



Ethnobotanical knowledge of wild edible and medicinal plants in Southern Morocco: The case of Guelmim Province

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Research

Abstract

Background: In Morocco, Wild edible plants (WEPs) constitute an essential element of traditional knowledge, contributing to food security, healthcare, and cultural heritage. However, their use is declining due to modernization, agricultural intensification, and the loss of local knowledge, highlighting the need for documentation.

Methods: An ethnobotanical survey was conducted from August 2024 to August 2025 in Guelmim Province, Southern Morocco. The study covered Guelmim city and three rural communes: Timoulay, Laqsabi Tagoust, and Tighmert. Ethnobotanical Data were collected using semi-structured interviews and focus group discussions with local informants and analyzed using descriptive statistics and quantitative ethnobotanical indices, namely the Fidelity Level (FL), Relative Frequency of Citation (RFC) and Informant Consensus Factor (ICF).

Results: A total of 36 wild edible plant species were recorded. The most dominant families are Asteraceae, Fabaceae, and Lamiaceae (8% each). The study revealed a diversity of uses, with leaves (29.09%) predominating for medicinal purposes, followed by fruits (7.27%) and seeds (5.45%). Decoction was identified as the most common preparation method (38.1%). FL ranged from 18.45% to 96.67%, and RFC values varied from 0.21 to 0.86, indicating variable use importance across species, while the ICF values showed overall high informant consensus.

Conclusions: The present study highlighted that the people of Guelmim Province possess valuable traditional knowledge. Documentation of this heritage can support biodiversity conservation, dietary diversification, and food security. Moreover, providing a foundation for sustainable agricultural practices, notably organic farming.

Keywords: Wild edible plants; Ethnobotany; Traditional knowledge; Food security; Guelmim Province; Morocco.

Background

Wild edible plants (WEPs) have played an essential role in people's diets for thousands of years, particularly in times of scarcity. They are still consumed and valued today, particularly in rural areas where older people continue to preserve and pass on ancestral knowledge related to the gathering and use of these plants. However, with current changes, this intangible heritage, as well as the consumption of these plants, is increasingly threatened (Bharucha & Pretty 2010; Oluoch *et al.* 2023). Indeed,

increasing urbanization, globalization, and the industrialization of food and agricultural systems have contributed significantly to the standardization of food while reducing the diversity of species consumed and concentrating people's eating habits around a limited number of standardized food products (Ickowitz *et al.* 2019). It is thus striking to note that, among the 7,039 species of WEPs recorded worldwide, only 417 are recognized as food crops, and barely 15 of them provide nearly 90% of the world's energy intake. Thus, it is clear that today more than four billion people depend primarily on three crops: rice, corn, and wheat (FOA 2010; Antonelli *et al.* 2020). This modern food system, although effective in feeding a growing world population, is failing to stem the persistence of hunger and malnutrition in many countries (Fang *et al.* 2023). Furthermore, the rise of health problems linked to industrial food (presence of pesticides, additives, colorings, and other chemical substances) is raising increasing public health concerns (Ren *et al.* 2021).

In this context, the promotion and reintegration of WEPs into existing food systems is attracting renewed interest. In fact, there has been a noticeable increase in scientific interest in these plants recently. Numerous studies have demonstrated the plants' exceptional nutritional potential, highlighting their abundance particularly in proteins, phenols, carbohydrates, minerals and vitamins (Casas *et al.* 2024). Certain studies have gone even further, showing that these plants have a nutritional profile that can exceed that of cultivated plants (Alam *et al.* 2020). Other research has also examined their medicinal potential and have demonstrated that edible wild plants may prevent or reduce chronic diseases, including some types of cancer (García-Herrera *et al.* 2014; Tadesse *et al.* 2024).

In response to the challenges of climate change, biodiversity loss, and dietary standardization, the rediscovery of these plants is showing promise as a means of promoting sustainable development, diversifying diets, and contributing to the protection of both human health and the environment (Jones 2017).

At the heart of the Mediterranean basin, home to approximately 10% of the world's known vascular plants, Morocco is recognized by its exceptional plant heritage and ecological diversity. This wealth is largely contributed by the country's strategic geographical position, located between Africa and Europe, as well as by the variety of its climatic conditions, impacted by both the Atlantic and the Sahara. The Moroccan flora includes nearly 7,000 plant species, divided into 920 genera and 130 families, of which approximately 4,500 species and subspecies are vascular plants (Radford *et al.* 2011).

WEPs occupy an important place in Moroccan culture, particularly in rural areas where they are used not only for food, but also for their medicinal properties and other traditional uses. However, despite this floristic richness, Morocco, like many regions of the world undergoing nutritional transition, remains largely dominated by the consumption of a limited number of standardized food crops. This phenomenon, accentuated by changing lifestyles and the growing disinterest of younger generations, contributes to the gradual erosion of traditional knowledge related to the use and consumption of WEPs, knowledge still preserved mainly by the elderly (Aboukhalaf *et al.* 2022; Kaoutar-Naciri *et al.* 2022; Essaih *et al.* 2023).

WEPs are also a model of plant food resilient to climate change as can be judged by their presence in different regions of Morocco with environmental and geographical differences extending from the edge of the Mediterranean basin to other areas in different provinces on the Atlantic and in the mountains as reported by several ethnobotanical studies undertaken in Morocco (Kaoutar-Naciri *et al.* 2022; Essaih *et al.* 2023). With the exception of the Saharan areas where data concerning these WEPs are lacking, hence the interest in conducting this study.

In this context, this work aims to promote WEPs by documenting them, through an ethnobotanical study conducted in four localities in the Guelmim province in southern Morocco, including the city of Guelmim and three rural communes (Timoulay, Laqsabi Tagoust, and Tighmert). The objective of this research is to identify locally used wild species with the aim of preserving ethnobotanical knowledge associated with these plants, as well as to assess their cultural importance to local populations and to analyze current trends in their exploitation.

Materials and Methods

Study area

The province of Guelmim, nicknamed the "Gateway to the Sahara" and located in southern Morocco, belongs to the greater Guelmim-Oued Noun region. It covers an area estimated at approximately 10,783 km², geographically bounded to the west by the Atlantic Ocean, to the east by the province of Tata, to the north by Sidi Ifni, to the southeast by Assa-Zag, and to the southwest by Tan-Tan. The province has a total population of 193,061 in 2024, of which 94,459 are men and 98,602 are women, divided between two residential areas: 150,767 inhabitants in urban areas and 42,294 in rural areas. Administratively,

were asked to provide for each species mentioned, the local name, the parts of the plant used, the related uses (food, medical, cosmetic, etc.), the preparation methods (infusion, decoction, poultice or other), the application methods, and the possible dangers related to toxicity.

To ensure the reliability of recent information (Alexiades 1996; Ali-Shtayeh *et al.* 2008), only species cited by at least three distinct participants were included in the final analysis, in accordance with the methodological ethnobotanic recommendations (Cotton 1996; Sukenti *et al.* 2016). Two complementary methods were implemented for data collection, semi-structured individual interviews and focus group discussions, allowing for the inclusion of a larger number of participants and stimulating interactions between different local stakeholders (users, herbalists, etc.). Each interview lasted between 30 and 40 minutes.

Consent was always obtained from study participants before the interviews began and after explaining the study objectives.

Taxonomy

The taxonomic identification of the plants studied was carried out at the Laboratory of the Faculty of Sciences of El Jadida (LABS) with the assistance of a florist. This scientific identification also used various botanical references (Bellakhdar 1997; Tattou *et al.* 1999; Fennane & Ibn Tattou 2012; Fennane *et al.* 2014) and was supplemented by consulting international databases, such as The Plant List (www.theplantlist.org), to strengthen the verification of scientific names.

Data Analysis

The survey data were entered into Microsoft Excel for tabulation and then analyzed using Origin software to create graphical representations.

Informant Consensus Factor (ICF)

The Informant Consensus Factor (ICF) was calculated to assess the level of agreement among informants for each treatment category, using the following formula (Heinrich *et al.* 1998):

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

Nur = Total number of use citations in each category.

Nt = Number of species used.

Fidelity Level (FL)

The Fidelity Level (FL) was used to determine the percentage of informants who reported the use of a plant species for treating a particular disease. The FL index was calculated according to the following formula (Friedman *et al.* 1986):

$$FL(\%) = \frac{I_p}{I_u} \times 100$$

I_p = Number of informants who reported the use of a species for a specific ailment.

I_u = Total number of informants who mentioned the species for any ailment.

Relative Frequency of Citation (RFC)

The Relative Frequency of Citation (RFC) is based on the percentage of informants who cited each species. It was calculated using the following formula (Tardío & Pardo-De-Santayana 2008):

$$RFC = \frac{FC}{N} \quad (0 \leq RFC \leq 1)$$

FC = Number of informants who cited the species.

N = Total number of informants in the study.

Results and discussion

Sociodemographic Characteristics

The ethnobotanical survey involved 210 individuals, primarily from the city of Guelmim (61.90%) and the three rural municipalities studied (Timoulay, Laqsabi Tagoust, and Tighmert) (38.10%). The majority of the population surveyed was female (64.76% versus 35.24% male). This result confirms numerous studies showing that women are more likely to use and preserve knowledge related to medicinal and food plants. Furthermore, analysis of the age distribution of the sample shows that respondents over 60 years old represented nearly half of the sample (49.52%), followed closely by those aged 40 to 60 (42.38%), while those under 40 represented only 8.10% of the sample. These results highlight the importance of older people as the primary custodians of traditional knowledge and their central role in its transmission and preservation, compared to younger generations. The origin of the knowledge reported by respondents confirms this trend. Indeed, the majority of participants (79%) reported acquiring their knowledge through a heritage passed down orally from generation to generation. The remaining 21% acquired their knowledge from herbalists, who also play an important role in preserving these practices. Regarding educational level, the majority of participants surveyed were illiterate (86.19%), while 6.19% had a Quranic level, 5.24% a primary level, and a small minority had a secondary level (2.38%). These data show that the ethnobotanical knowledge studied is essentially empirical, inherited from experience and intergenerational transmission, and remains largely independent of the formal education system.

Table 1. Sociodemographic characteristics of participants.

Categories	Number	Percentage
Gender		
Female	136	64.76%
Male	74	35.24%
Age		
< 40	17	8.10%
40-60	89	42.38%
60 >	104	49.52%
Education Level		
Illiterate	181	86.19%
Quranic	13	6.19%
Primary	11	5.24%
Secondary	5	2.38%
Area of residence		
Guelmim city	130	61.90%
Timoulay	38	18.10%
Laqsabi Tagoust	29	13.81%
Tighmert	13	6.19%
Source of information		
Ancestral heritage	166	79%
Herbalists	44	21%

Botanical data and plant uses

Wild plants identified during the survey

The survey identified 36 wild species reported in Guelmim province by the local population, belonging to 25 families used for food, for medicinal, or other purposes (Table 2). The study was limited to an inventory of wild plants native to the study area, excluding cultivated or domesticated species. The study results confirm that the Saharan region is distinguished by a particularly significant use of WEPS, a trend already noted in other studies, partly explained by its strategic location and its trade with other Moroccan regions as well as with neighboring countries, particularly Mauritania (Alaoui *et al.* 2018).

The most reported botanical families are Asteraceae, Fabaceae and Lamiaceae, represented each with 3 species, representing about 8% of the total reported species, followed by the families Amaranthaceae, Apocynaceae, Apiaceae, Convolvulaceae and Caryophyllaceae, with 2 species per group, representing about 6% each. The other families are represented by only one species each (Fig.2). These results agree with those of other botanical studies (Alaoui *et al.* 2018; Loud *et al.* 2025), conducted in the Saharan region, as well as with available data from other regions of Morocco (Bouayyadi *et al.* 2015; Aboukhalaf *et al.* 2022).

Table 2. Inventory of wild plants recorded in the study area.

Family	Species	Vernacular name	Type of use	Purpose of use	Part used	Method of preparation
Amaranthaceae	<i>Haloxylon scoparium</i> Pomel	Remth	M	Intestinal Disorders	Roots	Infusion
			M	Oral health (mouth infections, toothache relief)	Leaves	Decoction used as mouthwash
Amaranthaceae	<i>Chenopodium ambrosioides</i> L. (*)	Mkhinhza	M	Fever	Leaves	Skin application: poultice on the head
			M	Fever	Leaves	Infusion
Amaranthaceae	<i>Chenopodium ambrosioides</i> L. (*)	Mkhinhza	M	Fever	Leaves	Mixed with orange juice (oral use)
Anacardiaceae	<i>Rhus tripartita</i> (Ucria) Grande	Jdari	F		Fruit	Raw (Snack)
			M	Abdominal pain	Leafy stems	Light decoction
Apocynaceae	<i>Nerium oleander</i> L. (*)	Defla	M	Skin diseases (scabies, parasites)	Leaves	Poultice / skin application
			M	Digestive troubles	Leaves	Infusion/decoction
Apocynaceae	<i>Periploca angustifolia</i> Labill	Lhallab	F		Flower	Raw (Snack)
Apiaceae	<i>Eryngium ilicifolium</i> Lam	Zrayga	M	Sore throat	Leafy stems	Decoction
			M	Against poisonous bites and stings	Seeds	Seeds ground into powder, mixed with water, and applied as a poultice on the bite
Apiaceae	<i>Ammodaucus leucotrichus</i> Coss.& Durr	Kamoun reg	M	Abdominal pain, cold, poisoning	Seeds	Decoction/ Infusion
Asteraceae	<i>Asteriscus graveolens</i> (Forssk.) Less	Tafsa	M	Kidney stones	Flowers	Decoction
Asteraceae	<i>Artemisia herba-alba</i> Asso (*)	Chih	M	Antibacterial, Hair loss	Flowers / Leaves	External use: Ground into powder, mixed with oil
			M	Antibacterial, Hair loss	Flowers / Leaves	Decoction
Asteraceae	<i>Launaea arborescens</i> (Batt.) Maire	Oum Ibena	M	Skin mycosis "Goub"	Latex	Raw: Topical application of the plant latex on skin mycosis
			M	Against Warts "Taloul"	Thorns	Cauterize "Taloul"
Asparagaceae	<i>Urginea olivieri</i> Maire (*)	Teylum	F		Bulb	Raw: Snack
Brassicaceae	<i>Anastatica hierochuntica</i> L.	Lkamcha	M	Infertility, digestive and urinary disorders	Whole plant	Decoction
Cactaceae	<i>Opuntia ficus indica</i> (L.) Mill.	Aknari	F		Fruit	Raw
			M	Digestive disorders	Flower	Infusion / Decoction

			M	Topical anti-inflammatory	Cladodes	Poultice
Capparaceae	<i>Maerua crassifolia</i> Forssk	Atil	M	Digestive disorders	Leaves	Oral : Powder
Convolvulacea	<i>Convolvulus arvensis</i> L.	Luwaya	O	Oral hygiene	Stems	Raw : as toothbrush
Convolvulacea	<i>Convolvulus trabutianus</i> Schwi et Munson	Lgandoul	M	Cold, Caught	Whole plant	Decoction
Caryophyllaceae	<i>Corrigiola litoralis</i> L.	Tasrhint	M	Digestive disorders	Whole plant	Decoction
Caryophyllaceae	<i>Herniaria hirsuta</i> L.	Harasst Ihjar	M	Allergy	Whole plant	Oral: Cooked with camel bones, dried, ground into powder, mixed with honey
Cistaceae	<i>Helianthemum confertum</i> Dunal	Lyergig	M	Kidney stones	Whole plant	Decoction
Cupressaceae	<i>Juniperus phoenicea</i> L.	Araar	M	Anti-hair loss	Leaves	Infusion
Euphorbiaceae	<i>Euphorbia officinarum</i> L. ssp. <i>echinus</i> (Hook. f.) (*)	Daghmous	M	intestinal disorders, diarrhea	Leaves	Infusion
Fabaceae	<i>Ononis natrix</i> L.	Hennet reg	M	Anti-cancer	Stems	Decoction
Fabaceae					Leaves	Decoction
Fabaceae			F		Pulp	Raw: Snack
Fabaceae	<i>Ceratonia siliqua</i> L.	Kharoube	M	Digestive disorders	Pulp	Powder mixed with bread flour for preparation of bread
Fabaceae			M	Cough	Pulp	Decoction
Fabaceae			M	Diarrhea	Pulp	Oral : Powder
Fabaceae			M	Hypertension	Pulp	Decoction
Fabaceae			M	Regulation of blood sugar levels	Pulp	Oral : Powder
Fabaceae	<i>Acacia tortilis</i> ssp. <i>raddiana</i> Forssk	Talh	M	Kidney failure, antidiabetic, digestive disorders, hypertension	Gum "Aalk"	Raw: powder " Sfouf" mixed with water
Lamiaceae	<i>Lavandula stoechas</i> L.	Lhlahl	M		Leaves	Decoction
Lamiaceae	<i>Origanum compactum</i> Benth.	Azoukenni	F		Fruit	Decoction
Lamiaceae	<i>Ajuga iva</i> (L.) Schreb.	Chendgoura	M		Bark	Infusion
Lamiaceae			M	Antidiabetic	Leaves	Decoction
Lamiaceae			M	Cold, Caught	Leaves	Decoction
Lamiaceae			M	intestinal disorders	Leaves	Oral : Powder/ Dcoction
Lythraceae	<i>Lawsonia inermis</i> L.	Henna	M	Anti-dandruff / scalp disorders	Leaves	Externe application: poultice

			O	Cosmetic (Body and hair dye)	Leaves	Poultice: Dried leaves ground into powder, mixed with water or rose water to form a paste applied on the skin or hair
Malvaceae	<i>Malva parviflora</i> L.	Khoubiza	F		Leaves	Steamed, then seasoned with lemon, olive oil, and spices
Plumbaginaceae	<i>Limonium sinuatum</i> (L.) Mill.	Lgarssa	M	Stomachache	Whole plant	Raw
Poaceae	<i>Cynodon dactylon</i> (L.) Pers	Njem	M	Hypertension, urinary infections	Aerial parts	Decoction
Rhamnaceae	<i>Ziziphus lotus</i> (L.) Lam.	Sder	M	Stomach bacteria, Vomiting	Roots or leaves	Decoction or powder
			M	Urinary disorders	Fruit "Nbeg"	Oral: powder, sometimes mixed with honey or other plants
Sapotaceae	<i>Argania spinosa</i> L.	Argan	F		Seeds	Roasted and pressed to extract the oil
			M	Eczema, rheumatism, joint pain	Seeds	Oral and topical: Used raw or roasted, processed into oil or paste
			M	Hypertension	Fruit	Decoction
Solanaceae	<i>Datura stramonium</i> L. (*)	Chdak Jmel	M	Respiratory disorders (cold) and urinary disorders (cystitis, frequent urination)	Seeds	Rectal: Seeds roasted, ground into powder, then mixed with other plants to obtain a suppository
Tamaricaceae	<i>Lycium intricatum</i> Boiss.	Lagherdeg	M	Intestinal disorders, digestive disorders	Fruit	Raw
					Whole plant	Decoction
Urticaceae	<i>Urtica urens</i> L. (*)	Lhouriga	M	Rheumatism	Leaves	Externe application: poultice
			M	Cold, Caugh	Leaves	Infusion
Zygophyllaceae	<i>Zygophyllum gaetulum</i> Emb. & Maire	Al'agaya	M	digestive disorders	Leaves	Oral : powder

F: food, M: medicinal, O: Others, (*): toxic plant

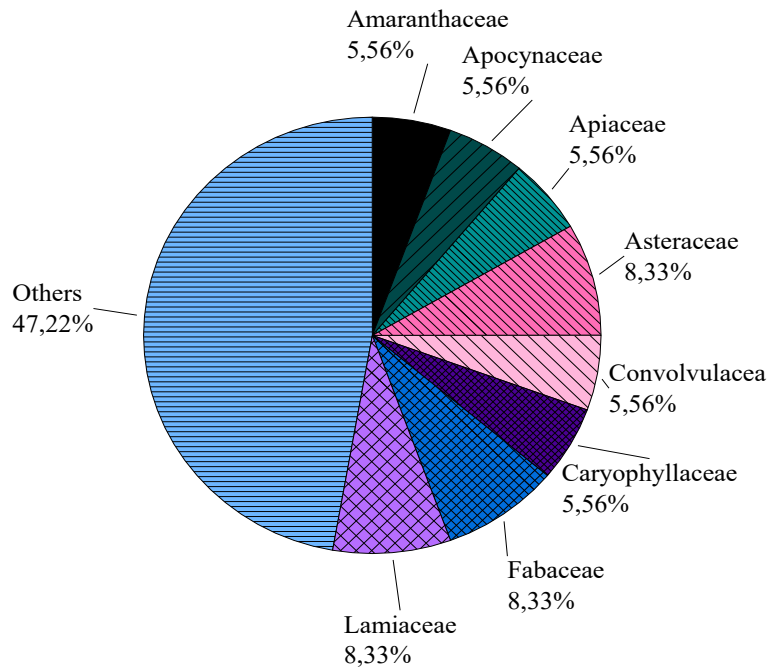


Figure 2. Distribution of the main plant families recorded.

Plant parts used

The ethnobotanical survey showed that leaves are the most commonly used part of the cited edible wild plants, with 29.09% being used for medicinal purposes, 4% for food, and 1.82% for other uses. The second most common use was the use of the whole plant (12.73%), followed by the fruits (7.27%), seeds, and flowers (5.45% each). Other plant organs, such as stems, roots, leafy stems, bulbs, latex, spines, cladodes, pulp, gum, and bark, were much less frequently mentioned, each accounting for less than 4% of uses (Fig.3). The predominance of leaves as a used part is linked to their accessibility, ease of harvesting, and richness in bioactive compounds (Loud *et al.* 2025). It has also been reported by other ethnobotanical surveys published in the literature, which confirmed the central role of leaves in local dietary and medicinal practices (Eddouks 2017).

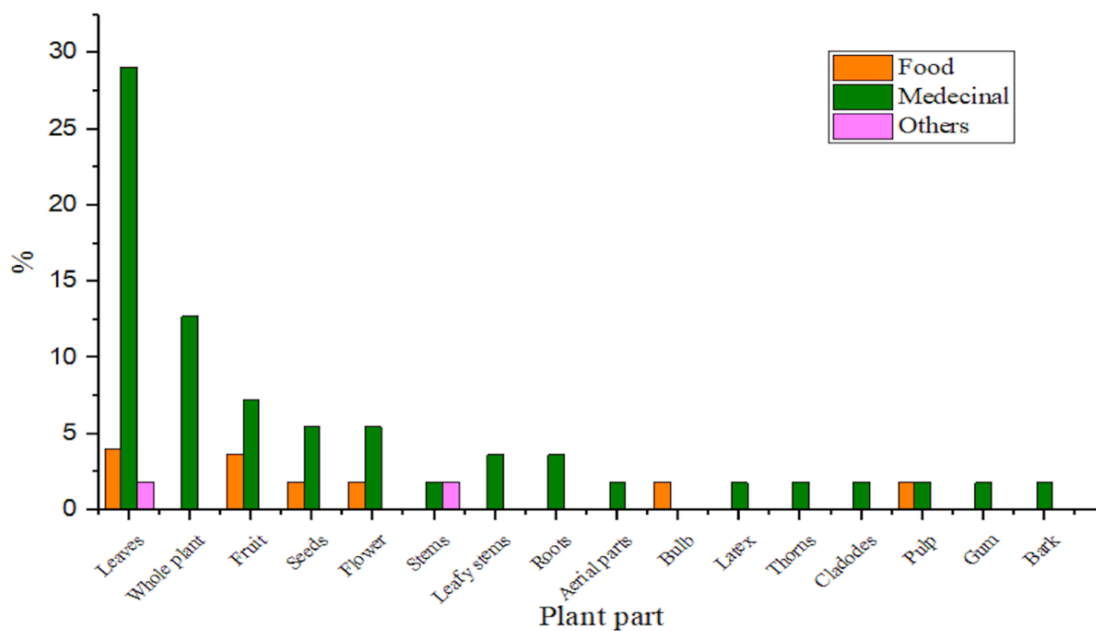


Figure 3. Plant used part.

Preparation Methods

Regarding the preparation methods of WEPs used, decoction largely dominates with 38.1% of citations, followed by preparation in powder form (20.6%) and infusion (14.3%). Poultrice represents 11.1% of cases, while consumption in the raw state was reported by 9.5%, and other forms of use remain marginal (6.3%) (Fig. 4). As previously seen in other ethnobotanical research carried out in dry and semi-arid regions of Morocco, the strong preference for decoction highlights the significance of water as a readily available and efficient solvent (Bouayyadi *et al.* 2015; Alaoui *et al.* 2018). While the raw consumption of these plants remains limited, their use in powder and infusion form also demonstrates the diversity of approaches to their dietary uses. This variety of processes demonstrates the richness of traditional knowledge and its adaptation to local conditions, enabling both the enhancement and preservation of the active properties of plants.

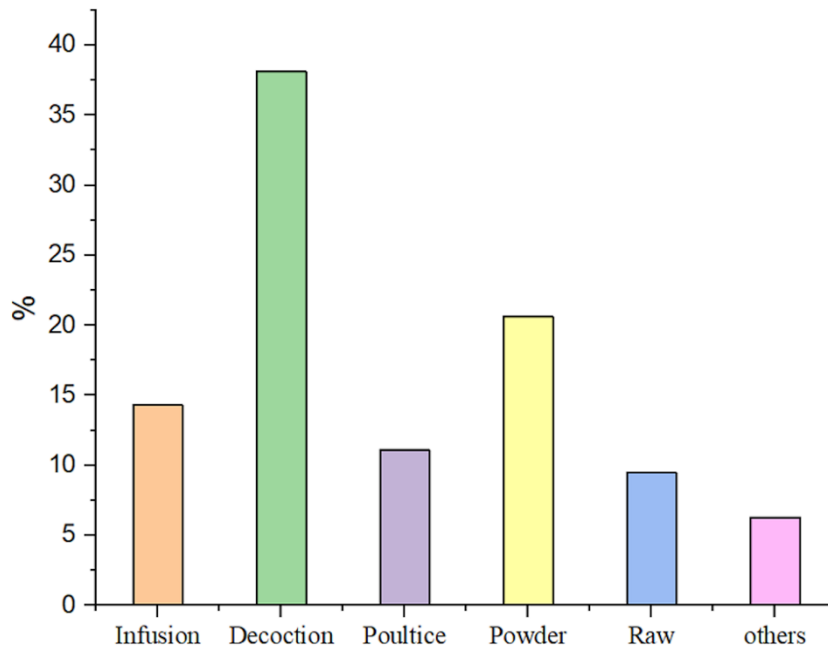


Figure 4. Distribution of plants by preparation method.

Therapeutic uses

Analysis of data from the ethnobotanical survey conducted in the province of Guelmim identified 36 species of wild plants used by local populations for various therapeutic, dietary, and domestic purposes. The study revealed that majority of these plants are not used for a single specific condition but cover a broad spectrum of disorders. Among these conditions, the reported indications mainly concerned digestive disorders (abdominal pain, diarrhea, intestinal disorders), Diseases of the genitourinary system, skin and parasitic conditions, as well as Diseases of the respiratory system. Many species are also reported to be used in the regulation of blood pressure, the treatment of rheumatic conditions, and, more rarely, for Neoplasms (anti-cancer) and oral health problems (Fig.5). This versatility of uses also confirms that traditional knowledge is based on a global empirical approach, where the same species can meet several therapeutic needs. These results corroborate the observations already reported in other ethnobotanical studies cited in the literature highlighting the importance of wild plants as primary health resources (Ghourri *et al.* 2014; Idm'hand *et al.* 2019).

Fidelity Level (FL), Relative Frequency of Citation (RFC) and Informant Consensus Factor (ICF)

The analysis of ethnobotanical indices revealed marked variations among the recorded species. The Fidelity Level (FL) ranged from 18.45% to 96.67% (Table 3). Several species exhibited high FL values, indicating a strong consensus among informants such as *Juniperus phoenicea* L. (FL=80.31% for digestive disorders), *Herniaria hirsuta* L (FL=96.67% for genitourinary ailments), *Ammodaucus leucotrichus* Coss.& Dur (FL=75.31% for respiratory diseases), *Launaea arborescens* (Batt.) Maire (FL=70.19 for skin and subcutaneous tissue) reflecting a high degree of consensus regarding their specific uses. Similar findings, where species with high FL are considered to have strong therapeutic potential and prioritized for pharmacological validation, have been reported in other ethnobotanical surveys (Vitalini *et al.* 2013; El Hachlafi *et al.* 2020). In contrast, other species showed lower FL values (<40%) such as *Argania spinosa* L.(FL=20.44% for musculoskeletal diseases) *Rhus tripartita* (Ucria) Grande (FL=22.15% for digestive disorders) and *Ceratonia siliqua* L., (FL=35.48% for circulatory system diseases) suggesting more

diversified or less unanimously recognized applications uses, a trend also observed elsewhere when multipurpose plants had reduced fidelity but remained culturally important (Song *et al.* 2013).

The Relative Frequency of Citation (RFC) was employed to evaluate the relative importance of each species in the community. RFC values varied from 0.21 to 0.86 (Table 3). The species with the highest RFC values included *Origanum compactum Benth* (RFC = 0.86), *Origanum compactum Benth.* (RFC=0.86), *Origanum compactum Benth* (RFC=0.86) and *Acacia tortilis ssp. raddiana Forssk* (RFC = 0.84) which were frequently cited by a large number of informants. Species with high RFC values are generally considered culturally salient and prioritized for phytochemical and pharmacological screening in other contexts (Vitalini *et al.* 2013; Radi *et al.* 2024). Conversely, species such as *Ononis natrix L* (RFC=0.21) and *Lycium intricatum Boiss.* (RFC=0.22) exhibited low RFC values, indicating a more restricted use.

The Informant Consensus Factor (ICF) values were very high and homogeneous across all disease categories (≈ 0.99), pointing to an almost unanimous agreement among informants and confirming the robustness of the traditional knowledge in the study area. Similarly high values of ICF have been reported in other ethnobotanical surveys, highlighting the collective reliability of local medicinal knowledge and the strength of shared practices (Heinrich *et al.* 1998; Rios *et al.* 2017).

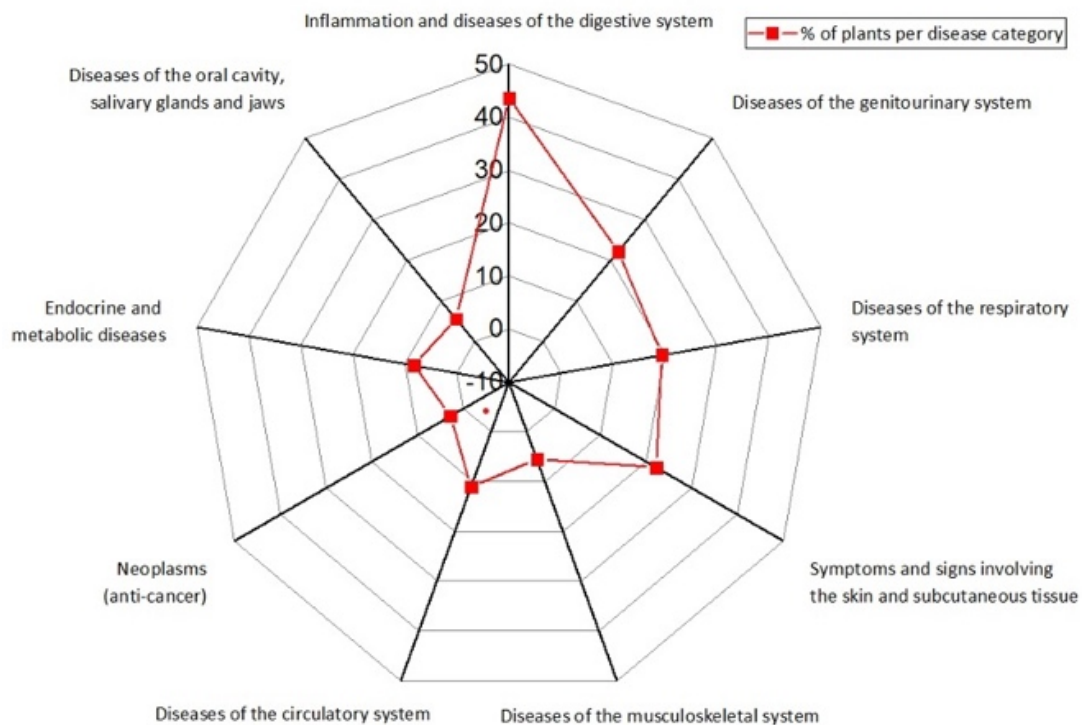


Figure 5. Radar chart showing the percentage of plants used for each disease category.

Table 3. List of plants used for the treatment of chronic diseases in Guelmim province.

Plant species	Therapeutic uses	Number of informants citing the species for a particular disease	Total citations	FL(%)	RFC
<i>Haloxylon scoparium</i> Pomel	Inflammation and diseases of the digestive system	113	158	71.52	0.75
<i>Rhus tripartita</i> (Ucria) Grande		33	149	22.15	0.71
<i>Nerium oleander</i> L.		65	125	52	0.59
<i>Periploca angustifolia</i> Labill		58	110	52.73	0.52
<i>Ammodaucus leucotrichus</i> Coss.& Dur		123	162	75.92	0.77

<i>Anastatica hierochuntica</i> L.		78	161	48.45	0.77
<i>Maerua crassifolia</i> Forssk		45	118	38.13	0.56
<i>Opuntia ficus indica</i> (L.) Mill.		81	168	48.21	0.8
<i>Convolvulus trabutianus</i> Schwi et Munson		28	47	59.57	0.22
<i>Juniperus phoenicea</i> L.		102	127	80.31	0.60
<i>Ceratonia siliqua</i> L.		46	93	49.46	0.44
<i>Acacia tortilis</i> ssp. <i>raddiana</i> Forssk		86	176	48.86	0.84
<i>Ajuga iva</i> (L.) Schreb.		67	98	68.37	0.47
<i>Limonium sinuatum</i> (L.) Mill.		25	83	30.12	0.39
<i>Ziziphus lotus</i> (L.) Lam.		63	135	46.67	0.64
<i>Lycium intricatum</i> Boiss.		22	47	46.81	0.22
<i>Zygophyllum gaetulum</i> Emb. & Maire.		38	102	37.25	0.48
<i>Asteriscus graveolens</i> (Forssk.) Less		44	61	72.13	0.29
<i>Anastatica hierochuntica</i> L.		130	161	80.74	0.77
<i>Herniaria hirsuta</i> L.		145	150	96.67	0.71
<i>Ononis natrix</i> L.	Diseases of the genitourinary system	21	45	46.67	0.21
<i>Acacia tortilis</i> ssp. <i>raddiana</i> Forssk		51	176	29	0.84
<i>Cynodon dactylon</i> (L.) Pers.		30	55	54.54	0.26
<i>Ziziphus lotus</i> (L.) Lam.		36	135	26.67	0.64
<i>Datura stramonium</i> L.		53	109	48.62	0.52
<i>Eryngium ilicifolium</i> La.		54	80	67.5	0.38
<i>Ammodaucus leucotrichus</i> Coss. & Dur.		122	162	75.31	0.77
<i>Convolvulus arvensis</i> L.		23	60	38.33	0.28
<i>Ceratonia siliqua</i> L.	Diseases of the respiratory system	50	93	53.76	0.44
<i>Origanum compactum</i> Benth.		109	180	60.55	0.86
<i>Datura stramonium</i> L.		45	109	41.28	0.52
<i>Urtica urens</i> L.		35	70	50	0.33
<i>Artemisia herba-alba</i> Asso		61	151	40.40	0.72
<i>Artemisia herba-alba</i> Asso		73	104	70.19	0.49
<i>Launaea arborescens</i> (Batt.) Maire		31	168	18.45	0.8
<i>Opuntia ficus indica</i> (L.) Mill.	Symptoms and signs involving the skin and subcutaneous tissue	30	47	63.83	0.22
<i>Helianthemum confertum</i> Dunal		27	125	21.6	0.59
<i>Nerium oleander</i> L.		49	118	41.52	0.56
<i>Argania spinosa</i> L.		75	181	41.44	0.86
<i>Corrigiola litoralis</i> L.		33	80	41.25	0.38
<i>Argania spinosa</i> L.	Diseases of the musculoskeletal system	37	181	20.44	0.86
<i>Urtica urens</i> L.		31	70	44.28	0.33
		70	176	39.77	0.84

<i>Acacia tortilis</i> ssp. <i>raddiana</i> Forssk	Diseases of the circulatory system	33	93	35.48	0.44
<i>Ceratonia siliqua</i> L.		23	55	41.82	0.26
<i>Cynodon dactylon</i> (L.) Pers		41	181	22.65	0.86
<i>Euphorbia officinarum</i> L. ssp. <i>echinus</i> (Hook. f.)	Neoplasms (anti- cancer)	93	178	52.25	0.85
<i>Acacia tortilis</i> ssp. <i>raddiana</i> Forssk	Endocrine and metabolic diseases	91	176	51.70	0.84
<i>Ceratonia siliqua</i> L.		45	93	48.39	0.44
<i>Lavandula stoechas</i> L.		21	48	43.75	0.23
<i>Haloxylon scoparium</i> Pomel	Diseases of the oral cavity, salivary glands and jaws	81	113	71.68	0.54
<i>Maerua crassifolia</i> Forssk		85	118	72.03	0.56

Toxicity

Among the 36 WEPs inventoried in the studied localities of Guelmim province, seven species (19.4%) are recognized by the local population as potentially toxic. These species are *Urtica urens* (Lhouriga), *Datura stramonium* (Chdak Jmel), *Artemisia herba-alba* (Chih), *Nerium oleander* (Defla), *Chenopodium ambrosioides* (Mkhinhza), *Euphorbia officinarum* (Daghmous), and *Urginea olivieri* (Teylum). However, these plants are frequently used for their therapeutic properties, but with strict preparation and dosage requirements to avoid the serious adverse effects of these species. Thus, the species *Nerium oleander*, used against skin and digestive disorders, contains cardiotoxic compounds making it a high-risk species (Dey 2020). Similarly, *Datura stramonium*, used to treat certain respiratory or urinary disorders, is also feared for its tropane alkaloids (Aćimović 2025). Furthermore, the species *Chenopodium ambrosioides* contains ascaridole, a substance toxic in high doses (Drioua *et al.* 2024). The latex of the plant *Euphorbia officinarum* is irritant and caustic (Boutoub *et al.* 2022). and the species *Artemisia herba-alba* has thujone levels that can cause neurotoxic effects (Lahna *et al.* 2020). Similarly, the species *Urginea olivieri*, close to *U. maritima*, is known for its cardiotoxic cardenolides (Merzek *et al.* 2022). The species *Urtica urens* causes skin irritations with its stinging hairs (Saeed *et al.* 2016). It is important to emphasize that the empirical knowledge of the populations revealed by this survey emphasizes mastery of specific preparation methods, using mixtures with other ingredients or consumption in very low doses, to mitigate toxicity. However, the lack of precise guidelines regarding safe quantities constitutes and increases the risk of accidental poisoning. These findings serve as a reminder that, even in a context of high value for local plant resources, the issue of toxicity remains a crucial public health issue and underscores the need for additional pharmacological studies.

Trends in the exploitation of edible wild plants

The results of this ethnobotanical survey conducted in the study region also highlight a general downward trend in the use of WEPs, whether for food or medicinal purposes, particularly among younger generations. This decline appears to be explained by several factors. A primary factor in the reduction in the use of local plant resources is, on the one hand, the increasing availability of cultivated agricultural products and modern medicines, considered faster and more effective (Ickowitz *et al.* 2019; Awoke *et al.* 2024). On the other hand, the impact of climate change and the increased use of herbicides, contributing to the scarcity of several species considered weeds (Gruss *et al.* 2025). This situation is consistent with the observations reported in the literature (Lahyaoui *et al.* 2025), indicating that the progressive impoverishment of traditional knowledge related to wild plants is driven by the dietary transition and medicalization. However, it is important to note that this decline does not affect all species equally. Indeed, certain species, such as *Chenopodium ambrosioides* (Mkhinhza) and *Ziziphus lotus* (Sder), are still widely used in the daily lives of the population due, in addition to their local availability, to their recognized therapeutic efficacy. The preservation and promotion of this traditional knowledge therefore appear essential, not only to preserve cultural heritage, but also to strengthen food security and promote more sustainable food systems in a context of climatic and socioeconomic vulnerability.

Conclusion

This ethnobotanical study conducted in the Guelmim province identified 36 wild edible and medicinal plants, demonstrating the richness and diversity of the local flora. These species, used by the population to meet their dietary and therapeutic needs, represent a valuable cultural and biological heritage. However, the transmission of this traditional knowledge is currently weakened by several factors, including the modernization of lifestyles, the growing disinterest of younger

generations, and the increasing scarcity of certain species due to environmental pressures. In this context, it appears essential to preserve this knowledge and promote the responsible use of wild plants, not only to enhance local biodiversity, but also to strengthen food and nutritional security. Integrating these resources into an organic farming approach could represent a promising avenue, reducing dependence on chemical inputs, diversifying agricultural systems, and promoting more sustainable diets.

Finally, further research is needed to better assess the nutritional, pharmacological, and toxic potential of these plants and to explore their role in the development of local sectors that combine biodiversity conservation, economic development, and the promotion of sustainable food systems.

Declarations

List of abbreviations: WEPs = wild edible plants, FL = Fidelity Level, RFC = Relative Frequency of Citation, ICF = Informant Consensus Factor.

Ethics approval and consent to participate: Consent was always obtained from participants before the interviews began and after explaining the study objectives.

Consent for publication: Not applicable.

Data Availability: Available from the corresponding author upon request.

Competing interests: Author declares that there is no conflict of interest.

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