

TRADITIONAL ETHNOBOTANICAL KNOWLEDGE OF WILD PLANTS OF TILLA JOGIAN DISTRICT JHELUM, PAKISTAN

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Abstract

This research was conducted to explore and document traditional ethnobotanical knowledge of wild plants of Tilla Jogian, and its adjoining areas, District Jhelum of Punjab, Pakistan. The data were collected by field visits and interview of local informants using open-ended and close-ended methodology. In this study, 64 plants of 37 families from five village areas were explored and their ethnobotanical information was collected. In field work, 45 informants (25 males and 20 females) consisting of peasants, herbalists, house-women, nomadic people and traditional practitioners were interviewed. Lamiaceae was prevalently dominant family of the area and out of 64 species; 31 species (47%) had single-use while 27 species (40%) double-use and nine species (15%) species multiple-use. Ethnobotanical quantitative analysis showed that relative frequency of citation (RFC) of studied taxa ranged from 0.97 to 0.02. High RFC of the plant proves their high citations and use in traditional ethnomedicines. According to use values (UV) index, *Justicia adhatoda* L. had (UV: 0.26), *Croton bonplandianus* Bail. (UV: 0.17) and *Salvia plebia* R. Br. (UV: 0.15); revealing that these species had high use in the area and were being exploited extensively. Relative importance (RI) values of the plants depicted their potential to cure different infirmities of the body. Jaccard index (JI) tool was used to compare current ethnobotanical knowledge with previous reports. JI values ranged from 2.07 to 16.07 which proved that most of ethnobotanical data provided was novel and reported for the first time. In this study, it was determined that various biotic interferences especially grazing, over exploitation and cutting of plants was the main pressure on many species, hence, the study area Tilla Jogian demands urgent measures for protection of wild plants of the area for future use and conservation.

Key words: Traditional knowledge, Ethnobotany, Jaccard's index, Quantitative ethnobotanical tools, Tilla Jogian, District Jhelum, Pakistan.

Introduction

The usage of plants as medicine dates back to the emergence of the human beings on this planet. Man has been using plants for coping his different necessities of the life. Pakistan is among countries in which customary use of plant-based medicines like Unani medicine is prevalently experienced to cure various ailments (Maqbool *et al.*, 2019a). Traditional Unani or herbal medicines profoundly depend on folklore therapeutics obtained from medicinal plants across globe (Goodman & Ghafoor, 1995). Ethnobotany is a systematic study of the associations among aboriginal people and plants of an area. Individual interactions with plants diverge owing to their uses, virtual significance and unreliable social, artistic and racial factors (Panhwar & Abro, 2007). There are about 258,650 plant species of which more than 10% are used medicinally. The worldwide advertise for therapeutic and fragrant plants were \$62 billion in 2002 and may get to \$5 trillion value by 2050. The core significant uses of plants as medicine are therapeutic synergistic and result neutralizing mixture of dynamic compounds (Altaf *et al.*, 2019; Gillani & Rehman, 2005). In Jhelum District, the medicinal plants have good potential but regrettably, very small scientific knowledge is known about the authentic production, amount and potential of diverse species, their management, definite employment and manufacture areas (Ahmad & Husain, 2008).

Jhelum District is located in Pothohar Plateau of the Punjab Province, Pakistan. Jhelum is one of the oldest districts among the Punjab (Fig. 1) lies at an altitude of 975 meters (3200 ft) above sea level; Tilla Jogian situated about 25 km to the West of the Jhelum city and 10 km west of the model village of the Khukha. The local climate is moderately extreme and cold with winter weather and when summer comes it become hot. Rohtas Fort is situated to the East of Tilla Jogian at the distance of about 7 Km from Dina on Grand Trunk Road (Fig. 1). Tilla Jogian is divided into small villages; the inhabitants of the villages use the wild plants of area to fulfill their daily needs. These villages are situated at the elevation of 286-301m, 430-453m, 270-300m, 260-290m and 299-330m, respectively. On the basis of difference in elevation, the flora of the areas differs with each other. The area is highly composed of associated with *Vachellia nilotica* (L.) P.J. Hurter, *Senegalia modesta* (L.) P.J. Hurter and *Olea ferruginea* (Aiton) Steud. The plants of area have very great potential of ethnobotanical studies. The objective of the current study was to (i) document the traditional ethnobotanical knowledge of local communities, (ii) to collect and preserve the medicinal plants of the area in scientific manner, (iii) to explore and record the ethnomedicinal uses of wild plants and its authentication by using quantitative ethnobotanical tools and (iv) to recommend the conservation of wild medicinal plants of the area.

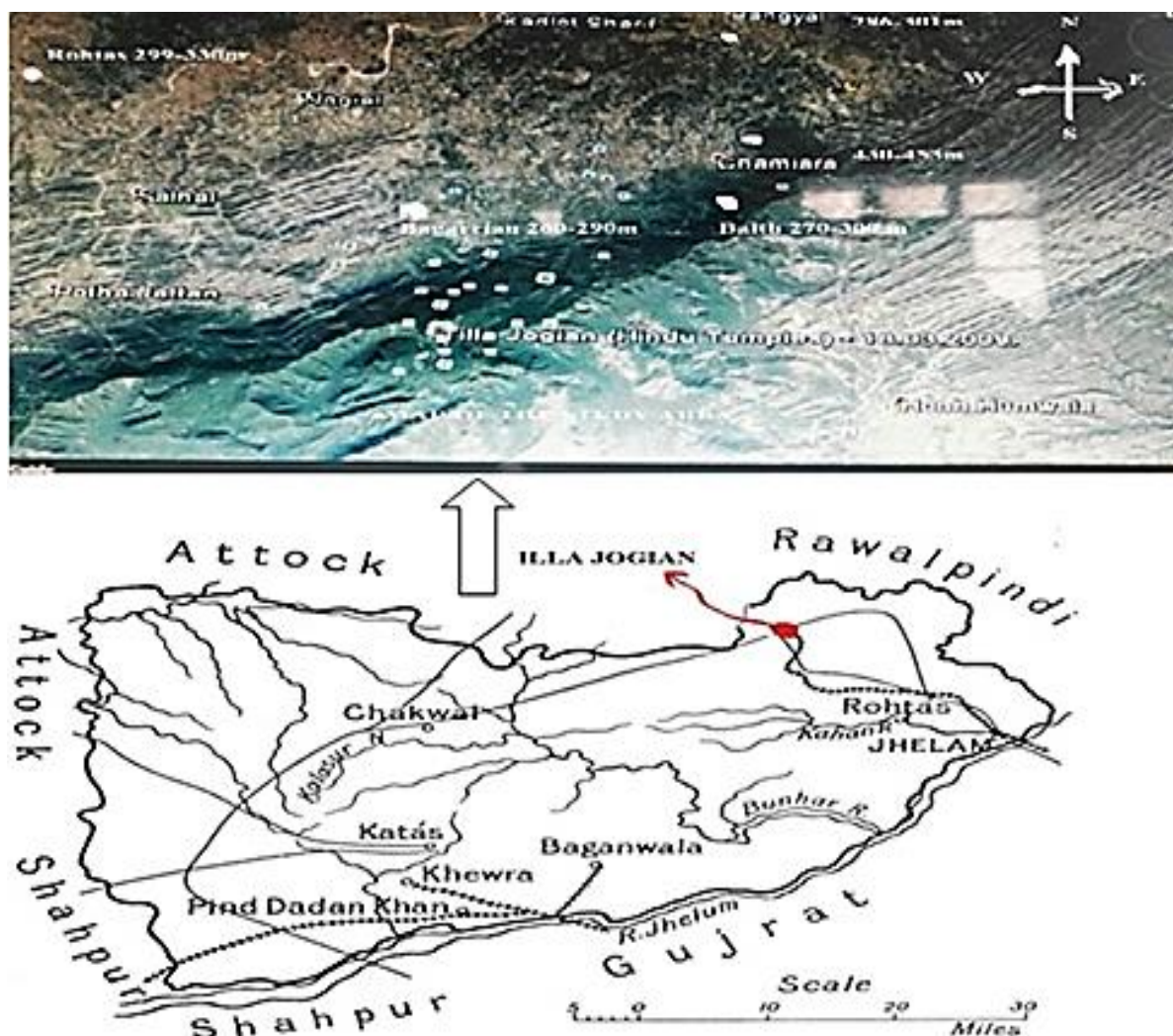


Fig. 1. Map showing location of study area-Tilla Jogian within District Jhelum, Pakistan.

Materials and Methods

Field method: Ethnobotanical field work was conducted during the year 2016. The study area was divided into five portions based on altitudinal variables which were as (i) Bangial village located between 286 and 301m, (ii) Mountain villages are located between 430 and 453m, (iii) Rohtas villages were those which are located between 299 and 330m, (iv) Bhatti village is located between 270-300m, (v) Bagarian village is located between 260-290m (Fig. 1). The ethnobotanical data were collected by using questionnaire format and using open-ended and close-ended interviews mechanism. In field survey, group discussion, plant interview and individual observations were also used to collect maximum informations about the plants. In the survey 45 (25 male and 20 female) respondents were involved and asked questions with help of local translator or guide to extract useful ethnomedicinal data (Fig. 2).

Plant collection and preservation: The collected plant specimens were dried, mounted on herbarium sheets and identified with the help of available literature such as Flora of Pakistan (Ishtiaq, *et al.*, 2017) and all the identified specimens were deposited in herbarium Botany Department, MUST, Bhimber Campus and their voucher numbers were assigned for further reference.

Quantitative ethnobotanical data analysis: The confirm the homogeneity, authentication and justification of reliability of ethnobotanical data different quantitative indices such as relative importance (RI), informant consensus factor (ICF), use value (UV) and relative frequency of citation (RFC) were applied for by analysis following protocols of Mehwish *et al.*, 2019a; 2019b) and data is formulated (Table 4).

Results and Discussion

An ethnobotanical expedition was conducted in Tilla Jogian and allied villages of District Jhelum to explore and document traditional ethnomedicinal (TEMs) uses of wild plants (Fig. 1 and Tables 1 and 3). In this exploratory research 64 plant species belonging to 37 families were recorded (Table 2). The family Lamiaceae was foremost with large number of species (25%) being used in TEMs followed by Euphorbiaceae and Amaranthaceae 11%, each (Table 2). TEMs data was compiled consisting of botanical name, vernacular name, family, plant part used, gathering period, habit, gathering area and their ethnomedicinal uses. It was concluded from results that herbaceous plants were dominant (62%) followed by shrubs (28%) trees (6%) and then climbers (Fig. 3).

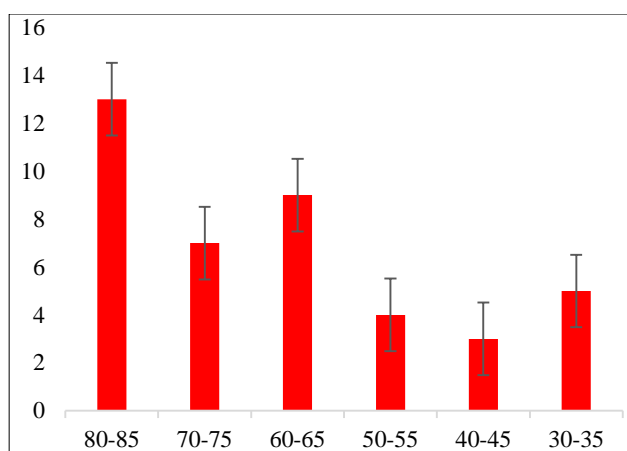


Fig. 2. Graphical presentation of number of informants and their ages, participated in ethnobotanical data collection from Tilla Jogian, District Jhelum, Pakistan.

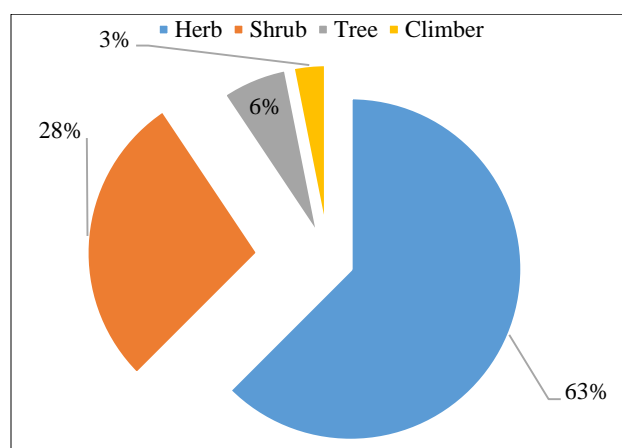


Fig. 3. Life form contribution of plants in study area of Tilla Jogian, District Jhelum.

Table 1. Social characteristics of sampling sites of Tilla Jogian, Jhelum, Pakistan.

Village name	Bangial	Bhait	Chamyara	Bagarrian	Chanhot	Rohtas
Village size (number of families)	250	30	58	40	60	68
Sample size (number of informants)	14	6	8	4	3	10
Dependency on livestock as a source of income	90%	75%	86%	82%	45%	50%
Informants average age	85-80	75-70	65-60	55-50	45-40	35-30
Average number of family members	16-7	18-4	20-5	12-3	10-2	13-1
Migration ratio	0%	25%	10%	0%	50%	20%
Bilingualism	5%	25%	35%	10%	40%	50%

Population distribution pattern of indigenous plants: It was found that due to increase in altitude level of different villages of the study area, there is trend of variable plants species occurrence seen in it. So, edaphological and climatic factors do affect the occurrence and population size of the plant communities which are described in next paragraph. The vegetation at (N.32° 52.288', E.073°26.532'. Elevation 430-453m) was represented by the plant species such as *Justicia adhatoda* locally called Baikar was found dominant at this area, *Gymnosporia royleana* locally called Pataki, *Colebrookea oppositifolia* commonly called bansa and *Grewia tenax* commonly called Gangaira was found at hilly place of the study area. The vegetation of Bangial village at (N.32°54.643', E.073°28.084', Elevation 286-301m) was herbaceous plant species such as *Digera muricata* commonly called Tandoola saag, *Capparis decidua* locally known as Karih, *Datura innoxia* locally called Safaid Datura and *Allium griffithianum* commonly known Jangali piaz are rich in amount. The vegetation of Rohtas villages at (N.32°57.784', E.073°34.419', Elevation 299-301m) (Fig. 1) *Capparis spinosa* locally called Cappero, *Withania somnifera* locally called Aksan, *Ziziphus mauritiana* locally called Jangli bairi was found.

Rationale of ethnobotanical research: The people of study area villages around Tilla Jogian do not have any easy approach to hospitals of big cities. So people in those areas use wild plant species mainly herbs as medicines in order to cure various human as well as animal's diseases. The generation of present time lacks the knowledge about indigenous plant species due to the cultural evolution and modernization of technologies. Although, local people of

Tilla Jogian and its adjoining area are depending on medicinal plants, directly or indirectly.

As earlier, there is very low ethnobotanical research done in the area although area is famous due to medicinal plant species and have a great history. The knowledge about wild plant species uses is mostly limited to Hakeems and old people of the area and is transferred in oral form and there is no certification. Iqbal *et al.*, (2011) conducted similar study on the area of Pind Dadan Khan District Jhelum, Punjab, Pakistan. The study shows that the lack of interest among younger generation about uses of plant species so, therefore it becomes need of time to gain and preserve the traditional system of medicines for future perspectives.

Plant part(s) used: Various plant parts are used in a variety of ways in local folklore herbal medicines depending upon the information and accessibility of those parts to the local communities. In present study, whole plant ranked 1st (37%) followed by leaves (20%) and seeds (15%) (Fig. 4). The common utility of whole plant in ethnomedicines may be due to amlagham of various phytoconstituents with high conc. Leaf was also frequently used in TEMs that may be due to activity of photosynthesis in it and excessive production of phytochemicals' amount in it. These findings are coincident with work of Chopda and Mahajan (2009) who investigated that different parts of plants of Jalgaon District of Maharashtra State, India were used to cure different troubles of human body. Similar results were reported that high numbers of leaves were used for treatment of diseases (Ishtiaq *et al.*, 2017).

Table 2. Families-wise percentage of different species occurring in Tilla Jogian area, District Jhelum.

S. No.	Families	Species No.	Percentage
1.	Amaranthaceae	4	11%
2.	Alliaceae	1	3%
3.	Apocynaceae	3	8%
4.	Acanthaceae	1	3%
5.	Asphodelaceae	2	6%
6.	Asteraceae	3	8%
7.	Asclepiadaceae	2	6%
8.	Aizoaceae	1	3%
9.	Boraginaceae	1	3%
10.	Brassicaceae	1	3%
11.	Capparidaceae	2	6%
12.	Chenopodiaceae	1	3%
13.	Celastraceae	1	3%
14.	Caryophyllaceae	1	3%
15.	Cyperaceae	1	3%
16.	Convolvulaceae	1	3%
17.	Equisetaceae	1	3%
18.	Euphorbiaceae	4	11%
19.	Iridaceae	1	3%
20.	Lamiaceae	9	25%
21.	Lythraceae	1	3%
22.	Leguminosae	3	8%
23.	Moraceae	1	3%
24.	Menispermaceae	1	3%
25.	Malvaceae	1	3%
26.	Nyctaginaceae	2	6%
27.	Primulaceae	1	3%
28.	Portulacaceae	1	3%
29.	Poaceae	1	3%
30.	Polygalaceae	1	3%
31.	Resedaceae	1	3%
32.	Rhamnaceae	1	3%
33.	Solanaceae	3	8%
34.	Sapindaceae	1	3%
35.	Scrophulariaceae	2	6%
36.	Tilliaceae	1	3%
37.	Zygophyllaceae	3	8%

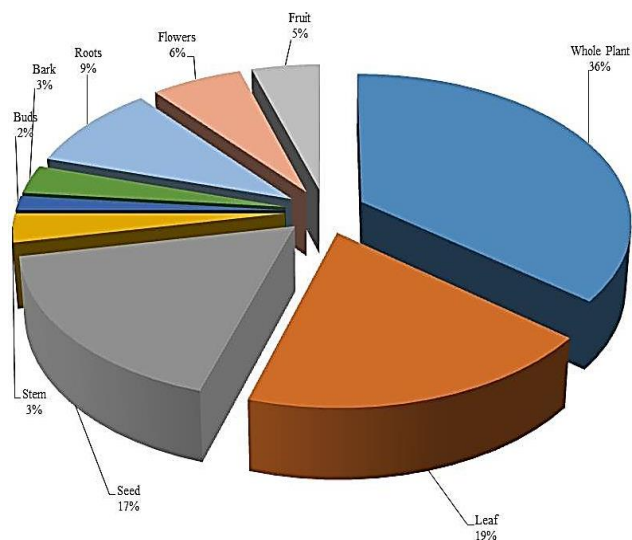


Fig. 4. Plant parts used in herbal medicines in study area of Tilla Jogian, District Jhelum.

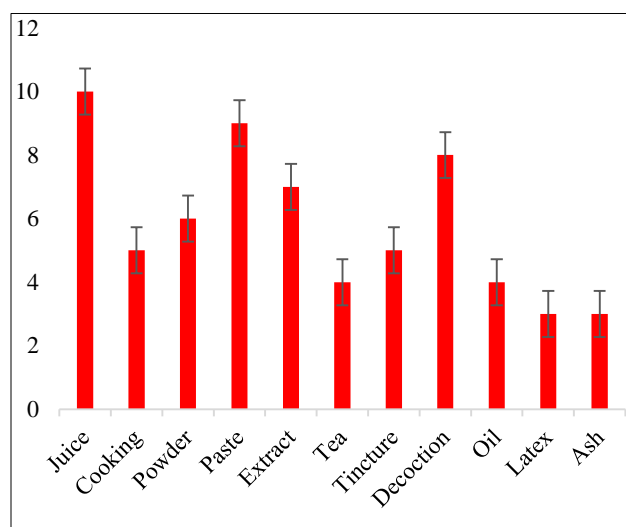


Fig. 5. Method of preparation of herbal recipes in study area of Tilla Jogian, District Jhelum.

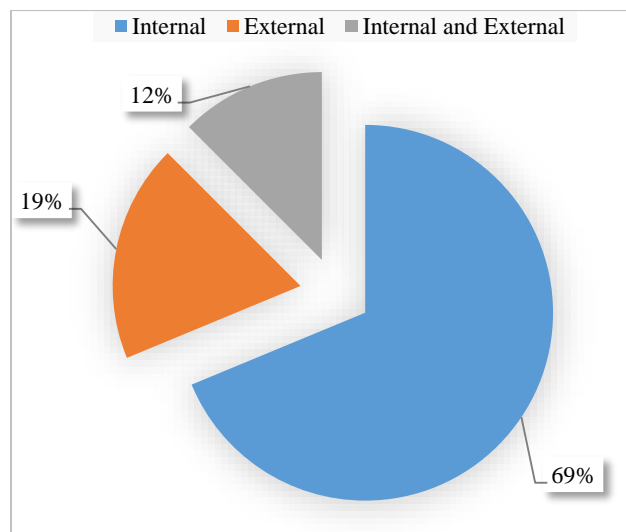


Fig. 6. Mode of application of folk recipes in study area of Tilla Jogian, District Jhelum.

Table 3. Traditional uses of wild plants reported from study area of Tilla Jogian and allied villages of District Jhelum, Pakistan.

S. No.	Botanical name and voucher specimen code	Family name	Common name	Part used	Gathering period	Gathering area	Traditional uses
1.	<i>Allium griffithianum</i> Boiss./ MUST. Bot. 561	Alliaceae	Jangli Piaze	Buds	Summer	Waste land	The juice of buds is used as expectorant and gives relief in cough.
2.	<i>Anagallis arvensis</i> L./ MUST. Bot. 562	Primulaceae	Khatri Buti	Whole herb	Summer	Abandoned places	It is used to cure epilepsy and headache. Leaves and shoots are used as vegetable.
3.	<i>Aerva javanica</i> (Burm f.) Juss. ex J.A. Schultes / MUST. Bot. 563	Amaranthaceae	Booh	Roots and woolly part	Summer	Sandy Soil	Roots are used as tooth cleaner. The wool is used for filling pillows.
4.	<i>Atriplex crassifolia</i> Ledeb. / MUST. Bot. 564	Chenopodiaceae	Orache	Whole plant	Summer	Waste land/saline soil	It is used as decorative plant in landscaping and can be used to prevent soil erosion. Many species are fit for human consumption.
5.	<i>Achyranthes aspera</i> L./ MUST. Bot. 565	Amaranthaceae	Puthkanda	All plant	Summer	wild vegetation	Ash of plant is used to cure the cough, piles and skin diseases.
6.	<i>Anisomeles indica</i> (L.) Kuntze / MUST. Bot. 566	Lamiaceae	Jangli Podina	All Plant	Spring	Moist Land	The oil of plant leaves are used to kill microbes, for hair dressing, in perfumes and cosmetics. It is used to cure cough, fever, abdominal ache, skin sores and snake bite.
7.	<i>Asphodelus tenuifolius</i> Cav. / MUST. Bot. 567	Asphodelaceae	Bastri	Seeds	Summer	Dry land	Seeds are used to treat piles.
8.	<i>Argyrolobium roseum</i> (Cambess.) Jaub. And Spach / MUST. Bot. 568	Leguminosae	Makhan Booti	Whole Plant	Spring	Waste land in dry sandy clay	It is used stomach, liver, bladder inflammation, impotency and membrane disease.
9.	<i>Boerhavia repens</i> L. / MUST. Bot. 569	Nyctaginaceae	Eit Sit	Root, Seeds and leaves	Spring	Sandy and Rocky soil	It is used to improve immune system. The boiled roots and seeds are applied to cure ulcers, worm infection. Leaves are used to cure asthma and Jaundice. The root juice is used as eye drops to cure eye infections.
10.	<i>Bridelia verrucosa</i> Haines / MUST. Bot. 570	Euphorbiaceae	Chilla	Leaves and Stems	Summer	Waste Land	It is used for fodder for cattle goat and sheep.
11.	<i>Blytia spiralis</i> (Forssk.) D.V. Field & J.R.I. Wood / MUST. Bot. 571	Asclepiadaceae	Akari bel	Tubers and root	Summer	Dry sandy land	Tubers are used as food. Root for medicine to treat gonorrhea and for cooling. It is also used as fodder.
12.	<i>Boerhavia procumbens</i> Banks ex Roxb. / MUST. Bot. 572	Nyctaginaceae	Punarva	Roots	Summer	Moist land	Root is used to cure skin diseases, snake bite, swelling, chest pain, hernia, cough, blood purification and asthma. The paste of root is used with honey as tonic.
13.	<i>Cardiospermum halicacabum</i> L. / MUST. Bot. 573	Spindaceae	Kareela bail/ Ghubara bail	Whole plant	Summer	Cultivated land	Extract of leaves are used to cure worms, diarrhea and dysentery. Roots are used to cure renal problems, joint pain, menstrual cramps, ear pain and irritated scalp and dandruff. It is also used as animal forage.
14.	<i>Capparis decidua</i> (Forssk.) Edgew. / MUST. Bot. 574	Capparidaceae	Kirreh	Roots and Fruits	Summer	Waste Land	Fruits are used as vegetable for diabetic patients and to prepare pickles used for cough, fever and itching. Children enjoy sucking the nectar. The root bark is used to cure swollen joints. The wood is used to make water pipes and foe charcoal and firewood.
15.	<i>Capparis spinosa</i> L. / MUST. Bot. 575	Caparidaceae	Caper	Leaves and Flower buds, Bark, Root	Winter	Stone Rocks	Leaves are used internally to treat gastrointestinal infections, diarrhea and externally to cure skin diseases and capillary weakness. Bark is used before meal to increase the appetite. Immature flower buds are used to treat cough, eye infections and vaginal thrush. Root extract is used in cosmetics.

Table 3. (Cont'd.).

S. No.	Botanical name and voucher specimen code	Family name	Common name	Part used	Gathering period	Gathering area	Traditional uses
16.	<i>Corbichonia decumbens</i> (Forssk.) Exell / MUST. Bot. 576	Aizoaceae	Patar Chatti	Leaves, Flowers	Summer	Waste land	The leaves of plant have high antimicrobial activities and use to treat various infections.
17.	<i>Cirsium arvense</i> (L.) Scop. / MUST. Bot. 576	Asteraceae	Kali jeeri	Leaves, root and Stem	Summer	Arable land/ cultivated land	Root is diuretic, and hepatic, chewed as a remedy for toothache also to treat worms in children. A paste of root combined with the equal quantity of root paste of <i>Amaranthus spinosa</i> , is used to cure indigestion.
18.	<i>Callicarpa macrophylla</i> Vahl / MUST. Bot. 577	Lamiaceae	Beautyberry	Whole plant	Summer	Hilly Place / Forest	Leaves are used to treat diarrhea, dysentery and gastrointestinal bleeding. Roots are chewed to treat the rashes on tongue. Paste of roots is used to cure fever. Juice of roots is used to cure indigestion. The wood is used for burning.
19.	<i>Colebrookea oppositifolia</i> Smith / MUST. Bot. 578	Lamiaceae	Bosik	Leaves and Root	Spring	Hilly places	Leaves are used to cure dermatitis, nose bleeding, ringworms, fever and headache. Roots extracts can be used as a therapy against epilepsy and peptic ulcers. It can be used as fodder. The dried twigs are used as firewood.
20.	<i>Croton bonplandianus</i> Baill. / MUST. Bot. 579	Euphorbiaceae	Ban Tulsi	Leaves, seeds and roots	Spring	Waysides and fallow lands/ Dry and sandy areas	Sap of 3-4 leaves are given for 3-4 days to cure cough. Seed paste is useful locally on eczema and ringworm. Seeds and roots are used to heal cuts and wounds.
21.	<i>Cuscuta reflexa</i> Roxb. / MUST. Bot. 580	Convolvulaceae	Akash Bail	Whole Plant	Summer	Along roads sides and cultivated areas	Plant juice is used to cure eye infections. The boil water of the plant is used to take bath to improve sickness. The whole plant is used as Jaundice, headache, paralysis, spleen diseases, backache and intestinal worms.
22.	<i>Calotropis procera</i> (Aiton) Dryand. / MUST. Bot. 581	Apocynaceae	Ak	Whole plant	Summer	Along cultivated sides and waste lands	The milky latex of leaves is used to remove insect poison from the infected part of body. Whole plant is used to cure different types of ailments such as diarrhea, stomachache, cardiovascular problems, pneumonia, fever and jaundice. Dried powder of roots with water is taken to enhance milk flow of nursing mother; ash of roots is used to cure skin rashes. Sheep and goats eat the leaves during droughts. If milk is regularly rube on the hairy surface of skin it cause the removal of hair from skin or face.
23.	<i>Cynodon dactylon</i> (L.) Pers. / MUST. Bot. 582	Poaceae	Khuble ghass	Whole grass	Summer	Waste land	It improves digestion, increase red blood cells and breast milk. Its juice is taken to normalize sugar level in empty stomach. Animals eat the grass and it help to enhance milk production in animals.
24.	<i>Cocculus pendulus</i> (J.R. Forst. & G. Forst.) Diels / MUST. Bot. 583	Menispermaceae	Parwati	Whole plant	Summer	Bushland	Flowers and fruit are used as food. Roots and stem bark are antipyretic.
25	<i>Digera muricata</i> (L.) Mart. / MUST. Bot. 584	Amaranthaceae	Tandoola saag	Leaves, seeds, flowers and young shoots	Summer	Waste land and moist places	Leaves and immature shoots are safe to eat as vegetable. The nector of flowers is sucked by children. Leaves and flowers are used to cure digestive disorders.
26.	<i>Datura innoxia</i> Mill. / MUST. Bot. 585	Solanaceae	Safaid Datura	Leaves and Seeds	Summer	Waste land/along roadsides	Leaves and fruits are used for fever, hydrophobia, ear pain, scabies, piles, ulcers, malaria, asthma, respiratory disorders and antidote for insect bites.

Table 3. (Cont'd).

S. No.	Botanical name and voucher specimen code	Family name	Common name	Part used	Gathering period	Gathering area	Traditional uses
27.	<i>Euphorbia prostrata</i> Aiton / MUST. Bot. 586	Euphorbiaceae	Dodali	Whole plant	Summer	Fields and roadsides	Rubbing the leaves remove pain from wasp and scorpion sting; the small balls of plant are used to treat female sterility and painful menstruation by placing it in birth canal. The crushed leaves are used as mouth wash. Whole plant juice is used in delivery. Boiled shoots are used reduce risk of miscarriage. The boiled water of whole plant is used to cure the measles and other skin infections.
28.	<i>Eclipta alba</i> L. ex B.D. Jacks. / MUST. Bot. 587	Asteraceae	Bhangra booti	Whole plant	Summer	Marshy places	It is used to cure intestinal worm infection, skin disorders, relief pain, and swelling. The juice extracts with castor oil is used to cure worm infections. Its paste is used to improve hair color and growth.
29.	<i>Equisetum arvense</i> L. / MUST. Bot. 588	Equisetaceae	Karvi booti	Whole plant	Summer	Marshy places	The dried plant powder is used to cure diarrhea and other abdominal disorders also used to remove kidney stone and to cure tuberculosis.
30.	<i>Ehretia laevis</i> Roxb. / MUST. Bot. 589	Boraginaceae	Dant rang	Whole plant	Summer	Forest	Root is used to cure teeth disorders and syphilis. Stem bark is used to cure diphtheria and leaves paste is used to treat eczema. Flower powder is used with milk as aphrodisiac.
31.	<i>Erigeron canadensis</i> L. / MUST. Bot. 590	Asteraceae	Kali Buti	Flowers	Summer	Waste land	It is used to stop bleeding in the digestive tract, flowers are used to make tea to cure fever, cough and throat infections.
32.	<i>Fagonia olivieri</i> DC. / MUST. Bot. 591	Zygophyllaceae	Dhamasa	Leaves and seeds	Summer	Rocky and places	It is used to cure cancer, diabetes, fever and stress disorders.
33.	<i>Ficus benghalensis</i> L. / MUST. Bot. 592	Moraceae	Bohar	Whole plant	Winter	Stony walls	The leaves are used to cure diarrhea, pain after delivery and skin disorders. Latex is used to treat piles & rectal problems while roots are emetic and used to clean teeth, to improve female sterility as well as to cure leucorrhoea. Twigs are used to make ropes and other material.
34.	<i>Farsitia jacquemontii</i> Hook.f. & Thomson / MUST. Bot. 593	Brassicaceae	Freed Buti	Whole plant	Summer	Stony walls	It is used to cure rheumatism and used for fodder.
35.	<i>Grewia tenax</i> (Forssk.) Fiori / MUST. Bot. 594	Tiliaceae	Gangaura	Whole plant	Summer	Rocky and Sandy land	It is used as fodder for cattle, goat and sheep. Roots and bark is used to make poultice. Mucilaginous bark is used by women as hair tonic, chest infection and as a typhoid remedy. Fruits are edible and bark is used to prepare ropes and house thatching. The wood is used as a fuel.
36.	<i>Gymnosporia royleana</i> Wall. ex M.A. Lawson / MUST. Bot. 595	Celastraceae	Pataki	Whole plant	Summer	Low hills	It is used to cure tumors. The wood is used as fuel and other proposes.
37.	<i>Iris aitchisonii</i> (Baker) Boiss. / MUST. Bot. 596	Iridaceae	Samp boti	Whole plant	Summer	Marshy and sandy places	The herb is used against snake poison it is used to cure many infections caused by bacteria and fungus.
38.	<i>Indigofera cordifolia</i> Roth. / MUST. Bot. 597	Leguminosae	Bhakhis	Whole plant	Summer	Hill slopes	Used to cure asthma and bronchitis.
39.	<i>Justicia adhatoda</i> L. / MUST. Bot. 598	Acanthaceae	Bakair	Whole plant	Summer	Hilly places	The nectar is sucked by children. It is used to cure cough, relief during high menstruation, for skin diseases, piles, inflammation, tuberculosis, throat infection and for asthma. Wood is used as fuel and leaves are rarely used as fodder.

Table 3. (Cont'd).

S. No.	Botanical name and voucher specimen code	Family name	Common name	Part used	Gathering period	Gathering area	Traditional uses
40.	<i>Lamium procumbens</i> (Roxb.) Ramayya and Rajagopal / MUST. Bot. 599	Asteraceae	Dodh phatri	Whole herb	Winter	Near cultivated areas	It is used to treat ringworms. Its water is used to take bath to cure prickly heat. Sheep and goats eat it as fodder to enhance milk production.
41.	<i>Lindenbergia macrostachya</i> Benth. / MUST. Bot. 600	Scrophulariaceae	Phool kandi	Leaf and seed	Summer	Rocky slopes	It is used to cure Cough, throat infection, arthritis and bronchitis.
42.	<i>Leucas aspera</i> (Wild.) Link / MUST. Bot. 601	Lamiaceae	Thumbai	Leaves	Summer	Dry wasteland	It is used to treat scorpion bites, to reduce fever. Whole plant is crushed and inhaled to cure internal infection. Flowers are used to cure worm infection in children. It is used to give fragrance in foods. It is also used in witchcraft.
43.	<i>Mentha spicata</i> L. / MUST. Bot. 602	Lamiaceae	Pehari podina	Whole plant	Summer	Low moist hills	Its immature leaves are used to cure nausea, stomach disorders and sickness. Leaves and flowers are safe to eat and cooked, dried leaves are used to make tea and local people used this tea to refresh mouth and for stomach disorders.
44.	<i>Ocimum americanum</i> L. / MUST. Bot. 603	Lamiaceae	Kali Tulsi	Leaves	Summer	Moist Forest	Leaves are crushed to make paste and applied to cure skin infections, wounds and burns. Immature leaves are used as salad. Oil extracted from leaves is used to make soaps and cosmetics.
45.	<i>Ocimum tenuiflorum</i> L. / MUST. Bot. 604	Lamiaceae	Niazboo	Whole plant	Summer	Cultivated areas	The young plant is used to cure skin diseases, diarrhea, bronchitis, malaria, insect bites, eye diseases, bronchitis, asthma, and fever and blood purifier. The oil of leaves is used to cure kidney problems.
46.	<i>Portulaca oleracea</i> L. / MUST. Bot. 605	Portulacaceae	Qulfa ka saag	Whole plant	Summer	Moist Soil	The leaves are used as vegetable. Stem, leaves, flowers and buds are edible. It is used to cure abnormal urine bleeding, asthma and diabetes.
47.	<i>Polygala sibirica</i> L. / MUST. Bot. 606	Polygalaceae	Ama	Root and leaves	Summer	Rocky places	It is used to cure breast pain also used to treat cough. Leaves are used to cure kidney disorders. Roots are used to lower the blood pressure also help to improve sexual disability.
48.	<i>Plantago ovata</i> Forssk / MUST. Bot. 607	Plantaginaceae	Ispaghul	Seeds	Summer	Waste and dry land	It is used as remedy for relieving the problem of constipation it is given the patients suffering from diarrhea and many stomach disorders.
49.	<i>Polygonum plebeium</i> R.Br./ MUST. Bot. 608	Polygonaceae	Jangli gul dupehari	Seeds, roots and leaves	Summer	Rocky ground and dry places	Leaves are used as vegetable and safe to eat. The seeds are cooked and used as a remedy for bowel complaints. The roots are useful to cure abdominal disorders.
50.	<i>Peganum harmala</i> L. / MUST. Bot. 609	Zygophyllaceae	Harmel	Whole plant	Summer	Dry land	It has been used to cure skin disease, inflammation; seeds are used to treat tapeworms and to cure fever. The smoke of plant is taken during menstrual cycle to relief pain. It is used against bad evils. Seeds are used to increase sterility. It is used to make inks.
51.	<i>Periploca aphylla</i> Decne. / MUST. Bot. 610	Apocynaceae	Baata	Whole plant	Winter	Rocky places	Root bark is used to cure heart diseases. Stem bark is used to cure autoimmune responses and also used to make ropes.

Table 3. (Cont'd.).

S. No.	Botanical name and voucher specimen code	Family name	Common name	Part used	Gathering period	Gathering area	Traditional uses
52.	<i>Ricinus communis</i> L. / MUST. Bot. 611	Euphorbiaceae	Arnoli	Whole plant	Winter	Roadside and dry land	It is used to cure skin infection, worms, constipation stomach disorders, joint pain. Oil from its seeds is used to cure headaches, inflammation in ear and skin disorders. It is used to cure skin disorders also used as fodder.
53.	<i>Reseda oligomeroides</i> Schinz / MUST. Bot. 612	Resedaceae	Hazar dani	Whole plant	Summer	Moist and sandy land	Used for bath after delivery for baby care. Its seeds are used to eat in winter to keep warm the body.
54.	<i>Rhynchosia minima</i> (L.) DC. / MUST. Bot. 613	Leguminosae	Jangali moath	Seeds	Summer	Sandy and moist areas	Fresh and dried leaves are used to cure wounds, mouth sores and throat pain. Leaves are used as silage by goats and sheep and the whole dry plant is used as fuel.
55.	<i>Rydingia limbata</i> (Benth.) Scheen and V.A. Albert / MUST. Bot. 614	Lamiaceae	Chitti botti	Whole plant	Summer	Dry and stony land	It is used to cure diarrhea, circulatory and urinary disorders. Cooked leaves are used in piles bleeding also used to treat leucorrhoea and gonorrhoea. The oil of herb is used to rub the muscles to relief the pain.
56.	<i>Sida cordifolia</i> L. / MUST. Bot. 615	Malvaceae	Bala/Beejband	Whole plant	Winter	Shady and moist places	Paste of plant is applied to cure wounds between foot toes. Seeds are used as condiment, to cure cough, inflammation and as aphrodisiac.
57.	<i>Sabia plebeia</i> R.Br. / MUST. Bot. 616	Lamiaceae	Samandar sookh	Seeds and leaves	Winter	Moist and waste land	It is used to cure throat infections, liver pain, pneumonia. Leaf sap is used as mouth wash. Fruit sap is rubbed into scarification around the eye to cure conjunctivitis. Its fruit is cooked and eat by diabetes patients.
58.	<i>Solanum incanum</i> L. / MUST. Bot. 617	Solanaceae	Mao kari	Whole plant	Summer	Waste land	The buds of rhizome are sweet in taste used to eat, young shoots are cooked. The powder of seeds with flour is used to make cakes. Roots are diuretic and traditionally used to cure cancer. Stem is used to make matt, chair and also for paper making.
59.	<i>Schoenoplectus lacustris</i> (L.) Falla / MUST. Bot. 618	Cyperaceae	Deela	Whole plant	Summer	Shady and moist Land	Whole plant is used to stimulate blood exchange also to cure rashes, dental care, snake bite and painful injuries.
60.	<i>Sagina maxima</i> A. Gray / MUST. Bot. 619	Caryophyllaceae	Lais booti	Whole plant	Summer	Waste rocky land	It is used as analgesic. It increases the fertility of men and promoting muscle building. Reduce the problems of menopause and improve cardiovascular system. Animals eat to increase milk production.
61.	<i>Tribulus terrestris</i> L. / MUST. Bot. 620	Zygophyllaceae	Bakhra	Seeds	Summer	Waste land	Flowers are astringent, used to cure dysentery and menopause. Its food is used as fuel.
62.	<i>Woodfordia fruticosa</i> (L.) Kurz / MUST. Bot. 621	Lythraceae	Dhai	Flowers	Summer	Open waste land	The root is used to balance the body hormones, to increase sexual potency, memory support and enhance fertility.
63.	<i>Withania somnifera</i> (L.) Dunal / MUST. Bot. 622	Solanaceae	Aksan	Root and leaves	Winter	Waste land	The paste of leaves is used to cure burn wounds. Fruits are eaten by traditional peoples to cure stomach problems. Leaves are highly used as fodder for goats and wood is used for fuel and for construction process.
64.	<i>Ziziphus mauritiana</i> var. <i>spontanea</i> (Edgew.) R.R. Stewart ex Qaiser & NAZIM / MUST. Bot. 623	Rhamnaceae	Jangli Bair	Whole plant	Summer	Forrest and rocky land	

Table 4. Relative frequency, use value and relative importance of for different plant species occurring in Tilla Jogian and allied villages of District Bhimber of Pakistan.

S. No.	Botanical name	Mode of preparation/ Property	Mode of application	Rel BS	Rel PH	RI	FC	RFC	UV
1.	<i>Allium griffithianum</i> Boiss.	Juice	Internal	0.008	0.005	0.65	14	0.088	0.04
2.	<i>Anagallis arvensis</i> L.	Eaten	Internal	0.012	0.01	1.1	15	0.044	0.17
3.	<i>Aerva javanica</i> (Burm f.) Juss. ex J.A. Schultes	Chewing	External	0.004	0.005	0.45	11	0.133	0.04
4.	<i>Ariplex crassifolia</i> Ledeb.	Decoration	Internal	0.012	0.015	1.35	4	0.244	0.2
5.	<i>Achyranthes aspera</i> L.	Ash, Powder	Internal	0.012	0.015	1.35	8	0.33	0.04
6.	<i>Anisomeles indica</i> (L.) Kuntze	Oil, Juice	Internal	0.030	0.04	3.5	14	0.155	0.08
7.	<i>Asphodelus tenuifolius</i> Cav.	Powder	Internal	0.004	0.005	0.45	5	0.2	0.06
8.	<i>Argyrolobium roseum</i> (Cambess.) Jaub. And Spach	Juice, Powder	Internal	0.025	0.025	2.5	7	0.177	0.2
9.	<i>Boerhavia repens</i> L.	Juice, Boiled Water	Internal and External	0.030	0.035	3.25	62	0.22	0.02
10.	<i>Bridelia verrucosa</i> Haines	Eaten, Fodder	Internal	0.004	0.005	0.45	3	0.311	0.13
11.	<i>Blyttia spiralis</i> (Forssk.) D.V. Field & J.R.I. Wood	Eaten	Internal	0.012	0.015	1.35	6	0.4	0.6
12.	<i>Boerhavia procumbens</i> Banks ex Roxb.	Paste, Juice	Internal and External	0.042	0.05	4.6	5	0.46	0.02
13.	<i>Cardiospermum halicacabum</i> L.	Juice	Internal	0.042	0.055	4.85	3	0.311	0.06
14.	<i>Capparis decidua</i> (Forssk.) Edgew.	Eaten, Fuel	Internal and External	0.025	0.035	3	2	0.088	0.3
15.	<i>Capparis spinosa</i> L.	Juice, Eaten	Internal	0.034	0.045	3.95	1	0.533	0.2
16.	<i>Corbichonia decumbens</i> (Forssk.) Exell	Juice	Internal	0.008	0.01	0.9	1	0.288	0.2
17.	<i>Cirsium arvense</i> (L.) Scop.	Chewing, Paste	External	0.025	0.03	2.75	0.8	0.422	0.1
18.	<i>Callicarpa macrophylla</i> Vahl	Chewing, Juice, Fuel	Internal and External	0.025	0.03	2.75	0.61	0.577	0.2
19.	<i>Colebrookea oppositifolia</i> Smith	Juice, Fodder, Fuel	Internal and External	0.034	0.04	3.7	14	0.622	0.13
20.	<i>Croton bonplandianus</i> Baill.	Latex, Paste	Internal and External	0.017	0.03	2.35	0.57	0.688	0.17
21.	<i>Cuscuta reflexa</i> Roxb.	Juice, Powder, Boiled Water	Internal and External	0.042	0.055	4.85	4	0.755	0.1
22.	<i>Calotropis procera</i> (Aiton) Dryand.	Powder, Milk, Fodder	Internal	0.055	0.06	5.75	1.1	0.911	0.11
23.	<i>Cynodon dactylon</i> (L.) Pers.	Juice, Fodder	Internal	0.021	0.03	2.55	2	0.266	0.2
24.	<i>Cocculus pendulus</i> (J.R. Forst. & G. Forst.) Diels	Juice, Fodder	Internal	0.004	0.01	0.7	2	0.4	0.3
25.	<i>Datura innoxia</i> Mill.	Extract	Internal	0.042	0.05	4.6	30	0.88	0.04
26.	<i>Euphorbia prostrata</i> Aiton	Juice	Internal	0.034	0.035	3.45	3	0.44	0.1
27.	<i>Eclipta alba</i> L. ex B.D. Jacks.	Juice	Internal	0.025	0.035	3	0.75	0.88	0.3
28.	<i>Equisetum arvense</i> L.	Powder	Internal	0.017	0.02	1.85	7	0.44	0.12
29.	<i>Ehretia laevis</i> Roxb.	Chewing, Powder	Internal	0.021	0.025	2.3	62	0.8	0.2
30.	<i>Erigeron canadensis</i> L.	Tea	Internal	0.021	0.015	1.8	13	0.11	0.08
31.	<i>Fagonia olivieri</i> DC.	Juice	Internal	0.017	0.01	1.35	5	0.33	0.2
32.	<i>Ficus benghalensis</i> L.	Extract	Internal	0.034	0.06	4.7	8	0.533	0.06

Table 4. (Cont'd.).

S. No.	Botanical name	Mode of preparation/ Property	Mode of application	Rel BS	Rel PH	RI	FC	RFC	UV
33.	<i>Farsekia jacquemontii</i> Hook.f. & Thomson	Juice, Fodder	Internal	0.004	0.005	0.45	0.43	0.622	0.08
34.	<i>Grewia tenax</i> (Forssk.) Fiori	Eaten, Paste, Fuel	Internal and External	0.017	0.07	4.35	0.57	0.911	0.3
35.	<i>Gymnosporia royleana</i> Wall. ex M.A. Lawson	Fuel	External	0.004	0.005	0.45	0.36	0.95	0.1
36.	<i>Iris aitchisonii</i> (Baker) Boiss	Extract	Internal	0.008	0.015	1.15	2	0.97	0.24
37.	<i>Indigofera cordifolia</i> Roth	Juice	Internal	0.008	0.01	0.9	0.53	0.822	0.1
38.	<i>Justicia adhatoda</i> L.	Decoction	Internal	0.030	0.04	3.5	1.1	0.6	0.26
39.	<i>Launaea procumbens</i> (Roxb.) Ramayya and Rajagopal	Juice, Boiled water	Internal and External	0.012	0.025	1.85	7	0.355	0.04
40.	<i>Lindenbergia macrostachya</i> Benth.	Decoction	Internal	0.017	0.02	1.85	62	0.6	0.2
41.	<i>Leucas aspera</i> (Wild.) Link	Powder	Internal	0.017	0.03	2.35	0.5	0.46	0.08
42.	<i>Mentha spicata</i> L.	Cooked, Tea	Internal	0.021	0.025	2.3	3	0.044	0.15
43.	<i>Nanorrhinum ramosissimum</i> (Wall.) Betsche	Extract	Internal	0.004	0.01	0.7	0.57	0.77	0.2
44.	<i>Ocimum americanum</i> L.	Eaten, Paste	Internal and External	0.012	0.02	1.6	14	0.244	0.1
45.	<i>Ocimum tenuiflorum</i> L.	Oil	Internal	0.047	0.05	4.85	8	0.97	0.3
46.	<i>Portulaca oleracea</i> L.	Eaten	Internal	0.012	0.015	1.35	2	0.577	0.13
47.	<i>Polygala sibirica</i> L.	Juice	Internal	0.025	0.025	2.5	0.8	0.911	0.2
48.	<i>Plantago ovata</i> Forssk	Dried powder	Internal	0.012	0.01	1.1	0.96	0.4	0.04
49.	<i>Polygonum plebeium</i> R.Br.	Eaten	Internal	0.008	0.02	1.4	0.75	0.244	0.1
50.	<i>Peganum harmala</i> L.	Extract	Internal	0.030	0.04	21.5	0.9	0.311	0.2
51.	<i>Periploca aphylla</i> Decne.	Extract	Internal	0.004	0.01	0.7	0.4	0.911	0.04
52.	<i>Riccinus communis</i> L.	Oil	Internal	0.034	0.035	3.45	0.61	0.288	0.2
53.	<i>Reseda oligomeroides</i> Schinz	Paste	External	0.004	0.005	0.45	5	0.6	0.1
54.	<i>Rhynchosia minima</i> (L.) DC.	Eaten	Internal	0.008	0.01	0.9	62	0.02	0.08
55.	<i>Rydingia limbata</i> (Benth.) Scheen and V.A. Albert	Paste	External	0.012	0.025	1.85	1.1	0.15	0.15
56.	<i>Sida cardifolia</i> L.	Paste, Juice	Internal and External	0.034	0.045	3.95	11	0.46	0.1
57.	<i>Salvia plebeia</i> R.Br.	Paste, Juice	Internal and Internal and	0.025	0.025	2.5	30	0.44	0.17
58.	<i>Solanum Incanum</i> L.	Eaten	Internal	0.034	0.045	3.95	30	0.11	0.2
59.	<i>Schoenoplectus lacustris</i> (L.) Palla	Cooked, Powder	Internal	0.004	0.04	20.2	4.7	0.2	0.1
60.	<i>Sagina maxima</i> A. Gray	Paste, Juice	Internal and External	0.021	0.025	2.3	4	0.133	0.08
61.	<i>Tribulus terrestris</i> L.	Powder, Paste	Internal and External	0.017	0.03	4.7	2	0.8	0.13
62.	<i>Woodfordia fruticosa</i> (L.) Kurz	Powder	Internal	0.012	0.02	1.6	6	0.311	0.1
63.	<i>Withania somnifera</i> (L.) Dunal	Powder	Internal	0.012	0.015	1.35	14	0.22	0.13
64.	<i>Ziziphus mauritiana</i> var. <i>spontanea</i> (Edgew.) R.R. Stewart ex Qaiser & Nazim	Paste, Fodder	Internal and External	0.008	0.02	1.4	11	0.488	0.15

Table 5. Informant consensus factor (ICF) by categories of diseases in study area of plants of different sampling sites of Tilla Jogian, District Jhelum Pakistan

S No.	Category/ Plants Used for Disease(s)	Species	(%) All species	Use citations	(%) All citations	ICF (nurt)/(nur-1)
1.	Flu, headache, bronchitis, cough	34	23.61	275	17.56	0.88
2.	Stomachic and constipation	21	14.58	166	10.60	0.88
3.	Jaundice, spleen/liver disorders.	46	31.94	255	16.28	0.82
4.	Snake stings and rabies	22	15.28	189	12.07	0.89
5.	Tuberculosis and leucorrhea	25	17.36	175	11.17	0.86
6.	Arthritis and joint inflammation	20	13.89	253	16.16	0.92
7.	Urinary and renal disorders	15	10.42	253	16.16	0.94

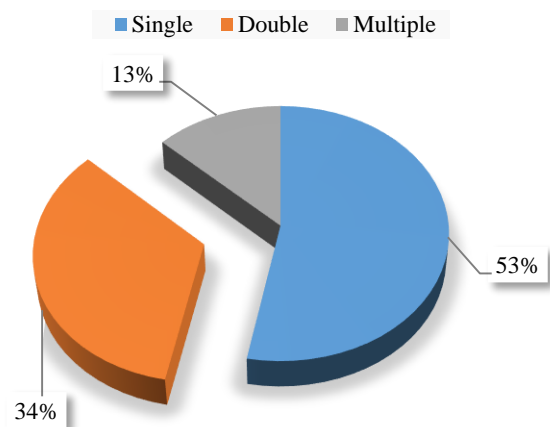


Fig. 7. Plants on the basis of their usage in study area of Tilla Jogian, District Jhelum.

Method of preparation and mode of application: The different plant parts have been used in different recipes prepared by using classical and indigenous cultural methods to treat different diseases. In current study, juice (23%) was most prevalent form of TEM use-form followed by cooking (14%), powder (13%), paste (12%), fodder (6%), extract (6%) and decoction (3%) (Fig. 5).

The most common use of TEMs in form of juice indicates that people like to take TEMs in liquid form that is easy to prepare and engulf. In this recipe sometime local people may add some sugar or salts to reduce its bitter taste. That is also used in previous studies (Mehwish *et al.*, 2019b; Umair *et al.*, 2017). It was found that most of the plant usage was internal (69%) whereas internal and external were 22% and externally applied plants were 9% only (Fig. 6). This is also similar with previous research works conducted by ethnobotanists (Ishtiaq *et al.*, 2017; Mehwish, *et al.*, 2019a; 2019b).

Plant usage-formulation: In the studied area, total 64 plant species were investigated and in the ethnobotanical exploration it was found that these MPs were used as single usage-form (55%), double usage-form (40%) and multi usage-form (15%) (Fig. 7). Out of 64 plant species 48% were single usage, 40% were double usage and 15% were multi usage (Fig. 7).

Lamiaceae was the dominant family of study area. Similar study was conducted by Ajaib *et al.*, (2016) in which 102 plant species were reported from Tehsil Jatlan, District Mirpur, Azad Jammu and Kashmir.

Informant consensus factor (ICF): It describes the common prevalence of different infirmities and plants based herbal medicines used to cure. According to ICF data urinary and renal disorders were ranking 1st (ICF: 0.94) which are the most common diseases in the area, followed by arthritis and joint inflammation (ICF: 0.92) and snake stings and rabies (ICF: 0.89) (Table 5). These findings depict that urinary and other snake cases are common in the rural communities of Tilla Jogian and the study results are coincident with past work Abbasi *et al.*, (2012) who reported 89 ethnomedicinal plant species belonging to 46 families from the region of lesser Himalaya of Pakistan with the maximum consensus factor associated to respiratory and reproductive disorders. In an another study conducted by Kiyani *et al.*, (2014), it reported TEMs uses of 120 plant species belonging to 51 families to treat 25 various respiratory diseases Abbottabad (KPK), Pakistan.

Relative frequency of citation (RFC) and use values (UV): This quantitative tool confirms the significance of each species with reference to number of informants who cited medicinal uses of these plant species. In present study, RFC ranged from 0.97 to 0.02 (Table 4). *Iris aitchisonii* (Baker) Boiss., *Indigofera cordifolia* Roth, *Grewia tenax* (Forssk.) Fiori, *Eclipta alba* L. ex B.D. Jacks., *Calotropis procera* (Aiton) Dryand. and *Portulaca oleracea* L. were the more cited ethnomedicinal plant species. These plants are prevailing in the study area and therefore community of the area is very familiar with them. The plant species with high RFC values confirmed that these plant taxa were of high medicinal potential and also prevalently used in the area. The plants of high RFC values should be selected and subjected to further phytochemical and pharmacological research for novel drug discovery and development to cure chronic and acute diseases.

In present study *Justaica adhatoda* L., *Croton bonplandianus* Baill., *Salvia plebeian* R.Br. and *Mentha spicata* L. etc. have high use-values (UV), with 0.26, 0.17, 0.17 and 0.15, respectively (Table 4). The species with high UV are more exploited in study area to cure a particular disease than those with low UV. This also confirms that these plants have high medicinal importance in local culture and these are easily available in the region. The plants with low UV scores showed that these species are less medicinal or have few number of populations and people are unable to collect for TEMs usage. These studies are confirming the past works of Mehwish *et al.*, (2019b) and Umair *et al.*, 2017.

Table 6. Jaccard's index depicting comparative ethnomedicinal profile of indigenous plants (Tilla Jogian and allied villages of District Bhimber of Pakistan) with other parts of country and world.

Area	Study year	Number of recorded plant species	Plants with similar use	Plants with dissimilar use	Total species common in both areas	Species enlisted only in aligned areas	Species enlisted only in study areas	% of plant with similar uses	% of plant with dissimilar uses	JI
Ziarat District Balochistan, Pakistan	2013	90	1	2	3	87	61	1.11	2.22	2.07
Pir Nasoora National Park Azad Kashmir, Pakistan	2015	104	1	3	4	100	60	0.96	2.88	2.56
Loralai District, Baluchistan	2013	28	3	2	5	23	59	10.71	7.14	6.49
Dinga, District Gujrat, Punjab, Pakistan	2013	50	3	4	7	43	57	6	8	7.53
Tehsil Kharian, District Gujrat	2014	50	5	4	9	41	55	10	8	10.35
Mianwali District Punjab, Pakistan	2007	21	1	1	2	20	63	4.76	4.76	2.47
Central Punjab, Pakistan	2013	35	1	3	4	31	60	2.85	8.57	4.59
District Kotli, Azad Jammu & Kashmir	2014	93	2	5	7	86	57	2.15	5.37	5.15
Pind Dadan Khan, District Jhelum, Punjab, Pakistan	2011	69	7	3	10	59	54	10.14	4.35	9.71
Puna Hills, District Bhimber, AJK	2016	100	3	2	5	95	59	3	2	3.36
Tehsil Jatlan Azad Jammu & Kashmir	2016	102	6	12	18	84	46	5.8	11.7	16.07

Relative importance (RI): RI values of different species was calculated to determine the potential of the plants to cure a number of diseases. The high RI values were obtained for *Calotropis procera* (Aiton) Dryand., *Ocimum tenuiflorum* L., *Tribulus terrestris* L., *Cardiospermum halicacabum* L. and *Solanum incanum* L., (Table 4) demonstrating that these plant species are extensively used in study area. These plant species having high RI values are used to cure many disorders of mankind in the folklore recipes in the rural area of the research target place. Similar study was conducted by Ullah *et al.*, (2013) at Wana District South Waziristan Agency, Pakistan. They investigated that *Xanthium strumarium* had highest use value (RI: 0.95) while *Duchesnea indica* showed low use-value with RI of 0.13. The confined populations of study area had significant familiarity about these plants because they cope most of their needs from these wild plant resources. It was known that RI values increased when information provided by interviewees was enhanced providing that most of plants were being used to treat various infirmities in the indigenous communities of the study area.

Jaccard's index: This index was used to find the novelty and authenticity by comparing the current collected ethnobotanical data of each plant with past conducted EB research in this area, country or world. Thus, it provides coincidence value of the plants explored confirming that this research is in-line with past stated medicinal uses of the plants, hence our findings are also very reliable and authenticated. If its values are low or different from the past reports which is indicator that these plants have not been explored for EB studies and hence these informations properly validated by use of microstatistical quantitative ethnobotanical tools. With due confirmation of TEMs data by statistical analysis provides authentic clues that reported ethnomedicines are novel and future research may be started to find or discover novel drugs to combat the diseases.

Due to dissimilarity in their origins and cultures of native communities, traditional ethnomedicinal knowledge also vary greatly yet these informations of TEMs can result in innovative achievement of drugs formulation. These studies also point out the significance of native familiarity on therapeutic plants with difference among regions arising as a result of chronological, phytochemical and environmental differences. The results of present study were compared with those twelve national and global studies. The statistics showed that across 64 plant species, the resemblance percentage ranged between 10.71 to 0.96 (Table 6) while dissimilarity percentage ranges from 11.7 to 2.0 (Table 6). The highest level of similarity catalog was with previous studies by Ajaib *et al.*, 2014a, Ajaib *et al.*, 2014b and Iqbal *et al.*, 2011 with JI values of 10.71, 10 and 9.71, correspondingly. These studies showed that there are similar flora types and it is also possible that cross cultural exchange of data could have occurred between native communities, either recently or past which also might offer a basis for high resemblance index values. The lowest JI values were for studies conducted by Qureshi *et al.*, 2009 (Table 6). In this study local people of area, i.e. Tilla Jogian collect the medicinal plants and

use them for various ailments for human being as well as to cure the many diseases of their domestic animals. Local community of study areas 90% depends on the livestock as a source of income. Ajaib *et al.*, (2014b) conducted similar studies on the plants of Tehsil Kharian, District Gujrat, whose results are coincident with the current research work.

Among 37 families, family Lamiaceae was the principal family with high number of species, i.e. 9 species. The plant species belonging to different families have high medicinal values and other uses, respectively. In similar study Mehwish *et al.*, (2019b) and Ishtiaq *et al.*, (2013) investigated that wild plants of District Bhimber, Azad Jammu & Kashmir were therapeutically being used by the local population of the area and concluded that wild plants species have tremendous therapeutic potential in Bhimber District of AJK.

Conclusion

Finally, it is concluded that Tilla Jogian and allied areas of District Jhelum are enriched with useful wild therapeutical plants. However, botanic ethnomedicines wealth based areas of Tilla Jogian (District Jhelum) are facing harsh biotic interferences and need to do defense and management by community contribution and other concerned departments involvement. Community contribution can be made feasible by provision of plants knowledge to the local inhabitants and creating awareness compaigns about the useful properties of remedial (medicinal) plants and their business values, so that indigenous people may take ownership and do conservation measures for future use. There is huge potential of wild plants to be explored for further screening using ethnopharmacological approaches to discover novel medico-therapeutic properties and subsequently formulation of novel drugs to combat the emerging resistant strains of bacteria and other pathogens.

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