



Traditional use of medicinal plant diversity in the Yawan district of Badakhshan, Afghanistan

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Received: 16 March 2023 / Revised: 11 May 2024 / Accepted: 13 May 2024
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Abstract

This survey was conducted from June to September of 2022 in the Yawan district, which is located in the western region of the Badakhshan province, Afghanistan. The aim of the study is to documentation of MPs that are growing in the area. Notably, no previous research has been done to evaluate the medicinal plant diversity in the area, and this is the first attempt to explore and document MPs in the region. Interviews and field surveys were conducted using semi-structured questionnaires. A total of 120 respondents were randomly selected from 115 households in 17 distinct villages to participate in the study. Additionally, transect walks were conducted within the research site to collect plant specimens deposited in the herbarium of the Biology Department at Badakhshan University. As a result, a total of 35 MPs belonging to 31 genera and 18 families were identified to have curative value. The highest percentage of MPs belonged to the families of Asteraceae (19%), Apiaceae (13%), and Fabaceae (10%). There were two species of Moraceae, Plantaginaceae, and Amaranthaceae (18%), while all other families identified in the area had only one species (36%), including 27 herbs, four shrubs, and four trees. The highest ratio of utilizable MPs parts were the leaves (24%), roots (22%), shoots (16%), flowers (13.5%), fruits (13.5%), and seeds (11%). in conclusion, the local community of 35 MPs is utilized to treat ailments like stomach diseases, kidney diseases, hypertension, anemia, diarrhea, fever, skin diseases, respiratory diseases, analgesia, eye diseases, diabetes, traumatic pain, and cough remedies.

Keywords Medicinal plants · Diversity · Traditional uses · Yawan district · Badakhshan

Introduction

The utilization of medicinal herbs is an old human civilization. Medicinal herbs have been the basis of traditional medicine to cure different diseases worldwide. Medicinal plant-derived medicines are essential in curing various diseases (Okoye et al. 2014). Medicinal herbs are still known as the crucial health care system in various rural communities

for their usefulness, absence of modern medical replacements, and ethnic favorites (Shrestha and Dhillion 2003). More than 80% of people in developing countries rely on medicinal herbs for their medicinal necessities. The presence of herbal medicine depends on knowledge of medicinal plant diversity and their utilization as medicines (Ssegawa and Kasenene 2007). The collection and utilization of MPs is an important livelihood of people living in underdevelopment countries. (Guo et al. 2022). Approximately 50,000 plant species are utilized for therapeutic purposes all over the world. Plants have some important biomolecules in their parts, for example, seeds, fruit, leaves, roots, and bark; it is used to cure different diseases in humans and other animals (Sakkir et al. 2012). People from different countries have developed their knowledge of plant resources and utilization (Sher et al. 2020; Sucholas et al. 2021). Medicinal plants have been a resource for curing rural people worldwide for thousands of years, and they are essential as primary healthcare for the world population (Fitzgerald et al. 2020; Rahman et al. 2004). Plants provide people with

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medicines, food, fodder for livestock, also materials for the construction of houses. Plant products are frequently utilized in different herbal medicine systems around the world. Traditional medicines of China, the ayurvedic medicine system of India, the homeopathic medicine of Pakistan, and some other systems exist in other countries (Ishtiaq et al. 2012; Shrestha and Dhillion 2003; Kujawska et al. 2017).

Afghanistan is a mountainous country in central Asia intersected by the mountains of the Hindu Kush. It has varied geo-climatic conditions; the country has a rich flora and many medicinal plants utilized in traditional medicines (Pharnzacie et al. 1987). Herbal medicines play a significant role in the treatment of ailments. Badakhshan province is famous in Afghanistan because of its vast medicinal plant species and diverse ethnic groups. Rich folklore uses medicinal herbs. As per the World Health Organization (WHO), traditional medicine treats around 50% of the population in Europe and the USA, 70% in Canada, and as high as 90% globally. Maximum people of the village and ethnic communities of Badakhshan province mainly depend on the traditional medicinal system to treat various ailments as a means of primary healthcare (Mukul, e 2007; Sajeeb et al. 2022). MPs are an important resource in Badakhshan because they are essential to maintaining human health, particularly in underdeveloped regions where most people are unable to purchase even inexpensive medicines (Ali and Akobirshoeva 2013). The application of medicinal plants for food and health sovereignty has grown in the Badakhshan mountainous region (Kassam et al. 2010). However, publications regarding MPs growing in various parts of the country are still very scarce. The country's long-lasting conflicts could be the main reason for the lack of comprehensive studies and publications regarding medicinal plant diversity and the folklore and traditions utilized in different parts of the country (Amini 2017).

Yawan is one of the 28 districts of Badakhshan province, Afghanistan. People of the Yawan District utilize different medicinal plants to cure different ailments. Medicinal plant parts can be utilized in different forms, such as preparations, teas, fresh crude forms, decoctions, powdered plant material, or extracted forms of medicinal agents. These parts include roots, fruits, rhizomes, leaves, flowers, seeds, stems, and bark, which can be used to create extracts, balsams, essential oils, water or juices, tinctures, and resins. Moreover, MPs could be significant in nutrition as they contain many biologically active substances like essential oils or vitamins. Today, medicinal plant diversity is a global concern, as is the preservation of that diversity for future generations. The loss of unique plant communities or any species in isolated areas reduces biodiversity and disrupts the natural balance of the surrounding environment regardless of the cause (Olonova et al. 2020). MPs are harvested from a vast range

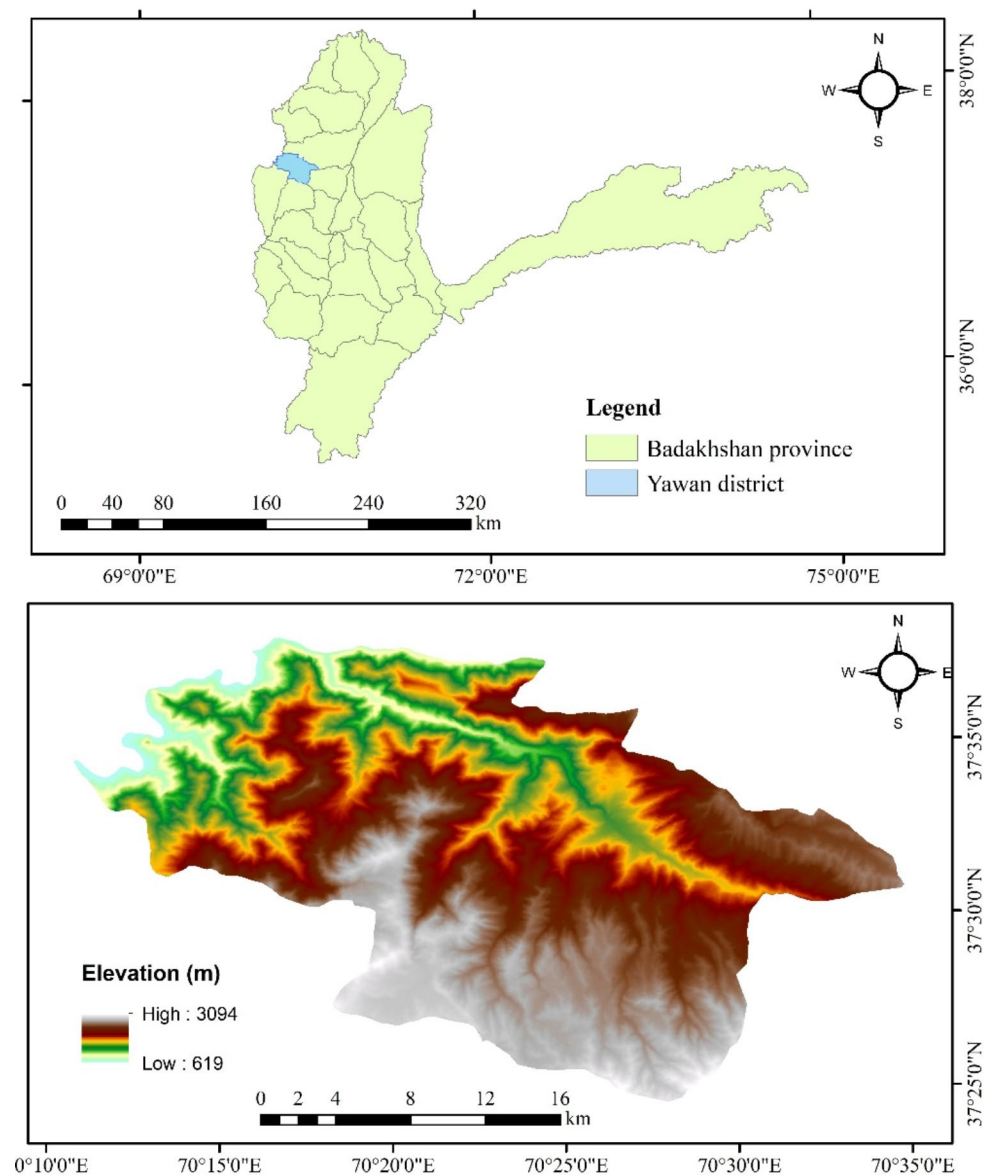
of plants, which are generally wild. Indeed, the demand for wild resources has increased daily (Majidi 2023). MPs and associated folk knowledge are endangered by continued utilization, habitat degradation, and unsustainable harvesting are the main threats to medicinal herbs. The loss of medicinal plant diversity likewise hampers folk knowledge. MPs play a vital role in the health care and economy of the local community (Okoye et al. 2014). This research aims to identify and document MPs in the Yawan district of Badakhshan Province, Afghanistan.

Study area

The study area is situated in the western region of Badakhshan province. It encompasses the Yawan district, which covers an area of 444 km² and is situated between latitudes 37° 24' 28" and 37° 37' 52" and longitudes 70° 10' 47" and 70° 34' 46" (Fig. 1). The intricate topography of Yawan district arises from its location on steep mountain slopes and within a significant valley. The altitude in the region ranges from 619 m to 3094 m, with snow covering the southern elevations from November to March. The district is classified as having a mountainous climate, with high-altitude areas resembling a tundra climate Augustine et al. (2019). The study reveals that the varied topography and climate of the region provide habitat for a multitude of flora and fauna, including medicinal plants that are used by the local community to alleviate a range of ailments.

The Yawan district's climate is characterized as a continental interior mountainous region, with cold temperatures dominating the winter season, presenting a monthly average of -5 °C, accompanied by heavy snowfall and substantial precipitation measuring 1410 cm³/month. Conversely, the summer season is typified by warm temperatures, with a monthly average of 22 °C, and aridity, with precipitation measuring 537 cm³/month. Rising temperatures and moderate rainfall mark the transitional period of spring. The precipitation and air temperature information pertinent to the study area has been ascertained using the ERA5-Land Monthly Averaged by Hour of Day - ECMWF Climate Reanalysis dataset for 33 years (1990–2023), executed within the Google Earth Engine cloud computing platform. The Yawan district community exhibits a low socio-economic status, primarily comprising farmers, with over 95% of individuals reliant on traditional agricultural practices. Livestock husbandry of sheep, goats, and cattle is a crucial source of milk production, while the local agricultural crop portfolio is dominated by barley, wheat, and pea cultivation (Omari 2023). Overgrazing and degradation are the main deleterious forces causing the loss of medicinal plant diversity.

Fig. 1 (a) The map depicts the region of Badakhshan province, with emphasis placed on the Yawan district. (b) The map illustrates the specific study area under (the Yawan district).



Method

Interviews and field surveys were conducted using semi-structured questionnaires between May and October 2022. One hundred twenty respondents (70 males and 50 females) from 115 households in 17 villages (Iadnil, Qatarbid, Darang, Morche, Now Abad, Enge, Aure, Jahad Abad, Eirsah, Sary, Zu, Maidan Salaiman, Shangane, Ruyraza, Ephache, Tirgaran, and wand) were interviewed. During the interviews, the following questions were asked. Which medicinal plant species are found in this region? Which part of the plant do you use for the treatment of diseases? Which diseases do you treat with medicinal plants found in this area? The informants were inhabitants of the study area aged 30 to 80; female informants were more knowledgeable than male informants about medicinal plants and medicine

preparation from herbs (Guo et al. 2022; Majidi 2023). In each village, at least five respondents were interviewed. The following data was gathered during the interviews, the Botanical name, local name, life form, parts used, and Treated diseases and current paper is the first report from the Yawan district of Badakhshan province.

The Field survey used the transect walks method to collect medicinal plant specimens. The targeted MPs were photographed, collected, and dried into the herbarium sheets. The newly collected species were compared with the existing medicinal plant specimens in the herbarium and new species stored in the herbarium of the laboratory of the biology department at Badakhshan University. MPs were identified with the help of Eisenman et al. (2013), and According to Jeppesen et al. (2012), “the flora of Badakhshan Mountains

is generally related to the Tibetan and Central Asian floras.” All data were calculated with Microsoft Excel 2013.

Results

Present research revealed that 35 medicinal plant species belonging to 31 genera and 18 families were identified to have maximum utilized traditionally and as folk medicines among the local community of Yawan district, as documented in (Table 1) (Bekele et al. 2022). The following families were found during the study Asteraceae, Apiaceae, Fabaceae, Cappariidaceae, Malvaceae, Elaeagnaceae, Ephedraceae, Poaceae, Linaceae, Moraceae, Papaveraceae, Zygophyllaceae, Plantaginaceae, Grossulariaceae, Punicaceae, Polygonaceae, Salvadoraceae, and Amaranthaceae (Fig. 2). It is found that local inhabitants of the Yawan district of Badakhshan province, Afghanistan, have used 35 medicinal plant species for treating different diseases.

In the present survey, 120 respondents were interviewed. The informants were inhabitants of the study area aged 30 to 80; female respondents were more knowledgeable than men about medicinal plants and medicine preparation from herbs. In each village, at least five respondents were interviewed. Many respondents knew 16 medicinal plant names and used them to treat different diseases; several were utilized explicitly for treating fever and kidney stones. The highest-mentioned PMs were *Achillea filipendulina*, *Carum carvi* L, *Glycyrrhiza glabra* L, and *Ribes nigrum* L (Table 1). The resident community in the study area collected MPs commonly for their consumption (90%), followed by for commercial purposes (10%).

Most medicinal plants belonged to Asteraceae, Apiaceae, and Fabaceae families, with 19%, 13%, and 10% species, respectively. Additionally, two species each of Moraceae, Plantaginaceae, and Amaranthaceae were identified (18%),

while the remaining families in the area contributed only one species each (36%) (Fig. 2) (Amini 2017; Sajeeb et al. 2022; Zeb and Ali 2021; Ali and Alamgir 2014). Among the 35 identified medicinal plants, 27 species were herbs (77%), four species were shrubs (11.5%), and followed by trees four species were trees (11.5%) (Fig. 3).

Notably, various parts of MPs, i.e., leaves, roots, shoots, flowers, fruits, and seeds, were utilized to treat different ailments (Fig. 4). Some plants are fresh and dried, and some plants' roots and shoots are used as medicines. It was found that identified medicinal plants used the following parts leaves nine species (24%), roots eight species (22%), six species (16%), flowers five species (13.5%), fruits five species (13.5%), and seeds (11%)%. Roots usually contain a high concentration of bioactive complexes. It is important to note that eliminating roots can significantly harm plant regeneration and survival (Amini 2017; Zeb and Ali 2021; Ghanimi et al. 2022).

It has been found that local inhabitants of the Yawan district have utilized 35 MPs to treat 14 ailments like stomach diseases (*Achillea filipendulina* Lam, *Achillea eupatorium* M.Bieb, *Achillea filipendulina*, *Alhagi pseudalhagi* (M. Bieb.) Desv, *Bunium persicum* (Boiss.) B. Fedtsch, *Glycyrrhiza glabra* L, *mentha pulegium*, and *Plantago lanceolata* L) were identified for various medicinal uses. *Althaea officinalis* L, *Ephedra viridis*, *Glycyrrhiza glabra* L, *Hordeum vulgare* L, and *Morus alba* L were effective for kidney diseases. *Ribes nigrum* L and *Ziziphora clinopodioides* Lam were identified as potential remedies for hypertension. *Spinacia turkestanica* Iljin and *Leontodon taraxacum* L were found to help treat anemia, while *Punica granatum* L and *Rumex confertus* Willd effectively treated diarrhea (Fig. 5). A comparison of MPs in the Yawan district of Badakhshan province shows that the highest medicinal plants were herbs, followed by trees and shrubs (Table 2) (Majidi 2023).

Fig. 2 Shows the medicinal plant families used as medicines for various diseases

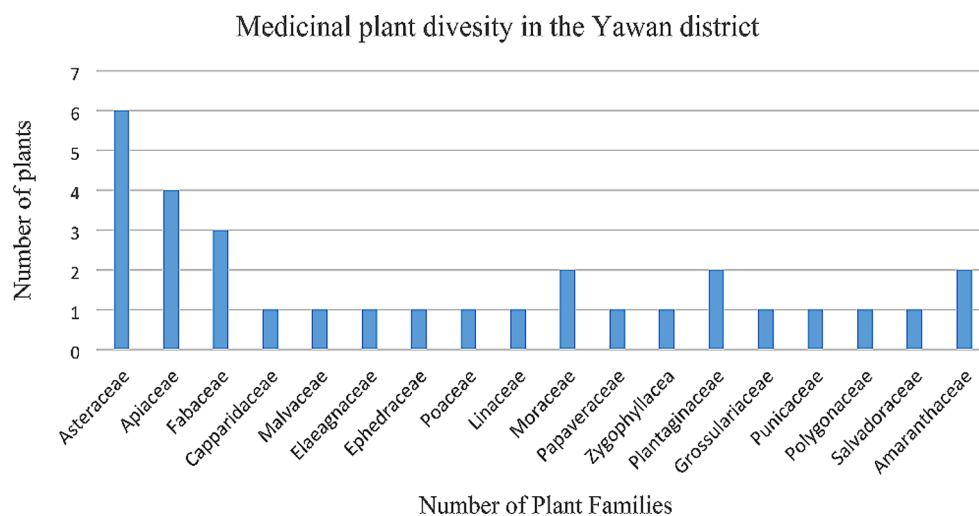


Table 1 Documentation of medicinal herbs by scientific name, family, local name, life form, parts used, and diseases that can be cured

MAPs Species	Coll. no	Family	L.name	Life form	Part use	Therapeutic use / Treated diseases
<i>Achillea filipendulina</i> Lam	7	Asteraceae	Zardsarak	Herb	Flower	Treatment of flatulence, fever, and Stomach diseases
<i>Achillea eupatorium</i> M.Bieb.	50	Asteraceae	Zardsarak	Herb	Flower	Treatment of flatulence, fever, and Stomach diseases
<i>Achillea filipendulina</i>	51	Asteraceae	Zardsarak	Herb	Flower	Treatment of flatulence, fever, and Stomach diseases
<i>Alhagi pseudalhagi</i> (M. Bieb.) Desv.	9	Fabaceae	Shirakhar	Herb	Whole plant	Treatment of Gastrointestinal diseases and Liver infection
<i>Althaea officinalis</i> L	21	Malvaceae	Gharmash	Herb	Leaf, flower	Treatment of Kidney stones
<i>Amaranthus retroflexus</i> L	41	Amaranthaceae	Tajkhoros	Herb	Flower	Treatment of upper respiratory diseases
<i>Berberis vulgaris</i> L.	22	Berberidaceae	Zerk	Shurb	Root	Treatment of Indigestion and traumatic pain
<i>Bunium persicum</i> (Boiss.) B. Fedtsch	39	Apiaceae	Gowzira	Herb	Seed	Treatment of stomach diseases
<i>Capparis spinosa</i> L	14	Capparidaceae	kawar	Herb	Fruit	Treatment of Gastrointestinal diseases
<i>Carum carvi</i> L	24	Apiaceae	Zira	Herb	Seed	Dyspepsia and diuretic
<i>Cichorium intybus</i> L	6	Asteraceae	kasni	Herb	Root	Treatment of fever, improve digestion
<i>Centaurea repens</i> L	13	Asteraceae	Talkha	Herb	Shoot	Treatment of Diabetes
<i>Cercis siliquastrum</i> L.	54	Fabaceae	Arghawan	Shrub	Leaf	Treatment of constipation relief
<i>Daucus carota</i>	52	Apiaceae	Zardak	Herb	Root	Treatment of eye diseases
<i>Elaeagnus angustifolia</i> L	33	Elaeagnaceae	Senjed	Tree	Fruit, Root	Treatment of skin diseases
<i>Ephedra viridis</i>	53	Ephedraceae	Bandak	Shrub		Treatment of kidney diseases
<i>Ficus johannis</i> Boiss.	26	Moraceae	Anjir	Tree	Fruit, Leaf	Treatment of Abdominal pains
<i>Foeniculum vulgare</i> Mill.	55	Apiaceae	Raziana	Herb		Cough remedy
<i>Glycyrrhiza glabra</i> L	4	Fabaceae	Sharinbuia	Herb	Root	Treatment of Stomach and intestine diseases
<i>Hordeum vulgare</i> L.	16	Poaceae	jaw	Herb	Seed	Treatment of urinary tract disorders
<i>Linum usitatissimum</i> L.	59	Linaceae	Zaghir	Herb	Seed	Treatment of Kidney stones
<i>mentha pulegium</i>	57	Lamiaceae	Podina	Herb	Shoot	Treatment of nausea and peptic ulcer
<i>Mentha spicata</i> L.	56	Lamiaceae	Nahna	Herb	Shoot	Treatment of peptic ulcer and nausea
<i>Morus alba</i> L	44	Moraceae	Toot	Tree	Leaf	Treatment of urinary system diseases
<i>Papaver somniferum</i> L	58	Papaveraceae	Tariak	Herb		Analgesia
<i>Peganum harmala</i> L	30	Zygophyllacea	Ispand	Herb	Leaf	Analgesic for the sick person
<i>Plantago lanceolata</i> L	3	Plantaginaceae	Zof midabarg	Herb	Root	Treatment of Gastritis and intestine diseases
<i>Plantago major</i> L	2	Plantaginaceae	Zof kalanbarg	Herb	Leaf	Treatment of wound, tumor
<i>Ribes nigrum</i> L.	12	Grossulariaceae	Qarakat	Shrub	Leaf, fruit	Treatment of hypertension
<i>Punica granatum</i> L	19	Punicaceae	Anar	Tree	Fruit peel	Treatment of diarrhea
<i>Rumex confertus</i> Willd	1	Polygonaceae	Shilkha	Herb	Leaf	Treatment of diarrhea, sunstroke, and fever.
<i>Salvadora persica</i> L.	60	Salvadoraceae	Maswak	Herb	root	Treatment of the germ of the mouth
<i>Spinacia turkestanica</i> Iljin	34	Amaranthaceae	Palak	Herb	Shout	Treatment of Anemia
<i>Leontodon taraxacum</i> L	42	Asteraceae	Qaquf	Herb	Leaf	Treatment of anemia
<i>Ziziphora clinopodioides</i> Lam	11	Lamiaceae	Gambilac	Herb	Shout	Treatment of hypertension

Life form of plants

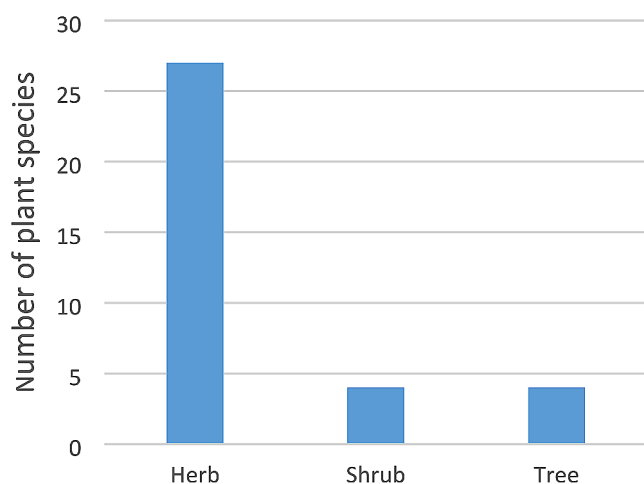


Fig. 3 Shows the life forms of medicinal plant diversity in the study area

Parts of the plants used as cured of drugs

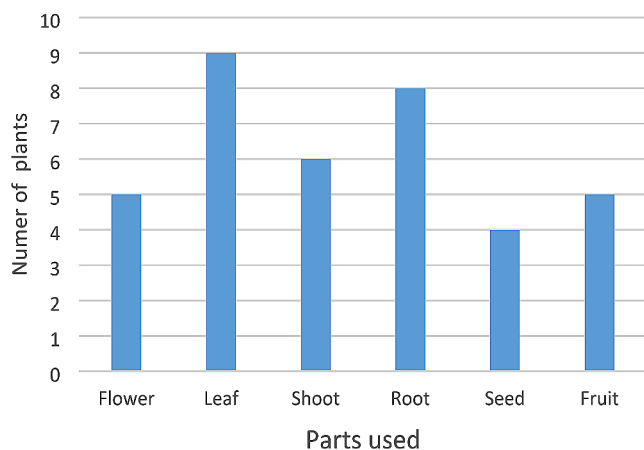


Fig. 4 Shows medicinal plant parts utilized to treat different ailments in the study region

Fig. 5 Shows various diseases cured by MPs in the study area, such stomach diseases(SD), kidney diseases(KD), hypertension(HY), anemia (AN), diarrhea (DI), fever (FE), skin diseases(SD), respiratory diseases(RD), analgesia (ANA), eye diseases(ED), diabetes(DIA), traumatic pain(TP) and cough remedy(CR).

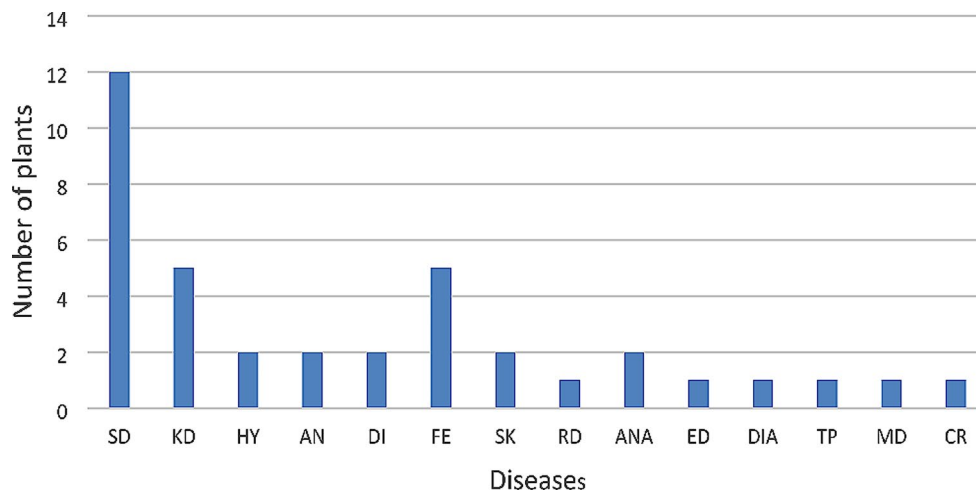


Table 2 Comparison table of medicinal herbs utilized for the treatment of various ailments

Life forms of MPs	Herbs	Shrubs	Trees	Total
Number of plants	27	4	4	35
Diseases cured by MPs				
Stomach diseases	10	1	1	12
Kidney diseases	2	1	1	4
Hypertension	1	1	-	2
Anemia	2	-	-	2
Diarrhea	1	-	1	2
Fever	4	-	-	4
Skin diseases	1	-	1	2
Respiratory diseases	1	-	-	1
Analgesia	2	-	-	2
Eye diseases	1	-	-	1
Diabetes	1	-	-	1
Traumatic pain	-	1	-	1
Cough remedy	1	-	-	1
Total	27	4	4	35

Yawan district is far from the center of the Badakhshan Province, and has limited access to health services over the years. The inhabitants have relied on various MPs found in the area and have long utilized traditional remedies to treat common ailments. MPs are used according to the guidance of experienced people who have known using of medicinal plants for the treatment of diseases. Utilizing herbal medicines was common among women, and still, some people do not go to the health center to treat some diseases. The specimens of some plants are used as herbal medicine are presented (Fig. 6).

Discussions

The present study revealed that 35 medicinal plant species belonging to 31 genera and 18 families were identified to have the highest utilized traditional and folk medicines

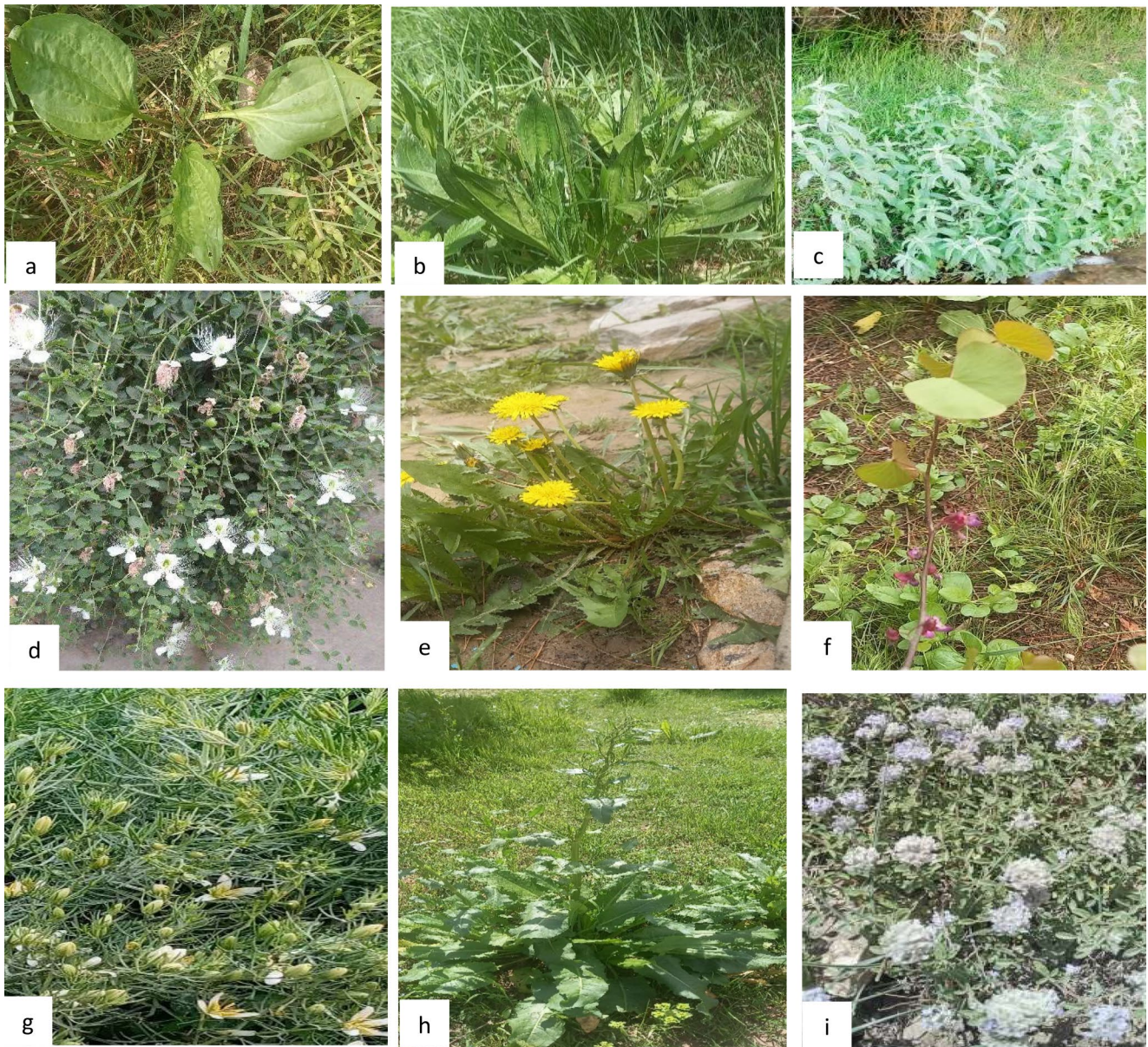


Fig. 6 The medicinal plants are often utilized in Yawan District (**A** *Plantago major* L, **B** *Plantago lanceolata* L, **C** *mentha pulegium* L, **D** *Capparis spinosa* L, **E** *Leontodon taraxacum* L, **F** *Cercis siliquastrum* L, **G** *Peganum harmala* L, **H** *Rumex confertus* Willd, **I** *Ziziphora clinopodioides* Lam)

among the inhabitants of the Yawan district in Badakhshan province, Afghanistan. Similar research has been done in some regions of Afghanistan and other countries. Current research consequences correspond with research reported 49 MPs traditionally used by the Argo district's local community in Badakhshan province of Afghanistan. Based on that research, 49 MPs have been utilized by inhabitants of the Argo district to treat 17 ailments such as fever, dysentery, hypertension, headache, cough, gastritis, diarrhea, anemia, wounds, Skin, Gastrointestinal and Respiratory diseases (Majidi 2023). Moreover, current findings agree with those reported by Amini (2017), who documented 37 (54%) MPs

for the cure of digestive system ailments from 68 medicinal plant species in the Guldara District of Kabul, Afghanistan (Amini 2017). Furthermore, in a study in the region of Sitamata Wildlife Sanctuary in India, 243 MPs belonged to 76 families. Regarding life, form trees were 77 species, followed by herbs 66 species, shrubs 40 species, climbers 31 species, and 20 species were tuberous plants (Jain et al. 2005). A study in the Pamir region of Badakhshan-Afghanistan reported 36 medicinal plant species. Another study in the Sango by area in southern Uganda documented that 186 MPs belonging to 163 genera and 58 families were used to treat various ailments (Ssegawa and Kasenene 2007).

Furthermore, Rahman et al. (2004) reported 254 medicinal plant species belonging to 7 families in Saudi Arabia for treating different diseases. In the eastern Gobi desert region of Mongolia, Magsar et al. 2018 found 78 species from 57 genera and 23 families that have medicinal properties and are used to treat various diseases. Other researchers, such as (Kujawska et al. 2017; Mukul et al. 2007; Neblea et al. 2012; Sher et al. 2020), have also reported the diversity of medicinal plants used for treating various ailments.

Badakhshan province of Afghanistan has varied climatic situations and has high medicinal plant diversity, tens of which are utilized traditionally in the study area. Unfortunately, due to the continuous war and conflict, MPs were not documented in all provinces of Afghanistan. However, in 1987, it was reported that 215 MPs were traditionally used in various Afghanistan regions (Amini 2017; Majidi 2022). However, the authors could not collect MPs from all provinces of Afghanistan. Therefore, more efforts are necessary to identify and document medicinal herb diversity in Afghanistan, and Badakhshan province has a vast range of MPs. In the research region, unsustainable harvest of MPs, overgrazing, and habitat loss are frequent activities that strongly negatively affect medicinal herb diversity (Majidi 2023). The current study is the first attempt to document medicinal plant diversity from the Yawan district of Badakhshan province, Afghanistan. Hence, these findings are essential for conserving MPs and future traditional and folk medicine studies. Meanwhile, similar surveys are also recommended for documentation of medicinal plant diversity in other regions of Afghanistan.

Conclusion

The present study was conducted in the Yawan district of Badakhshan province, Afghanistan. A total of 35 MPs belonging to 31 genera and 18 families were identified and documented to have the highest utilization traditionally and as folk medicines among the local community of the Yawan district. The highest percentage of MPs belonging to the families of Asteraceae 6 species (19%), Apiaceae 4 species (13%), Fabaceae 3 species (10%), there were two species of Moraceae, Plantaginaceae, and Amaranthaceae (18%). In contrast, all other families identified in the area had only one species (36%). Of the 35 identified MPs, 27 species were herbs (77%), four species were shrubs (11.5%), and followed by trees four species were trees (11.5%). It was found that identified medicinal plants used the following parts leaves nine species (24%), roots eight species (22%), six species (16%), flowers five species (13.5%), fruits five species (13.5%), and seeds (11%)%. The research found that the local community utilized 35 MPs to cure various

diseases such as stomach diseases, kidney diseases, hypertension, anemia, diarrhea, fever, skin diseases, respiratory diseases, analgesia, eye diseases, diabetes, traumatic pain, and cough remedies. However, habitat degradation, overgrazing, and harvesting before the time are the main threats to medicinal plant diversity in the study region.

Acknowledgements We are thankful to the local community for their help during this survey.

Declarations

Conflict of interest The authors declare that there is no conflict of interest regarding the publication of this article.

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