

Ethnobotanical investigation and phytochemical screening of two species of the lamiaceae family in el-bayadh province (Western of Algeria)

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An ethnobotanical survey was carried out on 200 people of different age categories, sex, professional situation and level of education in the province of El Bayadh; to find out the different traditional uses of two species belonging to the Lamiaceae family: *Rosmarinus officinalis alba*.L and *Mentha spicata*.L. This preliminary study was complemented by a phytochemical screening to identify the main secondary metabolites that make them plants with therapeutic virtues. Our results revealed that the leaves are the most used parts in the form of infusion, decoction and essential oils. Rosemary shows therapeutic effects concerning biliary insufficiency, which occupies the first place with a percentage of 40%, followed by digestive disorders 30%, and rheumatic disorders 30%. Whereas Mint is used for the treatment of various pathologies, neurological, digestive, circulatory, respiratory and rheumatic with respective percentages (38%, 30%, 21%, 8.50%, 2.50%). Phytochemical screening confirms the richness of these two species in alkaloids, tannins, flavonoids, carotenoids, saponosides, coumarins, quinones, glycosides and reducing compounds.

Keywords: *Rosmarinus officinalis alba* L, *Mentha spicata* L, El Bayadh, Ethnobotanical, Phytochemical screening.

Introduction

Medicinal plants constitute a very important natural resource whose development requires a perfect knowledge of the properties to be developed. These properties depend on the presence of various bioactive agents belonging to different chemical classes (Maihebiau, 1994, Rahou, 2017). The class of phenolic compounds, present in all higher plants, corresponds to a very wide range of chemical structures and is characterised by a very unequal qualitative and quantitative distribution according to the species considered but also according to organs, tissues and stages (Marcheix et al., 2005, Rahou, 2017). Among the properties underlying their biological activities are their capacity to bind to proteins (enzyme inhibition) and their antioxidant character (free radical scavenging) (Marcheix et al., 2005). Man has always used various plants found in his environment to treat and cure all kinds of diseases. It is estimated that at least 25% of all modern medicines are derived, directly or indirectly, from medicinal plants, mainly through the application of modern technologies to traditional knowledge (Selles, 2012). However, the Algerian flora with its more than 3000 species, of which 15% are endemic, remains little explored in terms of phytochemistry and pharmacology (Boukerker et al., 2016). The species identified in the province of El Bayadh, divided into 25 families, deserve to be protected and studied, and can be the subject of intensive cultivation to balance the excessive use of these plants (Bouzid et al., 2017), especially those belonging to the Lamiaceae family which are used for the treatment of common diseases in the region. The Lamiaceae family contains a large variety of plants mainly in temperate countries, it includes about 285 genera for 6900 more or less cosmopolitan species, but most of them are concentrated in the Mediterranean basin like thyme, lavender and rosemary (Bentabet, 2015). However, the main objective of this contribution is to better understand the different ways of using Rosemary (*Rosmarinus officinalis alba*. L) and Mint (*Mentha spicata*. L) of the Lamiaceae family through an ethnobotanical study in El Bayadh province. Also, in order to valorise the bioactive substances of these two species, a phytochemical screening to identify the main classes of secondary metabolites was adopted.

Materials and Methods

Presentation of the study area

The province of El Bayadh covers an area of 7 169 670 ha between the parallels 30°42' and 34°28' of the northern altitude and between the meridians of longitude 0°24' to the west in zone 30 and 2°16' to the east in zone 31 (National Investment for Development Agency, 2013). 1,272,223 ha of its surface area are classified as desert, 5,703,534 ha as steppe rangeland, and 122,211 ha as forest and scrubland, including 28,400 ha of reforestation of the Green Dam and 71,702 ha of useful agricultural area representing a ratio of 0.29 ha/inhabitant (Mederbal, 2002). The climate is arid in the pre-Saharan zone and the Saharan Atlas and semi-arid in the high plains, with very low rainfall (less than 200mm/year) of limited duration and high intensity, with a harsh winter

with an average temperature of 6°C, and a hot summer of 36°C (Benslimane et al., 2007). The province of El Bayadh is a very sensitive area to desertification because of the climate and overgrazing. The spontaneous medicinal species in the region are very irregular (Benslimane et al., 2007) (Fig. 1).



Fig. 1. Study area (Province of El Bayadh, western of Algeria).

Plant material

For our work, the two selected species were collected from the province of El Bayadh. The botanical identification was determined by the herbalists of the region of Bresina and confirmed in the laboratory of plant taxonomy of the faculty of natural and life sciences of the university of Sidi Bel Abbes with the determination key: la nouvelle flore de l'Algérie of Quezel et Santa 1962.

***Mentha spicata*. L**

Mint is a perennial plant of the Lamiaceae family, genus *Mentha*, cultivated as an aromatic plant (Fig. 2a).

***Rosmarinus officinalis alba*. L**

Rosemary is a highly aromatic, green, linear, evergreen perennial plant of the Lamiaceae family. It has a semi-creeping habit, very hardy with white flowers in autumn and at the end of winter (Fig. 2b).

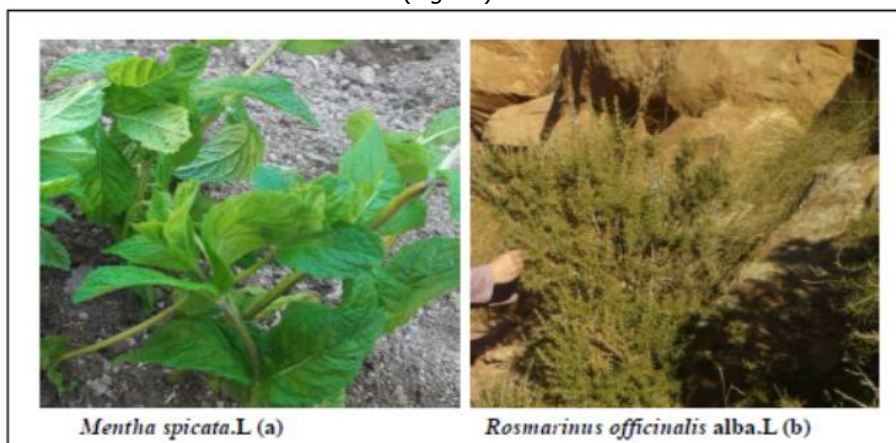


Fig. 2. Plant material used in this study.

Methodology of the ethnobotanical survey

We carried out the ethnobotanical study of rosemary and mint in the communes of El Bayadh, Sidi Amar, Krakda, Brésina, and El Abiodh Sidi Cheikh. After collecting data from the local population. The information was obtained using 200 survey forms for each species, individuals from the population or informants are chosen in a random way to express themselves freely, even if they will give details that are not requested. The questionnaire lasted 6 months and concerned the level of education, age, sex, family situation, parts used of the plant, method of preparation and therapeutic use or diseases treated.

Phytochemical screening

The parts used in this study were two organs (stems and leaves). The samples were cleaned and then dried at room temperature in a shaded ventilated area to better preserve the sensitive molecules, in order to proceed to the grinding step. Phytochemical screening is a qualitative method to detect the presence of groups of chemical families in plant extracts, by precipitation reactions or staining reactions (Badiaga, 2011). The main chemical constituents present in deferent extracts are identified by color reactions. The following chemical groups were identified by classical characterisation reagents: alkaloids (Dragendorff Mayer reagents)(Trease et Evans, 1997), tannins (FeCl₃ reactions) (Harbornej, 1998, Trease et Evans, 1997), reducing compounds (Fehling reagents) (Mibindzou, 2004), flavonoids (cyanidine reaction) (Bentabet, 2015), Harbornej, 1998, Trease et Evans, 1997), quinones and coumarin test (NaOH reaction) (Aworet,2003) and saponosides (foam index) (Lumbu et 2005), carotenoids (SbCl₃ reaction) (Bentabet, 2015), cyanogenetic compounds (CHCl₃ reaction) (Bentabet, 2015), cardiac glycosides (H₂SO₄ reaction) (Bruneton,

2009), Test for triterpenes and sterols (reaction of acetic anhydride and hydrochloric acid) (Mamadou, 2012, Bentabet, 2015), Test for steroids (reaction of acetic anhydride and concentrated H₂SO₄) (Lumbu et 2005).

Results

The use of Rosemary in El Bayadh concerns all age groups, with people aged between 20 and 40 years having the highest frequency of use, 40, 65% (Fig. 2). The 40 to 60 and 60 and over age groups come next with a percentage of 31% and 18% respectively. While for the very young (under 20 years) the percentage is very low. Women use the species more than men (75% against 25%), because they are the first to care for children as mothers. Regarding the level of education, the results obtained show that the majority of users are illiterate (40.92%), although the population with primary, secondary and higher education levels have a significant percentage of 20.80%, 20.80% and 17.28%. The results indicate that the leaves are the most used parts with 96%, while the stems and flowers are very little represented (2% for each organ). Decoction (34.5%) is the dominant method of preparation, followed by infusion (31.5%), essential oils (28%) and cataplasm (6%). To facilitate the use of drugs, four preparation techniques are used, namely: infusion 31.5%, decoction 30.5% in the belief that hot water solubilises the active molecules better, essential oil 32% and cataplasm 6%. The table shows that the respondents use the plant to treat three diseases: biliary insufficiency (40%), digestive problems (30%) and rheumatism (30%). The percentage of the population questioned on the use of Mint was 40.65% aged between 20 and 40 years, 31% between 40 and 60 years, 10.35% under 20 years, and 18% 60 years and over. The statistics show that women use more Mint to treat themselves or their families with a percentage of 58% against 42% for men. Illiterate people represent the largest percentage (33.50%) followed by 26.50% of people with primary level, secondary and higher levels represent the same percentage of the surveyed population 20%. Our study revealed that the foliage is the most used part of the plant (80%), while the stems come second (20%). The most dominant method of preparing remedies is decoction (41.20%), followed by infusion and essential oils (28.80% and 30% respectively). These remedies are still very much appreciated by the local population of the region in the treatment of various illnesses, notably neurological (38%), digestive (30%), blood circulation (21%), respiratory (8.5%) and rheumatism (2.5%).

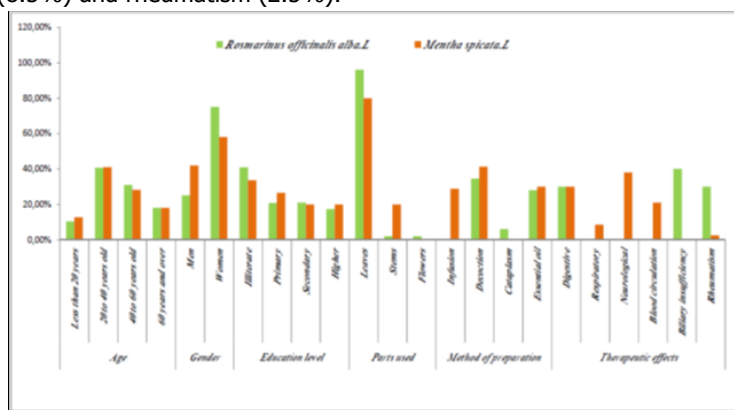


Fig. 2. Results of the ethnobotanical study of the two species studied.

The phytochemical screening

For Rosemary and according to Table 1 there is a high presence of alkaloids in the leaves and flowers compared to the stems. Gallic and catechic tannins are very present in the studied parts of the plant. A very intense purplish-pink colouration was observed in all three tests, indicating the presence of very high amounts of flavanones. Leucoanthocyanins are weakly present in the leaves and stems and very abundant in the flowers. Flavones, anthocyanins and cyanogenetic compounds tested negative (no colour change) (Table 1). Carotenoids and saponosides are very abundant in leaves and stems while they are present in trace amounts in flowers. Steroids are observed only in leaves, while coumarins, free quinones, cardiac glycosides, reducing compounds are strongly noticed in leaves, stems and flowers. On the other hand, negative tests are recorded for triterpenes and phytosterols. for Mint, and according to the results of Table 2 we notice that alkaloids are very abundant in the leaves but have a low presence in the stems and flowers. Tannins are strongly present in the leaves and flowers in the catechic and gallic forms, but only in the stems. A very positive test was noted for two types of flavonoids (flavones and flavanones) concerning the three organs of mint, which could imply interesting biological activities in this case antioxidant and anti inflammatory activity. The screening for leaves, stems and flowers revealed an abundance of other chemical compounds, namely free quinones, cardiac glycosides, reducing compounds, triterpenes and phytosterols. On the other hand, negative reactions were noted for the tests for: leucoanthocyanins, anthocyanins, cyanogenetic compounds, carotenoids, steroids and coumarins (Table 2).

Table 1. Results of phytochemical screening of *Rosmarinus officinalis alba L.*

Substances	Leaves	Stems	Flowers
Alkaloids	+++	+	+++
Catechic tannins	+++	+++	+++
Gallic tannins	+++	+++	+++
Flavonoids			
Flavones	-	-	-
Flavanones	+++	+++	+++

	Leucoanthocyanes	+	+	+++
	(Flavane-3,4-diols)			
	Anthocyanins	-	-	-
Cyanogenetic compounds		-	-	-
Carotenoids		+++	+++	+
Saponosides		+++	+++	+
Steroids		+	-	-
Coumarins		+++	+++	+++
Free quinones		+++	+++	+++
Cardiac glycosides		+++	+++	+++
Reducing compounds		+++	+++	+++
		-	-	-
Triterpenes and phytosterols				

Table 2. Results of the phytochemical screening of *Mentha spicata*. L.

Substances		Leaves	Stems	Flowers
Alkaloids		+++	+	+
Catechic tannins		+++	+	+++
Gallic tannins		+++	+	+++
Flavonoids	Flavones	+++	+++	+++
	Flavanones	+++	+++	+++
	Leucoanthocyanes	-	-	-
	(Flavane-3,4-diols)			
	Anthocyanins	-	-	-
Cyanogenetic compounds		-	-	-
Carotenoids		-	-	-
Saponosides		+++	+++	+++
Steroids		-	-	-
Coumarins		-	-	-
Free quinones		+++	+++	+++
Cardiac glycosides		+++	+++	+++
Reducing compounds		+++	+++	+++
		+++	+++	+++
Triterpenes and phytosterols				

Discussion

Our study was focused on an ethnobotanical study and biochemical characterization of *Mentha spicata*. L and *Rosmarinus officinalis alba*. L. We notice for both species studied that there is a strong presence of alkaloids in the leaves compared to the stems and flowers. Gallic and catechic tannins are very present in the leaves and flowers. Very high amounts of flavanones were found in all three organs of mint and rosmarinus, which could imply interesting biological activities, namely antioxidant and anti-inflammatory activity. Hassani et al., 2016; mentioned that the methanolic extract of rosemary contains very high contents of flavonoids, and variations can be encountered in the contents of the latter and they are due to certain ecological factors, the part of the plant used, the age of the plant and the period of the vegetative cycle, or even genetic factors. Carotenoids and saponosides are very abundant in the leaves and stems, while they are present in trace amounts in the flowers. Steroids are observed only in leaves, while coumarins, free quinones, cardiac glycosides, reducing compounds are strongly noticed in leaves, stems and flowers. According to Macheix et al., 2005; for a given plant species, the different organs can present very different phenolic equipments. Catechic tannins, anthocyanins, flavonoids, saponosides and terpenes and sterols possess several beneficial properties including antimicrobial, antioxidant, anti-inflammatory, vasculo-protective, antiulcer and many others (Bicchi et al., 2000, Bruneton, 2009, Harach et al., 2010). This variability is due to several factors such as: the presence of different types of enzymes that can modify phenolic compounds, in particular polyphenol oxidases and glycosidases, drying conditions can modify enzymatic functions and constitute a destructive factor of polyphenols (Bruneton, 2009, Hossain et al, 2010). Climatic factors can influence the quality and quantity of polyphenols, as well as variation in geographical area, drought, soil type, genetic make-up, and the relationship between harvest time and development stage (Kwon et al, 2006, Hossain et al, 2010, Cui et al, 2012). The presence of these secondary

metabolites at the level of the studied plant explains their high therapeutic power. Therefore, these results justify the wide use of these two plants in traditional medicine by the local population. According to our investigation, the infusion mode, decoction and essential oil are the most appreciated by the population surveyed to different degrees for the treatment of various diseases including neurological, digestive, blood circulation, respiratory, rheumatism, biliary insufficiency.

Conclusion

Traditional herbal medicine is currently in demand by people who trust in folklore and who cannot afford the consequences of modern medicine. This without forgetting the important current return to alternative medicine. Thus, the present work was carried out with the aim of carrying out an inventory as complete as possible on two medicinal plants, namely rosemary and mint, used in the province of El Bayadh, and to gather information concerning their practical therapeutic uses. The series of ethnobotanical surveys made it possible to appreciate and know the traditional practices used by the population. The richness of this know-how appears through the results obtained but it is important, on the one hand, to extend this kind of investigation to other regions of the country in order to safeguard this precious natural heritage through the most complete monograph possible, and on the other hand, the experimental validation of these remedies listed through rigorous scientific protocols. The phytochemical screening results obtained on the different parts of these two plants have proved that they contain different groups of chemical compounds. Finally, this ethnobotanical and phytochemical study proved the traditional and frequent use of these two species in the province of El Bayadh, hence the need to manage conservation methods to fight against the over-exploitation and extinction of this wealth.

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