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Original Research Article

Ethnobotanical and Ethnopharmacological Studies of Medicinal Plants in the Southern Mediterranean: Tangier-Tétouan Region, Northern Morocco

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ABSTRACT

Plants have been invaluable natural resources for nutrients and therapeutic compounds, playing a vital role in traditional medicine worldwide. In the Tanger-Tétouan region (Tanger-Assilah, Tétouan, Fahs-Anjra, and M'diq-Fnideq), aromatic and medicinal plants are integral to addressing various health issues. However, ethnobotanical knowledge of this region remains underexplored. This study aims to document ethnobotanical knowledge in the Tangier-Tetouan region, northern, Morocco. The surveys were conducted using 765 questionnaires across two campaigns in 2023 and 2024. The study documented the medicinal and aromatic plants used in the region, based on data collected from 760 participants belonging to diverse socio-demographics between November 2023 and September 2024. Using structured questionnaires and analytical metrics, including Frequency of Citation (FC), Relative Frequency of Citation (RFC), and Use Value (UV), the study identified 171 plant species across 55 botanical families, with Lamiaceae, Asteraceae, Fabaceae, Apiaceae, and Poaceae being predominant. Commonly used species include *Thymus satureioides*, *Rosmarinus officinalis*, and *Salvia officinalis*. Leaves, fruits, and seeds were the main parts used, primarily for gastrointestinal and respiratory ailments. Traditional remedies were mostly administered orally as decoctions or infusions. Approximately half of the respondents reported satisfaction with the treatments' effectiveness. This research highlights the continued relevance of plant-based remedies and provides a foundation for pharmacological studies to explore bioactive compounds, potentially contributing to pharmaceutical development or offering natural alternatives in modern medicine.

Keywords: Southern Mediterranean, Tanger-Tétouan Region, Northern Morocco, Aromatic and Medicinal Plants, Ethnobotanical, Ethno-pharmacological.

Introduction

The use of medicinal plants in traditional healthcare has been a fundamental practice for centuries. Approximately 391,000 plant species are cataloged worldwide, each possessing distinct medicinal properties. Notably, 88% of these plants—about 31,000 species—are recognized for their actual or potential therapeutic value.[1] Ancient civilizations such as the Sumerians, Egyptians, Greeks, and Romans documented their knowledge of these plants in medical texts.[2] During the Middle Ages, Arab scholars played a pivotal role in preserving and disseminating this knowledge, while Europeans expanded their pharmacopoeia during the Age of Discovery by introducing numerous plants from the New World.[3] In Africa, the use of medicinal plants is deeply embedded in local traditions, with traditional healers playing a central role in healthcare.

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This knowledge, often passed down through generations, is particularly rich in sub-Saharan Africa, a region known for its exceptional biodiversity.[4] Morocco, with its 4,500 species and subspecies of vascular plants, is renowned for its rich variety of aromatic and medicinal plants.[5] The indigenous Berber people have utilized these plants for centuries, drawing influence from both Mediterranean and Arab civilizations that have shaped the region's medical heritage. [6] Consequently, the use of aromatic and medicinal plants (AMPs) in Morocco represents a fusion of cultural and medicinal knowledge.[7] The Tanger-Tetouan region, situated between the Mediterranean Sea and the Rif Mountains, is characterized by unique biodiversity. This ecological richness offers a variety of plants with exceptional medicinal and aromatic properties, which have been utilized for generations by the region's inhabitants.[8] Despite the advancement of modern medical practices, the centuries-old traditions of harvesting and using medicinal plants continue to thrive in this region.[9] However, the global decline in cultural knowledge of medicinal plants poses a significant threat to these valuable resources.[10] This decline is fueled by factors such as cultural homogenization, modernization, and the undervaluing of traditional practices.[11] Additionally, Morocco's plant diversity faces threats from overexploitation, climate change, and habitat loss.[12] In light of these challenges, ethnobotanical surveys are essential for documenting indigenous knowledge, ensuring the conservation of biological resources, and fostering sustainable use practices. These surveys play a crucial role in engaging policymakers to develop effective strategies for preserving this heritage.[7] The study aims to document ethnobotanical knowledge in the Tangier-Tetouan region to preserve her cultural heritage, identify the most commonly used

medicinal plants and their role in local healthcare practices, and promote sustainable use practices for the conservation of biological resources.

Materials and Methods

Study area

The Tanger-Tétouan region (Figure 1) is part of the Tangier-Tétouan-Hoceima region, which is one of the twelve regions of Morocco established under the latest territorial division of 2015. It comprises two provinces (Tétouan and Fahs-Anjra) and two prefectures (Tanger-Assilah and M'diq-Fnideq). It is located at the extreme northwest of Morocco, at the far northwest of the African continent, bordered to the north by the Mediterranean Sea, to the west by the Atlantic Ocean, to the south by the province of Larache and to the southeast by the Province of Chefchaouen.[13]

The area benefits from a notable geographical position, bordered by two distinct coastlines: the Mediterranean Sea to the north and the Atlantic Ocean to the west. Aside from the coastal plains, more than 65% of the regional territory is characterized by steep or heavily valleyed reliefs. To the west, there are low coastal plains with rich alluvial soils, threatened by flooding and salinization of terraces, particularly around Assilah. To the north and east, the hills are higher, with prominent relief and altitudes ranging from 160 to 400 meters.[14] In the Tangier-Tétouan area, the temperature varies greatly both across time and space. It has two distinct seasons: a hot and dry summer and a somewhat chilly and wet winter, typical of the Mediterranean climate. Despite the fact that, nationally, this region receives the highest rainfall (between 100 and 700 mm), it is noteworthy that this precipitation is very irregular across all time scales.

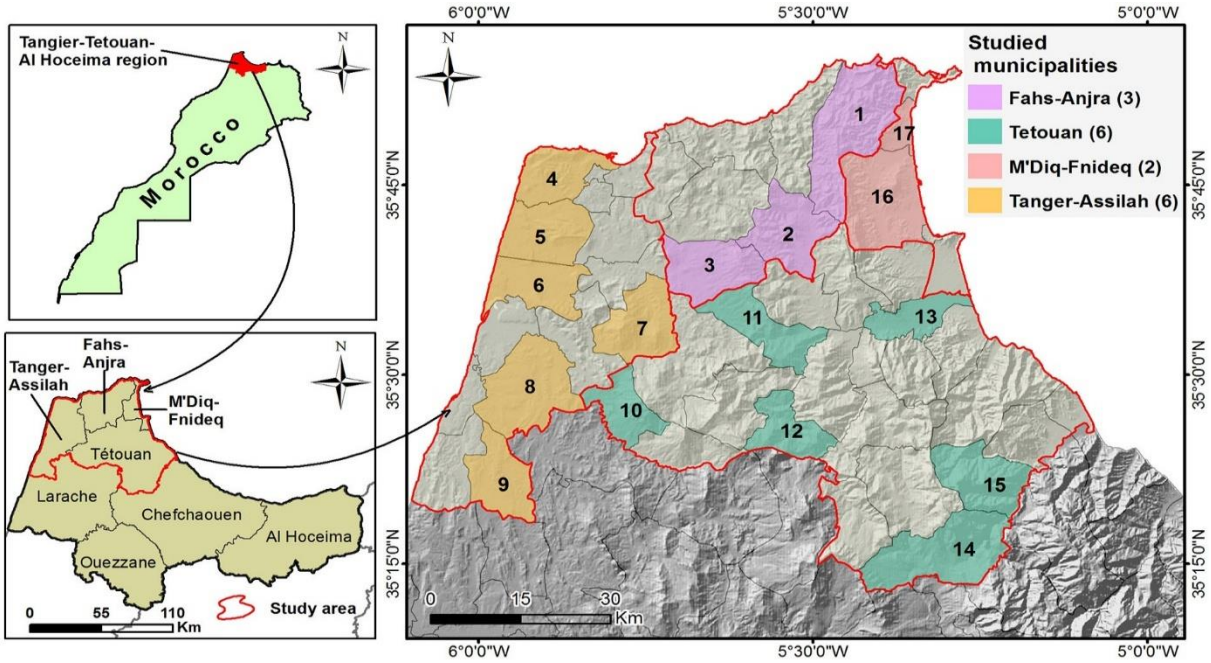

Figure 1: Geographical location of the study area

In terms of geographical distribution, precipitation follows two gradients: it increases in volume with altitude and also depending on the proximity of the Atlantic. Thus, the most irrigated areas are in the region of Tangérois. As we move away from the Atlantic, the slope overlooking the Mediterranean becomes drier.[14]

According to the 2020 population projections, Tanger-Tétouan-Al Hoceima Region has a population of 2,129,777 representing 5.92% of Morocco's total population. The urban population stands at 1,814,344 inhabitants, reflecting an urbanization rate of 85.18%, compared to the national rate of 63.4%. The relatively large population of the Tanger-Tétouan region, combined with its small area, makes it one of the most densely populated regions in Morocco, with a density of 606.4 inhabitants per km² in 2014. Furthermore, the prefecture of Tanger-Assilah has the highest population density in the region, with 1,119.3 inhabitants per km², followed by the prefecture of M'diq-Fnideq with 985.4 inhabitants per km².[14]

The localization of the various ethnobotanical survey sites and floristic surveys in the area studied was carried out using probability-stratified sampling techniques.[15] In this context, the sample was divided into 17 layers, of which 4 belong to urban areas and 13 to rural areas (Table 1). Using a simple random sampling method, limited-sized samples were formed for each of the 17 layers, and then grouped to form the overall sample of 760 people.

Ethnobotanical Survey

This study explores the ethnobotany of aromatic and medicinal plants used in the Tangier-Tetouan region over a period of 6 months, from November 2023 to April 2024. The surveys were conducted using 765 questionnaires across two campaigns in 2023 and 2024. Approximately 201 people declined the invitation to participate; some cited insufficient knowledge of the topics discussed, while others chose not to participate for unspecified personal reasons. Interviews using a structured questionnaire were conducted during peak hours in places frequented by the local population, such as markets, mosques, and cafeterias, as well as at their homes, without time limits.

Socio-economic status were categorized into low, middle, and high based on income and access to resources, as self-reported by participants. Professional groups included farmers, housewives, civil servants, herbalists, and individuals with no specific profession. Data analysis employed Frequency of Citation (FC), Relative Frequency of Citation (RFC), and Use Value (UV) to evaluate the prevalence and significance of plant use.

The questionnaire was structured into two sections: the initial section focused on the informant's demographics, encompassing age brackets (under 20 years, 20 - 35 years, 35 - 50 years, 50 - 65 years, and over 65 years), gender (male and female), educational background, family status, socio-economic status, place of residence, occupation, and source of information (Table 2).

Table 1: Distribution of surveys by layers

Province	Layer Names	Layer number	Number of surveys
Fahs-Anjra	*Jouamaa*	1	45
	Anjra	2	45
	Taghramt	3	45
Tanger-	*Tanger*	4	45
Assilah	*Gzanaya*	5	45
	Hjer nhal	6	45
	Dar chaoui	7	45
	Had gharbiya	8	45
	Sidi yamani	9	45
Tétouan	*Tétouan*	10	45
	El ouad	11	45
	Oulad ali mansour	12	45
	Beni yadder	13	45
	Jbal hbib	14	45
	Ain lahcen	15	45
M'diaq-	*Fnidaq*	16	45
fnidaq	*Alliyin*	17	45
	Total	17	765

The subsequent section delves into the plants used, their method of use, plant parts used, diagnosis, method of preparation, administration and storage, dosage, plant type, harvesting period, toxicity risk, outcomes, and potential adverse effects (Table 3).[16] The study followed the Nagoya Protocol's guidelines on access to genetic resources and the equitable sharing of benefits, as specified in the Convention on Biological Diversity. The traditional knowledge provided by participants was both respected and safeguarded, and any use of this information outside of scientific publications required the consent and agreement of the traditional knowledge holders.[17]

Categories of diseases

The main objective of this ethnopharmacological study was to scientifically assess and validate traditional medicinal systems and the remedies employed within them. To obtain a thorough understanding of therapeutic diversity, field surveys often categorize medicines according to their use.[18]

Utilizing the World Health Organization's classification, we categorized diseases based on body systems (WHO).[19] This established method is consistent with traditional ethnomedical practices. It is noteworthy that specific diagnostic labels was combined with symptom descriptions to accurately identify various diseases. Since some informants did not always use medical terminology, we collected as much information as possible about each disease to ensure accurate classification.[20] In this study, diseases were classified using both the use reports from local informants and the WHO's systematic categorization method.[18] Each mention of a plant used to treat a specific disease was recorded as a separate use report.

Data analysis

The information gathered from the survey forms was inputted into a computer, then processed and analyzed statistically using Microsoft Office Excel 2020, XLSTAT and Minitab software to generate tables and graphs. Socio-demographic data of participants were analyzed by simple descriptive statistics, employing percentages and frequencies. Ethnobotanical data were subjected to analysis through the following metrics:

Relative frequency of citation (RFC)

Based on the local therapeutic importance of each plant species, the RFC was calculated according to the following formula:

$$RFC = \frac{FC}{N} \quad \text{..... Eqn. 1}$$

Where FC denotes the number of participants citing the use of a plant species, N represents the total number of participants, and ($0 < RFC < 1$).[21]

Use Value (UV)

The Use Value (UV) is a commonly used indicator to assess the relative importance of a local species, particularly plants. The formula used to calculate this index is as follows:

$$UV = \frac{U}{N} \quad \text{..... Eqn. 2}$$

Where U represents the number of uses mentioned by each informant, and N refers to the total number of informants.[22,23]

Table 2: Socio-demographic and socio-economic profile of informants

Parameter	Category	Number of Surveys (N = 765)	Percentage
Age	Less than 20 years	95	**12%**
	Between 20 and 35 years	133	**17%**
	Between 35 and 50 years	262	**34%**
	Between 50 and 65 years	180	**24%**
	More than 65 years	95	**12%**
Gender	Female	319	**42%**
	Male	441	**58%**
Educational Level	Illiterate	355	**46%**
	Primary	197	**26%**
	Middle School	112	**15%**

	High School	66	**9%**
	University	35	**5%**
Marital Status	Single	238	**31%**
	Married	490	**64%**
	Other (widowed, divorced)	37	**5%**
Socioeconomic status	High	45	**6%**
	Medium	268	**35%**
	Low	452	**59%**
Occupation	Unemployed	74	**10%**
	Farmer	265	**35%**
	Herbalist	60	**8%**
	Civil Servant	101	**13%**
	Housewife	260	**34%**
Source of Information	Bibliography	63	**8%**
	Herbalist	182	**24%**
	Pharmacist	27	**4%**
	Experience of Others	488	**64%**
Locality	Rural	630	**82%**
	Urban	135	**18%**

Results and Discussion

A survey was conducted with 765 participants from the Tangier-Tetouan region, including herbalists, skilled villagers, traditional healers, and ordinary residents (from towns, villages, and douars). The results indicate that women are the primary users of medicinal plants, accounting for 58% of the total usage, while men represent 42%. This gender predominance can be attributed to several cultural and social factors. In rural areas, women often serve as the custodians of traditional knowledge regarding medicinal plants, taking responsibility for family health and primary care. This greater involvement in healthcare likely explains their higher usage of medicinal plants (Figure 2). These findings align with national researches that have been conducted,[24-27] as well as international studies.[28, 29]

The ethnobotanical survey also revealed the age distribution of medicinal plant use in the Tangier-Tetouan region. The most represented age group was 35 to 50 years old, which constituted 34% of the users. This was followed by the 50 to 65 age group (24%), the 20 to 35 age group (17%), those under 20 years old (13%), and finally, those over 65 years old (12%). This distribution suggests that the use of medicinal plants is particularly significant among middle-aged adults, likely due to their roles in family healthcare and their knowledge of traditional remedies. Elderly individuals continue to use medicinal plants, reflecting the persistence of traditional practices among older generations. In contrast, the relatively low proportion of young users may indicate either a reduced transmission of traditional knowledge or a preference for modern medical treatments (Figure 3). These results are consistent with national studies,[24,30] and international researches.[29,31,32] Traditional medicine was predominantly used by the married respondents (64%), compared to 31% of single individuals and 5% of widowed or divorced people (Figure 4). Married people, particularly women, tend to seek economical and effective ways to care for their families and children. These findings corroborated previous national studies,[24,26,30] as well as studies conducted in the Maghreb region.[32]

Moreover, rural areas represented the majority of users, with 82% of respondents compared to only 18% in urban areas (Figure 5). Several factors can be responsible for this predominance of medicinal plants use in rural areas. Firstly, direct access to plants in their natural environments allows rural inhabitants to rely easily on traditional remedies. Additionally, knowledge and practices related to medicinal plants are often better preserved and transmitted across generations in these regions. In contrast, in the urban areas, the easy access to modern healthcare and pharmaceuticals reduces the reliance on traditional remedies. These findings are consistent with previous national researches,[33, 25] and studies from North Africa.[34]

With respect to educational level, illiterate individuals constituted the majority of medicinal plant users (46%), followed by those with primary education (26%), secondary education (15%), and high school (9%). Users with a university education represent the smallest group (4%) (Figure 6). This distribution suggests that the use of medicinal plants is more widespread among individuals with lower educational levels. This may reflect greater adherence to traditional practices in these groups, as well as limited access to modern healthcare. In contrast, individuals with higher education levels preferred contemporary medical treatments, potentially indicating a decline in the transmission of traditional knowledge about medicinal plants among this segment of the population. These results are in line with previous national studies,[25,26,35] as well as studies in the Maghreb region.[31,32]

Most users (64%) relied on the experience of others, highlighting the importance of oral transmission and empirical knowledge within the community. Herbalists were the second most consulted source, representing 24% of users, which indicated significant trust in specialized traditional practitioners. Written resources, including books

and other references, accounted for only 8% of information sources, suggesting limited use of documented resources in the region. Lastly, pharmacists were the least consulted source, representing just 4%, which may reflect the limited integration of modern pharmaceutical advice into traditional healthcare practices (Figure 7). This distribution revealed a clear preference for traditional knowledge and personal advice, which can influence awareness and education strategies concerning the use of medicinal plants. These findings are consistent with those of Maache (2024)[24] and El-Assri (2021)[30], but do not agree with that of Kachmar (2021)[33], which stated that 54% of respondents preferred to consult herbalists.

Impact of socio-economic factors on medicinal plant utilization

The ethnobotanical study revealed that 59% of users belong to a low socio-economic status, indicating a higher reliance on traditional remedies due to their affordability and accessibility. In contrast, 35% of users were from a middle socio-economic status, often using these remedies alongside modern treatments, while only 6% were from a high socio-economic status, reflecting limited dependence on medicinal plants due to greater access to contemporary healthcare (Figure 8). These findings aligned with earlier studies which highlighted that traditional practices are more preserved among economically disadvantaged groups.[35-37]

Regarding professional distribution, farmers constituted 35% of respondents, underscoring their proximity to natural resources and traditional knowledge. Housewives represented 34%, reflecting their significant role in family healthcare with the use of medicinal plants. Civil servants accounted for 13%, indicating that traditional remedies remain relevant even among those with modern healthcare access. Herbalists made up 8%, showcasing their specialized knowledge, while 10% of respondents reported no specific profession (Figure 9).

This diverse professional representation underscores the cultural importance and practical use of aromatic and medicinal plants across socio-economic and professional groups. Many users cite extensive experience and perceive these treatments as having fewer adverse effects compared to conventional medicine. These findings are consistent with previous studies.[30,33]

The use of medicinal plants in Tangier-Tetouan region

The study results show that leaves are by far the most used part, representing approximately 34% of total usage. This predominance can be explained by the high concentration of active compounds in leaves, as well as their ease of collection and preparation. This was followed by fruits and seeds, with 13.31% and 11.50% of total usage, respectively, highlighting their important role in traditional remedies. Aerial parts and flowers were also significant, each representing around 11% of usage. Stems, whole plants, roots, rhizomes, and bulbs were less commonly used, with percentages ranging from 8% to less than 1% (Figure 10). This distribution indicates that, although various parts of plants are valued for their medicinal properties, leaves are particularly prized in the region, likely due to their therapeutic effectiveness and accessibility. These results are consistent with the findings from previous studies.[25,26,38]

For the preparation of remedies, decoction (31.37%) and infusion (18%) were the most commonly used methods for preparing medicinal plants, indicating a preference for effective and accessible methods of extracting active ingredients. These were followed by cataplasm (13.62%), fumigation (9.50%), and maceration (8.09%), which were moderately used, while powder (5.79%), crushing (4.50%), raw (3.5%), essential oils (3%), and cooking (3%) were the least common in terms of usage (Figure 11). This distribution indicates a preference for preparation methods that maximize the extraction of active principles while being accessible and easy to perform. The results reflect a rich tradition of herbal medicine in the region, where various methods are employed to harness the medicinal properties of plants. The present findings corroborated the findings from previous studies conducted in Morocco and Algeria.[25,26,31-33]

The most common mode of administration was oral administration, accounting for 58% of the total. This high percentage highlights the preference for ingesting plant-based remedies, likely due to the ease of consumption and direct delivery of active compounds to the body. This was followed by inhalation (14.66%), reflecting the importance of respiratory treatments, which are often used for ailments like colds and respiratory infections. Rinsing accounted for 12.81% of cases, suggesting its role in treatments for oral and throat conditions. Massage accounted for 8.80% of the total, indicating the use of topical applications for skin and muscle-related issues. Other methods of administration made up 6%, showcasing a variety of less common but still relevant practices (Figure 12). This distribution showed a high reliance on oral consumption, but also highlighted the versatility of plant-based remedies in the treatment of a wide range of health issues through various methods of administration. These results are largely similar to those of other studies.[39,40]

The results showed that water was the most common solvent accounting for 47% of the total number of solvents used, this may be due to its availability, safety, and effectiveness in extracting active compounds. Using the plant directly was the second most common method standing at a frequency of 32%, reflecting a preference for simplicity and direct application. Oil and honey, each at a frequency of 9%, highlight their importance in traditional remedies for their unique properties, such as oil's effectiveness in extracting fat-soluble compounds and honey's preservative qualities and health benefits. Milk was the least used solvent at 3%, suggesting its application in specific traditional contexts (Figure 13). Overall, the results indicated a preference for accessible, simple, and effective methods, with water and direct plant use being predominant, while traditional solvents like oil and honey remain relevant. These results are consistent with the findings from the work of Jeddi *et al*. (2021)[35], and Belhaj *et al*. (2020).[40]

Furthermore, 49% of users reported a complete cure, indicating significant efficacy of medicinal plants in treating certain conditions. While 39% of users reported symptom relief, highlighting the importance of plants in alleviating discomfort and pain, even if they did not lead to a complete recovery. About 8% of the participants observed a change without being able to qualify it as a cure or relief, suggesting varied effects that warrant further investigation. Finally, 4% of users noted other types of results, which could include side effects or unexpected improvements (Figure 14). This distribution of results highlights the positive perception of plant-based remedies in the region while emphasizing the need for additional research to fully understand the extent and limitations of their efficacy, which is in line with previous reports.[30,35]

The survey results showed that spring is the most preferred collection period, accounting for 44.27% of the total collection, this is likely due to the optimal growth conditions such as mild temperatures and adequate rainfall during spring. The next most preferred collection period after spring is summer, which accounted for 25.14% of the total collection. This may be attributed to high temperatures and longer days which favour the maturation of certain plants. In autumn, the collection decreased significantly to 7.41% due to the end of the growing season and the onset of cooler weather. Winter was the least favorable period of collection with only 4.69% of the total collection, and this may be due to cold temperatures and potential frost conditions during this season. However, some plants were harvested year-round, representing 18.33% of the total, likely due to robust species (Figure 15). Understanding these seasonal variations is crucial for sustainable harvesting practices and supply chain management, while ensuring the quality and potency of the plants for effective phytotherapy.

Floristic analysis and traditional therapeutic uses

The floristic analysis of the Tangier-Tetouan region revealed a significant wealth of aromatic and medicinal plants used in traditional medicine, encompassing 171 species across 55 botanical families (Table 3). When compared to the entirety of Morocco, which hosts approximately 4,200 species of vascular plants, with 800 to 1,000 of these recognized for their medicinal properties, this regional diversity represents a substantial proportion of the national botanical wealth.[41] This diversity can be attributed to the region's favorable climatic conditions, as well as local cultural practices that emphasize the use of plants in traditional medicine.

Table 3: List of therapeutic plants utilized by the people living in the Tanger-Tetouan region, northern Morocco

Species/Family	Common name	Type of Plants	Part used	Solvent	FC	RFC	UV	Disease/Disorder Treated
***Acacia albida Delile*.** **(Fabaceae)**	Talh	S	BA-RT	W	27	0.035	0.038	Diabetes/ Dermatological/ Metabolic
Agave americana.l **(Agavaceae)**	Sabra	S	FL-L	NS	69	0.090	0.097	Gastrointestinal/Dermatological
Agave sisalana perrine **(Agavaceae)**	Sissel	S	FL	NS	6	0.008	0.013	Diabetes
***Allium cepa L*.** **(Liliaceae)**	Bsal	C	B	NS	89	0.116	0.118	Neurological/ Hair Care/ Dermatological
Allium porrum L. **(Liliaceae)**	Borro	C	L	NS	13	0.017	0.021	Dermatological
Allium sativum L. **(Liliaceae)**	Touma	C	B	O-NS	114	0.149	0.158	Diabetes/ ENT / Metabolic/Cardiovascular
Aloysia citrodora Palau. **(Verbenaceae)**	Louiza	C	L	M-W	73	0.095	0.102	Gastrointestinal/ Neurological
Alpinia officinarum **Hance. (Zingiberaceae)**	Khodnjal	Int	RH	W	13	0.017	0.021	Osteoarticular/ Respiratory
Ammi majus **L. (Apiaceae)**	Tlillan	S	SE	W	41	0.054	0.059	Genitourinary/ Gastrointestinal
Ammi visnaga **(L.) Lam. (Apiaceae)**	Bechnikh	S	FR-SE	W-M	40	0.052	0.058	Diabetes/Cardiovascular/ Gastrointestinal
Anacyclus pyrethrum **(L.) Lag. (Asteraceae)**	Takdicht	S	SE-RT	NS	17	0.022	0.027	Gastrointestinal
Anacyclus radiatus **Loisel. (Asteraceae)**	Hallal	S	L-RT	W	61	0.080	0.084	Neurological/ Oral-Dentals/ Osteoarticular/ Dermatological/
Apium graveolens **L. (Apiaceae)**	Krafess	C	L	W	12	0.016	0.020	Gastrointestinal/Oral-Dentals
Arbutus unodo **L. (Ericaceae)**	Sassenou	S	BA-L-FL	W-NS	51	0.067	0.072	Metabolic/ Gastrointestinal/ Diabetes
Aristolochia baetica **L. (Aristolochiaceae)**	Berztam	S	RH-L	W-NS	49	0.064	0.071	Dermatological/ Genitourinary
Artemisia absinthium **L. (Asteraceae)**	Chiba	C	ST-L-FL	W-NS	42	0.055	0.061	Respiratory/ Gastrointestinal
Artemisia herba-alba **Asso. (Asteraceae)**	Chih	C	ST-WP-L	W-M-NS	65	0.085	0.088	Dermatological/Genitourinary/Respiratory/Diabetes/Neurological
Asparagus officinalis **L (Asparagaceae)**	Sakkoum	S	WP	W	26	0.034	0.037	Gastrointestinal /Oral-Dentals
Asphodelus microcarpus **L. (Asparagaceae)**	Berwak	S	RT	W	47	0.061	0.068	Dermatological/ Gastrointestinal/ ENT
Atractylis gummifera **Salem. (Asteraceae)**	Chokahmar	S	RT	NS	13	0.017	0.021	Hair Care/ Dermatological
Avena sativa **L. (Poaceae)**	Khortal	C	L-SE	W	25	0.033	0.035	Gastrointestinal/ Respiratory/ Cardiovascular/ Metabolic
Beta vulgaris **L. (Amaranthaceae)**	Barba	C	L	NS-W	27	0.035	0.038	Genitourinary/ Gastrointestinal/Metabolic
Brassica fruticulosa **Cirillo. (Brassicaceae)**	Harchae	C	SE-WP	W	10	0.013	0.016	Respiratory /Gastrointestinal

***Brassica nigra* L. (Brassicaceae)**	Khardal khal	S	FL	W	11	0.014	0.017	Diabetes/ Respiratory
***Brassica oleracea* f. alba DC. (Brassicaceae)**	Malfouf	C	L	W	10	0.013	0.016	Gastrointestinal/ Metabolic
***Brassica oleracea* L. (Brassicaceae)**	Kromb	C	L	NS-W	16	0.021	0.026	Diabetes/ Metabolic
***Brassica rapa* L. (Brassicaceae)**	Laft mahfor	C	RT	W	10	0.013	0.016	Respiratory/ Diabetes
***Brassica rapa* var. (Brassicaceae)**	Laft	C	L	W-NS	27	0.035	0.038	Cardiovascular/ Respiratory/ ENT
***Bryonia dioica* Jacq. (Cucurbitaceae)**	dib Aneb	S	RT-FR	W	28	0.037	0.041	Osteoarticular/ Gastrointestinal
***Calendula arvensis* M. Bieb. (Asteraceae)**	Jamra	S	FR-L	W	95	0.124	0.127	Diabetes/ Metabolic/ Osteoarticular/ Gastrointestinal
***Camellia sinensis* L. kuntze (Theaceae)**	Atay	Int	L	W	37	0.048	0.052	Dermatological/ Gastrointestinal
***Cannabis sativa* L. (Cannabaceae)**	Kkif	C	SE-FL	NS-W	28	0.037	0.039	Cardiovascular/ Dermatological/ Hair Care
***Capparis spinosa* L. (Capparaceae)**	Kappar	S	FR-WP-RT	W-M	76	0.099	0.106	Osteoarticular/ Diabetes
***Capsicum annuum* L. (Solanaceae)**	tahmira	C	FR	NS-W	31	0.041	0.044	Dermatological
***Capsicum frutescens* L. (Solanaceae)**	Sodaniya	C	FR	W	15	0.020	0.026	Dermatological/ Diabetes
***Caralluma europaea* (Apocynaceae)**	Daghmous	S	L	W	74	0.097	0.105	Diabetes/ Genitourinary
***Carum carvi* L. (Apiaceae)**	Karwiya	C	SE	W	44	0.058	0.063	Osteoarticular/ Gastrointestinal
***Ceratonia siliqua* L. (Fabaceae)**	Kharoub	S	L-B	W-NS-H	37	0.048	0.051	Gastrointestinal
***Chamaerops humilis* L. (Arecaceae)**	Ddoum	S	FR-RT	NS-W-M	31	0.041	0.043	Gastrointestinal/ Hair Care
***Chenopodium album* L. (Amaranthaceae)**	Braymel	S	L-S	W-H	12	0.016	0.018	Genitourinary/ Gastrointestinal
***Chenopodium ambrosioides* L. (Amaranthaceae)**	Mkhinza	C	ST-L	NS	113	0.148	0.156	Gastrointestinal/ Dermatological/ENT
***Cicer arietinum* L. (Fabaceae)**	Homiss	C	RT	NS-W	24	0031	0.035	Oral-Dentals/ Genitourinary
***Cinnamomum camphora* L. (Lauraceae)**	Cafour	Int	L	W	2	0.003	0.009	Respiratory
***Cinnamomum zeylanicum* Blume. (Lauraceae)**	Karfa	Int	BA	W-NS	24	0.031	0.035	Genitourinary/ Gastrointestinal
***Citrullus colocynthis* (L.) Schrad. (Cucurbitaceae)**	Hdej	S	FL-RT-ST-B	NS	23	0.030	0.034	Oral-Dentals/ Diabetes/ Dermatological
***Citrullus vulgaris* Schrad. (Cucurbitaceae)**	Dalah	C	FL-L	NS	22	0.029	0.034	Neurological/ Gastrointestinal

***Citrus aurantium* L. (Rutaceae)**	Ranj	C	FR	NS	38	0.050	0.054	Dermatological/ Genitourinary
***Citrus limon* L. (Rutaceae)**	Hamed	C	FR-FL	W-NS	35	0.046	0.048	Dermatological/ Genitourinary/ ENT
***Citrus reticulata* Blanco (Rutaceae)**	Mandari	C	FR	NS	12	0.016	0.018	Genitourinary / Respiratory
***Citrus sinensis* L. (Rutaceae)**	Lechin	C	FL-FR	W-NS	17	0.022	0.027	Dermatological / Respiratory
***Convolvulus althaeoides* L. (Convolvulaceae)**	Anesfal	S	FL-RT	W	66	0.086	0.092	Respiratory/ Osteoarticular
***Coriandrum sativum* L. (Apiaceae)**	Kasbour	C	SE	W	21	0.027	0.030	Diabetes/ Metabolic/ Gastrointestinal
***Corrigiola telephiifolia* Pourr. (Caryophyllaceae)**	Sarghina	S	L-ST-RT	W	67	0.088	0.094	Respiratory/Genitourinary/Hair Care/ Diabetes
***Cucumis melo* L. (Cucurbitaceae)**	Baetikh	C	L	NS	22	0.029	0.031	Neurological/ Gastrointestinal
***Cucurbita maxima* Duchesne. (Cucurbitaceae)**	hmar Kraa	C	SE	W	18	0.024	0.029	Gastrointestinal/ Genitourinary
***Cuminum cyminum* L. (Apiaceae)**	Kamoun	Int	SE	W-NS-H	60	0.078	0.082	Genitourinary/ Gastrointestinal
***Cupressus sempervirens* L. (Cupressaceae)**	Asrou	S	BA-L-FL	W	18	0.024	0.029	Oral-Dentals/ Gastrointestinal/ Neurological / Cardiovascular
***Cymbopogon citratus*. (Poaceae)**	Marssita	S	L-FL	W	15	0.020	0.025	Genitourinary/ Gastrointestinal/ Cardiovascular
***Cynara humilis* L. (Asteraceae)**	Kharchef lberi	C	ST-RT	W-NS	46	0.060	0.065	Diabetes/ Gastrointestinal
***Cynara scolymus* L. (Asteraceae)**	Kharchef romi	C	FR-ST	NS-W	43	0.056	0.061	Gastrointestinal/ Diabetes/ Cardiovascular
***Cynodon dactylon* L (Poaceae)**	Njem	S	RH	W	12	0.016	0.018	Osteoarticular/ Respiratory
***Dactyloctenium aegyptium* L. (Poaceae)**	djaja Rjel	S	RH	W-NS	11	0.014	0.017	Neurological
***Daucus carota* L. (Apiaceae)**	Jaada	C	B-L	NS-W	40	0.052	0.056	Gastrointestinal/ Cardiovascular
***Dittrichia viscosa* L. (Asteraceae)**	Biramel	S	L-WP	NS-W	96	0.125	0.135	Oral-Dentals / Gastrointestinal/ Osteoarticular/ Dermatological
***Dryopteris filix-mas* (L.) Schott. (Dryopteridaceae)**	Sarkh	S	RH-ST-L	W	27	0.035	0.010	Osteoarticular / Cardiovascular
***Elaeagnus angustifolia* L. (Elaeagnaceae)**	tork Tmar	Int	FR	NS	6	0.008	0.037	Gastrointestinal
***Eriobotrya japonica* Thunb. (Rosaceae)**	Mzah	C	L	W	27	0.035	0.037	Genitourinary/ Respiratory/Gastrointestinal
***Eryngium ilicifolium* Lam. (Apiaceae)**	Zerika	S	WT-RT-L	W-NS	29	0.038	0.042	Gastrointestinal/ Respiratory/ ENT
***Eucalyptus camaldulens*. (Myrtaceae)**	Kaliplus	S	L	W	103	0.135	0.141	Respiratory/ Diabetes
***Eugenia caryophyllata* Thunb. (Myrtaceae)**	Kranfel	Int	FL	W	52	0.068	0.073	Oral-Dentals/ Genitourinary/ Hair Care
***Euphorbia peplis* L. (Euphorbiaceae)**	Hallila	S	ST	W	32	0.042	0.046	Dermatological/ Metabolic

***Ferula communis* L. (Apiaceae)**	Fasoukh	S	L	NS-W	9	0.012	0.016	Gastrointestinal
Ficus carica L. (Moraceae)	Karmous	C	L-FR	NS-O	41	0.054	0.058	Gastrointestinal/ Metabolic
***Foeniculum vulgare* Mill. (Apiaceae)**	Basbas	C	SE-RT	W	21	0.027	0.030	Gastrointestinal/ Respiratory
***Fraxinus angustifolia* Vahl. (Oleaceae)**	tir Lsan	C	L	W	14	0.018	0.022	Genitourinary/ Osteoarticular/Respiratory
***Fumaria officinalis* L. (Papaveraceae)**	Chahmat felous	S	PA-RT	W	13	0.017	0.021	Diabetes/ Metabolic
***Galium aparine* L. (Rubiaceae)**	Lessika	S	L-ST	W	25	0.033	0.035	Dermatological/ ENT/ Cardiovascular
***Glycyrrhiza glabra* L. (Fabaceae)**	sous Aark	Int	RH-RT	NS	47	0.061	0.067	Oral-Dentals/ Gastrointestinal
***Hedera helix* L. (Araliaceae)**	Lawaya	S	L-ST	W	15	0.020	0.025	Respiratory
***Helianthus annuus* L. (Asteraceae)**	Nawar chemch	C	SE	W-NS	21	0.027	0.030	Metabolic
***Hordeum vulgare* L. (Poaceae)**	Chair	C	SE	W-NS	27	0.035	0.037	Gastrointestinal/ Osteoarticular
***Juniperus phoenicea* L. (Cupressaceae)**	Àaràar	S	L-FL	W	81	0.106	0.112	Diabetes/ Neurological/ Respiratory
***Lactuca sativa* L. (Asteraceae)**	Lkhoss	C	L	NS-W-M	22	0.029	0.031	Metabolic
***Lavandula dentata* L. (Lamiaceae)**	Khzama	S	L	M-W	133	0.174	0.186	Respiratory/Osteoarticular/ Gastrointestinal/ Genitourinary/Dermatological
***Lavandula multifida* (Lamiaceae)**	Hlihla	S	L-RT-PA	W-NS	35	0.046	0.047	Respiratory/Genitourinary
***Lavandula stoechas* L. (Lamiaceae)**	Halhal	S	L-FL	M-W-NS	55	0.072	0.077	Respiratory/Genitourinary/Gastrointestinal/ Neurological/ENT
***Lawsonia inermis* L. (Lythraceae)**	Henna	Int	L	W-	82	0.107	0.114	Dermatological/ Hair Care
***Lens culinaris* Medik. (Fabaceae)**	Àdess	C	SE	NS-W	48	0.063	0.069	Cardiovascular
***Lepidium sativum* L. (Brassicaceae)**	rchad Hab	Int	SE	W	45	0.059	0.064	Dermatological/Osteoarticular/Respiratory/Gastrointestinal
***Linum usitatissimum* L. (Lauraceae)**	Zariàt kettan	Int	SE	H-W-M	12	0.016	0.018	Respiratory / Diabetes
***Lupinus angustifolius* L. (Fabaceae)**	kalb Fol	S	WP	W	13	0.017	0.020	Genitourinary
***Lupinus pilosus* L. (Fabaceae)**	Tarmas		SE	W	11	0.014	0.017	Diabetes
***Malva hispanica* L. (Malvaceae)**	Khobizza	S	L	W	35	0.046	0.047	Respiratory/ Gastrointestinal
***Malva silvestris* L. (Malvaceae)**	Bekolla	S	L-FL	W-NS	31	0.041	0.043	Gastrointestinal/ Metabolic
***Marrubium vulgare* L. (Lamiaceae)**	Amariw	S	WP	M-W	115	0.150	0.161	Dermatological/ Gastrointestinal/Diabetes/Hair Care/ Neurological
***Matricaria chamomilla* L. (Asteraceae)**	Banonj	S	FL-WP	W	91	0.119	0.125	Diabetes/Hair Care/Genitourinary/Gastrointestinal/

***Medicago sativa* L. (Fabaceae)**	Fassa	C	L-SE	W-NS	21	0.027	0.030	ENT/ Cardiovascular
***Mentha piperita* L. (Lamiaceae)**	Naànaà abdi	S	L-ST	W-NS	24	0.031	0.035	Respiratory/ Neurological
***Mentha rotundifolia* L. (Lamiaceae)**	Mchachtro	S	L	W-NS	78	0.102	0.108	Diabetes/ Gastrointestinal/ Respiratory
***Mentha cervina* L. (Lamiaceae)**	Manta	C	L	H-W	14	0.018	0.022	Respiratory/ Osteoarticular
***Mentha pulgium* L. (Lamiaceae)**	Fliou	C	L	W-H	108	0.141	0.145	Respiratory/ ENT/ Neurological
***Mentha spicata* L. (Lamiaceae)**	Naànaà	C	L-ST	W-NS	41	0.054	0.058	Neurological / Respiratory/Genitourinary
***Mentha suaveolens* Ehrh. (Lamiaceae)**	Marssita		L	W	53	0.069	0.075	Gastrointestinal/ Respiratory/ Dermatological
***Mercurialis annua* L. (Euphorbiaceae)**	Zotifa	S	ST-WP-L	W	18	0.024	0.029	Genitourinary/ Diabetes
***Morus alba* L. (Moraceae)**	Tout	S	L	NS	59	0.077	0.081	Diabetes/ Metabolic
***Muscari comosum* (L.) Mill. (Asparagaceae)**	Bessila	S	B	NS-W	8	0.010	0.014	Gastrointestinal/ Osteoarticular
***Myrtus communis* L. (Myrtaceae)**	Rihan	C	L	W	85	0.111	0.013	Cardiovascular/ Respiratory/ Hair Care/ Genitourinary
***Nerium oleander* L. (Apocynaceae)**	Defla	S	L-RT	W-NS	95	0.124	0.116	Oral-Dentals/ Osteoarticular/ Diabetes
***Nigella sativa* L. (Ranunculaceae)**	Sanouj	Int	SE	NS-W-H-M	96	0.125	0.128	Osteoarticular/ Respiratory
***Ocimum basilicum* L. (Lamiaceae)**	Hbak	S	L	W	27	0.035	0.132	Cardiovascular/ Gastrointestinal/Hair Care/ ENT
***Olea europea* L. (Oleaceae)**	Zaytoun	C	L-FR	W-NS	117	0.153	0.037	Osteoarticular/ Oral-Dentals/ Gastrointestinal/ Dermatological/ Diabetes/ Hair Care
***Olea europea* var. sylvestris Mill. (Oleaceae)**	Lberri	S	L	W-NS	20	0.026	0.029	Metabolic/ Gastrointestinal/Diabetes
***Opuntia ficus* indica (L.) Mill. (Cactaceae)**	Hendiya	C	FR-FL	W-NS	16	0.021	0.167	Genitourinary/ Gastrointestinal
***Origanum majorana* L. (Lamiaceae)**	Merdedoch	C	L-PA	NS-M-W	59	0.077	0.029	Gastrointestinal/ Respiratory/ Neurological/ Osteoarticular
***Origanum vulgare* L. (Lamiaceae)**	Zaatar	S	L-ST	W-M-H	81	0.106	0.026	Genitourinary/ Gastrointestinal/Respiratory
***Oryza sativa* L. (Poaceae)**	Rouz	Int	SE	W-NS	81	0.106	0.080	Gastrointestinal/ Osteoarticular
***Papaver rhoeas* L. (Papaveraceae)**	Balaàman	S	FL	W	30	0.039	0.111	Dermatological / ENT
***Peganum harmala* (Zygophyllaceae)**	Harmal	Int	L-FL-SE	W	15	0.020	0.108	Dermatological/ Genitourinary/ Osteoarticular
***Persea gratissima* C.F.Gaertn. (Lauraceae)**	Lavoca	C	L-FR	M-NS	12	0.016	0.043	Dermatological/ Cardiovascular
***Petroselinum sativum* Hoffm. (Apiaceae)**	Maàdnous	C	L-ST-WT	W	94	0.123	0.025	Osteoarticular/ Genitourinary

***Phaseolus aureus* Roxb. (Fabaceae)**	Souja	C	SE	W-H	15	0.020	0.017	Dermatological/ Metabolic
***Phaseolus vulgaris* L. (Fabaceae)**	Loubya	C	SE	NS	46	0.060	0.125	Metabolic/ Diabetes
***Phoenix dactylifera* L. (Arecaceae)**	Nakhla	Int	SE-ST	NS-W	55	0.072	0.024	Cardiovascular
***Pimenta dioica* (L.) Merr. (Myrtaceae)**	Nwiwra	Int	SE	W	23	0.030	0.065	Genitourinary/ Oral-Dentals
***Pimpinella anisum* L. (Apiaceae)**	Habat hlawa	C	SE-WP-FR	W	42	0.055	0.076	Gastrointestinal/ Genitourinary
***Pinus pinaster* Aiton. (Pinaceae)**	Tayda	S	BA-FR	NS-W	26	0.034	0.034	Respiratory/ Dermatological/ENT
***Pinus sylvestris* L. (Pinaceae)**	Sanwbar	S	BA	W	20	0.026	0.060	Respiratory/ Dermatological
***Piper nigrum* L. (Piperaceae)**	Ibzar	Int	SE	W-M-H	14	0.018	0.037	Respiratory/ Gastrointestinal
***Pistacia atlantica* Desf. (Anacardiaceae)**	Btam	S	L-B-SE	W-NS	17	0.022	0.029	Gastrointestinal
***Pistacia lentiscus* L. (Anacardiaceae)**	Drou	S	L-B	W-NS	91	0.119	0.022	Diabetes/ Gastrointestinal/ Genitourinary
***Populus alba* L. (Salicaceae)**	byad Safsaf	S	RT-L-FL	W	28	0.037	0.027	Osteoarticular/ Gastrointestinal
***Populus nigra* L. (Salicaceae)**	Safasaf khal	S	BA-L	W	24	0.031	0.124	Gastrointestinal/ Respiratory
***Portulaca oleracea* L. (Portulacaceae)**	Rajla	S	L-ST	NS	17	0.022	0.039	Diabetes/ Metabolic
***Prunus armeniaca* L.(Rosaceae)**	Lmich	C	L-FR	NS-W	15	0.020	0.034	Respiratory/ Osteoarticular/ Dermatological
***Punica granatum* L. (Puncaceae)**	Roman	C	BA-FR-SE	NS-W-H	68	0.089	0.026	Diabetes/ Hair Care/ Gastrointestinal
***Quercus suber* L. (Fagaceae)**	Balout	S	RT-FL-BA	W-NS	35	0.046	0.024	Dermatological/ Gastrointestinal/Hair Care
***Retama monosperma* (L.) Boiss. (Fabaceae)**	Rtam	S	L	NS	62	0.081	0.094	Gastrointestinal/ Neurological
***Rhus pentaphylla* Desf. (Anacardiaceae)**	nsar Kaf	S	L-RT-B-FL	W-NS	67	0.088	0.047	Dermatological
***Ricinus communis* L. (Euphorbiaceae)**	Karnak	S	L	W	36	0.047	0.086	Dermatological/ Hair Care
***Rosmarinus officinalis* L. (Lamiaceae)**	Azzir	S	L	M-W-NS	183	0.239	0.092	Hair Care/ Metabolic/ Genitourinary/ Gastrointestinal/ Neurological
***Rubus ulmifolius* Schott (Rosaceae)**	Akhlij	S	L	W	62	0.081	0.051	Dermatological/ Cardiovascular
***Rumex acetosa* L. (Polygonaceae)**	Homayda	S	L-RT	W-NS	36	0.047	0.255	Gastrointestinal
***Salvia officinalis* L. (Lamiaceae)**	Salmiya	C	L	M-W	162	0.212	0.084	Dermatological/ Diabetes/Metabolic/ Respiratory

***Scolymus hispanicus* L. (Asteraceae)**	Garnina	S	FL-RT-ST	NS-W	57	0.075	0.050	Respiratory/ Gastrointestinal
***Sesamum indicum* L. (Pedaliaceae)**	Zanjlan	Int	L	W-M-H	28	0.037	0.224	Respiratory/ Genitourinary
***Silene vulgaris* Garcke. (Caryophyllaceae)**	Tghichta	S	L-RT	W	28	0.037	0.078	Dermatological/ Gastrointestinal
***Silybum marianum* (L.) Gaertn. (Asteraceae)**	Bozerwal	S	L-RT-SE	NS	13	0.017	0.039	Genitourinary
***Sinapis arvensis* L (Brassicaceae)**	Bohamou	S	WP-SE	W	10	0.013	0.038	Dermatological/ Respiratory
***Solanum lycopersicum* L. (Solanaceae)**	Maticha	C	FR	NS	20	0.026	0.020	Dermatological/ Genitourinary/ Gastrointestinal
Solanum melongena L. (Solanaceae)	Danjal	C	FR-ST	NS	9	0.012	0.016	Gastrointestinal
***Solanum nigrum* L. (Solanaceae)**	Baknina	S	L	NS	8	0.010	0.014	Gastrointestinal
***Solanum tuberosum* L. (Solanaceae)**	Batata	C	RH	NS	46	0.060	0.014	Neurological / Gastrointestinal
***Sonchus asper* (L.) Hill. (Asteraceae)**	Tifaf	S	L	W	37	0.048	0.064	Respiratory/ Metabolic/ Dermatological
***Spinacia oleracea* L. (Amaranthaceae)**	Salk	C	L	NS	63	0.082	0.051	Cardiovascular/ Gastrointestinal
***Tamarix gallica* L. (Tamaricaceae)**	Tarfa	S	FL-RT	W	20	0.026	0.086	Genitourinary/ Gastrointestinal
***Tanacetum vulgare* L. (Asteraceae)**	Balsam	C	FR-RT-SE	W	66	0.086	0.030	Osteoarticular/ Dermatological/ Metabolic/Diabetes
***Tetraclinis articulata* Mast. (Cupressaceae)**	Àar-àar	S	L	W	27	0.035	0.089	Hair Care/ Diabetes/ Neurological
***Thapsia garganica* L. (Apiaceae)**	Nafaà	S	L-RT	W	17	0.022	0.037	Oral-Dentals/ Gastrointestinal/ Respiratory
***Thymelaea virgata* (Thymelaeaceae)**	Matnane	S	L-RT	W	40	0.052	0.026	Genitourinary/ Diabetes/ Gastrointestinal
***Thymus satureioides* Coss. (Lamiaceae)**	Zàitra	S	L	M-W	196	0.256	0.055	Gastrointestinal/ Respiratory
***Trigonella foenum-graecum* L. (Fabaceae)**	Holba	C	SE	W-NS-M-O	72	0.094	0.099	Respiratory/Gastrointestinal/ Diabetes
***Triticum aestivum* L. (Poaceae)**	Kmah	C	SE	W-NS	20	0.026	0.029	Gastrointestinal
***Triticum turgidum* L. (Poaceae)**	Zraà	C	SE	W-NS	14	0.018	0.021	Dermatological
***Urtica dioica* L. (Urticaceae)**	Horika	S	RT-ST-L	W-NS	66	0.086	0.088	Genitourinary/ Osteoarticular/ Gastrointestinal
Vicia faba L. (Fabaceae)	Lfoul	C	SE	NS	53	0.069	0.073	Respiratory/ Cardiovascular
***Vicia sativa* L, *Vicia ervilia* L.) (Fabaceae)**	Karsena	C	SE	W	13	0.017	0.020	Dermatological/ Gastrointestinal/ Cardiovascular
***Vitex agnus-castus* L. (Lamiaceae)**	Kharwaà	S	FL	W	15	0.020	0.024	Genitourinary

***Vitis vinifera* L. (Vitaceae)**	Dalya	C	L	W-NS	40	0.052	0.055	Gastrointestinal/ Genitourinary/ Dermatological
***Zea mays* L. (Poaceae)**	Dra	C	SE	W-NS	26	0.034	0.035	Genitourinary/ Cardiovascular
Zingiber officinale Roscoe. (Zingiberaceae)	Sakinjbir	Int	RH	W-M-H	50	0.065	0.072	Osteoarticular/ Respiratory
***Ziziphus lotus* L. (Rhamnaceae)**	Nbak	S	L-SE-RT	H-NS-W	56	0.073	0.078	Genitourinary/ Dermatological/Diabetes/ Gastrointestinal

Abbreviations:

- **Part used: B: Bulbs, FL: Flowers, FR: Fruits, L: Leaves, PA: Aerial Part, RH: Rhizome, RT: Roots, SE: Seeds, ST: Stem, WP: Whole Plant**
- **Type of plants: C: Cultivated, Int: Introduced, S: Savage**
- **Solvent: H: Honey, M: Milk, NS: No Solvent, O: Oil, W: Water**

The floristic biodiversity of the southern Mediterranean, particularly in the Tanger-Tétouan region, is characterized by the predominance of certain botanical families. The Lamiaceae (17 species), Asteraceae (16 species), and Fabaceae (14 species) play a central role in traditional medicine and local culinary practices. The Lamiaceae, including plants like mint and thyme, are widely valued for their antiseptic and relaxing properties, while the Asteraceae, such as daisies and dandelions, are renowned for treating inflammations and digestive issues. The Fabaceae, essential for their nutritional value and ability to enhance soil fertility, are integral to local diets and traditional remedies. The Apiaceae (13 species) and Poaceae (9 species) are also significant, offering both staple foods and medicinal plants, while the Brassicaceae (8 species) and Solanaceae (6 species) provide key vegetables and medicinal plants, despite the toxicity of some species.

The less diverse families, such as Cucurbitaceae (5 species), Amaranthaceae, Lauraceae, Myrtaceae, and Rutaceae (4 species each), along with Anacardiaceae, Asparagaceae, Cupressaceae, Euphorbiaceae, Liliaceae, Oleaceae, and Rosaceae (3 species each), are equally crucial for local culture and medicine. For instance, the Rosaceae include fruit trees like apple, vital for the local economy, while the Oleaceae, with olive trees, are essential for olive oil production, a cornerstone of the Mediterranean diet. This plant diversity does not only highlight the importance of these species in the daily lives of local populations but also underscores the need to conserve this biodiversity to preserve ethnobotanical knowledge and the cultural identity of the region (Figure 16). Indeed, other ethnobotanical research has confirmed the significance of these key families in Morocco,[24,25,42] and in the Arab Maghreb.[43-45]

The results of the ethnobotanical study in the Tangier-Tetouan region (southern Mediterranean) show a high diversity of plants used for their therapeutic properties, with varying frequencies of citation (FC). *Thymus satureioides* Coss., with a FC of 196, was the most cited plant, followed by *Rosmarinus officinalis* L. (FC = 183) and *Salvia officinalis* L. (FC = 162), known for their antimicrobial and anti-inflammatory properties. Lavandula dentata L. (FC = 133) and Olea europaea L. (FC = 117) were also very common in traditional remedies. Plants such as *Marrubium vulgare* L. (FC = 115), *Allium sativum* L. (FC = 114), and *Chenopodium ambrosioides* L. (FC = 113) showed high citation frequencies, highlighting their importance in local treatments. *Mentha pulegium* L. (FC = 108) and *Eucalyptus camaldulensis* (FC = 103) were often used for their expectorant and antiseptic properties. The presence of *Dittrichia viscosa* L. (FC = 96) and *Nigella sativa* L. (FC = 96) underscores the diversity of medicinal uses. The variety of cited plants, including species with more modest FCs such as *Nerium oleander* L. (FC = 95) and *Matricaria chamomilla* L. (FC = 91), illustrates a rich tradition of phytotherapy, enabling the treatment of a wide range of ailments (Figure 17).

Traditional therapeutic uses

During the survey, twelve categories of illnesses were identified. Analysis of the collected data allowed for the identification of various ailments treated with medicinal plants in our study area (Table 4). Among these, gastrointestinal diseases were the most frequently treated with aromatic and medicinal plants, accounting for approximately 23% of uses. This highlights the importance of medicinal plants for digestive disorders in this region. This was followed by respiratory diseases (11.54%) and genitourinary diseases (11.38%), demonstrating that plants with expectorant, antiseptic, diuretic, and antibacterial effects play a crucial role in their treatment. Dermatological, neurological, and metabolic diseases were also well-represented, each accounting for about 8 to 9% of treatments. Osteoarticular and cardiovascular disorders comprised about 7% and 6% of uses, respectively, reflecting the use of plants for joint pain and heart problems. Diabetes and hair care each represented about 4%, while ENT and dental disorders were treated in about 2% of cases (Figure 18). This distribution showed a wide range of ailments treated with medicinal plants, illustrating the richness and diversity of traditional phytotherapy knowledge in this region. The results underscore the importance of these practices for local public health and the need to preserve this knowledge while encouraging further research to scientifically validate their efficacy and safety. Previous studies have reached the same conclusion, underlining that gastrointestinal, respiratory, genito-urinary, and skin disorders are most often treated with medicinal plants.[28,31,43,46-50]

Relative frequency of citation (RFC) and use value (UV)

The dataset contained 171 observations for both RFC and UV, with no missing values, ensuring that the analysis was based on a complete sample. The minimum values for RFC and UV differ slightly, with RFC starting at 0.003 and UV at 0.009. However, the maximum values were almost identical, with RFC reaching 0.256 and UV reaching 0.255, indicating that both variables span nearly the same range.

With respect to central tendency, RFC had a mean of 0.055, while UV had a slightly higher mean of 0.058, suggesting that, on average, UV values were marginally greater than RFC values. The standard deviations were also similar, with RFC at 0.044 and UV at 0.043, indicating comparable levels of variability around their respective means. These findings suggested that RFC and UV exhibited very similar behavior in terms of range, central tendency, and variability, with only minor differences in their minimum values and means (Figure 19 and Table 5).Examining the quartiles, the 1st quartile for RFC was 0.022, while for UV it was 0.027, showing a slightly higher value for UV. The median values were also closely aligned, with RFC at 0.039 and UV at 0.042. The 3rd quartile values were similarly close, at 0.076 for RFC and 0.078 for UV. These results suggest that both variables have nearly identical distributions, with UV consistently showing slightly higher values across the distribution.

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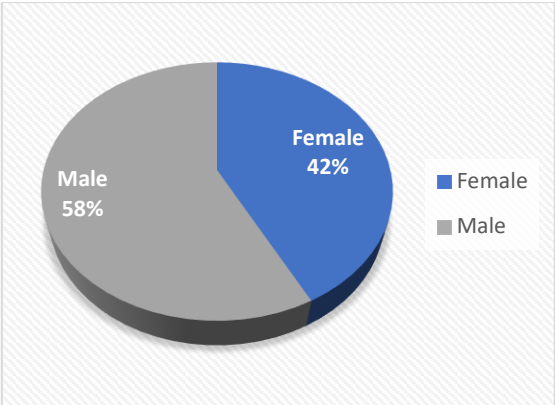

Figure 2: Distribution of respondents by gender

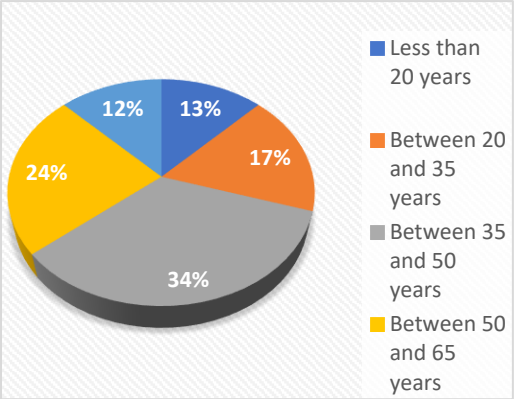

Figure 3: Age class by number of people surveyed

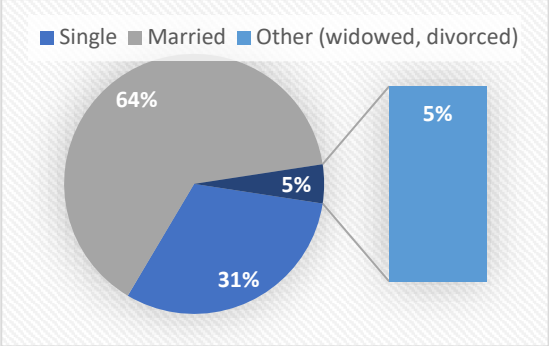

Figure 4: Use of medicinal plants by family situation

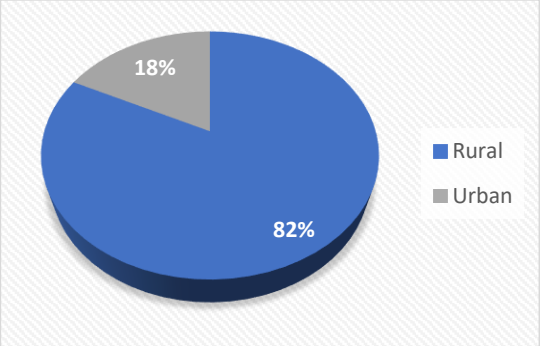

Figure 5: Distribution of respondents by housing type

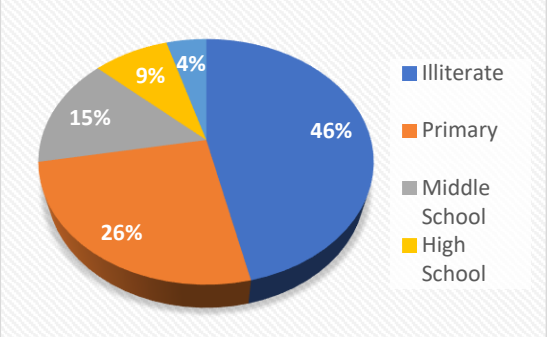

Figure 6: Distribution of surveys by level of education

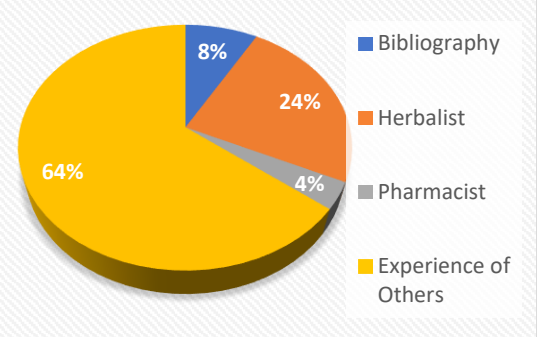

Figure 7: Distribution of surveys by source of information

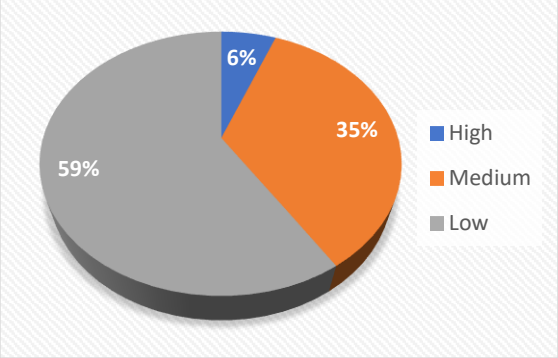

Figure 8: Use of medicinal plants by socio-economic status

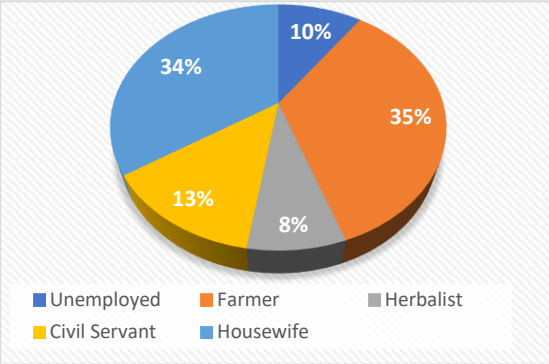

Figure 9: Use of medicinal plants by profession

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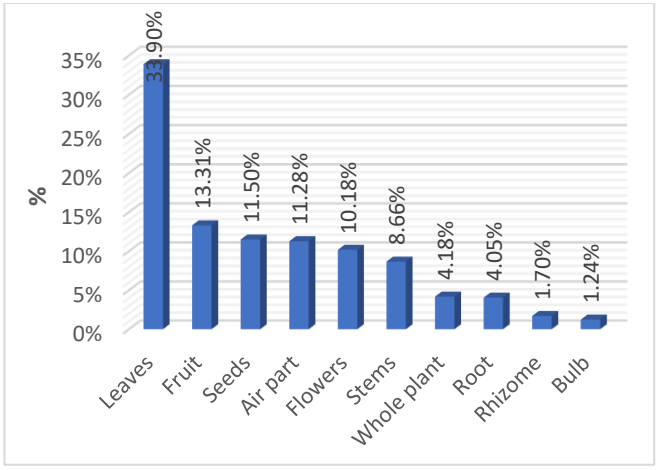

Figure 10: The used part of the plant in the Tangier-Tetouan region, northern Morocco

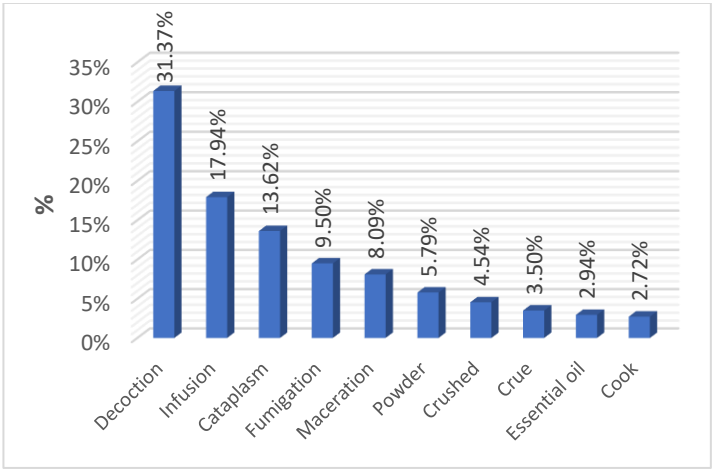

Figure 11: Preparation mode of the plants used in the Tangi Tetouan region, northern Morocco

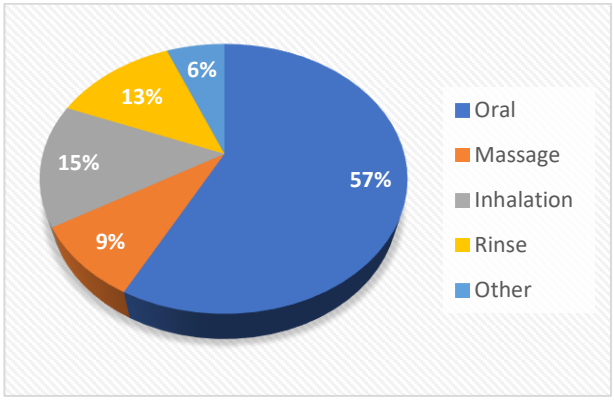

Figure 12: Method of administration of plants used in the Tangier-Tetouan region, northern Morocco

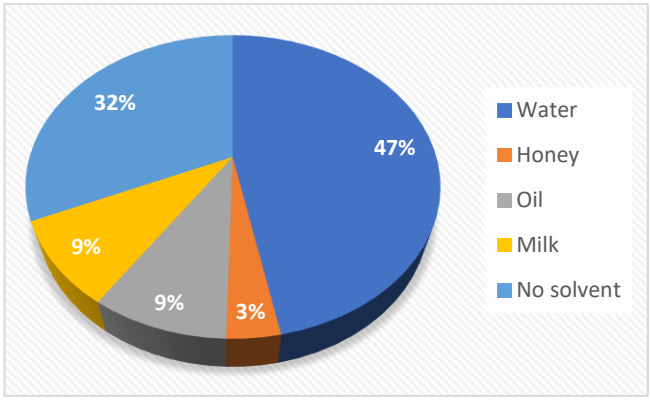

Figure 13: The solvent used for the preparation of plants used in the Tangier-Tetouan region, northern Morocco

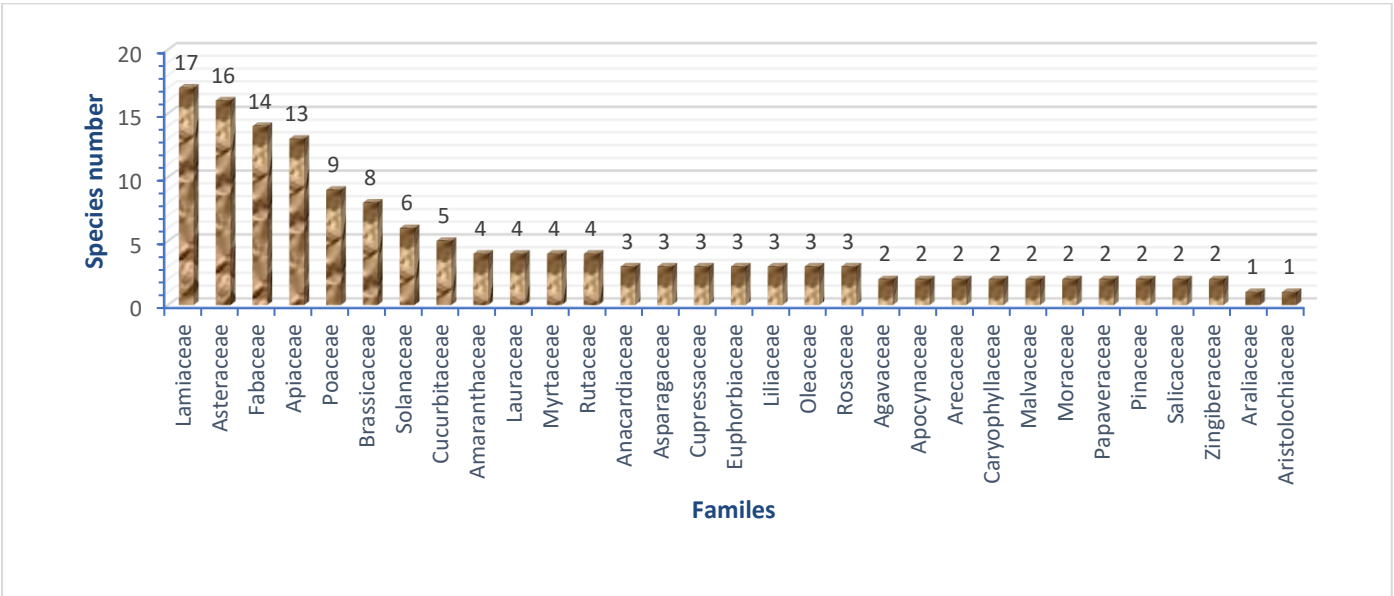

Figure 16: Botanical families most present in the Tangier-Tetouan region, northern Morocco

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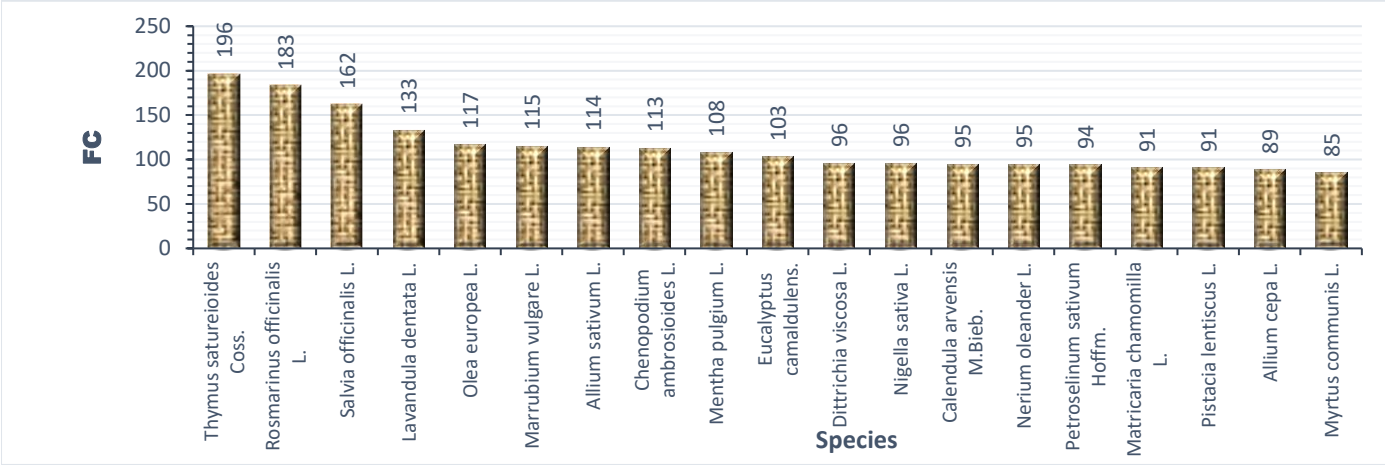

Figure 17: Main medicinal plants used in the Tangier-Tétouan region, northern Morocco

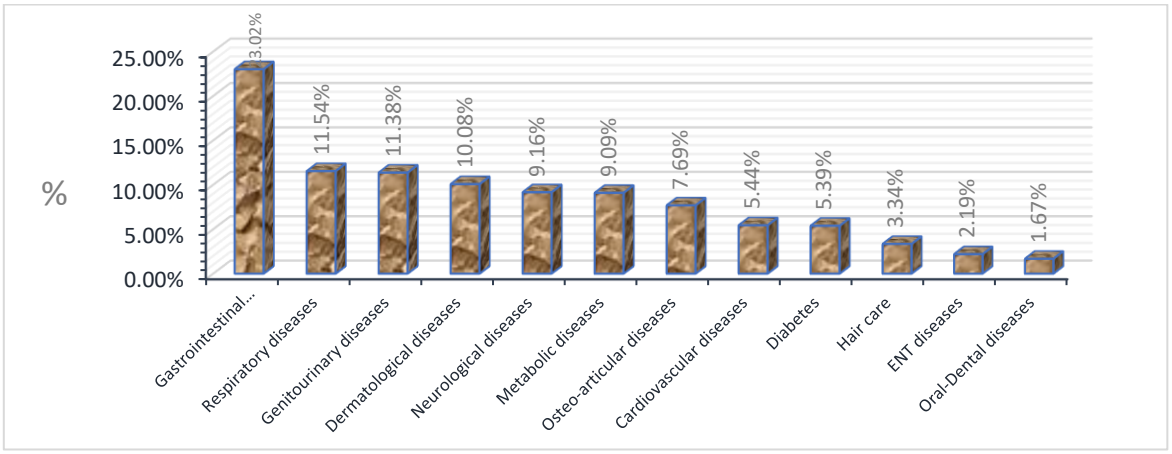

Figure 18: Percentage of illnesses treated with medicinal plants in the Tangier-Tetouan region, northern Morocco

Table 4: Identification of diseases recorded among informants interviewed in the Tangier-Tetouan region, northern Morocco

Categories of Diseases	Manifestations
Gastrointestinal	Digestive disorders (such as diarrhea, constipation, colic, and intestinal inflammations), baby diarrhea, dewormer, upset stomach, throwing up, helminth infections, gastric ulcer, intestinal gas, Stomach inflammation, Bile stimulant, Spastic colon, Dyspepsia, inflamed gallbladder, Stool softener, Strong laxative, Digestive aid
Respiratory	throat clearing, pneumonitis, Common cold, Scratchy throat, bronchial inflammation, bronchial asthma, Whooping cough.
Genitourinary	Urinary bladder issues, bladder retention, Renal inflammation, Kidney stones, Painful bladder syndrome, trouble urinating.
Dermatological	Spots, thermal injuries, itch mite infection, scratching urge, Fissures, Solar burn, Verrucae, adiposis edematosa, Breakouts, Eczema, Dermatitis, Psoriatic plaques, Ecchymoses, skincare, leukoderma, Hyperpigmentation, skin thickening, Skin ulcers, Skin ulcers, fungal nail infection, fungal skin infections,
Metabolic	Excessive weight, elevated blood fats, High cholesterol, hyperthyroidism, hypothyroidism, Goiter, Cushing's disease, Addison's disease

ENT (Ear/Nose/Throat)	Outer ear infection, Middle ear infection, Ringing in the ears, auditory impairment, Nasal congestion, Nasal inflammation, Sinus infection, Allergic rhinitis, Nasal growths, Pharyngitis, Laryngitis, acterial throat infection, epiglottis infection, Vocal cord nodules
Diabetes	Insulin-dependent diabetes, Non-insulin-dependent diabetes, Gestational diabetes, Hypoglycemia, Diabetic dermopathy
Cardiovascular	Cardiac node, dysrhythmia, High blood pressure, Irregular heartbeat, Palpitations, anal varices, weak heart, arteriosclerosis, varicosities
Osteoarticular	Osteoarthritis, Inflammatory arthritis, Osteoporosis, Gout, Ankylosing spondylitis, Joint inflammation, Tendinitis, Spinal degeneration, Paget's disease of bone, Psoriatic arthritis, Bone fractures, Joint dislocation, bone dislocation.
Oral-Dentals	Gum inflammation, dental discomfort, Periodontal diseases, Dental caries, tooth pain, tooth sensitivity, Oral care, dental hygiene, oral ulcers,
Hair Care	Hair treatment, Hair regrowth, Hair loss, Hair-pulling disorder, Folliculitis, stress-related hair shedding, Androgenetic alopecia, Tinea capitis, Seborrhea, inflammatory hair loss, Anagen effluvium?
Neurological	Amnesia, difficulty sleeping, anxiety, Nervousness, depressive disorder, Pain reliever, Nervous breakdown, Tranquilizer, Relaxant, Headaches, Fatigue, Dementia,

Table 5: Relationship between UV and RFC

Variable	Observations	Obs. with Missing Data	Obs. without Missing Data	Minimum	Maximum	Mean	Standard Deviation
RFC	171	0	171	0.003	0.256	0.055	0.044
UV	171	0	171	0.009	0.255	0.058	0.043

The variance and standard deviations for both variables are nearly identical, with RFC showing a standard deviation of 0.044 and UV at 0.043, indicating similar levels of variability in the data. The coefficient of variation (CV), which measures relative dispersion, was slightly higher for RFC (0.800) compared to UV (0.741), suggesting that RFC exhibited a slightly greater spread relative to its mean (Figure 20 and (Table 6). In summary, the analysis reveals that RFC and UV have closely aligned statistical properties. Both variables display similar central tendencies, variability, and distributions, with only minor differences. The slightly higher coefficient of variation for RFC indicates that it has a bit more relative variability compared to UV.

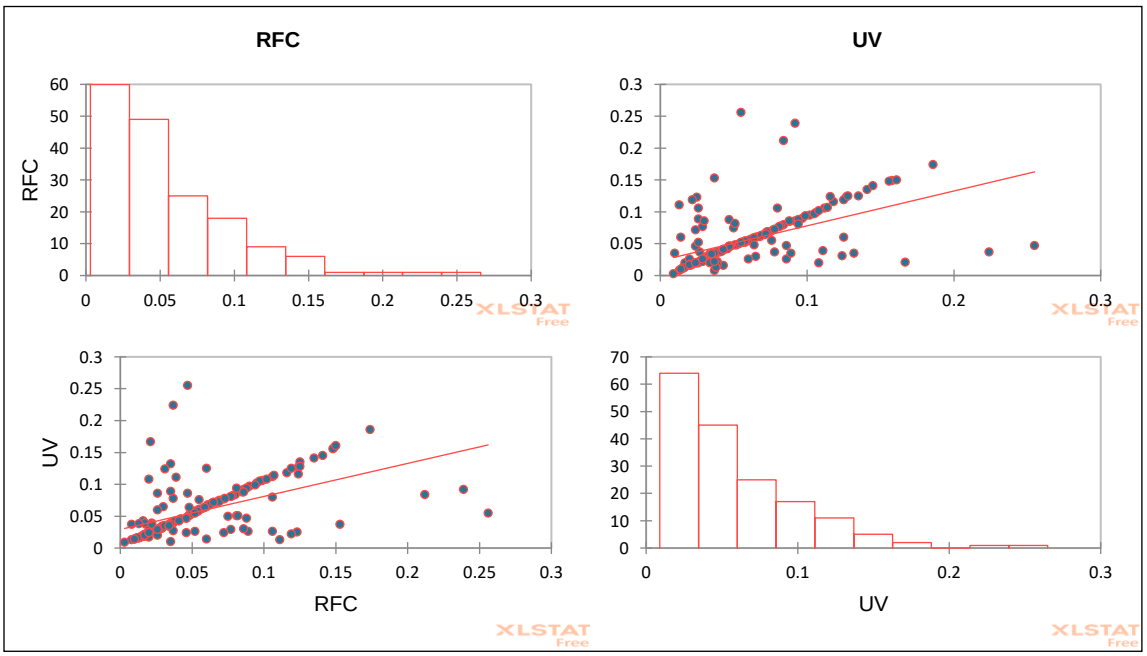

Figure 19: Correlation between UV and RFC

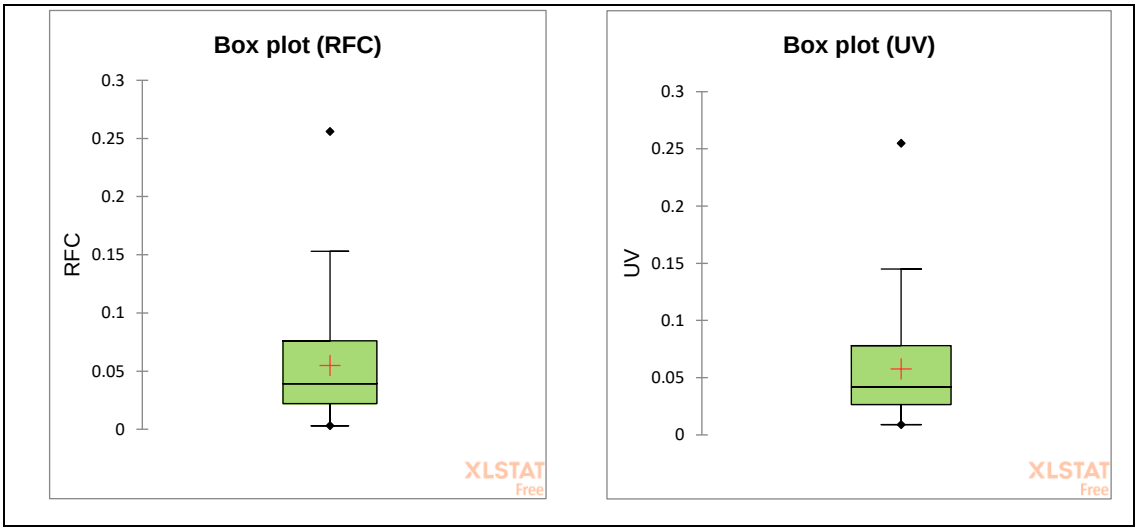

Figure 20: Box plot representations of the RFC and UV variable

Table 6: Descriptive Statistics for Numerical Data

Statistic	RFC	UV
Number of observations	171	171
Minimum	0.003	0.009
Maximum	0.256	0.255
1st Quartile	0.022	0.027
Median	0.039	0.042
3rd Quartile	0.076	0.078
Mean	0.055	0.058
Variance (n-1)	0.002	0.002
Standard deviation (n)	0.044	0.043
Standard deviation (n-1)	0.044	0.043
Coefficient of variation (n)	0.800	0.741

Conclusion

The ethnobotanical survey in the Tangier-Tétouan region provided extensive insights into the use of medicinal plants in traditional herbal medicine. The results showed that the local population primarily relies on these plants for their healthcare, with a notable correlation between the frequency of plant use and demographic profiles, particularly among individuals aged 35 to 50 years, women, and those from lower socio-economic backgrounds. The floristic analysis identified 58 plant families, with 168 documented species, including significant ones such as *Thymus satureioides*, *Rosmarinus officinalis*, and *Salvia officinalis*. The varying RFC values indicate different levels of consensus and efficacy among informants, highlighting the versatility and importance of certain plants in traditional medicine. Leaves are the most commonly used plant parts, with decoction as the prevalent preparation method and oral administration as the main route of intake. Most medicinal plants are used to treat digestive, respiratory, and genitourinary disorders. Despite improved access to modern healthcare, the study underscores the continued significant role of medicinal and aromatic plants in local disease treatment. The specific chemical properties of the plants explain their effectiveness in various disease categories, supporting their traditional use and providing a basis for future pharmacological and biological research. This data provides a valuable resource for understanding the medicinal flora of northern Morocco and preserving local knowledge and practices, while also opening up prospects for potential therapeutic applications of these plants.

Conflict of Interest

The authors declare no conflict of interest

Authors' Declaration

The authors hereby declare that the work presented in this article is original and that any liability for claims relating to the content of this article will be borne by them.

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