Therapeutic properties of trees and shrubs cultivated in the green spaces of the Algerian Sahara

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Research

Abstract

Background: Ethnobotanical studies are essential for understanding cultural diversity, the use of plant resources, drug discovery, and biodiversity conservation efforts. The current research highlights the medicinal properties of trees and shrubs growing in urban green spaces in the Algerian Sahara.

Methods: A total of sixty-five (65) articles published in academic journals between 1993 and 2024 were examined to identify the types of diseases treated, the plant parts used and the methods of preparing medical recipes from trees and shrubs growing in Saharan urban green spaces. The data were analyzed using statistical tools and techniques.

Results: Sixteen species belonging to 12 families and 15 genera were reported as being used to treat various diseases, grouped into 12 main categories. These include digestive, respiratory, dermatological, cardiovascular, endocrine, urinary, hematological diseases, musculoskeletal disorders and sexual problems. The plant families most commonly used to treat various diseases are Fabaceae (with 3 species), Lythraceae and Tamaricaceae (each with 2 species).

Conclusions: The findings provide valuable baseline information for further studies on the bioactive compounds derived from medicinal plants in Saharan urban green spaces, which may be effective in the treatment of various diseases.

Keywords: Biodiversity; Green spaces; Medicinal properties; Diseases; Sahara; Algeria

Background

Traditional medicine plays a crucial role in the lives of millions of people around the world, especially those living in rural areas (Elujoba *et al.* 2005). This form of medicine, which relies on natural resources, is often considered more accessible, affordable and acceptable to local populations and can therefore be a tool to help achieve universal health coverage (Zhang 2015). Plants provide humans with materials of economic, medicinal and fodder value, drawing on indigenous knowledge

regarding the use and management of plant resources within local communities (Bousta & Ennabili 2011). According to the World Health Organization (WHO), medicinal plants meet the health needs of around 80% of the world's population in developing countries (Hosseinzadeh *et al.* 2015).

In Africa, medicinal plants are an important resource for the majority of rural and urban populations and constitute the primary means of self-treatment (Badiaga 2011). Plant resources include approximately 300,000 species worldwide, of which 28 187 species are used for medicinal purposes worldwide, representing the broadest range of biodiversity utilized by humans (MPNS 2020). Algeria is a true phytogenetic reservoir, owing to the richness and diversity of its flora, which includes 4,300 species and subspecies of vascular plants (Quézel & Santa 1962-1963, Dobignard & Chatelain 2010-2013). These plant species represent bioresources that have great ecological, economic and aesthetic value. Among these plants, almost 600 species are considered as medicinal and aromatic plants (Mokkadem 1999, Chenouf 2009, Benaradj & Boucherit 2022). In Algeria's Saharan localities, the expansion of urban space is associated with the implementation of public and private green spaces that are home to both cultivated and spontaneous plants (Souddi & Bouallala 2021, 2022, Souddi *et al.* 2022, 2024a). These urban green spaces play an important role the daily lives of local populations, performing multiple functions and providing numerous ecosystem services for residents (MEA 2005, Nowak *et al.* 2006, Nomel *et al.* 2019). Trees and shrubs are key elements in the creation of green spaces in Saharan Urban Environments (SUE) as they provide numerous benefits to society (environmental, economic, energetic, medical, aesthetic and touristic services) (Sather *et al.* 2004, Nowak *et al.* 2006, McPherson *et al.* 2007, Larios *et al.* 2013, Costanza *et al.* 2014, Kidane *et al.* 2018). Lougbegnon (2013) reported that trees are commonly used as medicinal and ornamental plants in urban environments, serving as both remedies and preventive agents against various ailments. Several parts of trees and shrubs, whether wild or cultivated, are beneficial, such as fruits and leaves, which have properties that are essential for alleviating human health problems addressing food insecurity, particularly in developing countries (Kewessa *et al.* 2015). Jeambey *et al.* (2009) reported that the use of tree fruits improves blood circulation, prevents diabetes and reduces obesity, cancer and the risk of heart disease. Despite the importance of the use of plants in traditional medicine for many centuries, a relatively low number of tree and shrub species (local or introduced) are used in traditional medicine in Saharan localities, likely because knowledge and practices are transmitted only within a small segment of Saharan society (Hammiche & Maiza 2006, Chehma & Djebar 2008, Benhouhou & O'Hanrahan 2009, Kemassi *et al.* 2014, Selmani *et al.* 2017, Kadri *et al.* 2018, Amrouche *et al.* 2019, Kadri *et al.* 2019, Bradai *et al.* 2020, *Hacini et al.* 2022, Ayouaz *et al.* 2023, Souddi *et al.* 2023, Souddi *et al.* 2024b, Zemmouli *et al.* 2025). The conservation of ethnobotanical knowledge, cultural practices and the transfer of local knowledge and know-how from one generation to the next highlights the urgent need for biodiversity conservation measures (Souddi *et al.* 2023). The objective of this study is to examine the therapeutic relevance of trees and shrubs cultivated in Saharan urban green spaces, with a focus on the most frequently used species, the plant parts predominantly employed, and the preparation methods most commonly practiced.

Materials and Methods

Study area

The study area is part of the wilaya of Adrar (southwest of Algeria), bounded to the north by the commune of Aougrout, to the south by the commune of Fenoughil, to the east by the commune of Timokten and to the west by the commune of Adrar (Fig. 1). The climate of this area is hyper-arid, characterised by extremely low annual precipitation (averaging only 9.7 mm) and pronounced thermal variations. Winters are cold, with average minimum temperatures not exceeding 5.4 °C, while summers are intensely hot, with maximum temperatures reaching up to 46.2 °C (Bouallala *et al.* 2020, Souddi & Bouallala 2021, Souddi & Bouallala 2022, Souddi *et al.* 2022).

Data collection methods

To establish a comprehensive inventory of the trees and shrubs planted in urban green spaces in the study area, we first conducted a field survey to identify all existing spaces. Based on this survey, we recorded all trees and shrubs across three types of green space in the municipality of Tamentit: public gardens, alignment plantations, and private green spaces. Plant identification was performed using the *Flora of Algeria* (Quézel & Santa 1962-1963), the *Flora of the Sahara* (Ozenda 2004), the *Vascular Flora of Eastern Andalusia* (Blanca *et al*. 2011), as well as the Tela Botanica database.

Therapeutic aspects of plants studied

To determine the therapeutic effects of the inventoried plants, we based our research on the medicinal use of plant resources by different populations worldwide. Relevant ethnobotanical articles (mostly) published up till 2000 were retrieved from online bibliographical databases such as PubMed (http://www.ncbi.nlm.nih.gov/pubmed), ScienceDirect (http://www.sciencedirect.com/), Scopus (http://www.scopus.com/), Web of Science and Google Scholar

(http://www.scholar.google.com/) using keywords such as therapeutic effects, species names, used parts, and methods of preparation. The inventoried plants were classified into 12 major categories of pathologies (Appendix 1). The databases, as mentioned above, were also searched for pharmacological studies providing supporting evidence for the medicinal uses of each species.

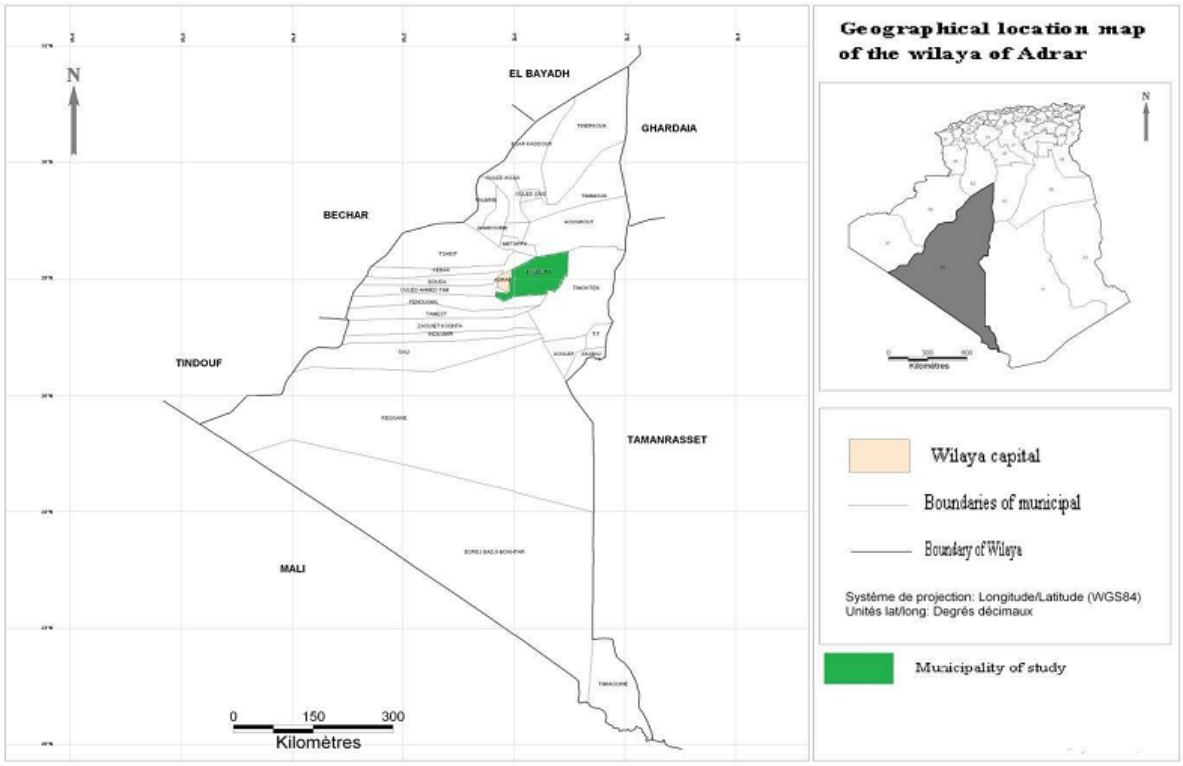

Figure 1. Geographical location of the study area

Results

Floristic composition and richness

The green spaces in the study area host a total of 16 species of trees and shrubs belonging to 12 families and 15 genera (Table 1). The most represented family is Fabaceae with 3 species (18.75%), followed by Lythraceae and Tamaricaceae with 2 species each (12.5% for each). In addition, 9 families are represented by a single species (Apocynaceae, Arecaceae, Casuarinaceae, Malvaceae, Moraceae, Moringaceae, Myrtaceae, Rhamnaceae and Sapindaceae). The percentage of plants introduced into these green spaces (75%) is greater than the percentage of native plants (25%).

Importance and therapeutic properties of the inventoried species

Therapeutic uses

The analysis of the results obtained allowed us to identify the different diseases treated by the inventoried species (Table 1). Trees and shrubs in Saharan urban green spaces can be used to treat digestive diseases, with 15 species, followed by respiratory diseases and musculoskeletal disorders, with 8 species each. Among the inventoried tree and shrub species, 7 species treat dermatological diseases, 6 species treat cardiovascular diseases, 5 species treat endocrine diseases, 4 species treat urological diseases, sexual problems and hematological diseases.

For each plant, the highest value for the number of diseases treated was recorded for *Ficus carica* (8 diseases), *Lawsonia inermis* and *Tamarix aphylla* recorded each with 7 diseases, while *Nerium oleander*, *Punica granatum* and *Moringa oleifera* recorded each with 6 diseases. On the other hand, the least used plants were *Vachellia farnesiana* and *Neltuma juliflora* (each with 2 diseases) (Fig. 2).

Table 2. List of trees and shrubs identified in the green spaces of southwestern Algeria, with their therapeutic effects, the parts used and the methods of preparation of the remedies (origin; I: Introduced, N: Native).

Family	Species	Therapeutic effects	Part used	Preparation methods	References
Apocynaceae (6.25%)	*Nerium oleander L.* (N)	Urological diseases Cardiovascular diseases	Leaves	Infusion	Adome *et al.* 2003, Souddi *et al.* 2023
		Endocrine diseases		Decoction	Elyebdri *et al.* 2017
		Digestive diseases		Powder	Elyebdri *et al.* 2017, Upadhyay 2024
			Flowers, Stem, Roots	Fumigation	Chehma & Djebar 2008
			Fruits	Nature	Guechi 2022
		Dermatological diseases	Barks	Powder	Radji & Kokou 2013
		Respiratory diseases	Leaves and barks	Maceration	Ayub *et al.* 2023
Arecaceae (6.25%)	*Phoenix dactylifera* L. (I)	Cardiovascular diseases	Leaves, seeds	Infusion , Powder	Telli *et al.* 2016, Souddi *et al.* 2024b
		Infectious diseases	Leaves	Decoction	Zerbo *et al.* 2011
		Sexual problems	Flowers (pollen)	Powder	Hacini *et al.* 2022
		Digestive diseases	Fruits, Leaves	Infusion , Powder	Tahraoui *et al.* 2007, Taleb *et al.* 2016
Casuarinaceae (6.25%)	*Casuarina equisetifolia* L. (I)	Infectious diseases	Seeds, Leaves	Infusion	Tiwari & Talreja 2023
		Nervous system	Branches	Decoction	
		Digestive diseases	Fruits	Powder	
			Barks	Decoction	Zerbo *et al.* 2011
		Musculoskeletal disorders	Seeds, Leaves	Powder	
Fabaceae (18.75%)	*Leucaena leucocephala* (Lam.) de Wit (I)	Infectious diseases	Leaves, Barks, Flowers, Stem	Decoction	Bussmann *et al.* 2010, Samoisy & Mahomoodally 2016
		Gynecological problems	Roots, Leaves, Barks, Fruits	Decoction	Jiofack *et al.* 2010
		Digestive diseases	Leaves	Decoction	Singh *et al.* 2014, Souddi *et al.* 2024b
			Barks	Decoction	Ramli *et al.* 2011, Sharmin & Mahazabin 2018, Subhan *et al.* 2018
	Vachellia farnesiana (L.) Wight & Arn. (I)	Infectious diseases	Barks, Leaves	Decoction	Nicolas 2012, Sharmin & Mahazabin 2018
		Dermatological diseases	Leaves, Seeds	Powder	Bora *et al.* 2007, Ramli *et al.* 2011, Sharmin & Mahazabin 2018
	Neltuma juliflora (Sw.) Raf. (I)	Digestive diseases	Leaves, Barks, Roots	Decoction	Tene *et al.* 2007, Laoualie*t al.* 2014, Jazy *et al.* 2017, Damasceno *et al.* 2017
		Respiratory diseases	Barks, Leaves, Flowers	Decoction	Kayani *et al.* 2014
			Leaves	Infusion, Decoction	Agra *et al.* 2008

Lythraceae (12.50%)	*Lawsonia inermis* L. (I)	Dermatological diseases, Sexual problems, Digestive diseases	Leaves, Seeds, Barks	Powder	Benderradji *et al.* 2021
		Hematological diseases, Sexual problems	Flowers	Decoction	Hacini *et al.* 2022
		Urological diseases, Nervous system	Roots	Decoction	Chaudhary *et al.* 2010
		Musculoskeletal disorders	Leaves	Maceration	Nazamuddin *et al.* 2013
	Punica granatum L. (I)	Dermatological diseases, Digestive diseases, Endocrine diseases, Respiratory diseases	Fruits, Flowers,	Powder	Nazamuddin *et al.* 2013, Gürdal & Kültür 2013
		Musculoskeletal disorders, Cardiovascular diseases	Barks, Seeds	Decoction	Ghorbani 2005, Benderradji *et al.* 2021
Malvaceae (6.25%)	*Gossypium herbaceum* L. (I)	Urological diseases	Leaves	Decoction	Nicolas 2012
		Digestive diseases	Seeds	Decoction	Balkrishnan *et al.* 2023
		Respiratory diseases, Nervous system	Seeds, Leaves	Infusion	
		Sexual problems	Flowers, Roots	Infusion	Rahman & Gondha 2014
Moraceae (6.25%)	*Ficus carica* L. (I)	Hematological diseases, Respiratory diseases,	Fruits	Decoction	Benderradji *et al.* 2021
		Respiratory diseases, Gynecological problems	Leaves, Fruits	Infusion	Ghazanfar & Al-Abahi 1993, Jaradat 2005, Tene *et al.* 2007, Idolo *et al.* 2010
		Endocrine diseases, Musculoskeletal disorders, Renal diseases	Leaves	Decoction	Tene *et al.* 2007, Zatout *et al.* 2021
		Digestive diseases	Fruits	Powder	Zatout *et al.* 2021
		Hematological diseases, Renal diseases, Dermatological diseases	Latex	Infusion	Ugulu 2011
Moringaceae (6.25%)	*Moringa oleifera* Lam. (I)	Urological diseases, Digestive diseases, Musculoskeletal disorders, Respiratory diseases	Roots	Decoction	Zerbo *et al.* 2011, Radji & Kokou 2013, Halliru *et al.* 2024
		Sexual problems	Leaves, Seeds	Powder	Zakawa *et al.* 2020, Alam *et al.* 2022, Diop *et al.* 2022, Mwami *et al.* 2024
		Respiratory diseases	Leaves	Infusion	Zakawa *et al.* 2020, Saïdou *et al.* 2024
		Cardiovascular diseases	Leaves	Decoction	Zakawa *et al.* 2020, Yabesh *et al.* 2014
Myrtaceae(6.25%)	*Eucalyptus camaldulensis* Dehnh. (I)	Respiratory diseases, Infectious diseases, Digestive diseases	Leaves	Fumigation	Zatout *et al.* 2021
			Leaves and Bark	Decoction, Infusion	Zerbo *et al.* 2011, Gbekley *et al.* 2017, Saïdou *et al.* 2024
			Seeds	Powder	Barkatullah *et al.* 2009
Rhamnaceae (6.25%)	*Ziziphus lotus* (L.)Lam (N)	Musculoskeletal disorders	Leaves	Decoction	Zatout *et al.* 2021
		Dermatological diseases	Roots, Fruits	Decoction Powder,	Chehma & Djebar 2008, Benderradji et *al.* 2021, Zatout *et al.* 2021, Hacini *et al.* 2022,
			Leaves	Infusion	Kadri *et al.* 2018
		Digestive diseases	Leaves, Fruits, Seeds	Infusion Maceration	Souddi *et al.* 2023, Ould Belle *et al.* 2024
		Endocrine diseases	Leaves, Fruits	Powder	El Yaagoubi *et al.* 2023

		Hematological diseases	Leaves, Fruits,	Infusion, Maceration, Decoction	Bencheikh *et al.* 2024
Sapindaceae (6.25%)	*Dodonaea viscosa* (L.) Jacq. (I)	Musculoskeletal disorders	Seeds	Powder	Barkatullah *et al.* 2009
			Stem	Decoction	Rahim *et al.* 2023
		Dermatological diseases	Leaves	Infusion, Decoction, Powder	Ali *et al.* 2004, Mothana*et al.* 2008, Haq *et al.* 2023, Jan *et al.* 2024
		Infectious diseases	Leaves, Seeds	Powder	Ahmad & Dastagir 2023
		Digestive diseases	Leaves and Bark	Infusion	Ali et al. 2004, Ayub *et al.* 2023
Tamaricaceae (12.50%)	*Tamarix aphylla* (L.) H. Karst. (N)	Dermatological disease, Musculoskeletal disorders	Stem , Leaves, Barks	Powder	Kadri *et al.* 2018, Bahadur *et al.* 2018
		Infectious diseases	Leaves		Rahim *et al.* 2023
		Gynecological problems	Leaves		
		Respiratory diseases	Leaves, Barks	Decoction, Infusion	Umair *et al.* 2019, Al-Fatimi 2019
		Endocrine diseases	Flowers	Decoction	Yaseen *et al.* 2015
		Cardiovascular diseases	Leaves	Decoction	Tahraoui *et al.* 2007
	Tamarix gallica L. (N)	Renal diseases	Flowers	Infusion	Rahim *et al.* 2023
		Cardiovascular diseases			
		Hematological diseases	Leaves, Flowers	Decoction, Infusion, Powder,	Adli *et al.* 2021
		Respiratory diseases	Leaves	Decoction	Meddour *et al.* 2020, Souddi *et al.* 2024b
		Digestive diseases			

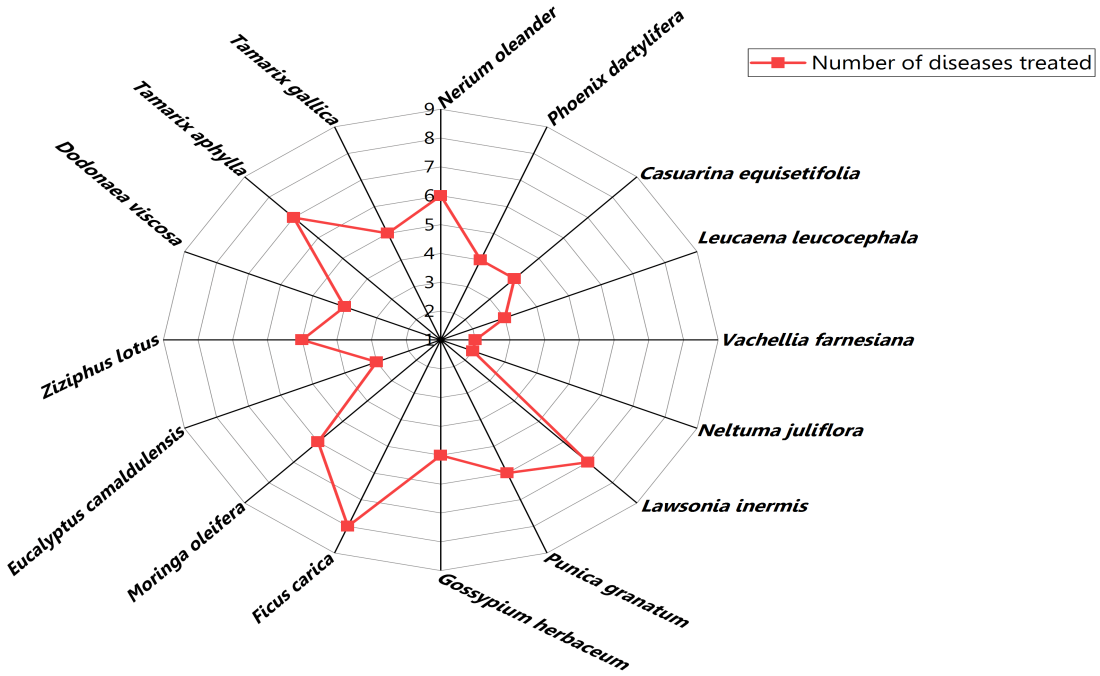

Figure 2. Number of diseases treated by the inventoried tree and shrub species in Saharan urban green spaces

Parts used

The analysis of the parts used in inventoried trees and shrubs revealed that the most commonly utilised parts in the treatment of various pathologies are leaves, with a frequency of 46 citations, followed by seeds (18 citations), fruits (17 citations), flowers (14 citations), bark (13 citations), and roots (11 citations). Other plant parts used in popular medicine, such as stems and branches, were cited less frequently, with fewer than 4 citations (Fig. 3).

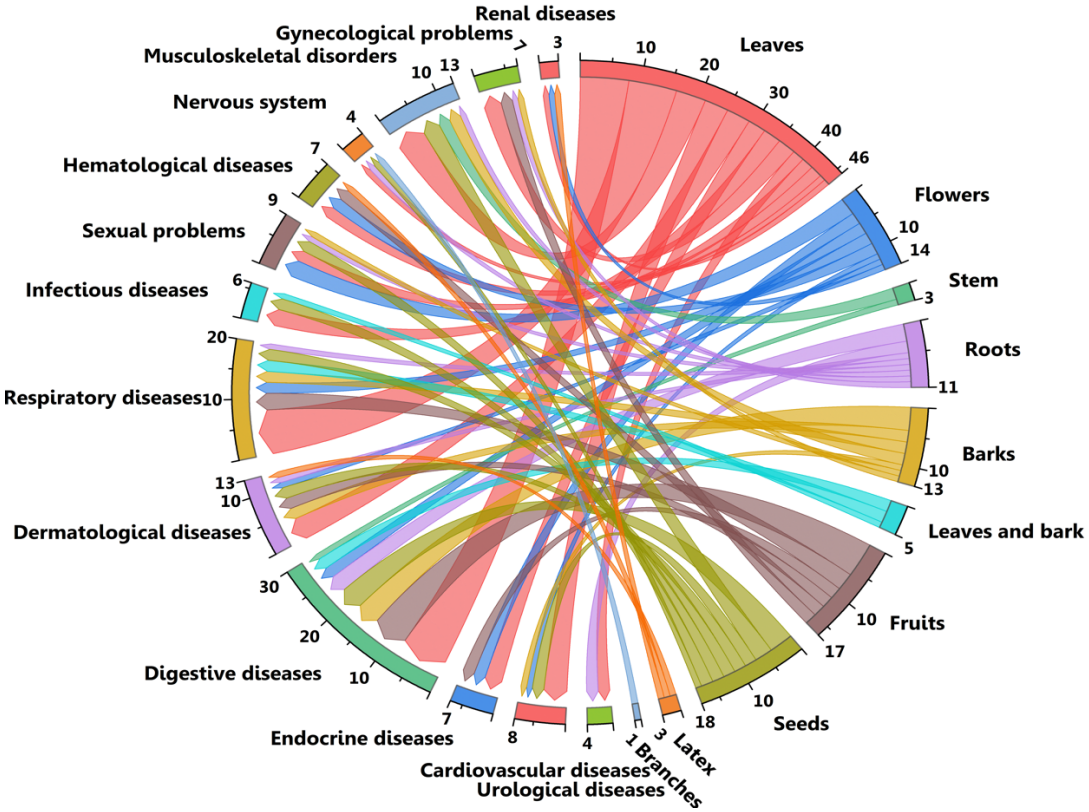

Figure 3. Links between diseases and used parts of inventoried trees and shrubs

Preparation methods

The inventoried plant species show a predominance of three forms of use to treat various pathologies, presented in descending order of citation as follows: decoction (41 citations), powder (29 citations), and infusion (25 citations). The less frequently cited preparation methods are maceration and fumigation (4 citations each) (Fig. 4).

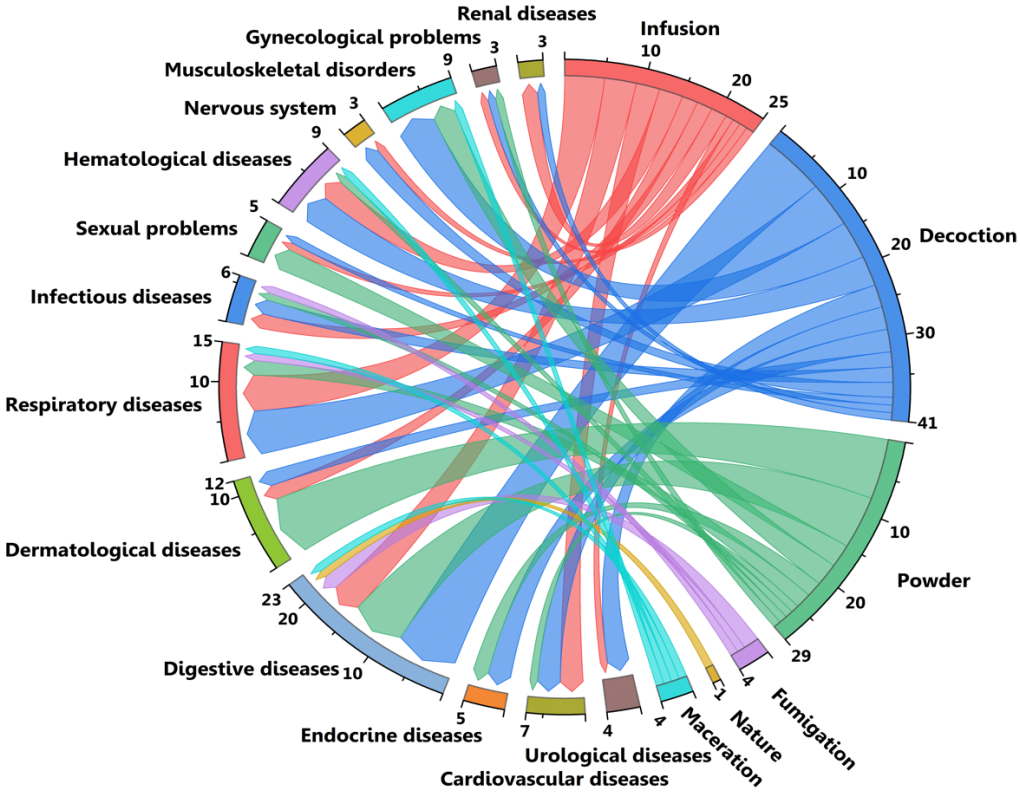

Figure 4. Links between diseases and methods of preparation of remedies

Discussion

Floristic composition and species richness

The current study aimed to survey trees and shrubs in Saharan urban green spaces in the region of Adrar (southwest Algeria). It is known that Saharan Urban Environments (SUE) subject plants to considerable stress, driven by elevated temperatures, air pollution, limited precipitation, and declining biodiversity. Consequently, plant communities often struggle to thrive in green roofs, parks, and living walls. However, although our study area is situated in the Algerian Sahara, its green spaces represent a special asset for the local population. The observed plants are known for their ability to adapt well to the arid climate despite the diversity of their geographical origins (El Faiz *et al.* 2016, Souddi & Bouallala 2021). The importance of the specific diversity of the plants identified in this study can be explained by the fact that these trees and shrubs play an aesthetic and recreational role (Souddi & Bouallala 2021). These species can also sustainably provide multiple ecosystem services (Escobedo *et al.* 2015) and their use in urban green space is fundamental to improve human wellbeing (Francini *et al.* 2022). The species diversity richness in the SUE is not directly comparable to that observed in green spaces of humid regions. In the current study, the Fabaceae family is the most representative, but only with 3 species which are generally well adapted to difficult environmental conditions (Chaer *et al*. 2011, Sreetheran *et al*. 2011) and play a crucial role in atmospheric nitrogen fixation and to improve plant health, growth, diversity and productivity in Saharan urban green spaces (Chaer *et al*. 2011; Raes *et al*., 2013, Baggnian 2021; Stewart *et al*., 2024). Consequently, the occurrence of Fabaceae species in the green spaces of our study area is of particular importance, given their ease of organ collection and their frequent use in medicine, which is attributable to their richness in bioactive compounds and associated pharmacological activities (Jan *et al.* 2021). According to Nadaf *et al.* (2023), the species of this family contain secondary metabolites such as tannins, phenolic compounds and alkaloids, which are responsible for their biological activity.

The family of Lythraceae is represented by two species, *Lawsonia inermis and Punica granatum* which are commonly planted in the region for several purposes. *Lawsonia inermis (hénné* in Arabic*)* is widely cultivated in the region of Adrar since it holds

a sacred social status and is used in several rituals and rites, symbolizing a significant cultural heritage. The species constitutes an important element in the composition of green space flora due to its aromatic properties as well as medicinal and cosmetic uses.

Diseases treated

In the current study, the results showed that the inventoried trees and shrubs are used in traditional medicine primarily to treat digestive diseases. Digestive diseases are prevalent worldwide and many plants are used to treat them by different communities worldwide (Shah & Afzal 2013, Alzaheb & Altemani 2018). Thus, trees and shrubs have been reported as promising alternatives for the treatment of such conditions (Nadaf *et al.* 2023). Digestive diseases include diarrhea, dysentery, hemorrhoids, colon disorders, abdominal colic, constipation, nausea, stomach, intestinal worms, stomach pain, abdominal pain, toothache, constipation, abdominal swelling, stomach ulcer and small intestine ulcers. Interestingly, the present work revealed that even some plants known for their high toxicity such as *Nerium oleander* (Barbosa *et al.* 2008, Benvenuti & Mazzoncini 2021), are used as medicinal plants. This finding reflects substantial folk expertise and traditional know-how in herbal medicine. At the same time, it underscores the importance of ethnobotanical surveys and studies aimed at preserving traditional knowledge and practices. In this study, musculoskeletal disorders, including back pain, rheumatism, arthritis and body aches, are treated with 8 out of the 16 plants examined. Musculoskeletal disorders affect more than 1.7 billion people worldwide and are considered the fourth most significant pathology affecting the overall physical condition of global populations, leading to both disability and mortality (Hignett & Fray 2010).

The current study listed 8 plants used to treat 7 types of respiratory diseases (allergy, flu, cough, cold, asthma, respiratory failure and bronchitis). These respiratory disorders are increasing for many reasons, including poor air quality, especially in urban areas (D'Amato *et al.* 2015). Epidemiological studies showed that urbanization, high levels of vehicle emissions, and a Westernized lifestyle correlate with an increased prevalence of respiratory allergies, mainly in urban areas (D'Amato *et al.* 2015). According to WHO, air pollution is the leading environmental risk factor worldwide, while ambient and household air pollution is responsible for almost 7 million deaths (WHO 2018). Spatial variations in pollution have significant implications, for air pollution monitoring, management and environmental epidemiology (Briggs *et al.* 1997, Al Mentashri & El Zerey 2021). The use of medicinal plants to treat respiratory disorders, has shown that trees and shrubs are favored because of their year-round availability and their resistance to drought (khan *et al.* 2013).

Parts used

All parts of trees and shrubs in Saharan urban green spaces are used to prepare recipes for therapeutic uses. Analysis of these recipes revealed a predominance of leaves followed by seeds. The relatively high frequency of leaf use can be explained by the ease and speed of their harvesting (Kouadio *et al.* 2016), as well as by the fact that leaves are the site of biochemical and metabolic reactions and represent the reservoir of organic matter and secondary metabolites. Ethnobotanical studies carried out by Oueld El Hadj *et al*. (2003), Kemassi *et al.* (2014), Bouallala *et al.* (2014), Hadj-Seyd *et al.* (2016), Kadri *et al.* (2018), Kadri *et al.* (2019), Amrouche *et al.* (2019), and Bradai *et al*. (2020) also indicated that the leaves are the parts most used in the various therapeutic preparations. The use of fruits is due to the concentrations of their bitter, carbohydrate or aromatic substances associated with certain pigments that give them their characteristic color, while the use of flowers is due to their richness in essential oils, while roots and seeds are rich in sugars and vitamins (Babba Aissa 1999).

Preparation methods

The pharmacological studies on this subject acknowledge that the best use of a plant would be one that preserves all of its properties while allowing the extraction and assimilation of the active ingredients (Dextreit 1984). Decoction is the most common method of use, as it is used for parts of the plant that are hard, or even very hard (such as roots, bark, hard fruit or stems). It helps to warm the body and disinfect the plant to eliminate the toxic effect of certain recipes, although it can destroy certain active ingredients of the species used (Benlamdini *et al.* 2014). The powder is able to fully restore all the components of the plant; thanks to its fine particle size, it releases the active substances better (Yang *et al.* 2014). Moreover, plants reduced in this form are used for their medical applications both internally (swallowed or absorbed through the oral mucosa) and externally (serve as a basis for poultices and can be mixed with ointments) (Chevallier 2001). Infusion, is generally applied to the delicate organs of the plant (leaves, flowers, etc.); where most of the principles are suitably dissolved (such as phenols, mineral salts, phytohormones, etc.). It is the method of preparation that best preserves the plant's active ingredients (Moatir *et al*. 1983).

Conclusion

In the region with scarce wild flora, gardens and green spaces are the principal source of medicinal plants after the herbal shop. In the current study, we analyzed the folk medicinal properties that can provide 16 plant species of trees and shrubs found in green spaces in the region of Adrar, a Saharan locality in southwest Algeria. These species hold great importance due to aesthetic, socio-economic and medicinal values, as the populations of this region continue to rely on medicinal plants to meet their basic healthcare needs. Therefore, these trees and shrubs can be used to treat various diseases such as digestive diseases, respiratory diseases, musculoskeletal disorders... etc. These plants can also play a fundamental role in supporting and improving the livelihoods of the inhabitants of Algeria's desert regions. The present study revealed a significant diversity in the plant organs used, the diseases treated with and methods of preparation and formula highlighting the importance of popular skills and traditional know-how that should be preserved and valued through modern scientific research. In addition, further studies on these plant species are necessary, particularly those with high added value, to identify essential metabolites that could attract the attention of future researchers, health professionals and the pharmaceutical industry.

Declarations

Ethics approval and consent to participate: Not applicable
Consent for publication: Not applicable
Availability of data and materials: All the data related to the present study is included in the manuscript
Competing interests: The authors declare that they have no conflict of interest
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Author contributions: MS: Conceptualization, Methodology, Investigation, Writing-Original draft.; AEB Reviewing and Editing, and drafted the initial manuscript; WE & MB: Reviewing and Editing. All authors participated in reading, revising, reviewing, and approving the final draft of the manuscript.

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