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EXPERIMENTAL PAPER

Ethnobotanical investigation of significant seasonal medicinal weeds of Toba Tek Singh District, Punjab, Pakistan

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Summary

Introduction: Medicinal plants are found throughout the world but most are considered weeds. They are – directly or indirectly – the major source of medicines in pharmaceutical and herbal industries. Formulations used to prepare medicines or the method of use for these plants are mainly based on folk or traditional knowledge. This folk knowledge is not documented in many areas and needs to be explored.

Objectives: This study was aimed to enlist the seasonal weed species with traditional medicinal usage in Toba Tek Singh District, Punjab, Pakistan.

Methods: Field surveys were arranged in winter and summer 2019–2020 to enlist the important medicinal weeds and traditional knowledge of the local community. Data collected were as follows: local name of weed, medicinal use, method and part used.

Results: Numerous wild perennial, biennial and annual plants were identified, 30 of them were ethnomedicinally important in the local community. They were grouped in 16 families. It was found that whole weed is used in many prescriptions (37%). *Achyranthes aspera* L. (*Amaranthaceae*) was the most common weed used in treating fevers, respiratory problems and asthma. *Cichorium intybus* L. (*Asteraceae*) was used in summer drinks to reduce thirst, improve digestion and liver function. *Chenopodium album* L. (*Amaranthaceae*) was used with 0.71 UV and 0.147 RFC values. *Medicago polymorpha* L. (*Fabaceae*) was used to treat kidney, intestinal and bladder infections. Its UV was 0.65 and RFC was 0.121. *Tribulus terrestris* L. (*Zygophyllaceae*) was used in impotency treatment, and in the removal of kidney stones and urinary tract infections treatment. It has 0.63 UV and 0.21 RFC values. This weed also showed the highest Fidelity Level (FL) (77%), as compared to other weeds.

Conclusion: It was concluded that there are many significant medicinal weeds in the Toba Tek Singh District, Punjab, Pakistan that are used in traditional medicines in treating various disorders. These plants also showed herbal or pharmacological importance that can be used to develop medicine at commercial scale.

Key words: *weeds, ethnobotany, flora, survey*

Ślowa kluczowe: *chwasty, etnobotanika, flora, badanie*

INTRODUCTION

Ethnomedicinal surveys are of great significance in the development of drugs from indigenous medicinal plants [1]. Most of the medicinal plants are found as weeds, as compared to cultivated plants. That is why weeds are considered as major source of medicines. Weeds are important among local inhabitants in the management of many diseases [2]. Ethnomedicinal surveys are appropriate to document the useful medicinal information [3]. This documentation of traditional or folk knowledge of native weeds has contributed to the discovery of many vital drugs [4]. It is estimated that about 25% medicines are obtained directly or indirectly from plants [5]. Ethnomedicinal surveys helped the researchers find the significant plants in the specific areas that are used in folk medicines [2].

In the world, there are many useful plants which can have significant medicinal importance [1]. In Pakistan, there is a great diversity in medicinal plants which are a big source of medicines in local communities [6]. The diversity concerns weather, terrestrial areas, conventional zones and flora [7]. Pakistan has predominantly huge, spotted and various diversity of medicinal plants. Shinwari [8] reported that about 6000 medicinal plants are available in Kashmir and Pakistan. Similarly, Khan *et al.* [9] described that these medicinal plants used in healthcare systems from ancient times. Folk medicines are important locally as well as are useful in pharmaceutical industry, worldwide [10]. Nearly 50,000 plants are used for medicinal purposes, worldwide [11]. Rural communities depend on indigenous plants in the treatment of many diseases [12]. Rehman *et al.* [2] described the flora of Gujrat district. Important weeds of this area have also been documented by Ali *et al.* [13].

There are only few reports describing the importance of weeds from various regions of Pakistan. The weeds of district Toba Tek Singh, Punjab, Pakistan have not been documented. That is why there was a need to document the useful weeds of the area with its medicinal significance. For this purpose, present study was conducted to document the weeds with its ethnomedicinal values in Toba Tek Singh District, Punjab, Pakistan.

MATERIALS AND METHODS

Site of study

This study was conducted in Toba Tek Singh District, Punjab province, Pakistan in summer and winter of 2019–2020 at a latitude of 30°33' to 31°2' N and at longitude of 72°08' to 72°48' E [1]. City is located at 162 m above sea level and consist of three tehsil that is Gojra, Toba Tek Singh and Kamalia (fig. 1).

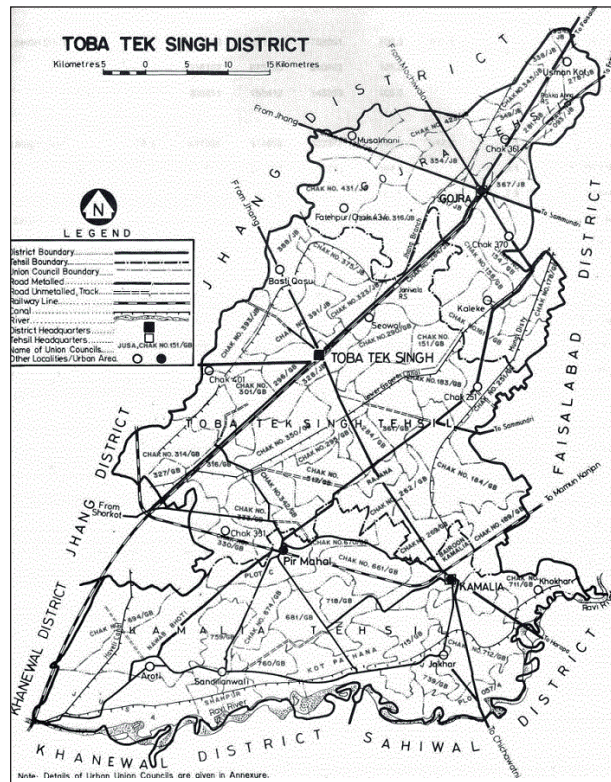


Figure 1.

Map of district Toba Tek Singh, Pakistan (study area). Map reference: <https://www.politicpk.com/toba-tek-singh-district>

There were a total of 25 visits performed and each visit lasted for 3–4 days. There were 18 study sites nearby rural areas where local community mainly uses weeds in treatment. Weed samples were collected with help of local guides. They were then collected

and dried, placed in herbarium sheets and identified with the help of field guides with their local names.

Collection of data

Information about local names of the weeds and parts used for treating a specific disease was compiled through interviews and questionnaires. There were 75 respondents. The age of respondents ranged from 20 to 75 years, both male and female. They were local health providers (hakims). The questionnaire was designed to collect the desired ethnomedicinal information. Plants were identified with the help of reference plants preserved at herbarium, Department of Botany, University of Gujrat, Pakistan and the collected plant specimens have been deposited in this herbarium. They were further cross-verified through "Flora of Pakistan" [15].

Data analysis

Plant parts were divided into various categories, i.e. root, shoot, leaf and flower and data was analyzed using the following formulae:

Use Value (UV)

UV was determined to calculate relative importance of given species collected from the study area. It was calculated by the following formula:

$$UV = \sum U/N$$

where U – number of citations per specific plant,
N – number of local informants.

Relative Frequency of Citation (RFC)

RFC was calculated by the given formula:

$$RFC = \frac{FC}{N}$$

where FC – the number of informants for the use of that species,
N – total number of informants in the survey.

Informant Consensus Factor (ICF)

Information of related homogeneity mixture of disease category collected from informants was calculated by the following formula:

$$ICF = \frac{Nur - Nt}{Nur - 1}$$

where Nur – the number of use citations from informants for a particular plant-use category,
Nt – the number of species or taxa utilized by all the informants for that specific plant use category.

ICF ranged from 0 to 1, whereas ICF value 1 indicated the highest level of informant consent and 0 was the lowest value.

Fidelity Level (FL)

FL was used to determine the importance of the species as it relates to medicines.

$$FL(\%) = \frac{Np}{N} \times 100$$

where Np – number of species that is present in the specific category,

N – accurate sum of consumption for a particular species.

Ethical approval: The conducted research is not related to either human or animal use.

RESULTS

In present study, 75 local inhabitants were interviewed and information was recorded through a questionnaire.

Identification of plant families

Weeds collected from Toba Tek Singh District belonged to 16 plant families. The area was found rich with trees, shrubs and herbs; however, 30 weeds were identified to have high ethnomedicinal use among local community. The families were: Asteraceae, Poaceae, Fabaceae, Polygonaceae, Amaranthaceae, Euphorbiaceae, Solanaceae, Brassicaceae, Convolvulaceae, Malvaceae, Oxalidaceae, Aizoaceae, Papaveraceae, Portulacaceae, Primulaceae and Zygophyllaceae (fig. 2). The families were ranked based on the number of weeds present in family. Fabaceae family was ranked at the top with 5 species, Asteraceae and Amaranthaceae with 4 species. There were 2 species of Poaceae and Euphorbiaceae, while all other families identified in the area had only one weed species.

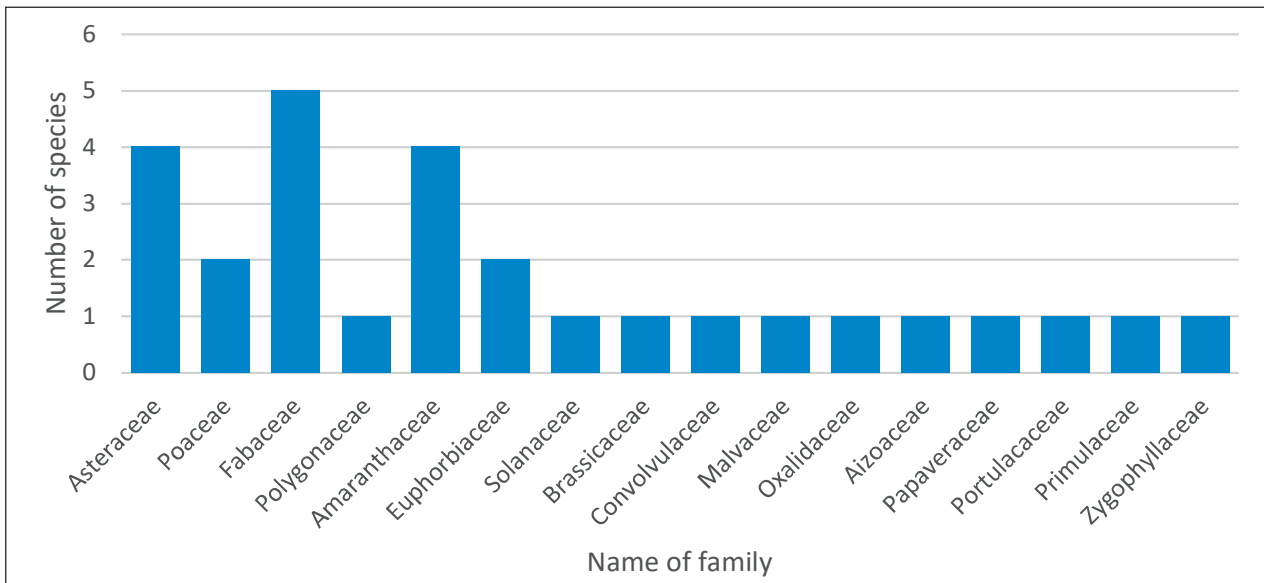


Figure 2.

Categories of families for collected weeds from district Toba Tek Singh, Pakistan

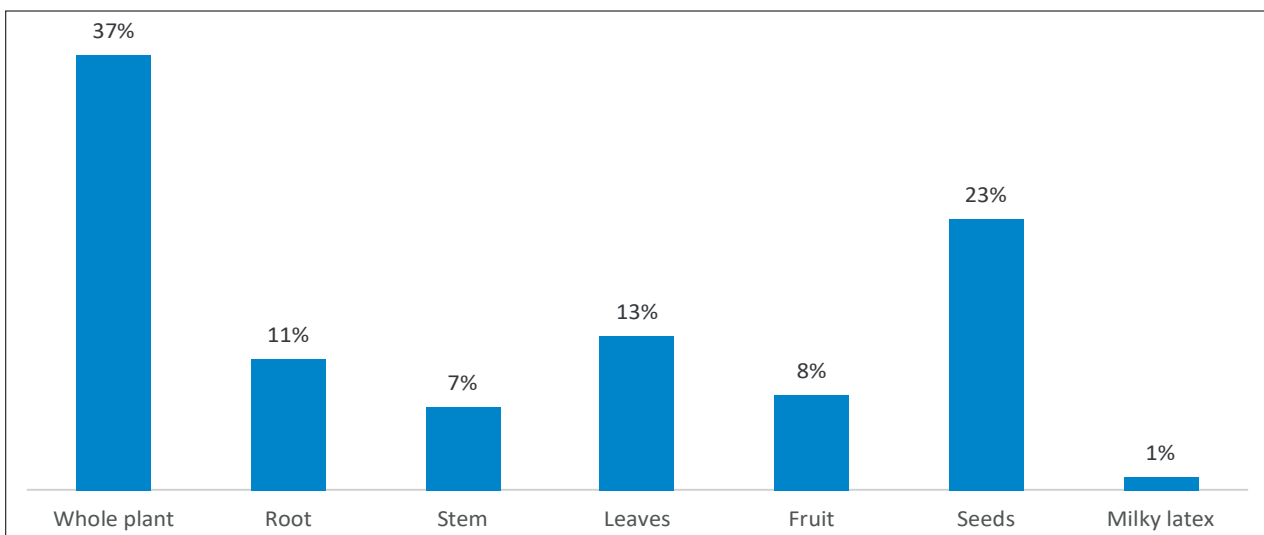


Figure 3.

Percentage of weed parts used for medicinal purpose collected from district Toba Tek Singh, Pakistan

Parts used in ethnomedicine

It was noted that different parts of weeds, i.e. roots, stem, leaves, latex, seeds and whole aerial parts were used to prepare different formulations. These parts were used both fresh and well dried in different medicines. Drugs from these plant parts were prepared in the form of infusion, extraction, paste powder, decoction and herbal tea. It was noted that various local medicine prescriptions used the following parts of plants: 37% whole plant, 23% seeds,

13% leaves, 11% roots, 8% fruits, 7% stem and 1% latex (fig. 3).

Ethnomedicinal uses

During this study, information on botanical name, family, UV, RFC, uses, part used, prescription, dosage was collected (tab. 1). It was noted from local informants that all the plants growing in the area are of significance in the treatment of various diseases.

Table 1.

Description of weeds with uses, method and prescription collected from district Toba Tek Singh, Pakistan

Botanical name of weed	Name of family	Folk uses	Prescription and part used	Method of use	Doses	Use value (UV)	Relative Frequency of Citation (RFC)
<i>Achyranthes aspera</i> L.	<i>Amaranthaceae</i>	All type of fevers, respiratory problems, cough, asthma	Fresh or dry leaves are mixed with honey and black pepper	Internal use	3 times per day	0.82	0.084
<i>Amaranthus viridis</i> L.	<i>Amaranthaceae</i>	Malaria, insect bite, skin rash	Seeds are mixed with rice or honey to make paste	Internal use	2 times per day	0.34	0.046
<i>Anagallis arvensis</i> L.	<i>Primulaceae</i>	Wound healings, skin infections	Fresh leaves to make poultice	External use	2 times per day	0.33	0.089
<i>Avena sativa</i> L.	<i>Poaceae</i>	Stomach and digestive problems, diabetes	Seeds are grinded with sugar to make tablets	Internal use	1 time per day	0.52	0.085
<i>Chenopodium album</i> L.	<i>Amaranthaceae</i>	Stomach/gastric and urinary disorders	Leaves are mixed with water for kidney disorder. Herbal tea is useful	Internal use	2 times per day	0.71	0.147
<i>Chenopodium murale</i> (L.) S. Fuentes, Uotila & Borsch	<i>Amaranthaceae</i>	Dry cough, respiratory or pulmonary obstruction	Whole plant part are recommended to rub at chest	External use	2 times per day	0.59	0.051
<i>Cichorium intybus</i> L.	<i>Asteraceae</i>	Shows cooling effects, reduce thirst, improve digestion and liver functioning	Fresh or dry leaves are used to make herbal tea to improve digestion. Used as summer drink	Internal use	2 times per day	0.78	0.137
<i>Cirsium arvense</i> (L.) Scop.	<i>Asteraceae</i>	Improves digestion and used for child worms	Roots are used in decoction	Internal use	3 times per day	0.48	0.18
<i>Convolvulus arvensis</i> L.	<i>Convolvulaceae</i>	Useful in urinary tract infections and stomach ulcers	Root juice is recommended	Internal use	2 times per day	0.45	0.08
<i>Cyperus rotundus</i> L.	<i>Cyperaceae</i>	Anti-diabetic, anti-inflammatory and anti-malarial properties	Grind its rhizome to make powder	Internal use	1 time per day	0.26	0.07
<i>Digitaria bicornis</i> (Lam.) Roem. & Schult.	<i>Poaceae</i>	Used to kill microbes of intestine	Leaves and seeds are grinded to make poultice	External use	1 time per day	0.34	0.25
<i>Eclipta prostrata</i> L.	<i>Asteraceae</i>	Anti-bacterial and anti-oxidant. Useful in fevers	Whole plant is mixed with olive oil	Internal use	1 time per day	0.31	0.15
<i>Euphorbia helioscopia</i> L.	<i>Euphorbiaceae</i>	Used in constipation, athlete's foot and intestinal problems.	Leaves are used as herbal tea	Internal use	3 times per day	0.54	0.13
<i>Euphorbia prostrata</i> Aiton	<i>Euphorbiaceae</i>	Recommended in jaundice, fever and kill intestinal worms.	Aerial parts are used to make powder or tablets	Internal use	2 times per day	0.51	0.16
<i>Fumaria indica</i> (Hausskn.) Pugsley	<i>Papaveraceae</i>	Used in fever, cures liver disorder and diarrhea	Leaves are boiled in water to make decoction	Internal use	2 times per day	0.62	0.041
<i>Lathyrus aphaca</i> L.	<i>Fabaceae</i>	Useful to skin infection and used in insect bites	Seeds are grinded and mixed with water	Internal use	1 time per day	0.24	0.05

Table 1. (continued)

Botanical name of weed	Name of family	Folk uses	Prescription and part used	Method of use	Doses	Use value (UV)	Relative Frequency of Citation (RFC)
<i>Lepidium didymium</i> L.	Brassicaceae	Useful for the treatment of gastrointestinal ulcers	Poultice of the leaves is applied	External use	2 times per day	0.55	0.14
<i>Malva parviflora</i> L.	Malvaceae	Antimicrobial, antibacterial and anti-inflammatory properties	Leaves are boiled in 3-4 cup water and then are mixed in cow milk	Internal use	Daily in the evening	0.22	0.14
<i>Medicago polymorpha</i> L.	Fabaceae	Improves kidney, intestinal and bladder infections	Powder of seeds are mixed with water to make a mush	Internal use	2 times per day	0.65	0.121
<i>Medicago sativa</i> L.	Fabaceae	Enhance metabolism and increase milk production in livestock	Whole plant is boiled with oat, alfalfa to make a syrup	Internal use	2 times per day	0.51	0.25
<i>Melilotus indicus</i> (L.) All.	Fabaceae	Useful in diarrhea and bowel complaints, intestinal problems	Seeds or whole plant is used to make tablets or dry powder	Internal use	1 time per day	0.54	0.35
<i>Oxalis corniculata</i> L.	Oxalidaceae	Cures redness of eyes and scurvy, and antimicrobial activity	Dry leaves are used to make powder	Internal use	2 times per day	0.54	0.16
<i>Portulaca oleracea</i> L.	Portulacaceae	Recommended in fever, ulcer and abnormal uterine bleeding	Whole plant is used to make poultice	Internal use	1 time per day	0.62	0.24
<i>Rumex dentatus</i> L.	Polygonaceae	It is a good appetizer, cure constipation and diarrhea	Leave juice is used. Leaves are also cooked vegetable	External use	2 times per day	0.55	0.25
<i>Solanum nigrum</i> L.	Solanaceae	Cures respiratory, hepatic and stomach disorders. Cure eye piles and diabetes	Leaves are mixed with honey	Internal use	2 times per day	0.43	0.16
<i>Sonchus asper</i> (L.) Hill	Asteraceae	Antimicrobial activity, paste is useful to cure wounds	Seeds are soaked in 1 cup water for one night	External use	1 time per day	0.38	0.08
<i>Trianthema portulacastrum</i> L.	Aizoaceae	Useful for the treatment of constipation, asthma	Plant juice is extracted and mixed with sugar	Internal use	3 times per day	0.541	0.14
<i>Tribulus terrestris</i> L.	Zygophyllaceae	Used in impotency, men sexual power. Removes kidney stones and urinary tract infections	Extract of leaves is used. Seeds are also used to make powder	Internal use	1 time per day	0.63	0.21
<i>Vicia sativa</i> L.	Fabaceae	Plant has anti-inflammatory and antioxidant properties	Poultice is recommended against skin infection	External use	1 time per day	0.41	0.13

From various ethnomedicinal data analysis it was found that there were 30 weeds in the study area. Most common were *Achyranthes aspera*, *Amaranthus viridis*, *Anagallis arvensis*, *Avena sativa*, *Chenopodium album*, *Chenopodium murale*, *Cichorium intybus*, *Cirsium arvense*, *Convolvulus arvensis*, *Cyperus rotundus* and *Digitaria bicornis*.

It was found that *Achyranthes aspera* (Amaranthaceae) was the most common weed used to treat fevers, respiratory tract problems and asthma with 0.82 UV and 0.084 RFC values. *Cichorium intybus* (Asteraceae) showed 0.78 UV and 0.137 RFC values and was used to in summer drinks to reduce thirst, improve digestion and liver functions.

Chenopodium album (Amaranthaceae) was used with 0.71 UV and 0.147 RFC values. *Medicago polymorpha* (Fabaceae) was used to improve kidney, intestinal and bladder infections. Its UV was 0.65 and RFC was 0.121. *Tribulus terrestris* (Zygophyllaceae) was used in impotency treatment. It also helps to remove kidney stones and treat urinary tract infections. It has 0.63 UV and 0.21 RFC values. This weed also showed the highest FL value (77%), as compared to other weeds (tab. 1).

Pharmacological data analysis

Informant Consensus Factor (ICF) by disease category and Fidelity Level (FL) showed values ranging from 77 to 51 for most reported medicinal weeds (tab. 2, 3). According to respondents and calculated ICF values, these weeds were recommended in respiratory tract diseases, gastric problems, kidney and liver disorders, diarrhoea, constipation, fever, cold, cough, asthma, flue, intestinal problems, arthritis, malaria, cancer, allergies, male infertility, sexual

Table 2.

Informant Consensus Factor (ICF) by disease category in district Toba Tek Singh, Pakistan

Disease Category	No. of Use Report (Nur)	No. of Species Used (Nt)	Nur-Nt	Nur-1	ICF
Asthma, flue, cold, cough, respiratory infection and fever	61	35	26	64	0.43
Bone pain, joint swellings, jaundice	32	17	15	21	0.24
Liver disorders	31	13	18	27	0.57
Headache, hypertension	15	9	6	19	0.63
Insect bite, body pain, epilepsy, convulsion, infections	21	5	16	16	0.69
Jaundice, malaria, bronchitis, vomiting, intestinal problems, arthritis	22	17	5	24	0.43
Kidney and liver disorders	33	11	22	28	0.58
Loose motion, constipation	45	22	23	41	0.53
Malaria, cancer, peralysis, tumor, allergies	19	14	5	23	0.42
Piles, snake bite, dropsy, cholera, toothache, rheumatism	23	13	10	22	0.54
Respiratory diseases, gastric problems, hepatitis	21	14	7	20	0.57
Stomach problems, gastric problems, intestinal problem, digestive problems	32	8	24	32	0.71
Wound healing, skin diseases or inflammation	62	35	27	61	0.48

Nur – number of citations from informants for a particular plant-use category; Nt – number of species

Table 3.

Fidelity Level (FL) value for most reported medicinal weeds in district Toba Tek Singh, Pakistan

Botanical name of weed	Local name	Major ailment	Fidelity level (FL) %
<i>Achyranthes aspera</i> L.	Putkanda	All type of fevers, respiratory problems, cough, asthma	74
<i>Amaranthus viridis</i> L.	Ghunar	Malaria, insect bite, skin rash	59
<i>Anagallis arvensis</i> L.	Bili booti	Wound healings, skin infections	54
<i>Chenopodium album</i> L.	Bathu	Stomach/gastric and urinary disorders	75
<i>Cichorium intybus</i> L.	Kasani	Reduces thirst, improve digestion and liver functioning	65
<i>Eclipta prostrata</i> L.	Bhangra	Anti-bacterial and anti-oxidant. Useful in fevers	51
<i>Fumaria indica</i> (Hausskn.) Pugsley	Shahtra	Used in fever, cures liver disorder and diarrhea	72
<i>Rumex dentatus</i> L.	Jangli palak	It is a good appetizer, cure constipation and diarrhea	61
<i>Solanum nigrum</i> L.	Kainch mainch	Cures respiratory, hepatic and stomach disorders. Cure eye piles and diabetes	69
<i>Trianthema portulacastrum</i> L.	Itsit	Useful for the treatment of constipation, asthma	71
<i>Tribulus terrestris</i> L.	Bhukhra	Used in impotency, men sexual power. Removes kidney stones and urinary tract infections	77

disorders, piles, snake bite, stomach problems, gastric problems, intestinal problem, digestive problems, insect bite, body pain, epilepsy, convulsion, infections, nervous disorders, swellings and pneumonia (tab. 2).

The FL value of most reported weeds have been given in table 3. *Tribulus terrestris* showed the highest FL value (77%) when used in impotency treatment. It is helpful in removal of kidney stones and in treatment of urinary tract infections. Similarly, a 75% FL value was noted for *Chenopodium album* recommended for gastric problems.

DISCUSSION

Present study revealed that there are many seasonal weeds, e.g. *Achyranthes aspera*, *Amaranthus viridis*, *Anagallis arvensis*, *Avena sativa*, *Chenopodium album*, *Chenopodium murale*, *Cichorium intybus*, *Cirsium arvense*, *Convolvulus arvensis*, *Cyperus rotundus* and *Digitaria bicornis* that have not been documented earlier in Toba Tek Singh District, Pakistan. Similarly, Rehman *et al.* [2] reported 32 families of weeds and showed the significance of seasonal weeds growing in Gujrat District, Pakistan against many diseases by local inhabitants. Muhammad *et al.* [14] described the weeds of wheat crop that had great significance in the treatment of various diseases in Tehsil Gojra, Pakistan. Pakistan has different seasons and a variety of soils, which is why the country is rich with medicinal plants.

It has been described that in most areas local communities rely on these plants to treat many diseases. The use of plants is based upon folk knowledge. As it was noted, the area had important wild flora belonging to various families. Similar results have been found in previous studies. Saurabh *et al.* [16] described that *Achyranthes aspera* L. is useful in treating asthma, piles, dropsy, snake bite, rheumatism and skin diseases. *Amaranthus viridis* (*Amaranthaceae*) was useful in the treatment of malaria, useful for prolapse of uterus, urinary tract infections, snake bite [17]. During this study it was noted that *Avena sativa* (*Poaceae*) is considered to have antioxidant and wound healing properties which is in accordance with the earlier findings of Akkol *et al.* [18]. *Calotropis procera* Aiton. has anti-diarrhoeal and anti-inflammatory activity [19]. Mishra *et al.* [20] described that the paste of *Fumaria parviflora var. indica* (*Papaveraceae*) was useful for treating joint swellings. All the plants

documented in this area showed many values for different pharmacological attributes which have been also observed in the past. Rehman *et al.* [2] observed that the most common medicinal plant used by local people was *Cichorium intybus* which had a 100% FL value when used as a liver tonic and blood purifier. Highest 0.76 ICF values were noted against stomach, gastric, intestinal and digestive problems. *Achyranthes aspera* showed the highest FL value (93%) when used in gastrointestinal disorders and menstrual pain. Padmavathi *et al.* [21] claimed that the high FL value showed the use of a particular weed to treat a specific disease. Rehman *et al.* [2] reported the significance of weeds in traditional medicines. They described 33 families with important weeds of the area that are used to treat various diseases including skin infection, respiratory and asthma problems, kidney, liver and heart diseases. Shinwari and Khan [22] recorded fifty species of herbs belonging to 27 families used medicinally by people native to Margalla Hills of National Park in Islamabad. From the total of 50 species, only 10 species were being sold in local market. Ahmad *et al.* [23] studied 6 important plant species of medicinal importance. *Achyranthes aspera* was used as purgative, laxative, diuretic, antiviral and styptic agent.

There are many reports describing the importance of weeds in other regions of Pakistan. Hussain *et al.* [7] reported 40 plant species from 39 genera and 32 families having medicinal properties in Haripur region of Pakistan. They described that *Acacia arabica var. nilotica* (L.) Benth. was used as astringent, tonic, antiseptic and purgative agent. Khan *et al.* [24] reported that *Calotropis procera* (*Apocynaceae*) were useful in cough, rheumatism and skin infection. Qureshi *et al.* [25] reported 63 herbs belonging to 50 genera and 29 families having medicinal importance.

It has been confirmed that weeds have significance in folk medicines. Local community depends on these weeds based upon traditional knowledge.

CONCLUSIONS

It was concluded that Toba Tek Singh District, Punjab, Pakistan has many weeds that are used in folk medicines to treat many diseases. There is a need to establish a link among local community, researchers and herbalist to develop medicine with mutual knowledge sharing about these weeds.

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