



Ethnopharmacological Survey of Plants Used for Immunological Diseases in Four Regions of Morocco

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Authors' contributions

This work was carried out in collaboration between all authors. Authors AEHEY, DB and LEM designed the study. Authors AEHEY and DB performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors DB, AEHEY, AD and IO managed the analyses of the study and the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Several ethnopharmacology studies have been conducted on medicinal plants used in traditional medicine to treat diseases related to digestive disorder, diabetes and hypertension etc. However, no study has focused on how the plants can be used to treat diseases related directly or indirectly to the immune system dysfunction.

The aim of this work is to study and to determine the therapeutic natural profile used in the Moroccan folk medicine to treat ten diseases related directly or indirectly to immune system dysfunction. Namely, Asthma, Allergy, Cancer, Eczema & Psoriasis, Hepatitis, Infectious diseases, Arthritis-rheumatoid, Rheumatism, inflammation pathologies and immune system depression.

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Ethnobotanical interviews were conducted out in four regions of Morocco from April 2006 to June 2008. A total of 140 interviews were carried out about plants used for immune system dysfunction using a formulary support.

The data of this study led to identify 130 medicinal plants belonging to 116 genera and 52 botanical families in four regions of Morocco; Fez-Boulmane (FB), Meknes-Tafilalt (MT), Tanger-Tetouan (TT) and Marrakech-Tensift-Al Haouz (MTH). The best families represented were: Asteraceae 36.5%, Lamiaceae 25% and Apiaceae 19.23%. The total species plants used correspond to the following percentages; 16% to treat Allergy, 18% Arthritis-rheumatoid, 40% Asthma, 28% Cancer, 13% Inflammation, 32% Rheumatism, 22% Infections diseases, 31% Eczema & Psoriasis, 20% Hepatitis and 9% immune system depression. Of these species, 3.07% are endemic to Morocco, 18.46% are common weeds, 2.77% are semi-cultivated and naturalized and the rest 75.7% are native to flora. The survey showed that leaves were the most used part. The majority of the traditional medications are prepared as decoction and infusion 29%. Globally, both modes of administration are used to treat diseases. Internal administration mode is presented by oral ingestion which is the most used route 76%. However, the external administration modes are highly used to treat some pathology such as Eczema and Rheumatism.

In conclusion, this study showed the pattern of single Moroccan herbs or herbal formulae that are used in treating ten diseases related to immune system dysfunction. Further, clinical trials are needed to evaluate the efficacy and safety of plants for the treating of these pathologies.

Keywords: Morocco; medicinal plants; ethnopharmacology; immune diseases.

1. INTRODUCTION

The traditional medicine practice is part of therapeutic habits based solely on experience and observation handed down from generation to another (orally or in writing) [1]. According to the World Health Organization (WHO) about 65–80% of the world's population in developing countries depends essentially on plants for their primary health care due to poverty and lack of access to modern medicine [2,3], where nearly 300.000 plant species were identified to have medicinal properties [4]. In Morocco, the traditional medicine plays an important role because of the diversity of plants and their uses [3]. More than 40.000 species from 150 families and 940 genera spread across the country with an area of 715.000 km² [5-8]. A large number of these plants are endemic [8,9]. These plants tend to be used in: hypertension and diabetes [10-12], cardiovascular affection [13,14], neurodegenerative diseases [15,16] and several other diseases. In this study, we are interested in plants that are used to treat the diseases related directly or indirectly to the immune system dysfunction because this area never was studied. So the important role of immune system has been previously determined. Indeed this system, like all systems, may lose its balance which causes the appearance of immunological pathologies. Most other immune disorders result from

either an excessive immune response, an 'autoimmune attack or an immune system depression. In the case of immunodepression many opportunistic diseases such as; immunodeficiency, cancercan be developed. Medically, conventional medicine today has means to explore and to modify the spontaneous course of immune responses. In fact, transplantation of cells, thymic extracts injection, immunotherapy and the immunomodulatory therapy are part of the therapeutic arsenal for the treatment of these pathologies. It is unfortunate that these approaches show their serious side effects thus to the treatment cost. So the research of the new bioactive molecules stripped of side effects and cheaper in the treatment cost is a tremendous interest.

It is known that plants are always the source of new molecules, for this the present study aims to describe and to collect some information about plants usually used by Moroccan folk medicine to treat the diseases related directly or indirectly to the immune system disorders in four regions of Morocco and to identify the natural drugs commonly used in the immune system dysfunction such as: Cancer, Asthma, Allergy, Rheumatism, Arthritis-rheumatoid, Infectious diseases, Hepatitis, Eczema & Psoriasis, Inflammation pathologies and immune system depression.

2. MATERIALS AND METHODS

2.1 Areas Studies

The choice of regions under survey is based on historical events diversity including several cultural civilizations living in Morocco.

The Areas studies characters (Fig. 1):

- **Fez-Boulemane region:** Located in the North-Central of the kingdom, and it is considered a crossroads between the East, the North East, and the South western united. It covers an area of 20.318 km², or 2.85% of the national territories, divided between the provinces of Fez, Sefrou and Boulmane. It includes 15 urban area and 48 rural communes. Normally, the Fez-Boulmane region is characterized by three types of climates; continental climate in the north, cold and wet in mountainous areas and semi-arid climate in the high hills of Boulmane. Depending on the type of prevailing climate, this

- region has a varied environmental diversity from one province to another. In 1994, its population is 1.322.473 inhabitants, representing 5.1% of the total population.
- **Meknes-Tafilalet region:** Located in the North of the country, it consists of the Prefecture of Meknes- El Menzah, the Prefecture of Al Ismailia and El Hajeb, lfrane, Khenifra, and Errachidia provinces. In addition to thus, it consists of 25 municipalities, an urban community and 111 rural communes. Its area covers 79.210 km², or 11.14% of the national territories. At the regional level, there are three main climatic areas; a semi continental Mediterranean climate is located mainly in the prefecture of Meknes, and the province of El Hajeb. A harsh and snowy winter's climate it extends over the Middle Atlas and Moulouya. At last, a desert climate is dominant over the entire province of Errachidia. So, its population is 1.903.790 inhabitants in 1994 which represents 7.3% of the total population.

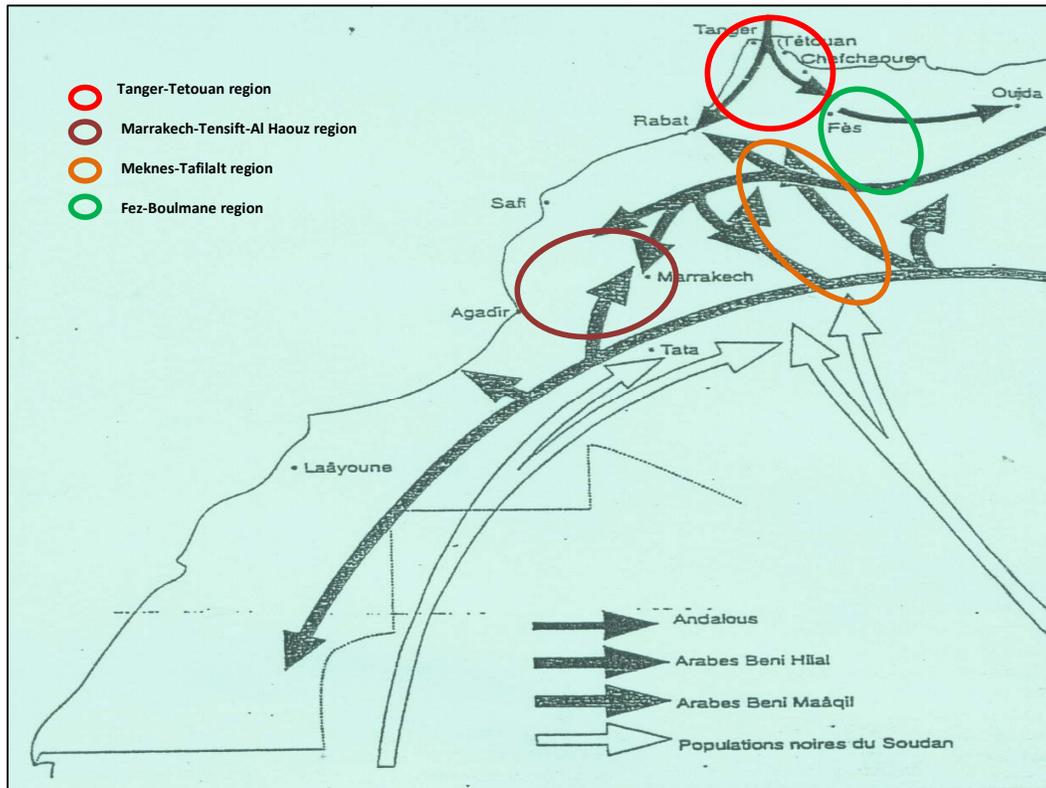


Fig. 1. Ethnopharmacological regions studied and cultural civilizations lived in Morocco

- **Marrakech-Tensift-Al Haouz region:** Located in the central regions to the west it is divided into four provinces; Essaouira, Kelâa Sraghna Al Haouz, Chichester and three prefectures; Marrakech-Menara, Marrakech-Medina and Sidi Youssef Ben Ali. It has 16 rings and 216 municipalities with 18 municipalities. The region of Marrakech-Tensift-Al Haouz covers 31.160 km² area equivalent to 4.4% of the national territories. Generally, the climate of this region is arid or semi-arid and humid in general in the Atlas (from 1500 m to 2000 m above sea level) and the coastline. Indeed, its population is estimated at 2.724.204 inhabitants in 1994 which represents 10% of the total population.
- **Tanger-Tetouan region:** Located at the extreme Northwest of the Kingdom of Morocco, Tanger-Tetouan region is bounded on the north by the Strait of Gibraltar and the Mediterranean to the west by the Atlantic Ocean, south by the Gharb region and Taza – Al Hoceima - Taounate. Covering an area of 11.570 km², or 1.6% of the national territories, the region is in the field of Mediterranean climate and consists of four units in a homogeneous environment: the Tanger, the coast, Mediterranean basins and Jbala Loukkos. Currently, it consists of two prefectures are Tangier-Assilah and Fahs-Bni Makada, and three provinces namely province of Chefchaouen, Larache and Tetouan. The region includes 10 clubs, 87 rural communes and 13 municipalities. Its population is 2.04 million inhabitants in 1994, representing 8% of the total population. In view of its size, the area is considered one of the most populated parts of Morocco and most densified (176 inhabitants/km in 1994 against 37 in the country).

2.2 Ethnobotanical Survey

According to method described by El Rhaffari and Zaid [9]. Our survey is based on three pathways:

- 1) Healers and traditional healers;
- 2) Herbalists;
- 3) Carried out.

This methodology was carried to collect information related to plants used in traditional

medicine in those regions. For this purpose, a questionnaire model was prepared, that includes the following parameters:

- Date, sheet N°, region, province, commune, and neighborhood of gathering information;
- Botanical and vernacular name of the plants;
- Immunological disease treated by plants;
- Parts used: leaves, fruits, aerial parts, roots, seeds, etc;
- The precision of doses (precise, not precise, little or sometimes precise);
- The preparation modes, the administration routes, and the treatment duration;
- The reasons for using medicinal plants (more effective, cheaper, or for the easy acquisition);
- The results of their therapy (good, average or variable).

We have included in our investigation the social profile of the persons interviewed, such as name (if possible), age, sex and profession.

From three hundred informants, one hundred forty interviewees have consented to participate in our investigation. However, some herbalists have declined to participate in this survey preferring preservation of their secret preparation.

2.3 Data Analysis

2.3.1 Fundamental study

Medicinal plants data record were analyzed using these fundamental criteria:

- **Coherence and convergence parameters studies:** We have selected the coherent plants recognized for its healing effects against the diseases related directly or indirectly to the immune system dysfunction. Although, the coherent information must be at least reported twice in two different locations and cited by different informants [9].
- **Botanical identity:** All plants were attributed a scientific name. However, we faced the problem of the confusion or the difference of the common name of the plants, such as various vernacular names of same specie or one vernacular name of several species.
- **Diseases:** For each pathology, we proceeded to select all plants used.

- **Parts used:** we have mentioned all parts used of every plants (leaf, stem, root, flower, fruit, or aerial part ...).
- **Preparation mode and administration route:** We specified exactly the mode of the preparation, and the administration route of every remedy. These remedies can be:
 - ✓ Internal remedies use: Taken orally;
 - ✓ External remedies use: skin applied (powder, poultice).
- **Classification of species:** the specie plants were classified according to families.

2.3.2 Statistical study

The database software, WinIDAMS version 1.3, was used for data linkage and processing. Regular statistics (mean and percentage) were displayed for the frequency of plants used, plant parts used, preparation and administration modes used and determinate the frequency of medicinal plants used in every region. This software was applied to calculate the prescription of the Moroccan herbs for immune diseases. For executing the program to identify the association rules in our dataset, we chose 0.5% as the minimum support factor and 30% as the minimum confidence level.

3. RESULTS AND DISCUSSION

The restraint information of these investigations is the result of the confrontational approaches:

- In space data, the regionality and the locality,
- In time, the informants discord the same locality and the same regionality [9].

3.1 Medicinal Plant Diversity

This study recorded one hundred thirty (130) plant species used in Moroccan traditional medicine to treat the diseases related directly or indirectly to the immune system disorders. These medicinal plants were distributed among 116 genera and 52 families. Species found are listed in Table 1. Data are ordered alphabetically by botanical families. The vernacular names (local Morocco name), the popular uses, the parts used, the preparation mode, the administration route, the citation region, and the percentage use of each plant are also reported. From used species, 4 (3.07%) are endemic to Morocco, 24

(18.46%) are common weeds, 4 (2.77%) are semi-cultivated and naturalized, and the rest (75.7%) are native to the flora.

The distribution of all species as shown in Table 2 reveals that the largest proportion of medicinal plants (80%) that were collected belong to three families: Asteraceae (19 species, 36.5% of the total uses), followed by Lamiaceae (13 species, 25% of the total uses), and Apiaceae (10 species, 19.23% of the total uses). From all the plants reported in this work, we have remarked that some plants were widely used to treat one disease in four regions. For example, *Aristolochia longa*, *Zygophyllum gaetulum*, *Berberis hispanica* are mostly used for cancer affections. Moreover, the *Myristica fragrans*, *Anabasis aretioides*, *Ephedra alata*, and *Pinus sylvestris* are used in the Arthritis-rheumatoid diseases (Table 3).

3.2 Parts of Plant Used

Most of the documented species are herbs (67.2%) followed by shrubs (15.1%), trees (10.5%), and climbers (7.2%).

The parts of the plants employed are very different. The most frequently used parts are leaves (25%), seeds (17%), aerial parts (16%), roots (7%), and 5% are flowers and stems (Fig. 2). While, the other parts including bulb, pulp, floral somite, capitulum are less used in comparison with other cited previously. It can be frequently observed that the percentage of plant part mostly used is depending on disease type treated. In cancer, allergy, arthritis-rheumatoid, hepatitis, and infectious diseases, the seeds are the parts most used. However, the leaves represent the important percent in asthma, rheumatism, inflammation, and eczema-psoriasis treatments.

3.3 Preparation Methods

In general remedies based on plants are prepared as decoctions, infusions, macerates, or syrups. In the preparation, plants could be slightly roasted on embers, toasted in pans, burnt on fire, or ground. Indeed, the decoction (29%) and infusion (29%) preparations in this study are the frequently used methods (Fig. 3) followed by the powder preparation (20%). At last, poultice, tea, lotion, maceration, and cigarette consist on the less used methods (Fig. 3). Sometimes, the plants preparations were added with oil, sugar or honey.

Table 1. List of medicinal plants used in traditional medicine to treat some immune diseases in: Tanger-Tetouan, Fez-Boulmane, Meknes-Tafilalt, Merrakach-Tensift-Al Haouz regions, Morocco

Scientific name	Vernacular names	Parts used	Preparation modes	Administration routes	Popular use	Citation areas (% of use)
Adiantaceae						
<i>Adiantum capillus-veneris</i> L.	Qezbûr l-ma	aerial part	Infusion	Oral	Asthma, Infections.	TT (25%)
Apiaceae						
<i>Ammi majus</i> L.	Atrilal/trilan/tlilan	Seed	Powder	Oral Poultice	Cancer, Asthma, Eczema & Psoriasis. Cancer.	FB (11%), MTH (7%)
<i>Ammi visnaga</i> (L.) Lam.	Bechnikha/Tabtechnikht/Khella	Seed	Decoction	Oral	Asthma. Infections.	MT (36%), FB (10%), MTH (6%). FB (27%)
<i>Ammodaucus leucotrichus</i> Coss. & Dur.	Kemmoun sofi/ Kemmount bousofa	Seed	Decoction	Oral	Asthma, Arthritis-rheumatoid.	MT (14%)
<i>Apium graveolens</i> L.	krafese	Seed	Infusion/Powder	Oral	Arthritis-rheumatoid, Rheumatism, Asthma.	FB (2%), MT (13%)
<i>Carum carvi</i> L.	karwiya	Seed	Decoction	Oral	Cancer, Allergy, Infections.	TT (7%), MTH (19%)
<i>Foeniculum dulce</i> DC./ <i>Foeniculum vulgare</i> Mill.	Nâfea/Nâfea fechtali	Seed	Decoction	Oral	Allergy, Asthma, Infections.	FB (23%), TT (11%)
<i>Heracleum sphondylium</i> L.	Awli, chabt	Fruit	Decoction	Oral	Infections.	FB (10%)
<i>Petroselinum sativum</i> Hoffm.	Mâadnous	Aerial part	Decoction	Oral	Allergy, Asthma, Infections.	MTH (17%), MT (8%)
<i>Pimpinella anisum</i> L.	Habbat hlâwa	Seed	Decoction/ Infusion	Oral	Allergy, Asthma, Infection.	TT (3%), MTH (34%), FB (10%)
<i>Smyrniolum olusatrum</i> L.	l-heyâr	Fruit	Powder	Ointment	Arthritis-rheumatoid.	MT (10%)
Apocynaceae						
<i>Nerium oleander</i> L.	Defla/Alili	Leaf	Powder Infusion	Ointment E.U.	Asthma. Cancer.	MT (2%), FB (14%)

Scientific name	Vernacular names	Parts used	Preparation modes	Administration routes	Popular use	Citation areas (% of use)
Aristolochiaceae						
<i>Aristolochia longa</i> Desf.	Bereztom, jtat-lehmîr-Iberri, ajararakh	Root	Powder Decoction	Ointment Oral	Eczema & Psoriasis. Asthma, Cancer.	FB (3%) FB (57%), MTH (69%)
Asclepiadaceae						
<i>Calotropis procera</i> (Ait.) R. Br.	Turzat/Tawarzat	Leaf	Decoction	Poultice	Eczema & Psoriasis.	TT (5%), MTH (18%), FB (2%), MT (7%)
Asteraceae						
<i>Achillea leptophylla</i> M. Bieb.	Shwihya/ Kort	Aerial part	Infusion	Oral	Inflammation, Allergy, Cancer.	FB (13%)
<i>Achillea millefolium</i> L.	Akilya/ Richiya	Flower/Leaf	Decoction Essential oil	Oral Ointment	Inflammation, Allergy, Cancer Rheumatism.	TT (14%). FB (1%).
<i>Anacyclus pyrethrum</i> (L.) Link	Tigentast , igentas, gentûs, úd el âttas.	Root	Decoction	Oral	Cancer, Asthma.	MT (4%), FB (10%)
<i>Andryala pinnatifida</i> Ait.	El-alk	Resin	Tea	Oral	Asthma.	MT (1.96%), MTH (3.75%)
<i>Anthemis nobilis</i> L.	Babounje/rûmi	Aerial part	Infusion	Oral	Rheumatism, Hepatitis, Asthma.	MT (12.84%)
<i>Arctium lappa</i> L.	Araktyun	Root	Powder Decoction	Oral	Cancer, Inflammation, Rheumatism. Eczema & Psoriasis, Arthritis-rheumatoid.	FB (2.22%), MTH (11.44%), TT (6%)
<i>Artemisia absinthium</i> L.	Chiba	Aerial part	Infusion Powder	Oral Ointment	Hepatitis. Eczema & Psoriasis.	TT (1.67%), MT (3%)
<i>Artemisia hera-alba</i> Asso.	chih	Aerial part	Infusion	Support Oral	Uterine cancer. Allergy, Asthma, Eczema	TT (2%) FB (8.3%)
<i>Atractylis gummifera</i> L.	Edad	Root	Decoction	Poultice	Eczema & Psoriasis.	FB (0.67%), MTH (5%)
<i>Bellis perennis</i> L.	Ghedala/ Zhar rabi'ae	Flower/Leaf	Infusion	Oral	Asthma, Rheumatism, Inflammation.	MTH (12%),

Scientific name	Vernacular names	Parts used	Preparation modes	Administration routes	Popular use	Citation areas (% of use)
<i>Calendula officinalis</i> L.	Ahmar er-ras	Flower	Essential oil Infusion	Ointment Oral	Eczema & Psoriasis. Stomach and intestine cancer	FB (3.67%) MTH (15.47%)
<i>Carduus marianus</i> L.	Shukt jmal/kharshuf jabli	Seed	Decoction	Oral	Hepatitis , Liver cancer	FB (1.67%), TT (9%)
<i>Chamomilla recutita</i> (L.) Rauschert	Babunj	floral Button	Powder	Oral Ointment	Allergy, Inflammation, Eczema, Asthma, Rheumatism	FB (13%). MT (5%)
<i>Chrysanthemum morifolium</i> Ramat.	Okhowan/Babunj lbaldi	floral Button / Leaf	Infusion	Oral	Rheumatism, Inflammation, Arthritis-rheumatoid, Infections.	FB (1%)
<i>Inula viscosa</i> (L.) Aiton	Terrahla	Root	Decoction	Oral	Allergy, Asthma, Inflammation.	FB (4.3%), MTH (2%)
<i>Matricaria chamomilla</i> L.	Babounje al-hamar	Fruit	Decoction/infusion	Oral Ointment	Hepatitis , immune system depression Eczema & Psoriasis.	MT (4%), MTH (1.8%), TT (7.67%). FB (2%), TT (1%)
<i>Onopordon macracanthum</i> Schousb.	Chubrak	Fruit/ Leaf	Powder	Oral Ointment	Cancer. Eczema & Psoriasis.	MT (0.96%), TT (8%)
<i>Silybum marianum</i> (L.) Gaertn.	Suk ez-zerwal/Bu-zerwal	Aerial part	Infusion	Oral	Hepatitis.	MTH (3.8%).
<i>Taraxacum officinale</i> (L.) Weber ex F.H. Wigg.	Hundoba el-bariya	Leaf Root Sap	Powder	Oral Oral Ointment	Hepatitis Cancer. Eczema & Psoriasis.	TT (1%). FB (9%). MTH (8.7%)
Berberidaceae						
<i>Berberis hispanica</i> Boiss. & Reut.	Arris	Stem bark	Infusion	Oral Ointment	Cancer. Eczema & Psoriasis.	FB (38%). FB (11%).
Betulaceae						
<i>Betula alba</i> L.	Batoula	Leaf /Bark	Infusion/ Maceration	Oral	Rheumatism.	TT (7%)

Scientific name	Vernacular names	Parts used	Preparation modes	Administration routes	Popular use	Citation areas (% of use)
			Essential oil	Ointment	Eczema & Psoriasis.	
Borraginaceae						
<i>Borago officinalis</i> L.	Al-hurraycha/lisân at-tûr	Aerial part /Seed	Essential oil	Ointment	Rheumatism, Eczema.	MTH (3%).
Brassicaceae						
<i>Lepidium sativum</i> L.	Hebb rchad/l-harf	Seed	Powder / Infusion	Oral	Asthma, Allergy, Hepatitis , Rheumatism, Infections.	MT (8%), FB (3%), TT (16%).
<i>Capsella bursa-pastoris</i> (L.) Medik.	Kiss raâe	Aerial part	Infusion	Oral	Asthma, Eczema & Psoriasis, Hepatitis, Infections, Inflammation.	MT (11.5%), FB (6%),
Burseraceae						
<i>Boswellia Carterii</i> Bridw.	Luban/Luban dakar	Resin	Infusion	Oral	Inflammation, Arthritis-rheumatoid, Asthma.	FB (15%)
<i>Commiphora molmol</i>	Murr hijazi/Murr mekka	Resin	Powder	Oral	Inflammation, Cancer.	MTH (3%)
Cactaceae						
<i>Opuntia ficus-indica</i> (L.) Mill.	Karmouss, hendi	Bat	-	Poultice	Eczema & Psoriasis.	MT (13%)
Caprifoliaceae						
<i>Sambucus nigra</i> L.	Khaman/ Balman	Flower	Infusion/Decoction	Oral	Inflammation, Asthma.	TT (28.5%)
		Fruit			Rheumatism.	
Caryophyllaceae						
<i>Herniaria fontanesii</i> J.Gay, / <i>H. hirsuta</i> L.	Herrast Lehjer/Dâyfa	Aerial part	-	Poultice	Eczema & Psoriasis.	TT (17%), FB (22%)
<i>Saponaria vaccaria</i> L.	Tighihgist, saboun el-fqar	Root/ Aerial part	Decoction/Infusion	Oral	Asthma, Rheumatism, Eczema & Psoriasis.	FB (27%), MTH (14%)
Chenopodiaceae						
<i>Anabasis aretioides</i> * Coss. & Dur.	Chou-fleur de Bou Hamama/ Sella/ chajra li ma ydihach rih	Aerial part	Powder	Oral	Arthritis-rheumatoid, Rheumatism.	MTH (30%), MT (14%)
<i>Bêta vulgaris</i> L.	L-barba	Fruit	Tea	Oral	Immune system depression, Cancer.	FB (10%)

Scientific name	Vernacular names	Parts used	Preparation modes	Administration routes	Popular use	Citation areas (% of use)
<i>Chenopodium ambrosioides</i> L.	Mkhinza	Aerial Part/ Capitulum	Tea	Oral	Asthma, Hepatitis	TT (8.5%)
Combretaceae						
<i>Terminalia chebula</i> Retz.	Hlilaj asfar/ Hlilaj aswad	Fruit	Powder	Oral	Hepatitis, Immune system depression.	MTH (20.5%), FB (11%).
Convolvulaceae						
<i>Convolvulus arvensis</i> L.	Luwaya/ Tarbouch la'grabe	Leaf/ Root	Infusion	Oral	Asthma.	TT (9%)
Cucurbitaceae						
<i>Citrullus lanatus</i> (Thunb.) Matsum. & Nakai	L –handal/Hdaj	Fruit	Maceration	Oral Poultice	Arthritis-rheumatoid, Infections. Rheumatism, Eczema & Psoriasis.	TT (16.5%), MT (11%), FB (7%).
Cupressaceae						
<i>Cupressus Sempervirens</i> L.	Siru/Blinz-azal	Leaf	Powder	Oral Ointment	Rheumatism. Eczema & Psoriasis.	MT (22%)
<i>Juniperus oxycedrus</i> L.	Taqqa/L-âarâar	Leaf	Powder	Poultice	Eczema.	MT (2%)
<i>Juniperus phoenicea</i> L.	Lâarâar/Adeghmam	Leaf /Fruit	Tea/Powder Decoction	Oral Poultice	Asthma, Hepatitis, Rheumatism Eczema & Psoriasis, Infections.	FB (1%), TT (9.5%) TT (5.5%)
Dipsacaceae						
<i>Dipsacus fullonum</i> L.	Macht raîi	Root	Dyeing	Ointment	Eczema & Psoriasis.	FB (2.5%)
Ephedraceae						
<i>Ephedra alata</i> Decne	Amater	Stem	Decoction	Oral Ointment	Asthma. Arthritis-rheumatoid.	MTH (13.5%) TT (23%)
EUPHORBIACEAE						
<i>Euphorbia falcata</i> L.	Hayat nofous	Aerial part	Decoction	Oral	Infections.	MT (1%)
<i>Ricinus communis</i> L.	kharwaa	Leaf/Flower	Decoction	Oral	Rheumatism, Arthritis-rheumatoid.	FB (10%)

Scientific name	Vernacular names	Parts used	Preparation modes	Administration routes	Popular use	Citation areas (% of use)
Fabaceae						
<i>Acacia raddiana</i> Savi.	Talh/tifizit/agerger	Resin	infusion	Oral	Asthma.	MT (8%)
			Lotion	E.U.	Eczema.	
<i>Astragalus sesameus</i> L.	Hchicht Ikanfud	Root	Decoction	Oral	Immune system depression.	TT (7%)
<i>Cassia senna</i> L.	Sanna-hram, sanna-mekkâ	Leaf /Bay/ Bud.	Powder/Decoction/ Infusion	Oral	Asthma, Cancer, Hepatitis, Rheumatism.	FB (28%), MTH (10%), TT (17%).
<i>Ceratonia siliqua</i> L.	Kharoub ,tikidit, sligwa	Fruit	Tea	Oral	Rheumatism.	FB (16.5%)
<i>Glycyrrhiza glabra</i> L.	Arq'souss	Aerial part	Powder	Oral	Allergy, Asthma.	MTH (6%)
<i>Lupinus albus</i> L.	Qarmaz	Seed	Powder	Oral	Hepatitis.	FB (21%)
<i>Ononis natrx</i> L.	Afezzaz/Afezdad	Root	Decoction	Oral	Arthritis-rheumatoid.	MTH (12%)
<i>Trigonelle foenum-graecum</i> L.	Halba haïla	Seed	Powder	Oral	Cancer.	MTH (5%), TT (9.5%)
Gentanaceae						
<i>Erythraea Centaurium</i> (L.) Pers.	Qasat el-haya	Stem	Decoction	Oral	Hepatitis, Asthma, Rheumatism.	TT (5%), MT (11%),
			Dyeing	Ointment	Eczema & Psoriasis.	MTH (14.5%)
Geraniaceae						
<i>Geranium Robertianum</i> L.	Jantina	Aerial part	Infusion	Oral	Rheumatism, Cancer.	FB (24.8%), MT (12.7%), FB (4.9%)
				Poultice	Eczema & Psoriasis.	
Globulariaceae						
<i>Globularia alypum</i> L.	Âin lerneb/Taselgha	Leaf	Decoction	Oral/E.U.	Skin cancer.	MT (7.5%), MTH (3%)
Illiciaceae						
<i>Illicium verum</i> Hook.f.	badfâna	Fruit	Tea	Oral	Hepatitis, Asthma.	TT (9.73%).
Iridaceae						
<i>Crocus sativus</i> L.	Zâafran	Stigma	Infusion	Oral	Rheumatism, Allergy. Asthma, Infections.	MT (11%), TT (6.5%)

Scientific name	Vernacular names	Parts used	Preparation modes	Administration routes	Popular use	Citation areas (% of use)	
Juncaceae							
<i>Juncus acutus</i> L.	Ssmar/Azlaf	Root	Decoction	Oral	Infections.	MT (9%)	
Lamiaceae							
<i>Ajuga iva</i> (L.) Schreb.	Touf-Telba/Chendgoura	Aerial part	Decoction/Powder	Oral	Rheumatism, Allergy, cancer.	FB (14%), MTH (3%)	
<i>Lavandula angustifolia</i> Mill.	Khzama fassiya	Flower	Decoction	Oral	Asthma.	FB (2%),	
		Floral somite	Infusion		Hepatitis.	MTH (5%)	
<i>Lavandula coronopifolia</i> Poiret	Taymerza/lekhzama	Aerial part	Decoction	Oral	Hepatitis, Infections.	TT (13.1%), MTH (8%).	
			Tea	Ointment	Eczema & Psoriasis.	FB (4%), TT (10%), MTH (3.8%).	
<i>Lavandula stoechas</i> L.	Halhal	Leaf/Stem	Decoction	Oral	Rheumatism, Asthma.	MTH (1.7%)	
<i>Lavandula multifida</i> L.	Kohila	Aerial part	Decoction/Powder	E.U.	Infections.	FB (3%)	
<i>Marrubium vulgare</i> L.	Merrîwa/Merriout/lfzi/	Aerial part	Decoction	Oral	Rheumatism, internal cancer.	FB (1.9%),	
			Aerial part /Leaf	Tea/Powder	Poultice	Skin cancer.	TT (31%),
					Oral	Hepatitis.	MT (6%), MTH (1%), FB (3%),
			Cigarette	Smoke/Oral	Asthma.	FB (12%), MT (4.8%)	
<i>Melissa officinalis</i> L.	Hbaq trunjani/Hbaq barbari	Leaf/Seed	Infusion	Oral	Asthma.	FB (1%)	
<i>Ocimum basilicum</i> L.	Lahbaq	Aerial part	Decoction/Tea	Oral	Asthma.	FB (5.9%)	
<i>Origanum compactum</i> Benth.	Zaatar/Sahtar/Zaatar tawlwi	Leaf	Infusion	Oral	Inflammation.	FB (12%), MT (7%), MTH (3.6%)	
<i>Origanum vulgare</i> L.	Zaatar/Star/Azwi	Aerial part	Infusion/Decoction	Oral	Allergy, Asthma, Cancer.	TT (4.3%), MT (10%), FB (15.9%),	

Scientific name	Vernacular names	Parts used	Preparation modes	Administration routes	Popular use	Citation areas (% of use)
<i>Rosmarinus officinalis</i> L.	Āzir/Yazir/Iklil al-jabal/Barkala	Leaf	Infusion	E.U.	Eczema & Psoriasis.	MT (22%)
				Oral	Allergy, Asthma, Cancer, Infections, Immune system depression.	FB (11.7%), MT (6.8%), MTH (2%), TT (4.3%).
				Essential oil	E.U.	Eczema & Psoriasis.
<i>Salvia officinalis</i> L.	Salma/Salmiya/Naâma	Leaf	Infusion/Tea	Ointment	Rheumatism.	MTH (5.2%).
				Oral	Asthma, Inflammation.	MTH (4%).
<i>Thymus vulgaris</i> L.	Zaitra	Leaf /Stem	Decoction/Tea	Cigarette	Asthma.	FB (8%), MT (1.2%).
				Oral	Asthma, Allergy, Arthritis-rheumatoid, Immune system depression.	MT (16%), FB (18.6%), MTH (3.7%), TT (11%).
				Smoke	Asthma	MT (6.3%).
Lauraceae						
<i>Cinnamomum camphora</i> (L.) Presl.	Kafur	Leaf	Cigarette	Smoke	Asthma, Allergy.	FB (13.2%),
				Essential oil	Ointment	Rheumatism, Eczema & Psoriasis.
<i>Cinnamomum cassia</i> Presl.	L-Qarfa	Bark	Powder	Oral	Infections,	FB (12.4%)
<i>Cinnamomum verum</i> Presl.	Dar syni	Bark	Essential oil	Oral	Immune system depression.	FB (7.4%), MT (3%)
<i>Laurus nobilis</i> L.	Warqa musa/ Er-rand	Leaf	Decoction/Infusion	Oral	Cancer.	FB (5%), MTH (2.15%)
Liliaceae						
<i>Allium cepa</i> L.	Basla/Azlim	Bulb	Lotion	E.U.	Inflammation, Rheumatism.	FB (1.67%), MT (3%).
				Oral	Rheumatism.	MT (8%).

Scientific name	Vernacular names	Parts used	Preparation modes	Administration routes	Popular use	Citation areas (% of use)	
<i>Aloe barbadensis</i> Mill.	Sbar/Sibr/Siber	Pulp	-	Oral	Immune system depression.	MT (3.54%), TT (10.3%),	
			Lotion	Ointment	Rheumatism, Arthritis-rheumatoid.	FB (14.2%)	
<i>Urignea maritima</i> (L.) Baker	Bsel l-far/ Bsel l-ansal	Bulb	Boiled	Poultice	Hepatitis	MTH (6.2%), MT (1%)	
Linaceae							
<i>Linum usitatissimum</i> L.	Zarrait al-kettan/bzar l-kettan	Seed	Powder	Oral	Allergy, Asthma, Arthritis-rheumatoid, Infections, Breast and uterus cancer.	TT (13%)	
				Poultice	Inflammation.	FB (6.4%)	
Lythraceae							
<i>Lawsonia inermis</i> L.	L-henna/henné	Bark Leaf	Decoction	Oral	Hepatitis.	MT (2%).	
				Poultice	Eczema & Psoriasis	FB (4%), TT (3%)	
<i>Punica granatum</i> L.	Ramman	Pericarp	Powder	Poultice	Eczema & Psoriasis.	FB (4.66%)	
Myristicaceae							
<i>Myristica fragrans</i> Houtt.	Bsibisa	Pericarp	Powder	Oral	Arthritis-rheumatoid., Infections, Cancer. Eczema.	FB (21%)	
				Essential oil	Poultice	Rheumatism.	FB (9%), MT (0.67%)
				Ointment		MT (20%)	
Myrtaceae							
<i>Eucalyptus globulus</i> Labill.	kalitus	Leaf/Fruit	Cigarette	Smoke	Asthma.	TT (5.89%), FB (11.76%)	
<i>Myrtus communis</i> L.	Rihane	Leaf	Infusion	Oral	Hepatitis.	FB (6.37%)	
<i>Pimenta officinalis</i> Lindl.	Nwewera	Bay	Powder	Oral	Infections.	MTH (17.65%)	
Papaveraceae							
<i>Fumaria officinalis</i> L.	Bouqoul assabîya/ijujer/dbâyba	Aerial part	Infusion	Ointment	Eczema & Psoriasis.	FB (2%)	
Pinaceae							

Scientific name	Vernacular names	Parts used	Preparation modes	Administration routes	Popular use	Citation areas (% of use)
<i>Pinus halepensis</i> Mill.	Tayda	Leaf/Bark	Decoction	Oral	Infections.	MT (8%)
				Ointment	Eczema.	MTH (3.64%)
<i>Pinus sylvestris</i> L.	Sanawbar	Leaf	Infusion	Oral	Arthritis-rheumatoid, Rheumatism.	FB (22%-35.1%)
			Essential oil		Asthma.	
Piperaceae						
<i>Piper cubeba</i> L.	Al'kabar	Seed	Powder	Oral	Infections, cancer.	FB (13.2%)
Plantaginaceae						
<i>Plantago akkensis</i> * (Coss.) Murb.	Talma/l-yelma	Seed/Leaf	Infusion	Oral	Asthma, Hepatitis.	MT (23%)
Poaceae						
<i>Cymbopogon schoenanthus</i> (L.) Spreng	Tben mekkâ/ Toudmas	Stem	Tea	Oral/ Ointment	Arthritis-rheumatoid.	TT (5.89%)
<i>Hordeum vulgare</i> L.	Chair	Seed	Boiled/Tea	Oral	Allergy, Hepatitis.	TT (0.67%), MTH (1%).
Ranunculaceae						
<i>Nigella sativa</i> L.	Sanûj/haba saoudae	Seed	Powder	Oral	Allergy, Arthritis-rheumatoid, Cancer, Infections, Hepatitis, Immune system depression.	FB (1%), MT (3.22%), MTH (6%), TT (9.67%).
			Essential oil	Ointment	Rheumatism, Eczema & Psoriasis.	MTH (11%)
				Inhalation	Asthma.	TT (7.98%).
Rhamnaceae						
<i>Ziziphus jujube</i> Mill.	Nnbeg/Ssdra	Fruit	Decoction	Oral	Hepatitis, Immune system depression.	TT (15%)
Rosaceae						
<i>Prunus armeniaca</i> L.	meshmash	Bark	Decoction	Oral	Inflammation.	MTH (3%)
		Seed	Powder		Asthma.	TT (1%)
<i>Prunus avium</i> (L.) L.	Hab el-mluk	Stem	Powder	Oral	Arthritis-rheumatoid.	MT (2.76%)

Scientific name	Vernacular names	Parts used	Preparation modes	Administration routes	Popular use	Citation areas (% of use)
Rubiaceae						
<i>Rubia tinctorum</i> L.	Fowa/tarubiya	Root	Infusion	Oral	Arthritis-rheumatoid, Hepatitis, Infections, Pancreatic cancer.	MTH (10%), MT (1%), FB (5.3%)
Rutaceae						
<i>Citrus aurantium</i> L.	Hammed I-beldi	Fruit	Lotion	Oral	Immune system depression	TT (1.86%).
<i>Ruta graveolens</i> L.	Rûta/ Mrijjô	Leaf	Decoction	Oral	Rheumatism.	MT (1.76%), MTH (5%)
<i>Ruta chalepensis</i> L.	L-fijel	Aerial part	Tea	Oral	Hepatitis.	MTH (7%)
			Oleate	Ointment	Arthritis-rheumatoid, Rheumatism.	FB (0.67%), MTH (4%).
		Floral somite	Decoction	E.U.	Skin cancer.	TT (5.45%)
Salicaceae						
<i>Salix alba</i> L.	Mmu-swalaf/Bu-swalaf	Bark/Leaf/floral Button	Infusion/Decoction/Powder	Oral	Rheumatism, Eczema & Psoriasis, Inflammation.	FB (4%)
<i>Populus nigra</i> L.	Sefsaf	Bark	Powder	Ointment	Arthritis-rheumatoid, Rheumatism.	MTH (1%)
Smilacaceae						
<i>Smilax aspera</i> L.	Ushba rumiya/Luwaya	Root	Lotion	Oral	Inflammation, Eczema & Psoriasis, Immune system depression, Rheumatism.	MT (9%), TT (13%), FB (2.67%),
Solanaceae						
<i>Atropa belladonna</i> L.	Zbîb lydour	Leaf	Infusion	Oral	Cancer.	MT (22%)
<i>Datura stramonium</i> L.	Chdaq jmel/Tabourziget/Tabourzizt.	Leaf/Flower Leaf/Seed	Cigarette	Smoke Poultice	Asthma. Rheumatism.	FB (8.97%) MT (7.89%)
<i>Hyoscyamus niger</i> L.	Sikran/Gengit	-	-	-	Allergy, Eczema & Psoriasis.	MTH (2%)
<i>Solanum nigrum</i> L.	Bouknina/Adil ouchen/Âneb Eddib	Stem	Powder	E.U.	Eczema& Psoriasis.	FB (12.9%)
			Tea	Oral	Hepatitis.	
<i>Withania adpressa</i> (Coss.) Batt.	Lbayda/lirremt/Hjjiou	Leaf	Decoction	Oral	Cancer, Hepatitis, Rheumatism, Inflammation.	MTH (17%), MT (7.6%)

Scientific name	Vernacular names	Parts used	Preparation modes	Administration routes	Popular use	Citation areas (% of use)
Tamaricaceae						
<i>Tamarix getula</i> Batt.	Takawat/Tikiout	Aerial part	Decoction	Oral Ointment	Asthma. Skin cancer.	FB (0.67%) MTH (3.9%)
Tiliaceae						
<i>Tilia silvestris</i> Desf.	Zayzafun	Flower	Infusion	Oral	Allergy, Hepatitis, Infections.	TT (1.8%), FB (4.2%)
Urticaceae						
<i>Urtica dioica</i> L.	L-hurriga/Timezrit	Seed	-	Poultice	Cancer.	TT (7%), FB (11.4%)
		Leaf	Maceration	Oral Ointment	Asthma, Rheumatism. Eczema & Psoriasis.	MT (6%) FB (1%)
Zingiberaceae						
<i>Amomum grana-paradisi</i> L.	Gouza sahwariya	Leaf	Infusion	Oral	Arthritis-rheumatoid, Infections.	TT (5.2%)
<i>Elletaria cardamomum</i> L.	Qaâqolla	Seed	Infusion/Tea	Oral	Asthma, Arthritis-rheumatoid, Cancer, Infections.	FB (7%), MT (3.9%)
Zygophyllaceae						
<i>Nitraria Schoberi</i>	l-gerzîm/âgerzîm	Leaf	-	Poultice	Eczema & Psoriasis.	FB (1%)
<i>Peganum harmala</i> L.	L'Harmel	Seed/Leaf	Decoction	Ointment	Rheumatism, Hepatitis.	MTH (1%), TT (2.76%)
<i>Tetraena gaetula</i> (Emb. & Maire) Beier & Thulin	L'âagaya	Aerial part	Infusion/Decoction	Oral	Cancer.	MT (49%)

Regions: Tanger-Tetouan (TT), Fez-Boulemane (FB), Meknes-Tafilalet (MT), Marrakech-Tensift-Al Haouz (MTH).

*: Endemic plants in Morocco. E.U: Externe usage

Table 2. The classification families based on the species numbers cited

Family	Number of species	% of uses
Apiaceae	10	19.3
Asteraceae	19	36.5
Brassicaceae	2	3.84
Burseraceae	2	3.84
Caryophyllaceae	4	7.69
Chenopodiaceae	4	7.69
Cucurbitaceae	5	9.61
Euphorbaceae	2	3.84
Fabaceae	5	9.61
Lamiaceae	13	25
Lauraceae	6	12
Myrtaceae	3	5.77
Pinaceae	2	3.84
Poaceae	2	3.84
Punicaceae	2	3.84
Rosaceae	2	3.84
Rutaceae	6	12
Solanaceae	5	9.61
Zingiberaceae	2	3.84
Zygophyllaceae	3	5.77
Adiantaceae, Apocynaceae, Aristolochiaceae, Asclepiadaceae, Berberidaceae, Betulaceae, Boraginaceae, Cactaceae, Caprifoliaceae, Convolvulaceae, Dipsacaceae, Ephedraceae, Fumariaceae, Gentanaceae, Geraniaceae, Globulariaceae, Iridaceae, Juncaceae, Liliaceae, Linaceae, Lythraceae, Magnoliaceae, Mimosaceae, Myristicaceae, Piperaceae, Plantaginaceae, Rhamnaceae, Rubiaceae, Smilacaceae, Tamaricaceae, Tiliaceae, Urticaceae.	1	1.93

Table 3. The most used plants for each disease

Pathology	The most used plants	Number of species uses	% of uses
Allergy	<i>Achillea leptophylla, Foeniculum vulgare, Petroselinum sativum, Thymus vulgaris, Achillea millefolium, Ajuga iva.</i>	21	16%
Arthritis-rheumatoid	<i>Myristica fragrans, Anabasis aretioides, Ephedra alata, Pinus sylvestris, citrulus colcyntis, Boswellia Carterii.</i>	23	18%
Asthma	<i>Aristolochia longa, Pinus sylvestris, Pimpinella anisum, Sambucus nigra, Cassia senna, Saponaria vaccaria.</i>	52	40%
Cancer	<i>Aristolochia longa, Zygophyllum gaetulum, Berberis hispanica, Marribium vulgare, Myristica fragrans.</i>	36	28%
Eczema & psoriasis	<i>Ammi majus, Cupressus sempervirens, Origanum vulgare, Saponaria vaccaria, Herniaria fontanesii, Erythraea Centaurium.</i>	41	31%
Hepatitis	<i>Cassia senna, Plantago akkensis, Lupinus albus, Terminalia chebula, Withania adpressa, Zizuphus jujuba.</i>	26	20%
Immune system depression	<i>Zizuphus jujuba, Smilax aspera, Terminalia chebula, Thymus vulgaris, Bêta vulgaris, Nigella sativa.</i>	12	9%
Infections	<i>Myristica fragrans, Ammi visnaga, Adiantum capillus, Carum carvi, Pimenta officinalis, Lepidium sativum.</i>	28	22%
Inflammation	<i>Sambucus nigra, Achillea leptophylla, Boswellia carterii, Achillea millefolium, Chamomilla recutita, Bellis perennis.</i>	17	13%
Rheumatism	<i>Sambucus nigra, Saponaria vaccaria, Geranium robertianum, Cupressus sempervirens, Pinus sylvestris, Myristica fragrans.</i>	42	32%

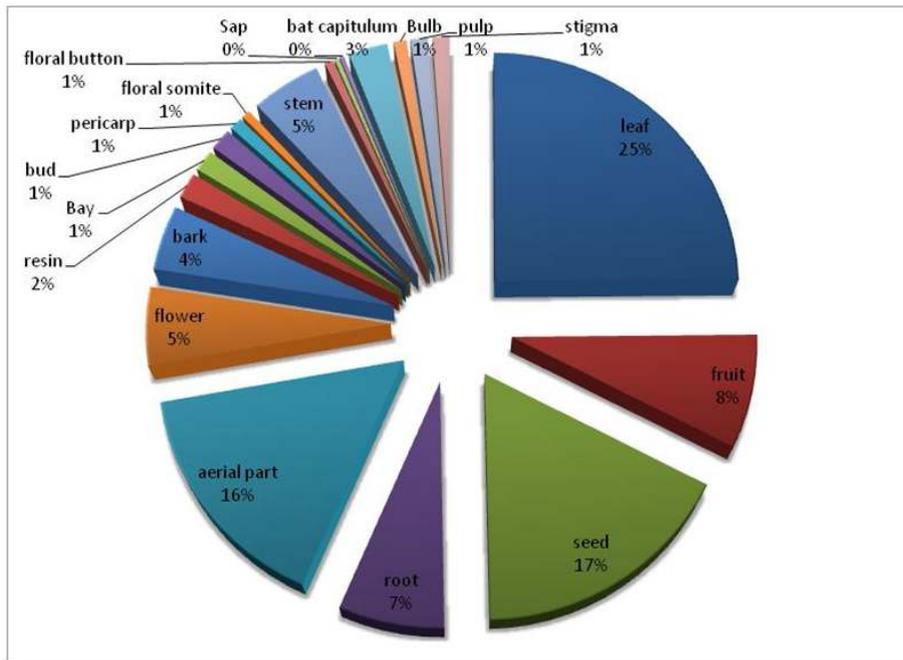


Fig. 2. The distribution of the medicinal plants parts percentages used in Morocco

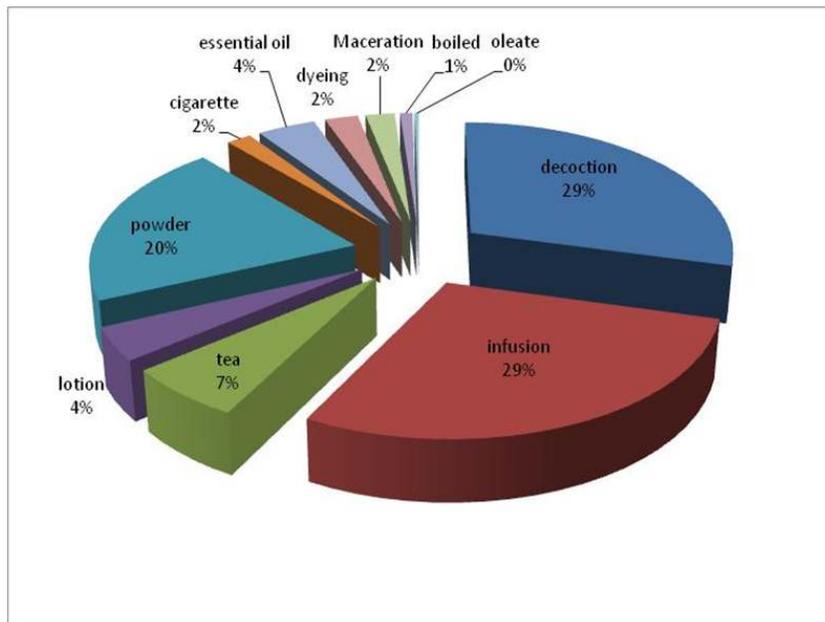


Fig. 3. The distribution of the medicinal plants preparation modes percentages

3.4 Administration Modes

In comparison with the external administration route, the internal route has the administration mode commonly used. Indeed, these administration modes are used according to

disease type treated. Thus, in ten diseases studied we have observed that oral ingestion is the administration route mostly used (76%), followed by ointment (13%) (Fig. 4). In fact, the oral ingestion is frequently reported in cancer, asthma, rheumatism, rheumatoid-arthritis,

inflammation, immune system depression and hepatitis treatment (60-80%). While, the ointment and poultice modes are highly used on eczema and psoriasis (10-17%).

3.5 The Percentage of Use of Plant in Each Region

Indeed, the percentage of use of medicinal plants is approximately similar in four regions FB (33%), MT (24%), TT (23%), and MTH (20%) (Fig. 5). This reflects that the Moroccan population use plant medication in all conditions, regardless the disease type treated. However, in these regions, we remarked an important difference between plant method and species used in a given pathology (Table 1). For example, the numbers of species listed for asthma were higher in MT region, while, in the FB region most species were cited for cancer (Fig. 6). This observation may be related to the proportion of diseases recorded in each region.

3.6 Adverse Effects of Medicinal Plants

In this study, we have remarked the use of some plants known by their toxicity [17,18]. The main ones are; *Nerium oleander*, *Aristolochia longa*, *Atractylis gummifera*, *Datura stramonium*, *Citrullus colocynthis*, *Cinnamomum camphora*, *Uriginea maritime*, *Piper cubeba*, *Nigella sativa*, *Atropa belladonna* (L), *Datura stramonium*, *Tamarix getula*, and *Peganum harmala* (Table 4). Some of these plants are used in the treatment of cancer, asthma, allergy, rheumatism, arthritis-rheumatoid, infectious

diseases and immune system depression (Table 1). Despite their toxic nature, these plants are often administered orally. Few prescribers / users are aware of the plant toxicity.

In all cases that had been studied, patients who didn't take any precautions did not suffer any adverse consequences. This later can be explained by the mode of the plant preparation and by the short treatment duration.

Table 4. The toxic plants and their percentage of use

Toxic plants	% of use
<i>Aristolochia longa</i>	86%
<i>Atractylis gummifera</i>	5.67%
<i>Atropa belladonna</i>	22%
<i>Cinnamomum camphora</i>	18.5%
<i>Citrullus colocynthis</i>	34.5%
<i>Datura stramonium</i>	17%
<i>Datura stramonium</i>	16%
<i>Nerium oleander</i>	16.5%
<i>Nigella sativa</i>	21%
<i>Peganum harmala</i>	4%
<i>Piper cubeba</i>	13.2%
<i>Tamarix getula</i>	4.5%
<i>Uriginea maritime</i>	7.2%

A comparison was done with the literature dealing with folk medicine in other parts of Morocco [18-22] indicates that there are many plants in commune which are toxic in nature and are usually used in traditional folk medicine. Moreover, the possible interaction problem between plant remedies and conventional medication can occur in patients who continue to take those therapies at the same time.

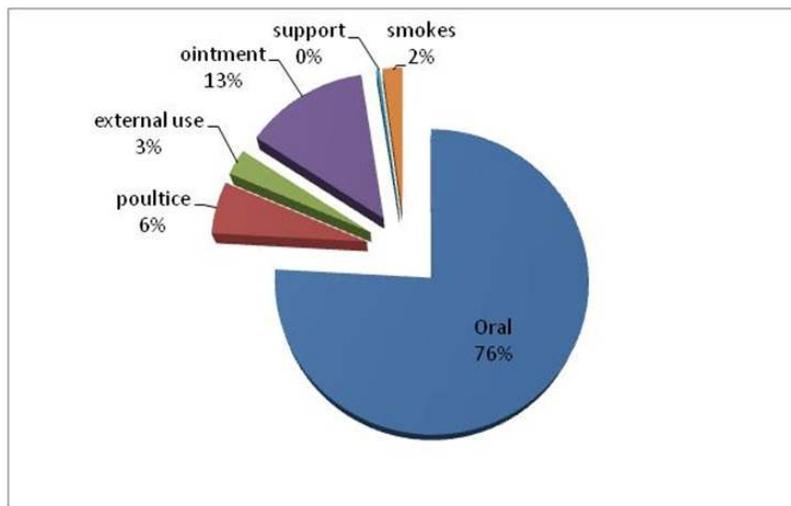


Fig. 4. The percentage of medicinal plants administration modes

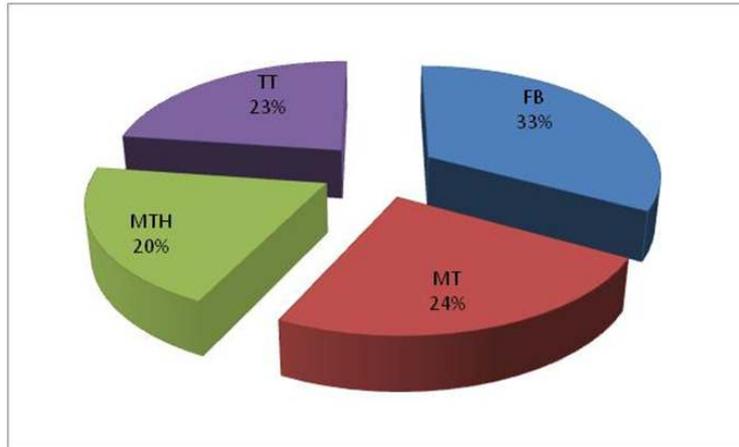


Fig. 5. Percents of the medicinal plant used in four regions of Morocco

TT: Tanger-Tetouan region, MTH: Marrakech-Tensift Al Haouz region, MT: Meknes-Tafilalet region, FB: Fez-Boulemane region.

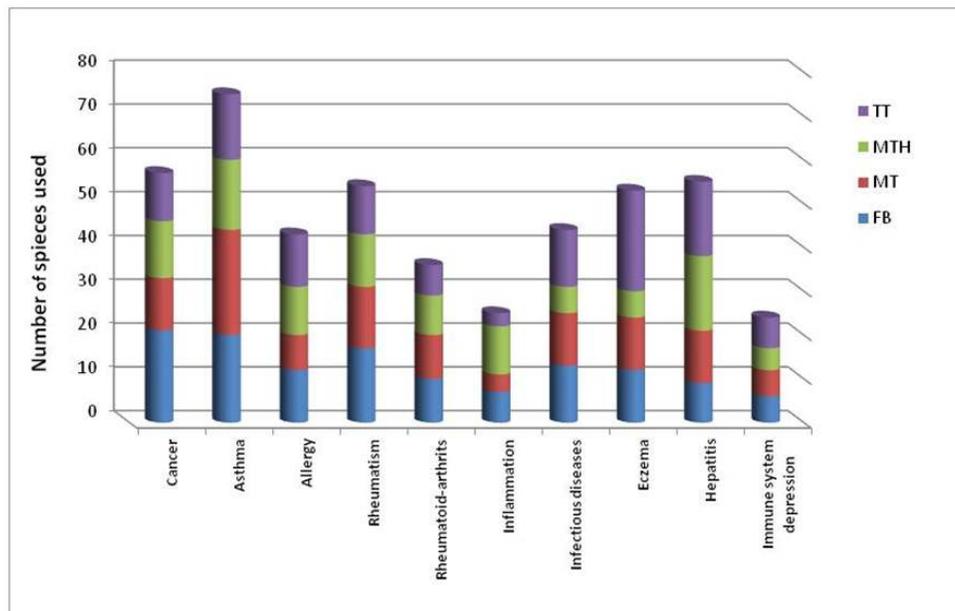


Fig. 6. The number of plant species used view to regions cited in terms of the category of diseases treated

TT: Tanger-Tetouan region, MTH: Marrakech-Tensift Al Haouz region, MT: Meknes-Tafilalet region, FB: Fez-Boulemane region

3.7 Preparations Remedies Identified

As shown in Table 5, in this survey we have identified some recipes used in the treatment of cancer, asthma, hepatitis, psoriasis, eczema and rheumatism. As indicated by some herbalists, the therapeutic effects of these recipes are due mainly to synergistic effects of medicinal plants used in the

preparation. Indeed, the duration of treatment is usually long varying from one week to six months.

Many patients confirmed the effectiveness of treatment especially in the case of rheumatism, eczema, hepatitis and asthma. While some of them reported the occurrence of some adverse reactions during the treatment.

Table 5. Some used recipe identified in ethnopharmacology study to treat many immune diseases

Diseases	Recipe	Preparation modes	Administration routes	Treatment duration	% of Use
Cancer	1 <i>Allium cepa</i> + <i>Quercus rotundifolia</i> +Honey	Powder	Oral	Four months	12
	2 <i>Allium cepa</i> + <i>Urtica dioica</i>	Juice	Oral	Two months	3
	3 <i>Allium cepa</i> + <i>Urtica dioica</i> + <i>Lowsania Henna</i>	Powder	Poultice	Four months	4.5
	4 <i>Trigonella foenum graecum</i> (1) + <i>Lycopodium clavatum</i> (2) + <i>Allium cepa</i> (3)	(1 and 2) Powder+(3) Juice	Poultice	To the vanishing	7
	5 <i>Ammi majus</i> (1) + <i>Nigella sativa</i> (2) + Honey	(1) Decoction+ (2) oil essence	Oral	Six months	32
Asthma	1 <i>Linum usitatissimum</i> (1) + <i>Uriginea maritima</i> (2) + Honey	(1) Powder+(2) Grilled	Oral	One month	25
	2 <i>Pistacia lentiscus</i> (L) + <i>Nigella sativa</i> + <i>Foeniculum vulgare</i>	Powder	Oral	One month	18
Hepatitis A	1 <i>Chelidonium majus</i> + <i>punica granatum</i>	Decoction	Oral	Five months	13
	2 <i>Ribes nigrum</i> + <i>Pistacia lentiscus</i> + <i>Mentha Peprinta</i>	Powder	Oral	Six months	10
	3 <i>Thymus vulgaris</i> + Honey	Powder	Oral	Two months	8
Psoriasis	1 <i>Arctium lappa</i> + <i>Fumaria officinalis</i> + <i>Scrofularia nodosa</i>	Powder	Oral	Three months	2
Eczema	1 <i>Allium cepa</i> + <i>Thymus vulgaris</i> + Honey	Powder	Ointment	Three weeks	7
	2 <i>Juniperus communis</i> (1) + Honey	(1) Decoction	Oral	Four months	3
Rheumatism	1 <i>Allium sativum</i> + <i>Trigonella foenum graecum</i> + Honey	Powder	Poultice	One week	5

4. CONCLUSION

Finally, from this ethnopharmacology evaluation, conducted in the four regions of Morocco; Fez-Boulmane (FB), Meknes-Tafilalt (MT), Tanger-Tetouan (TT) and Marrakech-Tensift-Al Haouz (MTH), we observed that plants occupy a prominent place in the Moroccan pharmacopoeia; since they are considered as the favorite remedy. Results highlight the richness and complexity of the Moroccan empirical knowledge of plant remedies. From this first evaluation of immunomodulatory plants, we have remarked that the largest proportion of medicinal species used (80%) belonged to three families: Asteraceae, Lamiaceae and Apiaceae. Most of these plants were used to treat, Asthma (40%), Rheumatism (32%), Eczema & Psoriasis (31%), and Cancer (28%). So the decoction and the infusion are two methods commonly used to prepare these plants.

In this study, we have remarked an important percentage use of some plants known by their toxicity and during their uses no precaution was taken by patients. In addition, we have noted many plants were cited for the first time to treat some diseases such as *Tetraena gaetula*, this data should encourage further research on these fields.

CONSENT

It is not applicable.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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