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# Ethnomedical Knowledge and Traditional Uses of Aromatic and Medicinal Plants of the Wetlands Complex of the Guerbes-Sanhadja Plain (Wilaya of Skikda in Northeastern Algeria)

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## Abstract

In Algeria, little research has focused on the use of spontaneous plant species in traditional medicine. Indeed, the majority of his work was based on surveys with users, neglecting the floristic aspect of the field. In this context, we carried out a floristic and ethnobotanical study with the residents of Guerbes-Sanhadja.

In order to know the medicinal plants traditionally used by the population of the villages and hamlets of the wet complex of Guerbes-Sanhadja, a floristic and ethnobotanical study was carried out in this region. 150 people were interviewed consecutively between January and May 2015. Ethnobotanical data were collected and their habits in traditional medicine were detailed.

The study of the medicinal flora made it possible to inventory 52 genera and 81 species belonging to 52 botanical families. Similarly, a series of ethnobotanical surveys carried out, using a questionnaire, made it possible to collect a certain amount of information. The results of this study showed that foliage is the most used part of the Aboriginal population. The majority of remedies are prepared as an infusion. Of all the diseases treated, digestive disorders represent the most cited diseases.

The results obtained constitute a very valuable source of information for the region studied concerning the Algerian medicinal flora. This will undoubtedly constitute a database for further research in phytochemistry and pharmacology whose purpose is to discover new natural substances of plant origin.

**Keywords:** Ethnomedicine; Guerbes-sanhadja; Medicinal flora; Ethnobotany

## Introduction

Medicinal plants are a significant treasure for human health, especially in developing countries. The availability of these plants provides primary treatment for the sick [1]. Notwithstanding the development of synthetic drugs and the progress of pharmacology, the plant medicine, in its various forms, continues to occupy a prominent place. There are thus cardiotoxic (*Digitalis*, commonly called foxgloves), purgatif (alder buckthorn, or glossy buckthorn), modifiers of the autonomic nervous system (*Belladonna* or deadly nightshade), antidiarrheals (Rosaceae) and others [2].

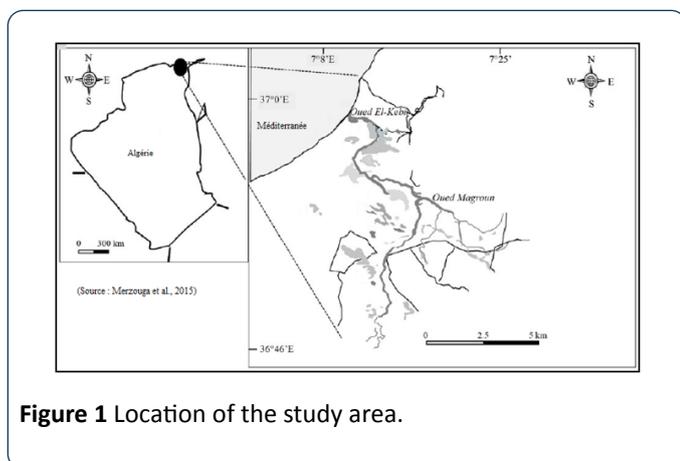
Among the scientific disciplines that are interested in traditional phytotherapy, ethnobotany is considered a science that allows the translation of popular know-how into scientific knowledge [3]. The passage of information by the ancestors is completed by the development of modern medicine [4], and he is now only held by a few people [5], hence the need to conduct ethnobotanical research on medicinal plants in different localities of Algeria in order to safeguard the knowledge acquired by the indigenous population [6].

The Algerian flora constitutes a true phylogenetic reservoir, with about 4,000 species of vascular plants [7], which allows it to occupy a privileged place among the Mediterranean countries which have a long medical tradition and a traditional know-how based on medicinal plants [8]. The majority of work on the aspect of the use of spontaneous species in traditional medicine is based on surveys with users while neglecting the floristic aspect of the field. The aim of this study is to conduct an ethnobotanical survey of the riparian population, to identify and characterize vascular plants by highlighting their therapeutic virtues.

## Materials and Methods

### Presentation of the study area

The eco-complex of the Guerbès-Sanhadja (36°46'-37°1' N, 7°8'-7°25' E) wetlands is limited to the northeast by the Edough Massif, in the north-west by the Filfila massif, to the south-west by the Boumaïza massif and it extends to the South-East to near Lake Fetzara (**Figure 1**). The total area of the wetland complex is 42,100 ha and the area of the wetland proper is around 20,000 ha [9]. This eco-complex is located in a sub-humid floor bordering the Chetaïbi mountains to the east and the Skikda coastal hills to the west [10].



**Figure 1** Location of the study area.

### Ethnobotanical investigation

An ethnobotanical investigation was conducted in the Guerbès-Sanhadja region over a period of five months

**Table 1** List of registered medicinal plants, therapeutic properties and methods of preparation.

Taxa	Biological Types	Therapeutic Interests	Modes of Preparation	Used Parts
<i>Adiantum capillus-veneris</i> L.	Hemcryptophyte	Respiratory tract treatment	Powder	Air part
<i>Allium triquetrum</i> L.	Geophyte	Vermifuge and hypotensive	Decoction	Bulbs
<i>Alnus glutinosa</i> (L.) Gaertn.	Phanerophyte	Healing and anti-inflammatory	Decoction	Barks and leaves
<i>Ammi visnaga</i> (L.) Lam.	Therophyte	Treatment of constipation	Infusion	Umbels
<i>Anagallis crassifolia</i> Thore	Hemcryptophyte	Diuretic	Infusion	Leaves
<i>Apium crassipes</i> (Koch) Rchb.	Hydrophyte	Antirheumatic	Infusion	Seeds
<i>Asparagus officinalis</i> L.	Geophyte	Treatment female sterility	Decoction	Rhizomes
<i>Asphodelus ramosus</i> L.	Geophyte	Vulnerable and antiseptic	Oil	Tubers
<i>Bellis prostrata</i> Pomel	Therophyte	Treatment of arteriosclerosis	Infusion	Leaves
<i>Borago officinalis</i> L.	Therophyte	Emollient	Infusion	Leaves
<i>Callitriche obtusangula</i> Le Gall.	Hydrophyte	Diuretic	Infusion	Leaves
<i>Calystegia sepium</i> (L.) R.Br.	Chamaephyte	Antipyretic	infusion	Leaves
<i>Centaurea napifolia</i> L.	Hemcryptophyte	Digestive	Infusion	Flowers
<i>Centaureum spicatum</i> (L.) Fritsch ex Janch.	Therophyte	Digestive	Infusion	Leaves

(January-May 2015) with 150 people of different age groups from whom we obtained samples of harvested plants. The investigation was based on a pre-established questionnaire containing information on the therapeutic interest, the part used and the method of preparation.

The identification of the collected samples was made from the flora of Quézel et al. [11] and the flora of North Africa of Maire [12]. The new nomenclature has been updated for inventoried species taking into account recent work compiled in the synonymic and bibliographic index of North African flora [7]. The species were recorded by their biological types recomposed according to Raunkiaer [13], Pignatti [14], Blanca et al. [15] and according to our own observations. Endemic species are recorded according to Dobignard et al. [7].

The species are also ranked according to their degree of rarity (Rare, or uncommon: R, Very Rare: VR). Let's add for endemic species (Common: C, Fairly Common: FC, Quite Rare: QR) as indicated by the flora of Quézel and Santa [11].

## Results

Of the 52 botanical families identified in the investigation, the most commonly used are *Lamiaceae* with 8 species or 9.87%, *Asteraceae* with 7 species (8.64%), followed by *Fabaceae* (4 species, 4.93%), *Poaceae* and finally *Apiaceae* (3 species, 2.7% each) (**Table 1**).

<i>Cerastium glomeratum</i> Thuill.	Therophyte	Treatment of gastric pain	Infusion	Leaves
<i>Ceratonia siliqua</i> L.	Phanerophyte	Diuretic and slightly purifying	Decoction	Fruits
<i>Ceratophyllum submersum</i> L.	Hydrophyte	Treatment of diarrhea and gastric pain	Decoction	Leaves
<i>Cistus monspeliensis</i> L.	Phanerophyte	Diabetes treatment and digestive assignments	Poultice	Leaves
<i>Cotula coronopifolia</i> L.	Hydrophyte	Digestive	Infusion	Air part
<i>Cynara cardunculus</i> L.	Hemicryptophyte	Protects the liver by eliminating toxins	Infusion	Capitulum and leaves
<i>Cynodon dactylon</i> (L.) Pers.	Geophyte	Urinary and biliary infections, treatment of arthritis and rheumatism	Decoction	Rhizomes and stems
<i>Cyperus fuscus</i> L.	Hemicryptophyte	Emmenagogue	Infusion	Air part
<i>Cytisus villosus</i> Pourret	Phanerophyte	Healing	Decoction	Leaves
<i>Daphne gnidium</i> L.	Phanerophyte	Treatment of syphilis, venereal diseases and dermatological	Powder	Barks
<i>Daucus carota</i> subsp. <i>maritimus</i> (Lam.) Batt.	Hemicryptophyte	Depurative	Infusion	Roots and seeds
<i>Dioscorea communis</i> (L.) Caddick & Wilkin	Therophyte	Antirheumatic	Poultice	Leaves
<i>Dittrichia viscosa</i> (L.) Greuter	Phanerophyte	Relieves rheumatic and healing pains	Decoction and powder	Roots and leaves
<i>Drimys numidica</i> (Jord. & Fourr.) J.C.Manning & Goldblatt	Geophyte	Relieves rheumatic pains	Decoction	Bulbs
<i>Dorycnium rectum</i> (L.) Ser.	Therophyte	Treatment of back and gastrointestinal pain; treatment of urogenital pain	Infusion and fumigation	Leaves
<i>Erica scoparia</i> L.	Phanerophyte	Anti-inflammatory	Infusion	Leaves
<i>Eucalyptus globulus</i> Labill.	Phanerophyte	Treatment of bronchitis and influenza states	Infusion	Leaves
<i>Euphorbia peplus</i> L.	Therophyte	Treatment of nephritis	Infusion	Leaves
<i>Fraxinus angustifolia</i> Vahl.	Phanerophyte	Astringent	Infusion	Barks
<i>Fuirena pubescens</i> (Poir.) Kunth.	Chamaephyte	Used during pregnancy so that the child grows normally, is healthy and the genitals are protected	Decoction	Whole plant
<i>Genista ulicina</i> Spach.	Phanerophyte	Diuretic	Infusion	Leaves
<i>Hedera algeriensis</i> Hibberd	Phanerophyte	Wound healing and anti-cellulite effect	Decoction	Leaves
<i>Hypericum afrum</i> Lam.	Phanerophyte	Antidepressant and anti-inflammatory	Maceration	Flowerheads
<i>Hypochoeris radicata</i> L.	Therophyte	Detoxifying	Decoction	Leaves
<i>Illecebrum verticillatum</i> L.	Therophyte	Astringent	Infusion	Leaves
<i>Juniperus oxycedrus</i> L.	Phanerophyte	Hair care and neurological	Infusion	Leaves
<i>Laurus nobilis</i> L.	Phanerophyte	Heals disorders of the upper digestive tract and arthritis pain	Infusion	Leaves
<i>Lavandula stoechas</i> L.	Phanerophyte	Relieves gastralgia and calms cough	Decoction	Leaves
<i>Linaria pinifolia</i> (Poir.) Thell.	Hemicryptophyte	Digestive and heals the liver	Decoction	Leaves
<i>Lonicera implexa</i> Aiton	Phanerophyte	Astringent and diuretic	Infusion and powder	Leaves and barks

<i>Lythrum salicaria</i> L.	Phanerophyte	Astringent	Infusion	Flowerheads
<i>Mentha aquatica</i> L.	Chamaephyte	Diuretic	Infusion	Leaves
<i>Mentha pulegium</i> L.	Chamaephyte	Treatment of painful periods, abdominal pain and relieves rheumatic pain	Infusion	Leaves and blooming branches
<i>Mentha suaveolens</i> Ehrh.	Chamaephyte	Treatment of uro-genital infections	Decoction	Leaves
<i>Myriophyllum alterniflorum</i> DC.	Hydrophyte	Treatment of inflammations of recent wounds	Infusion	Leaves
<i>Myrtus communis</i> L.	Phanerophyte	Treatment of gastric pain	Infusion	Leaves
<i>Nymphaea alba</i> L.	Hydrophyte	Diuretic	Infusion	Leaves
<i>Olea europaea</i> L. subsp. <i>europaea</i> var. <i>europaea</i> (autonyme)	Phanerophyte	Used in case of high blood pressure and diabetes	Infusion	Leaves
<i>Osmunda regalis</i> L.	Hemicryptophyte	Astringent	Decoction	Rhizomes
<i>Opuntia ficus-indica</i> (L.) Mill.	Phanerophyte	Digestive disorders and hair care	Raw	Fruits
<i>Oxalis pes-caprae</i> L.	Geophyte	Treatment of jaundice and urinary stones	Decoction	Stems
<i>Panicum repens</i> L.	Hemicryptophyte	Treatment of biliary diseases, wounds, ulcers and ophthalmic	Infusion	Leaves
<i>Pinus pinaster</i> Aiton	Phanerophyte	Healing	Powder	Fruits
<i>Pistacia lentiscus</i> L.	Phanerophyte	Healing, treatment of asthma and digestive	Decoction	Roots
<i>Polygonum cambricum</i> L. subsp. <i>cambricum</i>	Hemicryptophyte	Facilitates the drainage of abscesses in cases of furunculosis	Powder	Leaves and roots
<i>Populus alba</i> L.	Phanerophyte	Heals sciatica and stranguria	Powder, infusion	Barks and leaves
<i>Pteridium aquilinum</i> (L.) Kuhn	Geophyte	Heals spleen conditions and wounds	Infusion	Leaves
<i>Quercus suber</i> L.	Phanerophyte	Antidiarrheal	Decoction, powder	Barks and fruits
<i>Ranunculus flammula</i> L.	Therophyte	Remedy for ulcers	Infusion	Leaves
<i>Ranunculus ophioglossifolius</i> Vill.	Therophyte	Digestive	Infusion	Leaves
<i>Ricinus communis</i> L.	Phanerophyte	Purging effect very famous	Infusion	Seeds
<i>Rosa sempervirens</i> L.	Phanerophyte	Slightly diuretic	Powder	Fruits
<i>Rubus ulmifolius</i> Schott	Phanerophyte	Antidiarrheal	Infusion	Leaves
<i>Rumex arifidis</i> Coss.	Hemicryptophyte	Heals skin problems like acne	Infusion	Seeds
<i>Salix alba</i> L.	Phanerophyte	Antirheumatic	Decoction	Leaves
<i>Salvia verbenaca</i> L.	Hemicryptophyte	Treatment of heart disease	Decoction	Roots
<i>Sambucus nigra</i> L.	Phanerophyte	Anti-inflammatory and diuretic	Infusion decoction and	Flowerheads
<i>Scolymus hispanicus</i> L.	Hemicryptophyte	Treatment of neurological conditions	Infusion	Leaves
<i>Scrophularia tenuipes</i> Coss. & Durieu	Therophyte	Anti-inflammatory and haemostatic	Infusion	Leaves
<i>Smilax aspera</i> L.		Treatment of eczema	Decoction	Leaves
<i>Stachys arvensis</i> (L.) L.	Therophyte	Antidepressant and digestive	Decoction	Capitulums
<i>Stachys marrubifolia</i> Viv.	Hemicryptophyte	Relieves headaches and digestive	Infusion	Leaves
<i>Tamarix gallica</i> L.	Phanerophyte	Edema of the spleen	Decoction	Leaves

<i>Thymus munbyanus</i> Boiss. & Reut.	Chamaephyte	Treatment of intestinal bloat, genital and intestinal pains	Infusion	Leaves
<i>Trifolium repens</i> L.	Therophyte	Antidiarrheal	Infusion	Leaves
<i>Urtica pilulifera</i> L.	Therophyte	Astringent and diuretic	Infusion decoction or	Leaves
<i>Verbena officinalis</i> L.	Hemicryptophyte	Treatment of diarrhea and gastric pain	Decoction	Leaves

## Discussion

### Floristic diversity

This study has enabled us to identify 81 remarkable "heritage" species, that is to say rare and/or endemic divided into 78 genera (**Table 1**). The diversity of order 1 is increased, because in addition to the large number of species, the number of families is also [16].

The *Lamiaceae* family occupies an important place in the Algerian flora with 73 taxon [7]. This family is primarily an important source of essential oils, phenols and flavonoids [17].

In the family *Asteraceae*, the most sought after and used parts are basal rosette leaves. Artichoke (*Cynara cardunculus* L.) shows its effectiveness in the treatment of biliary diseases although the plant is consumed alone as a vegetable.

Among the Fabaceae, the most popular species is undoubtedly the Carob tree (*Ceratonia siliqua* L.). The pods are mixed with oatmeal, honey and beeswax to treat diarrhea.

A special place is occupied by the Prickly pear or Cactus pear (*Opuntia ficus-indica* (L.) Mill.) Which has become spontaneous and widespread in the study area. It is used as a fence for fields in very thorny forms, and in any case it is very popular for its ripe fruit during the summer and rich in essential fatty acids (EFA), necessary for the functioning and development of the central nervous system [18].

### Ecological value of the plants surveyed

Medicinal plants in the study area do not always have the same heritage value. Some of them may be both endemic, or

sub-endemic and rare. They are 6 taxa like the common hedgehog (*Stachys marrubifolia* Viv.), and the Pine-tree toadflax (*Linaria pinifolia* (Poir.) Thell.) Other endemic although widely distributed in Algeria, are also to be taken into consideration; such as the Numidian Squill (*Drimia numidica* (Jord. & Fourr.) J.C. Manning & Goldblatt) and St. John's Wort (*Hypericum afrum* Lam.) Other species are rare in the region, such as Elderberry, or Black elder, (*Sambucus nigra* L.).

The 1997 International Union for Conservation of Nature (IUCN; officially International Union for Conservation of Nature and Natural Resources) Red List [19] contains 64 rare and endangered Algerian species, one of which is listed in this study. In addition, 5 taxa are on the list of uncultivated and protected plant species that include 444 protected plants throughout the Algerian territory and 29 others that deserve to be J.O.R.A [20].

Most rare and endemic species deserve protection without which they will disappear, especially as they are not included in the list of protected species in Algeria. A large batch of rare and unprotected taxa deserves special attention and makes it urgent to revise the list of taxa to be protected locally (**Table 2**). In addition, several species find here their only region in Algeria, such as the White water rose or White nenuphar (*Nymphaea alba* L.), noted for Numidia K3 at Annaba and El-Kala [11].

**Table 2** Observed rare and endemic species and their status according to bibliographic data (QS: Quézel and Santa [11], IUCN [19], DE: Executive Decree [20]). P: protected; End.: Endemic; algero-tunis.: algero-tunisian.

Taxa [7]	Biogeographic types	Rarity	(IUCN, 1997)	(D.E, 2012)
<i>Anagallis crassifolia</i> Thore	Atlantic	R		
<i>Apium crassipes</i> (Koch) Rchb.	Mediterranean	VR		
<i>Bellis prostrata</i> Pomel	End algero-tunis.	VR		P
<i>Ceratophyllum submersum</i> L.	European	VR		P
<i>Fuirena pubescens</i> (Poir.) Kunth.	Paleotempered	VR		P
<i>Genista ulicina</i> Spach.	End algero-tunis.	AR		

<i>Hedera algeriensis</i> Hibberd	End algero-tunis.	FC		
<i>Hypericum afrum</i> Lam.	End algero-tunis.	FC		
<i>Linaria pinifolia</i> (Poir.) Thell.	End algero-tunis.	R		
<i>Myriophyllum alterniflorum</i> DC.	European	R		
<i>Nymphaea alba</i> L.	Eurasian	VR		
<i>Ranunculus flammula</i> L.	Eurasian	R		P
<i>Rumex aristidis</i> Coss.	End algero-tunis.	R		
<i>Sambucus nigra</i> L.	Paleotempered	R		
<i>Scrophularia tenuipes</i> Coss. & Durieu	Subend. maghreb	R	R	P
<i>Stachys marrubifolia</i> Viv.	Subend. tyrrhenien	R		
<i>Thymus munbyanus</i> Boiss. & Reut.	Subend. maghreb	QR		

## Biological types

According to the global list of listed species, the composition of the global biological spectrum (**Table 3**) shows that phanerophytes, with 30 taxa (37.03%), are predominant over other life forms (6-16 corresponding taxa) at 7.4-19.75%. Therophytes and hemicryptophytes are fairly well represented with 16 species (19.75%) and 15 species (18.51%) respectively. They are followed by geophytes and chamaephytes which contain the same number of species 7, i.e., (8.64%) for each type of plant. Hydrophytes are poorly represented with only 6 species (7.4%).

This dominance of perennial plants has been explained by their availability on the ground whatever the climatic hazards [6]. Unlike the therophytes, they are characterized by a short life cycle that lasts only a few weeks or days. They constitute the result of a degradation of the vegetal cover following disturbances of the biotope.

**Table 3** Global biological spectrum of medicinal species.

Biological Types	Number Species	of	Proportions (%)
Phanerophytes	30		37.04
Therophytes	16		19.75
Hemicryptophytes	15		18.52
Geophytes	7		8.64
Chamaephytes	7		8.64
Hydrophytes	6		7.41
Totals	81		100

## Use of medicinal plants

**By sex:** Medicinal and aromatic plants are used by both women and men. Women come first with 70.60% and men after with 29.40%. In general, women are more in possession of cultural heritage and traditional herbal knowledge [20].

**The family situation:** Medicinal plants are used much more by married people (89.77%) than by single people (10.23%), because they allow them to avoid or minimize the material charges required by doctors and pharmacists. They are also more confronted with pathology affecting young children, more frequent than adults [21].

**By age:** Data analysis showed that people aged between 40 and 60 years are the most concerned by the use of medicinal plants with a frequency of 42.47%. Next are the age groups (20-40 years), age over 60 and age under 20 with the respective frequencies 28.41%, 21.18%, and 7.94% respectively.

The results show that the elderly are the main source of information on the use of plants in traditional medicine. They come in third place, unlike other studies [4], which found that they are the most users of medicinal plants. This difference could be explained by the random choice of the respondents but also by a change in the habits of the local population which considers that the use of drugs is a good guarantee of healing.

A weakening of the immune system of local populations, through frequent consumption of antibiotics and chemical molecules, also weighs on the choice of a stronger and more effective medication against the accumulation of multi-resistant bacterial strains.

**According to the level of studies:** In the study area, the vast majority of users of medicinal plants are illiterate, with a percentage of 67.44%. This relatively high percentage is directly correlated with the education level of the local population. Nevertheless, people with primary education have a significant percentage of use (19.92%) of medicinal plants; while those with a high school and university level, use very little medicinal plants (respectively 7.59% and 5.05%).

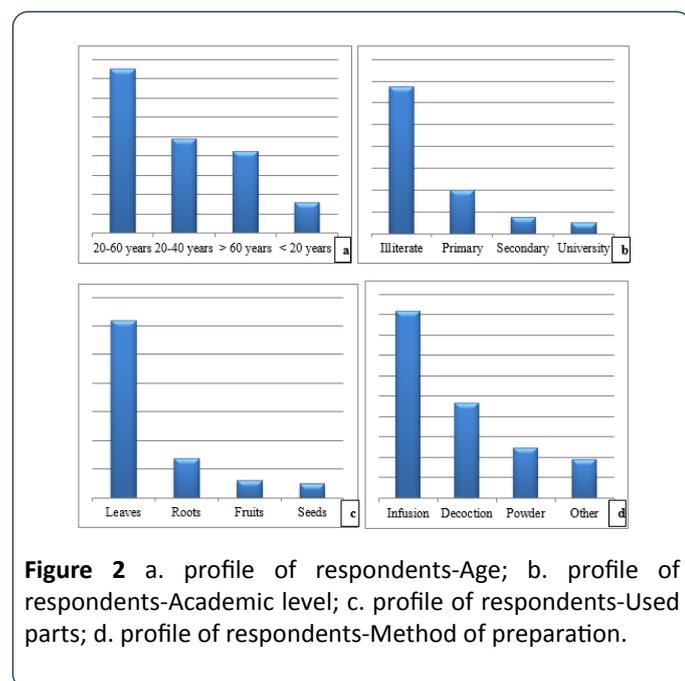
This ties in with the previous observation regarding the age of the target audience of the investigation. Indeed, academics who have not followed specialized studies in botany and ethnobotany believe that only chemical medication is

effective. This result is consistent with that obtained elsewhere by various authors [1,22].

**Used parts of plants:** The plant parts used are ranked in order of decreasing importance: leaves (61.72%), roots (13.58%), fruits (6.17%) and seeds (4.93%). The rest of the parts used represents a rate of 13.6%. The frequent use of the leaves is justified by the abundance of the chemical groups they contain. They are the site of synthesis of secondary metabolites of the plant [23].

### Method of preparation of therapeutic recipes

Infusion is the most common method of preparation (45.79%). It is prepared mainly from fresh leaves (Spearmint) or dried (Common vervain). Comes in second position the decoction with a percentage of 23.33%. Powder picks up the third position with 12.34%. The majority of remedies are prepared primarily by infusion to treat gastric, cardiovascular and urogenital diseases [22]. The other modes, namely fumigation, poultice, maceration and plant species, have a cumulative rate of 9.54% (Figure 2).



**Figure 2** a. profile of respondents-Age; b. profile of respondents-Academic level; c. profile of respondents-Used parts; d. profile of respondents-Method of preparation.

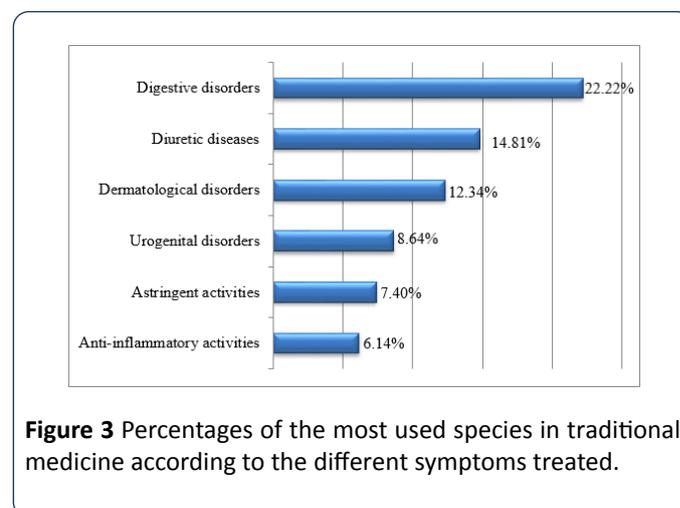
### Symptoms treated

Traditionally, Algerian Tell species are used for the treatment of a wide range of symptoms. They are used as diuretics, astringents, in the treatment of wounds, rheumatism, fever and pain. The results obtained show that most plants are used in the treatment of digestive disorders (22.22%).

They are followed by diuretic diseases (14.81%), dermatological diseases (12.34%) and urogenital diseases (8.64%). The astringent and anti-inflammatory species are respectively equal to 7.4% and 6.14%. The diseases least treated by residents of Guerbès-Sanhadja are internal

diseases, dermatoses, bronchopulmonary pathologies, heart disease, jaundice and respiratory diseases.

Generally, the diseases most treated by medicinal species are digestive disorders. These values are comparable to the results found by Meddour et al. [24] where digestive pathology is the most commonly treated disease. This similarity is explained by the fact that the population of the Tizi Ouzou region and that of the Guerbès-Sanhadja region share the same knowledge regarding the use of medicinal plants. In fact, the two regions are geographically neighbours and both belong to the Kabyle and Numidian sectors according to the biogeographical subdivision proposed by Quézel and Santa [11] (Figure 3).

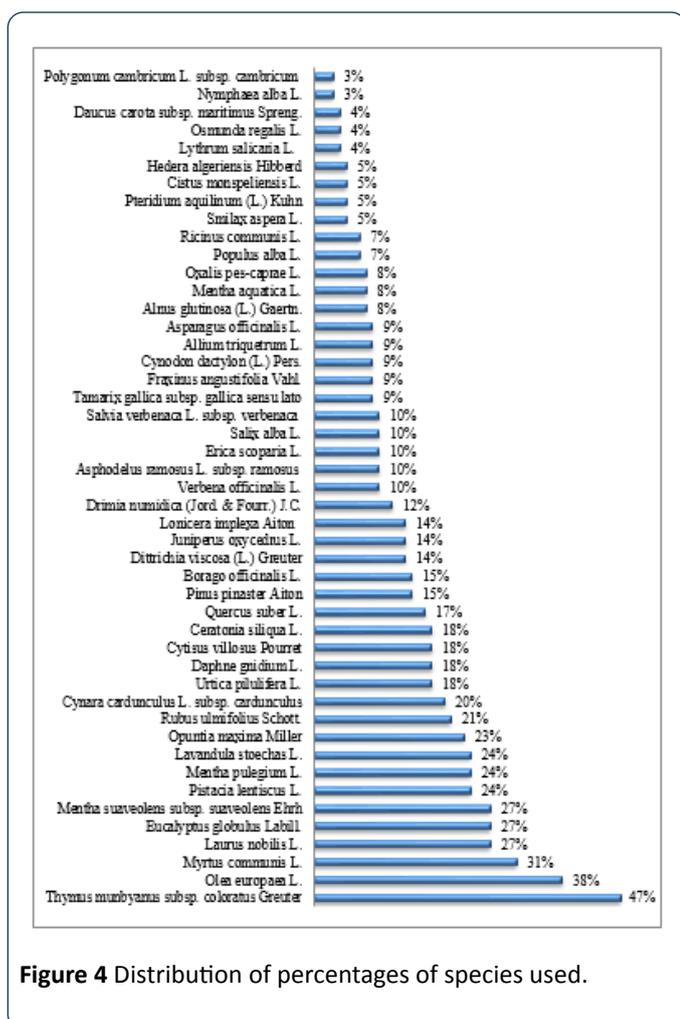


**Figure 3** Percentages of the most used species in traditional medicine according to the different symptoms treated.

### Species with very frequent uses

This work, which contributes to a better understanding of practical traditional care in the study area, has allowed us to list a number of chronic diseases treated by medicinal plants. The results obtained show that Munby Thyme (*Thymus munbyanus* Boiss. & Reut.) and Olive tree (*Olea europaea* L. subsp. *europaea* var. *europaea*) are the most widely used with 47% and 38% respectively (Figure 4).

Infused or decocted dried leaves of Munby's Thyme (*Thymus munbyanus* subsp. *coloratus* Greuter) are most commonly used to treat gastrointestinal disorders, pulmonary bronchitis and other infections [25]. In addition, the Olive tree is among the oldest known cultivated trees in the world that has been an important source of nutrition and medicine [26]. In addition, a large lot of species has a utilization percentage of between 1 and 2%, about 32 species, or 39.5% of the medicinal flora of the study area.



**Figure 4** Distribution of percentages of species used.

**Note:** 2%-*Adiantum capillus-veneris* L., *Centaurea napifolia* L., *Daucus carota* subsp. *maritimus* Spreng., *Ammi visnaga* (L.) Lam., *Scolymus hispanicus* L., *Stachys marrubifolia* Viv., *Stachys arvensis* (L.) L., *Genista ulicina* Spach., *Apium crassipes* (Koch ex Rchb.) Rchb., *Hypericum afrum* Lam., *Rosa sempervirens* L.

1%-*Sambucus nigra* L., *Anagallis crassifolia* Thore, *Bellis prostrata* Pomel, *Callitriche obtusangula* L. Gall., *Calystegia sepium* (L.) R. Br., *Centaureum spicatum* (L.) Fritsch, *Cerastium glomeratum* Thuill., *Ceratophyllum submersum* L., *Cotula coronopifolia* L., *Cyperus fuscus* L., *Dioscorea communis* (L.) Caddick & Wilkin, *Dorycnium rectum* (L.) Ser., *Euphorbia peplus* L., *Fuirena pubescens* (Poir.) Kunth., *Hypochoeris radicata* L., *Illecebrum verticillatum* L., *Linaria pinifolia* (Poir.) Thell., *Myriophyllum alterniflorum* DC., *Panicum repens* L., *Ranunculus flammula* L., *Ranunculus ophioglossifolius* Vill., *Rumex aristidis* Coss., *Scrophularia tenuipes* Coss. & Durieu, *Trifolium repens* L.

## Conclusion

The present work completes a first study conducted by our team where 81 spontaneous medicinal species were inventoried in the humid complex of Guerbès-Sanhadja. This also allowed us to list rare and endemic medicinal taxa. Some species are in danger of extinction because of their overexploitation (abusive uprooting). This is particularly the

case with *Thymus munbyanus* subsp. *coloratus* Greuter and *Stachys marrubifolia* Viv. In fact, the uncontrolled harvest causes a decrease in the population of certain plants.

The ethnobotany survey revealed a plethora of results on the use of medicinal plants. Women and men have shared medicinal knowledge, with a slight advantage for women. The forms of use are also numerous, but with particular importance for herbal teas and gastroenteric applications. In addition, Munby Thyme (*Thymus munbyanus* Boiss. & Reut.) is the most widely used plant, because of its interest in the treatment of digestive and urogenital diseases.

## Conflict of Interest

None of the co-authors of this manuscript have a conflict of interest.

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