Descriptive study of plant resources in context of the ethnomedicinal relevance of indigenous flora; a case study from Rajouri-Poonch region of Himalaya

Zishan Ahmad Wani, Shreekar Pant and Bikarma Singh

Research

Background: The study is an attempt to document the medicinal plants used in traditional health care systems in Rajouri-Poonch region of Himalaya. The study also highlights some direct relationships of botanical diversity with various social and cultural aspects, along with quantitative indices to validate the data investigated. This study presents the pioneering attempt to analyze the effect of various variables (age, gender, and education) for ethnobotanical data in Jammu and Kashmir.

Methods: Convenience sampling has been used by selecting a total of 128 informants. Questions regarding the utilization of different plants, their parts used, diseases treated, and mode of administration were asked through using questionnaires prepared for the purpose. Data were analyzed through different quantitative ethnobotanical indices.

Results: A total of 92 plant species belonging to 86 genera and 48 families investigated to be used in the traditional health care system of the region. Rosaceae is the most dominant family followed by Lamiaceae, Fabaceae, and Asteraceae. Most of the documented species were herbs (37.5%) followed by shrubs (17.96%), trees (11.71%), and climbers (4.68%). Leaves were the most common part used in herbal preparations followed by roots, whole plants, seeds, fruits, aerial parts, rhizomes, flowers, cloves and bark. The main method of preparation was decoction followed by extract, paste, powder, chewed, cooked, infusion, poultice and roasted. Species with the highest RFC were *Taraxacum officinale* (0.82), *Raphanus sativus* (0.68) and *Allium sativa* (0.67). Informant Consensus Factor for each disease category ranges from 0.94 to 0.97. The results reveals that there is a strong positive correlation between age and citations (r=0.64) and a negative correlation between the level of education and citations (r = -0.34).

Conclusion: Traditional knowledge is draining of rapidly because of modernization and urbanization. There is an immediate need to draft policies for documentation and preservation of such knowledge. Further, plants with high Relative Frequency of Citations and Fidelity Level should be prioritized for

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bioprospection studies like phytochemical investigation, pharmacological studies, microbiological and toxicological enquires to draw general conclusions on ethnopharmacological relationships.

Keywords: Rajouri-Poonch, Variables, Quantitative, Traditional, Correlation

Background

Ethnobotany primarily refers to the practices, innovations, and knowledge gained over the centuries for documentation, utilization, and management of plants by human societies and it directly deals with the botanical, social, and cultural diversity (Panday & Tripathi 2017). By its nature, ethnobotany recognizes the value of the traditional knowledge related to bioresources and presently appreciation of such traditional knowledge is growing fast. However, most of the ethnobotanical studies still highlight the traditional knowledge associated with plants without taking care of its quantitative assessment with several other aspects of society. Therefore, now-a-day ethnobotanists are mainly focusing on the application of different quantitative approaches to understand the relationship with social parameters. It is a contemporary precise approach that confirms the precision of data with statistical support and the use of quantitative indices of the data. Further, these indices estimate the utilization of plant bioresources for different purposes and thus determine the prominence of plants for the local popùlation (Hussain *et al*. 2019). Traditional knowledge is dynamic and changes with time, generation, culture, and resources, and further the new generation is diverted towards the allopathic medicines, so the accurate documentation of this knowledge is both timely and necessary because ethnomedicinal knowledge now remained restricted to the old people only (Amjad *et al*. 2017). The ethnobotanical information is affected by many elements and the variables known to affect knowledge about medicinal plants include education, occupation, age, gender, and psychosocial variables, but age and gender are commonly studied for their influence on knowledge about medicinal plants (Shaheen *et al*. 2017).

The Himalayas hosts a rich biological diversity and hence considered as Biodiversity Hotspot (Mittermeier *et al.* 2005), due to its unique topography, climatic conditions, and diverse habitats. The Indian Himalayan Region (IHR) is divided into five biogeographic regions i.e., Trans Himalaya (Ladakh), Northwest Himalaya (Jammu and Kashmir and Himachal Pradesh), West Himalaya (Kumaun and Garhwal), Central Himalaya (Sikkim and Darjeeling hills of West Bengal) and East Himalaya (Arunachal Pradesh) (Rodgers & Panwar, 1988) with 2, 500 km length and 240 km width: It covers an area of approximately 4, 19, 873 km^2. Jammu and Kashmir, a part of the Northwest Himalaya is well known for its unique biological and cultural diversity and supports a rich diversity of angiosperms, gymnosperms and pteridophytes. Further, the region is also culturally rich and various ethnic communities *viz*. Gujjars, Bakerwals and Paharis reside within the region. Medicinal plants and their traditional usage have been an integral part of social, cultural and religious aspects of ethnic civilizations (Folke 2004). Therefore, an attempt was made to highlight some direct relationships of traditional knowledge with various social and demographic aspects like age and gender in the Rajouri-Poonch region of Jammu and Kashmir (J&K) along with some quantitative indices to validate the data and also to compare the data with the previously published data and with the other ethnic groups of India. Further, it is the pioneering attempt to analyze the effect of various variable (age, gender and education) concerning ethnobotanical data in J&K.

Materials and Methods

Study area

The twin districts, Rajouri and Poonch of Jammu province are located in the southeastern foothills of Pir Panjal Range of Jammu and Kashmir residing in the Himalayan biodiversity hotspot. Rajouri lies between 32°57' to 33°33'N latitudes and 74°00 to 74°48 E longitude, whereas Poonch region is located between 33°28' to 34° 00' N latitudes and 74°56' to 74°32' E longitudes (Fig. 1). The climate and vegetation of the study area are sub-tropical, temperate, sub-alpine, and high-altitude areas with hilly and montane terrain (Pant *et al*. 2021). The two districts are inhabited by people of different linguistic groups but are mainly inhabited by Gujjars and Bakerwals. Both the tribes are nomadic and ethnically are more or less the same, speak a common language (Gojri) and share a common ecosystem to accommodate their day-to-day needs. The only difference is that Bakerwals rear sheep and goats while Gujjars rear buffaloes and cows. Both the communities possess herbal knowledge healers to cure their day-to-day health problems and oral dissemination is the only means of transmission of this traditional knowledge.

Data collection

Field assessment which involved plant collection, photography, and data recording was carried out from March 2018 to October 2019. Convenience sampling has been used by selecting a total of 128 informants based on their easy access and availability. Out of the total 128 informants, 72 were men and 56 were women. The age group of respondents varied from 31 to above 60 years,

having a different level of education from illiterate to above college level. Young persons were not interested in the work and thus refused to participate in the interviews. The information of the respondents has been collected through direct interviews (Table 1). Open-semi structured questionnaires were used for collecting ethnobotanical data, as this method allows a large number of respondents to be cross-examined in a relatively short period by asking the same questions within a flexible framework. Questions regarding the utilization of different plants, their parts used, diseases treated, and mode of administration were asked through using questionnaires prepared for the purpose.

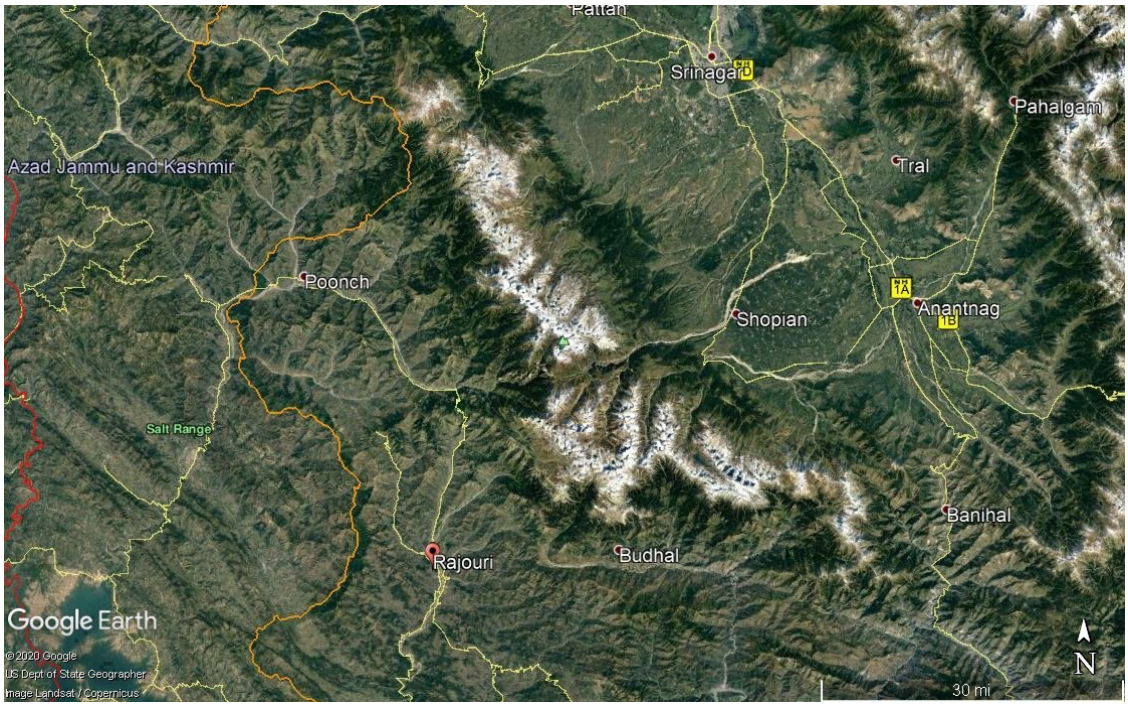

Figure 1. Map of the study area

Table 1. Demographic data of the Informants

Variable	Category	No. of respondents	Percentage
Gender	Male	72	56.25
	Female	56	43.75
Age (in years)	31 – 40	33	25.78
	41 – 50	38	29.68
	51 – 60	34	26.56
	Above 60	23	17.96
Education level (in years)	Illiterate	29	22.65
	Primary (5 years)	26	20.31
	Middle (8 years)	18	14.06
	Secondary (10 years)	14	10.93
	Intermediate (12 years)	19	14.84
	College (15 years)	15	11.71
	Higher (> 15 years)	07	5.46

Routine herbarium practices were carried out following standard SOP (Jain & Rao 1976) for preparing and preserving herbarium specimens. Fresh plant samples were collected from the field and were pressed, dried, and mounted on herbarium sheets for preservation. Collected plant samples were identified following standard references (Singh *et al*. 2002; Swami & Gupta 1998; Sharma & Kachroo 1981-82 and consultation of voucher samples housed at Janaki Ammal Herbarium (acronym RRLH). The botanical nomenclature of the collected species was authenticated using the International Plant Name Index (http://www.ipni.org), GRIN (http://www.ars-grin.gov/cgi-bin/npgs/html/queries.pl) and Plants of the World Online (http://www.plantsoftheworldonline.org*)*. Further, a literature survey was carried out to relate the study with the previously published ones. Data were retrieved from Google Scholar, Science Direct, Scopus and Web of Science by searching for the

following keywords; ethnobotany, ethnomedicine, traditional knowledge, medicinal plants, and folk use. The present study was related with the studies carried out in regions having similar as well as diverse floristic and cultural diversity.

Quantitative data analysis

The data has been analyzed by using the following quantitative and similarity indices:

Relative Frequency of Citation **(RFC)**

RFC is used to calculate the proportion of the informants that cited a particular species, assigning a use-value to that species. RFC was calculated following Amjad *et al*. 2017.

$$RFC = FC/N$$

where FC is the number of informants reporting the use of a particular species and N is the total number of informants.

Fidelity Level **(FI)**

FL is used to determine the most preferred species used in treatment of particular ailment (Musa *et al*., 2011; Friedman *et al*., 1986). It is calculated by using following formula;

$$Fl(\%) = \frac{N_p}{N} \times 100$$

where 'Np' is the number of use reports cited for a given species for a particular ailment and 'N' is the total number of use reports cited for any given species.

Informant Consensus Factor **(ICF)**

To calculate ICF, diseases treated are grouped into disease categories and it is used to estimate the agreement of the community regarding the use of different plant species in each disease category. Its value ranges from 0 to 1. ICF values are greater when only one or few plant species are used to cure a specific disease while its value is lower when many plant species are used to cure a specific disease and the informants have contradiction over which plant to use against that particular disease. ICF is calculated by using the following Heinrich *et al*. 1998.

$$\mathbf{IFC} = \frac{\mathbf{N_{ur}} - \mathbf{N_{tax}}}{\mathbf{N_{ur}} - \mathbf{1}}$$

where 'N_{ur}' refers to the number of use reports and 'N_{tax}' number of taxa used for a particular use category by all informants.

Jaccard Index **(JI)**

JI is calculated to compare the data recorded with the previously published data from other regions. JI is calculated by using the formula following Majeed *et al*. 2020

$$\mathbf{JI} = \frac{\mathbf{c} \times \mathbf{100}}{(\mathbf{a} + \mathbf{b}) - \mathbf{c}}$$

where 'a' is the number of species unique to the study area, 'b' is the number of species unique to the aligned area and 'c' is the number of species common to both the areas.

Rahman's Similarity Index (RSI)

RSI is calculated to compare the present study with the studies previously published from allied, regional, national, and global levels through the percentages of plant species analyzed and commonly cited with the same cultural medicinal uses (Rahman *et al*. 2019). In the present study, RSI has been used to compare the study with the other ethnic and tribal communities at the regional, national, and global levels. RSI is calculated by using

$$\mathbf{RSI} = \frac{\mathbf{d}}{\mathbf{a} + \mathbf{b} + \mathbf{c} - \mathbf{d}}$$

where, "a" is the number of species unique in an area (our study area), "b" is the number of species unique in an area B (studies already done), "c" is the number of common species in both A and B areas and "d" is the number of common species used for the similar ailment in both A and B areas. While a & b ≠ 0 and c & d ≥ 0.

Results

Demographic of the informants

Out of the total 128 informants, 56.25% were males and 43.75% were females. Based on age, the informants were divided into four age groups, 31–40 yrs (25.78%), 41–50 yrs (29.78%), 51–60 yrs (26.56%) and above 60 yrs (17.96%) (Table 1). Concerning education, 22.65% were illiterate, and 22. 65% have attended school up to primary level, 14. 06% up to middle level, 10.93% up to secondary level, 14.84% up to intermediate level, 11.71% up to college level, and 5.46% up to university level.

Medicinal plant diversity and utilization pattern

A total of 92 plant species belonging to 86 genera and 48 families were documented (Table 2). The most dominant family was Rosaceae with eight species (15.09%) followed by Lamiaceae and Fabaceae with six species (11.32%) and Asteraceae with five species each (9.43%) (Table 3). Herbs were the most commonly used life form (Fig. 2).

Table 2. Ethnomedicinal plants used by Gujjar and Bakerwal tribes of Rajouri-Poonch Region of Jammu and Kashmir

Taxon	Family	Local Name	LF	Part used	Disease Treated	Method of Preparation	Mode of Application	FC	RFC
Abrus precatorius L.	Fabaceae	Ratie	H	WP	Hair care	Extract	External	26	0.20
				L	Skin diseases	Paste	External		
Acer caesium Wall ex. Brandis.	Sapindaceae	-	T	W	Skin infection	Extract	External	38	0.29
Achillea millefolium L.	Asteraceae	Sultani booti	H	L	Toothache	Chewed	Internal	48	0.37
				AP	Fever	Decoction	Internal		
				WP	Tonic	Decoction	Internal		
				WP	Cold	Decoction	Internal		
Aconitum heterophyllum Wall. ex Royle	Ranunculaceae	Patrees	H	R	Tonic	Powder	Internal	28	0.21
				Rh	Cough	Powder	Internal		
Acorus calamus L.	Acoraceae	Bachh	H	Rh	Gastritis	Paste	Internal	36	0.28
				R	Diarrhea	Extract	Internal		
Aesculus indica (Wall. ex Camb.) Hook.	Sapindaceae	Ban Khori	T	L	Fever	Extract	Internal	27	0.21
Ajuga integrifolia Buch-Ham ex D. Don	Lamiaceae	Neel kanthi	H	WP	Lice	Decoction	External	33	0.25
				WP	Tonic	Decoction	Internal		
Ailanthus altissima (Mill) Swingle.	Simaroubaceae	-	T	Bk	Diarrhea	Decoction	Internal	42	0.32
Allium cepa L.	Amaryllidaceae	Piyaaz	H	Bl	Bee Sting	Paste	External	68	0.53
Allium sativa L.	Amaryllidaceae	Thoom	H	Cl	Hypertension	Edible	Internal	86	0.67
				Cl	Stomachache	Roasted	Internal		
				Cl	Boils	Paste	External		
				Cl	Alopecia	Paste	External		
Amaranthus caudatus L.	Amaranthaceae	Ganar	H	L	Fever	Extract	Internal	22	0.17
Amaranthus retroflexus L.	Amaranthaceae	Ganari	H	S	Measles	Powder	Internal	34	0.26
Artemisia absinthium L.	Asteraceae	Chhuma - Jom	H	AP	Worms	Decoction	Internal	58	0.45
				L	Stomachache	Paste	Internal		
Asparagus racemosus Willd.	Asparagaceae	Safed musli	S	R	Weakness	Extract	Internal	42	0.32
Aucklandia costus (Falc.) Lipsch.	Asteraceae	Kuth	H	R	Arthritis	Extract	External	70	0.54
Berberis aristata DC.	Berberidaceae	Kala Simloo	S	R	Fracture	Powder	External	42	0.32
				R	Jaundice	Powder	Internal		
Berberis lycium Royle	Berberidaceae	Simloo	S	Fr	Wounds	Paste	External	61	0.47
				Fr	Constipation	Edible	Internal		
				R	Jaundice	Decoction	Internal		
Bergenia ciliata (Haw.) Sternb.	Saxifragaceae	Bat-mevo, Zakhm-i-hayat	H	R	Gastritis	Extract	Internal	55	0.42
Buddleja asiatica Lour.	Scrophulariaceae	Batti	S	L	Skin disease	Extract	External	18	0.14
*Calotropis procera (*Aiton.) Dry.	Apocyanaceae	Aak	S	L	Joint pain	Paste	External	21	0.16
Cannabis sativa L.	Cannabaceae	Bhang	H	L	Wounds	Paste	External	52	0.40
Celtis australis L.	Cannabaceae	Khirak	T	Fr	Tonic	Edible	Internal	54	0.42

				S	Allergy	Paste	External		
Chenopodium album L.	Amaranthaceae	Bathuo	H	L	Gastric disorders	Decoction	Internal	38	0.29
Cichorium intybus L.	Asteraceae	JangliHaandh	H	R	Stomachache	Paste	Internal	40	0.31
				R	Typhoid	Extract	Internal		
Clematis montana Buch. – Ham. ex DC.	Ranunculaceae	Chamba	S	F	Fever	Extract	Internal	49	0.38
Coriandrum sativum L.	Apiaceae	Tandhel	H	L	Stomachache	Extract	Internal	32	0.25
Cuscuta reflexa Roxb.	Convolvulaceae	Neelatheri	CL	WP	Cold	Decoction	Internal	45	0.35
				WP	Hair fall	Decoction	External		
Cydonia oblonga Mill.	Rosaceae	Baie	T	S	Boils	Decoction	External	43	0.33
				S	Throat infection	Chewed	Internal		
Daphne papyracea Wall. ex Sm. & Cave	Thymelaeaceae	Chavan	S	L	Skin infection	Extract	External	28	0.21
Datura stramonium L.	Solanaceae	Tatoora	S	L	Dandruff	Extract	External	30	0.23
Dicliptera chinensis (L.) Juss.	Acanthaceae	Churu	H	R	Wounds	Extract	External	33	0.25
Dioscorea deltoidea Wall.	Dioscoreaceae	Kalo-mazo	CL	Rh	Gastritis	Extract	Internal	42	0.32
				L	Weak eyesight	Extract	External		
Elaeagnus umbellata Thunb.	Elaeagnaceae	Kankoli	S	Fr	Mouth ulcers	Edible	Internal	35	0.27
Equisetum arvense L.	Equisetaceae	Tarutkah	H	WP	Urine infection	Powder	Internal	22	0.17
Euphorbia helioscopia L.	Euphorbiaceae	Dhodul	H	WP	Boils	Extract	External	62	0.48
				L	Fungal infection	Paste	External		
				L	Wounds	Paste	External		
Euphorbia hirta L.	Euphorbiaceae	Dhoduli	H	WP	Jaundice	Powder	Internal	51	0.39
Ficus auriculata Lour.	Moraceae	Tussi	T	Fr	Constipation	Edible	Internal	38	0.29
Foeniculum vulgare Mill.	Apiaceae	Saunf	H	S	Abdominal pain	Decoction	Internal	70	0.54
				S	Blood purification	Decoction	Internal		
Fragaria nubicola Lindel. ex. Lacaita	Rosaceae	Kanichi	H	Rh	Tonsillitis	Powder	Internal	38	0.29
Fumaria indica (Haussk.) Pugsley	Fumariaceae	Pit papadda	H	S	Back pain	Extract	Internal	36	0.28
Hedera nepalensis K.Koch	Araliaceae	Batulo	CL	L	Dyspepsia	Extract	Internal	36	0.28
Indigofera heterantha Wall.ex Baker	Fabaceae	Kenthi	S	Tw	Toothache	Chewed	External	41	0.32
Isodon rugosus (Wall. ex Benth.) Codd.	Lamiaceae	-	S	L	Snake bites	Decoction	Internal	13	0.10
Jasminum humile L.	Oleaceae	-	S	L	Worms	Decoction	Internal	26	0.20
Juglans regia L.	Juglandaceae	Khorhi	T	BoR	Plaque	Chewed	External	84	0.65
Lamium album L.	Lamiaceae	Dhoodi bhooti	H	AP	Wounds	Paste	External	49	0.38
Malva sylvestris L.	Malvaceae	Sochal	H	L	Weak eyesight	Cooked	Internal	31	0.24
Medicago sativa L.	Fabaceae	RaariMaari	H	L	Kidney problem	Cooked	Internal	33	0.25
				L	Arthritis	Paste	External		
Melia azedarach L.	Meliaceae	Drek	T	L	Stomachache	Decoction	internal	24	0.18
Mentha longifolia (L.) Huds.	Lamiaceae	Putna	H	L	Fever	Decoction	Internal	75	0.58

Morus nigra L.	Moraceae	Toot	T	L	Wounds	Paste	External	48	0.37
Nepeta cetaria L.	Lamiaceae	-	H	L	Diarrhea	Extract	Internal	43	0.33
				L	Nausea	Paste	Internal		
Olea ferruginea Royle	Oleaceae	Kao	T	L	Toothache	Decoction	External	32	0.25
				L	Stomachache	Chewed	Internal		
Oxalis corniculata L.	Oxalidaceae	Shataali	H	WP	Abdominal pain	Extract	Internal	56	0.43
				WP	Blood purifier	Decoction	Internal		
				L	Fever	Extract	External		
Pinus roxburghii Sarg.	Pinaceae	Cheerrh	T	Rn	Skin rashes	Paste	External	52	0.40
Plantago lanceolata L.	Plantaginaceae	Chamchepatar	H	L	Urine infection	Extract	Internal	51	0.39
Plantago major L.	Plantaginaceae	Chamchepatar	H	L	Acidity	Decoction	Internal	38	0.29
Persicaria hydropiper (L.) Delarbre	Polygonaceae	-	H	L	Hypertension	Decoction	Internal	53	0.41
				L	Jaundice	Decoction	Internal		
				L	Gastric problem	Edible	Internal		
Populus ciliata Wall. ex Royle	Salicaceae	Safedo	T	Bk	Blood purification	Decoction	Internal	32	0.25
Princepia utilis Royle	Rosaceae	Phulwarho	S	L	Abdominal pain	Powder	External	26	0.20
Prunella vulgaris L.	Lamiaceae	Sir motio	H	Fl	Headache & Fever	Decoction	Internal	48	0.37
				AP	Wounds	Paste	External		
				WP	Body pain	Paste	External		
Prunus armeniaca L.	Rosaceae	Khubani	T	S	Constipation	Powder	Internal	55	0.42
Punica granatum L.	Lythraceae	Dharhuni	S	Fr	Jaundice	Extract	Internal	72	0.56
Pyrus pashia Buch.-Ham. ex D.Don	Rosaceae	Batangi	T	L	Hair fall	Extract	External	50	0.39
Ranunculus arvensis L.	Ranunculaceae	Khandbaria	H	WP	Diarrhea	Decoction	Internal	61	0.47
Raphanus sativus L.	Brassicaceae	Muli	H	R	Jaundice	Edible	Internal	88	0.68
				R	Urinary problem	Edible	Internal		
				R	Indigestion	Edible	Internal		
				R	Diarrhea	Extract	Internal		
Rheum australe D. Don	Polygonaceae	Revand	H	Rh	Boils	Paste	External	76	0.59
Robinia pseudoacacia L.	Fabaceae	Keekar	T	L	Gastric disorders	Infusion	Internal	36	0.28
Rosa moschata Herrm.	Rosaceae	Phulwari	S	Fl	Fever	Extract	Internal	55	0.42
Rubus ellipticus Smith	Rosaceae	Gracho	S	Fr	Constipation	Edible	Internal	51	0.39
Rubus fructicosus L.	Rosaceae	Pakana	S	L	Diarrhea	Infusion	Internal	39	0.30
Rumex nepalensis Spreng.	Polygonaceae	Hulla	H	R	Cough	Paste	Internal	52	0.40
Rubia cordifolia L.	Rubiaceae	Kai bel	CL	R	Stomachache	Extract	Internal	51	0.39
Senegalia catechu (L.f) P. J. H. Hunter & Mabb	Fabaceae	Khair	T	L	Sore throat	Decoction	External	52	0.40

Solanum nigrum L.	Solanaceae	Kachmach	H	L	Stomachache	Decoction	Internal	62	0.48
				L	Jaundice	Decoction	Internal		
Taraxacum officinale F.H. Wigg.	Asteraceae	Handh	H	WP	Fracture	Paste	External	106	0.82
				L	Weakness	Cooked	Internal		
				R	Jaundice	Decoction	Internal		
				L	Back pain	Paste	Internal		
				R	Fever	Decoction	Internal		
Triticum aestivum L.	Poaceae	Kanak	H	S	Worms	Decoction	Internal	76	0.59
Valeriana wallichii Jones	Caprifoliaceae	Balo	H	R	Headache	Paste	External	35	0.27
				R	Wounds	Paste	External		
Verbascum thapsus L.	Verbenaceae	Giddar	H	AP	Migraine	Decoction	Internal	43	0.33
				R	Swelling	Paste	External		
Verbena officinalis L.	Verbenaceae	-	H	AP	Worms	Decoction	Internal	24	0.18
Veronica persica Poir.	Scrophulariaceae	-	H	WP	Dermatitis	Powder	External	34	0.26
Viccia sativa L.	Fabaceae	Jangli Matar	H	WP	Skin disease	Poultice	External	46	0.35
Viola odorata L.	Violaceae	Banafsha	H	WP	Cold	Decoction	Internal	66	0.51
				WP	Throat infection	Decoction	Internal		
				R	Constipation	Edible	Internal		
Viscum album L.	Santalaceae	Aal	H	Fr	Epilepsy	Powder	Internal	54	0.42
				WP	Fracture	Poultice	External		
Vitis jacquemontii R. Parker	Viticaceae	Daakh	CL	R	Fever	Extract	Internal	34	0.26
				R & L	Jaundice	Extract	Internal		
Vitis vinifera L.	Viticaceae	Angoor	CL	L	Skin rashes	Paste	External	62	0.48
Vitex negundo L.	Verbenaceae	Bana	S	L	Worms	Extract	Internal	37	0.28
Withania somnifera (L.) Dunal	Solanaceae	Ashwagandha	S	R	Impotency	Powder	Internal	86	0.67
Woodfordia fruticosa (L.) Kurz	Lythraceae	Dataki	S	Fl	Constipation	Powder	Internal	45	0.35
				FL	Loss of appetite	Decoction	Internal		
Zanthoxylum armatum DC.	Rutaceae	Timer Timbro	S	Fr	Body pain	Decoction	Internal	70	0.54
				L & S	Jaundice	Powder	Internal		
Zea mays L.	Poaceae	Mak	H	FL	Kidney stones	Decoction	Internal	65	0.50
Ziziphus jujuba Mill.	Rhamnaceae	Singli	S	S	Jaundice	Decoction	Internal	63	0.49

Abbreviations used: H = Herb; T = Tree; S = Shrub; C = Climber; WP = Whole plant; L = Leaves; AP = Ariel portion; R = Root; Rh = Rhizome; W = Wood; Bk = Bark; Bl = Bulb; Cl = Cloves; S = Seed; Fr = Fruit; Fl = Flower; Tw = Twig; BoR = Bark of Root; Rn = Resin; FC = Frequency of Citation; RFC = Relative Frequency of Citation

Table 3. Family wise contribution to the ethnomedicinal flora of Rajouri – Poonch Region of Jammu and Kashmir

Family	No. of species	Percentage contribution	Contributing species	Disease/Ailments treated
Acanthaceae	01	1.88	*Dicliptera roxburghiana*	Wounds
Acoraceae	01	1.88	*Acorus calamus*	Gastritis and Diarrhea
Amaranthaceae	03	5.66	*Amaranthus retroflexus, Amaranthus caudatus and Chenopodium album*	Fever Measles and Gastric disorder
Amaryllidaceae	02	3.77	*Allium cepa* and *Allium sativa*	Bee Sting, Hypertension, Stomachache, Boils, Alopecia
Apiaceae	02	3.77	*Coriandrum sativum and Foeniculum vulgare*	Abdominal pain, Blood purification
Apocynaceae	01	1.88	*Calotropis procera*	Joint pain
Araliaceae	02	3.77	*Hedera nepalensis*	Dyspepsia
Asparagaceae	01	1.88	*Asparagus racemosus*	Body weakness
Asteraceae	05	9.43	*Achillea millefolium, Artemisia absinthium, Cichorium intybus, Taraxacum officinale* and *Aucklandia costus*	Toothache, Tonic, Fever, Cold, worms, stomachache, typhoid, fracture, jaundice, back pain, fever and arthritis
Berberidaceae	02	3.77	*Berberis aristata* and *Berberis lycium*	Fracture, Jaundice, Wounds and Constipation
Brassicaceae	01	1.88	*Raphanus sativus*	Jaundice, Urinary problem, Indigestion and Diarrhea
Cannabaceae	02	3.77	*Cannabis sativa* and *Celtis australis*	Wounds, tonic and allergy
Caprifoliaceae	01	1.88	*Valeriana wallichii*	Headache and Wounds
Convolvulaceae	01	1.88	*Cuscuta reflexa*	Cold and hair fall
Dioscoreaceae	01	1.88	*Dioscorea deltoidea*	Gastritis and weak eyesight
Elaeagnaceae	01	1.88	*Elaeagnus umbellata*	Mouth ulcers
Equisetaceae	01	1.88	*Equistum arvense*	Urine infection
Euphorbiaceae	02	3.77	*Euphorbia heliscopia* and *Euphorbia hirta*	Boils, Fungal infection, Wounds and Jaundice
Fabaceae	06	9.43	*Abrus precatorius, Indigofera heterantha, Medicago sativa, Robinia pseudoacacia, Senegalia catechu* and *Viccia sativa*	Hair care, Skin diseases, Toothache, kidney problems, arthritis, gastric disorders
Fumariaceae	01	1.88	*Fumaria indica*	Back pain
Juglandaceae	01	1.88	*Juglans regia*	Plaque
Lamiaceae	06	11.32	*Ajuga bracteosa, Isodon rugosus, Lamium album, Mentha longifolia, Nepeta cetaria* and *Prunella vulgaris*	Headache, body pain, diarrhea, nausea, fever, wounds, snake bites, lice and tonic
Lythraceae	02	3.77	*Woodfordia fruticosa and Punica granatum*	Constipation, Jaundice and Loss of appetite
Malvaceae	01	1.88	*Malva sylvestris*	Weak eyesight
Meliaceae	01	1.88	*Melia azedarach*	Stomachache
Moraceae	02	3.77	*Morus nigra* and *Ficus auriculata*	Constipation and Wounds
Oleaceae	02	3.77	*Olea ferruginea* and *Jasminum humile*	Toothache and Stomachache
Oxalidaceae	01	1.88	*Oxalis corniculata*	Abdominal pain, Blood purifier and Fever
Pinaceae	01	1.88	*Pinus roxburghii*	Skin rashes
Plantaginaceae	02	3.77	*Plantago lanceolata* and *Plantago major*	Urine infection and Acidity
Poaceae	02	3.77	*Triticum aestivum* and *Zea mays*	Kidney stones and Worms
Polygonaceae	02	3.77	*Persicaria hydropiper* and *Rumex nepalensis*	Cough, Hypertension, Jaundice and Gastric problems

Ranunculaceae	03	5.66	*Ranunculus arvensis, Clematis montana* and *Aconitum heterophyllum*	Tonic, Cough, Fever and Diarrhea
Rhamnaceae	01	1.88	*Ziziphus jujuba*	Jaundice
Rosaceae	08	15.09	*Cydonia oblonga, Fragaria nubicola, Princepia utilis, Prunus armeniaca, Pyrus pashia, Rosa moschata, Rubus ellipticus* and *Rubus fructicosus*	Diarrhea, Constipation, Fever, Hair fall, Abdominal pain, Tonsillitis, Boils and Throat infection
Rubiaceae	01	1.88	*Rubia cordifolia*	Stomachache
Rutaceae	01	1.88	*Zanthoxylum armatum*	Body pain and Jaundice
Salicaceae	01	1.88	*Populus ciliata*	Blood purification
Sapindaceae	02	3.77	*Acer caesium* and *Aesculus indica*	Skin infection and Fever
Saxifragaceae	01	1.88	*Bergenia aristata*	Gastritis
Scrophulariaceae	03	5.66	*Verbascum thapsus, Buddleja asiatica and Veronica persica*	Skin diseases, Migraine and Swelling
Simaroubaceae	01	1.88	*Ailanthus altissima*	Diarrhea
Solanaceae	03	5.66	*Datura stramonium, Solanum nigrum* and *Withania somnifera*	Dandruff, Stomachache, Jaundice and Impotency
Thymelaeaceae	01	1.88	*Daphne papyracea*	Skin infection
Verbenaceae	02	3.77	*Vitex negundo* and *Verbena Officinalis*	Worms
Violaceae	01	1.88	*Viola odorata*	Cold, Throat infection and Constipation
Viscaceae	01	1.88	*Viscum album*	Epilepsy and Fracture
Vitaceae	02	3.77	*Vitis jacquemonti* and *Vitis vinifera*	Fever, Jaundice and Skin rashes

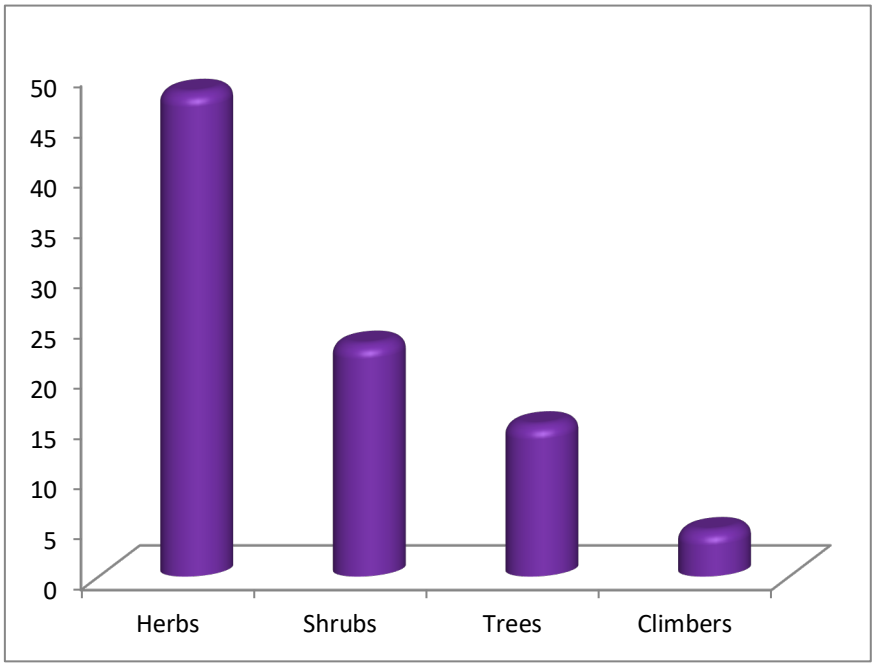

Figure 2. Life form of the plant species

Twenty-six families were represented by single species. In traditional health care systems, different parts of plants were used in different ways depending on the inherited knowledge and availability of those plants and plant parts to the inhabitants. In the present study, leaves were the most common part used in herbal preparations (34.53%) followed by roots (19.42%), whole plants (13.66), seeds (7.91%), fruits (6.47%), ariel parts, rhizome, and flowers (3.59 each), cloves (2.87%), bark (2.15%) and bulb, resin and twigs (0.71%) (Fig. 3). Plants and their parts are administrated through different modes of preparation. The main method of preparation was decoction (30.3%) followed by extracts (23.7%), paste (20.7%), powder (11.1%), chewed (3.7%), cooked (2.2%), infusion and poultice

(1.48%) and roasted (0.74%) (Fig. 4). Preparations are applied both externally and well as internally. 31.6% of preparations are administrated externally while 68.4% of preparations were administrated internally.

Quantitative Analysis

Relative Frequency of Citation (RFC)

RFC shows the local importance of each species about informants who cited these medicinal plant species. Species with the highest RFC were *Taraxacum officinale* (0.82) and *Raphanus sativus* (0.68) and *Allium sativa* (0.67). Species with the lowest RFC were *Isodon rugosus* (0.10) and *Buddleja asiatica* (0.14).

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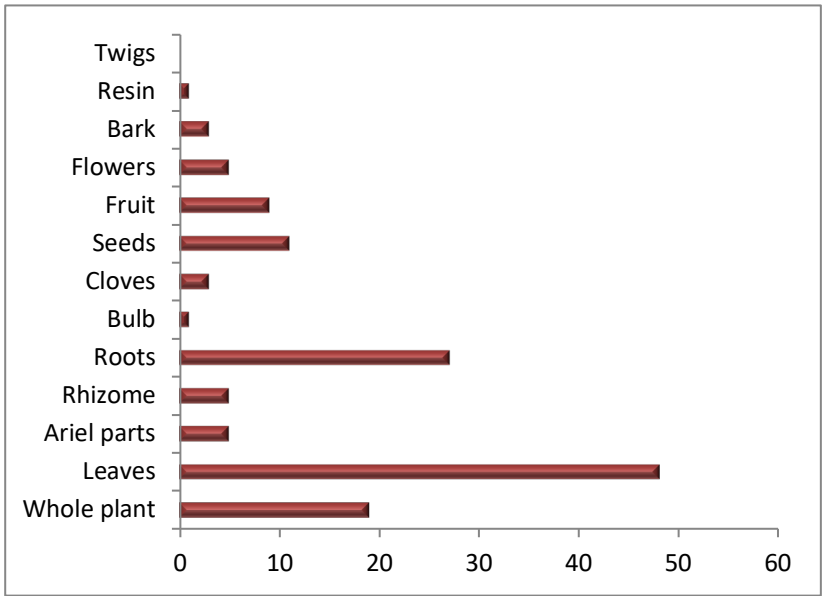

Figure 3. Utilization pattern of the plant species

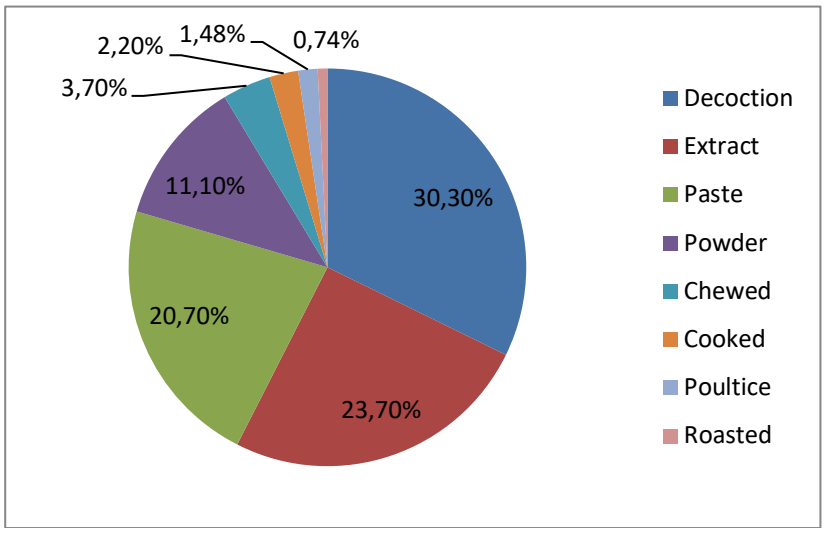

Figure 4. Methods of preparations

Fidelity Level (FL)

FL is used for most preferred medicinal plant species cited by the local formants for treating particular diseases (Majid et al. 2019). In the present study, Fidelity Level ranges from 12.7% to 100% (Table 4). Most of the plant species (22 species) with highest Fidelity level were associated with digestive system related problems plants and these species include *Acorus calamus, Ailanthus altissima, Ficus auriculata, Artemisia absinthium, Ranunculus*

arvensis, Verbena officinalis, Woodfordia fruticosa, Vitex negundo, Triticum aestivum, Nepeta cetaria, Chenopodium album, Rubia cordifolia, Jasminum humile, Coriandrum sativum, Melia azedarach, Princepia utilis, Plantago major, Hedera nepalensis, Robinia pseudoacacia, Rubus fructicosus, Rubus ellipticus, Prunus armeniaca. Some other plant species with 100% FL were *Equisetum arvense, Plantago lanceolata* and *Zea mays* for *Urinary problems, Acer caesium, Amaranthus retroflexus, Buddleja asiatica, Veronica persica, Vitis vinifera, Viccia sativa, Daphne papyracea, Pinus roxburghii, Rheum australe, Dicliptera chinensis, Cannabis sativa, Lamium album, Euphorbia helioscopia* and *Morus* nigra for skin diseases, *Pyrus pashia and Datura stramonium* for hair care, *Aesculus indica, Amaranthus caudatus, Mentha longifolia, Rosa moschata, Rumex nepalensis* and *Clematis montana* for Fever, cold and headache, *Withania somnifera, Populus ciliata* and *Asparagus racemosus* for Body weakness, tonic, blood purification, *Aucklandia costus* and *Calotropis procera* for Skeletal & muscular problems, *Fumaria indica, Ziziphus jujuba, Punica granatum* and *Euphorbia hirta* for Jaundice & typhoid, *Allium cepa* and *Isodon rugosus* for *antidote, Fragaria nubicola, Elaeagnus umbellata, Indigofera heterantha, Juglans regia* and *Senegalia catechu* for oral problems and *Malva sylvestris* for Other (hypertension, weak eye sight etc.) disease categories.

Table 4. Fidelity Level (FL) of the plants used by the local people of Rajouri-Poonch region of J&K

Disease Category	**Plants used**	**Np**	**N**	**FL%**
Digestive system related problems	*Acorus calamus*	36	36	100
	Ailanthus altissima	42	42	100
	Allium sativa	19	86	22.09
	Ficus auriculata	38	38	100
	Artemisia absinthium	58	58	100
	Ranunculus arvensis	61	61	100
	Viola odorata	35	66	53.03
	Verbena officinalis	24	24	100
	Berberis lycium	35	61	57.3
	Woodfordia fruticosa	45	45	100
	Vitex negundo	37	37	100
	Triticum aestivum	76	76	100
	Foeniculum vulgare	41	70	58.5
	Olea ferruginea	14	32	43.7
	Nepeta cetaria	43	43	100
	Solanum nigrum	26	62	41.9
	Chenopodium album	38	38	100
	Rubia cordifolia	51	51	100
	Jasminum humile	26	26	100
	Coriandrum sativum	32	32	100
	Melia azedarach	24	24	100
	Princepia utilis	26	26	100
	Bergenia ciliata	55	55	100
	Dioscorea deltoidea	24	42	57.1
	Plantago major	38	38	100
	Hedera nepalensis	36	36	100
	Robinia pseudoacacia	36	36	100
	Rubus fructicosus	39	39	100
	Rubus ellipticus	51	51	100
	Prunus armeniaca	55	55	100
	Oxalis corniculata	17	56	30.3
	Persicaria hydropiper	14	53	26.4
	Raphanus sativus	38	88	43.1

	Cichorium intybus	18	40	45
Urinary problems	*Equisetum arvense*	32	32	100
	Medicago sativa	18	33	54.5
	Raphanus sativus	24	88	27.2
	Plantago lanceolata	51	51	100
	Zea mays	65	65	100
Skin diseases	*Abrus precatorius*	16	26	61.5
	Acer caesium	38	38	100
	Amaranthus retroflexus	34	34	100
	Allium sativa	11	86	12.7
	Berberis lycium	26	61	42.1
	Buddleja asiatica	18	18	100
	Celtis australis	30	54	55.5
	Veronica persica	34	34	100
	Vitis vinifera	62	62	100
	Viccia sativa	46	46	100
	Daphne papyracea	28	28	100
	Pinus roxburghii	52	52	100
	Rheum australe	76	76	100
	Valeriana wallichii	13	35	37.1
	Dicliptera chinensis	33	33	100
	Cannabis sativa	52	52	100
	Prunella vulgaris	25	48	52
	Lamium album	49	49	100
	Euphorbia helioscopia	62	62	100
	Morus nigra	48	48	100
	Cydonia oblonga	22	43	51.1
Hair care	*Abrus precatorius*	10	26	38.4
	Ajuga integrifolia	19	33	57.5
	Allium sativa	24	86	27.9
	Cuscuta reflexa	19	45	42.2
	Pyrus pashia	50	50	100
	Datura stramonium	30	30	100
Fever, cold and headache	*Achillea millefolium*	29	48	60.4
	Aesculus indica	27	27	100
	Aconitum heterophyllum	17	28	60.7
	Cuscuta reflexa	26	45	55.5
	Prunella vulgaris	23	48	47.9
	Valeriana wallichii	22	25	88
	Oxalis corniculata	18	56	32.1
	Verbascum thapsus	23	43	53.4
	Taraxacum officinale	32	106	30.1
	Amaranthus caudatus	22	22	100
	Mentha longifolia	75	75	100
	Viscum album	26	54	48.1
	Vitis jacquemontii	16	34	47
	Rosa moschata	55	55	100

	Rumex nepalensis	52	52	100
	Clematis montana	49	49	100
Body weakness, tonic, blood purification	*Aconitum heterophyllum*	11	28	39.2
	Ajuga integrifolia	14	33	42.4
	Oxalis corniculata	21	56	37.5
	Foeniculum vulgare	29	70	41.4
	Celtis australis	24	54	44.4
	Zanthoxylum armatum	37	70	52.8
	Withania somnifera	86	86	100
	Populus ciliata	32	32	100
	Taraxacum officinale	41	106	38.6
	Asparagus racemosus	42	42	100
Skeletal & muscular problems	*Aucklandia costus*	70	70	100
	Berberis aristata	17	42	40.4
	Taraxacum officinale	21	106	19.8
	Verbascum thapsus	20	43	46.5
	Viscum album	28	54	51.8
	Calotropis procera	21	21	100
	Medicago sativa	15	33	45.5
Jaundice & typhoid	*Berberis aristata*	25	42	59.5
	Fumaria indica	36	36	100
	Cichorium intybus	22	40	55
	Zanthoxylum armatum	33	70	47.1
	Ziziphus jujuba	63	63	100
	Punica granatum	72	72	100
	Raphanus sativus	26	88	29.5
	Euphorbia hirta	51	51	100
	Vitis jacquemontii	18	34	52.9
	Solanum nigrum	36	62	58
	Taraxacum officinale	13	106	12.2
	Persicaria hydropiper	21	53	39.6
Antidote	*Allium cepa*	68	68	100
	Isodon rugosus	13	13	100
Oral problems	*Achillea millefolium*	19	48	39.6
	Cydonia oblonga	21	43	48.8
	Fragaria nubicola	38	38	100
	Viola odorata	31	66	46.9
	Elaeagnus umbellata	35	35	100
	Indigofera heterantha	41	41	100
	Juglans regia	84	84	100
	Senegalia catechu	52	52	100
	Olea ferruginea	18	32	56.2
Others (hypertension, weak eyesight etc)	*Allium sativa*	32	86	37.2
	Dioscorea deltoidea	18	42	42.8
	Malva sylvestris	31	31	100
	Persicaria hydropiper	18	53	33.9

Informant Consensus Factor (ICF)

It is also known as Respondent's Agreement Ratio and Ali *et al*. (2018) have used a new term 'Participant Agreement Ratio' (PAR) and is used to estimate the agreement of the community concerning the use of different plant species in each disease category. In the present study, ICF for each disease category ranges from 0.94 to 0.97 (Table 5). ICF value is high for all disease categories that reveal that the informants agree on which plants to use in the treatment of common diseases.

Table 5. Information Consensus Factor or Participatory Agreement Ratio of informants of Rajouri-Poonch Region of Jammu and Kashmir

Disease category	Nur	Ntax	ICF	Most used plants
Digestive system related problems	1051	34	0.97	*Acorus calamus, Artemisia absinthium, Berberis lycium, Bergenia ciliata, Chenopodium album, Coriandrum sativum, Foeniculum vulgare*
Urinary problems	178	5	0.96	*Equisetum arvense, Medicago sativa, Plantago lanceolata, Zea mays*
Skin diseases	763	22	0.97	*Morus nigra, Pinus roxburghii, Rheum australe, Vitis vinifera*
Hair care	200	6	0.96	*Allium sativa, Cuscuta reflexa, Datura stramonium*
Fever, cold & headache	429	14	0.97	*Cuscuta reflexa, Mentha longifolia, Prunella vulgaris, Viola odorata*
Body weakness, tonic, blood purification	324	10	0.96	*Aconitum heterophyllum, Oxalis corniculata, Taraxacum officinale*
Skeletal & muscular problems	197	9	0.95	*Fumaria indica, Aucklandia costus, Taraxacum officinale*
Jaundice & typhoid	337	12	0.96	*Berberis lycium, Euphorbia hirta, Punica granatum, Raphanus sativus,*
Antidote	25	2	0.94	*Isodon rugosus, Allium sativa*
Oral problems	320	9	0.96	*Juglans regia, Senegalia catechu, Indigofera heterantha*
Others (hypertension, weak eyesight etc)	149	6	0.96	*Allium sativa, Dioscorea deltoidea, Withania somnifera*

Jaccard Index

The data recorded from the present study were compared with the findings carried out at regional, national, and global levels and the observed percentage of similarity ranges from 1.4 to 32.2 with an average value of 10.69 (Table 6).

Rahman's Similarity Index

In the present study, RSI has been used to compare the traditional knowledge of the Gujjar and Bakerwal tribe with the other ethnic and tribal groups. No or least similarity was observed in comparison to the results with the previously published work on other ethnic groups (Table 7).

Table 6. Percentage Similarity, Dissimilarity and Jaccard Index of Rajouri-Poonch Region with other areas

Area	Study year	No. of Recorded plant species	Plants with similar use	Plants with dissimilar use	Species common in both areas	Species enlisted only in aligned area	Species enlisted only in study area	% of plants with similar use	% of plants with dissimilar use	Jaccard Index	Citation
Gulmarg region of J&K	2015	59	19	8	27	32	65	32.20	13.55	38.57	Kumar *et al*. 2015
Guldara district of Kabul, Afghanistan	2017	68	10	9	19	49	73	14.70	13.23	18.44	Amini and Hamdan 2017
Kishtwar district of J&K	2009	71	5	16	21	50	71	7.04	22.53	21	Kumar *et al*. 2009
Poonch valley Azad Kashmir	2016	169	9	14	23	146	69	5.23	8.28	11.97	Khan *et al*. 2011

Hathazari Chittagong, Bangladesh	2015	71	1	5	6	65	86	1.4	7.04	4.13	Sakib and uddin 2015
Ramnagar J&K	2015	45	5	10	15	30	77	11.11	22.22	16.30	Kumar *et al*. 2015
Hezar mountain, Southeast of Iran	2012	92	2	5	7	85	85	2.17	5.43	4.11	Rajaei and Mohamadi 2012
Bandipora district of J&K	2013	42	8	9	17	25	75	19.04	21.4	20.48	Lone *et al*. 2013
Tarai region of Kumaun, Uttarakhand	2013	206	7	10	17	189	75	3.39	4.85	6.88	Mathur and Joshi 2013

Table 7. Rahman's Index showing similarity of ethnic knowledge of Rajouri-Poonch Regions with other ethnic groups

Tribal community	**Species unique to our study area**	**Species unique to aligned area**	**Common species**	**Species used for similar ailments**	**Rahman's index**	**Citation**
Malaiyali	86	55	6	3	2.12	Kannadhasan *et al*. 2016
Manipuri, Bangladesh	91	31	1	0	0	Rana *et al*. 2010
Irular tribe of Redhills, Tamil Nadu, India	89	32	3	0	0	Bosco and Arumugam 2012
Kani tribe of Thudu hills of Kerela	89	32	3	0	0	Xavier *et al*. 2014
Tharu tribe, Nepal	85	64	7	0	0	Dangol and Gurung1991
Bheel and Sahariya tribes of Guna district Madhya Pradesh	89	28	3	0	0	Samar *et al*. 2015
Bodo tribe , Assam	90	18	2	1	0.9	Saikai *et al*. 2016

Discussion

Rajouri-Poonch region is a remote area and local inhabitants are dependent on natural resources for fulfilling their daily requirements of food, medicine, fodder, fuel, and timber (Nabi & Afsar, 2020). Results of the present study in terms of floristic diversity patterns are comparable with the earlier studies carried out in Himalayan as well as other regions. Plant families recorded to be dominant during the present study have been reported to be dominant in other studies also (Yineger et al. 2007; Khattak *et al*. 2015; Amjad *et al*. 2017; Sharafatmandrad & Mashizi 2020). The reason for the dominance of these families may be attributed to the presence of secondary metabolites having biological activities. Plants of family Lamiaceae are known for their essential oils and many active essential oils have been isolated from members of this family (Iwalokun *et al*. 2003; Okach *et al*. 2013). Further, plants from the family Asteraceae are well known for their ethnopharmacological importance (Rodriguez-Chavez *et al*. 2017; Tewari *et al*. 2017; Saleh & Van Staden 2018), and this family is widely distributed and is considered to be the largest family of flowering plants in the world (Gao *et al*. 2010) and in the study area also (Dar *et al*. 2014). In terms of life forms, several studies (Pant & Samant 2010; Kumari *et al*. 2013; Ajaz & Ahmad 2017; Dhal *et al*. 2014; Faruque *et al*. 2018; Bhattacharyya *et al*. 2020) have also reported herbs to be used frequently in traditional medicinal systems. The reason for the dominance of herbs in traditional and indigenous medicinal systems may be their easy modes of extractions and preparations due to presence of soft tissues (Yaseen et al. 2015). Leaves of medicinal plants are often used in herbal preparations due to the presence of active secondary metabolites like alkaloids, flavonoids, terpenoids, etc in leaves (Shoaib et al. 2017).This may be the reason for several other studies (Bose et al. 2014; Dolatkhani et al. 2014; Faruque et al. 2018; Malik et al. 2019), reporting leaves as the most highly exploited plant parts for medicinal purposes. Besides leaves, roots are also preferred in many cases probably as they also contain a higher concentration of phytochemicals than other plant parts (Asif et al. 2021). In the present study, decoction was found to be the most frequent mode of herbal preparations and the reason for the use of decoction in most of the cases may be their easy preparations and because heating can cause increased activity of many bio-active compounds.

The plant species documented during the present study with highest RFC are dominant in the study area and are also being cultivated, so these species are known to the local people for a long period. Thus, their particular properties for curing different diseases and ailments have become popularized and well recognized among the indigenous people. Plant species having high RFC and FL values could be subjected to pharmacological, phytochemical, and biological studies to assess and verify their validity for the development of novel pharmaceutical products. According to Aziz et al. (2017), the low financial state of the human population is the main reason for using plants for health care instead of synthetic medicines. According to a report, 23% of families in the Rajouri-Poonch region are without water drinking facilities, 79% of families are without flush latrines and 73% of families are residing in kaccha houses. Further, people living in this region are backward in education and other sectors (Nabi & Afsha 2020). These statics confirms the unhygienic conditions of the people of the Rajouri-Poonch region, so the ICF is high for digestive diseases, skin diseases, and oral diseases, which are caused by unhygienic conditions.

Based on the similarity of the finding of the present study with the previous ones, the maximum level of similarity was found with the study conducted by Kumar et al. (2015) in the Gulmarg region of J&K with a JI value of 38.57. The reason for this may be that the local population of the Rajouri-Poonch region used to migrate to Gulmarg and vice versa, as Gulmarg is in close vicinity with that of the Rajouri-Poonch region. A high level of similarity might be attributed to the fact that the communities living in adjoining areas have the same socio-cultural values and have more chances to interchange their traditional knowledge (Amjad *et al*. 2018). The lowest index of similarity was found in the study conducted by Sakib & Uddin 2015 in Hathazari, Bangladesh. Similarly, no or least similarity in terms of RSI revealed that different tribal communities have their traditional knowledge systems, and they use plant bioresources in their unique ways. The reason for this may be that due to geographic and other barriers, there is no transmission of knowledge from one community to another. Further, these indigenous groups live in different areas and the vegetation of these areas also diverges due to climatic and edaphic variances, which in turn decreases the similarity among the different tribal communities.

Medicinal knowledge and previous reports

Many studies have shown that age and gender are the two important factors to study while assessing the distribution of traditional knowledge within a group of informants (de Albuquerque *et al*. 2011; Torres-Avilez *et al*. 2016). However, no studies have analyzed the effect of these variables on the distribution of ethnomedicinal knowledge in Jammu and Kashmir to date. In the present study, it was found that there is a strong positive correlation between age and citations (r=0.64) (Fig. 5) and indicated that older persons have provided more citations about the medicinal plant uses than the younger ones. A study by Tefera & Yihune (2018) also reported that the older persons have more knowledge regarding traditional health care practices in comparison with younger persons. Negi *et al*. 2017 also reported that lower age groups knew lesser medicinal plants as compared to the higher age group. The reason for this may be that the younger generation is diverting from their traditional culture and are not interested in learning or understanding their traditional knowledge, not only regarding the use of medicinal plants but other aspects too. The difference may be due to the experience that a person gains with age. Older persons have experienced more than the younger ones, and this may also be the reason why older persons are more knowledgeable regarding the use of medicinal plants than the younger ones. The gender ratio was also compared, and it was found that females are more knowledgeable than males regarding the use of medicinal plants to cure day-to-day diseases.

On average, each man gave 28 citations and each woman gave 40 citations regarding the use of medicinal plants. Also, males mentioned 79 plant species and females mentioned 86 plant species. Six plant species were mentioned only by males and 13 plant species were mentioned only by females. There is no consensus in the literature about the effect of gender on traditional knowledge, though women are generally shown to hold a wider competence regarding medicinal plants than men (Shaheen *et al*. 2017; Tng et al. 2021). Further, a negative correlation was found between the level of education and the number of citations (r = - 0.34) (Fig. 6) and highlighted that more educated persons have less knowledge regarding the traditional uses of medicinal plants. Similar results have been provided by researchers from different areas (Khan *et al*. 2014; Gedif & Hahn 2003; Adnan *et al*. 2014). The reason for this may be that educated persons are more influenced by urbanization and modernization. And, as there is lack of quality education in rural areas, the students must shift to urban areas for higher and better education, so a vacuum is created between the educated and uneducated persons. Educated persons prefer to use other allopathic drugs instead of their traditional medicines.

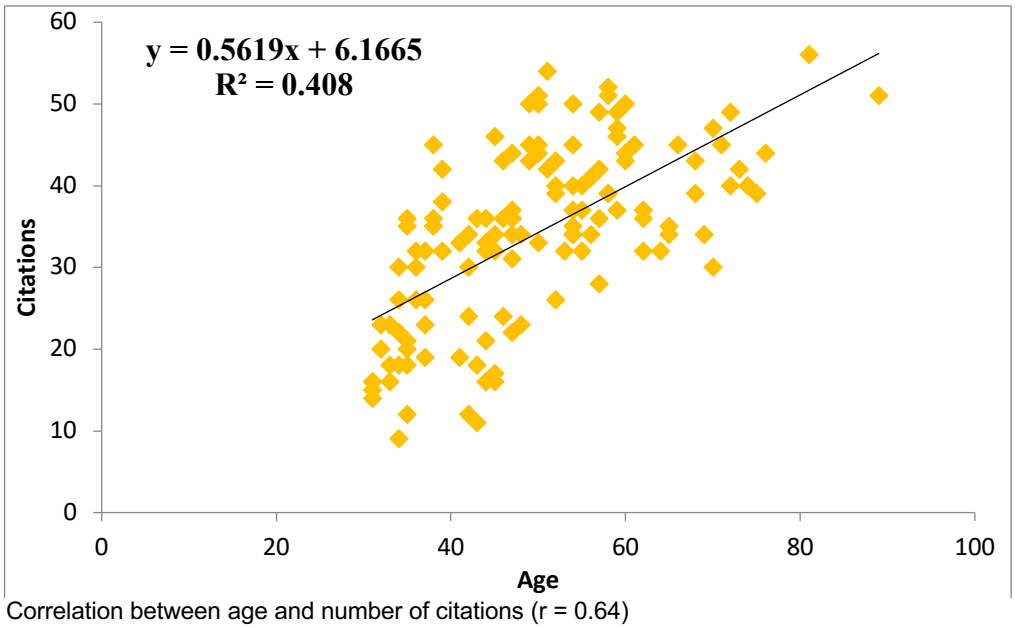

Figure 5. Correlation between age and number of citations (r = 0.64)

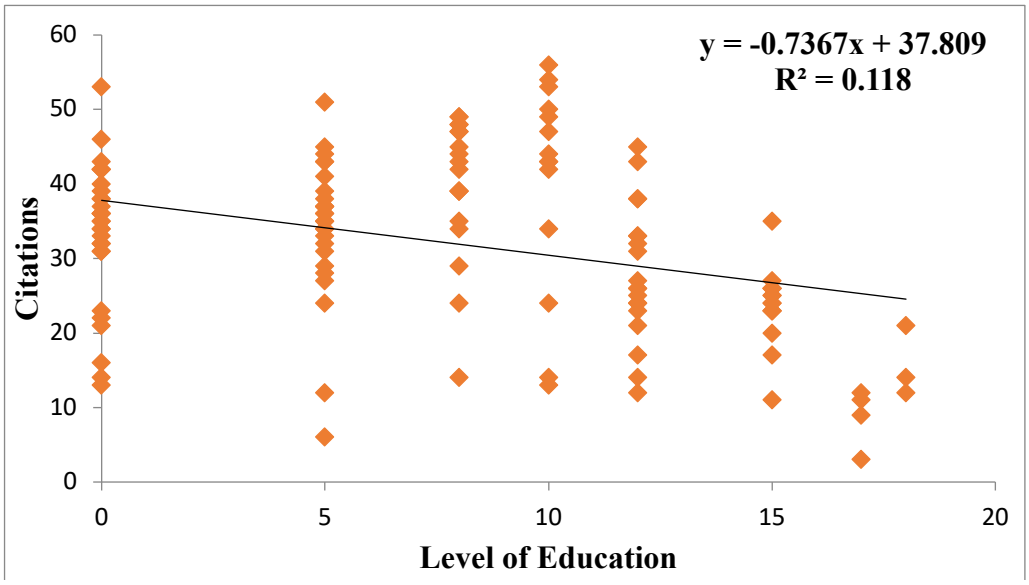

Figure 6. Correlation between level of education and number of citations (r = -0.34)

Conclusions

The present study provides comprehensive information on the traditional information knowledge-base that the local people of the Rajouri-Poonch region have developed with a certain cultural domain of plant use. A total of 92 plant species belonging to 86 genera and 48 families were documented. Rosaceae was the dominant family with 14 species. Leaves were the most common plant parts and decoction as frequent mode used in herbal preparations. It is also found that all plant species are not equally utilized but some species are more versatile and have significantly more impact on the ethnobotanical culture of the region. Such plants with high RFC and FL indicate the existence of valuable phytochemical compounds. Thus, these plants should be prioritized for phytochemical, pharmacological, microbiological, and toxicological enquires to draw general conclusions on ethnopharmacological relationships. Further, such species should also be prioritized for conservation as these species have more anthropogenic pressure, so conservational strategies and resource management should be adequately considered for the sustainable use of these precious and valuable resources. Further, it was found that there is a strong positive correlation between age and citations (r=0.64) and a negative correlation between the level of education and the number of citations (r = - 0.34). Thus, this study clearly shows that the traditional knowledgebase is eroding day by day and serious efforts should be taken to preserve this valuable information not only in the study area but throughout the Indian Himalayan Region.

Declarations

List of Abbreviations: Not Applicable
Funding: Not Applicable
Conflicts of interests: The authors have no conflict of interests.
Ethics approval: Participants provided oral prior informed consent.
Consent for publication: Not Applicable
Author's contributions: All the authors have contributed equally.
Availability of data and material: Data are available from the corresponding author.

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