International Research Journal of Biological Sciences _____E-ISSN 2278-3202
Vol. **5(7),** 68-84, July **(2016)** *Int. Res. J. Biological Sci.*

Ethno-Medicinal Inventory of Khanpur Valley and Some Archeological Sites Reflecting Ancient Gandhara Civilization, District Haripur, Khyber Pakhtunkhwa, Pakistan

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Available online at: www.isca.in, www.isca.me
Received 16th June 2016, revised 24th June 2016, accepted 9th July 2016

Abstract

An ethnomedicinal inventory was carried out during 2012-2013 in Khanpur Valley and some archeological sites reflecting ancient Gandhara civilization, District Haripur, Pakistan. Data pertaining to ethnomedicinal uses and folk recipes of local plants was collected through questionnaires and interviews during field visits. For the purpose local people including men, women, children, knowledgeable persons (Hakims/Pansaries/Traditional healers/ Herdsmen) were approached. As a result 61 important medicinal plants species belonging to 43 families including 20 trees, 18 shrubs, 21 herbs, 1 grass and 1 climber, along with folk medicinal recipes were documented. Detailed information pertaining to botanical name, local name, family, part used, active chemical constituent and ethno-medicinal recipes were also tabulated. The study indicated that medicinal plants of Khanpur Valley are under severe pressure due to deforestation, over grazing, over exploitation and subsequent fires. As a result valuable medicinal plants are getting depleted with alarming rate. Plant specimens collected were identified, preserved, mounted and voucher was deposited at the Department of Environmental Sciences, University of Haripur, KPK, Pakistan for future references.

Keywords: Ethnomedicinal, Gandhara civilization, Khanpur Valley, Deforestation.

Introduction

Man has been utilizing plants since long to fulfill different daily needs to maintain life processes. Plants provide people with food, medicines and fodder for livestock, as well as materials for construction of houses. The plants are used to make crafts, agricultural tools, fuel and many other economically important products[1]. Plant resources provide materials for survival, medicinal, forage values, but also possess and preserve cultural heritages, biological information and indigenous knowledge[2,3]. The history of discovery and use of different medicinal plants is as old as the history of discovery and use of plants for food[4]. Medicinal plants remained the primary source of medicines throughout the world. Any plant or part of a plant like root, stem, leaf, bark, fruit, and seed which contain active chemical constituents in the tissue that produce a definite physiological response in the treatment of various diseases in human and in the animals are called medicinal plants[5]. Plants are essential ingredients for healthier life because they provide us medicines, which are both effective and safe, without any side effect. Plants play a vital role in our lives more than animals mainly due to their extraordinary array of diverse class of bio-chemicals with a variety of biological activities[6,7].

From the history it is revealed that the ancient people used medicinal plants for treatment of various diseases[8]. The use of medicinal plants and herbs for the medicines is universal phenomenon and almost every nation and every country of the world had utilized medicinal plants as traditional medicines due to their therapeutic property[9]. Our Holy Prophet (Peace Be Upon Him) also used certain herbs to cure various diseases[10]. Literature regarding the research were reviewed[11-15]. The aim of the present study was to record medicinal knowledge and folk recipes of plants used by the local and ethnic communities living in the Khanpur Valley especially around the various archeological sites reflecting great ancient Gandhara civilization.

Study area: Khanpur valley (also Upper Khanpur or Hilly area of Khanpur) is the part of Harro Valley situated in District Haripur of Khyber Pakhtunkhwa, Pakistan. Khanpur itself is a beautiful large village in Valley and one of the 44 union council administrative subdivisions of Haripur District.It is located to the south of the District Capital Haripur at 33°48'53N 72°56'22E, and about 30 km from Islamabad in a beautiful green hilly place. It is famous throughout Pakistan for its Oranges and is also known for the Khanpur Dam. There are also various archeological sites in the Valley, which reflect great ancient Gandhara civilization. Major ethnic groups like Ghakhars, Gujars, Awan (sub sections Kutab Shais, Khokhars, and Chuhans), Jadoon, Syeds, Qureshi, Abbassi, Karrala,

Dhunds, Tareen are scattered in the area. Pictures of some important sites of study area were also taken as shown in Figure-1.

Methodology

Ethnobotanical Survey: Study area was frequently visited during January 2012 to January 2013. The main target sites in the study area were Khanpur, Bahmala, Joulian, Choi, Garmthun, Najafpur, Rajdhani, Khoi Kaman, Dartian, Babotri, Daboola, Baghpur dehri, Shah Kabul, Nilan Bhoto, Bees ban, Hali, Desra and Kohala Lassan. Information regarding ethno-medicinal uses of local plants was collected through well planned questionnaires and interview method. Questionnaire method was also helpful in documentation of folk indigenous knowledge. The interviews were conducted in local community, to investigate local people and knowledgeable persons (Hakims, Pansaries, Women and Herdsmen) who are the main user of medicinal plants. Plant specimens were collected, pressed, dried, preserved, mounted and identified through the available literature[16]. The specimens were deposited in the Herbarium, Department of Environmental Sciences, University of Haripur, Khyber Pakhtunkhwa, Pakistan.

Informant Consensus Factor (ICF): Informant consensus factor (ICF) was also calculated to determine the disease systems where there was highest consensus on plants used in treatments. Disease systems with 2 or fewer respondents were not considered when performing the ICF analysis. The ICF was calculated by using the following formula[17].

ICF = N-T/N-1

Where: "N" = Number of respondents mentioning a disease, and 'T' = Number of plant species mentioned for the disease.

Results and Discussion

During the present study, data on 61 ethno-medicinally important plant species belonging to 43 families and distributed in 56 genera, including 20 trees, 18 shrubs, 21 herbs, 1 grass and 1 climber were collected. The most dominant families of the study area were Lamiaceae (4 species), Moraceae (4 species), Apocynaceae (3 species), Solanaceae (3 species), Amaranthaceae (2 species), Apiaceae (2 species), Euphorbiaceae (2 species), Fabaceae (2 species), Malvaceae (2 species), Meliaceae (2 species), Mimosaceae (2 species), Rhamnaceae (2 species). Detailed information about each plant pertaining to botanical name, local name, family, part used and ethno-medicinal/folk recipes are listed in Table-1. It was also explored that almost every plant part is used as medicine in study area. Pictures of some important plants were also taken as shown in Figure-1.

Informant consensus factor (ICF) for disease system*:* Informant consensus factor (ICF) was also calculated for these 61 medicinal plant species and listed in Table 2, to analyze the potential and efficacy of these plants. It determines the disease systems where there was highest consensus on plants used in treatments as shown in Figure-3. Disease systems with 2 or fewer respondents were not considered when performing the ICF analysis. High consensus factor (close to 1) means that people are confident in the choice of plant. Whereas a low ICF (close to 0) means that the people are still testing and that the treatments may not be effective[18]. Only disease where 3 or more respondents mentioned herbal medicines were described.

Discussions: Man has been dependent on plants for various needs since time immemorial as all ancient and modern people have used plants as a source of medicines[19]. In Indo-Pak first record of plant medicine were compiled in Rig Veda between 4500-1600 BC and Ayurveda, 2500-600 BC. This system traces its origin to Greek medicine, which was adopted by Arabs and then spread to India and Europe[20]. Pakistan has about 6,000 species of wild plants of which about 400-600 are considered to be medicinally important[21]. There is a still great trend of using plants as medicines in Pakistan especially in rural areas of the country. About 80% population of the world depends on the traditional system of health care[20]. These medicines have less side effects and man can get it easily from nature.

In ancient times, people had knowledge of medicinal plants. Several hundred species were used as herbal remedies in indigenous system of medicines that used the whole plant or an extraction. Local people and practitioners with traditional knowledge collected these medicinal plants. Most were not involved in the trade of medicinal plants.

The local people had a little knowledge about the species and proper time of collection[22]. Our Holy Prophet (Peace Be Upon Him) also used certain herbs to cure various diseases[10]. The traditional knowledge on the uses of plants as medicines is mainly passed on verbally from generation to generation.

Remedies for different diseases: Present study revealed 61 plant species which are being utilized medicinally in Khanpur Valley of District Haripur, Pakistan. One hundred and forty seven remedies were those that use single plant while 8 use more than one plant. Local inhabitants use 31 remedies for digestive system related disorders followed by 21 remedies for respiratory system related disorders, 30 remedies for skin related problems, 16 remedies for circulatory system/blood related disorders, 14 remedies each for diabetes and fever, 13 remedies for jaundice/hepatitis, 10 remedies for mouth/oral cavity related problems, 11 remedies for rheumatism, 6 remedies each for bleedings and hemorrhoids/piles, 5 remedies for reproductive system/sex related disorders, 3 remedies each for headache and animal bites, 2 remedies each for backache and cooling effect, 1 remedy for typhoid and 8 remedies as tonic to liver, kidney, stomach and heart. The informant consensus factor (ICF) also reflected disease systems where there was highest consensus on plants used in treatments.

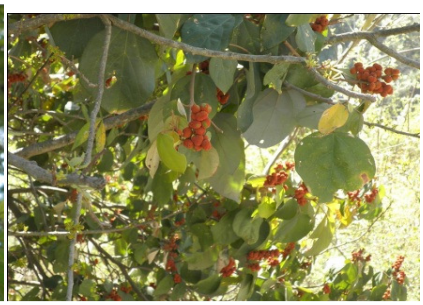

Adhatoda Vasica Nees


Berberis lycium Royle


Datura stramonium L.

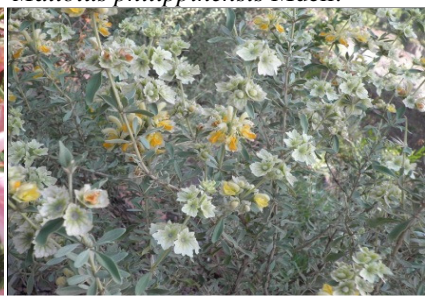

Dodonaea viscosa (L.) Jacq.


Ficus benghalensis L.


Mallotus philippinensis Muell.


Morus nigra L.


Nerium indicum L.


Otostegia limbata Benth


Pistacia integerrima


Punica granatum L.


Rubus fruticosus L.


Solanum nigrum L.


Vitex negundo L.


Zanthoxylum armatum DC

Figure-1
Pictures of some medicinal plants of Khanpur Valley

Table-1
Ethnomedicinally important flora of Khanpur Valley

S. No	Botanical Name	Local Name	Family	Habit	Part used	Ethnomedicinal uses/Folk recipes
1.	*Acacia modesta Wall.*	Phulai	Mimosaceae	Tree	Ba, W, L, G , T	For backache and post-delivery use: Gum obtained from bark is grinded and mixed with wheat flour and then fried in "*desi"* ghee. This is locally called "*Halwa*" and given in backache, especially to women after delivery. For gum bleedings and tooth decay: Twigs are used as *masvak*. For mouth boils: The decoction of bark is gargled, this is practiced several times a day. For rheumatism: 1-3 gram powdered wood is taken with water for few days. For blood disorders, Abscesses, boils and adulthood poxes: Half spoon powdered leaves are taken with water for few days or leaves are dipped in mud pot and this water is drunk at night.
2.	*Acacia nilotica*(L.) Delile.	Kikar	Mimosaceae	Tree	Fl, L, G	For *spermatorrhoea, nocturnal emission,likoria, uterus infections,* gum bleedings, nose bleedings and *hemorrhoids: 1-3 grams powdered flowers and leaves are taken with water in morning and evening. For stomach ulcer: 1-2 gram powdered gum is taken with milk or water.*For jaundice and hepatitis: 10 grams flowers are grinded and added in 1 glass of water. 3 cup of such juice is drunk every day for 40 days. For cough and bronchitis: Wheat starch is fried in ghee. White sugar and powdered gum obtained from this plant is added to this starch. Several tablets are made by adding a drop of water. These are stored and one tablet is eaten 10 times a day.
3.	*Achyranthes aspera* L	Puth-Kanda, Lehndi booti	Amaranthaceae	Herb	T, R, L	For chronic cough, throat infection and asthma: Whole plant or twigs are fried over the fry pan, honey or sugar in powdered form is added in same quantity. 1-2 gram of this is taken 3-4 times a day. For tonsillitis: Fresh root paste is applied externally twice a day for 1 week. For pneumonia: 2-3 leaves are boiled in 500 mL of water. This water is cooled and 1 spoon is taken twice a day.
4.	*Adhatoda vasica* Nees.	Bhaikur/ Arusa	Acanthacea	Shrub	L, Fl, R	For blood purification, diabetes, jaundice, pimples, toothache, cough and asthma: Leaves are crushed in water and juice so formed is filtered and taken ½ cup 2 times a day. For

S. No	Botanical Name	Local Name	Family	Habit	Part used	Ethnomedicinal uses/Folk recipes
						tuberculosis: 500 grams leaves are crushed and boiled in 2 liters water, till it is left to half. It is taken with honey 4 times a day, for15 days. For skin wounds: Leaves in powdered forms are applied. For pneumonia, asthma, cough, phlegm, throat infection: 2 cup of flower tea is used twice a day or flowers are grinded, honey is added and 10 grams taken with water. For diabetes: 1-3 gram roots are taken in empty stomach with water at morning and evening.
5.	*Ailanthus altissima* (Mill) Swingle	Darawa	Simarubaceae	Tree	Ba	For dysentery and diarrhea: ½ cup of Juice of bark is mixed with same quantity of milk and taken.
6.	*Allium sativum*Linn.	Thoom	Alliaceae	Herb	Bu	For toothache: 2 cloves are heated over the fry pan and chewed. For abdominal pain: 2 cloves are taken with water after meal. For high blood pressure and cholesterol level: 5 gram taken with meal. For rheumatism: 50 grams is fried in sweet oil. Then this oil is filtered and stored. This oil is used in any sort of rheumatism. For better result mild heated oil is used. For animal and insect bites: it is grinded in vinegar and made into paste, this is applied.
7.	*Aloe barbadensis* Mill.	Kanwar-ghandal	Liliaceae	Herb	Ge, L	For blood purification, constipation, intestinal worms, poor appetite, phlegm, pneumonia, diabetes and face pimples: Leaf gel is burnt over the fry pan and taken 1-3 gram with water at night. For hair dandruff: Gel of the leaves is applied for 3-4 hours and then washed with shampoo, after every week. For wounds, burns and other skin problems: Gel of leaves burnt over the fry pan and applied externally.
8.	*Althaea officinalis*Linn.	Khatmi	Malvaceae	Herb	L, S, Fl	For chest phlegm and constipation: Leaves are cooked as vegetable and eaten. For cough, cold, flu, chest infection, seasonal fever and tonsils: 1 cup of seed tea or leaf tea is used 3 times a day. For *Rectal bleedings*: 3-5 gram powdered leaves are taken with water. For skin burns: Powdered flowers and leaves are applied.
9.	*Amaranthus viridis Linn*.	Chulari	Amaranthaceae	Herb	WP	For abdominal troubles, pains and gases, perennial constipation*and gastritis: Leaves and twigs are cooked as vegetable and eaten.*For dysentery:

S. No	Botanical Name	Local Name	Family	Habit	Part used	Ethnomedicinal uses/Folk recipes
						½ cup of decoction of whole plant is taken 3-5 times a day. For ripeness of abscesses and boils: The upper surfaces of leaves are smeared with mustard oil, warmed gently and applied.
10.	*Artemisia vulgaris* L	Afsanteen	Asteraceae	Herb	T	For hepatitis and fever: 3 gram powdered twigs are taken with water 3 times daily till recovery. For prevention from harms of mosquitos: It is mixed in olive oil and massage on the body.
11.	Azadirachta indica Adr. Juss.	Nim	Meliaceae	Tree	L, Fr, S, Fl	For blood purification, skin pimples, boils and Abscesses, diabetes and intestinal worms: Leaves are dipped in water at night. In morning one spoon of this water is taken. For Diabetes: 1 spoon of dried powdered fruit is taken with water every day. For same, fresh flowers are eaten as much as easily possible, 3 times a day. For *hemorrhoids and constipation: 1-3 grams powdered seeds are taken with water.*For itching: 2 kg fresh leaves are boiled in water, cooled and bath taken with it for 3-4 days. For Hair dandruff: 300 gram fresh fruit is grinded and made into paste and applied on hair for 3-4 hours, then washed with shampoo, this is repeated for a week.For feet smell: Leaves are boiled in water, and feet are washed with this water.
12.	*Bauhinia variegata*Linn.	Kalyarh, kichnar	Caesalpinaceae	Tree	P, R, Fl	For stomach pain: 1-3 gram young powdered pods are taken with water twice a day. For stomach gases and dyspepsia: Half spoon of decoction of root is taken. For piles and dysentery: 3-5 grams dried powdered flowers and buds are taken with water. Young flowers are also cooked as vegetable.
13.	Berberis lycium Royle	Sumbul	Barberidaceae	Shrub	Ba, R, Fr	For constipation, rheumatism andabscesses: 10 gram powdered bark is taken with milk at morning and evening.For mouth boils, throat pains and internal wounds: 1-3 gram of dried powdered root is taken with water. For dysentery: 3-5 gram powdered bark is taken with water. For typhoid and fever: ½ cup of decoction of fruit is used twice a day.
14.	Calotropis procera (Ait.) Ait. f.	Ak	Asclepiadaceae	Shrub	L, Fl, La	For rheumatism and paralysis: Leaves are cooked in ¼ liter water and 100 gram sesame oil (til oil) till only the oil left. This oil is then used. For asthma: Above prepared oil is mixed with

S. No	Botanical Name	Local Name	Family	Habit	Part used	Ethnomedicinal uses/Folk recipes
						turmeric (haldi) and used externally. This oil also act as antiseptic. For cold, flu, pneumonia and chest congestion: 1 spoon of powdered flowers is mixed in 5 spoons of honey and taken 3 times a day. For stomach pain: 1-3 gram of powdered flowers is taken after having meal for once only. Pain will be relieved. For toothache: Leaves are burnt and ash is placed on the affected tooth. Pain will be relieved within 5-10 minutes. For removal of thorn of any plant: Just 2-3 drops of milk of this plant is poured 2-3 times a day. The thorn will come out within a day.
15.	*Cannabis sativa* L.	Pang, bhang	Cannabinaceae	Sub-shrub	L	For rheumatism: 1-3 gram dried leaves are taken with water. For cooling effect: Leaves are crushed in water, then almonds in grinded form are added. This drink is taken once only. For wounds: leaves are bound over the wound. This plant is also mosquito repellent. (Note: This plant has narcotic action hence should be administered carefully).
16.	*Caralluma edulis* (Edgew.) Bth ex HK.f.	Chong	Apocynaceae	Herb	S.S	For diabetes: succulent stem is cooked as vegetable and eaten or 1 cup of juice of stem is taken 3 times a day.
17.	*Carissa opaca Stapf ex Haines*	Grinda	Apocynaceae	Shrub	R, L, Fr	For jaundice: ½ cup of decoction of root is used twice a day. For diabetes: 1 cup of decoction of leaves is used twice a day. Fruit is eaten which is tasty.
18.	*Casia fistula* Linn.	Kinjal, Amaltas	Fabaceae	Tree	P, Ba, R	For constipation: Pulp of pods is mixed in mild heated milk and taken OR pulp is boiled in water and drunken 1 glass daily till recovery. This decoction is also used for pneumonia. For Hepatitis and Jaundice: 25-30g of bark is boiled in 1 liter of water until the color turned yellowish and cooled. 1 glass drunk twice a day for 40 days. For fever: 10 gram roots are boiled in water and 1 glass drunken daily for few days.
19.	*Celtis australis*auct. non L.; Brandis	Batkhar	Ulmaceae	Tree	L, Fr	For stomach problems: 3-5 grams of powdered fruit is taken with water. For diarrhea and dysentery: ½ cup of decoction of both leaves and fruit is used twice a day.
20.	*Centella asiatica*L.	Barhami booti	*Apiaceae/*Umbellif erae	Herb	L	*To enhance beauty, eyesight, memory and sound quality: Leaves are made into fine powder and taken half spoon*

S. No	Botanical Name	Local Name	Family	Habit	Part used	Ethnomedicinal uses/Folk recipes
						*with water or milk.*This also help thickens semen and prevent*spermatorrhea.*
21.	*Cissampelos pareira*Linn.	Phalaan jarhi, Ghora-sum	Menispermaceae	Climb-er	L, R	For itching and wounds: Leaves are crushed and applied. For dyspepsia and diarrhea: ½ cup of decoction of root is used twice a day.
22.	*Coriandrum sativum* Linn.	Dhania	Apiaceae	Herb	L, S	For high blood pressure: 5 gram leaves of *Coriandrum sativum* and 5 gram leaves of *Mentha arvensis are crushed and made into "Chatni" and taken.For brain strength and As appetizer and antacid: 1-3 grams powdered seeds are taken with water.*
23.	*Cynodon dactylon*L.	Khabal	Poaceae	Grass	WP	For nose and wound bleedings: Plant is crushed and made into paste and applied. For bleeding piles, vomiting and irritation of urinary organs: 5-10 gram powdered leaves are mixed in milk and used.
24.	*Dalbergiasissoo Roxb. Ex DC*	Taali, sheesham	Papilionaceae	Tree	L	For strength and shine to hairs and as anti-dandruff: Leaves are boiled in water and hairs are washed with this water. For abdominal worms: ½ cup leaf tea is used 2 times a day. For hotness of body: 10-20 g fresh leaves are grinded in 200-250 mL water, after filtration 1 cup is taken daily.
25.	*Datura stromonium* L.	Datura	Solanaceae	Herb	S, Fl, L, Fr	For strength to heart, brain, stomach and good sleep: It is not used directly as it is poisonous plant, but powdered seeds are taken 1-2 gram only mixed in 3 spoon honey, twice daily for 3 days. For hemorrhoids: Flowers and leaves are powdered, and used as ointment. For earache: One drop of juice of the flower is used at night. For scalp, dandruff and hair fall: Juice of the fruit is applied eternally on hairs then washed.
26.	*Diospyros lotus* Linn.	Amlok	Ebenaceae	Tree	Fr	For chest phlegm, muscle strength, to warmth body and as carminative: Fruit is eaten which is also tasty.
27.	*Dodonaea viscosa* (L.)Jacq.	Sanatha	Sapindaceae	Shrub	L, B	For diabetes: 2-4 gram powdered leaves are taken with water daily. For broken bones, skin boils and wounds: leaves are used as bandage with cloth. Powdered leaves are also applied over the wounds. For Hepatitis and Jaundice: ½ Kg barks is boiled in 2 liters of water till the color turned yellowish. Water is filtered and, 1 glass is drunk in fasting in every

S. No	Botanical Name	Local Name	Family	Habit	Part used	Ethnomedicinal uses/Folk recipes
						morning for 7 days.
28.	*Ficus benghalensis* L.	Bur	Moraceae	Tree	Aerial, R, La	For lowering high blood pressure: Aerial roots along with *Allium sativum* and vinegar are grinded and boiled. 2 spoons of this extract are taken daily.For Hepatitis and Jaundice: 1 kg of roots is boiled in 5 liters of water till the color changes to reddish. After filtration, 1 glass of this water is drunk twice a day for 35-40 days. For rheumatism: Milky juice is applied externally.For toothache: Aerial roots are used as "*masvak"* (tooth brush).
29.	*Ficus carica* L.	Anjeer	Moraceae	Tree	Fr	For blood production, good skin color, kidney efficacy, constipation, digestive troubles and hemorrhoids: fruit is dip in water at night, in morning this fruit (5 in numbers) is eaten as first food. As stomachic: fruit is eaten with honey. To pull out spine: Milky latex is also poured over the wound.
30.	*Ficus palmate* Forsk	Phagwari	Moraceae	Tree	Fr	For headache, constipation, blood deficiency, attractive skin color and stomach gases: Fruit is dip in water at night, in morning this fruit (5 in numbers) is eaten as first food.
31.	*Grewia optiva* J. R. Drumm. ex Burret	Taman	Tiliaceae	Tree	B	For constipation and smooth delivery: ½ cup of extraction of bark is given to relieve constipation and also to pregnant women for smooth delivery. Leaves are fed to cattle for better milk supply and quantity.
32.	*Mallotus philippensis (Lam.) Muell. Arg*	Kamila	Euphorbiaceae	Tree	Fr, S	For abdominal worms: ½ cup of decoction of fruit is taken twice only OR 1-3 gram powdered seeds are taken with water. For colic pain: 1 cup of powdery coat of fruit mixed with water is used for one week.
33.	*Malva sylvestris*Linn.	Khabazi	Malvaceae	Herb	L, Fl	For cold, flu, throat infection, chest phlegm and asthma: 2-3 gram dried powdered leaves are taken with mild heated water OR 1 cup leaf tea is taken 2-3 times a day.
34.	*Melia azedarach* L.	Daraik	Meliaceae	Tree	L, Fr	For diabetes, skin pimples, earache and as anthelmintic: ½ cup of leaves juice is taken once in a day. For elixir to stomach and kidney, lowering high blood pressure and haemorhoids: ½ spoon of powdered fruit is taken at night with water.For burns and mouth wash:

S. No	Botanical Name	Local Name	Family	Habit	Part used	Ethnomedicinal uses/Folk recipes
						Fresh leaf extract is applied externally in burns, and also used as mouth wash.
35.	*Menthaarvensis L.*	Podina	Lamiaceae/Labiatae	Herb	L	For dysentery: 10 gram dried powdered leaves are taken with curd. As blood purifier, carminative, diuretic and stomachic and appetizer: "Chatni" is made by crushing the leaves and eaten with meal. For fevers, headaches, digestive disorders, vomiting, nausea and obesity: Leaf tea is taken several times a day.
36.	*Mentha longifolia* L.	Chita podna	Lamiaceae/Labiatae	Herb	L	As elixir to liver and kidney, carminative and antacid: 1-2 spoon dried powdered leaves are taken with water for 3 times a day. For fevers, dysentery, vomiting and nausea: Leaf tea is taken several times a day.
37.	*Morus nigra* Linn.	Toot	Moraceae	Tree	Fr	For throat infection, tonsillitis, sound quality, cough, cold and flu: Fruit is dried and stored. Dried 5-10 gram fruit is taken into mouth and sucked or eaten 4 times a day.
38.	*Myrsine africana* L.	khokonr	Myricinaceae	Shrub	Fr, L	For backache, rheumatism, cough, improving digestion and as anthelmintic: Fruit is eaten or made into fine powder and taken 5 gram with water or milk 3 times a day. For blood purification: leaves are cooked as vegetable and eaten.
39.	*Nasturtium officinale* R. Br.	Tara meera	Cruciferae	Herb	L	For blood purification, herpes, *psoriasis, skin beauty, constipation, diuretic and obesity: 3-5 grams dried powdered leaves are taken with water daily or leaves are cooked as vegetable and eaten.*
40.	*Nerium oleander L.*	Kundair	Apocynaceae	Shrub	L, Fl, R	For scabies and external swellings: Decoction of leaves is applied. For asthma: Flowers dried in sun are smoked.For scorpion bite: Paste of root is applied over the wound. Sometime twigs are used as "masvak" (tooth brush) to clean the teeth. (It is poisonous hence may be used carefully).
41.	*Ocimum basilicum* L.	Niaz-bo	Lamiaceae/Labiatae	Herb	L, Fl, S	For skin care: Leaves are crushed and applied on skin or leaf juice is applied. For cough: flowers along with black peppers are grinded and made into tablets, 3 tablets are given to children in a day. For stomach ulcer, acidity and warmth of hands and feet: 3 gram powdered seeds are taken with water 3

S. No	Botanical Name	Local Name	Family	Habit	Part used	Ethnomedicinal uses/Folk recipes
						times a day. For feverish illnesses (especially colds and influenza) and poor digestion: Leaves and flowering tops are taken internally or locally "*chatni*" is made and used.
42.	*Olea ferruginea* Royle.	Kaho	Oleaceae	Tree	L, F, T	For blood purification, herpes, boils, pimples, hemorrhoids, diabetes and rheumatism: 5-10 gram of powdered leaves are taken with water 3 times a day OR leaf tea is used 1 cup twice a day. This recipe also has cold effect. For mouth boils: Young twigs are chewed under teeth. For throat problems and toothache: The decoction of leaves is used as gargle. Soft branches/twigs are also used as "*Masvak*" (tooth brush) for toothache. For diabetes: fruit is often eaten to cure diabetes.
43.	*Otostegia limbata* (Bth.) Boiss	Chita kanda, bamboli	Lamiaceae	Shrub	WP	For wounds: Whole plant is powdered, mixed in butter and applied.
44.	*Oxalis corniculata* Linn.	Khat-matra	Oxalidaceae	Herb	L	For jaundice: Fresh leaves are crushed, mixed in water, sugar is added, and 1 glass of this juice is drunk daily after filtration. For skin inflammations: Powdered leaves are applied as poultice.
45.	*Phyllanthus emblica* L.	Amla	Phyllanthaceae	Tree	Fr	As appetizer and for fever: Fruit is cooked in "*lassi*" (yogurt-based drink) and eaten as meal. For shine, strength and conditioner to hairs: Hairs are washed with decoction of fruit, or fruit oil is applied on hair.
46.	*Pinus roxburghii* Sargent	Chir	Pinaceae	Tree	W, Re	For skin complaints, burns, boils, wounds, hair removal and rheumatic affections: Resin is applied externally.
47.	*Pistacia integerrima*	kangur	Anacardiaceae	Tree	Ga, Ba	For dysentery: Galls are powdered, fried in ghee, and 1 spoon taken internally. For jaundice: ½ cup of decoction of bark is used daily for few days.
48.	*Punica granatum* L.	Daruna	Punicaceae	Shrub or small tree	Fl, Fr, S, R, R.B	For blood production, jaundice and fever: ½ cup of fruit juice is taken twice daily. For tonic to stomach, liver and heart: Tea is made from 5 gram fruit and 1 cup used in a day. As appetizer: Fruit fresh or dried is used to make "*chatni*" (grounded form with some other kitchen herbs like mint) and eaten with meal. For gum bleedings: Dried powdered flowers are used as tooth powder.

S. No	Botanical Name	Local Name	Family	Habit	Part used	Ethnomedicinal uses/Folk recipes
49.	*Riccinus communis* L.	Arand	Euphorbiaceae	Shrub	S	For prolonged constipation: I spoon of seed oil is mixed in 1 cup of mild heated milk and drunk twice only OR 1-3 gram powdered seeds are taken with milk. For rheumatism: seed oil is applied externally.
50.	*Rubus fruticosus* L.	Garacha	Rosaceae	Shrub	L, Fr	For diarrhea, cough, and fever and as diuretic: ½ cup of decoction of old leaves is taken for few days. As carminative: Fruit which is edible eaten as carminative.
51.	*Sageretia thea* (Osbeck) M.C	Gangeeri	Rhamnaceae	Shrub	Fr	For diabetes, kidney stone, rheumatism, vomiting and stomach weakness: ½ spoon of dried powdered fruit is taken with water in evening and morning daily.
52.	*Solanum nigrum* L.	Kach mach	Solanaceae	Herb	WP	For asthma: Leaves are dried in shade and used just as green tea, 3-4 cups are drunk in a day. For wound and boils: Powdered leaves, stems and roots are used externally as a poultice.
53.	*Solanum surattense* Burm. f.	Mohkree	Solanaceae	Herb	WP	For diabetes: 1-3 gram ripe yellow powdered fruit is taken with water early in the morning before breakfast. For chronic fever: 10 gram dried leaves are boiled in ½ liter of water till the color changes. ½ cup is taken twice daily. For skin infection: Whole plant is dried and made into powder, and applied on the skin infected area.
54.	*Tamarindus indica* L.	Imli	Fabaceae/Leguminosae	Tree	Fr, S, R.B	For hepatitis, jaundice and *Spermatorrhea*: One glass of fruit juice is drunk in fasting every day. For fever and liver tonic: Juice of pulp is drunk daily. As appetizer, stomachic and thickening of semen: 10 gram fruit is eaten daily.
55.	*Tribulus terrestris* L.	Gokhru	Zygophyllaceae	Herb	L, Th	For itching and retention of urine: 5-8 gram thorns are boiled in 1 glass of water with some sugar for taste. 1 cup of this water is taken. For male sexual weakness and "juriyan": 7-10 gram leaves are dipped in 1 glass of water for 2 minutes only. This is drunk for 3 times a day.
56.	*Trichodesma indicum* (L.) R. Br.	Kali booti	Boraginaceae	Herb	R, L	For Jaundice, fever, liver tonic, and anti-snake venom: ½ cup of decoction of leaf is taken twice in a day. Leaf bandage is also effective in snake bite.
57.	*Viola odorata* L.	Ba-nafsha	Violaceae	Herb	S, L, Fl	For cough, cold, flu, chest phlegm, constipation, good sleep and tonic to brain: leaves are grinded into fine powder and tea is made from it, honey

S. No	Botanical Name	Local Name	Family	Habit	Part used	Ethnomedicinal uses/Folk recipes
						is added and drunken 2 to 3 times a day.
58.	*Vitex negundo* Linn	Marvand	Verbenaceae	Shrub	T, L	For abdominal discomfort: Leaves dried in shade are made into powder. 2-3 g of this powder is taken without water twice a day. For flu: Dried leaves are taken as normal green tea for 2-3 times a day.For headache: Leaves are smoked to relieve headache.Branches are also used as tooth brush (*Maswak*).
59.	*Woodfordia fruticosa* (L.) S.Kurz.	Taawi, dhawi	Lythraceae	Shrub	Fl, L	*For Leukorrhea,*Spermatorrhea and uterine tonic: ½ spoon of powdered flower is taken with water 3 times a day. For skin diseases: Poultice of leaves is applied externally.
60.	*Zanthoxylum armatum DC*	Timber	Rutaceae	Shrub or tree	S	For stomach problems and to improve digestion: The seeds are dried and grinded, mixed with the powdered leaves of *Mentha*, and salt is added. This is taken 3-5 grams daily. For constipation, blood purification, face color, obesity and diabetes: 3-5 gram fruit is taken daily with water or fruit is used as "*chatni*". For jaundice: 1 cup of juice of both fresh and dried seeds is taken in morning and evening. As conditioner for hair: seeds are grinded, mixed with egg and then women washed their hairs with this.
61.	*Ziziphus nummulariaBurm.*	Beri	Rhamnaceae	Shrub	L, Fr	For wounds: leaves are grinded and made into paste and applied on wounds. For mouth and gum bleedings: Leaves are boiled in water, and gargled several times a day. For chronic fever: 10 gram roots are boiled in 1 glass of water till the volume of water reduced to half, ½ cup of this water is taken twice a day. For thirst and cooling effect: Fruit is eaten which is also tasty.

Key: Ba: Bark, Bu: Bulb, Fl: Flowers, Fr: Fruit, G: Gums, Ge: Gel, Ga: Gall, L: Leaves, La: Latex, P: Pods, R: Roots, R.B: Root bark, Re: Resin, S: Seeds, St: Stem, SS: Succulent stem, T: Twigs, Th: Thorns, W: Wood, WP: Whole plant

Plant parts used: People of the Khanpur Valley use different parts of the plant as medicine. Among these parts, leaves were most frequently used (70) for the treatment of various ailments followed by fruit (29), flowers (17), roots (13), seeds (12), bark (9), twigs (7), whole plant (4), gum and latex (4) and stem (2).

Methods of preparation: The methods of preparation fall into 6 categories viz. plant parts used as powder and grinded form used internally or externally (54), decoction/boiled form (33), directly eaten (16), as tea (11), cooked (8), paste/ointment/poultice (13). These treatments involves both internal and external uses.

Table-2
Informant consensus factor (ICF) for diseases by respondents from Khanpur Valley

S.No	Disease	I.C.F
1	Digestive system related disorders	0.94
2	Respiratory system related disorders	0.92
3	Skin related problems	0.90
4	Mouth/oral cavity related problems	0.80
5	Rheumatism	0.74
6	Jaundice/hepatitis	0.72
7	Backache	0.70
8	Circulatory system/blood related disorders	0.67
9	Diabetes	0.66
10	Fever	0.65
11	Reproductive system/sex related disorders	0.62
12	Cooling effect	0.58
13	Typhoid	0.54
14	Tonic to liver, kidney, stomach and heart	0.52
15	Hemorrhoids	0.48
16	Headache	0.46
17	Bleedings	0.42
18	Animal bites	0.34

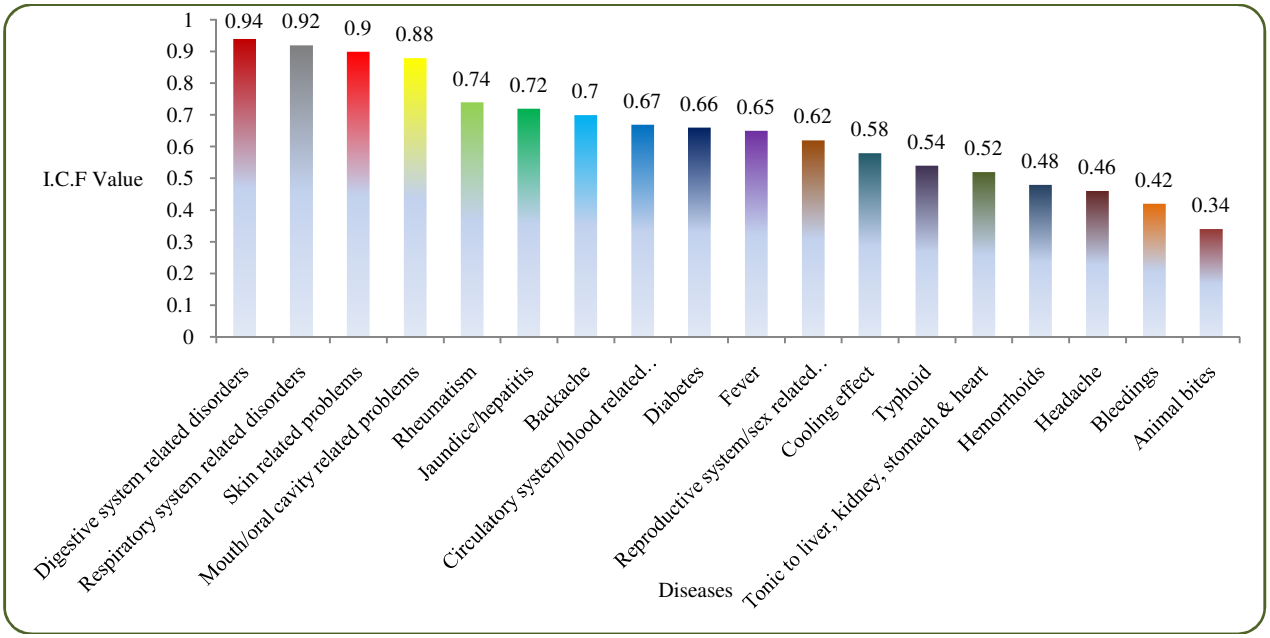


Figure-3
Informant Consensus factor for disease system

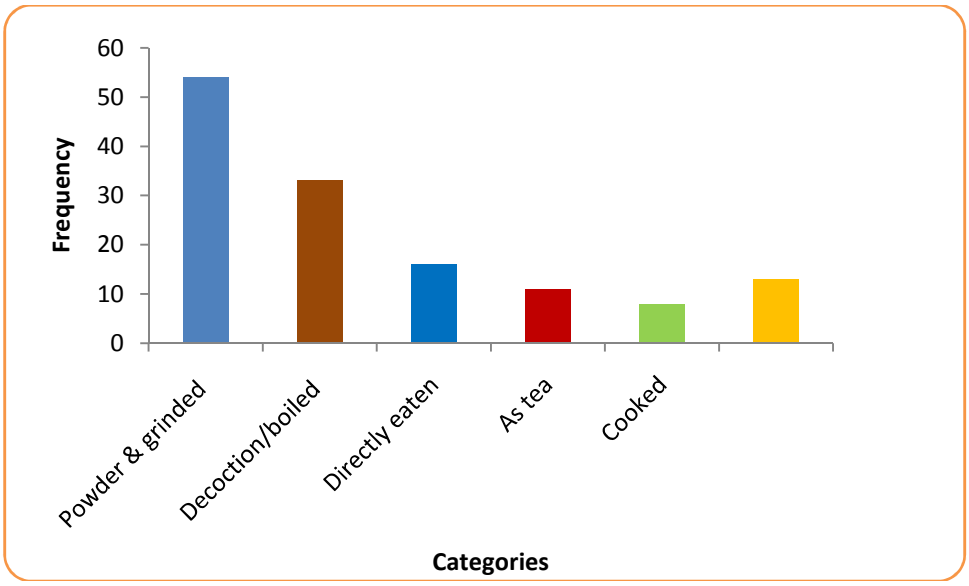


Figure-4
Methods of preparation

Multiple medicinal uses: Almost all the reported plants of Khanpur Valley have multiple medicinal uses. For example; *Adhatoda vasica* (blood purification, diabetes, jaundice, pimples, toothache, cough, asthma), Berberis lyceum (constipation, rheumatism,abscesses), *Casia fistula* (constipation, hepatitis, jaundice, fever) and *Celtis australis* (stomach problems, diarrhea, dysentery) etc. Mostly remedies consisted of single plant part and more than one method of preparation. For example; 5 gram bulb of *Allium sativum* are taken with meal for high blood pressure and cholesterol level, oil of bulb for rheumatism, bulb are grinded in vinegar and paste is applied for animal and insect bites. Leaf gel *Aloe barbadensis* is burnt over the fry pan and taken internally for blood purification, constipation, intestinal worms, poor appetite, phlegm, pneumonia, diabetes and face pimples, gel is applied externally over the wounds, burns and in other skin problems. Twigs of *Artemisia vulgaris are powdered and used for* hepatitis and fever, twigs are also mixedin olive oil and massage on the body for prevention from harms of mosquitos. Dried leaves of *Cannabis sativa* are taken for rheumatism; leaves are also bound over the wound. Leaves of *Dalbergiasissoo* are boiled in water andhairs are washed with this water for shine and strength, leaf tea is used for abdominal worms, fresh leaves are grinded water and drunk for hotness of body. Fruit of *Ficus carica* is dip in water at night and taken with water in morning for blood production, good skin color, kidney efficacy, constipation, digestive troubles and hemorrhoids, fruit is also eaten with honey as stomachic. Powdered leaves of *Menthaarvensis are* taken with curd for dysentery; leaf tea is taken for fevers, headaches, digestive disorders, vomiting, nausea and obesity, "Chatni" of leaves is used as blood purifier, carminative, diuretic and stomachic and appetizer. Juice made from fresh leaves of *Oxalis corniculata* is used for jaundice, powdered leaves are applied as poultice for skin inflammations. Fruit of *Phyllanthus emblica is cooked and eaten as* appetizer and for fever, hairs are washed with decoction of fruit for shine and strength. Powdered seeds of *Riccinus communis* are taken with milk for prolonged constipation, seed oil is applied in rheumatism. Similarly dried seeds of *Zanthoxylum armatum are mixed with powdered leaves of Mentha and taken to improve digestion, fruit is taken with water for obesity, blood purification, diabetes and constipation, and grinded seeds mixed in eggs are useful for hairs.*

Comparative analysis with published literature: Comparative analysis shows that ethnomedicinal uses of plants of Khanpur Valley may or may not be similar with the other reviewed ethnobotanical literature reported from various other areas. For example; present use of *Achyranthes aspera* in Khanpur Valley is chronic cough, throat infection, asthma, tonsillitis and pneumonia while in SoonValley Khushab (Pakistan) it is used for snake bite [23]. Similarly in Khanpur Valley Berberis lyceum is used for constipation, rheumatism, mouth boils, throat pains and typhoid, while in Kotli district of AJK Pakistan, it is used for dyspepsia, jaundice and liver diseases[24]. *Calotropis procera* is used for rheumatism, paralysis, asthma, cold, flu, pneumonia, chest congestion, stomach pain, toothache and removal of thorn of any plant, while in Kalat and Khuzdar regions of Baluchistan it is used for snake and insect bites and constipation[25]. *Cynodon dactylon* is used for nose and wound bleedings, bleeding piles and vomiting etc while in Mahal Kohistan (Khirthar National Park) it is used for diarrhoea and opthalmia[26]. *Datura stromonium* is used for strength to heart, brain, stomach, good sleep, hemorrhoids, earache, scalp, dandruff and hair fall while in Haramosh and Bugrote Valleys in Gilgit, Northern Areas of Pakistan it is used for injuries, wounds, bleedings and pains[27]. *Nerium oleander is used for* scabies, asthma and scorpion bite, while in Hazar Nao forest Malakand District Pakistan, it is used

for dental pain and bleeding gums[28]. *Riccinus communis* is used for prolonged constipation, while in Lawachara National Park Bangladesh, it is used for ringworm and abscess[12]. *Zanthoxylum armatum* is used for stomach problems, blood purification, face color, obesity, diabetes, jaundice and as conditioner for hair, while in southern Himalayan regions of Pakistan it is used for toothache and cardiac disorders[29]. Similarly Comparing with other literature[30-38]. It was observed that some species have new uses and addition in the folk herbal medicinal literature, while some have same uses.

Threats and major issues: Both the medicinal plants and folk knowledge are under severe stress. Due to changing socio-cultural trends folk knowledge is getting limited to elder people only. Likewise medicinal plants of Valley are under pressure due to subsequent fires, deforestation, over grazing and over exploitation.

Conclusion

Plants and people relationship is natural and dates back to very first day. Plants and people affect each other. Plants are indispensible for our survival. Ultimately green belts (flora) regulate the biological and physical environment. Plants seem weak in front of humans but their phenomenal power is much stronger than any other thing. Local people of Khanpur Valley rely on these plants for the treatment of various ailments and various other daily needs. Elder people have sufficient knowledge about the medicinal plants. Unfortunately this important traditional knowledge is getting depleted due to changing socio-cultural trends in the study area. Beside vigorous importance, plant resources are being depleted at alarming rate due to various threats like deforestation, over grazing, over exploitation and subsequent fires.This requires much and utmost attention at every level. It is also necessary to carry out more studies and also put some collective efforts for the conservation of these important medicinal plants.

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