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RESEARCH ARTICLE

Plant Diversity and Ethno-botanical Assessment of Tehsil Takht Bhai, Mardan, Khyber-Pakhtunkhwa, Pakistan

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Abstract

Ethno-botany is the scientific study of traditional knowledge, and customs of people concerning plants and their medical, religious and other uses. The present study was aimed to gather and document the traditional knowledge and practices of the local inhabitants related to medicinal uses of the plants in the area. To understand the ethno-botanical uses and importance of the plant, a questionnaire survey was conducted to collect quantitative, and qualitative information from randomly selected 138 local inhabitants of the Tehsil Takht Bhai, Mardan. The data were statistically analyzed by using SPSS software. The results reveals that medicinal plants are used for the treatment of various ailments and health issues, the plants were mostly used for diabetic (8.7%). The plants use was also recorded for backache (6.5%), followed by constipation and urinary tract infection (5.6), dry cough (4.3%), abdominal swelling and hemorrhoids (3.6%), and dysentery (3.5%). We also report on the people perception parts uses. According to report shows that the most commonly used part was fruits (24.6%), followed by bark (15.2%), whole plant (5.1%), roots (3.6%), stems (3.6%), flowers (1.4%), and seeds (1.4%). However, plant recipes were recorded from the local respondents, mostly reported recipe is powder form of plants (29.7%), followed by crushing (28.3%), directly use (15.2%), chewing (11.6%), boiling with water (7.2%), decoction (5.1%), boiling with tea (1.4%) etc. We conclude from the survey that the species population has been frequently used for various medicinal purposes, and the local inhabitants have more knowledge about the medicinal plant species. So, it is important the uncontrolled use of the plant as ethno-medicinal drug due to its great economic value. However, it is recommended that further investigation on local flora is necessary into their possible medicinal uses and proper documentation of the knowledge for young generation and researchers.

Keywords: Ethno-botany; Medicinal plants; Questionnaire method; Tehsil Takht Bhai; Mardan; Pakistan

Introduction

Plants are the primary producers and have the ability to synthesize their own food material via photosynthesis process and transfer minerals, gasses and water to other living things. Along with food plants also supply dyes, building material, fiber, landscape, cosmetics and medicines to human being as well as control air pollutions. Plants play important role in our lives, because it aid in the recycling of various functional nutrients, and provide us herbal medicines (Ajaib *et al.,* 2015; Ajaib *et al.,* 2013; Ajaib *et al.,* 2014). Ethno-botanical studies as the relationship between plants and people or the dynamic relationships between human and plants in a common habitat (Barnes *et al.,* 2003). The studies of ethno-botany focused on processing of our understanding of plant-biodiversity (Prada *et al.,* 2018). In order to validate how plants are used for various religious purposes, housing, clothing, medicine, food, and others ethnobotanical studies have a specific geographical, and culture area (Ajaib *et al.,* 2013; Shuaib *et al.,* 2014; Ullah *et al.,* 2022). The ethnobotanical research helps to develop community priorities to translate local values into efficient resource management, preservation of cultural knowledge, and biological diversity protection (Ngunde *et al.,* 2022). The ethnobotanical studies are needed to locate vital plant species unique to a specific region, mainly when looking for primitive plants. The research studies have documented traditional knowledge, and found several essential plant resources in modern medicines. The livelihoods of under-developed countries worldwide depend on medicinal plants and about 258,650 plant species were exist and above 10% of them are used medicinally (Shopo *et al.,* 2022).

The ancient practice of using therapeutic plants has been the precursor to modern medicine, with many contemporary treatments drawing on the wisdom of traditional herbal remedies. The pharmaceutical industries have trusted deeply on plant derived compounds, and this trend continues to the present day. Besides, the authors found that the important organizations, authors and nations have studied this subject, and their expansion with the passage of time have been recognized. The contacts between the nations, authors and new research has been observed via the finding of local communities. The study has been observed to have shrunk from the previous period comprised unclassified conventional medicines, drugs, cancer, anti-inflammation and in vivo studies of anti-diabetics in animals. Additionally, the authors made the case that cultivation or domestication of plant species with his established potential is less of a priority in global research trends instead of research for active compounds or novel drugs (Salmerón-Manzano *et al.,* 2020; Zulfiqar *et al.,* 2022).

Moreover, the ethno-botanists can play an important role in reintroducing and saving this precious knowledge that is rapidly being lost by the local populations. Then, it must be possibly maintained and documented the unwritten folk knowledge of plant resources for the recent increase civilization of the tribal. There are several people involved in trading of important medicinal plants on local, regional and global level, especially in rural areas people used native medicinal plants for the treatment of various diseases (Ali *et al.,* 2017; Kumar *et al.,* 2022). The ethnobotanical practices were passed down from generation to generation by the people of different areas and casts (Lev & Amar, 2000). According to report a wide range of people used medicinal plants for the treatment of various human diseases and people belief that medicinal-plants were the primary health care system of the people inhabiting in rural area i.e., Gokwe South District (Achour *et al.,* 2022).

In Pakistan, the ethno-botanical practices were commercially well established and the written record were save from last new decades, and about 85% Pakistani people were dependent on indigenous plants. In Baluchistan province the area of Musakhel and Barkhan flora were the focus of several ethnobotanical investigations. The ethno-botanical knowledge has a strong connection between plants and people culture, meanwhile it is known as the multidisciplinary approach that comprises various beautiful or fascinating characters, records, tradition, literature, culture and believes of plants (Ali *et al.,* 2017; Khan *et al.,* 2021). The finding of the present ethnobotanical studies were highlight that how local people use traditional ethnobotanical knowledge to treat

human related disorders as compare Pakistan with other developing countries (Jima & Megersa, 2018). The main aim of the study was to investigate the ethno-botanical survey of local medicinal plants and to identify the local names, botanical names, folk uses, parts uses, and method of uses in Tehsil Takht Bhai, Mardan.

Methodology

Data Collection

Frequent field trips were made to evaluate the species status from the residents of Tehsil Takht Bhai, Mardan. The local respondents were classified based on age groups. The survay was carried out during January 2022 to September 2022. A total of 138 people were interviewed and the interview were conducted in local language Pashto. The respondents were asked about the plant local name, botanical name, folk uses, parts used, and recipes of the plants (Table. 1). All the respondents were local inhabitants of Takht Bhai, Mardan. During various field trips the plants specimen i.e., plant branches, leavers, flowers, fruits and seeds were collected, documented, pressed and shade dried as well. We have a proper field note book to collect information related to plant species i.e., locality, sub-locality, leaves, flower colours, fruit types, uses, distribution and their influence among local flora. However, we also used canva camera for pictures record of the local plant species. Additionally, the shade dried fresh plant specimen were prepared by using some tools to press the plants for future use such as press straps, clippers, hand lens, newspapers, and ethyl-alcohol. The collated plant specimen were identified by using the online plant list (http://www.theplantlist.org) and flora of Pakistan (http://www.tropicos.org/Project/Pakistan) (Table. 1).

Study Area

The current study was carried out in a rural area Tehsil Takht Bhai, district Mardan, Khyber Pakhtunkhwa, Pakistan. The area were located about 15 kilometers to the north side of Mardan city. The area lies on 71°56′48 E latitude and 34°17′ 10 N longitude with elevation ranging from 1120 to 1430 feet above sea level. The mean annual temperature of the area ranges from 0.5 to 43.5 °C. The mean annual precipitation is rarely exceeding from 200m. The district is surrounded by Distrct Buner on North, District Nowshera on South, District Sawabi on East, and District Charsadda on west (Fig. 1; Khan, 2018; Ilyas *et al.,* 2013; Shah *et al.* 2014; Khan & Badshah, 2019; Khan & Ullah, 2019, Khan *et al.* 2020; Ullah & Asad, 2020, Parveen *et al.,* 2021).

Research Questionnaire

The ethnobotanical information of Tehsil Takht Bhai, district Mardan was collected from the local respondents via a questionnaire designed in MS Word (Parveen *et al.,* 2021). The questionarre comprises relevent questions i.e., peronal information of the respondents (name, age, occupation, village etc), plant name both local and botancal, plant uses, parts used, and method of use. The respone information of local interviwers were accurate and precise (Tembo *et al.,* 2021).

Statistical analysis

For statistical analysis of the collected data, firstly the data were organized and managed in MS office (MS-XL), and then a frequency distribution test or chi square test were used to statistically analyze the data by using SPSS version 22.0 (Navia *et al.,* 2022).

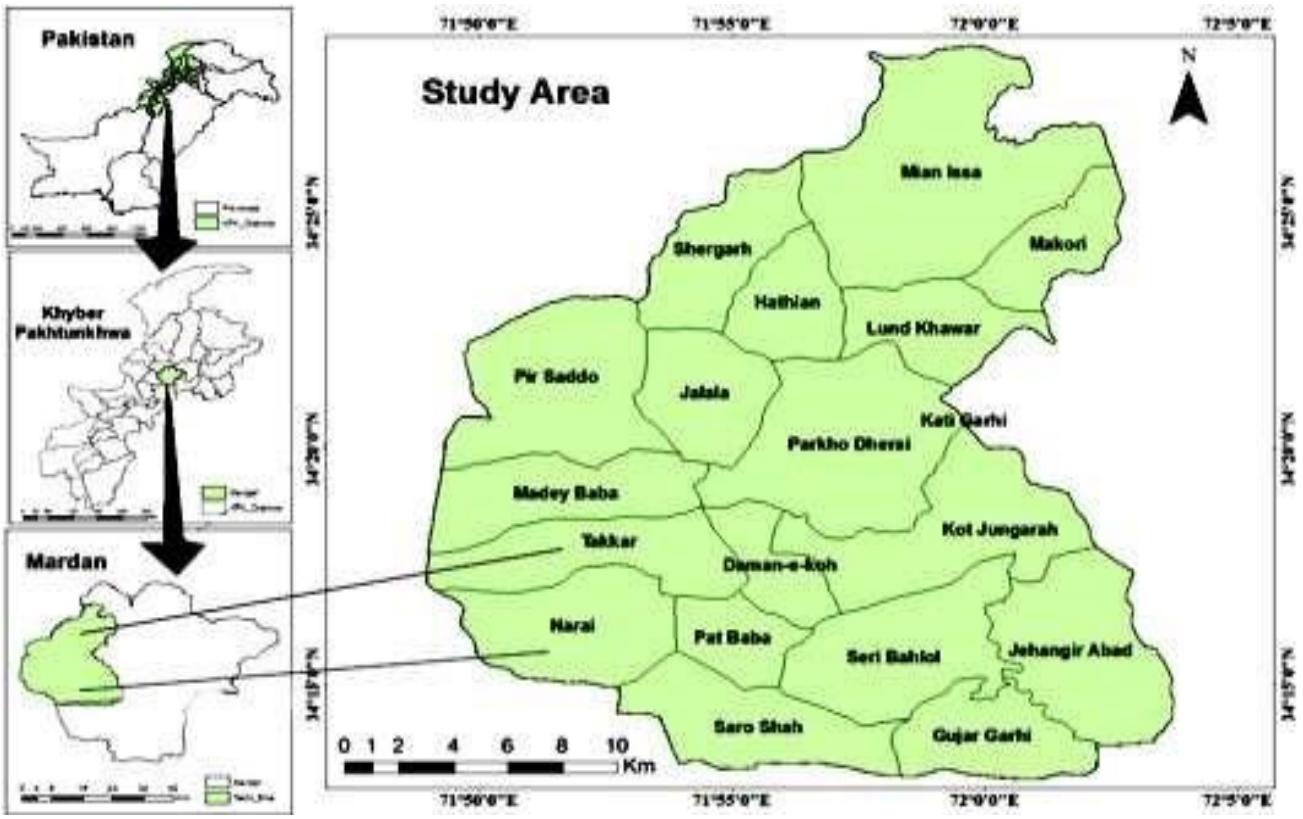

Fig. 1 Study area map of Tehsil Takht Bhai, Distrisct Mardan, Khyber Pakhtunkhwa, Pakistan.

Results

The study area is well-known for its diverse plant biodiversity, and ancient ethno-botanical knowledge. The current study focuses on 56 plant species belongs to 42 plant families, and the most commonly known plants are *Prunus domestica, Prunus armeniaca, Punica granatum, Psidium guajava, Ficus carica, Fragaria nubicola, Ricinus communis, Periploca aphylla, Polygonum aviculare, decne, Chenopodium albal, Datura stramonium, Mentha longifolia, Rheum australe, Juglans regia, Phoenix dactylifera, Rubus fruticosus, Foeniculum vulgarel, Vachellia, musa, Paeonia emodi, Papaver somniferum, Vinceloxicum, Malus pumila, Euphorbia helioscopia, Solanum surattense, Citrus limon, Citrus sinensis, Senegalia modesta, Mentha arvensis, Malva neglectar, Melia azedarach, Phoenix dactylifera, Chenopodium album, Nasturtium officinale, Trifolium repens, Calotropis procera, Rumex hastatus, Oxlis coniculata, Morus olba, Diospyros lotus,* and *Dicliptera bupleuroides nees* etc. However, the most widely used parts of plants were fruits, leaves, stems and roots. The plants parts are used for various purposes i.e., as a fuel for combustion, as a medicines for various diseases and as a building material. Meanwhile, the local inhabitants used these plants for many diseases i.e., fever, cough, diarrhea and skin disorders etc (Table. 1). The study offers essential knowledge for plant resource conservation and sustainable use.

Table. 1 Plants local name, botanical name, medicinal folk uses, parts used and method of uses of Tehsil Takht Bhai, Mardan.

S. No	Botanical Name	Local Name	Disorders	Parts Used	Method of Uses
1	*Prunus domestica*	Alocha	Back pain	Bark	Direct
2	*Diospyros kaki*	Amlook	Diarrhea	Fruits	Direct
3	*Psidium guajava*	Amrood	Diarrhea	Fruits	Direct
4	*Punica granatum*	Annar	Anemia	Fruits	Crushing
5	*Ficus carica*	Anzar	Peptic ulcer	Fruits	Direct
6	*Ricinus communis*	Arhand	Pimple /boil	Leaves	Direct
7	*Fagonia cretica*	Azghaky	Jaundice	Fruits	Crushing
8	*Polygonum aviculare*	Bandakai	Dysentery	Whole plant	Crushing
9	*Periploca aphylla*	Barara	Constipation	Leaves	Chewing
10	*Chenopodium album*	Chalwai	Laxative	Leaves	Boiling
11	*Mentha longifolia*	Ellanay	Jaundice, U.T. I	Leaves	Powder
12	Juglans regia	Ghoz	Bone injuries	Leaves	Crushing
13	*Mirabilis jalapa*	Gulabasi	Inflammation	Leaves	Direct
14	*Prunus armeniaca*	Hoobani	Respiratory	Fruits	Crushing
15	*Ficus carica*	Inzar	Cough and cold	Fruits	Crushing
16	*Syzygium cumini*	Jaman	Diabatic	Fruit	Direct
17	*Foeniculum vulgare*	Kaga	Diarrhea	Leaves	Decoction
18	*Rubus fruticosus*	Toor Tooth	Diarrhea	Leaves	Crushing
19	*Vachellia nilotica*	Kharboty	Scabies	Leaves	Direct
20	*Musa Paradisiaca*	Kilaa	Diarrhea	Fruits	Direct
21	*Papaver somniferum*	Kooknar	Dry Cough	Bark	Black tea
22	*Eucalyptus globulus*	Lachi Pana	Diarrhea	Leaves	Powder
23	*Paeonia emodi*	Mamekh	Back pain	Roots	Boiling
24	*Euphorbia Helioscopia*	Mandaro	Laxative, Toothache	Steam	Powder

25	*Malus pumila*	Manrda	Bone health	Fruits	Direct
26	*Solanum surattense*	Marraghonary	Toothache	Fruit	Chewing
27	*Citrus sinensis*	Naranj	Vomiting	Leaves	Boiling
28	*Citrus limon*	Nembo	Kidney stone	Fruits	Direct
29	*Spinacia oleracea*	Palak	Urinary calculi	Leaves	Boiling
30	*Senegalia modesta*	Palusa	Backache	Bark	Powder
31	*Malva neglecta*	Panerak	UTI	Leaves	Boiling
32	*Mentha arvensis*	Pasima	Peptic ulcer	Leaves	Chewing
33	*Mentha arvensis*	Podina	Vomiting	Leaves	Chewing
34	*Phoenix dactylifera*	Qajora	Oligo Spermia	Fruits	Direct
35	*Chenopodium album*	Sarmay	peptic ulcer	Whole plant	Direct
36	*Rumex, dentalus*	Shalkhay	Wound healing	Whole plant	Decoction
37	*Melia azedarach*	Shandai	Abdominal swelling	Leaves	Powder
38	*Trifolium repens*	Shawtal	Fevers	Leaves	Boiling
39	*Taraxacum officinale*	Shodasi	Constipation	Leaves	Decoction
40	*Gymnosporia royleana (Wall) Lawson*	Soor azgy	Heartburn	Leaves	Crushing
41	*Calotropis procera*	Spalmai	Hemorrhoids	Leaves	Crushing
42	*Morus olba*	Spen toot	Insomnia	Fruits	Chewing
43	*Fragaria nubicola*	Strawberry	CVS	Fruits	Direct
44	Nasturtium officinale	Tarmera	Backache	Whole Plant	Boiling
45	*Diospyros lotus*	Toor amlook	Dysentery	Fruits	Direct
46	*Rubus fruticosus*	Toor Tooth	Anti-diabatic	Fruits	Direct
47	*Melia azedarach*	Tora shandy	Anti-diabatic	Fruit	Direct
48	*Oxlis coniculata*	Triwaky	Peptic Ulcer	Leaves	Direct
49	*Dicliptera bupleuroides*	Tura panra	Peptic Ulcer	Whole plant	Boiling
50	*Cynanchum vinceloxicum*	Zangali toot	Diarrhea	Fruit	Direct

51	*Vachellia nilotica*	Kikar	Diabatic	Bark	Boiling
52	*Capsicum annuum*	Marchaky	Fever	Fruit	Powder
53	*Foeniculum vulgare*	Kagha	Heart burn	Seeds	Direct
54	*Coriandrum sativum*	Danya	Diabetic	Leaves	Crushing
55	*Prunus persica*	Shaltalo	Diabetic	Leaves	Crushing
56	*Citrus sinensis*	Manta	Cough and cold	Fruit	Direct

Classification of respondents based on age groups

The current study reports ethno-botanical knowledge from people of different ages. The local respondent's age ranges from 46 to 90 years old. The age group with the highest prevalence, with a frequency of 13 and a percentage of (9.4%), is 60. The second most predominant age-group is 70, with a frequency of 12, and a percentage of (8.7%). However, the age-groups with the lowest frequency i.e., 1 and percentage less than 1% is 46, 47, 56, 67, 77, and 82 years old respectively (Fig. 2).

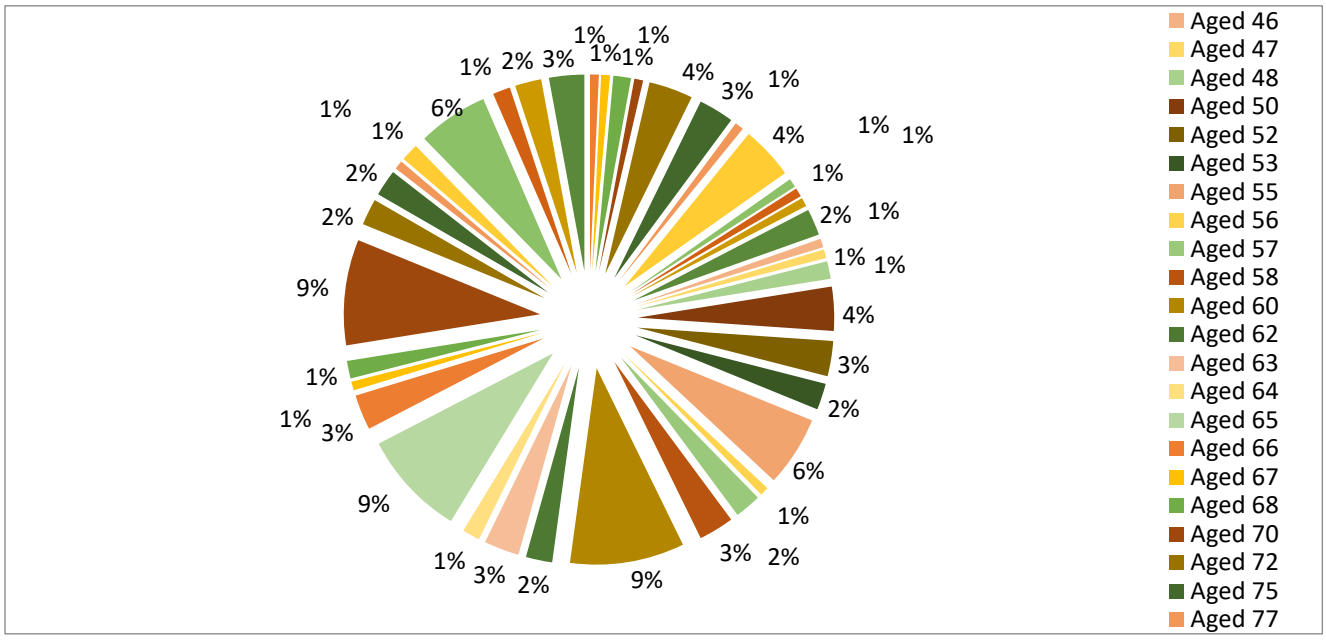

Fig. 2 Classification of local respondents based on age groups

Classification of respondent based on gender

The local interviewer including both male and female i.e., 5 (3.6%) of the 138 respondents were female, while 133 (96.4%) were male (Fig. 3).

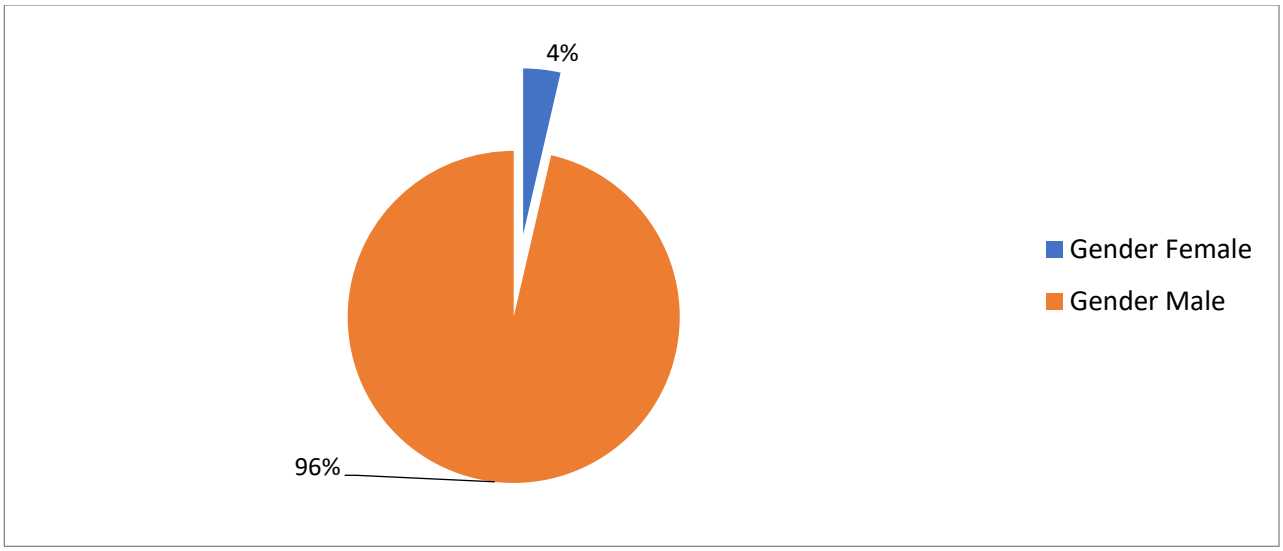

Fig. 3 Classification of local respondents based on gender i.e., male and female

Classification of respondents based on occupation

The distribution of respondents based on occupation are (45.6%) of the inhabitants were local farmers followed by shopkeepers and teachers (10.9%), entrepreneurs (7.2%), and drivers (5.8%). The local respondents also contain workers of other profession i.e., police (5.1%), medical storekeeper (3.6%), students (2.2%), and teachers (10.9%) etc. However, (5.8%) of the respondents having no occupation (Table. 2 and Fig. 4).

Table. 2 Classification of respondents based on occupation.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Business	10	7.2	7.2	7.2
	Driver	8	5.8	5.8	13.0
	Farmers	36	45.6	45.6	81.9
	Hakim	1	0.7	.7	59.4
	Labour	1	0.7	.7	60.1
	Medical Storekeeper	5	3.6	3.6	63.8
	Nill	8	5.8	5.8	69.6
	Police	7	5.1	5.1	74.6
	Shopkeeper	15	10.9	10.9	85.5
	Student	3	2.2	2.2	87.7
	Subadar	1	0.7	.7	88.4
	Teacher	15	10.9	10.9	99.3
	Veterinary	1	.7	.7	100.0
	Total	138	100.0	100.0	

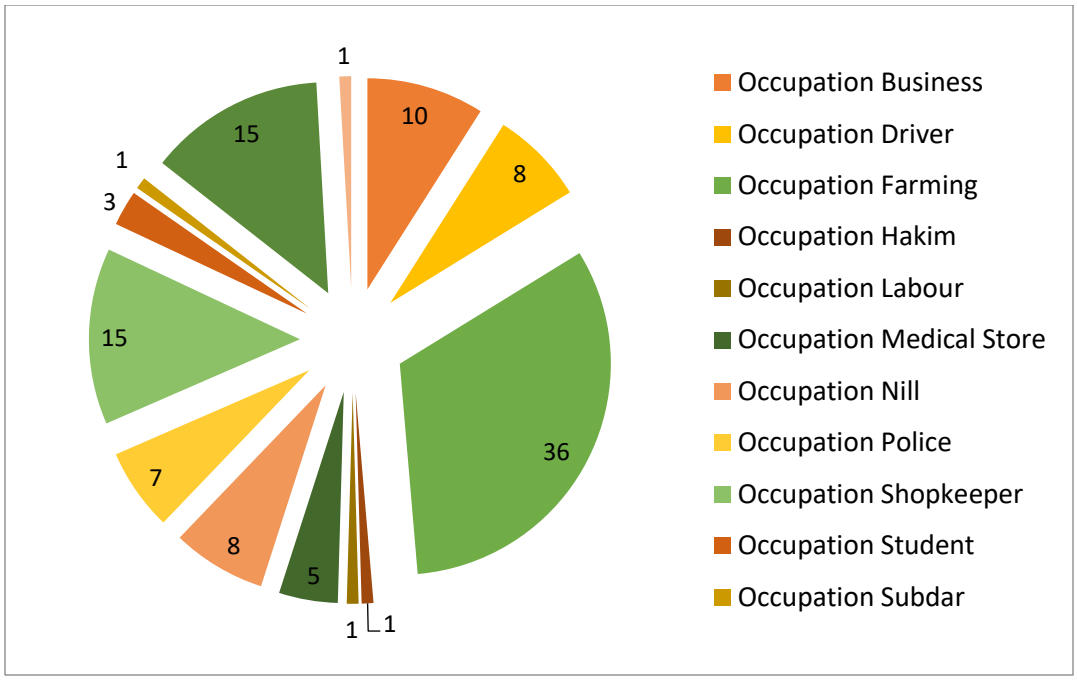

Fig. 4 Classification of local respondents based on various occupations.

Classification of respondents based on education level

The local interviewers were also classified based on education level i.e., (24.0%) of respondents were BA degree holders, followed by matric level (22.5%), middle level (17.4%), B. Sc level (10.1%), primary level (9.1%), FA level (7.2%), degree level (2.3%), and only (1.2%) is postgraduate level person. The result shows that majority of ethno-botanical information is provided by the respondents having low knowledge of modern techniques (Fig. 5).

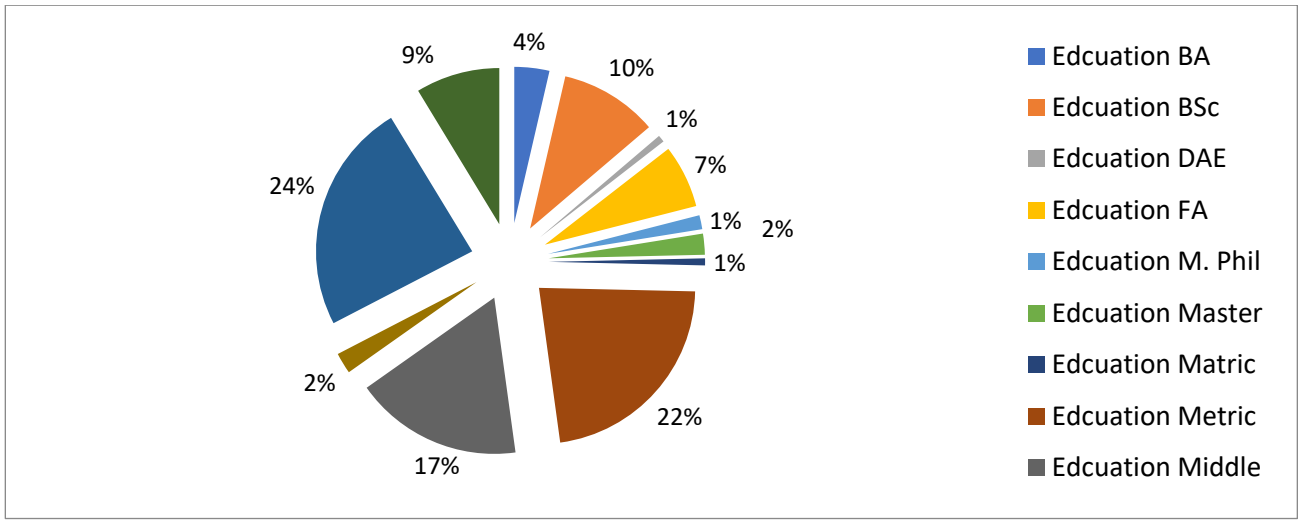

Fig. 5 Shows groups of respondents based on education level.

Medicinal uses of local plant diversity in Takht Bhai Mardan

The medicinal uses of the local plant diversity shows that it is used most abundantly as diabetic with (8.7%), backache with (6.5 %), constipation and urinary tract infection with (5.6 %), followed by dry cough with (4.3%), abdominal swelling and hemorrhoids with (3.6%), dysentery with (3.5%), gonorrhea, oligospermia, laxative, stomach discomfort, and scabies with (2.9%), peptic ulcer with and duodenal ulcer (2.8%), chicken fox with (2.5%), anemia and vomiting with (2.2%), burning wound, appetizers, CVS disease, heartburns, and nausea with (1.4%), and anti-helminthic, backache, purgative, carminative, digestive olba, dyspnea, eonslipation & stimulant, gastritis, jaundice, stomach acidity, gastroenteritis, gastric disorder, wound and purgative are reported rare with (0.7%) (Table. 3 & Fig. 6).

Table. 3 Medicinal folk uses of local plants in Tehsil Takht Bhai, district Mardan, KP, Pakistan.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		15	10.9	10.9	10.9
	Abdomen-swelling (Bloating)	5	3.6	3.6	14.5
	Anemia	3	2.2	2.2	16.7
	Anti-helminthic	1	0.7	0.7	17.4
	Antacid	1	0.7	0.7	18.1
	Backache	9	6.5	6.5	24.6
	Burning wound	2	1.4	1.4	26.1
	Carminative	1	0.7	0.7	26.8
	Chicken fox	5	2.5	1.4	28.3
	Purgative	1	0.7	0.7	31.2
	Constipation	9	5.6	5.6	36.2
	Diabetic	12	8.7	8.7	46.4
	Digestive olba	1	0.7	0.7	47.1
	Indigestion	2	0.8	0.8	47.8
	Dry cough	6	4.3	4.3	52.9
	Dysentery	5	3.5	3.8	55.1
	Dyspnea	1	0.7	0.7	56.5
	Appetizers	2	1.4	1.4	58.0
	Eonslipation & Stimulant	1	0.7	0.7	58.7
	Gastritis	1	0.7	0.7	59.4
	Gonorrhea	4	2.9	2.9	62.3
	Hemorrhoids	5	3.6	3.6	65.9
	Urinary tract infection	8	5.6	5.6	71.7
	Jaundice	1	0.7	0.7	72.5
	Laxative	4	2.9	2.9	75.4
	Oligospermia	4	2.9	2.9	78.3
	GERD	1	0.7	0.7	79.0
	Vomiting	3	2.2	2.2	81.2
	CVS disease	2	1.4	1.4	82.6
	Duodenal ulcer	3	2.8	2.8	84.8
	Scabies	4	2.9	2.9	87.7
	Stomach acidity	1	0.7	0.7	88.4
	Stomach discomfort	4	2.9	2.9	91.3
	Gastroenteritis	1	0.7	0.7	92.0

Peptic ulcer	4	2.8	2.8	93.5
Heartburns	2	1.4	1.4	94.9
Used as a purgative	1	0.7	0.7	97.1
Nausea	2	1.4	1.4	98.6
Gastric disorders	1	0.7	0.7	99.3
Wound	1	0.7	0.7	100.0
Total	138	100.0	100.0	

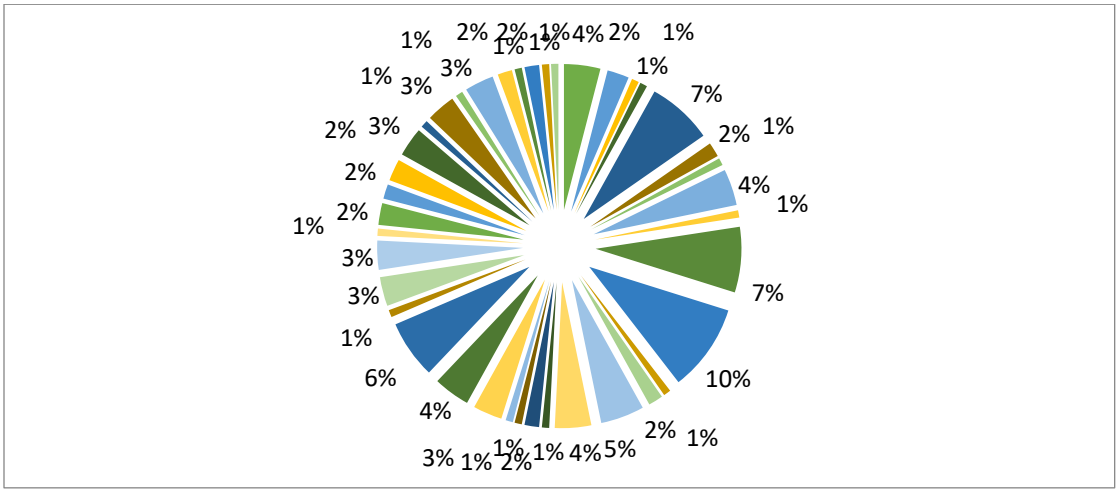

Fig. 6 Shows medicinal folk uses of local medicinal plants.

Parts used of local medicinal plants

According to responses to the question about the parts uses of medicinal plants, the most commonly used part was fruits (24.6%), followed by bark (15.2%), whole plant (5.1%), roots (3.6%), stems (3.6%), flowers (1.4%), and seeds (1.4%). The local inhabitants provide information that the plant parts were used partially for various domestic purposes (Table. 4; Fig. 7).

Table. 4 Parts used of medicinal plant in Tehsil Takht Bhai, district Mardan, KP, Pakistan.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		104	75.4	75.4	75.4
	Fruits	34	24.6	24.6	100.0
	Bark	21	15.2	15.2	100.0
	Stem	5	3.6	3.6	99.3
	Flower	2	1.4	1.4	100.0
	Roots	5	3.6	3.6	100.0
	Seed	2	1.4	1.4	100.0
	Whole plant	7	5.1	5.1	100.0
	Total	138	100.0	100.0	

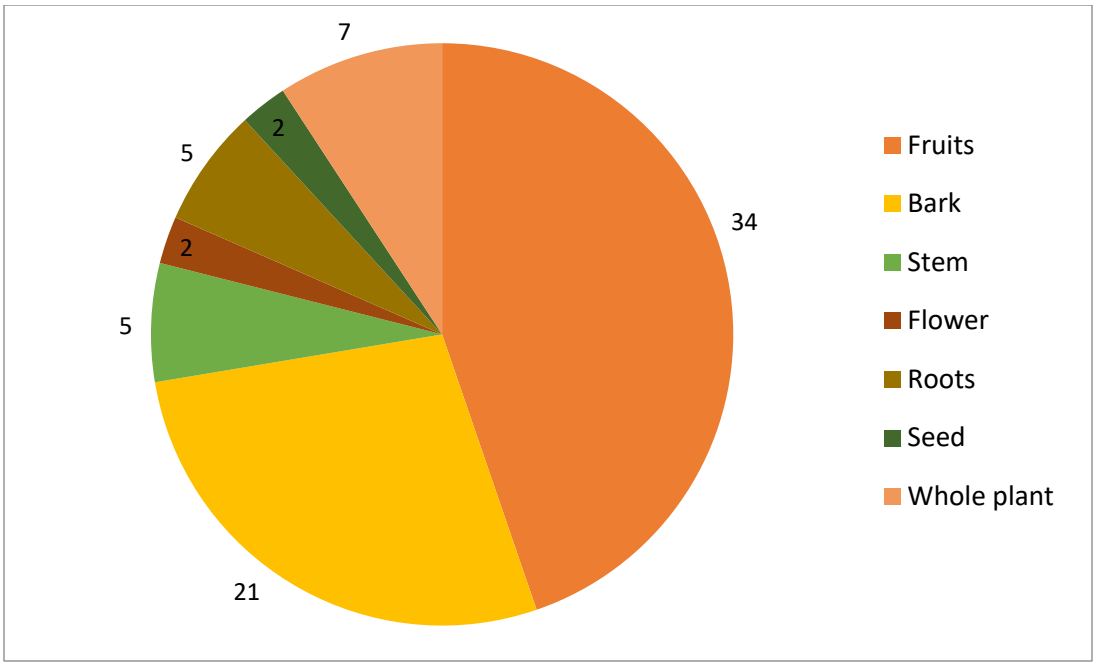

Fig. 7 Shows parts used of local medicinal plants.

Method of uses of local medicinal Plants

It is evident from the results that only 9 recipes are in common use by local inhabitants of the study area. Most of the inhabitants (29.7%) used the powder form of plant parts, followed by (28.3%) used the crushing or grinding form, (15.2%) used directly, (11.6%) used by chewing, (7.2%) used boiling with water, (5.1%) used as a decoction, (1.4%) used as boil with tea, and (0.7%) carminative and mixed with oil (Table.5; Fig. 8).

Table. 5 Use value of different recipes with medicinal plants for curing different diseases in tehsil Takht bhai, district Mardan, KP, Pakistan.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Boil with tea	2	1.4	1.4	1.4
	Boil with water	10	7.2	7.2	8.7
	Carminative	1	0.7	.7	9.4
	Chewing	16	11.6	11.6	21.0
	Crushing	39	28.3	28.3	49.3
	Decoction	7	5.1	5.1	54.3
	Direct use	21	15.2	15.2	69.6
	Mixed with oil	1	0.7	.7	70.3
	Powder	41	29.7	29.7	100.0
	Total	138	100.0	100.0	

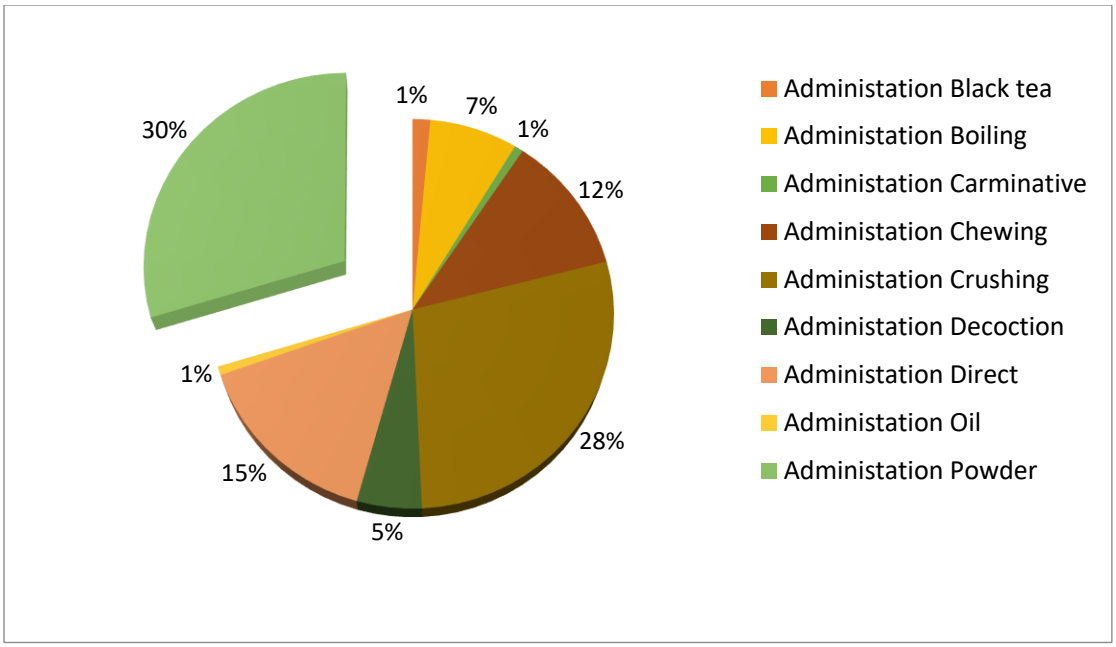

Fig. 8 Shows various plant recipes of the local medicinal plants.

Discussion

Plants are the primary producers and have the ability to synthesize their own food material via Photosynthesis and transfer minerals, gasses and water to other living things. Along with food plants also supply dyes, building material, fiber, landscape, cosmetics and medicines to human being as well as control air pollutions. Plants play important role in our lives because plants help in the reusing of various functional nutrients, and provide us herbal medicines (Ajaib *et al.,* 2013; Ajaib *et al.,* 2014; Maleki & Akhani, 2018). In Pakistan there are about 5000 traditional herb Practitioners (Hakeem), and more than 75% population of the country taking conventional remedies for their ailments on the recommendation of herb practitioners (Ahmad *et al.,* 2012; Barnes *et al.,* 2003). For the livelihoods of poor communities' medicinal plants are very important all over the world (Shinwari *et al.,* 2011).

The study area Tehsil Takht Bhai of district Mardan, Pakistan, is well known for its diverse plant's biodiversity and enrich with traditional knowledge of local communities. The ethnobotanical study used a comprehensive approach, including focus in groups, interviews, and in-depth field surveys with the residents, together this precious knowledge. The researchers observed many different plants and found that some were used extensively. These plants include *Prunus domestica (plum), Diospyros kaki* (Persimmon), *Psidium guajava* (guava), *Punica granatum* (pomegranate), and *Ficus carica* (Fig) etc. These plants' leaves, fruits, and roots were the most frequently used parts. The local people attached with these plant resources for many purposes, ranging from food and medicinal applications to fuel, fodder, and building materials. However, the study identified 56 plant species with medicinal properties that extended beyond common ailments like colds and flu, including treatments for fever, cough, cold, diarrhea, and various skin conditions. This abundance of knowledge in drug development and contemporary pharmaceutical research is crucial because it can open the door to developing novel, affordable, and effective medications. Therefore, the interaction of the region's traditional medicinal knowledge, biodiversity, and uses of plants highlights the possibility of comprehensive advances in science and medicine (Amjad *et al.,* 2020; Iqbal *et al.,* 2021; Ozioma & Chinwe, 2019).

Mostly, local people with age group are 60 (9.4%), having more knowledge about the ethnobotanical uses of medicinal plants, followed by age group 70 (8.7%). The local interviewers were mostly male 133 (96.4%) out of 138 respondents. According to the interview of local respondents the people having more ethnobotanical knowledge were usually illiterate (23.9%) and gain more knowledge from practically life experiences (Cheng *et al.,* 2022; Khajuria *et al.,* 2021). Medicinal folk uses, the local respondents reported various parts of the medicinal plants are used for different diseases i.e., 8.7% of respondents used it for diabetic, 6.5 % used it for backache, 5.6 % used it for constipation and urinary tract infection, 4.3% used it for dry cough, 3.6% used it for abdominal swelling and hemorrhoids, 3.5% used it for dysentery, 2.9% used it for laxative, oligospermia, scabies, stomach discomfort, gonorrhea, laxative, 2.8% used if for duodenal ulcer and peptic ulcer, 2.5% used it for chicken fox, 2.2 % used it for anemia and vomiting, 1.4% used it for burning wound, appetizers, CVS disease, heartburns, and nausea, and 0.7% used it for anti-helminthic, backache, purgative, carminative, digestive olba, dyspnea, eonslipation & stimulant, gastritis, jaundice, stomach acidity, gastroenteritis, gastric disorder, wound and purgative (Ali *et al.,* 2017; Ali *et al.,* 2017; Arshad *et al.,* 2020; Hrichi *et al.,* 2020; Karakose *et al.,* 2019; Rahman *et al.,* 2019).

Parts used, according to local interviewers the most commonly used plant parts were fruits, bark, whole plant, roots, stems, flowers and seeds, 24.6% of the respondents used its fruits, 15.2% respondents used plant bark, 5.1% respondents used whole plant, 3.6% respondents used plant stem and roots, 1.4% respondents used plant flowers, and 1.4% respondents used plants seeds accordingly (Ali *et al.,* 2017; Khare *et al.,* 2021; Usman *et al.,* 2021). Method of uses, the local respondents reported various method of uses. 29.7% of the respondents used it in powder form, 28.3% respondents used it in simple crushing form, 15.2% used it directly, 11.6% respondents used it in chewing form, and 7.2% respondents used it boiling with water, 5.1% used it as a decoction, 1.4% used it boiling with tea, and 0.7% used it mixed with oil (Ali *et al.,* 2017; Jan *et al.,* 2021).

Conclusions

Finally, in the light of the findings of the present study, the following conclusion were drawn. We conclude that medicinal plants commonly grown in the local Tehsil Takht Bhai of the district Mardan increase the local biodiversity of the area. We also conclude that the plants are highly medicinal and vast uses as an ethno-medicinal. 8.7% of respondents used it for diabetic, 6.5 % used it for backache, 5.6 % used it for constipation and urinary tract infection, 4.3% used it for dry cough, 3.6% used it for abdominal swelling, 3.5% used it for dysentery, 2.9% used it for laxative, oligospermia, scabies, stomach and discomfort, 2.8% used if for duodenal ulcer and peptic ulcer, etc. According to the opinion of local inhabitants the commonly plants parts were used as fruits (24.6%), bark (15.2%), whole plant (5.1%0, roots (3.6%), stem (3.6%), flowers (1.4%) and seeds (1.4%). The local people also opinion that the plants are used by various methods i.e., powder (29.7%), crushing (28.3%), direct use (15.2%), chewing (11.6%) and boiling (7.2%). The people of old age interviewed showed better knowledge of the ethno-medicinal of the species. We believe that due to modernization of our society, people are not pay attention to the conservation and preservation of the important ethno-botanical knowledge. We recommended for the young researchers that further studies on the local flora should be carried out in the area and the species need special attention of conservation for the next generation. Also, we recommend that the area having more potential of ethno-botanical knowledge, so explore the whole district Mardan and save the precious knowledge. We are thankful for the local interviewers for taking part and sharing their valuable knowledge.

Declarations

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Author's Contribution: Tariq Jamal and Fazli Malik Sarim conceived the idea, Imtiaz Ahmad, Yasmeen Begam designed methodology, Sheema and Jaweria helps in data collection, Aziz Ur Rahman design references, Shah Faisal and Sapna Umar helps in data analysis, Farman Ullah helps in scientific writing and make final drafts, and final approval.

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