



Ethnobotanical study of commercialized medicinal plants in the Beni Mellal-Khenifra region (Morocco), with special reference to *Myrtus communis* L.

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Research

Abstract

Background: The study of ethnobotany is to create a catalog of medicinal plants in order to preserve the indigenous knowledge and to promote the sustainable exploitation of these plant resources. The aim of this study was to evaluate the ethnobotanical of commercialized medicinal plants (MAPs) focusing on Myrtle species, in the Beni Mellal-Khenifra region of Morocco.

Methods: A series of ethnobotanical and socio-cultural surveys were conducted among the local population of the study area.

Results: The present study has allowed us to reveal that the most of commercialized MAPs are used primarily in the care of the digestive system and the glands attached to the digestive tract. The foliage is the most used part for treatment. Decoction is the most practiced method by the local population. Among the commercialized MAPs there is Myrtle specie that used mainly in hair care and in the treatment of digestive tract abnormalities. The female gender, aged between 40 and 50 years, traditionally uses the commercialized MAPs as well as the Myrtle more than the male gender. Whatever the gender, the illiterate use MAPs more than the educated.

Conclusions: This study shows the wealth of knowledge of the local population which has a rudimentary social level. Considering the importance

of Myrtle use in Morocco or internationally and following its cosmetic and therapeutic virtues, it is time to raise the awareness and enrich the traditional know-how of this species in the region of Beni Mellal-Khenifra within a framework of sustainable manner.

Key words: *Myrtus communis* L., therapeutic uses, ethnobotany, Beni Mellal- Khenifra region.

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Résumé

Contexte: L'étude de l'ethnobotanique vise à créer un catalogue de plantes médicinales afin de préserver les savoirs indigènes et de promouvoir l'exploitation durable de ces ressources végétales. Le but de cette étude était d'évaluer l'ethnobotanique des plantes médicinales commercialisées (MAP) en traitant le cas du Myrte, dans la région de Beni Mellal-Khenifra au Maroc.

Méthodes: Une série d'enquêtes ethnobotaniques et socioculturelles ont été menées auprès de la population locale de la zone d'étude.

Résultats: La présente étude nous a permis de révéler que la plupart des MAP commercialisées sont utilisées principalement dans les soins du système digestif et des glandes attachées au tube digestif. Le feuillage est la partie la plus utilisée pour le traitement. La décoction est la méthode la plus pratiquée par la population locale. Parmi les MAP commercialisées, il existe une espèce de myrte utilisée principalement dans les soins capillaires et dans le traitement des anomalies du tube digestif. Le genre féminin, âgé entre 40 et 50 ans, utilise traditionnellement les MAP commercialisées ainsi que le myrte plus que le genre masculin. Quel que soit le genre, les analphabètes utilisent davantage les MAP que les instruits.

Conclusions: Cette étude montre la richesse des connaissances de la population locale qui a un niveau social rudimentaire. Compte tenu de l'importance de l'utilisation du Myrte au Maroc ou à l'international et suivant ses vertus cosmétiques et thérapeutiques, il est temps de sensibiliser et d'enrichir le savoir-faire traditionnel de cette espèce dans la région de Beni Mellal-Khenifra dans un cadre de manière durable.

Mots clés: *Myrtus communis* L., usages thérapeutiques, ethnobotanique, région Béni Mellal-Khénifra.

Background

Ethnobotany does not only deal with the uses of plants, but it is the direct study of the relations between human beings and plants (Faulks 1958, Valadeau 2010). Ethnobotany is a multidisciplinary science which considers the plant in relation to its ecological and socio-cultural environment (Valadeau 2010, Veilleux & King 1996, Wickens 1990). Also the study of ethnobotany is to create a catalog of medicinal plants in order to preserve the indigenous knowledge and to promote the sustainable exploitation of these plant resources.

Morocco has a very old know-how based on principles of rural or pastoral lifestyle in relation to the plant resources of the surrounding environment (Aafi et al. 2002, Bellakhdar 1997, Hmamouchi 2012, Scherrer et al. 2005). This ethnobotanical knowledge tends to be lost over the generations as a result of the unlearning phenomenon peculiar to urban civilization (Aafi et al. 2002, Benkhniqne et al. 2011). Also, the consumption habits have begun to gradually drive out the old traditions of self-sufficiency. Ethnobotany has become foreign to the present generation, while it represents a promising potential in the country's research and development and socio-economic fields. The Moroccan medicinal and aromatic plants (MAP) sector provides employment to local and rural communities and the main export markets for these plants are the Mediterranean countries (Italy, France, Turkey, Spain, Tunisia, etc.) (Wahid 2013). Among the MAPs most commercialized in Morocco is Myrtle (*Myrtus communis* L.). Generally, it is marketed by cooperatives, associations and marginalized rural populations in the form of raw biomass or as an essential oil product (Wahid 2013, Wahid et al. 2016). The production of essential oils (HE) with a total weight of 2693 kg, for the period of the years 1999 to 2006, corresponds to a price of 611×10^3 MAD (Wahid 2013). Many Mediterranean countries, America from the south, northwest of the Himalayas, Australia and North West India, have invested heavily for decades for the cultivation of Myrtle by exploiting genetic variability between populations to create new generations of more efficient shrubs, very productive and very profitable (Wahid 2013). Moreover, the Myrtle plant and its secondary metabolites are being tested scientifically in order to feed future research in cosmetic, medicine, food industry and in biological plant protection (Mulas et al. 2008, Sabiha et al. 2011). In traditional medicine, Myrtle is much sought because of its aromatic and therapeutic properties and its nutritional qualities (Wahid 2013). In Morocco, ethnobotanical studies on Myrtle are less documented, fragmentary and scattered (Wahid 2013). These studies were conducted only in the natural distribution areas of Myrtle (Bellakhdar et al. 1991, Ennabili et al. 2000; El Hilaly et al. 2003, Lahsissen et al. 2009, El Mansouri et al. 2011, Khabbach et al. 2012, Wahid 2013). On the other hand, ethnobotanical work in areas where Myrtle is marketed, including the Beni Mellal-Khénifra region, is poorly studied. It is therefore necessary to undertake them in order to identify the ethnobotanical potential of Myrte in the Beni Mellal-Khénifra region in relation to the socio-cultural elements and the floristic wealth of this region. Hence, the aim of this study was to evaluate the ethnobotanical of commercialized medicinal

plants focusing on Myrtle species, in the Beni Mellal-Khenifra region of Morocco.

Material and Methods

Study area

The Beni Mellal-Khenifra region is a geographical entity located in the center of Morocco (Figure 1). It is bordered to the west by the Casablanca-Settat and Marrakech-Safi regions, to the South by the Draâ-Tafilalet region, to the east by the Errachidia regions and to the North by the Fès-Meknès and Rabat-Salé-Kenitra regions. The climate of the region is Mediterranean, characterized by intense cold in winter and very hot summers. It varies from a humid climate towards the peaks of the high mountains to a subarid climate below the mountain ranges. Economically, the local population of the area is generally based on agriculture, animal husbandry

and forestry activities in addition to fishing as the area has dams of national importance. The Beni Mellal-Khenifra region has a population about 2,520,776 inhabitants, 50.86% of whom are rural. According to the High Commission for Planning (HCP), the dominant age category is between 15 and 59 years (63%). And 38.7% of the inhabitants aged 10 and over, are illiterate.

Administratively, it comprises of five provinces (Figure 1): Most of these provinces and municipalities are characterized not only by significant geomorphological and climatic diversity but also cultural diversity. This contributes to a range of uses of plants in the region, developing a database of knowledge and therapeutic know-how owing to familiarization and activities of locals related mainly to nature and the forest.

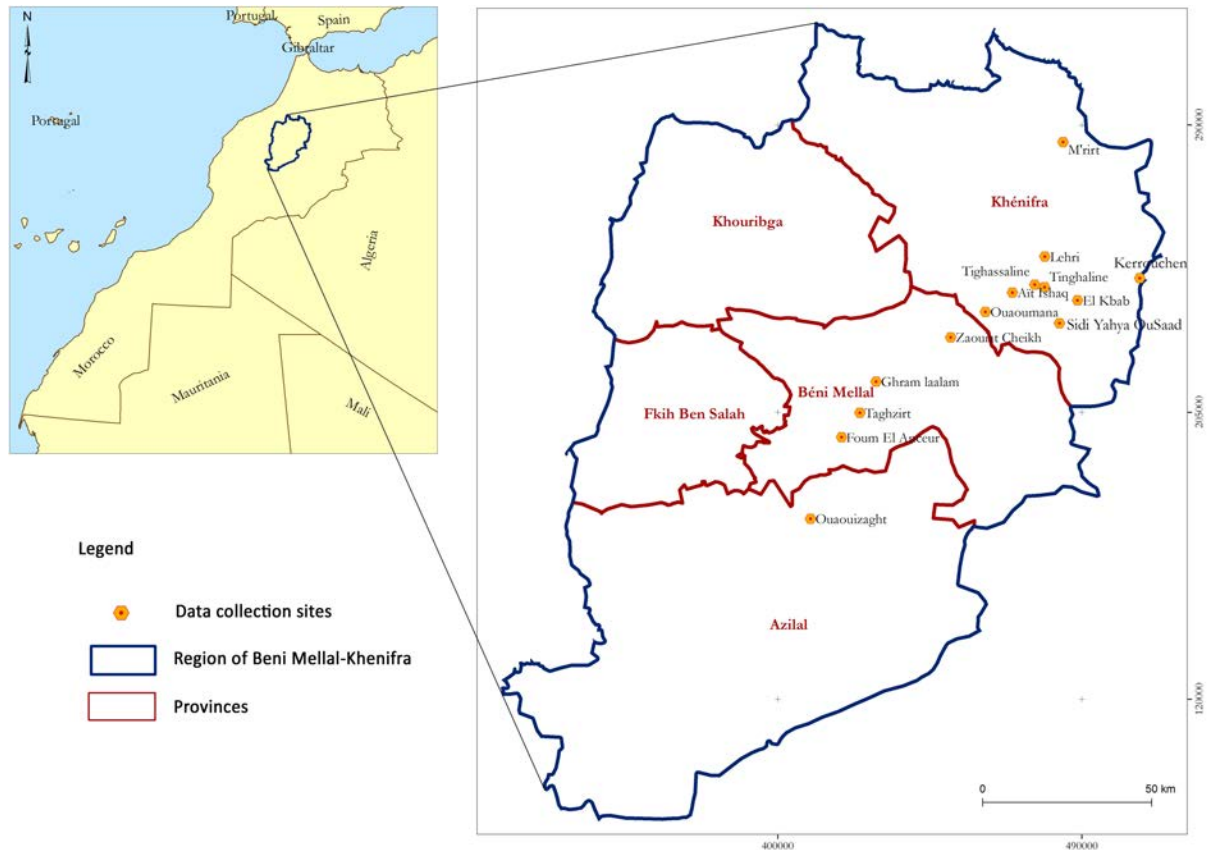


Figure 1. Geographical location of the study area with administrative breakdown.

Botanical description and geographical distribution of myrtle

Myrtus communis L. is a shrub with evergreen, belonging to the Myrtaceae family (Migliore 2012, Wahid 2013). It measures 1 to 3 m in height with upright and dense branches (Figure 2). It is characterized by its very open white flowers and numerous tufted stamens with a calyx tube welded to the ovary (Aafi et al. 2002). The leaves are opposite, ovate-lanceolate, leathery, glabrous, punctate-ting-

gular (Figure 2). This plant contains numerous secretory pockets, especially in the leaves, which give them a lanceolate fragrance. They are evergreen ovoid, persistent, and opposite 2 to 5 cm of length.

Myrtle is a typical species of the Mediterranean basin; it is native to southern Europe and North Africa (Migliore 2012). Since it extends from Macaronesia (Azores and Madeira) to the Iranian Uranian zone

(mountains of Alborz, Zagros and the Kerman region in Iran), and even, perhaps, in Asia (in Afghanistan or even Pakistan) (Migliore 2012, Wahid 2013). In Morocco, the common myrtle grows spontaneously in the scrubland of forest and peri-forest areas belonging to the cork oak, kermes oak plant series

and sometimes Aleppo pine forests, from Rif, Central Plateau, and the Middle and High Atlas (Aafi et al. 2005, Wahid 2013) (Figure 3). It develops on a most often siliceous and calcareous, substrate in subhumid, humid and perhumid climates with variant hot to temperate.



Figure 2. Presentation of the different biological parts of Myrtle (A: Branch. B: Shrub. C: Flowers. D: Fruits and leaves).

Elaboration of a questionnaire sheet

Ethnobotanical data collection was done with the administration of questionnaires containing a set of closed and semi-closed questions (Figure 4; see Hachi 2015, Salhi et al. 2010). The content of the questionnaire sheet has been established in order to collect as much information as possible on the therapeutic uses of medicinal and aromatic plants in relation to socio-cultural factors. This questionnaire contained two main parts; the first corresponding to the respondent's socio-cultural profile (age, gender, academic level, etc.). The second part of the questionnaire is devoted to the ethnobotanical knowledge of the local population and to the vernacular names of the marketed plants and included the Myrtle.

Survey and sampling methodology

The collection of ethnobotanical data from marketed plants is based on the printed questionnaire (Figure 4). The literate respondents completed the printed questionnaires themselves. If the respondents were illiterate, we fill edout the questionnaire. According to the administrative division of the communes in the region, we selected 14 strata in the study area for the data collection (Figure 1, Table 1). The choice of strata visited during our local population surveys was random based primarily on easy access. The strata correspond to the cities and towns closest to the piedmont and the high mountains. The choice of the mountains and piedmont strata is related to social inequalities in the health of local populations in these towns compared to that of the city. These local populations used ethnobotanical knowledge to cure themselves. This ethnobotanical knowledge tends to be lost over the generations as a result of the

unlearning phenomenon peculiar to urban civilization. On each stratum we surveyed a number of people ranging from 15 to 30 for a total of 280 interviewees (Table 1). The choice of respondents is based on a random stratified sampling (Gounot 1969), in order to understand the problem and to have an overall view on the traditional local uses of myrtle and on the floristic diversity of the

pharmacopoeia of this region. Ethnobotanical and socio-cultural interviews with the local population of the Beni Mellal-Khenifra region were conducted between March and July 2016. The survey interviewed 280 people of different ages, gender and educational levels, etc., who informed us about the therapeutic and traditional local applications of the plant species of the Beni Mellal-Khenifra region.

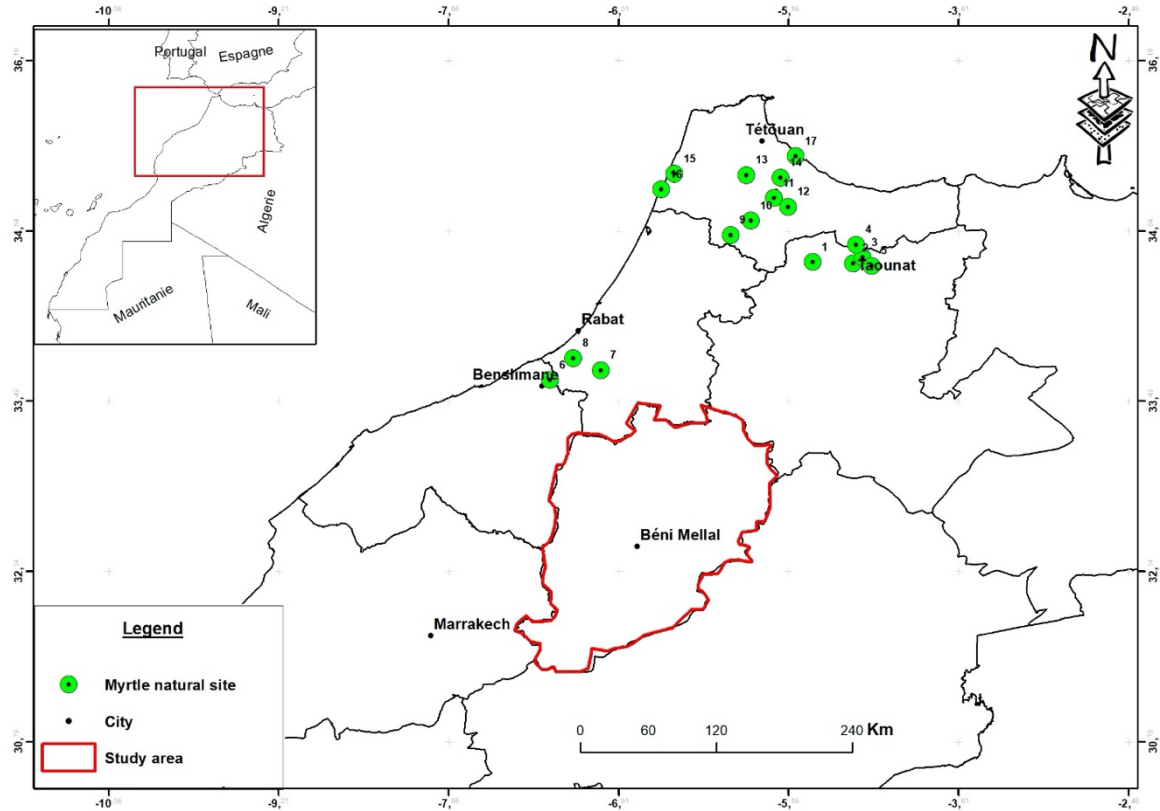


Figure 3. Distribution of natural Myrtle forests in Morocco compared to the study area.

Results and Discussion

Surveys of respondents in the study area showed that commercial medicinal and aromatic plants (MAP) occupy an important place among this population. The potential for ethnobotanical use of marketed MAP according to use, gender, family situation, etc. is analyzed and discussed in the sections below.

Floral analysis of medicinal and aromatic plants (MAP) used in the study area

Floral analysis of the data obtained on commercialized MAP in the study area made it possible to identify 80 species belonging to 37 families; 77 species belonged to angiosperms, divided between monocotyledons and dicotyledons, and 3 species belong to gymnosperms, represented by the members of Cupressaceae family. The dicotyledons were dominant with 72 species, or 90% of the total species in the region, while

monocotyledons represent only 5 species, or 6.25% and gymnosperms represent 3 species (Table 2).

Among the 37 plants families used in the study area, 4 families are clearly dominant in this medicinal flora: Lamiaceae (12 species or 15%), Asteraceae (10 species or 12.5%), Apiaceae (6 species or 7.5%), Euphorbiaceae 4 species or 5% (Table 3). These families alone hold 32 species, representing 42.5% of the total number of species. Next come the Euphorbiaceae, Caryophyllaceae, Myrtaceae and Cupressaceae, each of which encloses 3 species, i.e. a rate of 3.75% and all represent a rate of 15% of the total number of species. While Zingiberaceae, Oleaceae, Malvaceae, Lythraceae, Lauraceae, Apocynaceae, and Amaryllidaceae, each contain 2 species with a rate of 2.5% (representing 17.5% of the total number of species). The remaining families have one species for each with a rate of 1.25%, giving 27.5% of the total number of species (Table 3).

Interviewer Information

- Author (Investigator).....; . Statement number.....
- Date.....
- Municipality and region..... ; Strata.....

Socio-cultural information about the interviewee

- Age A1 <20 A2 [20-30] A3 [30-40] A4 [40-50] A5 [50-60] A6 >60
- Family situation : Single Married
- Sex : Male Female
- School and professional level: None Primary Secondary University Profession :...
- Locality : Douar Town City Nomad
- Collector Type : Nomad Shepherd Farmer Sedentary Other:
- Information Origin: Reading Achabe Pharmacist Experience of others
- Traditional medicine Modern medicine Both Reason :

Ethnobotanical information on Myrtle and local plants

- Vernacular name :; Scientific name :
- Type of plant : Wild Cultivated Imported
- Price (MAD/Kg) : < 10 [11-20] [21-30] [31-40] [41-50] >51
- Use of the plant : Therapeutic Cosmetic Others
- Harvesting technique: Manual Mechanical
- Collection period: Summer Autumn Winter Spring All year round
- Plant State: Fresh Dried After treatment
 - If dried, drying method:
- Part used: Stem Flowers Fruits Seed Bark Rhizome Bulb
- Leaves Whole plant Other combinations
- Use form: Herbal tea Powder Essential oils Fatty oils Extract (tincture, solution, capsule)
- Preparation mode : Infusion Decoction Cataplasm Raw Cooked Other : ..
 - Dose used: Pinch handle Spoon
 - Precise dose :
 - Quantity in g / glass :
 - Quantity in g/ litre :
 - Other :
- Administration mode : Oral Massage Rinsing Brushing Other.....
- Dosage: number of doses taken a day.
 - For children : 1 times/day 2 times/day 3 times/day Others
 - For Older People : 1 times/day 2 times/day 3 times/day Others
 - For Adults : 1 times/day 2 times/day 3 times/day Others
- Duration of use: One day One week One month Until healing
- Preservation method: Protect from light Exposed to light Others : ..
- Potential for pharmacopoeial use (Type of disease) :
 - Dermatological diseases
 - Digestive tract diseases
 - respiratory diseases
 - Accessory glands of digestive tract diseases
 - Cardiovascular diseases
 - Genitourinary diseases
 - Neurological diseases
 - Osteoarticular diseases
 - Metabolic diseases
 - Cosmetic
 - Culinary
- Diagnosis By: Himself The doctor The herbalist Others :
- Results: Healing Improvement Ineffective
- Side Effects:
- Toxicity:
- Precaution of use:

Figure 4. Ethnobotanical and socio-cultural questionnaire sheet adopted for this study.

Table 1. Presentation of the number of respondents by stratum selected in the area of study.

Strata	Province	Number of respondents
Tighassaline	Khenifra	30
Tintghaline	Khenifra	15
Sidi Yahya	Khenifra	20
Oussaâd		
Kerrouchen	Khenifra	15
El Kebab	Khenifra	18
Ait Isshaq	Khenifra	20
Ouawmana	Khenifra	20
Mrirt	Khenifra	25
Ghram Laâlam	Béni Mellal	20
Foum El Aansar	Béni Mellal	24
Tagzirt	Béni Mellal	15
Zaouit Cheikh	Béni Mellal	23
Ouawizaght	Azilal	20
Lehri	Khenifra	15
Total		280

Table 2. Systematic groups of commercialized MAPs identified in the study area.

Taxa	Number	Frequency (%)
Monocotyledons	5	6.25
Dicotyledons	72	90
Gymnosperms	3	3.75
Total	80	100

The traditional use of *Myrtus communis* L. as very limited (3.75%, Table 3) in comparison with the other MAPs. However, with its cosmetic and therapeutic virtues, this plant has become an important species in Morocco and internationally (Wahid 2013, Wahid et al. 2016). It is time to raise awareness and enrich the biodiversity used in traditional medicine of this species in the Béni Mellal-Khenifra region in a framework of sustainable development. The Béni Mellal-Khenifra region should put into perspective the valorization of this kind of advantage, through products intended for the cosmetics and perfumery, phytotherapy and pharmaceutical industries, but especially for the food industry. The local population of the region should be encouraged to cultivate this species and introduce improved varieties of economic value and significant social and ecological benefits. In the following sections below, we will discuss the results of the ethnobotanical potential of MAPs in general, but that of myrtle as like example in detail.

Ethnobotanical use of commercialized MAPs in the study area

The ethnobotanical analysis of the information collected allowed us to list a certain number of conditions treated by the MAPs marketed in the study area (Figure 5). Figure 5 shows that the

majority of PMAs were mainly involved in the treatment of diseases of the digestive system with a percentage of 26%, followed by diseases of the glands annexed to the digestive tract with a rate of 25%, then come respiratory diseases by 12.2% and genitourinary disorders by 8.4%. The rest of the conditions namely, osteo-articular conditions, metabolic conditions, neurological conditions, dermatological conditions and cardiovascular conditions represent low rates (6.6%, 6.5%, 5.9%, 5.4% and 4% respectively). Several studies have confirmed similar results regarding the quality of ethnobotanical use of MAPs in different regions of Morocco (e.g. Lahsissène et al. 2009, Mehdioui & Kahouadji 2007, Wahid 2013). They noted that digestive diseases occupy the first place in the use of medicinal and aromatic plants.

Table 3. Number and frequency of MAPs families used in the study area.

Family	Number	Frequency
Amaranthaceae	1	1.25
Amaryllidaceae	2	2.5
Anacardiaceae	1	1.25
Apiaceae	6	7.5
Apocynaceae	2	2.5
Asteraceae	10	12.25
Capparaceae	1	1.25
Caryophyllaceae	3	3.75
Cupressaceae	3	3.75
Euphorbiaceae	4	5
Fabaceae	1	1.25
Lamiaceae	12	15
Lauraceae	2	2.5
Lythraceae	2	2.5
Malvaceae	2	2.5
Moraceae	1	1.25
Myrtaceae	3	3.75
Oleaceae	2	2.5
Papaveraceae	1	1.25
Poaceae	1	1.25
Portulacaceae	1	1.25
Rhamnaceae	1	1.25
Rosaceae	4	5
Rubiaceae	1	1.25
Rutaceae	1	1.25
Thymelaeaceae	1	1.25
Verbenaceae	1	1.25
Zingiberaceae	2	2.5
Ericaceae	1	1.25
Brassicaceae	1	1.25
Ranunculaceae	1	1.25
Plantaginaceae	1	1.25
Cistaceae	1	1.25
Cucurbitaceae	1	1.25
Nitrariaceae	1	1.25
Urticaceae	1	1.25
Total	80	100

For most of the MAPs marketed in the study area, the leaves were the most used biological part (Figure 6). The leaf utilization rate was 37%. The rate of use of the stem for ethnobotanical care was 21.2%, followed by the whole plant (18.2%). The fruits and flowers were used for ethnobotanical care with a rate of 10.4%, followed by the rhizome (9.7%). The seeds, barks and bulbs were co-consumed by a cumulative percentage of 3.5% (Figure 6). According to Ouattara (2006), removing 50% of the leaves from a tree does not significantly affect its survival. While

the current method of exploiting bark and roots does not always guarantee the sustainability of the species. Hachi (2015) considered trees to be the most vulnerable morphological types to this mode of exploitation. Perennial bulbs or tubers represent another category of species threatened by excessive exploitation of their underground parts (Hachi 2015). Collecting the seeds of annual plants will generally have a greater impact on the survival of the species than that of seeds of perennial plants (Hachi 2015).

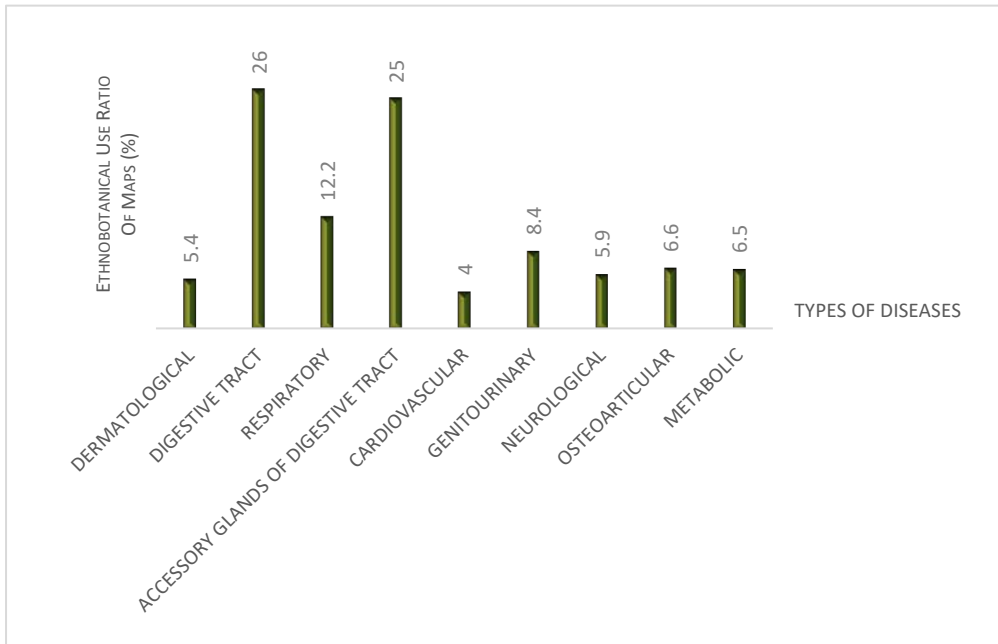


Figure 5. Distribution of ethnobotanical use rates of marketed MAPs according to the conditions treated in the study area.

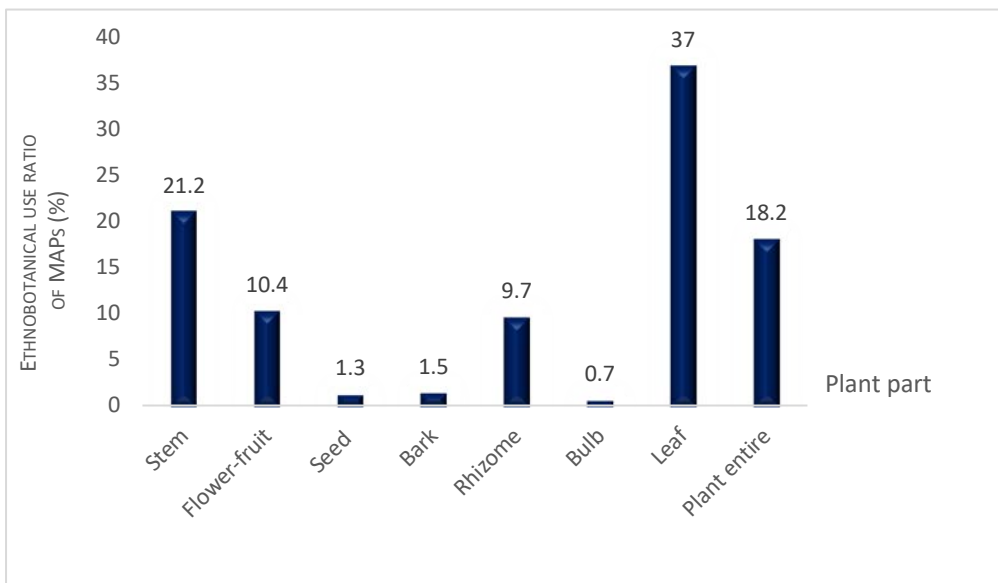


Figure 6. The rate of use of the different biological parts of MAPs by the populations of the study area

Potential use of MAPs commercialized according to the socio-cultural elements of the study area

Potential use of MAPs commercialized according to age

The use of marketed MAPs in the study area as widespread in all age groups with predominance in people aged 40 to 50 (33.6%) (Table 4). The 30 to 40, 50 to 60 and over 60 age groups came next with rates of 27.1%, 22.1% and 10.7% respectively (Table 4). For the 20 to 30 year age group, there was a rate of 6.4% of use of MAPs (Table 4). Knowledge of the properties and uses of medicinal plants was generally acquired through long experience accumulated and transmitted from one generation to another. The transmission of this knowledge is currently in danger because it is not always ensured (Anyinam 1995). The results obtained in this study show that people belonging to the age group 40 to 50 had more knowledge of ethnobotanical use compared to other age groups. There has been a loss of ethnobotanical information on MAPs among

young people, who tend to no longer believe too much in this traditional medicine for their medical safety.

Potential use of of MAPs commercialized according to gender

Across the study area, women and men are concerned with traditional medicine, with a slight predominance of women. Among those who practice traditional medicine, 51.8% are women and 48.2% are men (Table 4). This can be explained by the fact that women are traditionally the keepers of the secrets of medicinal plants. They give first aid in particular to their children. Heirs to a rich family knowledge, through the transmission of knowledge, they testified to a knowledge adapted to their family and their needs (Aquaron 2005). Several studies have shown that women are more holders of traditional phytotherapeutic knowledge (e.g. Mehdioui & kahouadji 2007, Benkhniqne 2011, Benlamdini 2014, Daoudi 2015).

Table 4. Use of MAPs and Myrtle according to the socio-cultural elements in the study area.

Socio-cultural elements of respondents	Age group (Year)					Gender		Academic level			
	20-30	30-40	40-50	50-60	>60	Female	Male	Illiterate	Primary	Secondary	Academic
Ethnobotanical use rate of MAPs (%)	6.4	27.1	33.6	22.2	10.7	51.8	48.2	76.4	16.8	3.9	2.9
Ethnobotanical use rate of Myrtle (%)	0	32	48	20	0	72	28	52	24	16	52

Potential use of MAPs commercialized according to education level

The illiterate population traditionally tends to use plants more than other categories of the intellectual level with a rate of 76.4% (Table 4). People with a primary education had a significant percentage of use (16.8%). Those with secondary and university education used herbal medicine less (3.9% and 2.9% respectively).

Ethnobotanical use of Myrtle in the study area

The surveys carried out among the population living in the piedmont and the high mountains (14 strata, Table 1) of the Beni Mellal-Khenifra region revealed that the use of myrtle was cited by 25 respondents, i.e. a percentage of almost 9%, compared with the 280 people interviewed as a total (Figure 7.A). This shows that the common myrtle occupies a significant place in the traditional medicine of the population of the study region compared to local plants for ethnobotanical and pharmacopeial use. Although myrtle is not a local or domesticated plant within the study area, the population buys it for their traditional uses. The migration flow of information on the importance and ethnobotanical value registered in several regions of Morocco (Wahid 2013), where the

forests of Myrtle are natural, is very high between the northern and southern regions of Morocco.

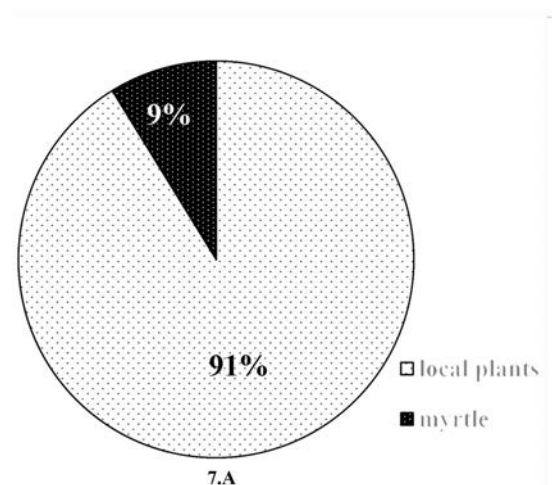


Figure 7A. Percentage of use of Myrtle according to commercialized MAPS

Thus, analysis of the information collected on ethnobotanical uses in the study region allowed us to identify a certain number of therapeutic and cosmetic uses for myrtle (Table 3). The analysis of the ethnobotanical use result of Myrtle in the study area

showed that it is used principally in the treatment of dermatological anomalies with a percentage of 44% (Figure 7.B), namely: toning the skin, controlling hair loss, softening and darkening hair. Other uses of myrtle include the treatment of metabolic abnormalities such as diabetes with a percentage of 24%, diseases of the digestive tract (16%, Figure 7.B), and diseases of the glandular appendages of the digestive tract (16%, Figure 7.B) as an antibacterial and antiseptic treatment. Similarly, in the other regions of Morocco; namely the regions of Taounate and Taza (Northern Morocco), Zaër (Western Morocco), and the Rissani oases (South-East Morocco), the most frequent uses in traditional medicine of the Common Myrtle are hair care and gastrointestinal difficulties (Bellakhdar et al. 1991, El-Hilaly et al. 2003, El Mansouri et al. 2011, Khabbach et al. 2012, Lahsissène et al. 2009). In addition to these uses in traditional medicine revealed in the Beni Mellal-Khenifra region, it should be noted that myrtle leaf infusion is used against respiratory diseases, heart disease and constipation in other regions of northern Morocco (El-Hilaly et al. 2003, Ennabili et al. 2000, González-Tejero et al. 2008). Also, myrtle leaves are exploited in aromatic extracts and essential oils extracted by several cooperatives and associations in the northern regions of Morocco (Ghanmi et al. 2011). In pastoral care, it is a source of organic matter for animals (Ennabili et al. 2000).

The Common Myrtle has known a wealth, importance and success of use in other regions of Morocco to cross the ages and the civilizations. For this reason, it is time to raise awareness and enrich the biodiversity used in traditional medicine of this species in the Béni Mellal- Khenifra region within a sustainable development framework. The Béni Mellal- Khenifra region should put into perspective the development of this species of advantage, through products intended for the cosmetics and perfumery, phytotherapy and pharmaceutical industries, but especially for the food industry. The local population of the region should be encouraged to grow this species and to introduce improved varieties of economic value and important social and ecological benefits.

According to the results of the surveys carried out in this study, it is very clear that all users refer to the experiences of other regions and to the instructions of the Aachabes (herbalists) to use Myrtle as a remedy against traditional therapeutic and cosmetic treatments (Figure 7.C). However, none of the respondents stated that they rely on reading or the pharmacist to use this plant as a remedy (Figure 7.C). This reflects the image of the relative transmission of traditional practices and therapeutic knowledge from one region to another over time.

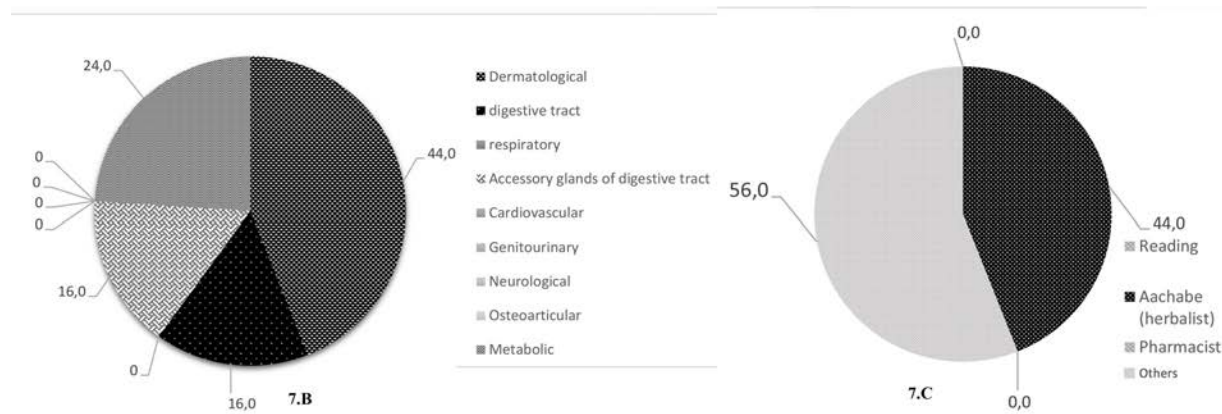


Figure 7B/C. Traditional use of Myrtle according to different therapeutic and treatment (7.B) and of users by origin of information dissemination (7.C).

Methods of using Myrtle in the study area

Parts of the plant used

In the study area, it is noted that all respondents use only myrtle leaves (Table 5) in the preparation of recipes to treat and remedy declared therapeutic and cosmetic abnormalities. The synthetic review conducted by Wahid (2013) noted that the leaves are the only part of the common myrtle used in traditional medicine in Morocco. This result could be explained by the reason that people believe that all active ingredients are concentrated only in the leaves of the plant. However, the active ingredients may be

located in different parts of aromatic and medicinal plants (leaves, flowers, roots, bark, fruit, seeds, rhizome, etc.) (Bellakhdar 1997).

Dosage used

Survey results revealed that most respondents do not use specific doses, but they do not consider high doses in myrtle recipes to avoid toxicity risks. The use of plants in traditional medicine can only be toxic by repeated, prolonged and excessive use in the daily diet (Bellakhdar 2006).

Myrtle leaf directions for use

The analysis of survey results in the study area showed that myrtle leaves are used in two directions for use: herbal tea (52%) and powder (48%) (Table 5). On the other hand, the population does not use myrtle in the form of essential oils or fatty oils because of the lack of knowledge and material for obtaining these compounds and due to their high cost.

Method of preparing myrtle leaf recipes

According to the Table 5, it is noted that aqueous decoction and infusion are the methods of preparation of myrtle leaf recipes in the Beni Mellal-Khenifra region with a proportion of 40% and 56%, respectively. These proportions show that the local population is growing in decoction mode and finds it suitable for therapeutic and cosmetic treatments. Namely that decoction collects the most active ingredients and reduces or cancels the toxic effect of certain recipes (Salhi et al. 2010).

Table 5. Therapeutic and cosmetic uses of Myrtle in the study area.

Part used	Used mode	Preparation mode	Uses
Leaves (100%)	Herbal tea (52%) Powder (48%)	Infusion (40%) / decoction (56%) = (96%) Raw (4%)	<ul style="list-style-type: none"> • Infusion and decoction of the leaves are used against spasms, diabetes and gastrointestinal abnormalities, as well as for skin toning. • Decoction leaves are used for softening and toning hair. • Myrtle leaf powder mixed with henna is used for blackening and controlling hair loss.

Potential use of Myrtle according to the socio-cultural elements of the area of study**Potential use of Myrtle according to age**

Myrtle use is widespread among people aged 40 to 50 (48%), followed by those aged 30 to 40 (32%) and those aged 50 to 60 (20%) (Table 4). On the other hand, people under 30 and over 60 years of age do not frequently use myrtle. These results show that people in the 40 to 50-year-old age group have more knowledge of Myrtle uses compared to other age groups. The knowledge of the properties and uses of myrtle is generally acquired following a long experience accumulated and passed on from one generation to the next. The transmission of this knowledge is currently in danger because it is not always ensured among the younger generations (Anyinam 1995). The experience accumulated with age is the main source of information at the local level about the use of common myrtle in traditional medicine. This result also reveals a loss of information on ethnobotanical practices, following the mistrust of young people. The latter no longer tend to believe too much in this traditional medicine for their medical safety.

Potential use of Myrtle according to gender

In the study area, women and men are concerned by the use of myrtle, with a predominance of women. Indeed, among the individuals surveyed 7 men (28%) declare that they use Myrtle in traditional care, in contrast, 18 women (72%) who declared their use

of Myrtle (Table 4). This can be explained by the fact that women are traditionally the keepers of the secrets of medicinal plants. Thus, they use plants in areas of therapy with their responsibility as mothers. They are the ones who give first care, especially for their children. Heirs to a rich family knowledge, through the transmission of knowledge, they bore witness above all to a knowledge adapted to their family and their needs (Aqaron 2005). These results confirm other ethnobotanical studies conducted at the national level, which have shown that women are more the holders of traditional phytotherapeutic knowledge.

Potential use of Myrtle according to education level

Of all Myrtle ethnobotanical users, illiterate people dominate with a percentage of 52% (Table 4). Those with primary education use Myrtle in some care with a percentage of 24%, followed by those with secondary education (16%). While academics do not frequently use myrtle as in traditional medicine.

Conclusions

The present study has allowed us to reveal that the most of commercialized MAPs are used primarily in the care of the digestive system and the glands attached to the digestive tract. The foliage is the most used part in the treatment of these affections, and the decoction represents the method of preparation most practiced by the local population. The

ethnobotanical results obtained show that it would be possible to use certain plants in development socio-economic and in particular in the Moroccan rural world. Among the commercialized MAPs there is Myrtle specie. Or, following to its cosmetic and therapeutic virtues, this plant become an important species in Morocco or internationally.

The analysis of the results obtained in this study showed that the leaf part of Myrtle occupies a significant importance in traditional phytotherapy in the Beni Mellal-Khenifra region. It confirmed the therapeutic and cosmetic virtues used in the other regions of Morocco. The female gender, aged between 40 and 50 years, traditionally uses the commercialized MAPs as well as the Myrtle more than the male gender. Whatever the gender, the illiterate use MAPs more than the educated. All the information collected on floristics used in phytotherapy in the study area shows the wealth of knowledge of the local population which has a rudimentary social level. Considering the importance of Myrtle use in Morocco or internationally and following its cosmetic and therapeutic virtues, it is time to raise the awareness and enrich the traditional know-how of this species in the region of Beni Mellal-Khenifra within a framework of sustainable manner. The Beni Mellal- Khenifra region should put into perspective the development of this species of advantage, through products intended for the cosmetics and perfumery, phytotherapy and pharmaceutical industries, but especially for the food industry. The local population of the region should be encouraged to grow this species and to introduce improved varieties of economic value and important social and ecological benefits. Indeed, the valorization of these traditional practices could be an empirical basis for the elaboration of a solid scientific knowledge within the framework of the research of bioactive molecules and the valorization of the local social level.

Declarations

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manuscript. Rahima Faïda contributed to the series of ethnobotanical and socio-cultural surveys. Abdelali Boulli and Aziz Hassib contributed to the realization of this work.

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