



An Ethnobotanical Study of Medicinal Plants of the Agadir Ida Ou Tanane Province (Southwest Morocco)

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ABSTRACT

Objective: As part of the development of natural heritage of Morocco, an ethnobotanical study was conducted in the region of Agadir Ida Ou Tanane (Southwest Morocco) with the aim to collect detailed information about the usage of plants in human therapy.

Methodology and results: The survey was carried out over a period of 24 months, by means of semi-structured and structured interviews. A total of 400 interviews were done with traditional health practitioners and knowledgeable villagers. Data collected was on, vernacular names of plants, their uses, parts used and mode of preparation. Other information about users was also collected such as age, sex, level of education. A total of 110 plants species belonging to 53 families and 95 genera were inventoried with 7.27 % of the species endemic to Morocco. Plants frequently used were: *Thymus satureioides* (Tazouknit, Zaitra), *Thymus broussonnetii* (Azoukni, Zaater), *Argania spinosa* (Argan), *Tetraclinis articulata* (Azouka, Aârar) and *Lavandula dentate* (Igerch, Halhal). The elderly (more than 50 years) have more knowledge in medicinal plants with regard to the other age groups, this indicates that knowledge was acquired by long experience accumulated.

Conclusion and application of results: This survey shows that traditional medicine is still used and constituted a very rich heritage in Agadir Ida Ou Tanane Region. The collected data may help to avoid the loss of traditional knowledge on the use of medicinal plants detained in the study area, and represent the preliminary information required in view of a future phytochemical investigation on the most used plants.

Key words: Ethnobotanical survey, medicinal plants, phytotherapy, Agadir Ida Ou Tanane province, southwest of Morocco.

INTRODUCTION

Plants are an important source of therapeutic drugs and play an important role in the survival of the tribal and ethnic communities (Abouri *et al.*, 2012). All old civilizations (Chinese, Greek, Roman, Muslim) resorted to medicinal plants for their medicinal, aromatic properties as well as ritual uses (Younos, 1997, Ghanmi *et al.*, 2011). Healing plants remain the only way of treatment for 70 % of the world

population (Rejdali, 1996, Peyron, 2000) and for 80 % of the African population (OMS, 2003). The percentage of use of healing plants in the preventive and curative virtues varies in the studied regions, from 50 to 80 % (Eddouks *et al.*, 2007). More than 25000 plants are used in the pharmacopoeia and more than 50 % of pharmaceutical products available on the market are of natural origin

(Hamilton, 2003). Medicinal plants have several advantages; they have affordable prices, are easily accessible, and there is no evidence of resistance to whole-plant extracts (Al-Adhroey *et al.*, 2010). Morocco is one of the Mediterranean countries with a long tradition in the field of phytotherapy (Jouad *et al.*, 2001; Scherrer *et al.*, 2005). Many authors have studied traditional pharmacopoeia in different areas of Morocco (Bellakhdar *et al.*, 1991; Sijelmassi, 2003; Bellakhdar, 1997; Ziyat *et al.*, 1997; Merzouki *et al.*, 2000; Jouad *et al.*, 2001; Eddouks *et al.*, 2002; El-Hilaly *et al.*, 2003; Mehdioui & Kahouadji, 2007; Tahraoui *et al.*, 2007; Hseini, 2008; Salhi *et al.*, 2010; Bourkhiss *et al.*, 2013; Daoudi *et al.*, 2013; Nassif & Tanji, 2013). To our knowledge, the South of Morocco made a few ethnobotanical studies (Abouri *et al.*, 2012; Saadi *et al.*, 2013). By its geographical situation between the Mediterranean Sea in the North, the Atlantic Ocean on the West and Sahara in the South, and considering altitudinal and climatic variations, Morocco presents a rich and diversified forest ecosystem. The flora of Morocco has more than 7000 species and subspecies among which approximately 800 are aromatic and medicinal plants (Benabid, 2000). The province of

Agadir Ida Ou Tanane is among Morocco regions which possess a potential in medicinal plants (Thyme, lavender, Argan tree). However, this region knows anarchy and intensive use of botanical species exceeding the threshold of bearable regeneration of used resources, which causes a threat for certain species. The valuation of these heritages suffers from a lack of precise knowledge on used species, as well their phytomasse potential and chemical composition. The aim of the present work is to identify medicinal plants species, mode of preparation, part used, handled diseases used by local population of the province of Agadir Ida Ou Tanane and thus to revitalize and to protect local empirical knowledge which stood the test of time (El Rhaffari & Zaid, 2000). The knowledge of medicinal plants use and procedures applied to their preparation is usually transmitted from generation to generation, but it is often in danger because this transmission is not always assured (Addo-Fordjour *et al.*, 2008; 2012). The inventory of this knowledge is of an extreme utility because it risks disappearing because of the trend of modes of life and means of communication (Bellakhdar, 1997).

MATERIALS AND METHODS

Study area: The area of Agadir Ida Ou tanane, which is part of Souss Massa Draa region, extends over a rough surface of 240.000 hectares and is a part of the Arganeary Reserve Biosphere approved by the UNESCO in 1998. This area is limited to the West by the Atlantic Ocean, to the South by Inezgane Ait Melloul's province, to the North by the provinces of Essaouira and Chichaoua and to the East by the province of Taroudant (figure n°1). It includes the urban district of Agadir and 12 rural districts of Drarga, Amskrout, Idmine, Tiqqi, Imouzzer, Akesri, Aourir, Taghazout, Tamri, Imsouane, Aziar and Tadrart. The population of Agadir Ida Ou Tanane is about 486 048 inhabitants. The density average is about 212 inhabitant /km². 21.2 % of the population live in rural areas and 78.8 % in urban zones (H.C.P., 2004).

The study area can be globally classified in the dry and semi-arid bioclimatic "etage" in freshly hot winter with a seasonal pluviometric regime where more than 51 % of the annual precipitation falls in winter. The area of Ida Ou Tanane is characterized by vegetation particularly formed by a mixture of tropical elements, macaronesian, Mediterranean and endemic (Benabid, 1976). The main plant formations are constituted by the Argan tree, the Thuja, and Holm oak or with a mixture of these species. Agriculture, handicrafts, commerce, and small business establish the skeleton of the rural economy in the mountainous part of Agadir Ida Ou Tanane. These sectors are strengthened at the level of outer-urban municipalities of this province by the employment in the services (Préfecture d'Agadir Ida Ou Tanane, 2011).

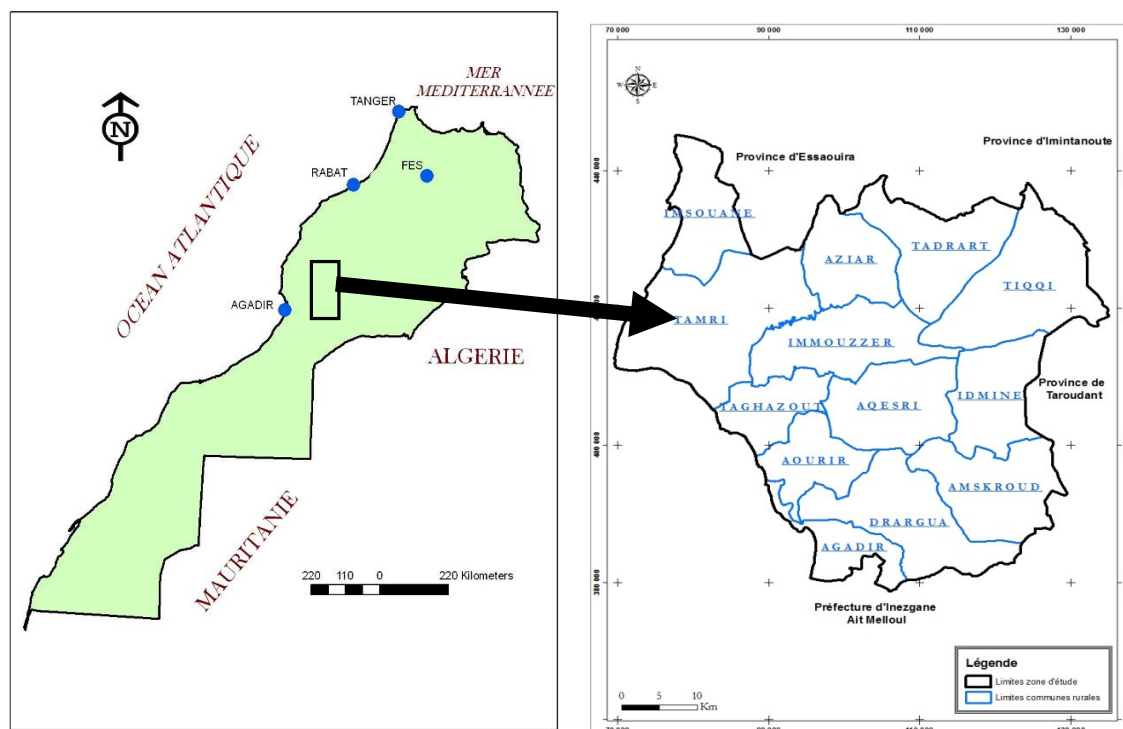


Figure 1: Location of the study area

Data collection: Information was obtained through ethnobotanic inquiries from the inhabitants, and herbal practitioners of the province of Agadir Ida Ou Tanane. The data was collected through semi-structured and structured interviews. To realize this ethnobotanical study, the method of sampling stratified was used to locate the various areas of inquiries (Kahouadji, 1986). Consequently, the zone of study was divided into 13 stratum. Then, samples from 30 to 32 people were investigated in stratum (one urban district: Agadir and twelve rural districts: Drarga, Amskroud, Idmine, Tiqqi, Imouzzer, Akesri, Aourir, Taghazout, Tamri, Imsouane, Aziar and Tadrart). Four hundred (400) interviews were conducted. Collected information concerned the profile of every investigated informant, the choice and the use of plants in traditional medicine, age, sex, level of schooling and income. Then, collected information about every plant used included its local name (Berber and/or Arabic),

its uses, its origin, its used parts and mode of use or preparation. All the species were mentioned by the respondents by their common label/name. The taxonomic identification of the species was later made by means of the literature: Moroccan Flora' (Fennane *et al.*, 1999, 2007); 'Vascular Flora of Morocco, Inventory and Chorology' (Fennane and Ibn Tattou, 2005, Ibn Tattou and Fennane, 2008), The traditional Moroccan pharmacopoeia (Bellakhdar, 1997), Guide of the healing plants (Pamplona-Roger, 2000), The healing plants of Morocco (Sijelmassi, 2003), Healing plants in the Maghreb and the basic care (Bellakhdar, 2006).

Data analysis: The ethnobotanical data was transferred in a database using software Sphinx and SPSS. The data were analyzed to study the socio-demographic characteristics of informants, diversity of medicinal plants used, therapeutic uses, plant parts used and mode of preparation and administration.

RESULTS AND DISCUSSION

Interviewee's demographic characteristics: The elderly from 50 to 60 years old have a frequency of use of medicinal plants by 31 % followed by people of more than 60 years of age with a 25 % frequency. The age brackets (20 to 30), (31 to 40), (41 to 50) and (< 20 years) have a frequency of 7 %, 13 %, 22 % and 2 %, respectively (figure n°2). These results show that the older people (more than 50 years with a 56 % frequency) have more knowledge in medicinal plants than the other age groups. This indicates that this kind of knowledge is acquired after a long accumulated experience. The experience accumulated with the age constitutes the main information source on a local scale about the use of plants in

traditional medicine (Mehdioui & Kahouadji, 2007). Most of the informants (91.7 %) acquired this knowledge from their parents and grandparents. The majority of the inquired subjects (93.7 %) said that they use herbal medicine to handle their disease. A total of 295 individuals depend on herbal medicine only, 78 individuals use herbal medicine before resorting to the modern medicine and 27 people have appeal only to modern medicine.

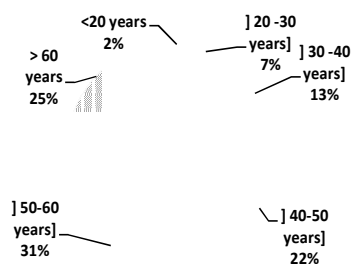


Figure n°2: Categories of ages

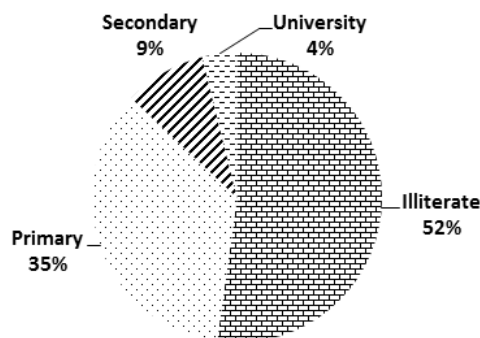


Figure n°3 : Educational level

Rural population opt for traditional treatment because its preparation is easy and low cost compared with the modern medicine. This reflects the reality of the local families with low income. Ethno-pharmacological surveys on the use of traditional medicinal materials conducted in other countries revealed similar trends where plants represent most of all the traditional medicinal substances (Addis *et al.*, 2001; Maroyi, 2011). Previous studies have reported a wide range of the rate of plant use (50-95%), which varied from region to region according to ethnology, richness of medicinal plant sector, and home environment (Sijelmassi, 2003; Bellakhdar, 1997; Ziyat *et al.*, 1997; Hmammouchi, 1999; Jouad *et al.*, 2001; Eddouks *et al.*, 2002; El-Hilaly *et al.*, 2003; Tahraoui *et al.*, 2007). In the study area, not educated occupy the first row in terms of use of medicinal plants with 52 % (figure n°3). The people having the primary level of education still have an important part (35 %) contrary to those having education level of secondary and university which represent 9 % and 4 %, respectively. These results indicate that interviewed people having a high level of education are bowed towards the modern medicine. The level of illiteracy is relatively high at the level of the province of Agadir Ida Ou Tanane and registers a 59, 65 % rate which is almost equal to the national average which is 60.2 % (HCP, 2004). Consequently, valuation and sustainable management of natural resources and

more particularly medicinal plants become difficult. These results are similar to those of other studies in other regions of Morocco (Mehdioui & Kahouadji, 2007, Abouri *et al.*, 2012, Saadi *et al.*, 2013). The women know better medicinal species than men at the level of the study area (52 % against 48 % respectively). The respondents having a lower income (2500 Dh / month) use medicinal plants more than those having an income more than 2500 Dh / month (65 % against 35 %); this can be explained by the moderate cost of healing plants. Ethnobotanic studies in other regions of Morocco ended in the same results (Jouad *et al.*, 2001; Eddouks *et al.*, 2002 ; Abouri *et al.*, 2012 ; Saadi *et al.*, 2013).

Diversity of medicinal plants: In this study, we inventoried one hundred and ten plant species belonging to 53 families and 95 genera. The most represented families (figure n°4) are Lamiaceae (14 species), Asteraceae (10 species), Apiaceae and Fabaceae (6 species each), Poaceae (4 species) and Anacardiaceae, Brassicaceae, Euphorbiaceae, and Myrtaceae (3 species each). The first five families, which are well represented in the study area, exist everywhere in Morocco and constitute the major groups of the medicinal flora in most of other Mediterranean countries (Kahouadji, 1995; Benitez *et al.*, 2010; El Rhaffari & Zaid, 2000; Savo *et al.*, 2011; Abouri *et al.*, 2012; Nassif & Tanji, 2013; Saadi *et al.*, 2013).

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Table 1: List of medicinal plants used in traditional therapy in Agadir Ida Ou Tanane Province

Scientific name and Family	Local name	Uses	Plant part used	Preparation	Administration
<i>Ajuga iva</i> (L.) Shreb. Lamiaceae	Timnra lznkad, Chendgoura	Digestive	Leaf, root, seed	Infusion, powder	Oral
<i>Allium cepa</i> L. Alliaceae	Azalim, Basla	Digestive, respiratory	Bulb	Cataplasm, decoction	Eye drops, oral
<i>Allium sativum</i> L. Alliaceae	Tskert, Touma	Respiratory, digestive, skin, skeleton, circulatory	Bulb, stem	Decoction	Oral
<i>Alouisia citriodora</i> Palau Verbenaceae	Louiza	Respiratory, digestive, skin, skeleton, circulatory, genital, nervous, auditory, visual, urinary	Leaf	Infusion, decoction	Oral
<i>Alpinia officinarum</i> Hance Zingiberaceae	Khoudanjel	Skeleton	Root	Decoction, powder	Oral
<i>Ammodaucus leucotrichus</i> Coss. & Durieu Apiaceae	Kamoun sofi	Digestive, circulatory, auditory	Leaf, seed	Powder	Oral
<i>Apteranthes europea</i> (Guss.) Merb. Asclepiadaceae	Igougan, Oukan	Respiratory	Aerial parts	Decoction, powder	Oral
<i>Argania spinosa</i> (L.) Skeels Sapotaceae	Argan	Digestive, skin, skeleton, circulatory, urinary	Leaf, flower, seed, bark	Infusion, friction, powder	Oral, external use
<i>Aristolochia baetica</i> L. Aristolochiaceae	Azлак ouchen, Berztem	Respiratory	Leaf, stem, root, fruit	Powder	External use
<i>Artemisia absinthium</i> L. Asteraceae	Chiba	Genital, auditory	Leaf	Decoction, powder, infusion	Oral
<i>Artemisia inculta</i> Delile Asteraceae	Izri, Chih	Respiratory, digestive, skin, skeleton, circulatory	Leaf, seed, whole plant	Decoction, infusion, powder, friction	Oral
<i>Asparagus altissimus</i> Munby Asparagaceae	Tikrargan	Nervous	Leaf	Powder	Oral
<i>Asparagus officinalis</i> L. Asparagaceae	Azzwi, Azzû, Ssekkum	Respiratory, nervous	Leaf, stem	Decoction	Oral
<i>Asphodelus ramosus</i> L. Asphodelaceae	Iguri, L-berwag	Skin	Seed, root	Friction, mixed with oil	Applied externally
<i>Asphodelus tenuifolius</i> Cav. Asphodelaceae	Iguri, L-berwag	Digestive, circulatory	Root, fruit	Decoction	Oral
<i>Boswellia sacra</i> Flueck. Burseraceae	Salaban, Luban	Respiratory	Root	Fumigation	Inhalation, external use
<i>Brassica rapa</i> L. Brassicaceae	Laft baldi	Digestive	Seed	Powder mixed with honey	Oral
<i>Capparis spinosa</i> L. Capparaceae	Tailloloute, Kabbar	Skeleton, nervous	Root, leaf, seed	Decoction, cataplasm	Oral, external use

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<i>Carlina gummifera</i> (L.) Less. Asteraceae	Addad, Ahfyun	Circulatory, genital, skin	Root	Decoction, cataplast, friction	Oral, external use
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Table 1. continued

<i>Carum carvi</i> L. Apiaceae	Carwiya	Digestive, circulatory	Stem, seed, whole plant	Decoction, powder, infusion	Oral
<i>Chenopodium ambrosioides</i> L. Chenopodiaceae	Mkhinza	Respiratory, skeleton, circulatory, nervous	Leaf, whole plant	Decoction, powder, infusion,	External use, oral
<i>Carlina racemosa</i> L. Asteraceae	Ahekja,	Respiratory, digestive, skin	Leaf, root	Decoction, infusion	Oral, external use
<i>Ceratonja siliqua</i> L. Fabaceae	Tikida, Kharroub	Digestive, skin, nervous	Seed, leaf, fruit	Infusion, powder, decoction	Oral
<i>Chamaerops humilis</i> L. Arecaceae	Tiznirt, Doum	Digestive	Seed	Raw	Oral
<i>Cinnamomum verum</i> J. Presl Lauraceae	Lkarfa	Digestive, genital	Stem	Decoction, powder	Oral
<i>Cistus creticus</i> L. Cistaceae	Irguel	Respiratory, digestive, skeleton, circulatory, urinary	Leaf, seed, fruit, root, whole plant	Decoction, infusion, powder	Oral
<i>Cistus salviifolius</i> L. Cistaceae	Tirguelt	Respiratory, digestive	Leaf, seed, stem	Decoction, infusion, powder	Oral
<i>Citrullus colocynthis</i> (L.) Shrad. Cucurbitaceae	Aferziz, Hadja	Respiratory, digestive, skeleton, circulatory	Fruit, whole plant, pulp	Cataplast, infusion, decoction	Oral, external use
<i>Cladanthus mixtus</i> (L.) Chevall. Asteraceae	Ijdig nbamlal, Babonj	Digestive, skin, circulatory	Capitulum	Friction	Applied on the affected part
<i>Coriandrum sativum</i> L. Apiaceae	Ikzbour	Digestive	Seed, aerial parts	Decoction, infusion	Oral
<i>Crocus sativus</i> L. Iridaceae	Zaâfran	Circulatory, genital	Stigma	Infusion	Oral
<i>Cuminum cyminum</i> L. Apiaceae	Lcamon	Digestive, circulatory	Fruit, leaf	Infusion, powder	Oral, external use
<i>Cymbopogon schoenanthus</i> (L.) Spreng. Poaceae	Tibremt, Tben mekkâ	Skeleton, urinary	Leaf, whole plant	Infusion	Oral
<i>Cynara scolymus</i> L. Asteraceae	Kharchouf	Respiratory	Root	Decoction	Oral
<i>Dittrichia viscosa</i> (L.) Greuter Asteraceae	Tinirane, Terhala	Skeleton	Root, leaf	Powder, decoction	Oral, external use
<i>Drimia maritima</i> (L.) Stearn Hyacinthaceae	Azalim Ouchen, Bsel al khenzir	Skeleton	Bulb	Decoction, maceration	Oral, external use, inhalation

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<i>Drimia noctiflora</i> (Batt. & Trab.) Hyacinthaceae	Azalim ouchen, Bsel Dib	Circulatory	Bulb	Cataplasm, maceration	Oral, applied on the affected part
<i>Echium horridum</i> Batt. Boraginaceae	Tanasat	Urinary	Leaf	Decoction	Oral
<i>Eucalyptus sp.</i> Myrtaceae	Calitous, Caliptous	Respiratory	Leaf	Decoction, infusion, fumigation	Oral, inhalation, external use
<i>Euphorbia officinarum</i> subsp. echinus (Hook. f. & Coss.) Vindt Euphorbiaceae	Tikiout, Zaggoum, Daghmus	Respiratory, skeleton, circulatory	Aerial parts	Powder	Oral
Table 1. continued					
<i>Euphorbia officinarum</i> L. subsp. officinarum Euphorbiaceae	Tikiout, Zaggoum, Daghmus	Respiratory	Aerial parts, latex	Decoction	External use, oral
<i>Fagonia cretica</i> L. Zygophyllaceae	Timechkla	Digestive	Whole plant	Infusion, powder	Oral
<i>Foeniculum vulgare</i> var. dulce Mill. Apiaceae	Nafaâ, Basbas	Digestive, circulatory	Fruit, bulb, seed, whole plant	Infusion, decoction, raw	Oral
<i>Genista ifniensis</i> Caball. Fabaceae	Azi, Ouchfoud	Skin	Leaf	Infusion, powder	External use
<i>Globularia alypum</i> L. Plantaginaceae	Tasselgha, Ain arnab	Respiratory, digestive, skin, circulatory, nervous, urinary	Leaf, stem, whole plant	Infusion, decoction, powder, friction	Oral, external use
<i>Herniaria cinerea</i> DC. Caryophyllaceae	Harrast lahjar	Urinary	Leaf, whole plant	Decoction, infusion	Oral
<i>Hordeum vulgare</i> L. Poaceae	Toumzine, Chaâir	Digestive	Seed	Decoction	Oral
<i>Illicium verum</i> Hook. f. Scisandraceae	L-badiane	Digestive	Fruit	Infusion	Oral
<i>Juncus rigidus</i> Desf. Juncaceae	Azmay, Smar	Skin, circulatory, nervous, urinary	Leaf, stem, fruit, seed	Decoction, infusion	Oral
<i>Juniperus oxycedrus</i> L. Cupressaceae	Katran	Skin	Fruit, strain	Decoction	External use, inhalation
<i>Kleinia antephorbium</i> (L.) Haw. Asteraceae	Acheberdeau	Respiratory, skeleton, circulatory	Stem	Juice, powder, infusion	External use
<i>Launaea arborescens</i> (Batt.) Murb. Asteraceae	Ifrskel, Oujan, Mmu-lbeyna	Respiratory, digestive, skin, skeleton, circulatory, urinary	Latex, root	Decoction, infusion, powder	Oral, external use
<i>Lavandula dentata</i> L. Lamiaceae	Igerch, Halhal	Respiratory, digestive, skeleton, circulatory, genital, nervous, urinary	Leaf, stem, root, fruit, seed, whole plant	Decoction, infusion, powder	Oral, external use

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<i>Lavandula maroccana</i> Murb. Lamiaceae	Iguiz, Khzama	Respiratory, digestive, skin, circulatory, genital	Leaf, fruit, seed	Decoction, infusion, powder	Oral, external use
<i>Lavandula multifida</i> L. Lamiaceae	Iguiz, Khzama	Respiratory, digestive, genital, nervous	Leaf, flower, seed	Infusion, decoction	Oral, external use
<i>Lavandula stoechas</i> L. Lamiaceae	Tigercht, Khzama	Respiratory, digestive, skin, circulatory, genital	Leaf, flower, seed	Decoction, infusion, powder	Oral, external use
<i>Lepidium sativum</i> L. Brassicaceae	Hab rchad	Respiratory, digestive, skin	Seed	Infusion, powder	Oral, external use
<i>Linum usitatissimum</i> L. Linaceae	Zriât Iktan	Digestive, urinary	Seed	Powder	Oral

Table 1. continued

<i>Lonicera biflora</i> Desf. Caprifoliaceae	Irfi	Respiratory, digestive	Leaf, fruit	Infusion, decoction, powder	Oral
<i>Lycium intricatum</i> Boiss. Solanaceae	Inzerki, L'gerdeg	Digestive	Seed	Decoction	Oral
<i>Malva parviflora</i> L. Malvaceae	Igoudi	Respiratory	Leaf, stem	Decoction, cataplasm	Oral, external use
<i>Malva sylvestris</i> L. Malvaceae	Tibi, Lkhabiza, Bakoula	Respiratory, urinary	Leaf, root	Decoction, cataplasm	Oral, external use
<i>Marrubium vulgare</i> L. Lamiaceae	Ifzi, Merout	Respiratory, digestive, skin, auditory	Leaf, whole plant	Infusion, powder	Oral, external use
<i>Mentha spicata</i> L. Lamiaceae	Liqamt, Naanaa	Respiratory, skin	Leaf, aerial parts	Infusion, friction, decoction	Oral, external use
<i>Mentha suaveolens</i> Ehrh. Lamiaceae	Timija, Mersita	Respiratory, digestive	Leaf, whole plant	Infusion, powder, decoction	Oral
<i>Musa sp.</i> Musaceae	Banane	Skin	Bark	Friction	External use
<i>Myristica fragrans</i> Houtt. Myristicaceae	Lgoza	Respiratory, digestive, skeleton, genital	Seed	Powder	Oral
<i>Myrtus communis</i> L. Myrtaceae	Rayhan	Digestive, skin	Leaf	Cataplasm, decoction, infusion	External use
<i>Nerium oleander</i> L. Apocynaceae	Alili, Dafla	Skin, nervous, auditory, visual	Leaf, latex	Powder, infusion	Oral, inhalation, external use
<i>Nigella sativa</i> L. Ranunculaceae	Sanouj, Habba saouda	Respiratory, digestive, circulatory, visual, urinary	Seed	Powder, powder mixed with honey	Oral
<i>Olea europaea</i> L. Oleaceae	Zitoun, Zit, Zbouj, Azemmour	Respiratory, digestive, circulatory, auditory, urinary	Leaf, fruit	Decoction, oil, infusion	Oral, external use

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<i>Ononis natrix</i> L. Fabaceae	Afezdad, Lhaanna	Respiratory, digestive, circulatory	Leaf, root, whole plant	Decoction, powder, infusion	Oral
<i>Opuntia ficus-indica</i> (L.) Mill. Cactaceae	Acnari, Sabbar, Handiya, Karmouss nsara	Respiratory, digestive, skeleton, circulatory, urinary	Flower, fruit	Decoction, powder, infusion	Oral, external use
<i>Papaver rhoeas</i> L. Papaveraceae	Kawch, Bellaaman	Skin	Petal, seed	Decoction, infusion	Oral, external use
<i>Peganum harmala</i> L. Nitrariaceae	Lharmel	Respiratory, digestive, genital, nervous	Seed, leaf	Fumigation	Oral, external use
<i>Pennisetum typhoides</i> (Burm.f.) Stapf & C.E. Hubb. Poaceae	Illan	Skeleton, genital	Seed	Decoction	Oral
<i>Periploca angustifolia</i> Labill. Apocynaceae	Aslif	Nervous, skeleton	Leaf, root	Cataplasm, decoction	External use

Table 1. continued

<i>Petroselinum crispum</i> Mill. Fuss Apiaceae	Maadnous	Digestive, urinary	Leaf, whole plant, seed	Decoction	Oral
<i>Phillyrea angustifolia</i> L. Oleaceae	Tamtoutla	Nervous	Leaf	Decoction	External use
<i>Pinus halepensis</i> Mill. Pinaceae	Iguenguem, Sanawbar (Tayda)	Respiratory, digestive, skin, circulatory, genital	Bark, resin	Powder	Oral, external use
<i>Pistacia atlantica</i> Desf. Anacardiaceae	Igg, Lebtam	Digestive	Gum, leaf, seed	Decoction, powder	Oral
<i>Pistacia lentiscus</i> L. Anacardiaceae	Titkt, Drou	Respiratory, digestive, skin, skeleton, circulatory, nervous, visual, urinary	Leaf, root, seed, bark	Decoction, powder, infusion	Oral
<i>Pulicaria mauritanica</i> Batt. Asteraceae	Bamghar	Digestive, circulatory	Flower, leaf	Decoction, maceration	Oral, external use
<i>Punica granatum</i> L. Lythraceae	Rmane	Digestive	Leaf, fruit, seed, bark	Infusion, powder, decoction	Oral, external use
<i>Quercus ilex</i> L. Fagaceae	Tassaft, Karrouche, Ballout	Respiratory, digestive, skin, skeleton, circulatory	Bark, leaf, fruit	Infusion, powder, decoction	Oral, external use
<i>Retama monosperma</i> (L.) Boiss. Fabaceae	Ilgui, Rtem	Skin, skeleton	Leaf, fruit	infusion	Oral, external use
<i>Ricinus communis</i> L. Euphorbiaceae	Awriyur, Lkherwaa	Digestive, skin	Leaf	Powder, decoction	Oral, massage
<i>Rhus pentaphylla</i> (Jacq.) Desf. Anacardiaceae	Tazzad, Azad	Digestive	Root	Decoction	Oral
<i>Rosa centifolia</i> L. Rosaceae	Tihfert, Ward	Digestive	Flower	Powder, decoction	Applied externally oral

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<i>Rosmarinus officinalis</i> L. Lamiaceae	Azir	Respiratory, digestive	Leaf, aerial parts	Decoction, infusion	Oral, external use
<i>Rubia peregrina</i> L. Rubiaceae	Tarouba, Foua	Digestive, circulatory	Root, whole plant, leaf, seed	Powder, decoction	Oral
<i>Rumex acetosa</i> L. Polygonaceae	Tismoumine	Skin	Seed, leaf, root	Powder, decoction	Oral
<i>Ruta montana</i> (L.) L. Rutaceae	L-fijel, Awermi	Respiratory, skin, skeleton, circulatory, auditory	Whole plant	Friction, infusion	External use, oral
<i>Salvia aegyptiaca</i> L. Lamiaceae	Iderki	Respiratory, circulatory	Aerial parts, root, leaf	Infusion, decoction	Oral
<i>Salvia officinalis</i> L. Lamiaceae	Salmia	Respiratory, digestive, circulatory	Leaf, whole plant	Infusion, decoction	Oral
<i>Senna alexandrina</i> Mill. Fabaceae	Sanae	Digestive	Leaf, seed	Infusion	Oral, external use
<i>Silene vulgaris</i> (Moench) Garcke Caryophyllaceae	Tighercht, Sabun el-fqar	Digestive, skin, genital	Root	Decoction, infusion	Oral

Table 1. continued

<i>Sinapis alba</i> L. Brassicaceae	Kalkas, Akhssur oufkir	Circulatory, genital	Seed	Powder mixed with honey, milk, oil	Oral
<i>Syzygium aromaticum</i> (L.) Merr. & L. M. Perry Myrtaceae	Korenfal	Digestive, circulatory, urinary	Clove	Decoction, cataplasm	Oral, external use
<i>Tetraclinis articulata</i> (Vahl) Mast. Cupressaceae	Azouka, Aârar	Respiratory, digestive, skin, skeleton, circulatory, nervous, urinary	Leaf, cone	Cataplasm, decoction, powder, infusion	Oral, external use
<i>Thymus broussonetii</i> Boiss. Lamiaceae	Tazouknit, Zaitra	Respiratory, digestive, skin, circulatory, genital, nervous, urinary	Leaf, stem, whole plant	Decoction, infusion	Oral
<i>Thymus pallidus</i> Coss. ex.Batt. Lamiaceae	Tajllabet, Ajllab	Respiratory, digestive, circulatory	Flower, leaf	Decoction, infusion	Oral
<i>Thymus saturoioides</i> Coss. Lamiaceae	Azoukni, Zaater	Respiratory, digestive, skin, circulatory, genital, nervous, visual, urinary	Flower, leaf, stem, whole plant	Infusion	Oral, external use
<i>Trigonella foenum-graecum</i> L. Fabaceae	Tifidass, Halba	Digestive, circulatory, genital	Seed, fruit	Decoction, infusion, powder	Oral
<i>Triticum aestivum</i> L. Poaceae	L-gemh, Irden, Zraa	Digestive	Seed	Powder	Oral
<i>Urtica urens</i> L. Urticaceae	Azentak, Harriga	Respiratory, urinary	Seed, leaf	Powder, decoction, infusion	Oral

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<i>Vitex agnus-castus</i> L. Verbenaceae	Angaref, Lkherwaa, Habb el-faqd	Skeleton, genital	Leaf, fruit, seed	Infusion, decoction, powder	Oral
<i>Withania frutescens</i> (L.) Pauquy Solanaceae	Tiremt, Tarremt	Respiratory, skin	Leaf, bark, root	Infusion, powder	Oral, applied on the affected part
<i>Zingiber officinale</i> Roscoe Zingiberaceae	Sknjbir, Zanjabil	Respiratory, digestive, skeleton, circulatory, auditory	Rhizome	Decoction, infusion	Oral
<i>Ziziphus lotus</i> (L.) Lam. Rhamnaceae	Azegar, Sedra, Nbeg	Digestive, circulatory, urinary	Fruit, leaf, root	Cataplasm , infusion, powder	Oral, external use

Most of the identified families are represented by one or two species, which shows that the used healing plants are of only concentrated in some families and genera. This agrees with other ethnobotanic studies made outside

Morocco and in the Mediterranean region (Raja et al., 1997; Merzouki, 2000; Novais et al., 2004; Tahraoui et al., 2007; Ugulu et al., 2009).

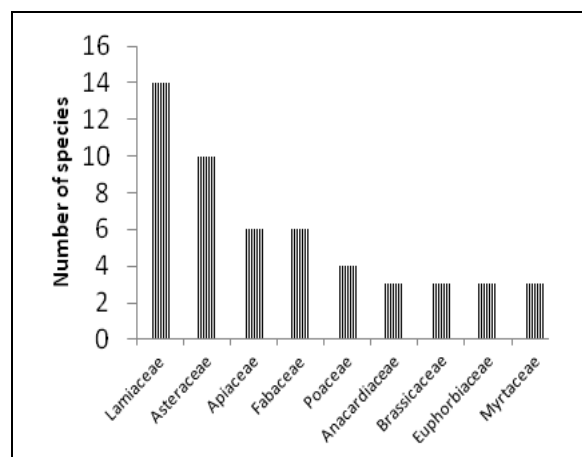


Figure 4: Most represented families

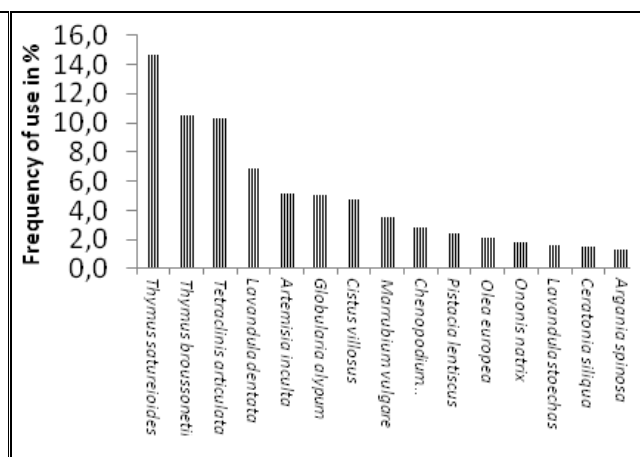


Figure 5: Most used species

Outcomes of the investigation show that 15 medicinal plants are the most used in the study area (figure n°5): *Thymus satureioides* (cited 238 times), *Thymus broussonetii* (171), *Tetradlinis articulata* (168), *Lavandula dentata* (111), *Artemisia inculta* (84), *Globularia alypum* (83), *Cistus villosus* (78), *Marrubium vulgare* (58), *Chenopodium ambrosoides* (46), *Pistacia lentiscus* (39), *Olea europea* (34), *Ononis natrrix* (30), *Lavandula stoechas* (26), *Ceratonia siliqua* (25) and *Argania spinosa* (22). These species are used frequently in other regions of Morocco (Abouri et al., 2012). Of special interest, among the species used at Agadir Ida Ou Tanane province, 8 species (7.27 %) are endemic of Morocco. The majority of healing plants (65.45 %) registered in this survey are spontaneous species (*Thymus satureioides*, *Argania spinosa*, *Tetradlinis articulata*, *Pistacia lentiscus*, *Lavandula dentata*, and *Ononis natrrix*). Many plants (19.1

%) are cultivated for food purposes (*Artemisia absinthium*, *Coriandrum sativum*, *Carum carvi*, *Hordeum vulgare*, *Mentha viridis*). Plants imported from other regions of Morocco or from other countries represent 15.45 % (*Crocus sativus*, *Boswellia sacra*, *Eugenia caryophyllata*, *Lepidium sativum* and *Myristica fragrans*). These results are similar to those of other studies carried out in certain zones of Morocco (Abouri et al., 2012; Saadi et al., 2013). The large number of plant species used in the study area indicates the dependence of local population on medicinal plants to handle various diseases and represent a good indicator of a deep knowledge of plants by the local population. The analysis of the biological forms of healing plants used in the study area revealed that most of the species are shrubs (32 %), followed by herbs (21 %), trees (16 %), hemicryptophytes (12 %), subshrubs (11 %), and geophytes (8 %) (Figure

n°6). This result is against other studies in which trees were the shape of the most dominant growth (Addo-Fordjour *et al.*, 2008; Moshi *et al.*, 2009). In the study area, as in most regions of Morocco as well as in other countries, a conflict exists between plant use and resources preservation (Sheldon *et al.*, 1998; Kala, 2000; Agelet & Vallés, 2001). The species of *Thymus*

satureioides and *Argania spinosa* are subject to a strong pressure of use for medicinal and commercial purposes. This factor combined with an increasing pressure of the local population, besides the irregular precipitation like that of last years, can lead to the reduction of the natural habitat of healing plants.

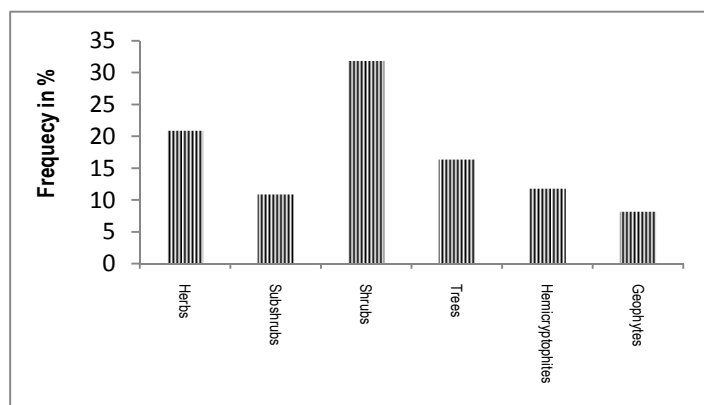


Figure 6: Growth habit of the plants used in Agadir Ida Ou Tanane Province

Therapeutic uses: The species indicated in the table n°1 are used by local population of Agadir Ida Ou Tanane to handle various diseases. It was noticed that each of the plants has more than one therapeutic use. For example, *Thymus satureioides* is used against respiratory and digestive tracts disease; which explains the particular pressure exerted on this species plant in this province. All diseases were structured according to the device or the system which they affect: digestive system, respiratory system, circulatory system, reproductive organ, genito-urinary organs, ear, nose and throat system, ocular system, skin, skeleton and nervous system. The population of the study area suffers; first, from all diseases affecting digestive system (22 %) especially stomach pain, diarrheas, intestinal gases, constipations, etc. Gastro-intestinal disorders are found to be the most common application of medicinal plants by ethnobotanical surveys carried out in other studies (Merzouki *et al.*, 2000; El-Hilaly *et al.*, 2003; Benitez *et al.*, 2010; Mati & De Boer, 2011). The-diseases of the respiratory system come in the second place with 18 % rate: asthmas, rum, coughs and lung affections. The diseases affecting the circulatory system (low blood pressure, high blood pressure, glycemia) and the skin (cook hair, facial skincare, the eczema, the burns, the wounds) come in the third position with 16 % and 12 %

rate respectively. This noticed are similar to those of the study carried out at the level of the province of Rabat (Hseini & Kahouadji, 2007). The other diseases concern skeleton (9 %), urinary system (8 %), reproductive organ and nervous system (6 % each), hearing aid (2 %) and visual device (1 %).

Plant parts used, mode of preparation and administration : The results obtained at the level of the province of Agadir Ida Ou Tanane show that the most used plant part is the leaf (74 %) followed by seed, fruit, root, whole plant, stem and flower with a respective percentage of 8 %, 5 %, 4 %, 3 %, 2 % and 1 % (figure n°7). The underground organs (bulbs and roots) of plants used locally for medicinal purpose represented around 6 %. This percentage is relatively lower to what has been found in other Moroccan regions (Ouarghidi *et al.*, 2013). The high rate of leaves use can be explained by the harvest ease but also, by the fact that these organs are exposed to the sun what gets those virtues and benefactions (El Rhaffari & Zaid, 2000). This can be explained by the photosynthesis phenomenon which favours the biosynthesis and the storage of metabolites. Also, leaves of plants have been reported to accumulate, inulins, tannins and other alkaloids which may be responsible for their medicinal properties, explaining its wide use (Simbo, 2010).

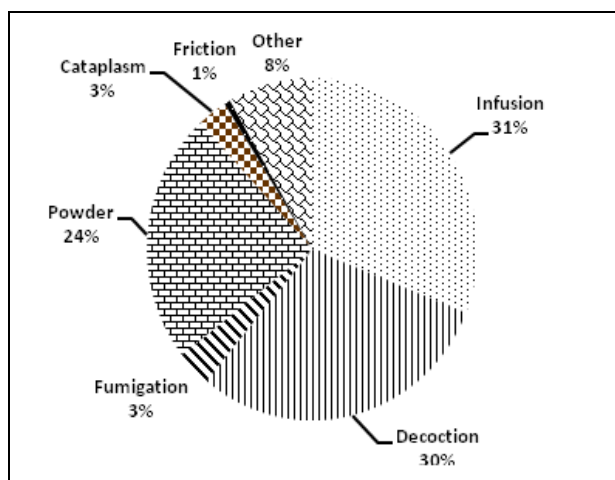


Figure 8: Methods of preparation of plants

The methods used in the zone of study are: the infusion, the decoction, the powder, the fumigation, the cataplasm, the friction, the maceration, plant brute or in mixture with the honey or the oil, etc. The local population always looks for the easiest mode to prepare phytomedicaments. The decoction, the infusion and the powder were generally the method of choice, accounting for 31, 30 and 24% respectively, followed by fumigation preparation (3%), cataplasm (3%) and friction (1%) (Figure n°8). The decoction allows collecting most active ingredients and limiting or cancels the toxic effect of certain recipes (Salhi, 2010). In other regions of Morocco, decoction and infusion were also the most used herbs preparations (Ziyyat *et al.*, 1997; Merzouki *et al.*, 2000; El-Hilaly *et al.*, 2003; Tahraoui *et al.*, 2007, Abouri *et al.*, 2012). Most preparations were drawn from single plant, but their mixtures are also generally used. Some remedies contain varying combinations of plant organs. For 15 % of plants,

CONCLUSION

The present study shows that a large number of medicinal plants are used for treating different ailments highlighting significant cultural diversity in the Agadir Ida Ou Tanane province. The elderly and people with no formal education were found the most users of this herbal medicine and consequently are more knowledgeable, which underlies the question on the conservation of this traditional knowledge through generations. Most of the medicinal plants used are sourced from the wild and some of them are unfortunately over-exploited, which threatened their survival in the area. Digestive disorders were found as the most ailments treated with plants in the

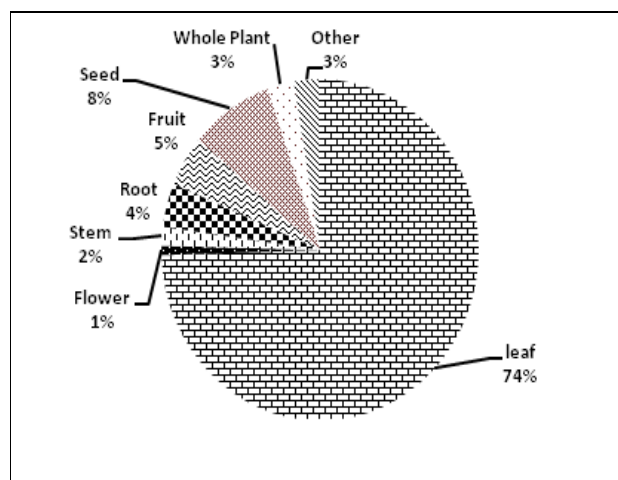


Figure 7: Plants parts used

all plants parts were used. Furthermore, the use of more than a species of plant to prepare a remedy for diseases is attributed to additive or effects of synergy which they could have (Bussman & Sharon, 2006). Most of the preparations are made with water as a solvent. Diverse parts of the plant were also mixed with oil, honey, milk or tea to improve their acceptability and their medicinal properties. For example, the powder of *Nigella sativa* mixed with honey is used for respiratory, digestive and urinary system diseases. The mode of administration mostly used is oral (64.5 %). Herb teas (obtained by infusion or decoction) are usually drunk as teas. The external application was also used with 31.5 % rate and consists, generally, in a local application of the affected part. The remaining modes (eye-drops, wash of mouth) represents 5 % only. These modes of administration are similar to those brought back by Saadi *et al.* (2013).

province. Decoctions and infusions were the most common method of preparation and most of the medicines are administered orally. It's clear that the documentation of traditional knowledge on medicinal plants in Agadir Ida Ou Tanane province still needs more efforts at the national level, to prevent this valuable knowledge from being lost. Such ethnobotanical studies are essential for this purpose because they contribute to document the therapeutic practices of the community and consequently permit to consolidate the indigenous knowledge of the local population.

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