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Full Length Research Paper

Contributions of folk medicine knowledge in South-western Morocco: The case of rural communities of Imouzzer Ida Outanane Region

Baha Saadi, Fouad Msanda and Hassan Boubaker*

Laboratoire de Biotechnologies et Valorisation des Ressources Naturelles, Université Ibn Zohr, Faculté des Sciences, B.P 8106, Agadir, Morocco.

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The present work was undertaken with the aim to collect detailed information about the usage of plants in human therapy in the Imouzzer Ida Outanane region (south-western Morocco). The survey was carried out over a period of 15 months, by means of semi-structured and structured interviews. A total of 350 interviews were conducted with traditional health practitioners and with people who had knowledge in traditional medicine. For this purpose, we collected information about the plants used, the prescriptions and the procedure applied to prepare the used plant. A total of 119 plant species representing 101 genera and 52 families were used in the treatment of various diseases. The most encountered medicinal plant families were Lamiaceae (18 species), Asteraceae (14 species), Apiaceae (10 species) and Fabaceae (8 species). Plant leaves were the most commonly used plant part, and decoction and infusion were the most common methods of traditional drug preparation. The major source of remedies came from wild plants, indicating that cultivation of medicinal plants is not a common practice. This study has established a monograph of medicinal plants used in traditional herbal medicine in Imouzzer Ida Outanane region of south-western Morocco.

Key words: Ethnobotanical survey, medicinal plants, traditional medicine, Imouzzer Ida Outanane Region, Morocco.

INTRODUCTION

In Morocco, the rural people exploit a variety of herbals for effective treatment of various ailments. According to the World Health Organization (WHO), as many as 80% of the world's people depend on traditional medicine to meet their primary health care needs (WHO, 2002). Approximately 50% of the Moroccan people reside in rural areas where access to modern health care facilities is lacking. Furthermore, it is estimated that there is a ratio of one physician for 1,845 people and the ratio of governmental health post to rural population is also very low (Anonymous, 2010). Due to these conditions and other socioeconomic and cultural factors, local people rely more heavily on traditional forms of medicine.

Traditional medicinal plants have several advantages; they are affordable, easily accessible and there is no evidence of resistance to whole-plant extracts (Al-Adhroey et al., 2010). Morocco is known for its rich vegetation and plant biodiversity (Msanda et al., 2005), due to its geographical and climatic conditions. It is one of the Mediterranean countries that have a long medical tradition and know-how in traditional herbal medicines (Jouad et al., 2001; Scherrer et al., 2005). The local traditional pharmacopoeia continues to be an important source of remedies for primary healthcare in the country (Merzouki et al., 2000). Furthermore, this diversity in flora provides also a rich source of natural bioactive substances against plant pathogens (Ameziane et al., 2007; Talibi et al., 2011; Talibi et al., 2012).

The knowledge of the use of medicinal plants and the procedures applied to their preparation is usually transmitted from generation to generation, but it is often in danger because transmission between older and younger generation is not always assured. Consequently, it is essential to make the complete inventory of the medicinal component of the flora of any

*Corresponding author. E-mail: hassanboubaker@yahoo.fr. Tel: 212 0528 220957. Fax: 212 0528 220100.

country for conservation and sustainable use. Although many studies have been carried out on the ethnomedicinal uses of plants described from different parts of Morocco (Bellakhdar, 1997; Bellakhdar et al., 1991; Sijelmassi, 1993; Ziyyat et al., 1997; Merzouki et al., 2000; Jouad et al., 2001; Eddouks et al., 2002; El-Hilaly et al., 2003; Tahraoui et al., 2007), there is however only a few such studies of medicinal plants in the southwestern region of Morocco in general, but none in Imouzzer Ida Outanane region.

Therefore, the present study was carried out to establish a preliminary ethnobotanical database for the plants traditionally used in human therapy in Imouzzer Ida Outanane region (south-western Morocco).

MATERIALS AND METHODS

Study area

The study was carried out in four rural communes (Immouzzer, Tiqqi, Aqesri and Idmine) of Agadir Ida Outanane Province, which is located in the south western of Morocco. The study area was located at about 60 Km North Est of Agadir (Figure 1). Geographically the area corresponds to the western side of the mountains of the High-Atlas. The study site has 300 to 600 mm mean annual rainfall. The main rainy season is between November and March and a smaller one is between December and February. Imouzzer Ida Outanane region is characterized by Mediterranean climate, semi-arid bioclimate, with altitudinal variations of 400 to 1400 masl. The district has characteristic vegetation dominated by shrubby plant communities. The Imouzzer Ida Outanane region is mountainous with fragile ecosystems where local biodiversity plays an important role in meeting the basic daily needs of the rural peoples inhabiting this region. The main activity is agriculture, followed by beekeeping and small-scale animal breeding (goats and poultry).

Data collection

An ethnobotanical survey was carried out in Imouzzer Ida Outanane region from January 2011 to April 2012, during which we conducted 350 interviews in different localities of the district. The data were collected through semi-structured and structured interviews with traditional healers (called “Achab”) and with people having knowledge of traditional medicine. The people interviewed were either born or had been living in the district for more than 20 years. The medicinal plants listed in this inventory were only included if they satisfied, two criteria: the herbal remedies handed down from oral tradition and only those plant species that could be directly identified and/or collected by the person interviewed are cited in this paper. At each interview, the following data were gathered and set on an identity card:

1. Age, sex, and cultural level
2. Vernacular name (Arab or Berber) of the used plants, local or imported, cultivated species or spontaneous
3. Part of the plant being used
4. The reasons for using medicinal plants
5. Form of use, mode of preparation and administration

A medicinal property was accepted as valid only if it was mentioned by at least five independent interviewees. Most of the interviews and discussions were held in Berber, the dialectal language of the region.

The medicinal plants mentioned by interviewees were collected and voucher specimens were deposited at the herbarium of the Laboratory of Biotechnology and Valorization of Natural Resources (LBVRN), Faculty of Sciences, Ibn Zohr University, Agadir. The plant species were identified following ‘Moroccan Flora’ (Fennane et al., 1999, 2007); ‘Vascular Flora of Morocco, Inventory and Chorology’ (Fennane and Ibn, 2005, Ibn and Fennane, 2008), ‘Flora of North Africa’ (Maire, 1952-1980), ‘Moroccan Plants Catalogue’ (Jahandiez and Maire, 1931-1934) and ‘Flora of Sahara’ (Ozenda, 1977).

RESULTS AND DISCUSSION

Demographic characteristics of interviewees

Traditional healers and herbal medicine play an important role in healthcare of rural areas in Morocco (El-Hilaly et al., 2003). Local people have different kinds of indigenous knowledge systems to utilize local herbs. Majority of interviewers acquired the traditional medical knowledge from members of their families mainly grandparents and parents. Majority of respondents replied that they use local herbal medicine to treat their illness. A total of 172 individuals depend on herbal medicine alone, 148 individuals use both herbal medicine and modern medicine, and 30 people have recourse to modern medicine alone. Majority of people opted for a traditional treatment because of its low cost compared to modern medicine; that reflects the reality that local families have low incomes and therefore resort to traditional medicine that is cheap. Ethno-pharmacological surveys on the use of traditional medicinal materials conducted in other countries revealed similar trends where plants represented most of all the traditional medicinal substances (Addis et al., 2001; Maroyi, 2011).

Previous studies have reported a wide range of the rate plant use (50 to 95%), which varied from region to region according to ethnology, richness of medicinal plant sector and home environment (Sijelmassi, 1993; Bellakhdar, 1997; Ziyyat et al., 1997; Hmammouchi, 1999; Jouad et al., 2001; Eddouks et al., 2002; El-Hilaly et al., 2003;

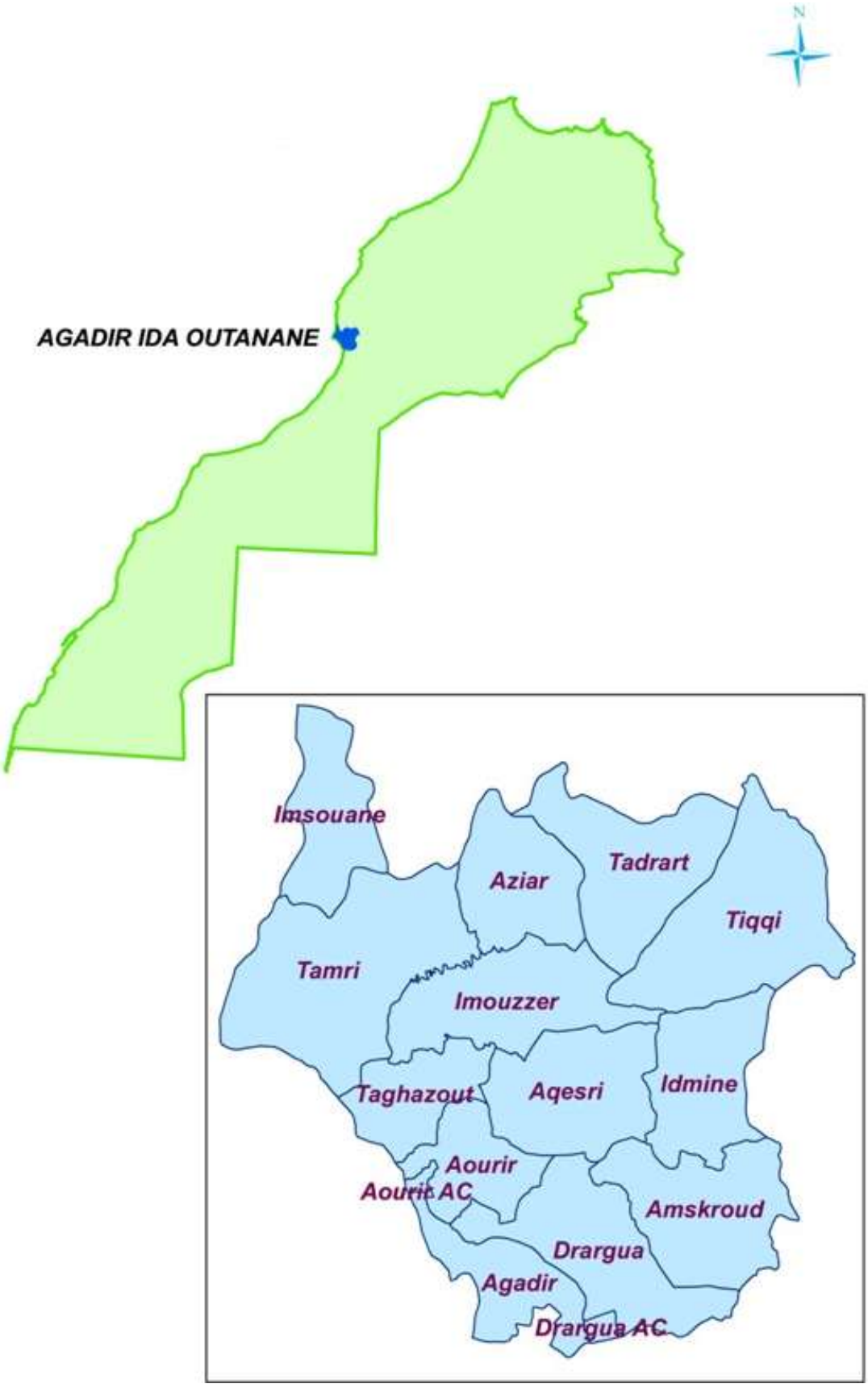

Figure 1. Localisation of study sites in Agadir Ida Outanane Province (South-western Morocco).

Tahraoui et al., 2007). We observed that women had more knowledge of medicinal species by 69% against 31% for men. In contrast to men, women learn mainly from their mother through routine observations. Similar findings were also reported in other parts of Morocco (Ziyyat et al., 1997; Jouad et al., 2001; Eddouks et al., 2002) and elsewhere in world (Savo et al., 2011; Packer et al., 2012). The study showed that people older than 50 years of age have a frequency of use of medicinal plants by 58%, followed by age categories (41 to 50) (31 to 40) (21 to 30) and finally the age of 20 with 16, 12, 8 and 6%, respectively.

Interestingly, the frequency of use of medicinal plants was inversely related to the level of education of the interviewed population. Indeed, herbal medicine is practiced mostly by illiterate (77%), while 15.5% of users have primary level of education. On the other hand, respondents with secondary (7%) and university (0.5%) level of education used very few medicinal plants. The youngest respondents and people who studied up to the age of 20 or over were more inclined towards the modern medicines resulting loss of valuable herbal-based knowledge.

Most of the interviewees suggested that medicinal plants are an important source for daily healthcare and the associated knowledge was traditionally transmitted. They also suggested that these species help maintain the ecological balance of the area by decreasing soil erosion and increasing moisture in the soil, thus improving conditions for human and livestock needs.

Medicinal plants recorded and life forms

The present ethnobotanical survey recorded information on 119 plant species, belonging to 52 families and 101 genera, used to relieve various ailments (Table 1). The families with the most reported plant species were Lamiaceae with 18 species (15.12%), Asteraceae with 14 species (11.76%), Apiaceae with ten species (8.40%), Fabaceae with eight species (6.72%), Anacardiaceae with four species (3.36%), Poaceae and Rutaceae had three species each (2.52%), Zygophyllaceae, Zingiberaceae, Verbenaceae, Rosaceae, Polypodiaceae, Oleaceae, Myrtaceae, Linaceae, Lauraceae, Cupressaceae, Cucurbitaceae, Cistaceae, Burseraceae, Alliaceae, Aizoaceae had two species each (1.68%).

The five first families are well represented in the study area as well as throughout Morocco and also constitute the major groups of medicinal flora in most of other Mediterranean countries (Benitez et al., 2010; Savo et al., 2011). Most of the families recorded are represented by two to four species which shows that the medicinal plants used are not concentrated only in a few families and genera. This agrees with other ethnobotanical studies carried out in Morocco and in Mediterranean area (Raja et al., 1997; Merzouki, 2000; Novais et al., 2004; Tahraoui et al., 2007; Ugulu et al., 2009).

The most commonly used plant species were *Thymus satureioides, Artemisia inculta, Mentha pulegium, Argania spinosa, Trigonella foenum graecum*, *Nigella sativa, Lawsonia inermis* and *Zizyphus lotus*. Most of these species are widely used in other regions of Morocco. Also of interest, among used species 11 (9.25%) are endemic to Morocco.

The study revealed that some plant species could be used to treat several diseases. For example, *T. satureioides* was used against diseases of digestive and respiratory tract, which explains the particular pressure exerted on the plant. The majority of medicinal plants (58%) recorded in this survey were wild species (for example, *T. satureioides, T. pallidus, Tetraclinis articulata, Z. lotus, Lavandula dentata*), reflecting the social importance of the local floristic resources. Some plants (5%) are cultivated for food purposes (for example, *Ficus carica, Olea europaea, Hordeum vulgare, Zea mays*). About 27.7% of the plant species are imported from other regions of Morocco (for example, *Crocus sativus, Euphorbia resinifera*, *L. inermis*) and some (9.2%) species are imported from the outside of Morocco (for example, *Cinnamomum zeylanicum, Syzygium aromaticum, Boswellia carterii*, *Boswellia frereana*). Some species were also associated with beliefs and myths (for example, *B. carterii*, *B. frereana, Styrax benzoin, Peganum harmala*). The large number of plant species used in the study area indicates a dependence on a great diversity of plant species to treat ailments, and represents a good indicator of the profound knowledge on herbal plants held by the local people living in Imouzzer Ida Outanane region.

The analysis of the growth forms of the medicinal plants used in the study area revealed that most of the species were shrub (24.4%) followed by subshrub (21.8%), trees (16%), herb (16%), geophytes (11.7%) and hemicryptophytes (10.1%). In the study area, like most regions of Morocco as well as in other countries, a conflict may be established between plant use and resources conservation (Sheldon et al., 1998; Kala, 2000; Agelet and Vallés, 2001). Some species suffer a high collection pressure with medicinal purposes. These factors combined with an increasing population pressure may lead to further reduction in natural habitats of the medicinal plants. Furthermore, during collection of plants, users tend to uproot the whole plant instead of collecting only the desired parts. This method of collection may seriously compromise the sustainability of medicinal species. Several plant species, such as *T. satureioides, Lavandula maroccana and Rubia peregrina*, were becoming rare in the study area due to overexploitation and aridity.

Therapeutic uses

Plant species listed in Table 1 were used in the treatment of 99 types of diseases; some species were also used in

Table 1. List of medicinal plants used in traditional therapy in Imouzzer Ida Outanane region.

Scientific name and Family	Local name	Habit	Uses	Plant part used	Preparation	Administration
Acacia gummifera Willd. Fabaceae	Taddoute	Tree	Buttons skin, diabetes, hypotensive, pulmonary diseases	Gum, leaf, root	Infusion, powder	Oral, external use
Adenocarpus cincinnatus (Ball) Maire Fabaceae	Tazate	Shrub	Ophtalmia	Leaf	Decoction	Eye drops
Adiantum capillus-veneris L. Polypodiaceae	Liquamt ntama waman	Geophyte	Asthma	Leaf	Powder	Oral
Aizoon canariense L. Aizoaceae	Lghassoul	Herb	Emetic, skin diseases	Fruit, leaf	Cataplasm, decoction, powder	External use, oral
Ajuga iva (L.) Shreb. Lamiaceae	Chendgoura	Hemicryptophyte	Antiseptic, carminative, colds, fever, flatulence, gastric pains, hypotensive, menstrual pains, vermifuge	Leaf, seed, whole plant	Decoction, infusion	Oral
Allium cepa L. Alliaceae	Lbesla - Azalim	Geophyte	Asthma, colds, eye infection, fever, helminthiasis, skin abscesses	Bulb	Cataplasm, decoction	Eye drops, external use, oral
Allium sativum L. Alliaceae	Touma - Tiskert	Geophyte	Antifungal, antitoxic, aphrodisiac, colds, cough, cutaneous infection, depurative, diabetes, hair care, headache, helminthiasis, hypotensive, intestinal pains, sterility	Bulb, stem	Boiled in oil, decoction, raw	External use, oral
Aloysia citriodora Palau Verbenaceae	Lwiza	Subshrub	Antiseptic, calming, carminative, digestive, sedative	Leaf	Infusion	Oral
Alpinia officinarum Hance Zingiberaceae	Khudenjal	Geophyte	Calefacient, colds, rheumatism, dysmenorrhea, sexual impotence	Root	Decoction, powder	Oral
Apium graveolens L. Apiaceae	Lkrafess	Hemicryptophyte	Aphrodisiac, bladder diseases, kidney stones, stomach ache	Fruit	Decoction	Oral
Argania spinosa (L.) Skeels Sapotaceae	Argane	Tree	Aphrodisiac, burns, diabetes, eczema, fungus, gastritis, headache, rheumatic pains, skin and hair care	Leaf, root, seed	Decoction, oil, powder	External use, oral
Aristolochia baetica L. Aristolochiaceae	Armdad - Berreztem	Liana	Skin diseases	Root	Powder	External use
Artemisia absinthium L. Asteraceae	Chiba	Subshrub	Analgesic, antiseptic, calefacient, carminative, colds, hypertensive, stomachic, tonic, vermifuge	Leaf	Decoction	Oral
Artemisia inculta Delile Asteraceae	Chih - Izri	Shrub	Antiseptic, carminative, cholagogue, colds, emmenagogue, hypoglycaemic, gastric pains, rheumatic diseases, sedative, spasmolitic, stomachic, tonic, vermifuge	Leaf	Decoction, infusion	Oral
Artemisia reptans Buch Asteraceae	Chih	Shrub	Colds, diabetes, gastric pains	Leaf, stem	Infusion	Oral
Asphodelus ramosus L. Asphodelaceae	Ighri	Geophyte	Colds, skin diseases	Root	Maceration	External use
Atractylis gummifera L. Asteraceae	Addad	Hemicryptophyte	Abortifacient, emetic, labour pains, skin diseases, toxic	Root	Decoction, powder	External use, oral
Boswellia carteri Birdw. Burseraceae	Salaban	Tree	Ritual and magic practices	Resin	Raw	Fumigation
Boswellia frereana Birdw. Burseraceae	Jawi	Tree	Ritual and magic practices	Resin	Raw	Fumigation
Bubonium odorum (Schousb.) Maire Asteraceae	Tafsa	Shrub	Diarrhea, gum and tooth ailments, spasmolitic	Leaf	Infusion, powder	Oral, mouth wash
Capparis spinosa L. Capparaceae	Lkebbar - Taylouloute	Shrub	Colds, headache, hypertension, rheumatism, skin buttons, tonic	Flower, fruit	Decoction, maceration	External use, oral
Carthamus lanatus L. Asteraceae	Wiskijja	Herb	Kidney diseases	Flower	Infusion	Oral
Carum carvi L. Apiaceae	Krwiya	Hemicryptophyte	Aphrodisiac, as aroma, diabetes, carminative, colds, gastric ailments, spasmolitic, stomachic	Fruit	Decoction	Oral
Ceratonia siliqua L. Fabaceae	Kharroub - Tikida	Tree	Diarrhea, emetic, gastrointestinal ailments, melliferous, stomachic, tonic	Leaf, fruit	Infusion, powder	Oral
Chamaecytisus mollis (Cav.) Greuter and Burdet Fabaceae	Ouchfoud awram	Subshrub	Tonic for children	Root	Powder mixed with flour	Oral

Table 1 Contd.

Chamaerops humilis L. Arecaceae	Tiznirte	Subshrub	Diarrhea	Fruit	Raw	Oral
Chenopodium ambrosioides L. Chenopodiaceae	Mkhinza	Herb	Asthma, carminative, colds, fever, gastrointestinal pains, headache, menstrual pains, vermifuge,	Leaf, stem	Cataplasm, infusion, juice	External use, oral
Cinnamomum zeylanicum Blume Lauraceae	Lkorfa	Tree	Aphrodisiac, calefacient, digestive, tonic, spasmolitic	Bark	Decoction, powder	Oral
Cistus salviifolius L. Cistaceae	Tirguelt	Shrub	Colds, diabetes, stomach pains	Leaf, seed	Decoction, infusion, powder	Oral
Cistus villosus Auct. Cistaceae	Irguel	Shrub	Colds, diabetes, flatulence, gastric ailments,	Seed, leaf	Infusion, powder	Oral
Citrullus colocynthis (L.) Shrader Cucurbitaceae	Lhedja – Aferziz	Geophyte	Diabetes	Fruit	Raw	External use
Citrus limon L. Rutaceae	Lhamed	Subshrub	Angina, antiseptic, headache, fever	Fruit	Cataplasm, juice, raw	External use, oral
Citrus vulgaris Risso Rutaceae	Litchin - Limoune	Subshrub	Analgesic, sedative	Flower, leaf	Infusion	Oral
Coriandrum sativum L. Apiaceae	Kezbor	Herb	Aphrodisiac, bladder ailments, gastrointestinal pains, insomnia, rheumatic pains, sedative	Aerial parts, seed	Decoction, infusion, powder	Oral
Crocus sativus L. Iridaceae	Zaafran Ihorr	Geophyte	Aphrodisiac, menstrual pains, sterility, tonic	Stigma	Infusion	Oral
Cucumis melo L. Cucurbitaceae	Lbettikh - Lemnoune	Herb	Digestive, laxative	Pulp, seed	Decoction, raw	Oral
Cuminum cyminum L. Apiaceae	Kemmoun	Herb	Carminative, diarrhea, emmenagogue, gastrointestinal pains	Seed	Decoction, powder	Oral
Cynodon dactylon (L.) Pers. Poaceae	Afar	Geophyte	Colds, diuretic	Rhizome, whole plant	Decoction	Oral
Daphne gnidium L. Thymeleaceae	Alzaze	Subshrub	Hair care	Leaf	Decoction, powder	External use
Echinops spinosus L. Asteraceae	Taskra	Hemicryptophyte	Colds, kidney stones, diabetes	Aerial parts	Decoction	Oral
Eryngium ilicifolium Lam. Apiaceae	Zerriga – Tasennante	Herb	Colds, angina, throat irritation	Leaf, root	Decoction, infusion	Oral
Eryngium tricuspidatum L. Apiaceae	Hessika	Hemicryptophyte	Angina	Leaf mixed with honey	Raw	Oral
Euphorbia beaumierana Hooker fil. Cosson Euphorbiaceae	Daghmouss - Tikioute	Subshrub	Colds, eczema, female sterility, melliferous, purgative, warts	Aerial parts, latex (diluted)	Decoction, raw	External use, oral
Fagonia cretica L. Zygophyllaceae	Tamechgalte	Shrub	Anemia, stomach pains	Root, whole plant	Decoction	Oral
Ficus carica L. Moraceae	Tazarte - Karma	Tree	Abscesses, laxative, stomach pains,	Fruit, latex	Raw	External use, oral
Foeniculum vulgare Miller Apiaceae	Besbass - Wamsa	Shrub	As aroma, carminative, cough, digestive ailments, galactagogue, kidney pains, spasmolitic, tonic	Bulb, seed	Decoction, infusion	Oral
Genista ifniensis A. Caballero Fabaceae	Ouchfoud - Azziye	Shrub	Hair care	Leaf	Powder	External use
Globularia alypum L. Globulariaceae	Taslgha	Shrub	Antiseptic, baldder ailments, burns, diabetes, digestive, skin buttons, tuberculosis , wound healing	Leaf	Cataplasm, decoction, maceration, powder	External use, oral
Glycyrrhiza glabra L. Fabaceae	Aarq souss	Geophyte	Carminative, constipation, cough, gastrointestinal ailments hoarseness, mouth care	Root	Infusion	Oral
Herniaria cinerea DC. Caryophyllaceae	Herraste lahjar	Herb	Colds, kidney stones, urinary system	Aerial parts	Decoction,	Oral
Hordeum vulgare L. *Poaceae*	Tomzin	Herb	Diarrhea, gastrointestinal ailments	Seed	Decoction	Oral
Inula viscosa (L.) Aiton Asteraceae	Terrhla	Shrub	Kidney stones, rheumatism	Leaf	Maceration, infusion	External use, oral
Juglans regia L. Juglandaceae	Grgaa - Swak	Tree	Against bad breath, antiseptic, aphrodisiac, tonic, tooth and gums care	Bark, fruit, leaf	Decoction, infusion, raw	External use, oral

Table 1 Contd.

Juniperus oxycedrus L. Cupressaceae	Tikki	Tree	Against vertigo, skin care	Fruit, resin	Fumigation, raw	External use, inhalation
Launaea arborescens Batt. Maire Asteraceae	Iferskel - Moulbina	Subshrub	Diabetes, diarrhea fever, weaning	Latex, root	Infusion	External use, oral
Laurus nobilis L. Lauraceae	Wraqt sidna moussa	Tree	As aroma, asthma, digestive, gingivitis, rheumatism	Leaf	Decoction, infusion	Oral, mouth wash
Lavandula dentata L. Lamiaceae	Lkhzama – Tijercht - Ijarch	Shrub	Against bad breath, antiseptic, as aroma, calefacient, colds, gastric ailments, tonic, ulcers, wounds healing	Flower, leaf, seed	Decoction, infusion, powder	Oral, external use
Lavandula maroccana Murbeck Lamiaceae	Igguiz	Shrub	As aroma, colds, **diabetes, fever**, gastrointestinal ailments, headache	Leaf	Decoction, infusion	External use, oral
Lavandula multifida L. Lamiaceae	Igguiz	Shrub	As aroma, diabetes gastrointestinal ailments	Leaf	Infusion	External use, oral
Lavandula stoechas L. Lamiaceae	Lhelhal	Shrub	As aroma, asthma, colds, cough, stomach ailments, rheumatism	Aerial parts, flowering tops	Decoction, infusion	External use, oral
Lawsonia inermis L. Lythraceae	Lhenna	Shrub	Antifungal, antiseptic, burns, emetic, hair care, headache, hypotensive, skin diseases, sprains, stomach pains	Leaf	Decoction, powder	External use, oral
Lepidium sativum L. Brassicaceae	Hebb Rchad	Herb	Asthma, bone care, calefacient, colds, diarrhea, digestive, galactagogue, headache, labour pains, sterility, tonic	Seed	Decoction, infusion, powder	External use, oral
Linum usitatissimum L. Linaceae	El Kettane - Zerriaat El Kettane	Herb	Anticholesterolemic, colds, constipation, cutaneous diseases, diuretic	Seed	Raw	Oral
Malva sylvestris L. Malvaceae	Lbakkoula - Lkhoubbiza	Hemicryptophyte	Colds, constipation, cough, gastrointestinal pains, ,	Leaf	Decoction	Oral
Marrubium vulgare L. Lamiaceae	Merroute – Mrriwt - Ifzi	Shrub	Abscesses, antiseptic, colds, diabetes, ear ache, fever, stomach ache	Leaf	Decoction, Infusion	External use, oral
Matricaria chamomilla L. Asteraceae	Babunj	Herb	Calming, cough, emmenangogue, hair care, rheumatism, wound healing	Flower, leaf	Decoction, powder	External use
Mentha. pulegium L. Lamiaceae	Flyou	Hemicryptophyte	Bronchitis,carminative, colds, cough, digestive, hypotensive, refreshing, respiratory ailments, rheum, rheumatism, sedative, stomachic, tonic	Flower, leaf, stem	Infusion	Inhalation, oral
Mentha suaveolens Ehrh. Lamiaceae	Timija	Hemicryptophyte	Colds, calefacient, tonic	Leaf	Infusion	Oral
Mentha viridis L. Lamiaceae	Nanaa - Likama - Likamt	Hemicryptophyte	Carminative, colds, headache, tonic	Aerial parts	Infusion	Oral
Mesembryanthemum crystallinum L. Aizoaceae	Lghassoul - Taghassoult	Herb	Emetic	Aerial parts	Infusion	Oral
Myristica fragrans Houtt. Myristicaceae	Lgouza	Tree	Aphrodisiac, asthma, calefacient, colds, digestive, rheumatism,	Seed	Powder	Oral
Myrtus communis L. Myrtaceae	Rihane	Subshrub	Hair care, skin diseases	Leaf	Cataplasm, decoction, infusion	External use
Nigella. sativa L. Ranunculaceae	Shanouj – Habba sawda	Herb	Anemia, aphrodisiac, asthma, colds, cough, galactagogue, hair care, headache, pulmonary diseases, rheumatism, spasmolitic, stomach pains, tonic	Seed	Oil, powder, raw	External use, oral
Notholaena vellea (Aiton.) Desv. Polypodiaceae	Tirifite	Geophyte	Burns	Leaf, stem	Maceration	External use
Olea europaea L. Oleaceae	Azemmour - Zitoun	Tree	Aphrodisiac, asthma, constipation, colds, cough, diabetes, gingivitis, hair care, hypotensive, mouth diseases, pulmonary ailments, rheumatism, skin care, stomachic	Leaf, fruit	Decoction, maceration, oil, raw	External use, oral

Table 1 Contd.

Ononis natrix L. Fabaceae	Afezdad	Shrub	Jaundice	Flower, leaf, stem	Decoction	Oral
Opuntia ficus-barbarica A. Berger Cactaceae	Aknary - Lhendia	Subshrub	Colds, diarrhea, hair care, kidney diseases, stomachic	Flower, fruit, leaf, stem	Decoction, powder, raw	External use, oral
Papaver rhoeas L. Papaveraceae	Bellaaman - Flillo	Herb	Cough, calefacient, sedative, skin buttons, throat irritation, tonic	Petal, seed	Decoction	External use, oral
Peganum. harmala L. Zygophyllaceae	Lharmel	Shrub	Abortifacient, antiseptic, baldness, colds, eczema, hair care, hallucinant, rheumatism, ritual, magic practice and to relieve bad fate, spasmolitic, toxic,	Leaf, seed	Fumigation, powder, raw	External use
Periploca angustifolia Labill. Asclepiadaceae	Asellif	Subshrub	Abortifacient, burns, rheumatism, skin buttons	Leaf, root	Cataplasm, decoction, powder	External use
Petroselinum sativum Hoffm. Apiaceae	Lmaadnouss	Hemicryptophyte	Diuretic, stomachic, tonic	Aerial parts, seed	Decoction	Oral
Phillyrea angustifolia L. Oleaceae	Asghar mlloulne - Benzemmour - Iskawn	Subshrub	Rheumatism	Leaf	Decoction	External use
Pimpinella anisum L. Apiaceae	Habbat hlaoua	Herb	Aphrodisoiac, asthma, carminative, diuretic, spasmolitic, stomachic	Seed	Decoction, infusion	Oral
Pistacia atlantica Desf. Anacardiaceae	Lbtam - Iggue	Tree	Aphrodisiac, diarrhea, gastric ailments, gingivitis, mouth care stomach ache, tooth ache	Gum, leaf, seed	Decoction, raw	Oral
Pistacia lentiscus L. Anacardiaceae	Titekt	Subshrub	Diabetes, gingivitis, mouth care, stomach ache	Bark, gum, leaf,	Decoction, powder	Oral
Prunus dulcis (Miller) D.A. Webb Rosaceae	Louz	Tree	Cosmetic, tonic	Seed	Oil, raw	Mask, oral
Pulicaria mauritanica Batt. Asteraceae	Bamghar	Shrub	As aroma, diarrhea, kidney diseases, scorpion bite	Flower, leaf	Infusion, maceration	External use, oral
Punica granatum L. Punicaceae	Rman	Tree	Antiseptic, diarrhea, gastrointestinal diseases, scalp and hair care, stomachic,	Pericarp	Infusion	External use, oral
Quercus ilex L. Fagaceae	Tasaft	Tree	Colds, kidney diseases, stomach ache, wound healing	Bark, leaf	Decoction, powder	External use, oral
Rhaponticum acaule (L.) DC. Asteraceae	Tafgha	Hemicryptophyte	Intestinal pains, stomachic	Root	Decoction	Oral
Rhus pentaphylla (Jacq.) Desf. Anacardiaceae	Tizgha - Azade	Subshrub	Gastric ailments	Root	Decoction	Oral
Rhus tripartita (Ucria) Grande Anacardiaceae	Jdari –- Awingue	Subshrub	Gastrointestinal ailments	Bark, leaf	Decoction	Oral
Rosmarinus officinalis L. Lamiaceae	Azir	Subshrub	Anticholesterolemic, bronchitis, digestive, kidney diseases, liver diseases, skin care, stomach ache, throat irritation,vulnerary	Leaf	Cataplasm, infusion	External use, oral
Rubia. peregrina L. Rubiaceae	Taroubit	Geophyte	Anemia	Root, whole plant	Decoction	Oral
Rubus ulmifolius Schott. Rosaceae	Akhlij - Seroua	Subshrub	Skin buttons, wounds healing	Leaf	Cataplasm, infusion	External use
Ruta montana (L.) L. Rutaceae	Awermi - Lfijel	Shrub	Abortifacient, colds, liver diseases, rheumatism	Leaf, whole plant	Cataplasm, infusion	External use, oal
Salvia aegyptiaca L. Lamiaceae	Idergui	Shrub	Colds, fever, stomach and intestinal pains	Aerial parts	Infusion	Oral

Table 1 Contd.

Salvia officinalis L. Lamiaceae	Salmia - Iguergui	Subshrub	Carminative, colds, cough, diabetes, gastric pains, rheumatism, spasmolitic, stomachic, tonic	Leaf	Infusion	Oral
Satureja macrosiphon (Cosson) Maire Lamiaceae	Azoukenni ighouyyalne	Shrub	Diabetes	Leaf	Infusion	Oral
Senecio anteuphorbium (L.) Sch. Bip. Asteraceae	Achbarto	Subshrub	Eye irritation, melliferous, rheumatism	Stem	juice	External use
Sesamum. indicum L. Pedaliaceae	Zenjlane	Herb	Aphrodisiac, tonic	Seed	Powder mixed with honey	Oral
Smilax aspera L. Smilacaceae	Anjale - Armdade	Liana	Colds, sterility	Root	Decoction	Oral
Styrax. enzoin Dryand. Styracaceae	Jawi	Tree	Aromatic, incense in ritual and magic practices	Resin	Fumigation	-
Syzygium. aromaticum (L.) Merr. and L.M. Perry Myrtaceae	Qranful	Tree	Antiseptic, calefacient, tooth ache	Clove	Infusion, raw	Oral, mouth wash
Tetraclinis articulata (Vahl) Masters Cupressaceae	Aaraar - Azouka	Tree	Colds, diuretic, fever, hair care, headache, skin diseases, stimulates the immune system, stomach and intestinal pains, tannic	Leaf, cone	Cataplasm, decoction, powder, raw	External use, oral
Teucrium polium L. Lamiaceae	Jaaidya - Tazgourte	Shrub	Diabetes, fever, gastric pains, vulnerary	Flower, leaf, stem	Decoction, infusion, powder	External use, oral
Thapsia transtagana Brot. Apiaceae	Deriass	Geophyte	Cough, rheumatism, spasmolytic, sterility	Root	Decoction	External use, oral
Thymus broussonetii Boiss Lamiaceae	Azoukenni	Shrub	Angina, bronchitis, colds, gastric pains, stomach and intestinal pains, spasmolitic,	Leaf, stem	Decoction, infusion	Oral
Thymus leptobotrys Murb. Lamiaceae	Azoukenni	Shrub	Colds, headache, gastric pains	Leaf, stem	Infusion	Oral
Thymus pallidus Batt. Lamiaceae	Ajellabi	Shrub	Colds, gastric pains, melliferous	Flower, leaf	Decoction, infusion	Oral
Thymus satureioides Cosson Lamiaceae	Tazoukennite	Shrub	Colds, cough, bronchitis, diabetes, diarrhea, gastrointestinal ailments, gum and throat ailments, hair care, melliferous, stomach ache, tonic, tooth ache, vermifuge,	Flower, leaf, stem	Infusion	External use, oral
Trigonellla. foenum graecum L. Fabaceae	Hlba - Tifidas	Herb	Anemia, asthma, bone care, cough, diabetes, fever, galactagogue, hair care, increases appetite, skin care, stomachic, tonic	Seed	Cataplasm, decoction	External use, oral
Urginea maritima (L.) Bake Liliaceae	Azalim ouchen	Geophyte	Abscesses, calefacient, colds, jaundice, skin care	Bulb	Decoction, maceration	External use, inhalation, oral
Vitex agnus-castus L. Verbenaceae	Angarf - Lkhrwaa	Subshrub	Burns, colds, headache	Leaf, seed	Powder	External use, fumigation
Warionia saharae Benth. and Coss. Asteraceae	Ali ijjan - Afessas	Subshrub	Rheumatism	Leaf	Decoction	External use
Withania frutescens L. Pauquy Solanaceae	Tiremt	Subshrub	Burns, headache, stomach ache, tannic	Bark, leaf	Infusion, powder	Applied on affected parts, oral
Zea mays L. Poaceae	Dra - Asngar	Herb	Urinary system ailments,	Stigma	Decoction	Oral
Zingiber officinale Rosc. Zingiberaceae	Skinjbir	Geophyte	Aphrodisiac, asthma, calefacient, colds, diabetes, digestive, rheumatism, tuberculosis	Rhizome	Decoction, infusion	Oral
Ziziphus lotus (L.) Lam Rhamnaceae	Sedra – Azouggar - Nbeg	Subshrub	Intestinal ailments, colds, skin care	Fruit, leaf, root	Cataplasm, infusion, powder	External use, oral

cosmetic and ritual practice. The majority of plant species had more than a single therapeutic use. All reported ailments were structured into 14 different pathological groups: gastro-intestinal ailments, dermatological pains, respiratory system diseases, genito-urinary ailments, rheumatic

diseases, cardiovascular and circulatory system disorders, liver problems, skeleto-muscular problems, dental care, hair and face care, ear, nose and throat problems, diabetes, cooling agents and general health. The pathological groups with the greatest number of records were the gastro-intestinal ailments (22%), cold and rheumatic pains (12.6%), skin problems (8.6%), respiratory system (6.6%), genito-urinary system (5.5%), followed by diabetes (4.2%), (2.7%). Other diseases (for example, circulatory system, liver problems, headache, fever, mouth and tooth care) were represented by less than 4%. Gastro-intestinal disorders were also 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; Mati and De Boer, 2011; Benitez et al., 2010). Almost all of the identified plant remedies are used for curative than prophylactic purposes. More than half of the reported species (56.3%) were used for stomach and intestine related disturbances (Table 1).

Among the 11 endemic species recorded in this study, four species with new medicinal uses were reported here for the first time; for example the use of a decoction of *Adenocarpus cincinnatus* leaves against eye diseases; the use of *Euphorbia beaumierana* to treat women sterility; *Genista ifniensis* leaves for hair cares; the use of *L. maroccana* leaves against diabetes and fever. Thus, these species constitute new potential sources of natural medicines. Table 1 reports in bold the uses of plant species for which we did not find any medicinal use in the literature. The number of medicinal plants and their potential applications reflect the rich ethnomedicinal knowledge in the Imouzzer Ida Outanane communities. Similar potentialities were found in other Moroccan regions (El-Hilaly et al., 2003; Jouad et al., 2001) as well as worldwide (Addis et al,. 2001; Bussman and Sharon, 2006).

Plant parts used, mode of preparation and administration

Leaves were the most frequently used plant parts (33%), followed by seeds (13%), root (9%), fruits (8%), flowers or flowering tops (6.5%) and stems (5%) (Table 1). Other organs (bark, bulb) or extracts of aerial plant parts (gum, latex, resin) are also used for less than 3% each. The results of this study showed that aerial plant parts play an important role in herbal medicine preparation in Imouzzer Ida Outanane region, agreeing with the results of Camejo-Rodrigues et al. (2003) and De-la-Cruz et al. (2007).

Most preparations were drawn from single plant, but their mixtures were also commonly used (data not shown). In 3% of plant remedies all plant parts were used. The use of more than one plant species to prepare a remedy for ailments is attributed to the additive or synergistic effects that they could have (Bussman and Sharon, 2006). Most preparations are made with water as a solvent. Various plant parts were also mixed with oil, honey, milk or tea for enhancing their acceptability and medicinal properties. For example, powder of *Sesamum indicum* seeds mixed with honey was used as aphrodisiac. The decoction and infusion were generally the method of choice, accounting for 32 and 24.6% respectively, followed by powder preparation (17.2%), cataplasm (6.9%) and maceration (3.4%). It was also observed that some plants were used in more than one form of preparation. Other less common ways of preparation include juice, raw consumption and fumigation. Decoction and infusion were also the most used herbal preparations in other regions of Morocco (Ziyyat et al., 1997; Merzouki et al., 2000; El-Hilaly et al., 2003; Tahraoui et al., 2007).

The great majority of the remedies were taken orally (60.8%). External application were also employed, accounting for 32.7%, and may consist, generally, in a local application to the affected part. The other routes of administration (eye drops, mouth wash…) accounted for less than 2%. These routes of administration are similar to those reported by Agelet and Valles (2001), Ghorbani et al. (2011) and Maroyi (2011). As reported in other ethnobotanical survey in Morocco (Merzouki et al., 2000; Tahraoui et al., 2007), there is a lack of standardized dosage and quality control in the Imouzzer Ida Outanane region.

Conclusion

Our study showed that medicinal plants continue to play an important role in the primary healthcare system for the local people living in the Imouzzer Ida Outanane region, southwestern Morocco. Most of the people have limited economic means to buy western medicine, and still have a strong belief in the efficacy of herbal medicine. A great variety of plants was used by traditional healers for treatment of numerous diseases. An ethnobotanical catalogue composed by 119 plant species belonging to 101 genera in 52 families which resulted from 350 interviews. Moreover new or uncommon medical uses were reported. The current study represents a useful documentation, which can contribute to preserving knowledge on the use of medicinal plants in this region. Moreover, protective measures are necessary for the conservation and preservation of the natural herbal resources, to avoid their overexploitation.

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