoction	Internal	Oligomenorrhea (6), Fever (2), Constipation (2)	Decoction with added turmeric is taken to check menstrual irregularities in women. Seed decoction is also taken to cure fever, constipation.	60	0.185

Triticum aestivum L. (Kaenak) 3577-KASH	Poaceae	Herb	SD: Decoction, SD: Decoction, SD: Infusion	External and Internal	Wormicide (4), Abdominal pain(2) Fever (1), Back pain (2), Toothache (1)	Decoction of seeds is given to children as wormicide and for abdominal pain. Grain husk is boiled in water for long time and this hot water extract is used by women for bathing to cure fever and back pain. Seeds are soaked in water and placed on aching teeth to relieve toothache.	40	0.19
Urtica dioica L. (Soi) 3578-KASH	Urticaceae	Herb	LF: Poultice, RT: Paste, LF: Infusion	External and Internal	Joint pain (5), Wound (3), Stomachic (3)	Leaves are made into paste and applied as poultice in case of joint pain. Paste of root is used for wound healing. Extract of leaves is stomachic.	45.45	0.20
Viola odorata L. (Bunfsha) 3581-KASH	Violaceae	Herb	FL: Paste	Internal	Throat infection (11)	Flowers crushed with some added sugar is used to make a jaggery called *Khambir* and is used to cure throat infection during winters.	100	0.20
Vitis vinifera L. (Daech) 3582-KASH	Vitaceae	Tree	FR: Juice, LF: Decoction, TW: Juice	Internal and External	Fever (6), Headache (2), Indigestion (2), Skin rashes (2), Blood purifier (1)	Fruit juice is taken orally against fever, headache and indigestion. Leaves are boiled in water and the extract is used as water bath to treat skin rashes. Sap obtained from the twig is used as blood purifier.	46	0.24
Zizyphus jujuba (L.) Gaertn. (Brai) 3583-KASH	Rhamnaceae	Tree	FR: Decoction, LF: Juice, LF: Decoction	Internal and External	Lactation (6), Cough (1), Cold (1), Fever (1), Scabies (1)	Dried fruit decoction given to nursing women to increase the breast milk. Juice obtained from fruits is used to treat cough, cold and fever. Leaf extract is used as water bath to treat scabies.	60	0.19

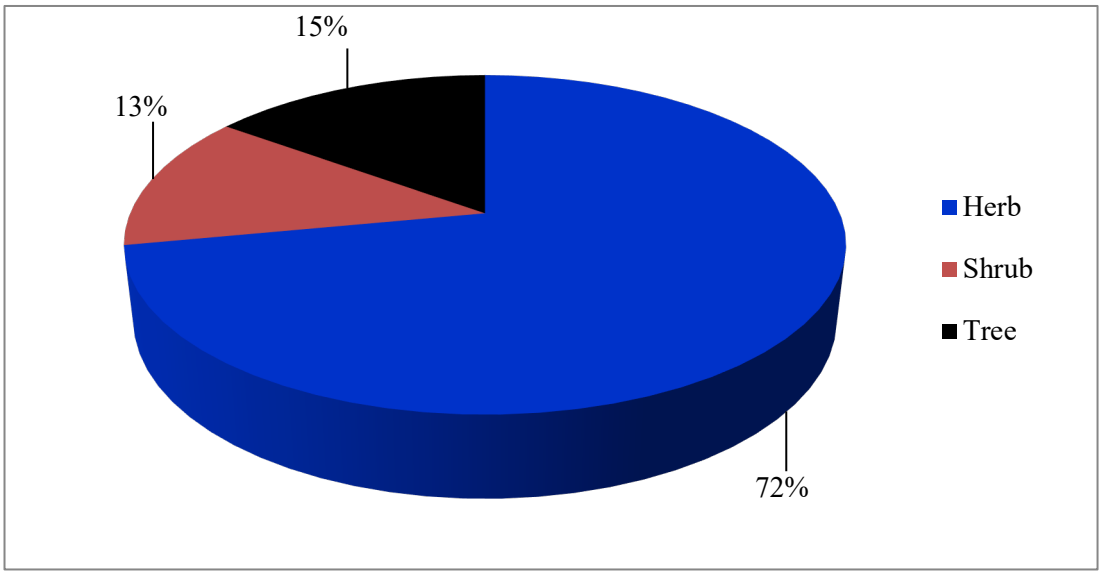

Figure 2. Distribution of species according to their life form

Table 4. Percentage contribution of different families to ethnomedicinal flora in the study area.

Family	Number of species	Percentage contribution
Asteraceae	11	18
Lamiaceae	5	8
Pinaceae	3	5
Fabaceae	3	5
Solanaceae	3	5
Berberidaceae	2	3
Brassicaceae	2	3
Malvaceae	2	3
Poaceae	2	3
Plantaginaceae	2	3
Rosaceae	2	3
Polygonaceae	3	5
Others	1-each	2

Herbal preparation and administration

During the present study, it was found that Decoction was the most frequently used mode for herbal recipe preparation with a percentage contribution of 24% followed by Paste (21%), Powder (11%), Poultice (10%), Infusion (9%), Cooked (7%), Juice (7%), Oil (3%), rubbed (3%), raw (2%), smoked (1%) and roasted (1%) (Fig. 4). Our results are in line with other studies (Ribeiro *et al.* 2010; Shah *et al.* 2015) showing decoction to be the most preferred herbal preparation to cure various diseases. Since decoction is easy to handle and prepare, and hence is the most favored herbal remedy preparation of local communities in the study area. Some studies (Barkaoui *et al.* 2017) reported that decoction enhances the effectiveness of plant extracts and thereby increasing its bioactivity. People of the study area use 53% of the herbal recipes internally, while 46% were used externally which is in line with some other studies (Bussmann & Glenn 2010) carried out in different parts of the world.

Informant consensus factor

Different diseases reported from Gulmarg Mountainous region were classified into 12 ailment categories (Table 2) in order to develop consensus of the informants on medicinal plant species. The informant consensus factor (ICF) values ranged from 0.67-0.83 (Table 5), with highest value of 0.83 for dermatological disorders. *Ranunculus arvensis, Lavetera cashmeriana, Rheum emodi, Centaurea iberica, Plantago lanceolata* were most frequently used plants to treat dermatological problems. During the study it was found that around 29 plant species with 162 use reports were used to treat different skin diseases. These medicinal plant species also find mention in traditional medicine all over the world and some have already been objectively validated using experimental pharmacological assays. *Rananculus arvensis* produces chemicals that belong to many secondary metabolite classes, such as triterpenes, saponins, alkaloids, flavonoids, and others, and have been proven to have antioxidant, antibacterial, antiviral, anti-inflammatory, and nematocidal properties (Hachelaf *et al.* 2015). The phytochemical examination of *Lavetera cashmeriana* root and leaf extracts revealed a wide range of bioactive compounds. Steroids, saponins, glycosides, alkaloids, flavonoids, gums and mucilages. Antibacterial activity of *L. cashmeriana* has been documented in human pathogenic bacteria including *E. coli, B. cereus, S. aureus, P. aeruginosa, K. pneumoniae,* and *C. perfringens*. It was also found that, if appropriately exploited, the roots and leaves of *L. cashmeriana* might be used as an antibacterial source in the pharmaceutical, food, and cosmetic industries (Mir *et al.* 2017).

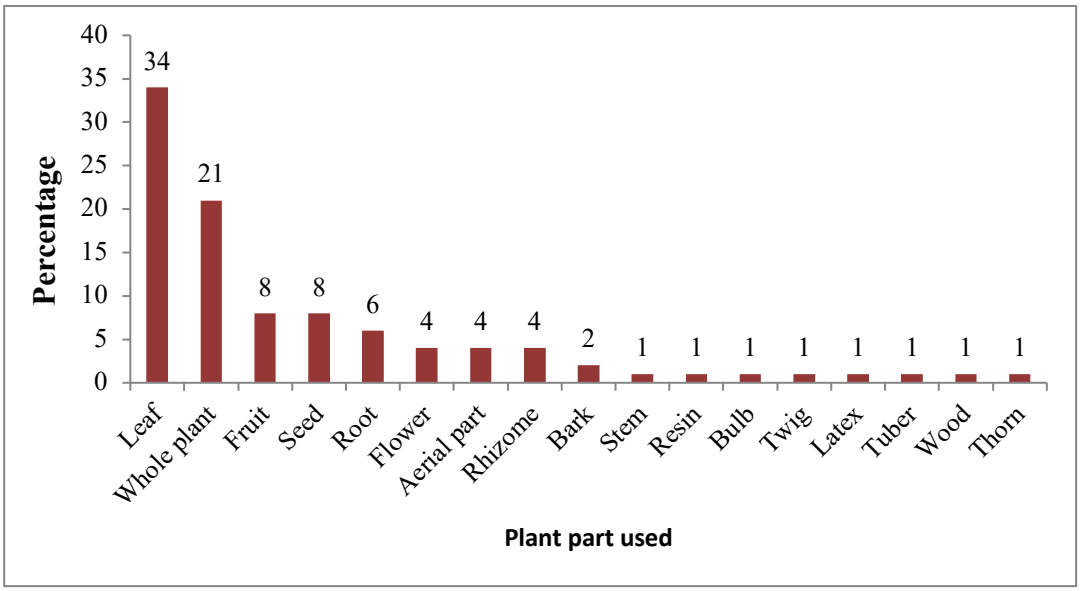

Figure 3. Percentage contribution of plant parts used

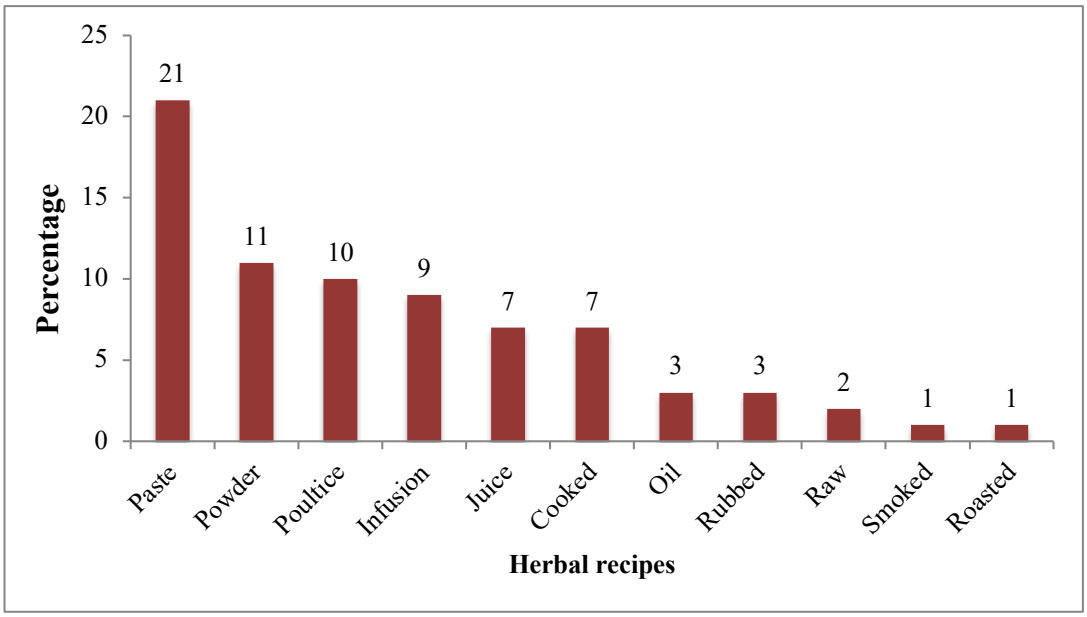

Figure 4. Percentage contribution of herbal recipes

Table 5. Value of informant consensus factor (ICF) for each disease category.

Disease Category	Number of use reports (Nur)	Number of taxa (Nt)	ICF
Gastrointestinal	158	29	0.82
Dermatological	162	29	0.83
Wounds	45	15	0.68
Nervous disorder	26	8	0.72
Respiratory	51	11	0.80
Gynaecological	60	12	0.81
Skeletomuscular	67	18	0.74
Cardiovascular	10	4	0.67
Antipyretic	40	12	0.72
Ear, Mouth, Eye (EME)	42	11	0.76
Liver and Kidney	15	5	0.71
Body weakness	20	7	0.68

Rheum emodi is a valuable medicinal plant with a wide range of pharmacological properties. More than 56 compounds have been found in the roots and rhizomes of this plant, including flavonoids, lignins, phenols, esters, and anthraquininones, which have antimicrobial, hepatoprotective, antioxidant, and antidiabetic properties (Rokaya *et al.* 2012). *Rheum emodi* is used in the Unani system of medicine to treat constipation, cough, and cold (Uniyal *et al.* 2006). *Plantago lanceolata* have been shown to contain Steroids, alkaloids, flavonoids, tannins, saponins, glycosides, phenols, and terpenoids and the presence of these key phytochemicals in the plant provides scientific support for its use as a medical treatment for a variety of human ailments (Fayera *et al.* 2018). The second highest value i.e., 0.82 was calculated for gastrointestinal disorders. *Artemisia absinthium, Ajuga bracteosa, Chenopodium album* and *Rumex nepalensis* are commonly utilized by the people of study area for the treatment of gastrointestinal disorders. For treatment of gastrointestinal disorders 29 plant species with 158 use reports have been recorded in the present study. The third highest value i.e., 0.81 was reported for gynecological disorders (12 plant species with 60 use reports). *Capsella bursa-pastoris, Taraxacum officinale, Zizyphus jujube, Trigonella foenum graecum* are abundantly utilized by the tribal people for treating gynecological disorders. The next ICF value of 0.80 was calculated for respiratory disorders (11 plant species with 51 use reports) followed by 0.76 for Ear, Mouth, Eye (EME) diseases (11 plant species with 42 use reports); 0.74 for Skeletomuscular disorders (18 plant species with 67 use reports); 0.72 for Nervous disorder (8 plant species with 26 use reports); 0.71 for Liver and Kidney disorders (5 plant species with 15 use reports) and 0.68 for both wound and body weakness. The lowest ICF value of 0.67 was calculated for cardiovascular disorders. 4 species including, *Allium sativum, Cotula anthemoides, Mentha arvensis* and *Vitis vinifera* were utilized to treat such disorders with 10 use reports (Table 4). Some other ethnomedicinal studies carried out in India and other parts of the world also reported a high value of ICF for dermatological disorders (Yabesh *et al.* 2014, Umair *et al.* 2017, Tounekti *et al.* 2019). The highest ICF for dermatological disorders suggests that there is a better communication among the informants and that the knowledge regarding the use of medicinal plants for treating various diseases of skin is shared among them. It can also be attributed to the fact that such disorders are relatively high in the study area.

Fidelity value

Fidelity level value recognizes the most preferred medicinal plant species used to treat different ailments and illustrates the fraction of informants reporting the use of a particular plant species. In the present study the fidelity value of medicinal plants range from 23-100% (Table 2). Plant species *Taraxacum officinale* and *Viola odorata* (for post-partum hemorrhage and throat infection respectively) have the highest fidelity value (100%). The second highest fidelity value i.e., 93% was reported for *Artemisia absinthium* used against worms; followed by *Lavetera cashmeriana* used against skin irritation by pregnant women (92%); *Ranunculus arvensis* used against fungal infections (91%); *Mentha arvensis* for diarrhea (90%); *Juglans regia, Rheum emodi* used against toothache and burns respectively (83%); Chenopodium album used to stimulate bowl movement *(*79%); *Prunella vulgaris* for muscle pain (78%); *Centauria iberica* for skin rashes(77%); *Ajuga bracteosa, Capsella bursa-pastoris, Malva neglecta* for Postpartum haemorrhage, body tonic and abdominal pain respectively (75%). Plant species having high fidelity value are more commonly utilized by the native population of the study area to treat various ailments as compared to those plants with low fidelity value. Farooq *et al.* (2019) reported the highest fidelity value for *Taraxacum officinale* which in in line with our study. *Taraxacum officinale* is well-known for its therapeutic potential among the local population of Kashmir valley for treating post-partum disorders (Yousuf *et al.* 2012, Mir *et al.* 2021).*Viola odorata* is also considered an important medicinal plant in Unani and Ayurvedic system of medicine for respiratory disorders (Vohora 1986). Various studies in Kashmir as well have reported *Viola odorata* to be used against respiratory disorders (Malik *et al.* 2011). It has also been reported to possess antioxidant and diuretic properties (Vishal *et al.* 2009).

Use value

To estimate the relative importance of medicinal plant species in the study area, use value (UV) was calculated on the basis of informant's citations. In our study use value ranged from 0.13-0.33 (Table 2). *Achillea millefolium* had the highest use value of 0.33 followed by *Chenopodium album, Phytollaca acinosa,* (0.31 each); *Ajuga bracteosa* (0.30); *Cannabis sativa* and *Senecio chrysanthemoides* (0.28 each). Lowest use value of 0.01 was exhibited by *Solanum tuberosum.* High use value of medicinal plant species indicates the richness of these plants in the region and the dependence of local population on such species for treating various ailments (Hussain *et al.* 2019).

Many of the plants used by native people in Baramulla district that were found to have high use value have been mentioned in previous medicinal literatures and are also used in Unani and Ayurvedic medicine systems, and some of the plants

mentioned in this study have already been scientifically validated using pharmacological assays. Savikin *et al.* (2013) in their study on traditional use of medicinal plants in South-western Serbia, Zlatibor district reported a high use value for *Achillea millefolium* which in in agreement with our study. The presence of many chemical constituents, such as essential oils, sesquiterpenes, phenolic compounds, and others, gives *Achillea millefolium* a broad variety of pharmacological properties, including spasmolytic, anti-inflammatory, analgesic, haemostatic, anti-diabetic, cholagogue, antitumor, antioxidant, antifungal, antiseptic, and liver protective effects (Ali *et al.* 2017). Local people of the study area use *Chenopodium album* to stimulate bowel movement, against Intestinal worms and Diarrhoea. This plant has been found to have antiviral, antifungal, anti-inflammatory, antiallergenic, antiseptic, and immunomodulatory properties (Amjad and Alizad 2012). Chenopodium album has also been claimed to possess strongest anti-breast cancer efficacy (Khoobchandani *et al. 2009*).

Phytolacca acinosa is another multi utility medicinal plant species used against stomach disorder, swelling of nipples and arthritic pain. Tannins, flavonoids, carbohydrates, proteins, polyphenol, tannins, and phenolic compounds were found in preliminary phytochemical screening of *Phytolacca acinosa* plant extract, which showed significant antibacterial and antifungal activity (Manzoor *et al.* 2017). *Ajuga bracteosa* is used by the locals to relieve abdominal pain. Malik *et al.* (2011) also reported *Ajuga Bracteosa* to cure abdominal pain whereas, Uniyal *et al.* (2006) reported it to cure mouth ulcers and breathing problems and Gairola *et al.* (2014) reported its use against leucorrhea, diarrhea, malaria. *Ajuga bracteosa* has been used in medicine since ancient times, with anti-inflammatory, antifungal, antibacterial, and anthelmintic properties (Israili and Lyoussi 2009). In the present study *Cannabis sativa* is reported to treat depression, excessive urination and ear-ache. This plant is well-known around the world for its stimulating and therapeutic effects, and its formulations have also been employed in antibacterial experiments (Kreji 1958).

Herbal remedies comparative analysis and novelty of the study

The ethnomedicinal data reported in the present study was compared with previously published national and international articles (Malik *et al.* 2011, Bhatia *et al.* 2014, Shah *et al.* 2015, Dutt *et al.* 2015, Kumar *et al.* 2015, Singh *et al.* 2016, Ishtiyak & Hussain 2017, Jeelani *et al.* 2018, Mir *et al*. 2021) similar to our study from Northwestern Himalaya. It was observed during comparison that a total of 26 different medicinal plants were reported to have some of the novel medicinal uses (designated in bold letters in Table 3). Of the total 55 ailments treated by using these 26 medicinal plants, 33 were recorded as novel ailments reported for the first time. Our study adds some novel ethnomedicinal claims of different medicinal plants used in the study area, which may serve for pharmacological and phytochemical analysis for the discovery of new drugs.

Conclusions

Medicinal flora forms the pillar of our traditional healthcare structure with a huge part of population still dependent on traditional medicines in most of the developing countries. Present study was an attempt to underline the potential medicinal plants used by the Gujjar and Bakerwal communities of Gulmarg mountainous region of Baramulla for obtaining their primary healthcare. It can be concluded from present research that people of the study area possess a rich traditional knowledge inherited from their forefathers and documentation of this valuable knowledge has provided novel information from the area. Native populations still rely on medicinal plant for their primary health care, but at the same time are alarmed about the degradation of the flora in wild. It was found that the elderly people possessed a great wealth of indigenous knowledge in comparison to the younger ones, this difference in knowledge might be due to the changing lifestyle of younger folk, changing views of ethnic communities and the increasing influence of industrialization, due to which traditional medicinal knowledge of plant species is frequently vanishing at an alarming rate. Therefore, there is a need to speedily document the important plants and associated knowledge and to take necessary measures for the conservation of these resources so as to save this treasure; otherwise a great number of medicinally important plants will become extinct in wild Thus, our research could prove helpful in the direction of the local biodiversity catalogues for the conservation of biodiversity. We recommend that species reported with high use value (UV) and fidelity level value (FL) should be employed for further phytochemical and pharmacological investigation to authenticate this indigenous knowledge.

Declarations

List of abbrevations: LF-Leaf, BR-Bark, RS-Resin, WP-Whole plant, BL-Blub, AP-Aerial portion, FR-Fruit, RT-Root, WD, Wood, TH-Thorn, FL-Flower, SD-Seed, RH-Rhizome, ST-Stem, TB-Tuber, TW-Twig.

Ethics approval and consent to participate: The study was conducted after approval from the local government organizations of the area. Prior consent

was also taken from the participants before their participation in the study.

Consent for publication: Not applicable.

Availability of data and materials: The plant specimens were deposited in KASH herbarium of Department of Botany, University of Kashmir, Srinagar, India.

Competing interests: The authors declare no competing interests.

Funding: No funding was received for this study.

Authors contributions: Muatasim Jan, Tawseef Ahmad Mir, Aijaz Hassan Ganie and Rakesh Kumar Khare did the preliminary work, semi-structured interviews, plant collection, data generation, drafted the manuscript, verification and revision of the manuscript reviewed and approved the final version of the manuscript. All authors have equal contribution.

Acknowledgments

The authors are thankful to management of Government Model Science College, Jiwaji University, Gwalior, India for providing necessary facilities and support to carry out this work. Authors are highly grateful to local population of Gulmarg Mountainous Region of Baramulla, Jammu and Kashmir for sharing their indigenous medicinal plant knowledge. Authors are grateful to Mr. Akhtar H. Malik, Curator KASH Herbarium, University of Kashmir, for helping in the identification of plant species.

Literature cited

Abbas Z, Khan SM, Abbasi AM, Pieroni A, Ullah Z, Iqbal M, Ahmad Z. 2016. Ethnobotany of the Balti community, Tormik valley, Karakorum range, Baltistan, Pakistan. Journal of Ethnobiology and Ethnomedicine 12:38.

Ahmad L, Qayoom S. 2019. Precipitation and Rainy Day Trends in Kashmir Valley, Jammu & Kashmir, India. Indian Journal of Ecology 46(1):83-87.

Ali SI, Gopalakrishnan B, Venkatesalu V. 2017. Pharmacognosy, Phytochemistry and Pharmacological Properties of *Achillea millefolium* L.: A Review. Phytotherapy Research 31(8):1140-1161.

Amjad L, Alizad Z. 2012. Antimicrobial activity of the Chenopodium album leaves and flowers extract. International Journal of Medical and Biological Sciences 6 (1).

Ara S, Naqshi AR. 1992. Ethnobotanical Studies in Gureiz Valley. Journal of Economic and Taxonomic Botany 17:3

Baba IA, Dubey S, Alia A, Saxena RC, Itoo AA, Powar K. 2012. Ethnobotanical survey of medicinal plants used by the people of District Ganderbal Jammu and Kashmir. Research Journal of Pharmaceutical, Biological and Chemical Sciences 3:549-556.

Barkaoui M, Katiria A, Boubaker H, Msanda F. 2017. Ethnobotanical survey of medicinal plants used in the traditional treatment of diabetes in Chtouka Ait Baha and Tiznit (Western Anti-Atlas), Morocco. Journal of Ethnopharmacology 198:338–350.

Bassam ARH. 2012. Medicinal plants (importance and uses). Pharmaceutica Analytica Acta 3:10.

Bhatia H, Sharma YP, Manhas RK, Kumar K. 2014. Ethnomedicinal plants used by the villagers of district Udhampur, J&K, India. Journal of Ethnopharmacology 151(2):1005-1018.

Bolson M, Hefler SA, Chaves EID, Junior AG, Junior ELC. 2015. Ethno-medicinal study of plants used for treatment of human ailments, with residents of the surrounding region of forest fragments of Paraná, Brazil. Journal of Ethnopharmacology 161:1-10.

Bussmann RW, Glenn A. 2010. Medicinal plants used in Northern Peru for reproductive problems and female health. Journal of Ethnobiology and Ethnomedicine 6:30.

Dar MS, Khuroo AA, Malik AH, Dar GH. 2018. Ethno-veterinary uses of some plants Gujjar and Bakerwal community in Hirpora Wildlife Sanctuary, Kashmir Himalaya. *SKUAST Journal of Research* 20(2):181-186.

Dutt HC, Bhagat N, Pandita S. 2015. Oral traditional knowledge on medicinal plants in jeopardy among Gaddi shepherds in hills of northwestern Himalaya, J&K, India. Journal of Ethnopharmacology 168:337-348.

Farooq A, Amjad MS, Ahmad K, Altaf M, Umair M, Abbasi AM. 2019. Ethnomedicinal knowledge of the rural communities of Dhirkot, Azad Jammu and Kashmir, Pakistan. Journal of Ethnobiology and Ethnomedicine 15:45.

Farooq U, Abaas G, Saggoo MIS, Dar M. 2014. Ethnobotany of some selected Monochlamydeae plant species from the Kashmir Himalaya, India. Journal of Medicinal Plants Research 8(23):834-839.

Fayera S, Neelaiah Babu G, Dekebo A, Bogale Y. 2018. Phytochemical Investigation and Antimicrobial Study of Leaf Extract of *Plantago lanceolata*. Natural Products Chemistry and Research 6:2.

Friedman J, Yaniv Z, Dafni A, Palewitch D. 1986. A preliminary classification of the healing potential of medicinal plants, based on a rational analysis of an ethnopharmacological field survey among Bedouins in the Negev desert, Israel. Journal of Ethnopharmacology 16:275-287.

Gazzaneo LRS, Lucena RFP, Albuquerque UP. 2005. Knowledge and use of medicinal plants by local specialists in a region of Atlantic Forest in the state of Pernambuco (Northeastern Brazil). Journal of Ethnobiology and Ethnomedicine 1(9):1-8.

Giday M, Teklehaymanot T, Animut A, Mekonnen Y. 2007. Medicinal plants of the Shinasha, Agew-awi and Amhara peoples in northwest Ethiopia. Journal of Ethnopharmacology 110(3):516-525.

Hachelaf A, Ahmed T, Zellagui A, Rhouati S. 2015. Antioxidant and antibacterial activities of essential oil extracted from *Ranunculus arvensis* L. Scholars Research Library Der Pharma Chemica 7(9):170-173.

Hamill FA, Apio S, MubirU NK, Mosango M, Bukenya-Ziraba R, Maganyi OW, Soejarto DD. 2000. Traditional herbal drugs of Southern Uganda. Journal of Ethnopharmacology 70(3):281–300.

Heinrich M, Ankli A, Frei B, Weimann C, Sticher O. 1998. Medicinal plants in Mexico: Healers' consensus and cultural importance. Social Science and Medicine 47:1863-1875.

Hooker JD. 1879. The Flora of British India, Vol 2. L. Reeve and Co., Ashford, Kent, England. 78-99.

Hu R, Lin C, Xu W, Liu Y, Long C. 2020. Ethnobotanical study on medicinal plants used by Mulam people in Guangxi, China. Journal of Ethnobiology and Ethnomedicine 16:32.

Hussain S, Hamid A, Ahmad KS, Mehmood A, Nawaz F, Ahmed H. 2019. Quantitative ethnopharmacological profiling of medicinal shrubs used by indigenous communities of Rawalkot, District Poonch, Azad Jammu and Kashmir, Pakistan. Brazilian Journal of Pharmacognosy 29:665-676.

Ishtiyak P, Hussain SA. 2017. Traditional Use of Medicinal Plants among Tribal Communities of Bangus Valley, Kashmir Himalaya, India. Ethnomedicine 11(4): 318-331.

Israili ZH, Lyoussi B. 2009. Ethnopharmacology of plants of genus *Ajuga.* Pakistan Journal of Pharmaceutical Sciences 22:425-462.

Jain SK, Rao RR. 1977. A Handbook of Field and Herbarium Methods. Today and Tomorrow's Printer, New Delhi, India. 157.

Jeelani SM, Rather GA, Sharm A, Lattoo SK. 2018. In perspective: Potential medicinal plant resources of Kashmir Himalayas, their domestication and cultivation for commercial exploitation. Journal of Applied Research in Medicinal and Aromatic plants 8:10-25.

Kadir MF, Bin Sayeed MS, Setu NI, Mostafa A, Mia MM. 2014. Ethnopharmacological survey of medicinal plants used by traditional health practitioners in Thanchi, Bandarban Hill Tracts. Bangladesh Journal of Ethnopharmacology 155(1):495-508.

Kala CP. 2005. Ethno-medicinal botany of the Apatani in the Eastern Himalayan region of India. Journal of Ethnobiology and Ethno-medicine 1:11.

Kaul MK. 2010. High altitude botanicals in integrative medicine-Case study from Northwest Himalaya. Indian Journal of Traditional Knowledge 9(1):18-25.

Khan ZS, Khuroo AA, Dar GH. 2004. Ethnomedicinal survey of Uri, Kashmir Himalaya. Indian Journal of traditional Knowledge 3(4):351-357.

Khoobchandani M, Ojeswi B, Sharma B, Sirivastava MM. 2009. "*Chenopodium album* prevents progression of cell growth and enhances cell toxicity in human breast cancer cell lines. Oxidative Medicine and Cellular Longevity 2(3):160-165.

Khuroo AA, Malik AH, Dar AR, Dar GH, Khan ZS. 2007. Ethno-veterinary medicinal uses of plant species by the Gujar tribe of the Kashmir Himalaya. Asian Journal of Plant Sciences 6(1):148-152.

Kreji Z. 1958. Univ-palacky, Olomouc, Czech, hemp *Cannabis sativa* an antibiotic drug II methods and results of bacteriological investigations and preliminary clinical experiences. Journal of Pharmacy. 13:155-166.

Kumar K, Shrama YS, Manhas RK, Bhatia H. 2015. Ethnomedicinal plants of Shankaracharya Hill, Srinagar, J&K, India. Journal of Ethnopharmacology 170:255–274.

Leonti MM, Pamirez F, Sticher O, Heinrich M. 2003. Medicinal flora of the Populuca: a botanical systematical perspective. *Economic Botany* 57:218-230.

Lone FA. 2003. Folklore medicinal system of Uri sector Kashmir valley, India, Proceeding of the 2nd world congress on Biotechnology Development of Herbal medicine, India 91-92.

Lone PA, Bhardwaj AK, Shah KW, Tabasum S. 2014. Ethnobotanical study of some threatened medicinal plants of Kashmir Himalaya, India. Journal of Medicinal Plants Research 8(47):1362-1373.

Malik AH, Rashid I, Ganie AH, Khuroo AA, Dar GH. 2015. Befitting from Geoinformatics: Estimating floristic diversity of Warwan valley in Northwestern Himalaya, India. Journal of Mountain Science 12(4):854-863.

Malik AR, Siddique MAA, Sofi PA, Butola JS. 2011. Ethnomedicinal Practices and Conservation Status

of Medicinal Plants of North Kashmir Himalayas. Research Journal of Medicinal Plant 5(5):515-530.

Manzoor N, Wani I, Singh KP, Pal. 2017. In-Vitro Antimicrobial Activity Phytochemical Screening *of Phytolacca acinosa* in Kashmir Valley. International Journal of Science and Research 6(3):102-106.

Mehraj G, Khuroo AA, Qureshi S, Muzafar I, Friedman CR, Rashid I. 2018. Patterns of alien plant diversity in the urban landscapes of global biodiversity hotspots: a case study from the Himalayas, Biodiversity Conservation 27 (5):1055-1072.

Mir MA, Shafi A, Wani G. 2017. Investigation of Biochemical Analysis and Antibacterial Properties of *Lavatera Cashmiriana*. International Journal for Science and Advance Research in Technology 3(11): 2395-1052.

Mir TA, Jan M & Dhyani S. 2018b. A Comprehensive account of ethno-medicinal uses of monocot flora (reported from February-June) of Karwapani forest Doon valley-Uttarakhand. SERBD-International Journal of Multidisciplinary Sciences 1(2):22-27.

Mir TA, Jan M, Khare RK, Dhyani S. 2021. Ethno-Survey of Traditional Use of Plants in Lolab Valley, Kashmir Himalaya. Indian Forester 147(3):281-287.

Musa MS, Rasool A, FE, Elsheikh EA, Ahmed LAMN, Mahmoud ALE, Yagi SM. 2011. Ethnobotanical study of medicinal plants in the Blue Nile State, South-eastern Sudan. Journal Of medicinal Plants Research 5(17):4287-4297.

Navchoo IA, Kachroo P. 1995. Flora of Pulwama, Kashmir. Bishen Singh and Mahendra Pal Singh, Dehradun.

Navchoo IA, Bhat GM. 1994. Studies on the medicinal plants used by Gujjar, a backward tribe of Jammu and Kashmir. In: Sahni KC, (Ed), Advances in plant science and research. Dehradun (India), Bishen Singh & Mahendra Singh 191-203.

Phillips O, Gentry AH. 1993. The useful plants of Tambopata, Peru: i. Statistical hypotheses tests with a new quantitative technique. Economic Botany 47:15-32.

Rajadurai M, Vidhya VG, Ramya M,Bhaskar A. 2009. Ethno-medicinal plants used by the traditional healers of Pachamalai hill, Tamilnadu, India. Ethnomedicine 3(1):39-41.

Ribeiro A, Romeiras MM, Tavares J, Faria TM. 2010. Ethnobotanical survey in Canhane village, district of Massingir, Mozambique: medicinal plants and traditional knowledge. Journal of Ethnobiology and Ethnomedicine 6:33.

Rokaya MB, Münzbergová Z, Timsina B, Bhattarai KR. 2012. *Rheum australe* D. Don: A review of its botany, ethnobotany, phytochemistry and pharmacology. Journal of Ethnopharmacology 141:761-774.

Savikin K, Zdunic G, Menkovic N, Zivkovic J, Cujic N, Terescenko M, Bigovic D. 2013. Ethnobotanical study on traditional use of medicinal plants in South-Western Serbia, Zlatibor district. Journal of Ethnopharmacology 146:803-810.

Shah A, Bharat KA, Ahmad J, Sharma MP. 2015. New ethnomedicinal claims from Gujjar and Bakerwals tribes of Rajouri and Poonch districts of Jammu and Kashmir, India. Journal of Ethnopharmacology 166:119-128.

Simbo DJ. 2010. An ethnobotanical survey of medicinal plants in Babungo, northwest region, Cameroo. Journal of Ethnobiology and Ethnomedicine 6:8.

Singh B, Sultan P, Hassan QA, Gairola S, Bedi YS. 2016. Ethnobotany, Traditional Knowledge, and Diversity of Wild Edible Plants and Fungi: A Case Study in the Bandipora District of Kashmir Himalaya, India. Journal Of Herbs, Spices & Medicinal Plants 22(3):247–278.

Singh JB, Kachroo P. 1994. Forest Flora of Pir Panjal Range (North Western Himalaya). Bishen Singh Mahendra Pal Singh, Dehradun, India.

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

Singh V. 1995. Herbal remedies in traditional medicines of the local valley in Kashmir Himalayas, India, round progress in medicinal plants. Ethnomedicine and Pharmacology *1*:63-71.

Sullivan K, Sheally CN. 1997. *Complete Natural Home Remedies* (Element Books Limited, Shaftesbwey, U. K). 3.

Tali BA, Khuroo AA, Ganie AH, Nawchoo IA. 2019. Diversity, distribution and traditional uses of medicinal plants in Jammu and Kashmir (J&K) state of Indian Himalayas. Journal of Herbal Medicine 17-18.

Tounekti T, Mahdhi M, Khemira H. 2019. Ethnobotanical Study of Indigenous Medicinal Plants of Jazan Region, Saudi Arabia. Evidence-Based Complementary and Alternative Medicine 3:1-45.

Trotter RT, Logan MH. 1986. Informant consensus: a new approach for identifying potentially effective medicinal plants, In: Etkin NL, (Ed), Plants in Indigenous Medicine and Diet, Redgrave, Bedford Hill, NY, USA, 91-112.

Umair M, Altaf M, Abbasi AM. 2017. An ethnobotanical survey of indigenous medicinal plants in Hafizabad district, Punjab-Pakistan. PLoS ONE, 12(6):e0177912. doi:10.1371/journal.pone.0177912

Uniyal SK, Singh KN, Jamwal P, Brij L. 2006. Traditional use of medicinal plants among the tribal communities of Chhota Bhangal, Western Himalaya. Journal of Ethnobiology and Ethnomedicine 2:14.

Vishal A, Parveen K, Pooja S, Kannappan N, Kumar S. 2009. Diuretic, Laxative and Toxicity studies of *Viola odorata* aerial parts. Pharmacology Online 1:739-748.

Vohora SB. 1986. Unani Joshandah drugs for common cold, catarrh, cough, and associated fevers. Journal of Ethnopharmacology 16:201-211.

Yabesh JEM, Prabhu S, Vijayakumar S. 2014. An ethnobotanical study of medicinal plants used by traditional healers in silent valley of Kerala, India. Journal of Ethnopharmacology 154(3):774-789.

Yousuf J, Verma RK, Dar H. 2012. Traditional plant-based therapy among rural communities of some villages of Baramulla district (Jammu and Kashmir). Journal of Phytology 4(5):46-49.