Exploration of ethnobotanical and ethnomedicinal importance of naturally growing plants of District Neelum from areas of Dawarian to Ratti Gali, Azad Jammu and Kashmir

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Abstract

Background: Ethnobotanical study was continued from old civilization to date. Kashmir covered with 46 % vagatation and out of these many are naturally growing plants. Many areas are still unexplored the plants ethnomedicinal importanmce of wild plants. In this regard, ethnobotanical survey on the unexplored area of District Anthmaqam, Azad Jummu & Kashmir was conducted for identification of wild plants and their ethnomedical values.

Methods: The current research work was carried out by interviewing the local people through a questionnaire method. Data analysis was done by different novel statistical tools such as fidelity level (FL), Spearman’s rank correlation (SRC), informant consensus factor (ICF) and direct matrix ranking (DMR) strategies. The ethnobotanical uses of many wild plants were correlated with the plants who already used by societies in some countries of the world. But few plants are used as medicines only indigenous peoples and we reccomented these plants for peoples in other parts of country as well as throughout the world in future.

Results: Peoples used plants in daily life as in form of vegetables, fodder, fuel, timber as well as for medicinal purposes. Indegeneous peoples are using many types of wild plants to cure different diseases like asthma, dysentery, constipation, cold, fever, joint pain, wound healing, kidney
infection and many types of skin diseases. Current study revealed on 103 plants species belonging to 46 plant families from selected area of District Neelum, Azad Jammu and Kashmir. It was observed that Asteraceae with 12 plants species was the most prominant family occurs in the study area. Out of 103 plants, 75.72% have single-usage, 20.38% have dual-usages and 3.88% have multiple-usage. Among plant partused, leaves having the highest percentage (34 %) that are used by people of the study area for the treatment of different diseases followed by the root 25.2%. Powdered is the dosage form having highest percentage 38% followed by juice and mixture with 29% and 13%, respectively. Some plants used as fodder having highest percentage 37% followed by Food (vegetables and fruits) with 32%. Construction having lowest percentage with 6%. Different statistical tools were applied for more concise results elaboration as mentioned in method section. Data analysis through FL depicted that Allium griffithianum and Adiantum aethiopicum have highest fidelity level of 75% followed by the Mentha longifolia with fidelity level of about 72 %. The highest ICF value for recorded for ear-ache and house-thatching (0.91) followed by the construction (0.89) while the lowest ICF value recorded for fodder (0.03) followed by blood purification (0.5). Spearman’s rank correlation test confirmed that the number of uses of plants increases with the increase in the number of species.

**Conclusions:** The present research focused to explore the uses of plants in different purposes by experience of old peoples in the study area. Ethnobotanical research focused to explore the uses of plants in different purposes by experience of old peoples in the study area. Young generation of the area did not know ethnobotanical importance of wild plants in the area. So, this study will be useful those peoples and researchers in different fields such as ethnopharmacology, agriculture and biotechnology for future work.

**Keywords:** Ethnobotanical study, Wild plants, Statistical tools, Spearman’s rank correlation, Allium griffithianum, Ethnopharmacological analysis

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**Background**

The ethnobotany came into being when earliest man observed animal intake various plants, assembled and alarmed for his food and for fixing his lesion. Ethnobotany plays a significant role between biology, social and traditional system [1, 2]. It was observed that indigenous plants related
knowledge has been continued from one generation to other generation and so on through experience of local peoples. The knowledge of rural areas peoples is best example and key of ethnobotanical study of plants [3]. This study of ethnobotany provides better uses of plants in the field of ethnomedicines as well as it includes use of plants for medicines, food, rituals, social life and others fields of human societies This multi-disciplinary connection between human societies and plants isn't restricted to the utilization of plants for attire, food and asylum yet in addition remembers their utilization for different fields as; strict functions, decorative purposes and medical services [4].

Plants are widely used by every type of community as medicines, whether directly as tribe recipes or medication of different indigenous schemes. There is critical necessity of supporting the medicinal plants that are over collected so that, coming future generations could advantage from these valuable plants that are actual gift of nature for the mankind. The indigenous ethnomedical value of plants is helpful to different fields of botany as in the field of Taxonomy, Ecology, Pharmacology and Wildlife in civilizing the prosperity of an area, besides highlightening the traditional uses [5].

The specific plants are used for particular ethnic aims and on particular occasions by cultural groups throughout the existence [6]. It was assessed that 25 % drugs are integrated from restorative plants and right around 80 % people groups of creating nations are still relies upon conventional and local prescriptions to fix ailments as well as fundamental medical services [7].

In our neighbouring country, 27 plant species are used traditionally as ethnomedicinal plants which belong to 18 different taxonomic families for the treatment of different diseases and ailments. The green parts of plants (leaves) are used most frequently and many types of medicines are manufactured in the form of paste and administrative orally [8].

The therapeutic uses of plants have been verified by using informents agreement factor (ICF) values and it was explored that some medicinal plants were used to treat jungle fever (0.71), jaundice (0.62), urological issues (0.56), dermatological issues (0.45), torment (0.30) and respiratory turmoil (0.33), and keeping in mind that the overall wellbeing (0.15) and gastro-intestinal issues classification (0.28) [9].
Greater part of therapeutic plants might be utilized as a wash to shower the body with less meds being ingested. Before the advancement of current pipes innovation, clean water was not so much accessible but rather more valuable. In such conditions, it might be favorable for washing to happen less as often as possible yet with the utilization of therapeutic plants. Lab testing of a considerable lot of the therapeutic plants utilized by the Tiwi have discovered them to have against microbial properties. Customarily the utilization of such plants are accepted to have happened regularly in a similar way that food plants were gathered.

All necessary requirements of life from medicine to shelter and food to fibre are gained from forests’ vegetation. [10]. If the processing of raw woodland material which produce wood, branches, logs and fibres for creating different merchandise that had been useful in every day life for sustainable livelihood [11].

It was estimated that 2500 plant species are recommended internationally as medicinal purpose. The percentage of use value of medicinal plants ranges between 4 - 20 % in different countries of the world. Similarly, it was observed about 6000 higher plant species are used for medicinal purposes in different locations, their falls between 10 – 30 % of the flora of Pakistan. The use of medicinal plants is very important in rural and tribal areas of Pakistan where as it is considered as initial treatment against different diseases remedies [12].

Some therapeutic plants are financial and utilized in treatment of certain sicknesses. An aggregate of 59 plants species were utilized for fourteen distinct classifications of illnesses, for example, skin ailment. Restorative greenery, for example, Berberis lyceum, Ajuga bracteosa, Aconitum heterophyllum, Bistorta amplexicaule, Saussurea lapa and Jurinea dolomiae are on the edge of eradication due to over misuse [13].

The ethnomedicinal information were accumulated from various region of Punjab Pakistan through polls and broad individual discoursed with local people including 40 guys 20 females of different age bunches between 50 to 80 years and furthermore dark-striped cats and hakims. Around 40 plant species having a place with 22 families were explored which are used by local individuals to fix issues and sicknesses, for example, asthma, ulcer, gonorrhea, heaps, stomach agony, and skin illnesses. The outcomes exhibited that the zone is wealthy in vegetation yet remained organically unexplored [14].
The ethnobotanical concentrates on trees of region Kotli, Azad Kashmir uncovered conventional use of 50 tree spp., having a place with 39 genera and 24 families with Moraceae, the most well-known family having 9 species. The regular use of tree was restorative, fuel and grain. The phonological examinations uncovered that 65% of the species bloomed from the period of August forward or in winter season [15].

The ethnobotanical assessment on the restorative plants of Darguti, Tehsil Khuiratta, Azad Jammu and Kashmir was perceived during 2014-2015 by meeting the neighborhood occupants through a poll. A sum of 100 plant species having a place with 47 families were reported. It was noticed that individuals utilize plants as vegetables and grain, fuel just as therapeutic commitments. Neighborhood individuals use treatment of various ailments like lockjaw, diabetes, looseness of the bowels, asthma, kidney contamination, clogging, gastric ulcer, bronchial illnesses, gonorrhea, scabies, throat aggravation and numerous sorts of skin maladies with nearby plants [16].

The utilization of customary ethnomedicinal by the nearby seniors of Area Mirpur Azad Jammu and Kashmir saw by mehmood and his partners. Ethnomedicinal information was gathered by mean of poll strategy, meets and direct perception. An aggregate of 38 plant species having a place with 22 families were accounted for of hurling ethnomedicinal use. About 13 hakims and 78 local people were visited to collect ethnomedicinal data [2]. The ethnobotanical estimations of the most normally utilized plants of the Neelum Valley AJ&K, investigated and gives an account of the indigenous information on various networks of the examination zone [17].

The State of Azad Jammu and Kashmir (AJ&K) is declared as diverse habitats, variable climatic conditions and appropriate fertile soil with rich nutrients [18–19]. It has variety of natural resources particularly rich in medicinal plant flora [20]. The state of AJK has a wide range of mountainous ecosystems which are affluent in flora and fauna. The area of Azad Kashmir has scrub forest, alpine and grasslands ecosystem as vegetational categories. Anthropogenic and other natural hazerds depicted a high effect on the ecosystems of the areas [21].

The examination zone "Neelum Valley" is arranged North-East of Muzaffarabad at an elevation of 900-6325 meters above ocean level. It lies between 73°-75° E longitude and 32°-35° N scope [22]. It is the biggest vale of Azad Jammu and Kashmir (AJ&K) covering a territory of 3737 Km. Dawarian town is arranged at 110 km north of the capital Muzaffarabad and is around
5299 ft over the ocean level. The atmosphere is calm with freezing winters (normal 0-4 °C) and moderate summers (normal temperature 20-30 °C). Normal precipitation is 1650 mm yearly. The territory has different sorts of landforms and little levels. Soil is loamy and sandy topsoil, fit for holding dampness and great development of woodlands. Larger part of the region is secured with thick vegetation and woods trees [23]. The sampling site “Ratti Gali” is situated at 19 km from Dawarian and is about 12130 ft above the sea level. It lies between 74°-76° E longitude and 34°-36° N latitude [22]. Vegetation mainly consist of herbs and shrubs with some tree species. Ratti Gali is famous place because of lake know as Ratti Gali lake which is an alpine glacial lake. The territory has inadequately evolved street and other foundation. Principle crops incorporate corn (Zea mays L.), turnip (Brasica rapa L.), and bean (Phaseolus vulgaris L.) in a coordinated framework. A high extent of nearby individuals are related with animals [24].

Many plant species used as ethomedicines in different areas of AJ&K. The older indigenous peoples of Azad Kashmir have more ethnobotanical knowledge of plant species as comparison to younger ones [24]. However, the current research area is rarely reported except few plant species. Many species of the study were unexplored and reported first time in this paper. Therefore, the present research paper was focused on social and geographical characteristics of different study sites. Then all types of plants were collected for identification, preservation and exposed their ethnobotanical uses. To document the indigenous knowledge of wild plant from Dowariyan and Rati Gali. To explore the indeginous use of plants by local communities. Other key medicinal values and different perspectives for better livelihood were also observed and highlighted. Floristic composition of various species compiled for further novel and authentic ethnobotanical exploration. All data was analysed by different statistical tools for more accurate and significant assessment of all identified plant species with special reference to ethnomedicinal importance from the selected study area of District Atmokam, Azad Kashmir, Pakistan and their future perspective as for pharmaceutical analysis. The research will also assist in conservation of the precious medicinal flora of the area.
Map of the study area that indicated study sites in circle

**Materials and methods**

The current ethnobotanical analysis was conducted during the year 2019 from Dawarian to Rati Gali sites of District Athmaqam Neelum Valley, Azad Jammu and Kashmir.

*Ethnobotanical information collection*
Ethnobotanical informations were gathered from the local peoples of the study area by random visits with help of local guide or translator. The data collected from the local people indicate local name, local uses, recipe, part used, occurrence, characters involved in the collection, marketing and other related information. The plants of Dawarian and Rati Gali District Athmaqam Neelum valley were categorized according to their economic value such as medicinal, fodder, vegetable, thatching and fuel wood etc. through meeting poll from various individuals however inclination was given to neighborhood senior individuals, who had a ton of data about the plants and their customary employments. Survey and observations added more information in literature [24]. Various age bunches were perceived and organized based on 10 years' age contrast. The 60-70 age bunch was more educated therefore close to home understanding.

**Data collection by questionnaire method**

For obtaining our concerned objectives questionnaire method using open and close-ended interview was applied to extract useful data from the local people and herbalists. About 40 informants were interviewed of both the genders randomly for obtaining ethnobotanical data. Our informants consist of local people. Informants were asked about the plants they used in the treatment of different ailments. The interviewer also briefed us that how a particular plant is used, its dosage form, its part used and also the recipe of plant used for the treatment of certain diseases [25]. In the open-ended interviews, people were allowed to speak openly about the plants used for the treatment of different diseases. The researcher interviewed the people in their local language so as to extract allmost and reliable information from the people following protocol of Thompson [25] with some modifications.

**Plant samples collection and identification**

The plant examples were gathered from the study zone. They were dried, squeezed and mounted appropriately and submitted in Herbarium, (MUH). MUST, Bhimber Campus, AJ&K with voucher numbers for additional reference. They were related to the assistance of vegetation of Pakistan [19] and properly identified plants were kept for future reference.

**Data analysis**
Data analysis was conducted by using different quantitative ethnobotanical tools. The dependability and legitimacy of ethnobotanical research work and data was checked and upheld by calculating informant consensus factor (ICF), fidelity level (FL) and Family index (FI) and spearman’s rank correlation followed by previous botanists [26, 27].

**Fidelity level (FL)**

The fidelity level (FL) is the level of witnesses guaranteeing the utilization of certain plant for a similar object, was determined for the most habitually revealed by usage or ailments as:

\[
FL (\%) = \frac{N_p}{N} \times 100
\]

Where, \(N_p\) indicated the number of informants that claim a use of plant species used for a particular purpose/disease, and \(N\) is mentioned the number of informants that use the plant as a medicine to treat any given disease. This statistical tool was also applied by Farooq and his group [26].

**Informants consensus factor (ICF)**

ICF identifies the agreement of the informants on the reported medicines for the group of ailments. It was calculated by the following equation:

\[
ICF = \frac{nur - nt}{nur} - 1
\]

Where \(nur\) = number of used citation in each category and \(nt\) = number of specie used. This method is used for further examinations in drug investigation and other exploration ventures [28].

**Family index (FL)**

Family index is also calculated to check the member of which family is mostly used to cure against different diseases [13].

**Direct Matrix Ranking (DMR)**
Direct matrix ranking was applied which depicts populace thickness of plant species and their protection status in the investigation territory. DMR depicts highest biotic pressure on the plants which are most commonly used by the local people in the investigated area for the treatment of various ailments [24].

**Spearman’s correlation test**

In spearman’s rank correlation, analysis was calculated about indigenous knowledge of male and female to find out the fact that whether male have better knowledge than female or not as well as to explore correlation of number of uses with number of plants. It was proved that the number of uses of plants also increases as the number of plants species increases. It is calculated as:

$$r_s = 1 - 6 \frac{\sum d^2}{n(n^2-1)}$$

Where $d^2$ is the square of the sum of the ranks and $n$ is the number of informants [29].

**Results and discussion**

The present ethnobotanical examination persual generated a checklist of plants of Dawarian and Rati Gali, District Athmaqam, Azad Jammu and Kashmir, Pakistan. In this study, some medicinal plants were explored first time from the study area occurring at high elevated sites for detailed phytochemical and ethnopharmaceutical research point of view. Ethnobotanical as well as ethnomedicinal explorations were also elaborated in consise form after identification of each plant species. Individuals of the examination territory generally use plants and trees for different purposes such as fodder, wood, medicine, food and other purposes.

In the recent study it is observed and investigated that the local community of study areas used wild plant species for fulfillment of their daily life needs such as medicines, as food/vegetables, silage for animals, for fuel use and to making household tools and construct their houses. Local people of area collect the medicinal plants and used them for various ailments for human being as well as to cure the many diseases of their domestic animals. *Berberis lycium, Oxyria digyna, Aconogonon alpinum* were most important plants in the study area. Local community of study areas 90% depends on the livestock as the source of income. Similar studies on the plant species of Neelum Valley, Azad Jammu and Kashmir, Pakistan were documented by
Mahmood and his research group [17]. In which 40 plant species having a place with 31 families were discovered to be important for therapeutic, food, grain/scavenge, fuel, lumber, cover and farming purposes. Neighborhood individuals utilized indigenous plants for their basic ailments. e.g., *Berberis lycium*, *Podophyllum hexandrum*, *Oxyria digyna*, *Rheum austral*, *Aconogonon alpinum*, *Angelica cyclocarpa* and *Geranium wallichianum* were most important plants from the study area.

The Table 1 indicated 6 social comparisons between two observed sites names as Dawarian and Rati Gali prior to plants collection and identification for ethnomedicinal study. These characters’ observation directly correlates with plants distribution in the study area. It was observed that more families (52), number of informants (12), average number of families (15-8) and livestock dependence (90%) maximum in Dawarian site as comparison to Rati Gali. These findings were indicated that less number of plants and their minimum diversity appeared Dawarian site. These findings were strongly supported by some ethnobotanist who conducted research on this and other allied areas of AJK [24, 28].

Table 1: Social characteristics of the variable samples between two study sites: Ratia Galli and Dewarian of Dist. Atmaqam of Azad Jammu and Kashmir

| S.No | Social characteristics                      | Dawarian | Rati Gali |
|------|---------------------------------------------|----------|-----------|
| 1    | number of families                          | 52       | 8         |
| 2    | number of informants                        | 12       | 5         |
| 3    | Reliance on livestock as an income source  | 90%      | 30%       |
| 4    | Average age of informants                   | 70-50    | 40-30     |
| 5    | Average number of family members            | 15-8     | 10-3      |
| 6    | Migration ratio                             | 70%      | 100%      |

Different geographic characteristics like topography, area climates, population size, altitude/elevation and vegetation size were measured in Table 2. It was observed that Dawarian has 1615 feet altitude while Rati Gali present at 3700 feet height. This huge elevation difference showed diversity in geographic characteristics [22].

Table 2 Geographical characteristics observation of the two study sites: Ratia Galli and Dewarian of Dist. Atmaqam of Azad Jammu and Kashmir
| S. No. | Sites    | Elevation (m) | Geographical characteristics                                                                                                                                 |
|-------|----------|---------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | Dawarian | 1,615         | The village has very fertile soil and thick vegetation. Village has ever green thick forest of *Pinus wallichiana*. It is mountainous area. Population of the village is small sized but the area is huge. |
| 2     | Rati Gali| 3,700         | This area is located at high altitude. Vegetation mainly consist of herbs or shrubs. There is very low population but area is huge. People migrates here with their domestic animals in summers from different areas. |

**Plants collection, identification and preservation**

The plants were gathered from the selected towns of District Atmakam, AJK. The plants were identified mainly with the help of Flora of Pakistan. The specimens were submitted in Herbarium, Department of Botany, MUST, Bhimber Campus with voucher numbers for further reference. Family-wise inventory of the plants was given in Table 3. Total 103 plants were identified from the study area with their family names, habit observed (herb, shrub or tree) and local name of each plant elaborated in the Table 3. Similar findings were counted by other taxonomists in other countries [30].

**Table 3** Family-wise Inventory of some plants of Dawarian to Ratti Gali, District Athmaqam Azad Jammu and Kashmir

| Sr. No. | Family           | Species                                           | Habit  | Local name         |
|---------|------------------|---------------------------------------------------|--------|--------------------|
| 1       | Asteraeae        | *Achillea millefolium* L.                         | Herb   | Gandana            |
| 2       |                   | *Artemisia japonica* Thunb.                       | Herb   | Chaou              |
| 3       |                   | *Anaphalis triplinervis* Clarke                   | Herb   | Butt mehndi        |
| 4       |                   | *Artemisia macrophylla* Fisch. ex Besser          | Herb   | Chita chaou        |
| 5       |                   | *Gerbera gossypina* (Royle) Beauverd              | Herb   | Kofe               |
| 6       |                   | *Ligularia thomsonii* (Clarke) Pojark.            | Herb   | Jungli surajmukh   |
| 7       |                   | *Matricaria chamomilla* L.                        | Herb   | Tamak boti         |
| 8       |                   | *Saussurea lappa* (Decne.) Sch.Bip.               | Herb   | Khut               |
| 9       |                   | *Cirium arvense* (L.) Scop.                      | Herb   | Jungli kandyara    |
| 10      |                   | *Sonchus asper* (L.) Hill                        | Herb   | Dhodal             |
| 11      |                   | *Senecio chrysanthemoides* DC.                    | Herb   | Chir hand          |
| 12      |                   | *Solidago virgaurea* L.                           | Herb   | Pinja phool        |
| 2       | Amaryllidaceae   | *Allium griffithianum* Boiss.                     | Herb   | Jungli pyaz        |
| 3       | Araceae          | *Arisaema tortuosum* (Wall.) Schott              | Herb   | Ssanp ki boti      |
| 4       | Aquifolaceae     | *Ilex dipryena* Wall.                            | Tree   | Kandaro            |
| 5       | Anacardiaceae    | *Rhus succedanea* L.                              | Tree   | Akhal             |
| No. | Family            | Scientific Name                                      | Type     | Common Name       |
|-----|-------------------|------------------------------------------------------|----------|-------------------|
| 6   | Berberidaceae     | Berberis lycium Royle                                | Shrub    | Sumbal            |
| 18  | Podophyllum hexandrum Royle | Podophyllum hexandrum Royle                      | Shrub    | Ban kukri         |
| 19  | Podophyllum emodi Wall. ex Hook. f. & Thomson     | Podophyllum emodi Wall. ex Hook. f. & Thomson    | Shrub    | Tra patra         |
| 7   | Buddlejaceae      | Buddleja crispa Benth.                              | Shrub    | Gansu             |
| 8   | Buxaceae          | Buxus wallichiana Bai.                              | Herb     | Chiriri           |
| 22  | Sarcococca saligna Müll. Arg.                    | Sarcococca saligna Müll. Arg.                     | Shrub    | Shangal           |
| 9   | Boraginaceae      | Cynoglossum lanceolatum Forssk.                    | Herb     | Chiro             |
| 24  | Onosma bracteata Wall.                            | Onosma bracteata Wall.                            | Herb     | Gao zuban         |
| 10  | Betulaceae        | Corylus colurna L.                                  | Tree     | Aurni             |
| 11  | Brassicaceae      | Erysimum hieraciifolium L. f.                       | Herb     | Mirchi            |
| 27  | Erysimum hedgeanum Al-Shehbaz                    | Erysimum hedgeanum Al-Shehbaz                     | Herb     | Maneera           |
| 12  | Convolvulaceae    | Convolvolus arvensis L.                             | Herb     | Berrhi            |
| 29  | Cuscuta reflexa Roxb.                              | Cuscuta reflexa Roxb.                              | Herb     | Neela tari        |
| 13  | Campanulaceae     | Campanula pallida Wall.                             | Herb     | Bikh              |
| 14  | Colchicaceae      | Colchicum luteum Baker                              | Herb     | Sorinjan          |
| 15  | Celastraceae      | Euonymus hemsleyanus L.                             | Tree     | Seeki             |
| 16  | Crassulaceae      | Hylotelephium ewersii (Ledeb.) H.Ohba              | Herb     | Loon salooni      |
| 17  | Cupressaceae      | Juniperus communis L.                               | Tree     | Bentheri          |
| 18  | Caprifoliaceae    | Morina persica L.                                   | Herb     | Bekh-e-Akwar      |
| 36  | Valeriana jatamansi Jones                          | Valeriana jatamansi Jones                          | Herb     | Panchi hola       |
| 37  | Viburnum cotinifolium D. Don                      | Viburnum cotinifolium D. Don                      | Shrub    | Ukloo             |
| 19  | Caryophyllaceae   | Silene vulgaris (Moench) Garcke                    | Herb     | Murkun            |
| 20  | Fumariaceae       | Corydalis govaniana Wall.                           | Herb     | Bhutkas           |
| 40  | Corydalis vaginans Royle                           | Corydalis vaginans Royle                           | Herb     | Mameri            |
| 21  | Geraniaceae       | Geranium rotundifolium L.                           | Herb     | Ratan jut         |
| 42  | Geranium villosum Ten.                             | Geranium villosum Ten.                             | Herb     | Gull-e-attar      |
| 22  | Gentianaceae      | Swertia paniculata Wall.                            | Herb     | Charyta           |
| No. | Family          | Genera and Species                         | Type | Common Name                        |
|-----|-----------------|--------------------------------------------|------|-----------------------------------|
| 23  | Juncaceae       | *Juncus articulatus* L.                    | Herb | Jungli ghass                      |
| 24  | Lamiaceae       | *Ajuga parviflora* Benth.                  | Herb | Chita chaou                       |
|     |                 | *Ajuga bracteosa* Wall                     | Herb | Janeadam                          |
|     |                 | *Clinopodium vulgare* L.                   | Herb | Asaba-el-fetiyal                  |
|     |                 | *Elsholtzia strobilifera* Benth.           | Herb | Perilla                           |
|     |                 | *Isodon rugosus* Codd.                     | Shrub | Pemar                           |
|     |                 | *Mentha longifolia* L.                     | Herb | Pahari podina                     |
|     |                 | *Origanum vulgare* L.                      | Herb | Nazbu                            |
|     |                 | *Phlomis bracteosa* Royle.                 | Shrub | Kukarjari                        |
|     |                 | *Scutellaria linearis* Benth.              | Herb | Birch                            |
|     |                 | *Thymus linearis* Benth.                   | Herb | Ban jamani                        |
| 25  | Oxalidaceae     | *Oxalis corniculata* L.                    | Herb | Khatimili                         |
| 26  | Orobanchaceae   | *Pedicularis brevifolia* D.Don             | Herb | Khasturi                          |
| 27  | Orchidaceae     | *Satyrium nepalense* D.Don                 | Herb | Gagun                            |
| 28  | Papilionaceae   | *Astragalus graveolens* Benth.             | Herb | Ban phali                         |
|     |                 | *Astragalus heratensis* Bunge              | Shrub | Phut Kanda                       |
|     |                 | *Indigofera heterantha* Brandis            | Shrub | Kanthi                          |
|     |                 | *Lespedeza juncea* (L.f.) Pers.            | Herb | Kanthi ranga                     |
|     |                 | *Vicia sativa* L.                          | Herb | Chiri panja                       |
|     |                 | *Trifolium repens* L.                      | Herb | Sinja                           |
| 29  | Pteridaceae     | *Adiantum aethiopicum* L.                  | Herb | Kahkawa                          |
| 30  | Polygonaceae    | *Onychium japonicum* (Thunb.) Kunze        | Herb | Kangu                           |
|     |                 | *Aconogonon alpinum* (All.) Schur          | Herb | Chikro                          |
|     |                 | *Bistorta amplexicaulis* (D.Don) Greene    | Herb | Masloons                        |
|     |                 | *Oxyria digyna* (L.) Hill                  | Herb | Kakri                            |
|     |                 | *Persicaria mitis* (Schrank) Holub         | Herb | Pahari masloons                  |
| No. | Class          | Taxonomy                               | Type       | Common Name   |
|-----|----------------|----------------------------------------|------------|---------------|
| 70  | Rheum emodi Wall. | Herb                                  | Chit patra |
| 71  | Rheum australe D. Don | Herb                                  | Chutyal    |
| 31  | Polygalaceae      | 72 Polygala chinensis L. | Herb      | Sanp ki jari  |
| 32  | Pinaceae          | 73 Abies pindrow Royle                | Tree       | Partal        |
| 74  | Cedrus deodara Don | Tree                                  | Davdaar    |
| 75  | Pinus wallichiana Jacks. | Tree                                  | Kayal      |
| 76  | Pinus roxburghii Sarg. | Tree                                  | Cheer      |
| 77  | Picea smithiana (Wall.) Boiss. | Tree                                  | Kachal     |
| 33  | Poaceae           | 78 Bromus pectinatus Thunb.           | Herb       | Pero          |
| 79  | Cenchrus pennisetiformis Steud. | Herb                                  | Lidder     |
| 80  | Digitaria cruciata (Nees) A.Camus | Herb                                  | Ghaa       |
| 81  | Sorghum halepense (L.) Pers. | Herb                                  | Baru       |
| 34  | Primulaceae       | 82 Primula denticulata Sm.            | Herb       | Mamera        |
| 35  | Plantaginaceae    | 83 Plantago lanceolata L.             | Herb       | Kala chamchi part |
| 84  | Wulfenia anherstiana Benth. | Herb                                  | ---------- |
| 36  | Ranunculaceae     | 85 Actaea spicata L.                  | Herb       | Moneeri       |
| 86  | Aconitum heterophyllum Wall. ex Royle | Herb                                  | Ptrees     |
| 87  | Caltha alba Cambess. | Herb                                  | Makanpath  |
| 37  | Rosaceae          | 88 Cotoneaster microphyllus Wall. ex Lindl. | Herb | Loni         |
| 89  | Rosa microphylla Roxb. ex Lindl. | Shrub                                | Shigari    |
| 90  | Rubus niveus subsp. horsfieldii (Miq.) Focke | Shrub                               | Pakana     |
| 91  | Fragaria nubicola (Lindl.) Lacaita | Herb                          | Mehwa      |
| 38  | Rutaceae          | 92 Skimmia laureola Franch.           | Shrub      | Neri          |
| 39  | Sapindaceae       | 93 Acer cappadocicum Gled.            | Tree       | Tera Kanna   |
| 94  | Aesculus indica Hook. | Tree                                  | Ban khaur  |

12
Ethnobotanical data of wild plants

Ethnobotanical data of wild plants including voucher number, local names, botanical family, parts used, gathering period and traditional uses were compiled in Table 4. Among them Asteraceae having 12 (11.65%) species, Lamiaceae having 9 (8.73%) whereas Polygonaceae having 7 (6.79%) species, respectively. Papilionaceae having 6 (5.82%) species. Poaceae and Rosaceae each having 4 (3.88%) species while Berberidaceae, Caprifoliaceae and Ranunculaceae each having 3 (2.91%) species. Buxaceae, Boraginaceae, Brassicaceae, Convolvulaceae, Fumariaceae, Geraniaceae, Pteridaceae, Plantaginaceae, Spindaceae, Salicaceae and Violaceae each having 2 (1.94%) species., Amaryllidaceae, Araceae, Aquifoliaceae, Buddlejaceae, Butelaceae, Campanulaceae, Colchicaceae, Celastraceae, Crassulaceae, Cupressaceae, Caryophyllaceae, Gentianaceae, Juncaceae, Oxalidaceae, Orobanchaceae, Orchidaceae, Primulaceae, Rutaceae, Saxifragaceae, Sabiaceae, Symlocaceae, Taxaceae and Viscaceae each having 1 (0.97%) species. A pie-chart of all families having number of species given in (Fig.1).
In the investigated area total 103 plant species belonging to 37 families were recorded. Asteraceae was the dominant family of study area with 12 plant species. Somewhat similar ethnomedicinal study was conducted by many researchers on 59 plant species belonging to 35 families being used by local people District Athmaqam, Neelum valley, Azad Jammu and Kashmir [13]. In which Asteraceae was the dominant family of the study area with 8 plant species. These previous findings were strongly correlated and supported our study.

The present study provides information about different uses of 103 plant species belonging to 46 families. We found that 78 species (75%) had single use, 21 species (20%) had dual uses and 4 species (3%) had multi uses. Single usage plants have been categorized into medicinal, fodder, food and fuel. Among 78 single usage plant species 45 species (58%) had medicinal uses, 15 species had food and fodder values each and 3 species (3%) had fuel values. Double usage plant species had been classified into six different categories. Among 21 species, (33%) had medicinal and food, fodder and food uses. While (14%) had medicinal plus fodder values, (9%) had fodder and fuel uses, (4%) had medicinal plus fuel and medicinal plus condiments values. Multi usage plants have classified into three categories. Among 4 plant species (50%) were used as medicinal, furniture, fuel and house thatching, (25%) were used as fodder, ropes, fuel and medicinal, food and fodder. Similar study was conducted on the plants of District Kotli, Azad Jammu and Kashmir, Pakistan [6]. They investigated 93 plants species belonging to 46 families in which 49 (52.68%) plants for single usage, 35 (37.63%) for double purposes and 7 (7.52) for three purposes and 2
(2.15%) for multi purposes. Some other researchers were also explored ethnobotanical importance and use of medicinal plants from Khyber Pakhtoonkwa province of Pakistan [31].
Table 4 Traditional ethnobotanical uses of wild plant species recorded from Dawarian to Ratti Gali, District Atmakam, Azad Jammu and Kashmir

| S. No. | Species name                  | Family            | Collecting Period | Part used          | Traditional uses                                                                 |
|--------|-------------------------------|-------------------|-------------------|--------------------|----------------------------------------------------------------------------------|
| 1      | *Acer cappadocicum* Gled.     | Sapindaceae       | Summer            | Leaves, Wood       | Leaves are used as fodder. Wood is used as fuel for domestic.                      |
| 2      | *Ajuga bracteosa* Wall.       | Lamiaceae         | Summer            | Whole plant        | Root extracts are used for purification of blood. Paste of leaves helpful to cure headache while powder of whole plant is given to treat abdominal pain. |
|        | *Ajuga parviflora* Benth.     | Lamiaceae         | Summer            | Whole plant        | It is used as fermifuged. It is used as fodder.                                   |
| 3      | *Allium griffithianum* Boiss. | Amaryllidaceae    | Summer            | Leaves             | It is used to cure fever and cough. It is used as food.                          |
| 4      | *Aconogonon alpinum* (All.) Schur | Polygonaceae     | Summer            | Whole plant        | Leaves are used as food. Root is used for the treatment of joints pain.          |
| 5      | *Actaea spicata* L.           | Ranunculaceae     | Summer            | Roots              | Juice of roots is used to kill lice.                                             |
| 6      | *Aesculus indica* (Wall. ex Cambess.) Hook. | Spindaceae | Summer            | Whole plant        | Leaves are used as fodder. Wood and stem is used as fuel.                       |
| 7      | *Aconitum heterophyllum* Wall. ex Royle | Ranunculaceae | Summer            | Root               | Roots are used for the treatment of fever, vomiting, dysentery, flu cough and abdominal pain with boiled milk. |
| 8      | *Abies pindrow* Royle.        | Pinaceae          | Summer            | Leaves             | The paste of the leaves apply on cuts wounds bruises to get rid of bacteria and germs. |
| 9      | *Achillea millefolium* L.     | Asteraceae        | Summer            | Whole plant        | Paste prepared from this plant is used in stanching the flow of blood from wounds. Leaves are chewed to treat teeth pain. Leaves juice is poured in ear to treat ear pain. plant is also used to treat T.B., stomach disorder and fever in form of Tea. |
| 10     | *Artemisia japonica* Thunb.   | Asteraceae        | Summer            | Leaves             | The juice of leaves is used for cough and asthma.                                |
| 11     | *Anaphalis triplinervis* Clarke | Asteraceae      | Summer            | Whole plant        | The paste of whole plant is used as tonic for animals.                           |
| 12     | *Artemisia macrophylla* Fisch. ex Besser | Asteraceae | Summer            | Leaves, Shoot      | Leaves are used for cough and asthma. Shoot is used for fodder.                  |
| 13     | *Astragalus graveolens* Benth. | Papilionaceae    | Summer            | Fruit              | Fruit is eatable.                                                               |
| 14     | *Ajuga parviflora* Benth     | Lamiaceae         | Summer            | Whole plant        | It is used as fodder.                                                           |
| No. | Species Name                      | Family       | Season       | Part     | Uses                                                                 |
|-----|----------------------------------|--------------|--------------|----------|----------------------------------------------------------------------|
| 15  | *Adiantum aethiopicum* L.        | Pteridaceae  | Summer       | Leaves   | Juice of leaves is used for the treatment of chest burning, stomachache and blood purification. |
| 16  | *Arisaema tortuosum* (Wall.) Schott | Araceae     | Summer       | Whole plant | The roots are used as wormicide. The extract of leaf is used to cure cattle worms and stomach issues. The dried tubers are used as cure of snake poison. |
| 17  | *Astragalus chlorostachys* Bunge | Papilionaceae | Summer       | Whole plant | The plant is used as fodder for the livestock and cattle. |
| 18  | *Bergenia ciliata* (Haw.) Sternb. | Saxifragaceae | Summer       | Whole plant | Extracts of leaves is used as earaches relieve while roots are used as a tonic in treatment of fevers, diarrhoea and pulmonary affections. |
| 19  | *Bromus pectinatus* Thunb.       | Poaceae      | Summer       | Whole plant | It is used as fodder. |
| 20  | *Berberis lycium* Royle          | Berberidaceae | Summer       | Leaves   | Dried leaves are used for the treatment of headache, stomachache, joints pain and teethache. Boiled water of roots is used to treat internal wounds, especially bone fracture. |
| 21  | *Bistorta amplexicaulis* (D.Don) Greene | Polygonaceae | Summer       | Root, Leaves | Dried roots are used in making tea. The herbaceous roots are also used as fodder or cattle. |
| 22  | *Buddleja crispa* Benth.         | Buddlejaceae | Summer       | Whole plant | It is used as fodder. |
| 23  | *Buxus wallichiana* Baill.       | Buxaceae     | Summer       | Leaves   | Dried leaves are used in the treatment of joints pain and muscles pain. |
| 24  | *Convolvulus arvensis* L.        | Convolvulaceae | Summer       | Leaves   | Leaves are used as vegetable. It is also used as fodder. |
| 25  | *Cirsium arvense* (L.) Scop.     | Asteraceae   | Summer       | Whole plant | Powdered form mix with water is used as tonic. |
| 26  | *Campanula pallida* Wall.        | Campanulaceae | Summer       | Whole plant | It is used as fodder. |
| 27  | *Cynoglossum lanceolatum* Forssk. | Boraginaceae | Summer       | Whole plant | The foliar past is applied on abscess to remove pus. It is also used in asthma. |
| 28  | *Cuscuta reflexa* Roxb.          | Convolvulaceae | Summer       | Whole plant | Juice of the whole plant used to increase the length of hairs and make strong. It is also used as fodder. |
| 29  | *Cedrus deodara* (Roxb. ex D.Don) G.Don | Pinaceae | Summer       | Wood      | Oil of wood is used for toothache, applied to skin for skin problems. Wood is also used as fuel. |
| 30  | *Colchicum luteum* Baker         | Colchicaceae | Summer       | Whole plant | Juice of plant is used for purification of blood. |
| 31  | *Corylus colurna* L.             | Butalaceae   | Summer       | Fruit     | Fruit is eatable. |
| 32  | *Corydalis vaginans* Royle       | Fumariaceae  | Summer       | Sap       | The sap of the plant is used in the treatment of eye diseases. |
| No. | Scientific Name | Family | Season | Part Used | Uses |
|-----|-----------------|--------|--------|-----------|------|
| 33  | *Cotoneaster microphyllus* Wall. ex Lindl. | Rosaceae | Summer | Whole plant | It is used as fodder for cattle and goats. |
| 34  | *Corydalis govaniana* Wall. | Fumariaceae | Summer | Leaves | Juice of leaves is used for the treatment of fever and skin problem. |
| 35  | *Caltha alba* Cambess. | Ranunculaceae | Summer | Whole plant | Dried powdered or juice of this plant is used to reduce muscle pain and sedative. |
| 36  | *Cenchrus pennisetiformis* Steud. | Poaceae | Summer | Whole plant | It is used as fodder for cattle and rodents. |
| 37  | *Clinopodium vulgare* L. | Lamiaceae | Summer | Leaves | A sweet and aromatic herb tea is made from the fresh leaves. |
| 38  | *Digitaria cruciata* (Nees) A.Camus | Poaceae | Summer | Whole plant | It is used as fodder for cattle and goats. |
| 39  | *Erysimum hieraciifolium* L. f. | Brassicaceae | Summer | Whole plant | It is used as food and source of vegetable. |
| 40  | *Erysimum hedgeanum* Al-Shehbaz | Brassicaceae | Summer | Whole plant | This is poisonous herb. The juice of whole plant is used to kill lice in animals. |
| 41  | *Euonymus hemsleyanus* Loes. | Calastraceae | Summer | Whole plant | It is used as fodder cattle and rodents. |
| 42  | *Elsholtzia strobilifera* (Benth.) Benth. | Lamiaceae | Summer | Whole plant | It is used as fodder cattle and rodents. |
| 43  | *Fragaria nubicola* Lacaita | Rosaceae | Summer | Fruit | Fruit is eatable and used as antioxidant agent. |
| 44  | *Geranium rotundifolium* L. | Geraniaceae | Summer | Root, Leaves | Dried root powder is dotted on wounds. The dried roots were ground, sugar and milk are added in it, and then used for pain relief of joints. |
| 45  | *Geranium villosum* Ten. | Geraniaceae | Summer | Whole plant | It is used as food for cure of edema. |
| 46  | *Gerbera gossypina* (Royle) Beauverd | Asteraceae | Summer | Whole plant | It is used as fodder cattle and rodents. |
| 47  | *Hylotelephium ewersii* (Ledeb.) H.Ohba | Crassulaceae | Summer | Leaves | It is believed to be having cooling effect if the juice of the leaves mix with water and drink. |
| 48  | *Ilex dipyrena* Wall. | Aquifoliaceae | Summer | Leaves | It is used as fodder. It is also the source of fuel and wood. |
| 49  | *Indigofera heterantha* Brandis | Papilionaceae | Summer | Shoots | Shoots are used as fodder, branches as ropes, brooms and fuel. |
| 50  | *Isodon rugosus* (Wall.) Codd | Lamiaceae | Summer | Leaves | Juice of the leaves is used for stomachache. |
| No. | Species                                      | Family       | Season | Part Used      | Uses                                                                 |
|-----|---------------------------------------------|--------------|--------|----------------|----------------------------------------------------------------------|
| 51  | *Juncus arcticus* Wahlenb.                  | Juncaceae    | Summer | Whole plant    | It is used as fodder cattle and rodents.                               |
| 52  | *Juniperus communis* Brand.                 | Cupressaceae | Summer | Wood           | It is the source of fuel and commercial wood.                          |
| 53  | *Lespedeza juncea* (L.f.) Pers.             | Papilionaceae| Summer | Leaves        | It is used as fodder cattle and rodents.                               |
| 54  | *Ligularia thomsonii* Clarke.               | Asteraceae   | Summer | Root           | Dried root or powdered of root is used in the treatment of asthma, stimulate blood flow, reduce inflammation and stopping cough. |
| 55  | *Mentha longifolia* L.                     | Lamiaceae    | Summer | Whole plant    | Shoot is used for stomachache and gas trouble. Juice of leaves expels worms from the stomach. It is also as condiment.     |
| 56  | *Matricaria chamomilla* L.                  | Asteraceae   | Summer | Root           | Root is used for toothache.                                          |
| 57  | *Morina persica* L.                        | Caprifoliaceae | Summer | Aerial parts  | It is used for treatment of cold.                                      |
| 58  | *Meliosma simplicifolia* (Roxb.) Walp.     | Sabiaceae    | Summer | Leaves, Wood  | Leaves are used as fodder. It is also source of fuel.                 |
| 59  | *Oxalis corniculata* L.                    | Oxalidaceae  | Summer | Leaves, Flowers| Juice of leaves and flowers mixed together is used for the treatment of eyes. |
| 60  | *Onychium japonicum* (Thunb.) Kunze         | Pteridaceae  | Summer | Whole plant    | It is used as vegetable. Dried root or powdered root is used for the treatment of asthma and flu.                        |
| 61  | *Oxyria digyna* (L.) Hill                   | Polygonaceae | Summer | Shoot          | Shoot extracts are used for constipation, liver disorders and stomachache. |
| 62  | *Onosma bracteata* Wall.                   | Boraginaceae | Summer | Whole plant    | Powder of dry root is used against asthma and bronchitis. Decoction of leaves is given in stomach and bladder irritation. |
| 63  | *Origanum vulgare* L.                      | Lamiaceae    | Summer | Whole plant    | It is used for muscles pain, cold and toothache. It is also as vegetable and fodder.                                 |
| 64  | *Polygala chinensis* L.                    | Polygalaceae | Summer | Whole plant    | This plant is used for treatment of snake bites.                      |
| 65  | *Phlomis bracteosa* Royle ex Benth.        | Lamiaceae    | Summer | Leaves, Flowers| Powdered leaves are mixed in tea and used against cough and cold. Flowers are crushed and used against toothache.         |
| 66  | *Pedicularis brevifolia* D.Don              | Orobancheace | Summer | Leaver, Root   | Powdered leaves is used for the treatment of cough, fever, asthma and skin disease. Dried or powdered root is used for the treatment of stomachache. |
| 67  | *Primula denticulata* Sm.                  | Primulaceae  | Summer | Stem           | Juice of stem is used for eye diseases.                                |
| No. | Scientific Name | Family | Season | Part Used | Description |
|-----|----------------|--------|--------|-----------|-------------|
| 68  | *Podophyllum hexandrum* Royle | Barberidaceae | Summer | Leaves | Powdered leaves is used in the treatment of asthma. It is also used to reduce bulb in throat. |
| 69  | *Populus alba* L. | Salicaceae | Summer | Whole plant | Leaves are used as fodder. Wood is used as fuel. |
| 70  | *Plantago lanceolata* L. | Plantaginaceae | Summer | Whole plant | It is used as vegetable and laxative. |
| 71  | *Persicaria mitis* (Schrank) Holub | Polygonaceae | Summer | Root | Tea is made by root which help to reduce the joints pain. |
| 72  | *Picea smithiana* (Wall.) Boiss. | Pinaceae | Summer | Wood | Wood is the source of fuel. |
| 73  | *Podophyllum emodi* Wall. ex Hook.f. & Thomson | Barberidaceae | Summer | Whole | It is used as fodder cattle and rodents. |
| 74  | *Pinus wallichiana* A.B.Jacks. | Pinaceae | Summer | Whole plant | Smell of resin reduce severe cough. Powder of leaves and bark used with cold water useful for dysentery. Wood is used to make house thatching. Cones are used for fuel purposes and seeds are edible. |
| 75  | *Pinus roxburghii* Sarg. | Pinaceae | Summer | Whole plant | Powder of leaves and bark used with cold water for dysentery. Wood is used for furniture and fire purpose. Smoke is used to repel the mosquitoes and other insects. |
| 76  | *Rosa macrophylla* Lindl. | Rosaceae | Summer | Fruit | Fruit is used in fever to cure from it. |
| 77  | *Rheum emodi* Wall. | Polygonaceae | Summer | Whole plant | Leaves are used as vegetable. The powdered root and stem mix together with hot water to relieve constipation. |
| 78  | *Rubus niveus* subsp. *horsfieldii* (Miq.) Focke | Rosaceae | Summer | Fruit | Fruit is eatable. |
| 79  | *Rheum australe* D. Don | Polygonaceae | Summer | Root, Leaves | Leaves are used as vegetable. Paste of root is used for wound healing. |
| 80  | *Rhus succedanea* L. | Anacardiaceae | Summer | Whole plant | It is used as fodder. It is also source of fuel. |
| 81  | *Saussurea lappa* (Decne.) Sch.Bip. | Asteraceae | Summer | Root | Powder of root is used for cough and tootache, also as vermifuse for intestinal worm. Juice of root is used with a sweetner to cure rheumatism and pneumonia. |
| 82  | *Silene vulgaris* Garcke. | Caryophyllaceae | Summer | Whole plant | It is used as vegetable. |
|   | Species Name | Family   | Season  | Part Used       | Uses                                                                 |
|---|--------------|----------|---------|-----------------|----------------------------------------------------------------------|
| 83| *Sonchus asper* Hill. | Asteraceae | Summer  | Whole plant     | Young leaves and stem is cooked as vegetable.                         |
| 84| *Sorghum halepense* Pers. | Poaceae | Summer  | Whole plant     | Juice of root is used for the asthma. It is also used for fodder.     |
| 85| *Senecio chrysanthemoides* DC. | Asteraceae | Summer  | Whole plant     | It is used as vegetable.                                             |
| 86| *Skimmia laureola* Franch. | Rutaceae | Summer  | Leaves          | Tea is made by dry leaves which is very effective in joints pain, muscles pain, stomach pain and bone pain. Powdered leaves also used in deserts. |
| 87| *Salix tetrasperma* Roxb. | Salicaceae | Summer  | Whole plant     | It is used as fodder. Wood is used as fuel.                          |
| 88| *Symlocos paniculata* (Thunb.) Miq. | Symplocaceae | Summer  | Leaves          | Powdered leaves is used in the treatment of menorrhagia, eye disease. |
| 89| *Sarcococca saligna* Müll.Arg. | Buxaceae | Summer  | Leaves          | Powdered leaves is used in constipation, blood purification and muscles relaxation. |
| 90| *Satyrium nepalense* D.Don | Orchidaceae | Summer  | Tuber           | Tubers are used as tonic and to cure dysentery and malaria fever.     |
| 91| *Scutellaria linearis* Benth. | Lamiaceae | Summer  | Leaves          | Powdered leaves is used to reduce inflammation and diarrhea.         |
| 92| *Swertia paniculata* Wall. | Gentianaceae | Summer  | Whole plant     | Powdered plant is used to cure from fever.                           |
| 93| *Solidago capitata* Fisch. ex Herder | Asteraceae | Summer  | Whole plant     | Powdered plant is used to heal wounds.                               |
| 94| *Thymus linearis* Benth. | Lamiaceae | Summer  | Whole plant     | Tea is made by this plant which help to reduce fats in body, abdominal pain and gas trouble. |
| 95| *Taxus baccata* L. | Taxaceae | Summer  | wood            | It is used as fuel.                                                  |
| No. | Scientific Name | Family          | Season   | Part       | Uses                                                                 |
|-----|-----------------|-----------------|----------|------------|----------------------------------------------------------------------|
| 96  | *Trifolium repens* L. | Papilionaceae    | Summer   | Leaves     | Used as vegetables.                                                   |
| 97  | *Viola biflora* L.       | Violaceae       | Summer   | Leaves     | Leaves are used as vegetables. Tea is made by dry leaves which helps in cough headache and flu. |
| 98  | *Vicia sativa* L.        | Papilionaceae    | Summer   | Leaves     | Leaves are used as vegetable.                                        |
| 99  | *Viburnum cotinifolium* Don. | Caprifoliaceae  | Summer   | Fruit      | Fruit is eatable.                                                     |
| 100 | *Viscum album* L.        | Viscaceae       | Summer   | Leaves     | Powdered leaves are used in the treatment of cough and asthma.        |
| 101 | *Valeriana jatamansi* Jones | Caprifoliaceae  | Summer   | Root       | Powdered root is used for the treatment of joints pain. It is also used in sweet dishes. |
| 102 | *Viola canescens* Wall.  | Violaceae       | Summer   | Leaves, Flowers | Powder of leaves and flowers is given internally in the treatment of coughs and asthma. |
| 103 | *Wulfenia amherstiana* Benth. | Plantaginaceae | Summer   | Whole plant | It is used as fodder cattle and rodents.                               |
Summary of ethnobotanical investigation

To summarize the identified (103 plants) species in pie-chart as; out of which 75.72% were single usage, 20.38% were dual usages and 3.88% were multiple usages. A pie-chart of all plants uses is given in Fig. 2.

![Pie chart of plant usage](image)

**Fig. 2** Graphical presentation of plants on the basis of their usage

Single-usage plants

The plants which are used for only one purpose are called single-usage plant, e.g. *Solidago capitata* used as a medicinal purpose. Out of 103 plant species reported from the study area (Dowariya and Rati Gali), 78 were single usage. Out of 78 plants, medicinal plants were 45 (57.69%), whereas food, fodder and fuel were 15 (19.23%), 15 (19.23%) and 3 (3.84%) respectively. A pie-chart of all single-usage plants is given in Fig. 3. These findings were strongly correlated with Uniyal medicinal practices in Kangra district of Himachal Pradesh, Western Himalaya [32].
Dual-usage plants

The plants that used for two key purposes, are called dual-usage plants. For example, *Artemisia macrophylla* is used for medicinal as well as fodder. Out of 103 plants species, 21 (20.38%) were representing dual-usage plants. There were 6 categories of dual-usage of plants representing 21 species, i.e. medicinal & food and fodder & fuel were 7 (33.33%) while medicinal & fodder and food & fodder were 3 (14.28%) and 2 (9.52%) respectively. Medicinal & condiments and medicinal & fuel were 1 (4.76%). A pie-chart of all dual-usage plants is given in (Fig. 4). Many researchers positively correlate with our findings as Polat and his co-researchers discussed an ethnobotanical use of medicinal plants in Espiye and its surroundings in 2015 [33].

![Fig. 3 A pie-chart of single-usage plants](image-url)
Dosage form such as powdered, juice, mixture and decoction were frequently used for the treatment of different diseases in the study area. Powdered is the dosage form having the highest percentage 38% used among the local people, after that juice is widely used by the local people having the percentage of about 29% while the least administrated form is oil 1.61%. Other purposes such as fodder, food, fuel and construction were used by local people. Mostly plants frequently used for domestic animals as fodder having the highest percentage 37%, and after that as food is widely used by the local people having percentage of about 32%. Similar studies were conducted on the plants of Kel village, Neelum Valley, Azad Jammu and Kashmir. They investigated 50 plants belonging to 33 families from the study area [24]. Among plant part utilized, Leaves (30%) and the entire plant (23%) were the most most of the time utilized plant parts followed by roots (14%), bark (11%), seeds (8%), natural products (6%) elevated parts and stem (3%) and blossoms (2%) while the most widely recognized strategies for readiness was decoction (20%), extricate (17%), mixture (15%), powder and squeeze (13% each), glue (11%), poultice (7%), and oil (8%). Comparative tradicional employments of therapeutic plants were additionally investigated by Oliver in 2013 [34].

**Multiple-usage plants**
The plants which are used for multiple purposes, are called multiple-usage, e.g. *Pinus wallichiana* A.B.Jacks. is used for fuel, furniture, medicinal and thatching. Out of 103 plant species, 4 were representing multi-usage plants. There were 3 categories of multi-usage plants representing 4 plant species. Out of 4 plants, fodder, ropes and fuel were 1(25%), medicinal, furniture, fuel and thatching were 2(50%) while Medicinal, food and fodder were 1(25%). A list of all the multiple-usage plants, their local names and families is given in (Table 6). While a pie-chart of all multiple-usage plants is given in (Fig.5). Similar multiple Traditional use of medicinal plants among Kalasha, Ismaeli and Sunni groups in Chitral District, Khyber Pakhtunkhwa province Pakistan were documented in year 2016 [31].

![Multiple-usage plants %](image)

**Fig. 5** A pie chart of multiple-usage plants

Similar research was conducted on the plants of Darguti, Tehsil Khuiratta, AJK, Pakistan were being used by the local population of the area [16]. The plants species have single, double and multiple usages. 12 plant species have single uses, 24 have double uses and 64 species have multiple uses which is quite match with our findings. This district falls in subtropic region but my study area occurs in temperate region. Therefore, few plants species were grown different from our research area.
**Fig. 6** A pie-chat of different parts of plants used for the treatment of different diseases

**Fig. 7** A pie chart of Dosage form used against diseases
Fig. 8 A Pie chart of different plants used by local people in different categories

Fidelity level of the data depicts that *Allium griffithianum* (Jungli pyaz) and *Fragaria nubicola* (Mehwa) is the leading species with 75% value which is frequently used by local people of Dawarian. Second most important plant with respect to fidelity level of about is the *Mentha longifolia* (Pahari podina) with 72%. Whole plant is used for stomachache and gas trouble. Juice of the leaves expel worm from the stomach. It is also used as condiments. Third plant with respect to fidelity level is *Abies pindrow* (Partel), the paste of the leaves applied on cuts wounds bruises to get rid of bacteria and germs (Table 8). It is also the source of fuel. Ahmad and his colleagues conducted similar studies on the plants of Kel village, Neelum Valley, Azad Jammu and Kashmir [24]. They researched that the species having the most elevated FL esteem were *Berberis lyceum* (95%) utilized in jaundice, hepatitis, typhoid, fever, and tuberculosis issues, trailed by Dioscorea bulbifera, *Impatiens glandulifera* (90%) utilized in stiffness, joint torment and *Artemisia vulgaris* (90%) utilized in liver issues. Additionally, FL level was likewise seen by Farooq and his exploration bunch [26]. Five plant species including Berberis lyceum, Mentha arvensis Pyrus malus, Taraxacum officinale, and Viola canescens had 100% loyalty level.

Table 8 Fidelity level of plants in study area of Dawarian to Ratti Gali, AJK
| Sr. No. | Species name                  | Local name       | FL | FL% (NP/N) × 100 |
|---------|-------------------------------|------------------|----|-----------------|
| 1       | Acer cappadocicum             | Tra kanna        | 20 | 50%             |
| 2       | Ajuga bracteosa               | Jan-e-Adam       | 15 | 37%             |
|         | Ajuga parviflora              | Chita chaou      | 24 | 60%             |
| 3       | Allium griffithianum          | Jungli pyaz      | 30 | 75%             |
| 4       | Aconogonon alpinum            | Chikro            | 25 | 62%             |
| 5       | Actaea spicata                | Moneeri           | 20 | 50%             |
| 6       | Aesculus indica               | Ban khaur        | 10 | 25%             |
| 7       | Aconitum heterophyllum        | Ptrees            | 18 | 45%             |
| 8       | Abies pindrow                 | Partal            | 28 | 70%             |
| 9       | Achillea millefolium          | Gandana           | 10 | 25%             |
| 10      | Artemisia japonica            | Chaou             | 10 | 25%             |
| 11      | Anaphalis triplinervis        | But mehndi        | 5  | 12%             |
| 12      | Artemisia macrophylla         | Chita chaou       | 17 | 42%             |
| 13      | Astragalus graveolens         | Ban phali         | 21 | 52%             |
| 14      | Adiantum aethiopicum          | Kahkawa           | 30 | 75%             |
| 15      | Arisaema tortuosum            | Sanp ki jari      | 9  | 22%             |
| 16      | Astragalus chlorostachys      | Phut kanda        | 12 | 30%             |
| 17      | Bergenia ciliata              | Betbewa           | 25 | 62%             |
| 18      | Bromus pectinatus             | Pero              | 5  | 12%             |
| 19      | Berberis lycium               | Sumbal            | 19 | 47%             |
| 20      | Bistorta amplexicaulis        | Masloon           | 18 | 45%             |
| 21      | Buddleja crispa               | Gansu             | 10 | 25%             |
| 22      | Buxus wallichiana             | Chiriri           | 17 | 42%             |
| 23      | Convolvulus arvensis          | Berrhi            | 14 | 35              |
| 24      | Cirsium arvense               | Jungli kandyara   | 8  | 20%             |
| 25      | Campanula pallida             | Bikh              | 10 | 25%             |
| 26      | Cynoglossum lanceolatum       | Chiro             | 12 | 30%             |
| 27      | Cuscuta reflexa               | Neela tari        | 3  | 7%              |
|   | Plant Name                  | Location     | Quantity | Percentage |
|---|-----------------------------|--------------|----------|------------|
| 29 | Cedrus deodara              | Devdaar      | 16       | 40%        |
| 30 | Colchicum luteum            | Sorinjan     | 11       | 27%        |
| 31 | Corylus colurna             | Aurni        | 25       | 62%        |
| 32 | Corydalis vaginans          | Mameeri      | 9        | 22%        |
| 33 | Cotoneaster microphyllus    | Loni         | 12       | 30%        |
| 34 | Corydalis govaniana         | Bhutkas      | 15       | 37%        |
| 35 | Caltha alba                 | Makanpath    | 7        | 17%        |
| 36 | Cenchrus pennisetiformis    | Lidder       | 6        | 15%        |
| 37 | Clinopodium vulgare         | Asaba-el-fetiyal | 23   | 57%        |
| 38 | Digitaria cruciata          | Ghaa         | 4        | 10%        |
| 39 | Erysimum hieraciifolium     | Mirchi       | 11       | 27%        |
| 40 | Erysimum hedgeanum          | Maneera      | 20       | 50%        |
| 41 | Euonymus hemsleyanus        | Seeki        | 3        | 7%         |
| 42 | Elsholtzia strobilifera     | Perilla      | 10       | 25%        |
| 43 | Fragaria nubicola           | Mehwa        | 30       | 75%        |
| 44 | Geranium rotundifolium      | Ratan jut    | 11       | 27%        |
| 45 | Geranium villosum           | Gull-e-attar | 8      | 20%        |
| 46 | Gerbera gossypina           | Kofe         | 10       | 25%        |
| 47 | Hylotelephium ewersii       | Loon salooni | 6      | 15%        |
| 48 | Ilex dipyrena               | Kandaro      | 2        | 5%         |
| 49 | Indigofera heterantha       | Kanthi       | 13       | 32%        |
| 50 | Isodon rugosus              | Pemar        | 21       | 52%        |
| 51 | Juncus arcuatus             | Jungli ghass | 11      | 27%        |
| 52 | Juniperus communis          | Bentheri     | 4        | 10%        |
| 53 | Lespedeza juncea            | Kanthi ranga | 9      | 22%        |
| No. | Species                  | Latin Name                     | Common Name           | %  |
|-----|-------------------------|--------------------------------|-----------------------|----|
| 54  | Ligularia thomsonii     | Ligularia thomsonii            | Jungli surajmuk       | 14 | 35% |
| 55  | Mentha longifolia       | Mentha longifolia              | Pahari podina         | 29 | 72% |
| 56  | Matricaria chamomilla   | Matricaria chamomilla          | Tamak boti            | 20 | 50% |
| 57  | Morina persica          | Morina persica                 | Bakh-e-Akwar          | 8  | 20% |
| 58  | Meliosma simplicifolia  | Meliosma simplicifolia         | Bakhaish              | 5  | 12% |
| 59  | Oxalis corniculata      | Oxalis corniculata             | Khatimli              | 24 | 60% |
| 60  | Onychium japonicum      | Onychium japonicum             | Kangu                 | 2  | 5%  |
| 61  | Oxyria digyna           | Oxyria digyna                  | Kakri                 | 10 | 25% |
| 62  | Onosma bracteata        | Onosma bracteata               | Gao zuban             | 4  | 10% |
| 63  | Origanum vulgare        | Origanum vulgare               | Nazbu                 | 9  | 22% |
| 64  | Polygala chinensis      | Polygala chinensis             | Sanp ki jari          | 10 | 25% |
| 65  | Phlomis bracteosa       | Phlomis bracteosa              | Kukarjari             | 16 | 40% |
| 66  | Pedicularis brevifolia  | Pedicularis brevifolia         | Khasturi              | 14 | 35% |
| 67  | Primula denticulata     | Primula denticulata            | Mamera                | 3  | 7%  |
| 68  | Podophyllum hexandrum   | Podophyllum hexandrum          | Ban kukri             | 12 | 30% |
| 69  | Populus alba            | Populus alba                   | Sufaida               | 18 | 45% |
| 70  | Plantago lanceolata     | Plantago lanceolata            | Kala chamchi patr    | 25 | 62% |
| 71  | Persicaria mitis        | Persicaria mitis               | Pahari masloon        | 13 | 32% |
| 72  | Picea smithiana         | Picea smithiana               | Kachal                | 10 | 25% |
| 73  | Podophyllum emodi       | Podophyllum emodi              | Tra patra             | 10 | 25% |
| 74  | Pinus wallichichiana    | Pinus wallichichiana           | Kayal                 | 23 | 57% |
| 75  | Pinus roxburghii        | Pinus roxburghii               | Cheer                 | 23 | 57% |
| 76  | Rosa macrophylla        | Rosa macrophylla               | Shigari               | 29 | 72% |
| 77  | Rheum emodi             | Rheum emodi                    | Chit patra            | 7  | 17% |
| 78  | Rubus niveus            | Rubus niveus                   | Pakana                | 18 | 45% |
| 79  | Rheum australe          | Rheum australe                 | Chutyal               | 11 | 27% |
| 80  | Rhus succedanea         | Rhus succedanea                | Alkhal                | 7  | 17% |
| No. | Species                                   | Location     | Species         | Location | Family with highest number of plant species, number of species contained in each family and family ranking (FR) explored from the study area. It was observed that highest FR was shown Asteraceae and lowest FR indicated by Rosaceae. These findings were very closely supported by Maqbool and his colleagues [30]. |
|-----|------------------------------------------|--------------|----------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| 81  | *Saussurea lappa*                         | Kuth         | 20             | 50%      | **Table 9** Measurement of Family index (with highest number of species) in the study area                                                                 |
| 82  | *Silene vulgaris*                         | Murkun       | 24             | 60%      |                                                                                                                                                    |
| 83  | *Sonchus asper*                           | Dhodal       | 20             | 50%      |                                                                                                                                                    |
| 84  | *Sorghum halepense*                       | Baru         | 1              | 2%       |                                                                                                                                                    |
| 85  | *Senecio chrysanthemoides*                | Chir hand    | 14             | 35%      |                                                                                                                                                    |
| 86  | *Skimmia laureola*                        | Neri         | 21             | 52%      |                                                                                                                                                    |
| 87  | *Salix tetrasperma*                       | Bheens       | 4              | 10%      |                                                                                                                                                    |
| 88  | *Symlocos paniculata*                     | Ludder       | 1              | 2%       |                                                                                                                                                    |
| 89  | *Sarcococca saligna*                      | Shangal      | 5              | 12%      |                                                                                                                                                    |
| 90  | *Satyrium nepalense*                      | Tera Kanna   | 4              | 10%      |                                                                                                                                                    |
| 91  | *Scutellaria linearis*                    | Birch        | 9              | 22%      |                                                                                                                                                    |
| 92  | *Swertia paniculata*                      | Charyta      | 2              | 5%       |                                                                                                                                                    |
| 93  | *Solidago capitata*                       | Pinja phool  | 7              | 17%      |                                                                                                                                                    |
| 94  | *Thymus linearis*                         | Ban jamani   | 19             | 47%      |                                                                                                                                                    |
| 95  | *Taxus baccata*                           | Thuni        | 6              | 15%      |                                                                                                                                                    |
| 96  | *Trifolium repens*                        | Sinja        | 21             | 52%      |                                                                                                                                                    |
| 97  | *Viola biflora*                           | Phul naqsh   | 12             | 30%      |                                                                                                                                                    |
| 98  | *Vicia sativa*                            | Chiri pancha | 17             | 42%      |                                                                                                                                                    |
| 99  | *Viburnum cotinifolium*                   | Ukloo        | 14             | 35%      |                                                                                                                                                    |
| 100 | *Viscum album*                            | --------------| 11             | 27%      |                                                                                                                                                    |
| 101 | *Valeriana jatamansi*                     | Panchi hola  | 16             | 40%      |                                                                                                                                                    |
| 102 | *Viola canescens*                         | Thandi jari  | 15             | 37%      |                                                                                                                                                    |
| 103 | *Wulfenia amherstiana*                    | --------------| 3              | 7%       |                                                                                                                                                    |
S. No. | Family       | Number of species | Ranking |
-------|--------------|-------------------|---------|
 1     | Asteraceae   | 12                | 1st     |
 2     | Lamiaceae    | 10                | 2nd     |
 3     | Polygonaceae | 7                 | 3rd     |
 4     | Papilionaceae| 6                 | 4th     |
 5     | Pinaceae     | 5                 | 5th     |
 6     | Poaceae      | 4                 | 6th     |
 7     | Rosaceae     | 4                 | 7th     |

Spearman’s rank correlation test confirmed that the number of uses of plants increases with increases in the number of species. In spearman’s correlation, we correlated the indigenous knowledge of males and females to find out the facts that either the females have better knowledge as compared to males or not as well as we also correlated the number of uses with the number of plants (Table 10, 11, 12). Similar studies were conducted by Ahmad and his colleagues [24] in Kel, Neelum Valley Azad Jammu and Kashmir and Amjad and his colleagues were also done work in Toli Peer National Park, Azad Jammu and Kashmir. They were investigated plant species from their respected areas and applied statistical tools such as FL, ICF, DMR and FI [28]. Similar statistical tools were also applied by Maqbool et al., 2019 on ethnobotanical data compiled from district Bhimber, Azad Jammu and Kashmir, Pakistan [30].

Table 10: Spearman’s rank correlation and data analysis from Dawarian to Rati Gali, AJK

| Age range | Number of interviews | Male informants | Female informants |
|-----------|----------------------|-----------------|-------------------|
| 20-29     | 13                   | 2               | 11                |
| 30-39     | 2                    | 1               | 1                 |
| 40-49     | 8                    | 6               | 2                 |
| 50-59     | 4                    | 3               | 1                 |
| 60-69     | 5                    | 1               | 4                 |
| 70-79     | 3                    | 0               | 3                 |
| 80-89     | 3                    | 2               | 1                 |
| 90-99     | 2                    | 1               | 0                 |
Table 11 Spearman correlation for male informants in study area

| Age | Number of species | $d_1$ | Number of uses | $d_2$ | $d = d_2 - d_1$ | $d^2$ |
|-----|------------------|-------|---------------|-------|----------------|-------|
| 25  | 14               | 5     | 16            | 5     | 0              | 0     |
| 35  | 9                | 2     | 4             | 1     | −1             | 1     |
| 44  | 16               | 6     | 28            | 7     | 1              | 1     |
| 55  | 12               | 4     | 11            | 3     | −1             | 1     |
| 66  | 7                | 1     | 10            | 2     | 1              | 1     |
| 85  | 18               | 7     | 20            | 6     | −1             | 1     |
| 94  | 10               | 3     | 13            | 4     | 1              | 1     |

Sum of value of $d^2 = 6$

$r_s = 1 - 6 \left[ \frac{\sum d^2}{n(n^2 - 1)} \right]; r_s = 1 - 6 \left[ \frac{6}{7(7^2 - 1)} \right]; r_s = 1 - 6 \left[ \frac{6}{7(49 - 1)} \right]; r_s = 1 - 6 \left[ \frac{6}{7(48)} \right]; r_s = 1 - 6 \left[ \frac{6}{336} \right]; r_s = 1 - 6 [0.01]; r_s = 1 - 0.06; r_s = 0.9

Table 12 Spearman correlation for female informants in study area

| Age | Number of species | $d_1$ | Number of uses | $d_2$ | $d = d_2 - d_1$ | $d^2$ |
|-----|------------------|-------|---------------|-------|----------------|-------|
| 24  | 11               | 2     | 13            | 1     | −1             | 1     |
| 35  | 14               | 5     | 18            | 4     | −1             | 1     |
| 45  | 18               | 7     | 20            | 6     | −1             | 1     |
| 54  | 10               | 1     | 15            | 2     | 1              | 1     |
| 65  | 12               | 3     | 16            | 3     | 0              | 0     |
| 75  | 13               | 4     | 19            | 5     | 1              | 1     |
| 84  | 15               | 6     | 22            | 7     | 1              | 1     |

Sum of value of $d^2 = 6$

$r_s = 1 - 6 \left[ \frac{\sum d^2}{n(n^2 - 1)} \right]; r_s = 1 - 6 \left[ \frac{6}{7(7^2 - 1)} \right]; r_s = 1 - 6 \left[ \frac{6}{7(49 - 1)} \right]; r_s = 1 - 6 \left[ \frac{6}{7(48)} \right]; r_s = 1 - 6 \left[ \frac{6}{336} \right]; r_s = 1 - 6 [0.01]; r_s = 1 - 0.06; r_s = 0.9

Informant consensus factor (ICF) was used to support the data and to see the degree of agreement on each plant reported by informants (Table 13 A). The highest value of ICF is 0.91 for earache who depict prevalence of diseases mostly in children in the area and for construction houses because people in study area only depends on tree for construction their houses. The lowest
value is for fodder 0.03 (Table 13B). Similar findings were correlated and strongly supported by Farooq and his colleagues [26]. Maximum informant consensus factor (0.88) was calculated for digestive and liver disorders (Table 13B). According to diseases vise ICF was also measured by different scientists in rest of the world [30].

**Table 13A** Informant consensus factor (ICF) for different categories (For diseases)

| Diseases       | Species (nt) | All spp. % | Used citation (nur) | All citation % | ICF = \frac{(nur-nt)}{(nur-1)} |
|----------------|--------------|------------|---------------------|----------------|---------------------------------|
| Cough          | 13           | 12.7%      | 26                  | 65%            | 0.52                            |
| Stomachache    | 11           | 10.6%      | 30                  | 75%            | 0.65                            |
| Asthma         | 10           | 9.70%      | 20                  | 50%            | 0.52                            |
| Wounds healing | 9            | 8.73%      | 14                  | 35%            | 0.33                            |
| Joint pain     | 7            | 6.79%      | 22                  | 55%            | 0.71                            |
| Toothache      | 7            | 6.79%      | 25                  | 62%            | 0.75                            |
| Fever          | 5            | 4.85%      | 19                  | 47%            | 0.77                            |
| Chest burning  | 5            | 4.85%      | 10                  | 25%            | 0.55                            |
| Dysentery      | 4            | 3.88%      | 5                   | 12%            | 0.25                            |
| Muscle pain    | 4            | 3.88%      | 12                  | 30%            | 0.72                            |
| Eye allergy    | 4            | 3.88%      | 15                  | 37%            | 0.78                            |
| Blood purification | 4   | 3.88%      | 7                   | 17%            | 0.5                             |
| Constipation   | 3            | 2.91%      | 6                   | 15%            | 0.6                             |
| Headache       | 3            | 2.91%      | 18                  | 45%            | 0.88                            |
| Flu            | 3            | 2.91%      | 11                  | 27%            | 0.8                             |
| Skin allergy   | 3            | 2.91%      | 2                   | 5%             | 0.25                            |
| Cold           | 2            | 1.94%      | 9                   | 22%            | 0.87                            |
| Earache        | 2            | 1.94%      | 13                  | 32%            | 0.91                            |
| Diarrhea       | 2            | 1.94%      | 6                   | 15%            | 0.8                             |

**Table 13B** Informant consensus factor (ICF) for different categories (For other purposes)
| Category          | Species (nt) | All spp. % | Used citation (nur) | All citation % | ICF $= \frac{(nur - nt)}{(nur - 1)}$ |
|-------------------|--------------|------------|---------------------|----------------|--------------------------------------|
| Fodder            | 28           | 27.9%      | 29                  | 72%            | 0.03                                 |
| Food              | 24           | 23.3%      | 35                  | 87%            | 0.32                                 |
| Fuel              | 13           | 12.6%      | 32                  | 80%            | 0.61                                 |
| Furniture         | 5            | 4.94%      | 34                  | 85%            | 0.87                                 |
| Construction      | 5            | 4.94%      | 39                  | 97%            | 0.89                                 |
| House Thatching   | 4            | 3.88%      | 36                  | 90%            | 0.91                                 |
Table 14 Direct matrix ranking (DMR) of tree species with different uses other than medicinal value in the study area (AJK)

| Uses            | P. wallichiana | P. roxburghii | P. smithiana | C. deodara | A. pindrow | A. cappadocicum | P. alba | S. tetrasperma |
|-----------------|---------------|---------------|--------------|------------|------------|----------------|---------|---------------|
| Construction    | 40            | 40            | 35           | 36         | 30         | 0              | 0       | 0             |
| Hedge, Fencing  | 20            | 18            | 15           | 10         | 15         | 14             | 20      | 22            |
| Fire wood       | 25            | 29            | 35           | 38         | 30         | 32             | 28      | 19            |
| Cash income     | 40            | 38            | 30           | 35         | 20         | 0              | 2       | 0             |
| Fodder          | 5             | 2             | 8            | 4          | 10         | 20             | 22      | 29            |
| Fruit, Food     | 0             | 0             | 0            | 5          | 0          | 0              | 0       | 0             |
| Total           | 130           | 127           | 123          | 128        | 105        | 66             | 72      | 70            |
| Rank            | 1st           | 3rd           | 4th          | 2nd        | 5th        | 8th            | 6th     | 7th           |

According to Direct matrix ranking (DMR), plant species were also used for other purposes than medicinal values as indicated in Table 14. These results indicated that the plant species *P. wallichiana* top of the list with DMR 1<sup>st</sup> (130). While *S. tetrasperma* indicated 2<sup>nd</sup> position according to other use value. These findings were strongly justified by different taxonomists. They calculated DMR from various regions of the world as strongly correlated with our studies [35-40].

Thus, the study is very useful as it provide baseline data compilation about traditional ethnomedicinal uses of wild plants of the area and it also describes the biotic threats to the flora of the area. Through this study important and unique medicinal plants are selected for further studies to confirm their ethnopharmacological analysis and drug discovery.
Conclusion

The present research focused to explored the uses of plants in different purposes by experience of old peoples in the study area. Ethnobotanical research focused to explored the uses of plants in different purposes by experience of old peoples in the study area. Ethnobotanical survey on the unexplored areas of District Anthmaqam, Azad Jummu & Kashmir were selected for identification of wild plants and their ethnomedical impacts exploration. This research was carried out by interviewing the local peoples through a questionnaire method. Data analysis was done by different novel statistical tools such as fidelity level (FL), informant consensus factor (ICF), direct matrix ranking (DMR) strategies. Some plants were used as medicines only for indigenous peoples continuously and we recommeded these plants for peoples in other parts of country as well as throughout the world in future. It was observed that peoples used plants as vegetables, fodder, fuel, timber and as well as for medicinal purposes. Local peoples are using many types of indrgenous wild plants to cure different diseases like asthma, dysentery, constipation, cold, fever, joint pain, wound healing, kidney infection and many types of skin diseases. A total of 103 plants species belonging to 46 families were recorded. The most dominant family of that area was Asteraceae having 12 species. Among 103 plants 75.72% have single-usage, 20.38% have dual-usages and 3.88% have multiple-usage. Among plant partused, leaves having the highest percentage 34 % which are commonly used by local people for the treatment of various diseases followed by the root 25.2%. Some plants used as fodder having highest percentage 37% followed by Food (vegetables and fruits) with 32%. Data analysis through FL depicted that Allium griffithianum and Adiantum aethiopicum have highest fidelity level of 75% followed by the Mentha longifolia with fedility level of about 72 %. The highest ICF value for recorded for ear-ache and house-thatching (0.91) followed by the construction (0.89) while the lowest ICF value recorded for fodder (0.03) followed by blood purification (0.5). Spearman’s rank correlation test confirmed that the number of uses of plants increases with the increase in the number of species. So, this study will be useful those peoples and researchers in different fields such as ethno-pharmacology, agriculture and biotechnology for future work.

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Declaration
An ethnobotanical exploration of naturally growing plants of District Athmaqam from Dawarian to Ratti Gali, Azad Jammu and Kashmir.

Authors’ contributions
MA supervised the project, TH designed the study, conducted field survey and data analysis, MI helped in data interpretation and correction of the final draft of the paper. All the authors critically read this article and approved it as the final manuscript.

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Availability of data and materials
The data and materials already included in this manuscript.

Ethics approval and consent to participate
The present ethnomedicinal research is purely based on a field survey instead of human or animal trails. Therefore, ethical approval and consent to participate is not applicable.

Concent of publication
This manuscript data related to ethnobotanical research is sharing to the journal of ethnobiology and ethnomedicine after consent of all author/coauthor.

Competing interests
The authors declare that they have no competing interests.

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